Acta Zoologica
Academiae Scientiarum Hungaricae

VOLUME 40 - NUMBER 1 - 1994

HUNGARIAN NATURAL HISTORY MUSEUM, BUDAPEST

ACTA ZOOLOGICA
ACADEMIAE SCIENTIARUM HUNGARICAE

AN INTERNATIONAL JOURNAL OF
ANIMAL TAXONOMY AND ECOLOGY

Acta Zoologica Academiae Scientiarum Hungaricae will be published quarterly from February 1994 (other issues in May, August and November) by the Hungarian Natural History Museum with the financial support of the Hungarian Academy of Sciences.

SUBSCRIPTION INFORMATION

Orders should be addressed to

Editorial Office of the Acta Zoologica
Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13, Hungary

Benevolo Lectori Salutem

On the 1st of September 1992, when the Biological Section of the Hungarian Academy of Sciences appointed me to the editorship of *Acta Zoologica Hungarica*, I was authorized not only to follow previous usage but also to reform our journal. The necessity of the reform was/is not directly connected with any of the extensive political and social changes still going on in our country. The publication of the journal as a whole, or any and all papers in it, had never been restricted by powers not in the field of science. The editors, to mention by name Dr. Árpád Soós only, produced a high level scientific journal, enforcing among others, respect for formal requirements. The original publication of four issues per year was at an early date contracted to two issues, numbering (1-2) and (3-4).

Our journal was published, from its foundation to Volume 39, by the Akadémiai Kiadó, Budapest. During the last years the haphazardness in the dates of publication, the high cost of production, etc., called for reforms. The difficulties in publishing the last volume (Vol. 39) underlined the necessity of prompt action. The publishing house Akadémiai Kiadó required an unreasonably high financial support from the Hungarian Academy of Sciences for the production of Volume 39, at least so in our opinion. And since there was a decision made by that time for a change in the publisher, beginning with 1994, the task to be undertaken by the Hungarian Natural History Museum, the cost of publication was proposed to be shared by the Akadémiai Kiadó, for the sake of a smooth transition. Namely, issue (1-2) was to be produced by them, issue (3-4) – the less voluminous one – by the Museum. Subsequently they changed their mind and renumbered issue (1-2) as (1-4) and thus declared papers for the original issue (3-4) as manuscripts for Volume 40. These latter papers will be published in our issues 40(1) and 40(2). *Their volume will not be restricted* - since they were "inherited" – *as it will with future issues.*

The journal *Acta Zoologica Academiae Scientiarum Hungaricae* (thus returning to its original name) will be published by the Hungarian Natural History Museum as its new steward. The production is sponsored by the Biological Section of the Hungarian Academy of Sciences through a grant system for the publication of scientific books and journals in biology. This system had to be established first, while the necessary steps in reforming the journal began only in November, 1993.

Besides research papers, also short reviews, short communications (all those of international organisations and meetings), methodological reports and book reviews are planned to be published.

Our "Instruction to Authors" are printed on the inner covers. The journal welcomes original papers in animal taxonomy and systematics as well as in animal ecology, community ecology and those discussing "pure science" basis for biodiversity and nature conservation problems – from any country in the world. Foreign authors are requested to pay a low page charge in order to cover costs of correspondence, postage of manuscripts and reprints. In case of bulkier papers this distinction vanishes: page charge for papers longer than 16 printed pages will be a sum of the gross cost (i.e. 40 USD) for *everybody.*

Only manuscripts on floppy diskettes are acceptable for review and publication (any file is admissible which is compatible with ASCII format). The four issues per year permit a more immediate publication. Papers will be issued *possibly* within a year from their submittal, and we guarantee a publication within six months after an acceptance.

Two-thirds of the Editorial Advisers are not Hungarians (their names will be disclosed in issue 40 (2) only, because some of those invited have not responded up to the close of the present issue). Their activity will also contribute to raise the level of English of the papers (it has been decided that the journal will publish papers *exclusively in English*). Every manuscript will be read by two reviewers and only concordant positive opinions can serve a basis for acceptance.

The *Acta* are published in four issues (each comprising 96 printed pages) per year. Accordingly, the yearly volume does not change; if the volume happens be larger in some cases, it will not cost more to the subscribers. The subscription fee is only three-fourths of the former one. The present issue 40 (1) is mailed to all former subscribers *free of charge*. All those who place their trust in this renewed journal are kindly requested to send their subscription fee to the Hungarian Natural History Museum. Issue 40 (2) will subsequently be sent to the subscribers only.

Cordially yours,

The Editor
Department of Zoology
Hungarian Natural History Museum

Call for Papers

Acta Zoologica Academiae Scientiarum Hungaricae is a renewed/reformed journal published by the Hungarian Natural History Museum and sponsored by the Hungarian Academy of Sciences. Our aim is to accomodate an increasing interest in animal taxonomy and systematics as well as in animal ecology, for community ecology, biodiversity and nature conservation problems in particular. It has become an international journal with a body of the Editorial Advisers of wide disciplinary interest. *Our journal is open for papers from any country in the world.*

Original research papers, short reviews (by prior arrangement with the editor), opinion papers, short communications, methodological reports and book reviews may also be accepted.

A moderate page charge is required from authors outside Hungary in order to cover costs of correspondence, reprint mailing, lingustic revision, etc. As a consequence, foreign authors are kindly requested to send proper information on coverages of their page charge.

Acta Zoologica Academiae Scientiarum Hungaricae 40 (1), pp. 1-14, 1994

COMPARATIVE ANALYSIS OF EDGE EFFECT ON BIRD AND BEETLE COMMUNITIES

A. BÁLDI & T. KISBENEDEK*

Ecological Research Group
Hungarian Natural History Museum
Budapest, Baross u. 13. H-1088, Hungary

Effect of edge was studied at the same time and place on bird and beetle communities in a riparian forest in Hungary. The diversity of birds was similar in the edge and in the interior habitats, but density increased in the edge. There were no significant differences between the edge and the interior bird communities. The beetle communities sampled in the forest edge, interior-edge and interior habitats differed significantly from each other. There were differences in calculated species number, diversity and equitability. Flying ability was related to habitat, with the number of species with flying ability increasing towards the edge. Our study revealed that the effect of edge may have similar consequences on taxonomically distant groups, but the applied scale was appropriate to detect significant differences only for beetles, not for birds. With two original figures.

Key words: edge effect, bird communities, beetle communities, spatial scale

INTRODUCTION

An edge can be defined as the junction of two different habitats (FORMAN & GODRON, 1986, YAHNER, 1988). Animal communities associated with edges have been of considerable interest to conservation biologists and wildlife managers, because recent human induced changes in the landscape increase the amount of edge habitats.

Studies of edge effect and fragmentation usually have included only one taxonomic group, for example mammals (e.g. BENNETT, 1987), birds (e.g. HANSSON, 1983, HELLE & HELLE, 1982, KROODSMA, 1984, TEMPLE & CARY, 1988, MØLLER, 1989), amphibians (e.g. MANN *et al.*, 1991), or different invertebrates (e.g. DUELLI *et al.*, 1990, MAJER, 1987). There are also studies of a single species from several taxonomic groups (DE VRIES & DEN BOER, 1990, DODD, 1990, GJERDE & WEGGE, 1989, HANSKI, 1989, LANKESTER, *et al.*, 1991).

The number of complex or comprehensive studies are limited (HELLE & MUONA, 1985, NILSSON *et al.*, 1988, ROSENBERG & RAPHAEL, 1986) and generally include taxonomically, or from an anthropogenic point of view, closely related groups. Investigations on the relationship between distant groups, usually between vertebrates and invertebrates, are based on indirect data from the lit-

* Authors in alphabetic order

erature. Such comparisons were made on data collected at different times and from different places, which may have affected the results (SCHOENER, 1986).

In the present paper we investigated the effect of edge on bird and beetle communities, with emphasis on comparing differences in community structure parameters for beetles and birds across the edge. The two studies were carried out concurrently in the same system, solving the problem of comparing indirect data.

STUDY AREA AND METHODS

The study was conducted in the Szigetköz region, Hungary, near the village Feketeerdő, in Felső Forest (47°53'N, 17°15'E). The original vegetation on the whole area of the Szigetköz were grove forests. Now the landscape is mainly farmland with remnants of seminatural vegetation.

The study site is situated along the River Mosoni Duna. The forest site is 220 ha bounded mainly by cultivated fields. The forest is managed (mainly selective cuts, but there are clear cuts and plantations as well), divided by paths into 200×200 m blocks. The paths are linear, and about 3-5 m wide, allowing cars to use them. The forest association of the area is a seminatural oak–elm–ash grove, *Querco-Ulmetum.* Trees are mixed in the canopy layer, largely consisting of *Quercus robur, Fraxinus angustifolia* and *Ulmus laevis.* The shrub layer is abundant, consisting of *Viburnum, Crataegus, Cornus, Acer* and *Frangula* species. In the grass layer, the abundant species are *Rumex saguineus, Rubus caesius, Festuca gigantea,* and *Carex* spp.

Bird census – Bird censuses were carried out in the edge and in the interior part of the forest, about 2-400 m from the edge, in 1990 and 1991. Two censuses were carried out, one in April, and one in May to record both early and late breeders. The transects in the two years were altogether 5.2 km long (13 ha) in the forest edge and 3.4 km long (16.9 ha) in the forest interior habitats. Average density values were used in the analysis so we could analyse the data in the similar way as the beetle data. We used the line transect method (JÄRVINEN & VÄISÄNEN, 1975), with only the forest side being counted at the edge. The other side was an intensively managed agricultural land, which was almost bare in spring. All birds detected were noted in the main belt (MB, <25 m) and supplementary belt (SB, >25 m). The quantitative indices and measures were based on the density estimations (MB, only) (Appendix A), whereas the qualitative measures were based on the whole data set (MB and SB). Description of the main types of bird communities in the Szigetköz region is reported by WALICZKY (1992).

Collection of beetle data – The data were collected from April to September, 1991, using pitfall trapping. Sixty plastic 300 cm^3 jars were set out into the study area. Three groups were formed, each contained twenty jars. The jars were placed along a line, with about 1m between each trap. The first group of the traps was placed within the forest-agricultural land boundary, along a line parallel with the edge of the forest. The second group was inside the forest (200 m apart from the edge) but was placed along a line beside a path, 2.5 m from it. The third group was inside the forest (300 m apart from the edge) in the center of a 200×200 m block.

All jars were filled with 1 dl ethylene-glycol to preserve the caught animals. Traps were emptied three-weekly. We did not include the rarely caught species in the analysis.

To determine the community structure parameters we applied some simple biomathematical methods (see e.g. SOUTHWOOD, 1978, KREBS, 1989). The Shannon-Wiener diversity index (H') was used to calculate the diversity of the communities:

$$H' = -\sum p_i \ln p_i$$

where

H'= Shannon-Wiener diversity index and p_i= relative frequency of the species i

The most commonly used index of evenness (equitability) in the literature is based on the Shannon-Wiener function:

$$J' = H'/\ln(S)$$

where

J' = evenness measure (range 0-1) and S = total number of species.

To examine the similarity of the edge and inside communities in the same taxon we used the Sørensen index:

$$C_S = 2j/(a+b)$$

where

C_S=Sørensen coefficients, j=number of common species (in both communities), a=number of species in community a, b=number of species in community b

The Bray-Curtis index, a modified version of the Sørensen index, was also applied:

$$C_{BC} = 2jN/(aN+bN)$$

where

C_{BC}= Bray-Curtis index, jN = the sum of the lesser values for the species common to both habitats, aN = total individuals sampled in habitat a, bN= total individuals sampled in habitat b.

As the sample sizes differed, we applied the rarefaction method (see KREBS, 1989) to estimate the expected species number on a unit area using the program RAREFRAC.BAS (LUDWIG & REYNOLDS, 1988).

Chi-square tests were applied to test differences between the distribution of individuals per species, species area and dominance curves.

RESULTS

There were 38 bird species observed in the study period, 34 in the forest edge and 28 in the forest interior part. The total density of birds preferring edge was three times higher than that of the birds preferring forest.

Edge preference or avoidance was determined for 15 species from the total 38 based on density estimations. Two species were excluded from these 15 species, *Garrulus glandarius* and *Turdus iliacus* because only one flock was observed for each species. The remaining 13 species can be clustered into different groups based on their preference for edge (Appendix A). Most of the species show edge preference, some did not show any preference, and only *Parus major* exhibited a weak avoidance of edge.

During the study period we emptied the pitfall traps six times. We caught 822 individual beetles of 65 species (Appendix B). Six species were abundant in the edge, seven species in the interior-edge, and three species in the forest interior habitats. One species was equally distributed in inside-edge and edge habitats.

Rarefaction is an appropriate method to calculate the expected species number for species richness. The distribution of number of individuals per species did not differ significantly between the inside and edge communities of birds, but for

Table 1. Values of chi-square tests between edge and interior communities of birds and beetles, based on number of individuals per species.

		χ^2	D.f.	Significance
Birds	edge-interior	38.241	32	NS
Beetles	edge - interior edge	138.702	64	p<0.001
	interior edge-interior	203.056	64	p<0.001
	edge - interior	195.355	64	p<0.001

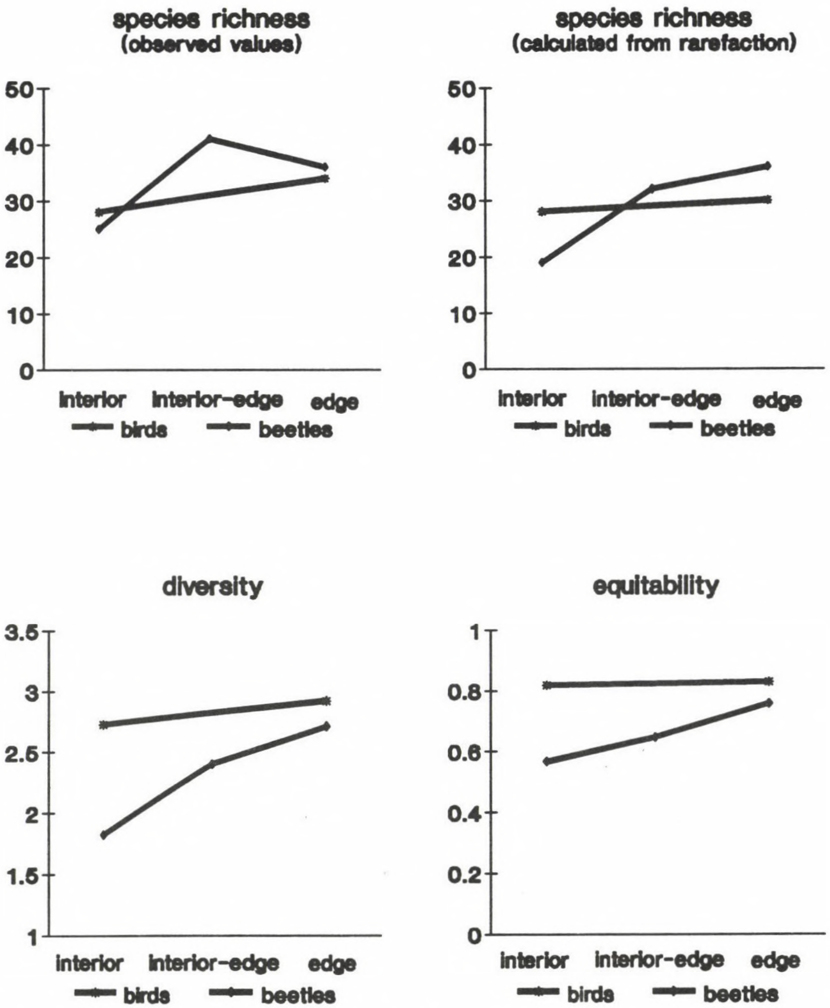


Fig. 1. Changes in community structure parameters for birds and beetles from the forest interior to the edge habitats.

beetles there were significant differences in each case (Table 1). The changes of community structure parameters (species richness, rarefied species richness, diversity and equitability) were compared within and between taxa (Fig. 1). In birds there was a slight increase in species richness from inside toward the edge in both observed values and calculated values by the rarefaction method and almost no change in diversity and equitability. In beetles the observed values of species richness showed an increasing tendency toward the edge, but the inside-edge community had higher species richness than that of the edge community. However, after rarefying there was a continuous increase in the expected species number $E(S_n)$ from inside to the edge (Fig. 1). The diversity and equitability values of beetles also increased gradually from the inside community to the edge community.

The slopes of rarefaction curves of birds were similar, and the distances between them were small (Fig. 2). In beetles the curve for the forest interior community separated from the other two curves. The increase in species number of these two latter communities was higher (Fig. 2).

The similarity indices showed high similarity between the edge and interior bird communities (Table 2). Comparisons among beetle communities by the indices showed that the difference was highest between the inside and edge communities. The indices showed that the difference between edge and interior communities was much smaller for birds than for beetles.

DISCUSSION

In this study we use the term community to refer to only birds or only beetles, not as the entire animal community.

Birds and the edge effect

Data from the literature show great variety on the edge preference or avoidance of bird species (see e.g. FROCHOT, 1981, 1987, FULLER & WHITTINGTON, 1987, FULLER & WARREN, 1991, MOSKÁT & FUISZ, 1992 for data from deciduous forests). This diversity suggests that great differences exist in the behaviour of species and communities in relation to the type and/or pattern of landscape and habitat. Naturally many other factors may affect the distribution of birds, for example HAILA *et al.* (1987) argued that the habitat selection of hole-nesting passerines related to the number of available snags rather than to the area of fragments. However, there are some species which may be considered edge-species, because they were found to show the same preference in most of the studies, e.g.,

Table 2. Values of Sørensen and Bray-Curtis similarity indices between edge and interior communities of birds and beetles.

	Birds	Beetles		
	edge and interior	edge and interior edge	interior edge and interior	edge and interior
Sørensen	0.7741	0.5741	0.4545	0.3606
Bray-Curtis	0.4623	0.4061	0.5205	0.3697

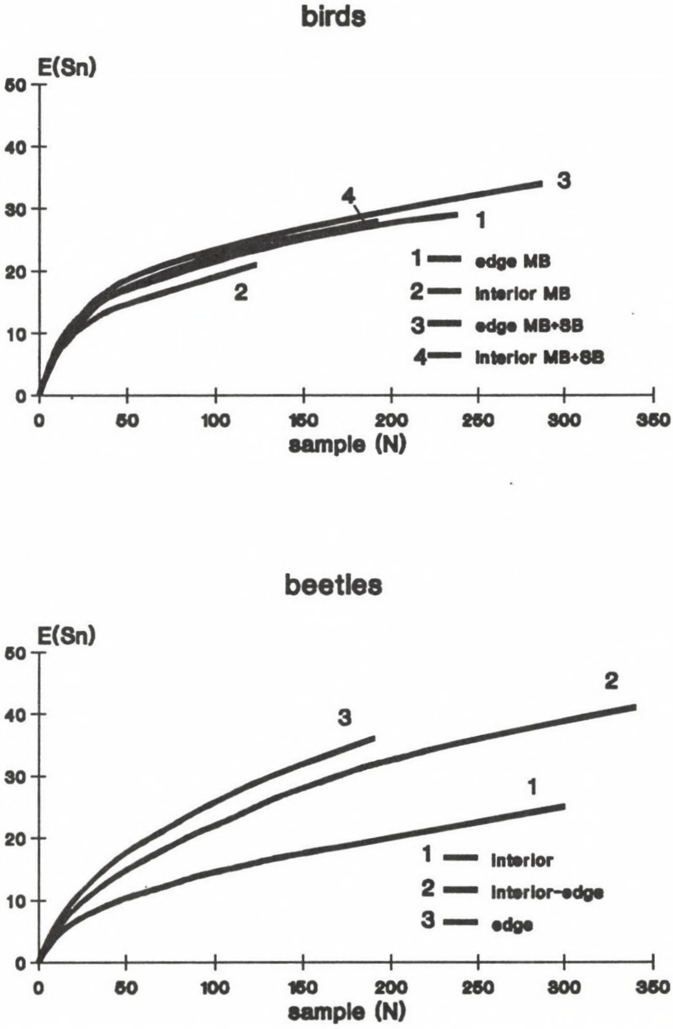


Fig. 2. Rarefaction curves for birds and beetles in the forest edge and forest interior habitats.

Sylvia atricapilla, Emberiza citrinella. The variability of results within taxon also strengthens the argument to conducting comparative studies at the same time and place.

Recently MOSKÁT & FUISZ (1992) reflected on the importance of vegetation structure. They counted birds in three habitats, edge, interior without shrubs and interior with shrubs. They found that the distribution of some species were not related to the edge, but to the presence of the shrub-layer (e.g. *Sylvia atricapilla*). Other species preferred shrubs, but avoid edge (e.g. *Erithacus rubecula*), or avoid interior habitats at all (e.g. *Carduelis chloris*).

Ecotones often harbour more diverse and dense communities than either of the two joining habitats (first reported by LEOPOLD (1933), cited in YAHNER (1988)). In our study the density of breeding birds was three times higher in the edge (within 0-25 m) than in the interior forest. However, the diversity values were almost the same. We suggest that the increased density in the edge was mainly a consequence of the nesting possibilities in tree holes (e.g. for *Sturnus vulgaris* and *Passer montanus*). The high density of these two species may be due to the proximity of the village. Indeed, the great majority of them were observed in that edge section which was nearest the village. The agricultural fields which bounded the other sites harboured only a few species, therefore open fields did not contribute much to the observed number of species.

Carduelis carduelis, C. chloris, Emberiza citrinella and *Serinus serinus* preferred edge trees for singing or resting, otherwise they are field species. On the other hand, a group of forest species also showed edge preference (*Parus caeruleus, Sitta europaea, Sylvia atricapilla, Phylloscopus collybita, Erithacus rubecula*).

Beetles and the edge effect

Studies of edge effect and fragmentation on invertebrates have showed that abundance and species diversity usually increase toward the edge of habitats (DENNIS & FRY, 1992, DUELLI *et al.*, 1990, HELLE & MUONA, 1985, KROMP & STEINBERGER, 1992, LAGERLÖF *et al.*, 1992). Our results on species richness are in accordance with this after rarefying the observed data.

The Coleoptera species fulfil an important role in terrestrial ecosystems (THIELE, 1977, WEIDEMANN, 1971, 1972). They are good indicators for the condition of habitats (THIELE, 1977), and management (KROMP, 1990, RUSHTON *et al.*, 1989), and have been shown to be useful indicators of conservation value (EYRE & RUSHTON, 1989). For this reason the examination of their distribution in different habitats and the effects of different factors and processes on them and their habitat characteristics are important for their preservation and management.

The microclimates of the edge and interior areas are markedly different (HANSSON, 1992, LOVEJOY *et al.*, 1986). Microclimate has a significant effect on the distribution of Coleoptera species, mainly on ground-dwelling beetles (THIELE , 1977).

In our study community distribution seems to change gradually from the interior toward the edge of the forest. Six species were found to prefer edge (Appendix B). *Harpalus rubripes* prefer bushy ravines and *H. rufipes* is found widespread on cultivated land (THIELE, 1977), therefore their edge preference reflected their normal habitat selection. Half of these species are perdators and half are herbivores. All of them can fly. Three species preferred the interior site; *Barypeithes* species, which is herbivorous; *Abax carinatus*, which is a predator; and *Platarea dubiosa* also a predator. Only one of them can fly. We found that eight species preferred the interior-edge habitat (Appendix B). There were pherbivors, predators and dung-eaters among them. There was an equal proportion of flying and non flying species, which reflects a gradual change in this characteristic from edge to interior habitats.

Comparison of the effect of edge on birds and beetles

The comparison of different ecological communities has a long history, dating from the CLEMENTS-GLEASON debate (SCHOENER, 1986). However, comparable studies of vertebrates and arthropods are lacking (SCHOENER, 1986, but see NILSSON *et al.*, 1988). Comparison of communities between distant taxa causes difficulties. Many measures of community cannot be applied because of the lack of common species. Therefore only indirect measures can be used, such as distributional characteristics and community structure parameters. However, the differences between vertebrates and invertebrates, namely between birds and beetles, are so large that even comparisons of community indices may not be valid. Therefore we restricted our analysis to a comparison of the changes in bird and beetle communities between the edge and interior habitats.

WIENS (1989) pointed out that ecologists must study nature on the appropriate scale. FUISZ & MOSKÁT (1992) showed that beetle community parameters vary at different hierarchical levels of the local spatial scale. The imposition of a single scale on all of the species in a community causes difficulties in interpreting the results.

Spatial scaling has an important role on conservation biology as well. WIENS (1989) pointed out that the disagreements over the design of nature reserves are at least partly due to a failure to appreciate scaling differences among organisms.

The samples of birds and beetles in the present study were collected at the same spatial scale, therefore differences in the significance of edge effect were expected. However, two points need further discussion. First, the strong similarity between edge and interior bird community parameters and distributions showed that for birds there was not as pronounced edge effects at the studied scale as for beetles. The small distance between edge and interior transects and the small area of the forest plot may have caused the lack of differences.

Second, for beetles the applied spatial scale was much more appropriate. Significant differences between beetle communities of edge and interior-edge, and between interior and interior-edge showed that the beetles were sensitive to even a 4 m wide path in the forest.

The present study shows that a conservation biological survey of an area requires multiple studies on different scales to determine the needs of a wide range of taxa. Conservation biologists frequently apply the keystone or umbrella species hypothesis (e.g. SOULÉ & SIMBERLOFF, 1986). This hypothesis states that if a large-bodied or specialised animal is able to survive in a site, because of the large area, heterogeneity or conservation management of the site, a lot of smaller or more generalized species can survive there as well. Nevertheless, there are controversies over this hypothesis at the species level, because the "valuable" species have usually different ecological requirements. However, our study seems to strengthens this hypothesis, at least at the community level, since the beetle communities showed high variability, whereas the bird communities did not. That is, if we provide an appropriate area for birds, the beetle communities will show much greater diversity.

* * *

Acknowledgements – We are indebted to L. HANSSON, C. MOSKÁT, J. SWENSON and two anonymous reviewers for valuable and constructive comments. L. ÁDÁM and G. SZÉL collected and identified the beetles. The field work was financed by a grant of the Hungarian Academy of Sciences to F. MÉSZÁROS (AKA fund, No. 1-300-2-91-0-759). Preparation of the paper was supported by a grant of the National Scientific Research Fund to C. MOSKÁT (OTKA, No. I/3 3188).

REFERENCES

BENNETT, A. F. (1987) Conservation of mammals within a fragmented forest environment: the contributions of insular biogeography and autecology, pp. 41-52. *In* SAUNDERS, D. A., ARNOLD, G. W., BURBIDGE, A. A. & HOPKINS, A. J. M. (eds) *Nature conservation: the role of remnants of native vegetation.* Surrey Beatty & Sons, Chipping Norton, Australia.

DENNIS, P. & FRY, G. L. A. (1992) Field margins: can they enhance natural enemy population densities and general arthropod diversity on farmland? *Agr. Ecosyst. Environ.* **40**: 95-115.

DE VRIES, H. H. & DEN BOER, P. J. (1990) Survival of populations of *Agonum ericeti* Panz. (Col., Carabidae) in relation to fragmentation of habitat. *Neth. J. Zool.* **40**: 484-498.

DODD, C. K. (1990) Effects of habitat fragmentation on a stream-dwelling species, the Flattened Musk Turtle *Sternotherus depressus*. *Biol. Conserv.* **54**: 33-45.

DUELLI, P., STUDER, M., MARCHAND, I. & JACOB, S. (1990) Population movements of arthropods between natural and cultivated areas. *Biol. Conserv.* **54**: 193-207.

EYRE, M. D. & RUSHTON, S. P. (1989) Quantification of conservation criteria using invertebrates. *J. Appl. Ecol.* **26**: 159-171.

FORMAN, R. T. T. & GODRON, M. (1986) *Landscape ecology*. Wiley & Sons, New York, 620 pp.

FROCHOT, B. (1981) A quantitative study of edge effect, pp. 64-66. *In* PURROY, F. J. (ed.) *Bird census and mediterranean landscape*. Proceed. VII Int. Con. Bird Census IBCC. Universidad de León, León.

FROCHOT, B. (1987) Synergism in bird communities: a method to measure edge effect. *Acta Œcologica* **8**: 253-258.

FUISZ, T. & MOSKÁT, C. (1992) The importance of scale in studying beetle communities: hierarchical sampling or sampling the hierarchy? *Acta Zool. Hung.* **38**: 183-197.

FULLER, R. J. & WARREN, M. S. (1991) Conservation management in ancient and modern woodlands: responses of fauna to edges and rotations, pp. 445-471. *In* SPELLERBERG, I. F., GOLDSMITH, F. B. & MORRIS, M. G. (eds) *The scientific management of temperate communities for conservation*. Blackwell, Oxford.

FULLER, R. J. & WHITTINGTON, P. A. (1987) Breeding bird distribution within Lincolnshire ash-lime woodlands: the influence of rides and the woodland edge. *Acta Œcol.* **8**: 259-268.

GJERDE, I. & WEGGE, P. (1989) Spacing pattern, habitat use and survival of Capercaillie in a fragmented winter habitat. *Ornis Scand.* **20**: 219-225.

HAILA, Y., HANSKI, I. K. & RAIVIO, S. (1987) Breeding bird distribution in fragmented coniferous taiga in southern Finland. *Ornis Fennica* **64**: 90-106.

HANSKI, I. (1989) Habitat selection in a patchy environment: individual differences in common shrews. *Anim. Behav.* **38**: 414-422.

HANSSON, L. (1983) Bird numbers across edges between mature conifer forest and clearcuts in Central Sweden. *Ornis Scand.* **14**: 97-103.

HANSSON, L. (1992) Landscape ecology of boreal forests. *TREE* **7**: 299-302.

HELLE, E. & HELLE, P. (1982) Edge effect on forest bird densities on offshore islands in the northern Gulf of Bothnia. *Ann. Zool. Fennici* **19**: 165-169.

HELLE, P. & MUONA, J. (1985) Invertebrate numbers in edges between clear-fellings and mature forests in Northern Finland. *Silva Fennica* **19**: 281-294.

JÄRVINEN, O. & VÄISÄNEN, R. A. (1975) Estimating relative densities of breeding birds by the line transect method. *Oikos* **26**: 316-322.

KREBS, C. J. (1989) *Ecological methodology*. Harper & Row, New York, 654 pp.

KROMP, B. (1990) Carabid beetles (Coleoptera, Carabidae) as bioindicators in biological and conventional farming in Austrian potato fields. *Biol. Fert. Soils* **9**: 182-187.

KROMP, B. & STEINBERGER, K.-H. (1992) Grassy field margins and arthropod diversity: a case study on ground beetles and spiders in eastern Austria (Coleoptera: Carabidae; Arachnida: Aranei, Opiliones). *Agr. Ecosyst. Environ.* **40**: 71-93.

KROODSMA, R. L. (1984) Effect of edge on breeding forest bird species. *Wilson Bull.* **96**: 426-436.

LAGERLÖF, J., STARK, J. & SVENSSON, B. (1992) Margins of agricultural fields as habitats for pollinating insects. *Agr. Ecosyst. Environ.* **40**: 117-124.

LANKESTER, K., APELDOORN, R. VAN, MEELIS, E. & VERBOOM, J. (1991) Management perspectives for populations of the Eurasian Badger (*Meles meles*) in a fragmented landscape. *J. Anim. Ecol.* **28**: 561-573.

LOVEJOY, T. E., BIERREGAARD, R. O., RYLANDS, A. B., MALCOLM, J. R., QUINTELA, L. E., HARPER, L. H., BROWN, K. S., POWELL, A. H., POWELL, G. V. N., SCHUBART, H. O. R. & HAYS, M. B. (1986) Edge and other effects of isolation on Amazon forest fragments, pp. 257-286. *In* SOULÉ, M. E. (ed.) *Conservation Biology. The science of scarcity and diversity*. Sinauer Associates, Sunderland, Massachusetts.

LUDWIG, J. A. & REYNOLDS, J. F. (1988) *Statistical Ecology. A primer on methods and computing*. Wiley & Sons, New York, 337 pp.

MAJER, J. D. (1987) The conservation and study of invertebrates in remnants of native vegetation, pp. 333-335. *In* SAUNDERS, D. A., ARNOLD, G. W., BURBIDGE, A. A. & HOPKINS, A. J. M. (eds) *Nature conservation: the role of remnants of native vegetation*. Surrey Beatty & Sons, Chipping Norton, Australia.

MANN, W., DORN, P. & BRANDL, R. (1991) Local distribution of amphibians: the importance of habitat fragmentation. *Global Ecol. Biogeogr. Lett.* **1**: 36-41.

MØLLER, A. P. (1989) Nest site selection across field-woodland ecotones: the effect of nest predation. *Oikos* **56**: 240-246.

MOSKÁT, C. & FUISZ, T. (in press) Forest management and bird communities in the beech and oak forests of the Hungarian Mountains. *In* HAGEMEIJER, W. (ed.) *Bird census and atlas studies*. Proceed. 12th Int. Conf. on Bird Census and Atlas Work, Nordwijkerhout, The Netherlands.

NILSSON, S. G., BENGTSSON, J. & ÅS S. (1988) Habitat diversity or area per se? Species richness of woody plants, carabid beetles and land snails on islands. *J. Anim. Ecol.* **57**: 685-704.

ROSENBERG, K. V. & RAPHAEL, M. G. (1986) Effects of forest fragmentation on vertebrates in douglas-fir forests, pp. 263-273. *In* VERNER, J., MORRISON, M. L. & RALPH, C. J. (eds) *Wildlife 2000. Modelling habitat relationships of terrestrial vertebrates*. The University of Wisconsin Press, Madison, Wisconsin.

RUSHTON, S. P., LUFF, M. L. & EYRE, M. D. (1989) Effects of pasture improvment and managment on the ground beetle and spider communities of upland grasslands. *J. Appl. Ecol.* **26**: 489-503.

SCHOENER, T. W. (1986) Patterns in terrestrial vertebrate versus arthropod communities: Do systematic differences in regularity exist?, pp. 556-587. *In* DIAMOND, J. & CASE, T. J. (eds) *Community ecology*. Harper & Row, New York.

SOULÉ, M. E. & SIMBERLOFF, D. (1986) What do genetics and ecology tell us about the design of nature reserves? *Biol. Conserv.* **35**: 19-40.

SOUTHWOOD, T. R. E. (1978) *Ecological Methods*. 2nd edition. Chapman & Hall, London, 524 pp.

TEMPLE, S. A. & CARY, J. R. (1988) Modeling dynamics of habitat-interior bird populations in fragmented landscapes. *Conserv. Biol.* **2**: 340-347.

THIELE, H.-U. (1977) *Carabid beetles in their environments. A study on habitat selection by adaptations in physiology and behaviuor*. Springer-Verlag, Berlin, 355 pp.

WALICZKY, Z. (1992) Structure of avian communities in the forests of Szigetköz, Hungary. *Ornis Hung.* **2**: 25-31. (In Hungarian with English abstract.)

WEIDEMANN, G. (1971) Food and turnover of predatory arthropods of the soil surface. *Ecological Studies* **2**: 110-118.

WEIDEMANN, G. (1972) Die Stellung epigäischer Raubarthropoden im Ökosystem Buchenwald. *Verh. Zool. Ges. Helgold* **1971**: 106-116.

WIENS, J. A. (1989) Spatial scaling in ecology. *Funct. Ecol.* **3**: 385-397.

YAHNER, R. H. (1988) Changes in wildlife communities near edges. *Conserv. Biol.* **2**: 333-339.

Received February 1, 1993; accepted December 1, 1993

Appendix A. Population densities (pair/10ha) of birds in forest edge and interior habitats. (E: edge preference; I: inside preference; r: rare species, not considered in the analysis at the population level; *: one flock was seen.)

	Inside	Edge	Status
Aegithalos caudatus		0.39	r
Anthus trivialis	0.59	0.77	r
Carduelis carduelis		1.89	E
Carduelis chloris	0.30	1.93	E
Coccothraustes coccothraustes	0.30	0.39	r
Corvus corone cornix		0.39	r
Dendrocopos major	2.07	2.31	?
Emberiza citrinella	1.19	4.62	E
Erithacus rubecula	4.14	6.54	E
Ficedula albicollis		0.39	r
Fringilla coelebs	6.81	8.85	?
Garrulus glandarius	1.19		*
Hippolais icterina		0.77	r
Muscicapa striata		1.93	E
Oriolus oriolus	0.30		r
Parus caeruleus	2.37	5.77	E
Parus major	7.40	5.20	?
Passer montanus	0.89	7.31	E
Phylloscopus collybita	2.07	3.08	E
Phylloscopus sibilatrix	0.59	0.77	r
Phylloscopus trochilus	0.30		r
Picus viridis		0.39	r
Serinus serinus	0.59	2.31	E
Sitta europaea	0.59	4.23	E
Streptopelia turtur	0.30	0.77	r
Sturnus vulgaris	0.30	15.0	E
Sylvia atricapilla	3.85	10.0	E
Sylvia borin		0.39	r
Sylvia nisoria		0.39	r
Turdus iliacus		4.23	*
Turdus merula	0.30		r
Turdus philomelos		0.39	r

Appendix B. Abundance of beetle species in the inside, inside-edge and inside habitats. (E: edge preference; IE: inside-edge preference; I: inside preference; r: rare, not considered in the analysis at the population level).

	Inside	Inside-edge	Edge	Status
Abax carinatus	124	14	2	I
Abax paralellepipedus	60	93	42	IE
Alapsodus compressus			1	r
Allocypus melandris		1	1	r
Amara anthobia			1	r
Amara saphyrea		1	2	r
Anobiidae			1	r
Anoplotrupes stercorosus	1			r
Anthobium atrocephalum	1	1		r
Aphthona euphorbiae		1		r
Athous haemorrhoidalis	1	1	2	r
Atomaria analis		1		r
Barypeithes sp.	5	2	1	I
Bothynoderes punctiventris		2		r
Carabus coriaceus		4	1	r
Carabus ulrichii	28	50	22	IE
Coccinella septempunctata			1	r
Dienerella separanda	1			r
Dorcus paralellepipedus		2		r
Harpalus atratus		4	11	E
Harpalus rubripes		1	6	E
Harpalus rufipes			24	E
Kolon sp.	1			r
Lamprohiza splendidula		1		r
Loricera pilicornis		1		r
Margarinotus carbonarius	2			r
Melandryidae	1			r
Meligethes aeneus			1	r
Meloe proscarabeus	1			r
Meloe violaceus	3	2		r
Mesosa curculionoides			1	r
Mocyta fungi			1	r
Nicrophorus vespillo	1	2		r

Appendix B continued

	Inside	Inside-edge	Edge	Status
Nothiophylus rufipes		2	5	E
Omalium rivulare	1	1	4	E
Onthophagus coenobita	1	9		IE
Onthophagus nutans		5	1	IE
Ontholestes haroldi		1	19	E
Otiorhynchus ligustici	1	3	1	r
Otiorhynchus raucus	1	20	2	IE
Ouchaemus caesareus		3	3	IE-E
Philonthus laminatus		1		r
Philontus proximus			1	r
Phosphuga atrata	1	2	1	r
Platarea dubiosa	11	4	1	I
Platydracus chalcocephalus	48	79	14	IE
Podoxya vicina	2			r
Polydrusus pterygomalis			1	r
Pseudocypus mus		3		r
Pterostichus anthracinus			1	r
Pterostichus oblongopunctatus	1			r
Ptomaphagus sericatus			1	r
Rhagonycha sp.	2			r
Rugilus rufipes		1	4	r
Salpingus ruficollis		1		r
Scaphidema metallicum		1	1	r
Sepedophilus marshami			2	r
Sitona hispidulus	1			r
Sitona sp.		3		r
Stenomax aeneus		1		r
Tachyporus sp.		1		r
Tasgius pedator			1	r
Trox sabulosus		2		r
Trypocopris vernalis		6		IE
Valgus haemipterus		1		r

Acta Zoologica Academiae Scientiarum Hungaricae 40 (1), pp. 15-19, 1994

NEW GRANULOPPIIDAE (ACARI: ORIBATEI, OPPIOIDEA) FROM COSTA RICA

P. BALOGH

Department of Zoosystematics and Ecology
Loránd Eötvös University
H-1088 Budapest, Puskin u. 3, Hungary

A new genus, *Bornemiszaella*, is established. Three new species are described. With 9 figures. Three new species are described. With 9 figures.

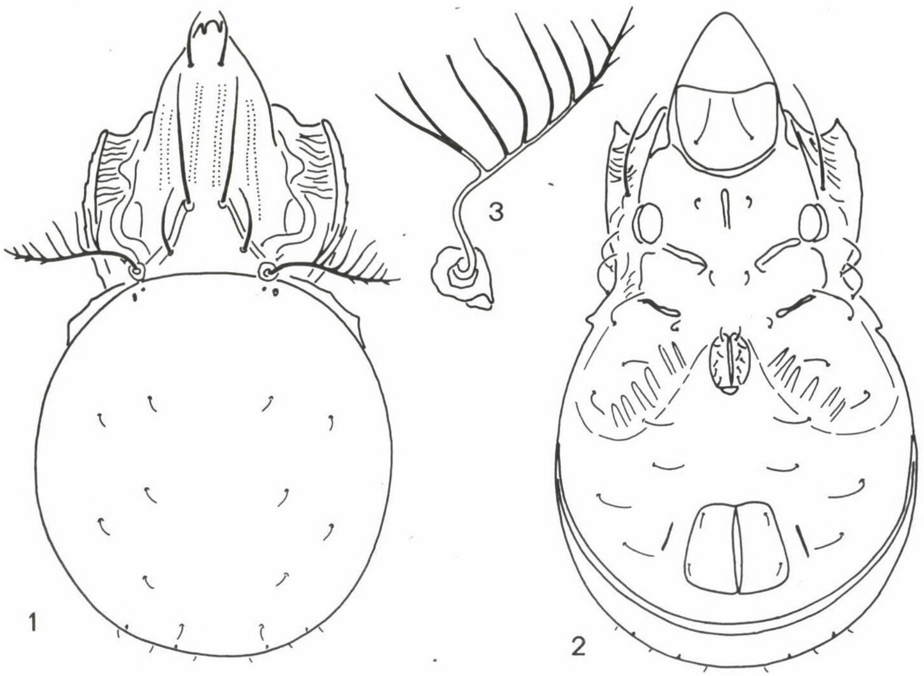
Key words: Oribatida, Granuloppiidae, Costa Rica, Bornemiszaella

In 1992 Dr. J. BALOGH visited Costa Rica with the purpose of carrying out talks with Costa Rican scientists about possible collaboration between Costa Rican and Hungarian zoologists. During the visit the opportunity to carry out soil-zoological field work arose. Costa Rica is especially important since over one thousand species of oribatids have been described from the Neotropical Region, yet this country remains large unexplored in this respect. The very rich material collected during the course of this trip is under study and several publications are expected to result from this work. It this paper a new genus and its three species are described. The newly described genus is the first representative of the family Granuloppiidae in the Neotropical Region and throws new light on the phylogenetic relationships of the family. The author names the new genus in honour of the Costa Rican Academy of Sciences formed in 1992, whose president is Dr. ELEMÉR BORNEMISZA, and the new species are named after outstanding Costa Rican agronomist.

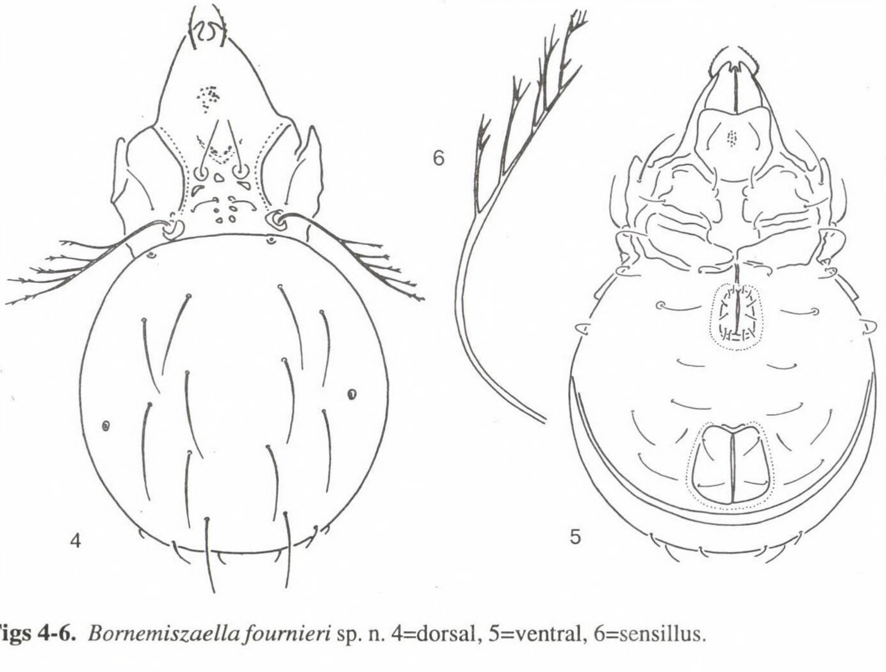
Bornemiszaella gen. nov.

Fam. Granuloppidae. Notogaster with well-developed setae; setae *ta* represented only by their alveoli. Genital plates with 6 pairs of setae. Setae ad_1 in adanal position and far from anal plates. Setae ad_3 in preanal position. Apodemata IV absent. Pedotecta I large. Rostrum incised. Lamellar setae much nearer to interlamellar setae than to rostral setae. Costula short. Sensillus pectinate; brnaches on the distal half usually bifurcate or with some setae. Fissurae *iad* very long and far from anal plates. Anal setae originating near to exterior margin of anal plates.

Type species: *Bornemiszaella fournieri* spec. nov.



Figs 1-3. *Bornemiszaella salasi* sp. n. 1=dorsal, 2=ventral, 3=sensillus.



Figs 4-6. *Bornemiszaella fournieri* sp. n. 4=dorsal, 5=ventral, 6=sensillus.

Bornemiszaella fournieri sp. n.
(Figs 1-3)

Length: 402-443 μm; width 242-250 μm. Colour: light brown.

Prodorsum: Sensillus pectinate, long; with four long branches. Distal part of branches with 2-4 short setae. Interlamellar setae short, fine. Lamellar setae about twice longer than interlamellar setae; each surrounded with a large circle. Extrabothridial setae very long, longer than lamellar setae. Rostral setae shorter and thicker than lamellar setae, their exterior margin sparsely ciliate. Costulae first almost parallel, then exteriorad and anteriorad directed. There are 9 small tuberculi in the interlamellar area.

Notogaster: almost circular. Setae *ta* represented only by their alveoli. Seven pairs of notogastral setae long: three pairs in postero-marginal position very short.

Ventral side: some epimeral setae (*1c*, *3c*, *4c*) longer than remaining ones. Aggenital, adanal and anal setae much longer than genital setae.

Material examined: Costa Rica, Parque Nacional "La Selva", 14 January, 1992. Very thin and wet rainforest litter, one holotype, four paratypes, Balogh collection, Budapest. Dedicated to Professor LUIS ALBERTO FOURNIER, member of the Costa Rican Academy of Sciences, Escuela de Biología, Universidad de Costa Rica, San José.

Bornemiszaella salasi sp. n.
(Figs 4-6)

Length: 410-426 μm, width 230-246 μm. Colour: light brown.

Prodorsum: sensillus pectinate, but not very long; with 7 simple (neither bifurcate nor ciliate) branches. Opposite of branches on the distal half of sensillus 3-4 short ciliae. Interlamellar setae medium long, arched, smooth. Lamellar setae very long, as long as sensillus, directed anteriad, almost touching the alveoli of rostral setae. Rostral setae smooth, shorter than interlamellar setae. Exobothridial setae very small. Costulae converging, connecting bothridium and lamellar seta. Interlamellar area smooth. Pedotecta I very large, much longer than half length of prodorsum. There is a foramen between the interlamellar area and pedotecta I.

Notogaster: almost circular. Setae *ta* represented only with their alveoli. Nine pairs of very short and fine notogastral setae.

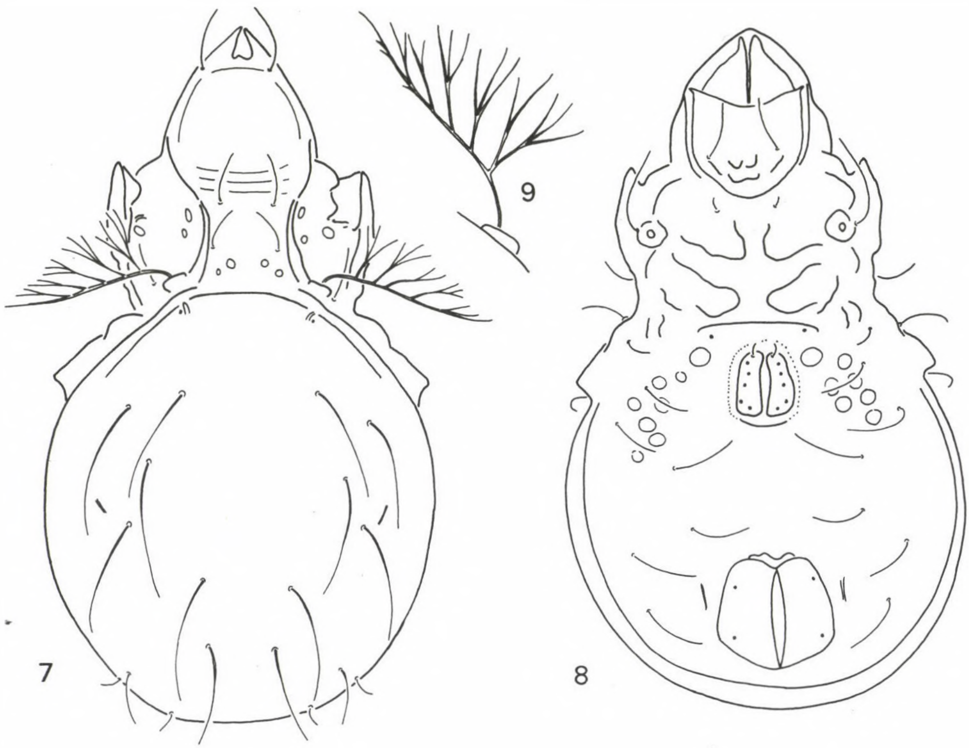
Ventral side: some epimeral setae (*3c*, *4c*) longer, setae *c1* abnormally long, longer than anal plates. Genital and anal setae very short, aggenital and adanal setae much longer.

Material examined: Costa Rica, Parque Nacional "La Selva", 14 January, 1992. Decomposing litter, roots and humus. One holotype, four paratypes are deposited in the BALOGH collection, Budapest. Dedicated to Professor LUIS ANGEL SALAS, Universidad de Costa Rica, San José.

Bornemiszaella ramirezi sp. n.
(Figs 7-9)

Length: 299-324 μm; width 168-172 μm. Colour light brown.

Prodorsum: sensillus pectinate, long with 5-6 bifurcate or trifurcate branches. Interlamellar, lamellar, exobothridial and rostral setae medium long, fine; rostral and exobothridial setae sometimes a little longer. Costulae arched, diverging; connecting bothridium and prodorsum margin. Pedotecta I large, as long as half length of prodorsum. Interlamellar area with two, pedotecta I with three pairs of foveolae.



Figs 7-9. *Bornemiszaella ramirezi* sp. n. 7=dorsal, 8=ventral, 9=sensillus.

Notogaster: almost circular. Setae *te* represented only by their alveoli. Six pairs of long, one pair of medium-long, two short and fine notogastral setae.

Ventral side: epimeral setae *1c* very long; the remaining epimeral setae, the aggenital and adanal setae medium long or short.

Material examined: Costa Rica, Sierra de la Muerte, lower montane wet forest, 1800 m a.s.l., La Gloria, 24 January, 1992. Litter and decaying leaves. One holotype, five paratypes, Balogh collection, Budapest. Dedicated to Professor WILLIAM RAMIREZ, member of the Costa Rican Academy of Sciences, director of the Museo de Entomología, Universidad de Costa Rica, San José.

DISCUSSION

The family Granuloppiidae BALOGH, 1983 was hitherto known to consist of two genera. Two species and further two subspecies of the genus *Granuloppia* BALOGH, 1958 occur in the Ethiopian Region, more precisely, in West Africa, four species of *Senectoppia* AOKI, 1977 inhabit the Oriental Region, that is, Japan, Indonesia and Malaysia. In the Neotropical Region the family is represented by the three newly described species. The sensillus of the first two genera is essientially similarly constructed, setiform, whereas that of *Bornemiszaella* is remarkably reminiscent of the pectinate sensillus of the also neotropical genus *Sternoppia*. The position of the adanal and aggenital setae in the families Granuloppiidae and Sternoppiidae is similar and of the same type is the ventral setation of the family Teratoppiidae. Judging from the material prepared for examination from the Costa Rican Berlese samples, in all probability several more species of the genus *Bornemiszaella* will come to light.

REFERENCES

BALOGH, J. (1972) *The Oribatid genera of the world*. Akadémiai Kiadó, Budapest, 188 pp., 71 pls.

BALOGH, J. & BALOGH, P. (1992) *The Oribatid mite genera of the world*. Hungarian Natural History Museum, Budapest, Vols 1-2, 263 pp. + 375 pp., 371 pls.

Received November 1, 1993; accepted December 1, 1993

Acta Zoologica Academiaea Scientiarum Hungaricae 40 (1), pp. 21-27, 1994

NEW TAXA OF THE GENUS ORTHOSIA OCHSENHEIMER, 1816 (s.l.) III. (LEPIDOPTERA, NOCTUIDAE)

M. HREBLAY and J. PLANTE

H-2030 Érd, Somfa u. 15, Hungary
2, Rue des Prés de la Scie, CH-1920 Martigny, Switzerland

Descriptions of *Orthosia* (*Orthosia*) *faqiri* sp. n., *O.* (*O.*) *feda* sp. n., from North Pakistan and *O.* (*O.*) *reshoefti* from Afghanistan. With 20 figures.

Key words: Orthosia, Palaearctic, taxonomy

INTRODUCTION

The centre of the distribution of the genus *Orthosia* OCHSENHEIMER, 1816 is the eastern and south-eastern parts of Asia, though several species occur in other territories of the Holarctic region.

A series of new *Orthosia* species had recently been described from Asia (SUGI, 1982, 1984, 1986, KONONENKO, 1988, HACKER et al., 1988, YOSHIMOTO, 1993, HREBLAY, 1991, 1993). The new discoveries reveal the fact that the late autumnal-early spring fauna of these regions is less explored. Presumably many new *Orthosia* taxa will be found and described in the next years from various parts of Asia.

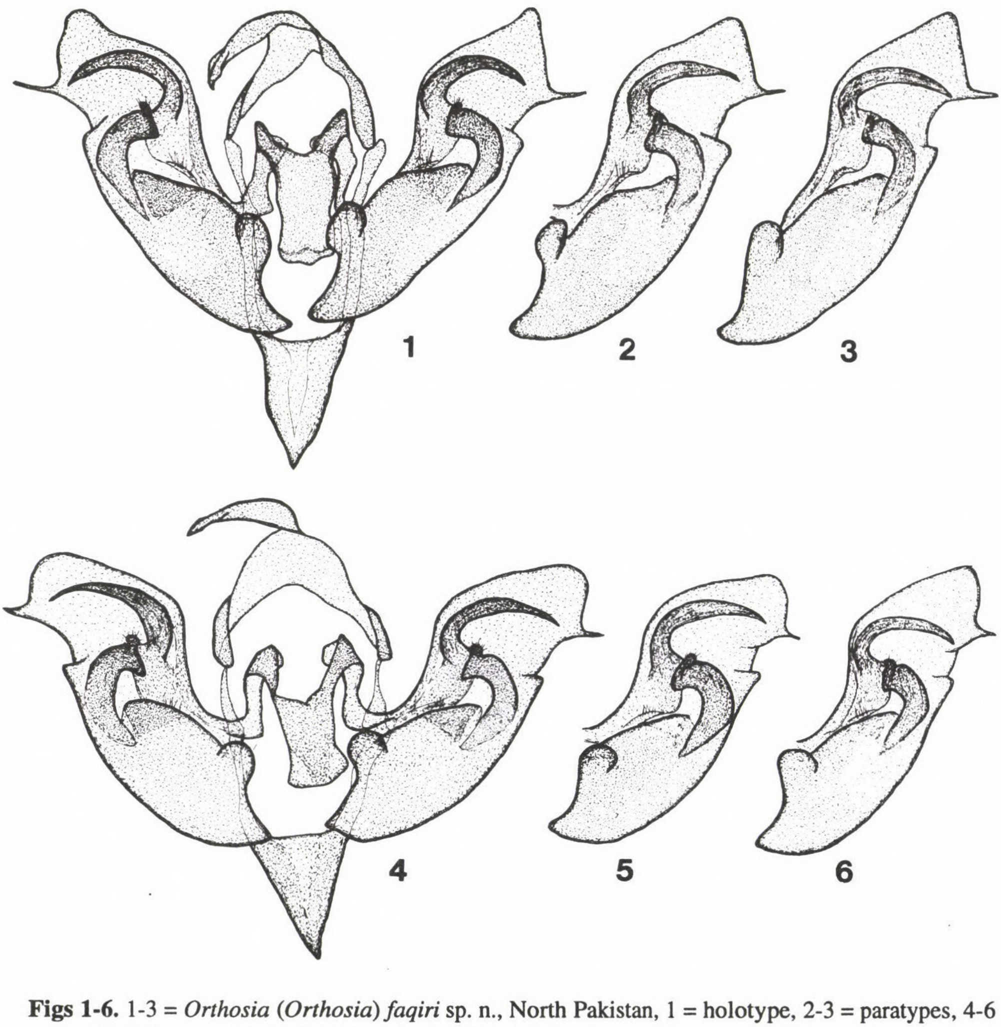
The *incerta*-group has a Holarctic area, the majority of the taxa is rather stenochorous, occurring mostly in the eastern confines of Asia. The only European species of the group is *incerta* (HUFNAGEL 1766), which is one of the most widespread members of the genus *Orthosia* (s. l.).

THE PALAEARCTIC TAXA OF THE INCERTA SPECIES-GROUP

Orthosia incerta (HUFNAGEL, 1766)
O. picata (BANG-HAAS, 1912)
O. faqiri HREBLAY & PLANTE sp. n.
O. feda HREBLAY & PLANTE sp. n.
O. reshoefti HREBLAY sp. n.
O. ariuna HREBLAY, 1991
O. evanida (BUTLER, 1879)
O. perfusca SUGI, 1986 (Taiwan)
O. aoyamensis (MATSUMURA, 1926)

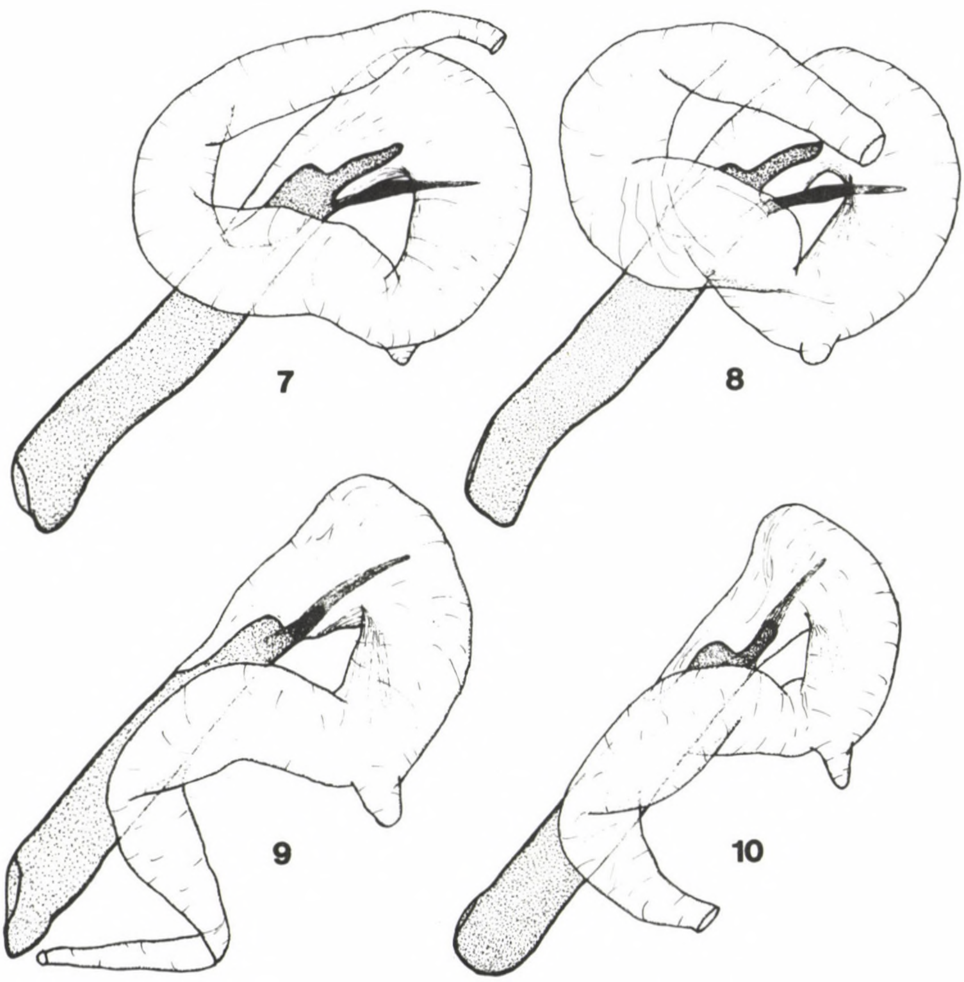
TAXONOMY

The species of the incerta-group are very similar externally and resembling also some other species of the *Orthosia* subgenus. The species group can be separated from the other species groups of the subgenus *Orthosia* by some features of the male and female genitalia which are as follows: the typical form of the valva, the less developed corona consisting of short, minute bristles, the arcuate basis of the harpe, which has a very small, thin extension. The ampulla is big, curved, strong, the carina has a long, acute thorn. The vesica is tubular, recurved,



Figs 1-6. 1-3 = *Orthosia* (*Orthosia*) *faqiri* sp. n., North Pakistan, 1 = holotype, 2-3 = paratypes, 4-6 = *O.* (*O.*) *feda* sp. n., North Pakistan, 4 = holotype, 5-6 = paratypes.

having a small diverticulum at middle. The specific differences can be found in the form and size of the cucullus, the size and the direction of the thorn of the vesica. The female genitalia are characterized by the well-developed ostium, its shape is a good key feature for the separation of the species. The ductus bursae is long, bearing long, sclerotized crests. Corpus bursae membranous with four long, ribbon-like signa. Apex bursae less sclerotized, its distal part recurved.



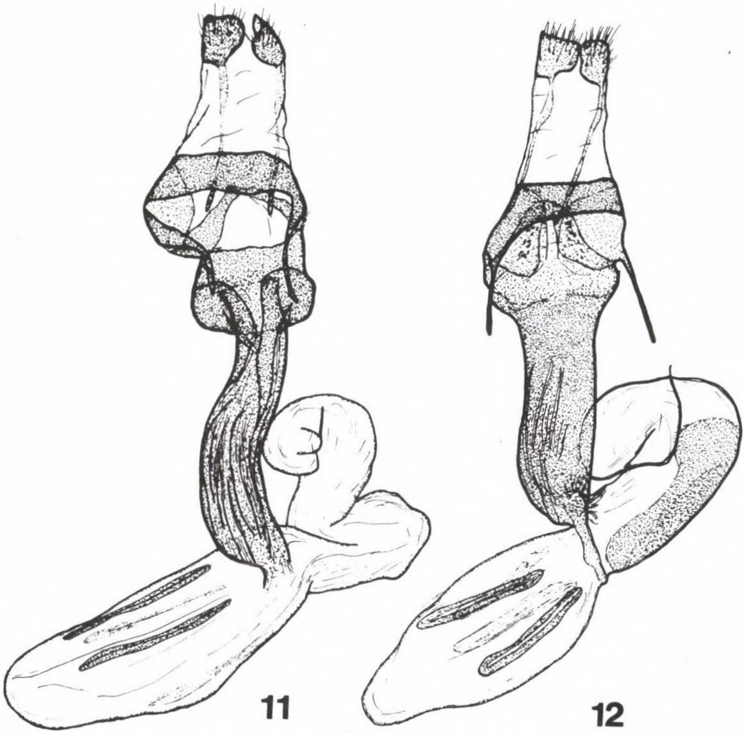
Figs 7-10. 7-8 = *Orthosia* (*Orthosia*) *faqiri* sp. n., North Pakistan, 7 = holotype, 8 = paratypes, 9-10 = *O.* (*O.*) *feda* sp. n., North Pakistan, 9 = holotype, 10 = paratypes.

Orthosia (Orthosia) faqiri HREBLAY & PLANTE sp. n. (Figs 1-3, 7-8, 11, 13-15)

Holotype: male, "NW-Pakistan, Kalam, 3000 m, 35°31'N, 72°36'E, 25-26.V.1992, leg.: M. HREBLAY, G. CSORBA", slide No. 3303 HREBLAY, (coll. M. HREBLAY).

Paratypes: 2 males, NW-Pakistan, Kalam, 3000 m, 35°31'N, 72°36'E, 25-26.V.1992, leg.: M. HREBLAY, G. CSORBA, slide Nos 3338, 3339 HREBLAY, (coll. M. HREBLAY et J. PLANTE); 1 female, NW-Pakistan, Prov. Swat, Madyan, 1400 m, 35°70'N, 71°90'E, 12.VI.1972, slide No. 3085 HREBLAY, (leg. et coll. E. VARTIAN).

External morphology: Wingspan 36-40 mm (males), 44 mm (female). Body and fore wings ash-grey, palpi and base of eyes black(ish). Reniform encircled with whitish, its centre somewhat darker below. Orbicular elliptical, less discernible; claviform absent. Postmedial line sinuous, subterminal line more or less straight, whitish, defined by grey-brown at apex, between veins m_1-m_3 and at tornus. Medial line diffuse, wide, somewhat darker than ground colour. Terminal line whitish-ochreous, cilia greyish. Hindwing relatively dark, whitish suffused by brownish grey, veins and discal spot well marked; cilia whitish-grey. Underside of wings scarcely irrorated by brown-grey scales, discal spots and upper part of transverse line clearly visible.



Figs 11-12. 11 = *Orthosia* (*Orthosia*) *faqiri* sp. n., North Pakistan, paratype, 12 = *O.* (*O.*) *reshoefti* sp. n., Afghanistan, holotype.

Male genitalia: Uncus slightly scaphoidal, tegumen narrow. Apical arms of fultura inferior sclerotized, vinculum pointed. Sacculus long, sclerotized, clavus rounded. Valva with apex pointed, cucullus short, almost rectangular. Pollex small, slender, directed to ventral margin of valva in a right angle, shape and sclerotization of harpe and ampulla are typical for the group. Aedeagus cylindrical, long, straight, thorn of carina not reaching over the curve of vesica, rather strongly diverging out from aedeagus (Figs 1-3, 7-8).

Female genitalia: Ovipositor weakly sclerotized, gonapophyses long and thin. Ostium bursae well developed with proximal part quadrangular, ductus bursae long, strongly sclerotized. Apex bursae weak, recurved distally; a big diverticulum originating at base of cervix. Corpus bursae membranous, sacculiform, with four long, ribbon-like signa (Fig. 11).

Diagnosis: The external appearance of the members of this group are more or less the same, but *O. faqiri* has a characteristic ash-greyish ground colour of the fore wings and a relatively strong darker suffusion of the hind wing; these features can be used for the separation of *O. faqiri* from *O. ariuna* and *O. picata*.

The distinctive genital characters are the following: in males the uncus of *O. faqiri* is smaller, narrower than that of *O. incerta* but larger than those of *O. picata* and *O. ariuna*. The valvae of the new species are larger with the clavus more developed than in any other species of the group. The basal part of the pollex is narrower than those of the related taxa, its distal extension is directed almost in a right angle with the ventral margin. The thorn of the carina does not reach over the recurving tube of the vesica as in *O. incerta* and *O. picata*, its direction, as compared with that of *O. ariuna*, is different. The female genitalia of *O. faqiri* differ from those of *O. incerta* and *O. picata* by its quadrangular ostium, from *O. ariuna* by its shorter apex bursae and longer signa.

The new species is dedicated to Mr. FAQIR SHAH (Islamabad), who helped in the organization, and suggested the route of the expedition to the Karakoram-Himalaya region in 1992.

Orthosia (Orthosia) feda HREBLAY & PLANTE sp. n.
(Figs 4-6, 9-10, 16-18)

Holotype: male, "N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, 5.VI.1992, leg. M. HREBLAY et G. CSORBA", slide No. 3305 HREBLAY, (coll. M. HREBLAY).

Paratypes: 2 males, N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, 5.VI.1992, leg. M. HREBLAY et G. CSORBA, slide Nos 3387, 3393 HREBLAY, (coll. M. HREBLAY et J. PLANTE).

External morphology: Wingspan 36-38 mm (males). Body and fore wings ash-grey, reniform and the orbicular encircled with darker scales and filled with ground colour; claviform absent. Postmedial line sinuous, subterminal line whitish, defined by grey-brown at tornus. Medial line diffuse, wide, somewhat darker than ground colour, terminal line whitish-ochreous; cilia greyish. Hindwing relatively dark: whitish suffused by brownish grey, veins and discal spot pale but visible; cilia whitish grey. Underside of wings scarcely irrorated by brown-grey scales, discal spots small, well discernible, transverse lines diffuse (Figs 16-18).

Male genitalia: Uncus slightly scaphoidal, tegumen narrow. Apical arms of fultura inferior sclerotized, vinculum pointed. Sacculus long, sclerotized, clavus rounded. Valva with apex rounded, cucullus short, corona represented by some fine, short bristles at apical part. Pollex small, tapering, standing at a right angle on the ventral margin. Ampulla large, strong, arcuate, its base enlarged. Basal part of harpe curved, strong, its distal extension very small. Aedeagus long, straight, carina well developed, its apical thorn does not overreach the tube of vesica and directed in the axis of the aedeagus. Vesica recurved at proximal third, medial part bearing a small diverticulum (Figs 4-6, 9-10).

Diagnosis: The new species is closely related to *O. faqiri*, differing externally by its less darkened hind wing with paler veins and smaller discal spot; the differences, compared with the other species of the *incerta*-group are the same as those of *O. faqiri*.

The male genitàlia of *O. feda* are similar to those of *O. faqiri* but the valva is slightly larger, the cucullus is rounded, the pollex is smaller and the vinculum is shorter. The thorn of the carina of *O. feda* has the same direction as the axis of aedeagus and not angled laterally as in *O. faqiri*.

Orthosia reshoefti HREBLAY sp. n.
(Figs 12, 19-20)

Holotype: female, "Afghanistan, Dare Porandey, 2400 m, 15.V.1974, leg Dr. RESHÖFT", slide No. 5417 HREBLAY, (coll. M. HREBLAY).

External morphology: Wingspan 37 mm. Ground colour of body and fore wings brown-grey, palpi and basal ring of eyes black. Reniform outlined with whitish and filled with dark grey-brownish, orbicular lighter greyish, claviform absent. Postmedial line sinuous, darker brownish, subterminal line straight, light whitish-ochreous, defined by darker patches at apex and at tornus. Terminal line comprising a row of dark brown spots, cilia somewhat darker than ground colour of the wing. Hind wing light, ochreous-white, veins rather pale, discal spot small, clearly visible; cilia milky whitish. Underside of wings ochreous-whitish with sparse blackish brown scales, basal area of fore wing irrorated by brown. Discal spots and transverse lines rather strong, cilia much darker than on upperside.

Female genitalia: Ovipositor weakly sclerotized, gonapophyses long, thin. Proximal part of ostium bursae dilated caudally with a calyciform distal part. Ductus bursae long, strongly sclerotized. Apex bursae membranous, conical, recurved apically, its basal third with a long, sclerotized zone. Corpus bursae saccular, with four long signa (Fig. 12).

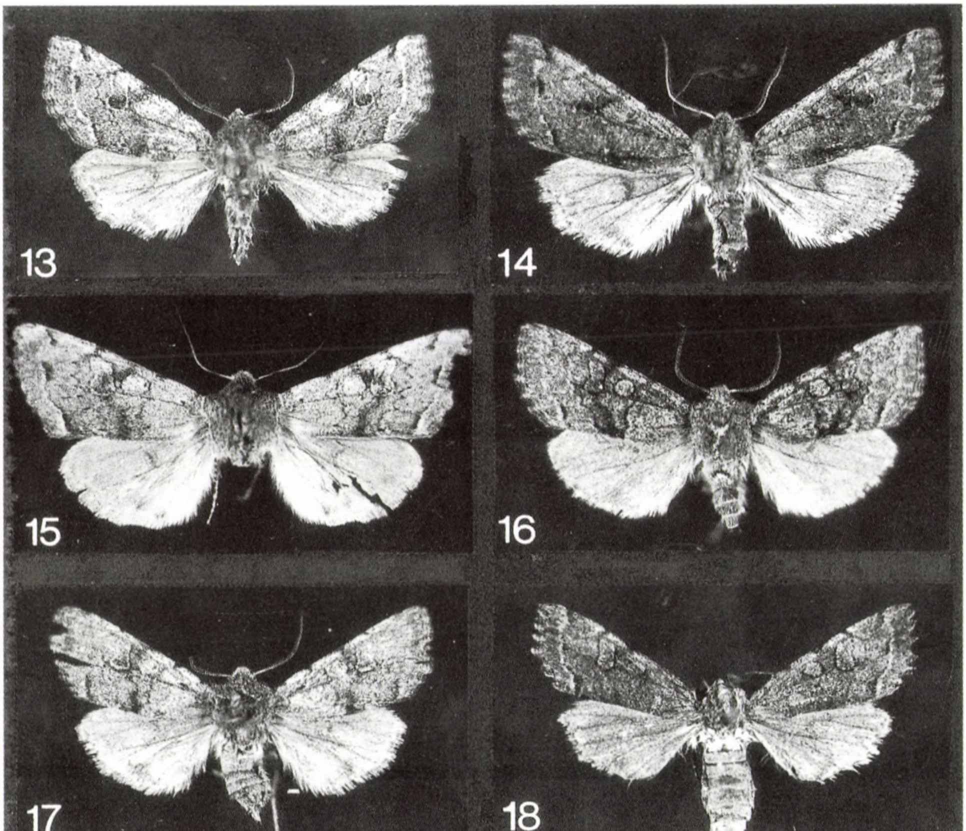
Diagnosis: The new species strongly resembles externally to *O. picata*, especially in the hind wing colouration which is significantly darker in the other taxa of the species-group.

The female genitalia of *reshoefti* has the largest ductus bursae as compared with those of the related species and the shape of the ostium bursae is also unique within the group.

* * *

Acknowledgements – The authors would like to express their thanks to Ms. E. VARTIAN (Wien), Dr. M. HONEY (London), Dr. K. RESHÖFT (Kiel), for the loan of the important material including some types. We are indebted to Mr. FAQIR SHAH for his extensive help during the field work in Pakistan. Many thanks are due to Dr. L. RONKAY (Budapest) for the consultations and Mr. G. CSORBA and Mr. A. KEVE (Budapest) for the technical assistance while preparing the manuscript.

The research was supported by the OTKA Foundation (No. 3181).



Figs 13-20. 13 = *Orthosia* (*Orthosia*) *faqiri* sp. n. North Pakistan, holotype, 14 = *O. faqiri* sp. n. North Pakistan, paratype, male, 15 = *O. faqiri* sp. n. North Pakistan, paratype, female, 16 = *O.* (*O.*) *feda* sp. n. North Pakistan, holotype, 17-18 = *O. feda* sp. n. North Pakistan, paratypes, males. 19-20 = *O. reshoefti* sp. n. Afghanistan, holotype.

REFERENCES

BANG-HAAS, A. (1912) Neue oder wenig bekannte paläarktische Macrolepidopteren V. *Iris* **26**: 156-157.

HACKER, H., HUBER, K. & KUHNA, H. (1988) Achter Beitrag zur systematischen Erfassung der Noctuidae der Türkei. Beschreibung von sechs neuen Taxa und Notizen über bemerkenswerte Funde aus der neueren Aufsammlungen (Lepidoptera). *Atalanta* **18**: 339-369.

HAMPSON, G. F. (1894) *The fauna of British India including Ceylon and Burma. Moths.* vol. 1. Taylor and Francis, London, XXII, 609 pp.

HREBLAY, M. (1991) Neue Taxa aus der Gattung *Orthosia* Ochsenheimer, 1816 (s. l.) (Lepidoptera, Noctuidae) *Acta zool. hung.* **37**: 193-203.

HREBLAY, M. (1993) Neue Taxa aus der Gattung *Orthosia* Ochsenheimer, 1816 (s. l.) (Lepidoptera, Noctuidae) II. *Acta zool. hung.* **39**: 7-90.

KONONENKO, V. S. (1988) *Orthosia ussuriana* sp. n. (Lepidoptera, Noctuidae, Hadeninae) from the Primorye Territory, USSR. *Ann. Ent. Fennici* **54**: 103-105.

POOLE, R. W. (1989) *Lepidopterum Catalogus, Noctuidae.* I-III. Brill, Leiden etc., 1314 pp.

SUGI, S. (1982) Noctuidae. *In*: INOUE H. *et. al.*: *Moths of Japan. II.* Tokyo, Kodansha.

SUGI, S. (1984) A new species of *Orthosia* from Japan (Lepidoptera: Noctuidae). *Tyo to Ga, Osaka* **35**: 77-79.

SUGI, S. (1986) The Noctuidae of Taiwan 2. Genus *Orthosia* Ochsenheimer (Lepidoptera). *Ent. Pap. pres. Kurosawa,* Tokyo, pp. 98-105.

STAUDINGER, O. & REBEL, H. (1901) *Katalog der Lepidopteren des Palaearktischen Faunagebietes. I.* Friedlander und Sohn, Berlin, pp. 201-202.

SWINHOE, C. (1901) New genera and species of eastern and Australian moths. *Annals and Magazine of Natural History*, series 7, **7**: 489-501.

YOSHIMOTO, H. (1993) Moths of Nepal, Part II., Noctuidae. *Tinea* **13** (suppl. 3): 124-141.

Received November 2, 1993, accepted December 5, 1993

Acta Zoologica Academiae Scientiarum Hungaricae 40 (1), pp. 29-49, 1994

FURTHER NOTES, ADDITIONS AND REDESCRIPTIONS OF THE ORIBATID SPECIES PRESERVED IN THE BERLESE COLLECTION (ACARI, ORIBATIDA) I.

S. MAHUNKA

Zoological Department, Hungarian Natural History Museum
H-1088 Budapest, Baross utca 13, Hungary

Discussion of 25 Oribatid species preserved in the BERLESE Collection (Florence). Among them the statement of the up-to-date systematic position of 2 species, 9 new combinations, 1 new status and for 2 species the establishment of new genera (*Ovobates* gen. n. in the family Oribatulidae and *Italobates* gen. n. in the family Haplozetidae) are also given. With 27 original figures.

Key words: Acari, Oribatida, BERLESE Collection, taxonomy

INTRODUCTION

In my previous works (MAHUNKA, 1991, 1992) I outlined the reasons and the goals why I think it necessary to study the Oribatida specimens of the BERLESE Collection, and to give as much information on them as much the circumstances allow.

In this year I again had the opportunity to work in the BERLESE Collection within the frame of the agreement signed between the Hungarian Academy of Sciences and the CNR (Italy) and partly supported by OTKA (The Hungarian National Scientific Research Foundation, No. 3165). I enjoyed the help of Dr. M. CASTAGNOLI for which I should like to express my most heartfelt thanks.

Subsequently I discuss 25 species. Several of them are well known, many scholars studied these species thus their ranking is quite certain. However, specimens preserved in the BERLESE Collection have not been revised, at least as far as I know. I restated 25 species and established new combinations in 9 cases, while for 2 species I erected new genera.

In the present contribution I follow my work referred to above (MAHUNKA 1992) as well as those of NORTON & KETHLEY (1986) and/or MARSHALL, REEVES & NORTON (1987).

Table 1. Original and current combinations of the studied species

Protoribates (Scheloribates) incisura	= *Italobates incisura*
Micreremaeus subnitidus	= *Ovobates subnitidus*
Oribatula navicula	= ?*Heteroleius navicula*
Oribatula amlyptera	= *Oribatula amblyptera*
Oribatula exilis var. caliptera	= *Oribatula caliptera*
Oribatula tibialis var. sardoa	= *Oribatula tibialis sardoa*
Oribatula venusta	= *Oribatula venusta*
Oribatula caudata BERLESE, 1910	= *Sellnickia caudata* (MICHAEL, 1908)
Oribatula (Zygoribatula) angulata	= *Zygoribatula angulata*
Oribatula (Zygoribatula) arcuatissima	= *Zygoribatula arcuatissima*
Oribatula connexa	= *Zygoribatula connexa*
Oribatula (Zygoribatula) exarata	= *Zygoribatula exarata*
Oribatula (Zygoribatula) excavata	= *Zygoribatula excavata*
Oribatula (Zygoribatula) lineola	= *Zygoribatula exilis* (NICOLET, 1855)
Oribatula (Zygoribatula) socia	= *Zygoribatula socia*
Oribatula (Hemileius) proximus	= *Hemileius proximus*
Oribatula (Hemileius) scrobina	= *Hemileius scrobina*
Oribatula (Hemileius) sternalis	= *Hemileius sternalis*
Oribatula tibialis var. sicula	= *Siculobata sicula*
Oribatula (Hemileius) sicula var. platensis	= *Siculobata platensis*
Podoribates elamellatus	= *Rykella elamellata*
Podoribates latissimus	= *Annobonozetes latissimus*
Peloribates depilatus	= *Africoribates depilatus*
Peloribates glabratus	= *Africoribates glabratus*
Peloribates conspicuus	= ?*Ramsayellus conspicuus*

COMMENTS ON THE SURVEYED TAXA

1. New genera based on "BERLESE's species".

Italobates gen. n.

Diagnosis: Family Haplozetidae. Rostrum rounded. Lamellae strong, their distal part curved inwards like the short part of a translamella, cuspis absent, lamellar setae arising on the curved part. Prelamella present. Sensillus reclinate, setiform. Pteromorphae movable, but the junction between the notogaster and the pteromorpha is not visible anteriorly. Fourteen pairs of notogastral setae, 4 pairs of sacculi, one pair opening of the gland and the lyrifissures *iad* observable on the notogaster. Anogenital setal formula: 6 – 3 – 2 – 3. Lyrifissures *iad* in adanal position. All legs tridactylous.

Type species: *Protoribates* (*Scheloribates*) *incisura* BERLESE, 1916.

Remarks: On the basis of the anogenital setal complex the new taxon belongs to the relationships of the genera *Pilobates* BALOGH, 1960 and *Pilobatella* BALOGH et MAHUNKA, 1967. However, both genera have only one claw and the genus *Pilobatella* bears only ten pairs of notogastral setae.

Italobates incisura (BERLESE, 1916) comb. n.
(Figs 1-2)

Protoribates (Scheloribates) incisura BERLESE, 1916: 312. – *Protoribates (Scheloribates) incisura*: CASTAGNOLI & PEGAZZANO 1985: 194.

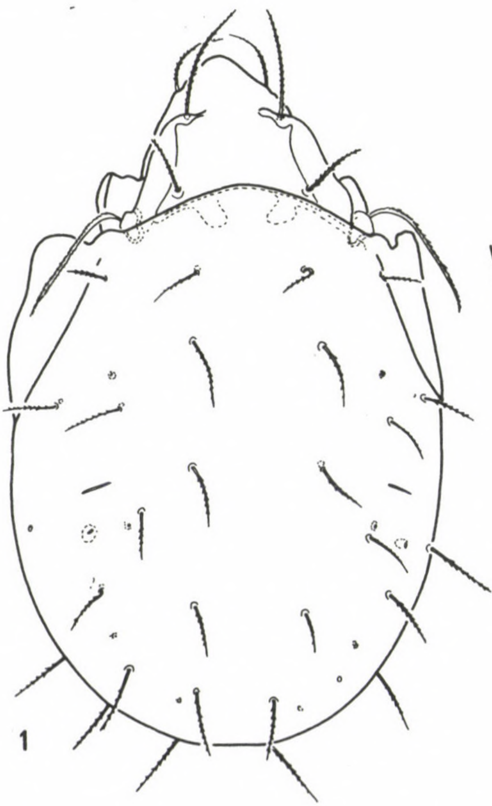
There are three slides (183/23, 183/24, 24bis) in the collection, one of them labelled "tipico". I follow BERLESE'S designation and regard the specimen in slide 183/23 as lectotype. Of course, on the basis of the number of slides the other two obviously belong to the type series.

Measurements: Length of body: 647 µm, width of body: 398 µm.

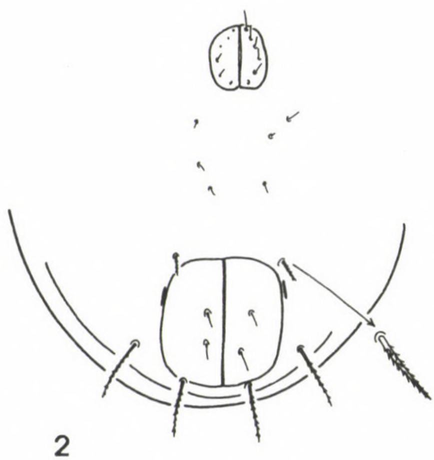
Prodorsum: Anterior part of lamellae characteristically dilated at the basis of the insertion of the lamellar setae. Among the prodorsal setae *le* longer than the others, *in* the shortest, all distinctly ciliate. Sensillus long, characteristically reclinate, its cilia arranged in two longitudinal rows.

Notogaster: Dorsosejugal suture convex. Anterior margin of pteromorphae with incisure. All notogastral setae rigid and ciliate, setae in the anterior part slightly shorter than the those in posteromarginal position. All 4 pairs of sacculi very small, hardly observable (Fig. 1).

Ventral regions: Genital setae minute, they arise in a longitudinal, curved row. These and the aggenital setae minute. Setae ad_1 and ad_2 much longer than ad_3 (Fig. 2), but all three pairs ciliate like the notogastral setae. Anal setae short and simple. Lyrifissures *iad* in adanal, setae ad_3 in preanal position.

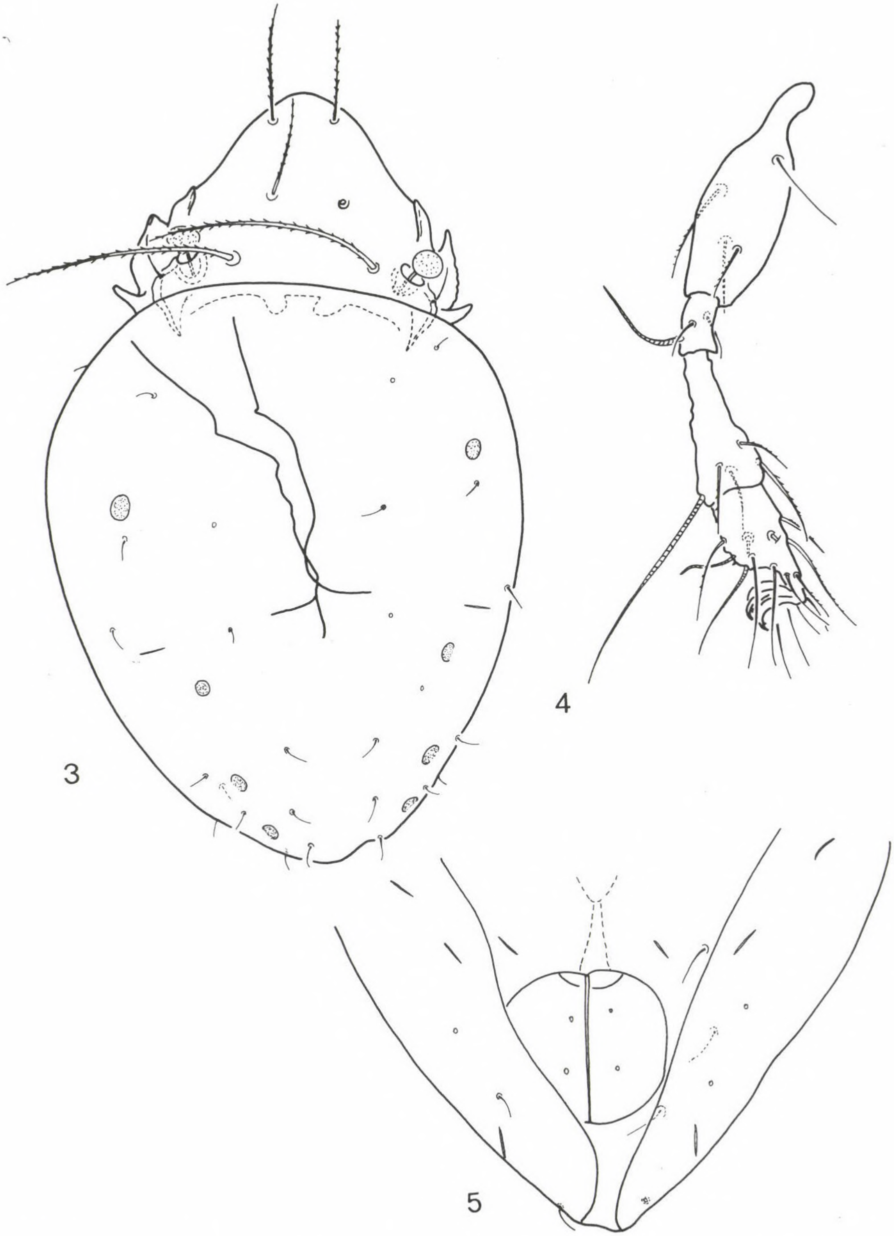


1



2

Figs 1-2. *Italobates incisura* (BERLESE, 1916) – 1: dorsal aspect, 2: anogenital region



Figs 3-5. *Ovobates subnitidus* (BERLESE, 1913) – 2: dorsal aspect, 4: leg I, 5: anal region

Ovobates gen. n.

Diagnosis: Family Oribatulidae. Rostrum rounded. Prodorsum without lamella and prelamella, a short lateral crest runs from the bothridium posteriorly, exobothridial seta arising on it. Bothridium open dorsally, not covered by a humeral tectum. Sensillus short, with capitate head. Dorsosejugal suture slightly convex, the humeral region rounded, pteromorpha absent. Four pairs of well developed areae porosae and 14 pairs of short and fine notogastral setae present. Epimeral setal formula: 3-1-2-2(!), anogenital setal formula: 4-1-2-3. Lyrifissures *iad* in preanal position. All legs tridactylous, claws large, equal in size. Tarsi shortened, legs setation reduced(!).

Type species: *Micreremaeus subnitidus* BERLESE, 1913.

Remarks: The relation of this taxon is rather problematic. It is well charactersied by the above mentioned characters, and some of them well correlated with the characters of the *Eporibatula* complex. However on the basis of the reduced legs setation, and firstly of the form of leg I the new taxon is distinguishable from the heretofore known related genera.

Ovobates subnitidus (BERLESE, 1913) comb. n.
(Figs 3-7)

Micreremus subnitidus BERLESE, 1913: 97. – *Micreremus subnitidus:* CASTAGNOLI & PEGAZZANO 1985: 402.

A good series of slides of this species is present in the collection. All slides contain the same species, but two of them (145/1 and 145/2) enclose an other oribatid species. Exepting one slide (144/50) all bear the designation "tipico". I designate the specimen in slide 150/1 as lectotype, the drawings were made partly after it.

Measurements. – Length of body: 390-414 µm, width of body: 234-242 µm.

Prodorsum: Inner surface completely smooth. All prodorsal setae well visible, setae *ro*, *le* and *in* arising on the prodorsal surface. Their basal part slightly lighter than their other parts. All setae well ciliated, setae *in* much stronger and longer than the others (Fig. 3) Exobothridial setae arising on the basal crest in the exobothridial region. This region granulated. Sensillus short, its head disitnctly spiculate.

Notogaster: Humeral region rounded, smooth. All 14 pairs of notogastral setae nearly equal in length and thickness. Among the form and size of porose area no characteristic difference exists. Lyrifissures *ih, ips* and *ip* present in normal position (Fig. 5).

Ventral regions (Fig. 6): Epimeral borders and apodemes are weakly developed, hardly observable. Epimeral setae conspicuously long, setae *1b, 3b* longer than the others, setae *1c* much shorter than *1a*. Setae in the anogenital region also short and well observable.

Legs: All claws of legs large, lateral claws with strong tooth ventrally. Tarsus of leg I (Fig. 4) shortened, w_2 of tibia I absent. Some dorsal wrinkles observable on tarsus IV (Fig. 7). Legs setal formulae:

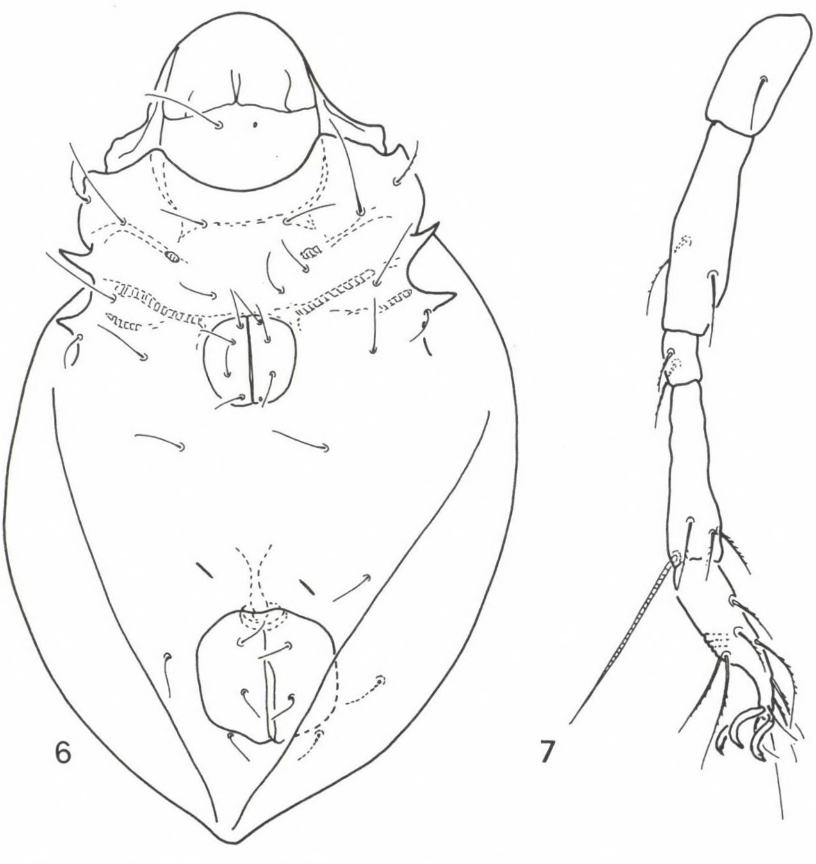
I: 1 – 4 – 2+1 – 4+1(!) – 13+2(?) – 3
III: 2 – 3 – 1+1 – 3+1 – 10 – 3
IV: 1– 2 – 2 – 3+1 – 10 – 3

2. BERLESE's "*Oribatula*" species

In the beginning the genus *Oribatula* BERLESE, 1895 was used by the author in very broad, later in much narrower sense. He divided himself the genus into some subgenera, today appear as valid genera.

Among the species, described by BERLESE, which was listed under the name *Oribatula* by CASTAGNOLI & PEGAZZANO (1985), *O. florens* BERLESE, 1908 was taken out earlier by NORTON & KETHLEY (1989) who established a new genus *Floribates* on this species.

Oribatula caudata BERLESE, 1910 and *O. navicula* BERLESE, 1913 do not belong to this genus, so today only *O. amblyptera, O. caliptera, O. sardoa* and *O. venusta* might be ranged to this genus. To distinguish these species from one another and from the *O. tibialis* (NICOLET, 1855) is very problematic and further investigations are necessary.



Figs 6-7. *Ovobates subnitidus* (BERLESE, 1913) – 6: ventral aspect, 7: leg IV

?**Heteroleius navicula** (BERLESE, 1913) comb. n.

Oribatula navicula BERLESE, 1913: 89. – *Oribatula navicula*: CASTAGNOLI & PEGAZZANO 1985: 269.

There are three slides in the collection, one of which (145/28) was designated by BERLESE as "tipico" and in this case I follow BERLESE's interpretation and consider it the holotype of this specimen. The position of this species is uncertain, it is sure that it does not belong to the relationship of the genus *Oribatula*. On the basis of its habitus and chaetotaxy I place it provisionally in the genus *Heteroleius* Balogh et Mahunka 1966.

Complementary morphological characters: Lamella well developed, lamellar setae arising on its slightly dilated distal end. Sensillus very short, with capitate head. Dorsosejugal suture uncertain, probably absent. Pteromorphae absent and no humeral tectum present. Three pairs of genital setae present. All legs tridactylous.

Oribatula amblyptera BERLESE, 1916
(Figs 8-9)

Oribatula amblyptera BERLESE, 1916: 317. – *Oribatula amblyptera*: CASTAGNOLI & PEGAZZANO 1985: 12.

There are six slides in the collection. Only 180/2 labelled as "tipico", and respecting BERLESE's declaration I consider it lectotype. Among the other slides 180/3, and 180/4 (duplicated) and all four contain the same species. They belong to the type series. Slide 14/25 contains a specimen of an other species. The figures were made after slide 180/2.

Complementary morphological characters: Rostrum conical. Lamellar cusp reaching over the insertion of the lamellar setae anteriorly (Fig. 9). Dorsosejugal suture strongly arched anteriorly. Pteromorph only hardly projecting from the outline of the notogaster (Fig. 8). Notogastral setae normal. All four pairs of porose area small, Ap_2 and Ap_3 located conspicuously near to each other.

Length of body: 302 µm, width of body: 195 µm.

Oribatula caliptera BERLESE, 1902
(Figs 10-11)

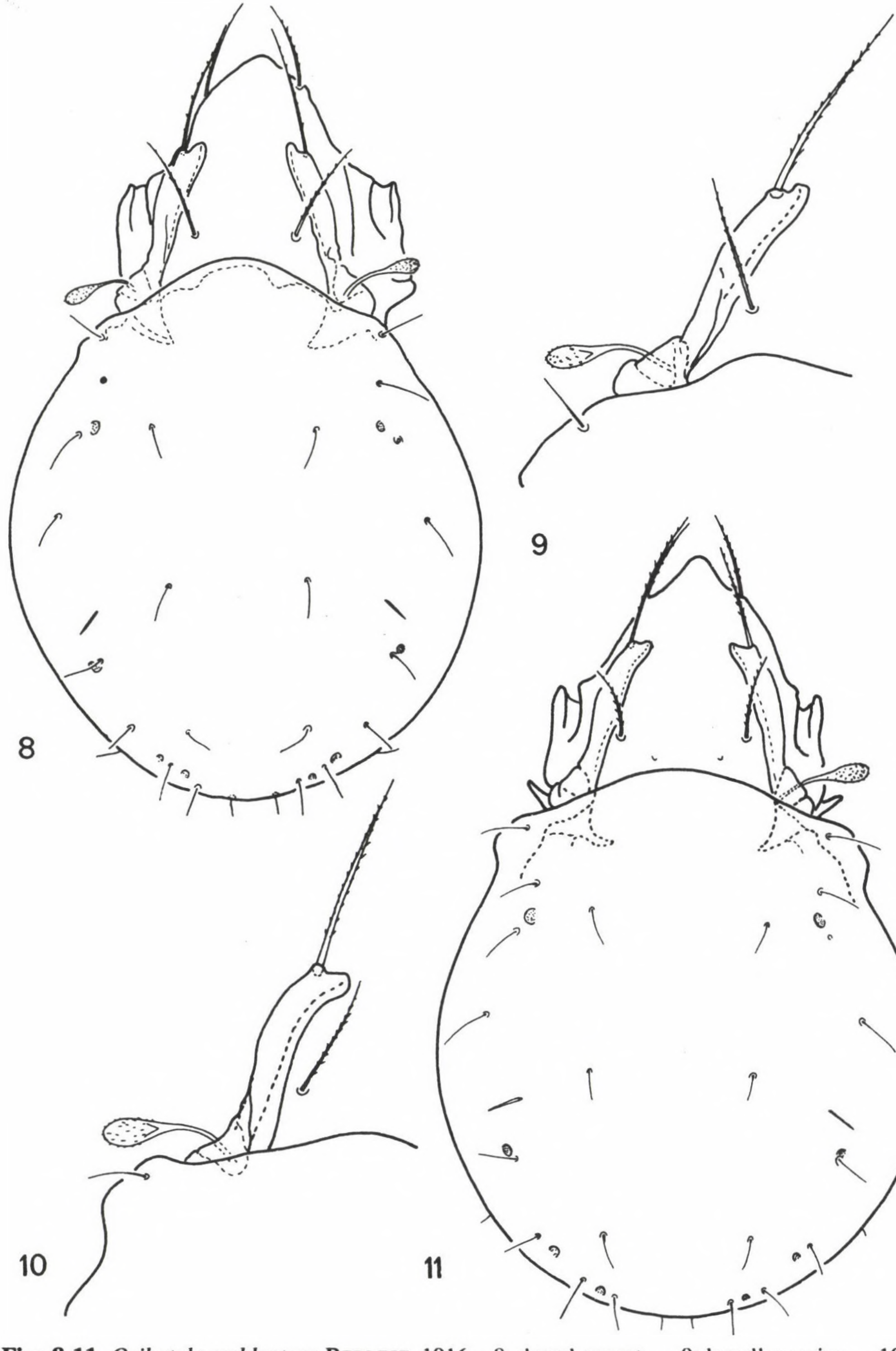
Oribatula exillis var. caliptera BERLESE, 1902: 698. – *Oribatula caliptera* CASTAGNOLI & PEGAZZANO 1985: 58. – *Oribatula caliptera*: F. BERNINI, A. M. AVANZATI & S. BERNINI 1987: 445.

There is a long series of this species in the collection, but only one slide (75/34) bearing "tipico". I have not seen all the slides enumerated in the CASTAGNOLI & PEGAZZANO's catalogue. The figure were made after slide 75/33.

Complementary morphological characters: Rostrum slightly elongated, nasiform. Lamellae blunt, their cusps directed medially, so this part seems to be truncate (Fig. 10). Well developed pteromorphae observable (Fig. 11) they are well protruding from the notogastral outline. Dorsosejugal suture normal, the notogastral setae very thin, hair-like. Four pairs of porose areas present, they are in normal position.

Length of body: 278-282 µm, width of body: 174-184 µm.

Remarks: These two species stand very near to each other, but on the basis of the characters mentioned in the complementary description they are distinguishable from each other. Both are well distinguishable from *O. tibialis* (NICOLET, 1855) by the measurements of the body.



Figs 8-11. *Oribatula amblyptera* BERLESE, 1916 – 8: dorsal aspect, – 9: lamellar region. – 10-11. *Oribatula caliptera* BERLESE, 1902 – 10: lamellar region, 11: dorsal aspect

Oribatula tibialis sardoa BERLESE, 1916

Oribatula tibialis var. *sardoa*: BERLESE, 1916: 317. – *Oribatula tibialis* var. *sardoa* CASTAGNOLI & PEGAZZANO 1985: 369.

The collection contains a single slide (180/11) with two specimen! They are syntypes. This variety is probably identical with *O. tibialis*.

Oribatula venusta BERLESE, 1908 (Fig. 12)

Oribatula venusta BERLESE, 1908: 8. – *Oribatula venusta*: CASTAGNOLI & PEGAZZANO 1985: 435.

A single specimen (17/22) from Norway is in the collection, labelled "tipico". It is considered to be the holotype by monotypy. This species is also very similar to *O. tibialis* (NICOLET, 1855), but some minor differences are observable.

Complementary morphological characters: Rostrum sligthly narrowed, lamellae wide, running marginally, comparatively straight. Lamellar cusps sligthly excavated (Fig. 12). Sensillus short, its head small. Small pteromorpha present, seta c_2 straight, spiniform, arising on it. The other notogastral setae curved, setiform.

Length of body: 562 μm, width of body: 367 μm.

Sellnickia caudata (MICHAEL, 1908)

Oribatula caudata BERLESE, 1910: 383 syn. n. *Oribatula caudata*: CASTAGNOLI & PEGAZZANO 1985: 67. – *Notaspis caudata* MICHAEL 1908: 139. – *Sellnickia heveae* OUDEMANS, 1927: 268. – *Sellnickia caudata:* Hammer 1966: 92. – *Sellnickia caudata*: LUXTON 1985: 66.

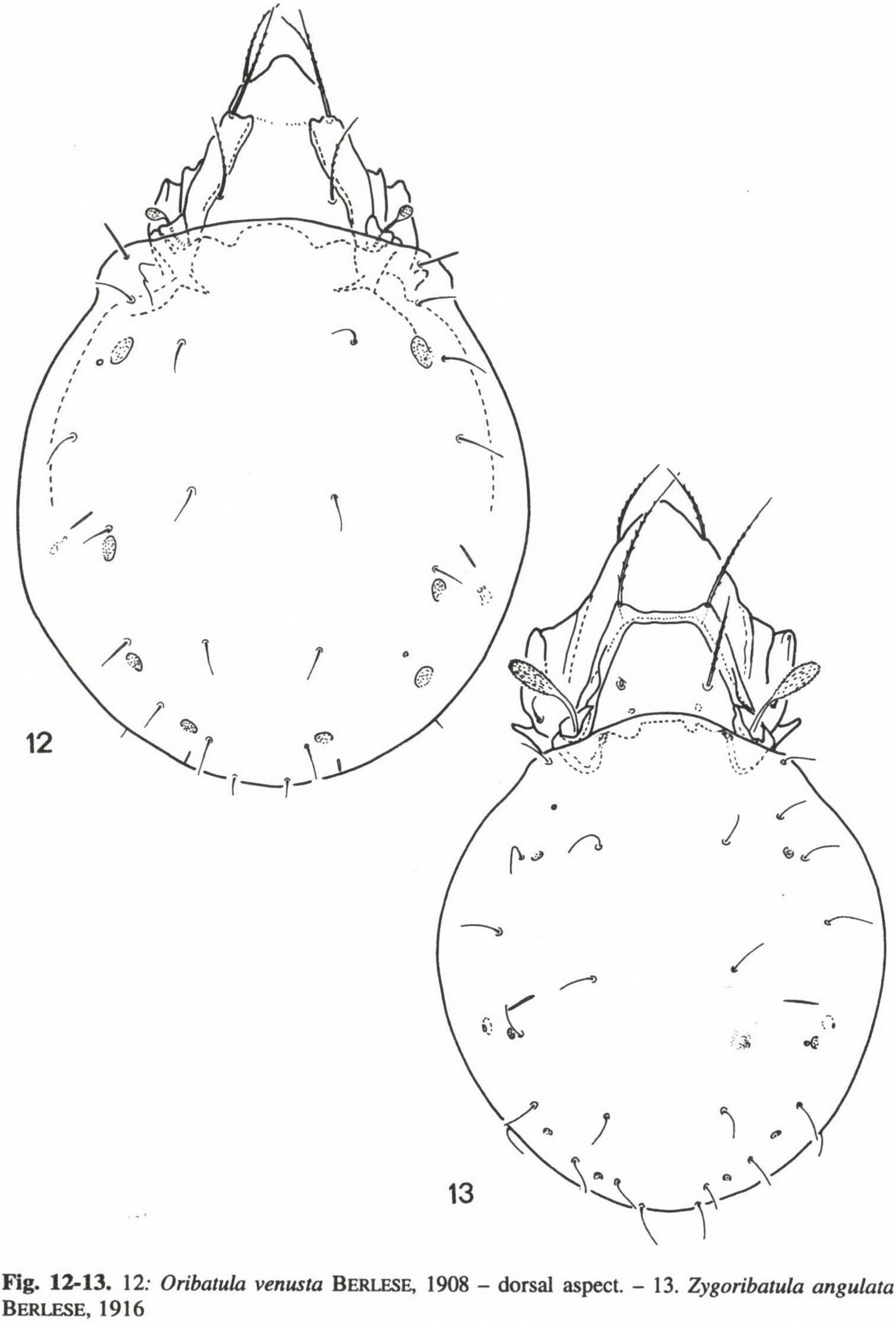
There is a long series of slides (101/1 – 101/13), all labelled "tipico". No doubt that this species is identical with MICHAEL's species therefore it is a junior subjective synonym and homonym of *Sellnickia caudata*.

Zygoribatula angulata (BERLESE, 1916)

Oribatula (Zygoribatula) angulata BERLESE, 1916: 319. – *Zygoribatula* cf. *angulata*: BERNINI 1973: 458. – *Oribatula (Zygoribatula) angulata*: CASTAGNOLI & PEGAZZANO 1985: 18 – *Zygoribatula glabra* (MICHAEL, 1890) sensu F. BERNINI, A. M. AVANZATI & S. BERNINI 1987: 446, a questionable senior synonymy.

There is a good series of this species in the collection. Two of them (202/16 and 180/25) labellled "tipico". I examined now also slides 180/23 and 180/28. Some of them are in good condition. I designate the specimen in slide 202/16 as lectotype.

Complementary morphological characters: Wide spread lamellar composition (Fig. 12), translamella narrowed medially, lamellar cusps well observable. Sensillus large, directed outwards. All notogastral setae fine, short, smooth. Porose areas small, all rounded.



12

13

Fig. 12-13. 12: *Oribatula venusta* BERLESE, 1908 – dorsal aspect. – 13. *Zygoribatula angulata* BERLESE, 1916

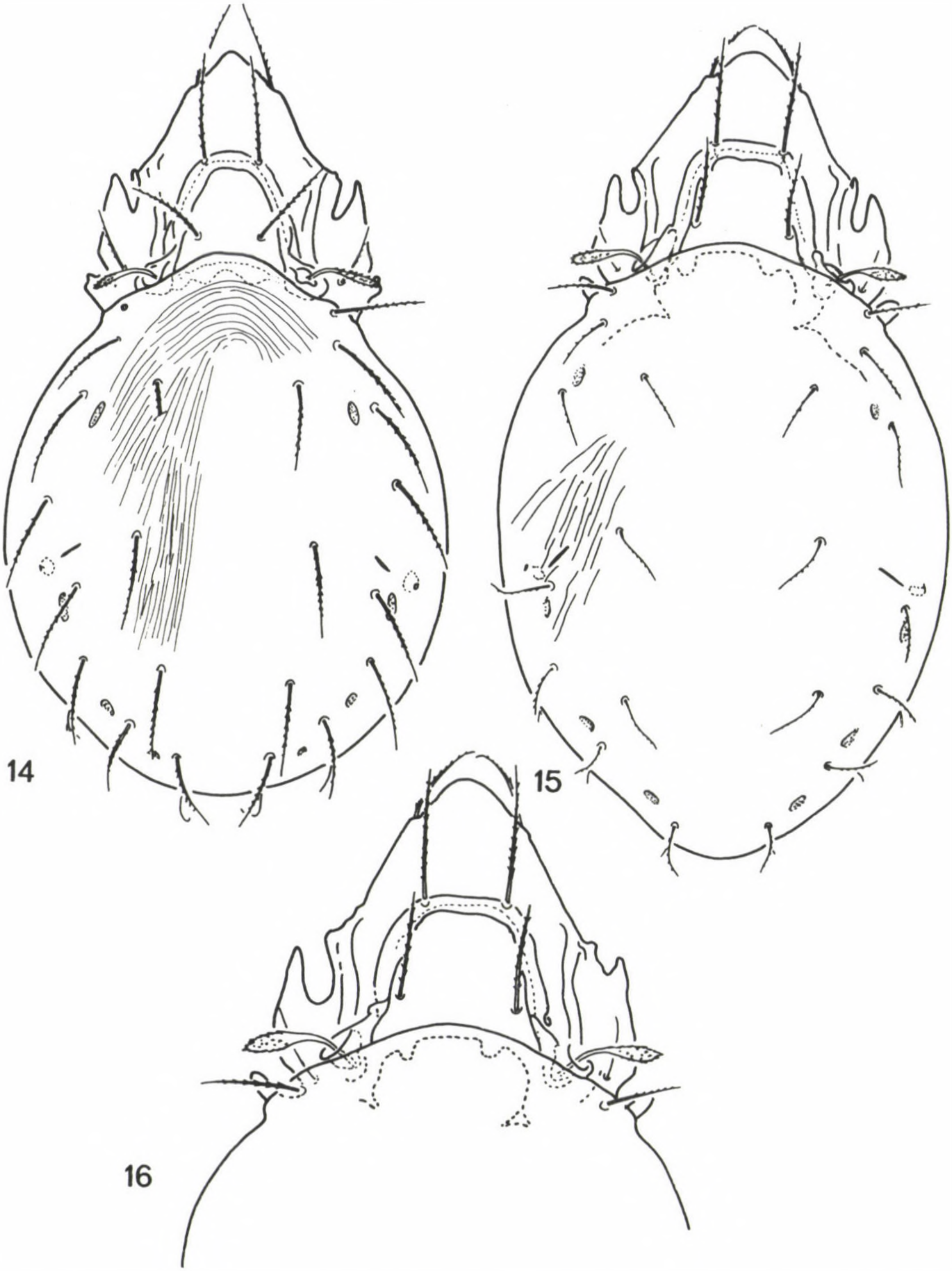


Fig. 14-16. 14: *Zygoribatula arcuatissima* BERLESE, 1916 – dorsal aspect. – 15-16. *Zygoribatula connexa* BERLESE, 1904 – 15: dorsal aspect, 16: prodorsum

Zygoribatula arcuatissima (BERLESE, 1916)
(Fig. 14)

Oribatula (Zygoribatula) arcuatissima BERLESE, 1916: 320. – *Oribatula (Zygoribatula) arcuatissima:* CASTAGNOLI and PEGAZZANO 1985: 22. – *Zygoribatula arcuatissima:* F. BERNINI, A. M. AVANZATI & S. BERNINI 1987: 446.

A single specimen (180/31) is present in the collection. It is considered the holotype by monotypy.

Complementary morphological characters: Lamellar formation comparatively narrow, lamellae and translamella compose an unbroken arch, translamella not narrowed, lamellar cusps absent (Fig. 14). Sensillus conspicuously narrow and short. Notogastral surface ornamented by very fine scratches. All notogastral setae long, well ciliate, humeral setae directed forwards, all the other backwards. Porose areas comparatively large, *Aa* and A_1 larger than the others.

Zygoribatula connexa (BERLESE, 1904)
(Figs 15-16)

Oribatula connexa BERLESE, 1904: 273. – *Oribatula (Zygoribatula) connexa*: BERLESE 1916: 317. – *Oribatula (Zygoribatula) connexa:* CASTAGNOLI & PEGAZZANO 1985: 85.

Only a single specimen in slide 14/25 exists in the collection labelled "tipico". It is the holotype by monotypy.

Complementary morphological characters: On the basis of some important characters this species is similar to *Z. arcuatissima*, however the lamellar formation is much wide spread, lamellar cusps also absent (Figs 15-16). Head of sensillus wider than by the preceding species, notogastral ornamentation consisting of stronger but sparse scratches. Notogastral setae shorter, but similarly well pilose. All porose areas are smaller.

Zygoribatula exarata (BERLESE, 1916)

Oribatula (Zygoribatula) exarata BERLESE, 1916: 318. – *Zygoribatula exarata*: PÉREZ-IÑIGO 1974: 374. – *Oribatula (Zygoribatula) exarata*: CASTAGNOLI & PEGAZZANO 1985: 135.

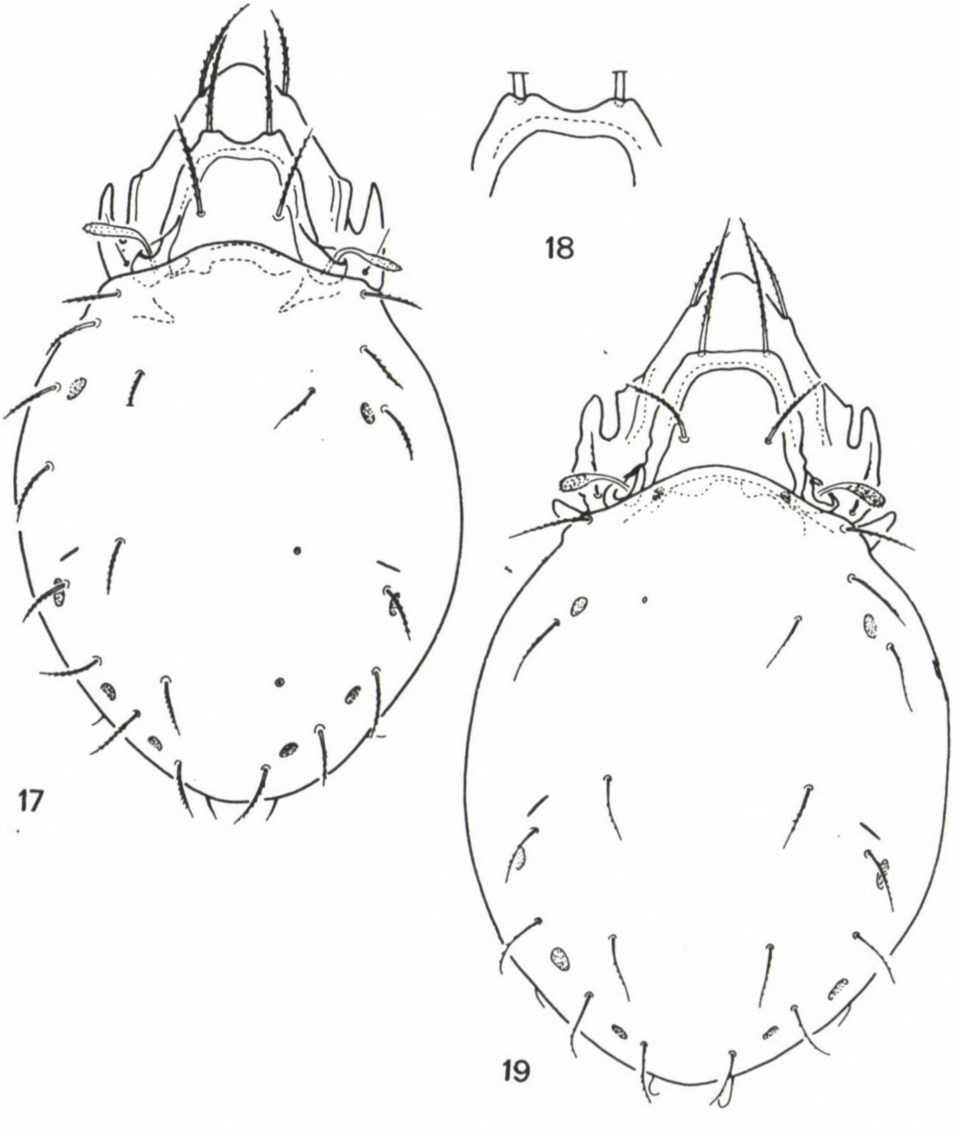
The single specimen in slide 180/19 labelled "tipico" is the holotype by monotypy. The species is well known, widely distributed in Central Europe and in the Mediterranean Region.

Zygoribatula excavata (BERLESE, 1916)
(Figs 17-18)

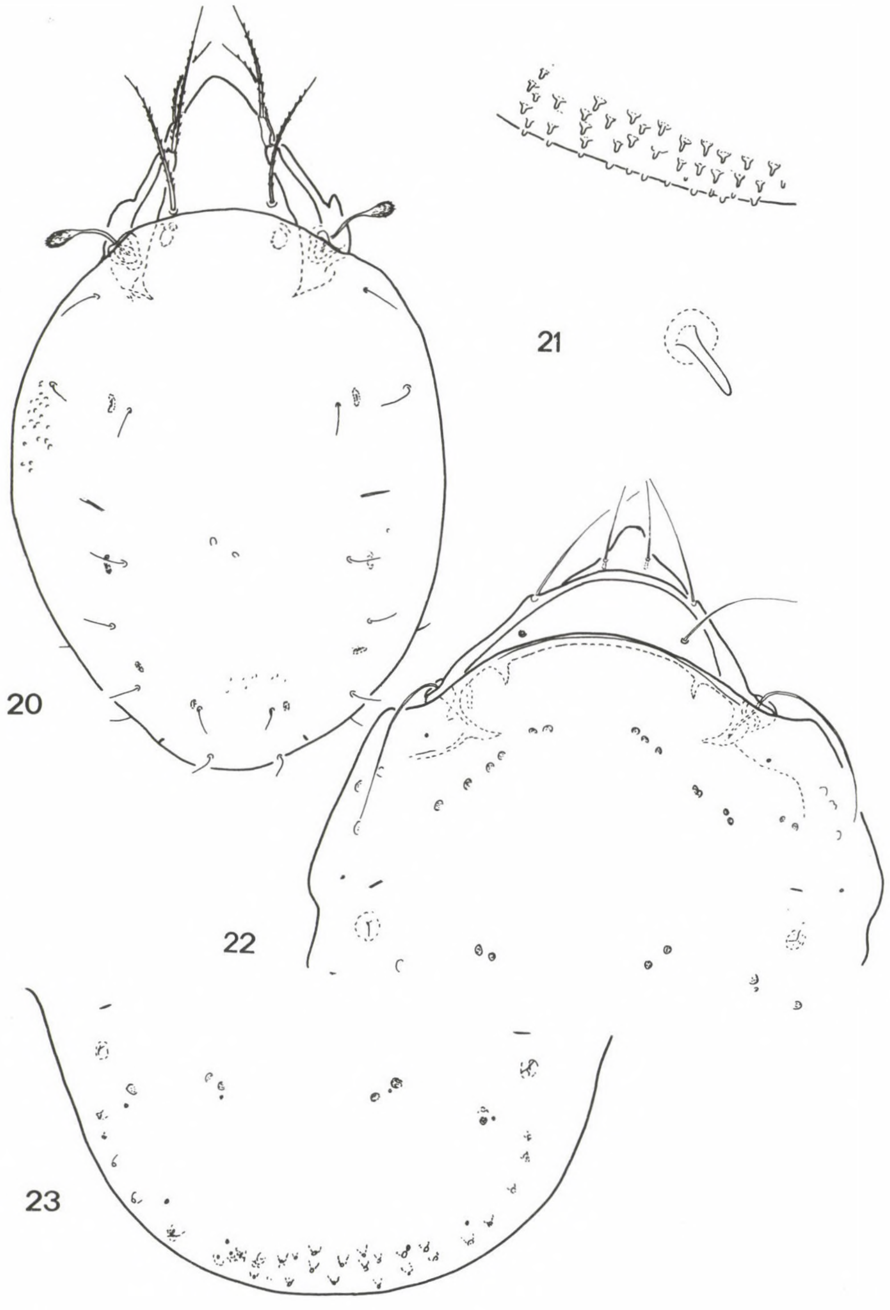
Oribatula (Zygoribatula) excavata BERLESE, 1916: 318. – *Oribatula (Zygoribatula) excavata:* CASTAGNOLI & PEGAZZANO 1985: 136. – *Oribatula (Zygoribatula) excavata*: F. BERNINI, A. M. AVANZATI & S. BERNINI 1987: 446.

There are three slides and two this time unexamined, tubes exist in the collection, two slides (180/21-22) are labelled "tipico". My drawing was made after the specimen embedded in slide 180/21, therefore I designate it as lectotype.

Complementary morphological characters: Translamella robust, but narrowed medially, so lamellar cusps well observable (Figs 17-18). Sensillus conspicuously narrow, directed outwards.



Figs 17-19. 17-18: *Zygoribatula excavata* BERLESE, 1916- dorsal aspect, 18: lamellar cusp. – 19: *Zygoribatula socia* BERLESE, 1916 – dorsal aspect



Figs 20-23. 20-21: *Hemileius scrobina* BERLESE, 1916 -20: dorsal aspect, 21: sculpture of the notogaster. – 22-23: *Rykella elamellata* (BERLESE, 1916) – 22: anterior part of the body, 23: posterior part of the body

Notogastral setae well developed, distinctly pilose. Humeral setae slightly erect and shorter than the others.

Zygoribatula lineola (BERLESE, 1916) syn. n.

Oribatula (Zygoribatula) lineola BERLESE, 1916: 320. – *Oribatula (Zygoribatula) lineola*: CASTAGNOLI & PEGAZZANO 1985: 221. – *Notaspis exilis* NICOLET, 1855: 448, sen. syn. – *Zygoribatula exilis:* WUNDERLE, BECK & WOAS 1990: 20.

There is a long series of slides, I have seen slides 180/32, 180/33, 180/33bis, among them only one (180/32) was labelled "tipico". I respect BERLESE's opinion and I choose it lectotype. But the species is unambiguously synonym to be of *Zygoribatula exilis* (NICOLET, 1855).

Zygoribatula socia (BERLESE, 1916)
(Fig. 19)

Oribatula (Zygoribatula) socia BERLESE, 1916: 319. – *Oribatula (Zygoribatula) socia*: CASTAGNOLI & PEGAZZANO 1985: 386.

There are four slides in the collection, only one (180/30) is labelled "tipico". It is not sure, whether the other specimens (75/20, 75/21, 75/21bis) belongs to the type series. BERLESE's designation is unambiguous, I follow him, and consider this specimen as lectotype.

Complementary morphological characters: Lamellar fomation robust, lamellae are continuous with the translamella, but the formation angular anteriorly. Translamella not narrowed medially, so the lamellar cusps not separated (Fig. 19). Head of the sensillus comparatively large, finely ciliate. Notogastral setae well ciliate, humeral one belongs to the same type. Porose area large.

Hemileius proximus (BERLESE, 1916)

Oribatula (Hemileius) proxima BERLESE, 1916: 324. – *Oribatula (Hemileius) proxima*: CASTAGNOLI & PEGAZZANO 1985: 334.

The collection contains a long series of slides of this species, but I was able to study only one slide (180/10), labelled "tipico". It contains many specimens, so I consider them to be syntypes. I have superficially studied them, so I noted only that it is characterisable by the slightly convex dorsosejugal suture and a small humeral squama. Lamellar cusp observable. Sensillus elongate.

Hemileius scrobina (BERLESE, 1916)
(Figs 20-21)

Oribatula (Hemileius) scrobina BERLESE, 1916: 323. – *Oribatula (Hemileius) scrobina:* CASTAGNOLI & PEGAZZANO 1985: 371. – *Hemileius* cf. *scrobina*: F. BERNINI, A.M: AVANZATI & S. BERNINI 1987: 448.

I have seen three slides (58/34, 180/47, 180/47fil) the collection, though Castagnoli & Pegazzano listed one more (74/10). One of them labelled "tipico". I follow the BERLESE's designation and I regard this specimen to be lectotype.

Complementary morphological characters: Rostrum conical. Lamellae with small, short cusp, lamellar seta arising on it. prelamella present. Sensillus directed laterally, slightly reclinate, its head finely spiculate. Notogaster typically hemileioid (Fig. 20), without pteromorphae, obovoid. Its surface covered by short, digitiform pustules (Fig. 21). Ten pairs of equally long, fine notogastral setae and four pairs of small sacculi present.

Hemileius sternalis (BERLESE, 1916) comb. n.

Oribatula (Hemileius) sternalis BERLESE, 1916: 323. – *Oribatula (Hemileius) sternalis:* CASTAGNOLI & PEGAZZANO 1985: 397.

Only a single specimen exists in the collection in slide 180/46, labelled "typico", therefore, it is the holotype by monotypy.

This species unambiguously belongs to the genus *Hemileius* BERLESE, 1908, but I did not study it thoroughly now. Its rostrum is conspicuously protruding, nasiform.

Siculobata sicula (BERLESE, 1892)

Oribatula tibialis var. *sicula* BERLESE, 1892: XLIV, 1. – *Oribatula (Hemileius) sicula:* BERLESE 1916: 322. – *Siculobata sicula:* GRANDJEAN 1953: 117.

This species is well known, it is widely distributed (?). It is only one specimen mounted on slide 40/45 in the collection labelled "tipico". I consider it as the holotype by monotypy, because there is some other material in alcohol designated also "tipico" but definitely originates from a later date. Unfortunately the mounted specimen is in a very bad condition, very hard to study or to identify.

Siculobata platensis (BERLESE, 1916) stat. et comb. n.

Oribatula (Hemileius) sicula var. *platensis* BERLESE, 1916: 322. – *Oribatula (Hemileius) sicula* var. *platensis*: CASTAGNOLI & PEGAZZANO 1985: 326.

There are two slides from La Plata in the collection, one of them (180/43) is labelled "tipico" but it contains 3 specimens. I consider them as syntypes.

Complementary morphological characters: Lamella, prelamella present. Sensillus short, with capitate head. Dorsosejugal suture straight, pteromorpha absent. Ten pairs of notogastral seatae and 4 pairs of sacculi present. Anogenital setal formula: 4 – 1 – 2 – 3. All legs tridactylous.

There is no doubt that this species belongs to the genus *Siculobata* GRANDJEAN, 1953.

3. TWO BERLESE'S PODORIBATES SPECIES

Rykella elamellata (BERLESE, 1916) comb. n.
(Figs 22-23)

Podoribates elamellatus BERLESE, 1916: 59. – *Podoribates elamellatus*: CASTAGNOLI & PEGAZZANO 1985: 123.

A single specimen (164/46) in good condition is present in the collection. It is considered to be the holotype by monotypy. There is no doubt that it belongs to the genus *Rykella* BALOGH, 1962. It is probably identical with the type species of this genus (*R. insignis* BALOGH, 1962). Specimens of the latter species was not available for me, therefore, further comparative investigations are necessary.

Complementary morphological characters: Rostrum elongated nasiform. Well developed lamella and translamella present, lamella without sharp cusp (Fig. 22). Lamellar setae arising on its outer corner. Lamellar and interlamellar setae nearly equal in length, rostral setae slightly shorter than the preceding ones. Sensillus setiform. Approximately 25 pairs of porose area (Fig. 23) and six pairs of genital setae may be observable.

Length of body: 749 µm, width of body: 670 µm.

Annobonozetes latissimus (BERLESE, 1916) comb. n.
(Fig. 24)

Podoribates latissimus BERLESE, 1916: 59. – *Podoribates latissimus:* CASTAGNOLI & PEGAZZANO 1985: 216.

There are two slides (164/44, 164/45) in the collection, but only one (164/45) is labelled "tipico". The other slide contains also an *Annobonozetes* species, but on the basis of the position and size of the saccculi (S_1 and S_2) I am not sure whether both belong to the same species. Therefore, I follow BERLESE and consider the specimen in slide 164/45 the lectotype of this species. The type of the heretofore monotypic genus (*A. sphaericus* PÉREZ-IÑIGO, 1983) is characterised by the interrupted translamella and the absence of lamellar cusps, but I think this species unambiguously belongs to this genus, so *Podoribates latissimus* BERLESE, 1916 = *Annobonozetes latissimus* (BERLESE, 1916) comb. n.

Complementary morphological characters: Rostrum triangular in dorsal aspect. Lamellae and translamella well developed, lamellar setae arising from the short lamellar cusps. Interlamellar setae very long, nearly twice longer than the rostral ones. Sensillus short, with small, oval head. Ten pairs of setal alveoli and four pairs of sacculi present, two saccculi (S_1 and S_2) located very near to each other. Four pairs of genital setae observable, all legs tridactylous.

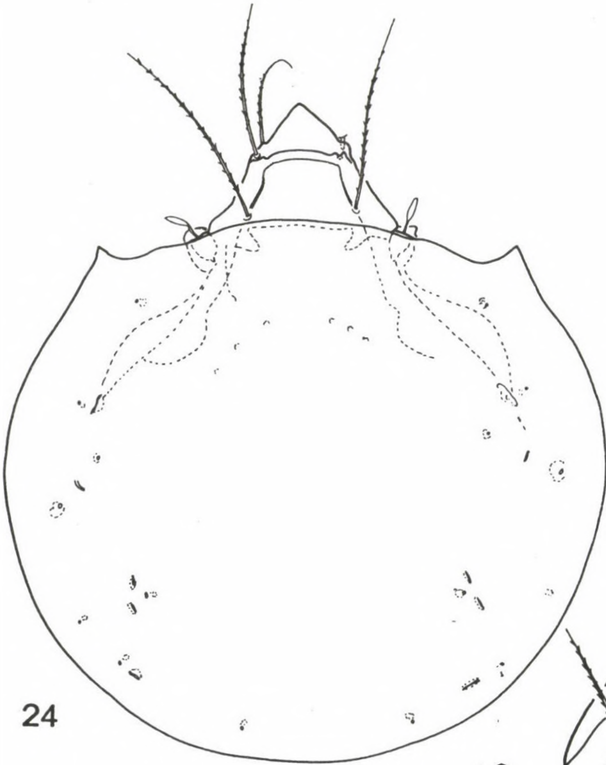
Length of body: 1170 µm, width of body: 1014 µm.

4. BERLESE'S "PELORIBATES" SPECIES

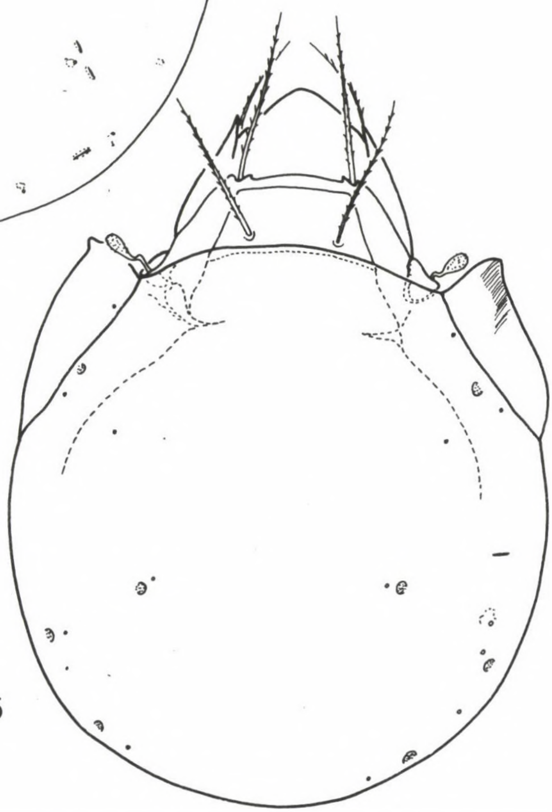
In their catalogue CASTAGNOLI & PEGAZZANO listed 7 *Peloribates* species, but only four were described by BERLESE. *P. histricinus* BERLESE, 1910 (= *P. hubbardi* BANKS, 1904) was discussed by NORTON & KETHLEY (1989). None of the other three species (see below) belongs to the genus *Peloribates* (BERLESE, 1908) in the modern sense.

Africoribates depilatus (BERLESE, 1910) comb. n.
(Fig. 25)

Peloribates depilatus BERLESE, 1910: 385. – *Peloribates depilatus*: CASTAGNOLI & PEGAZZANO 1985: 112.

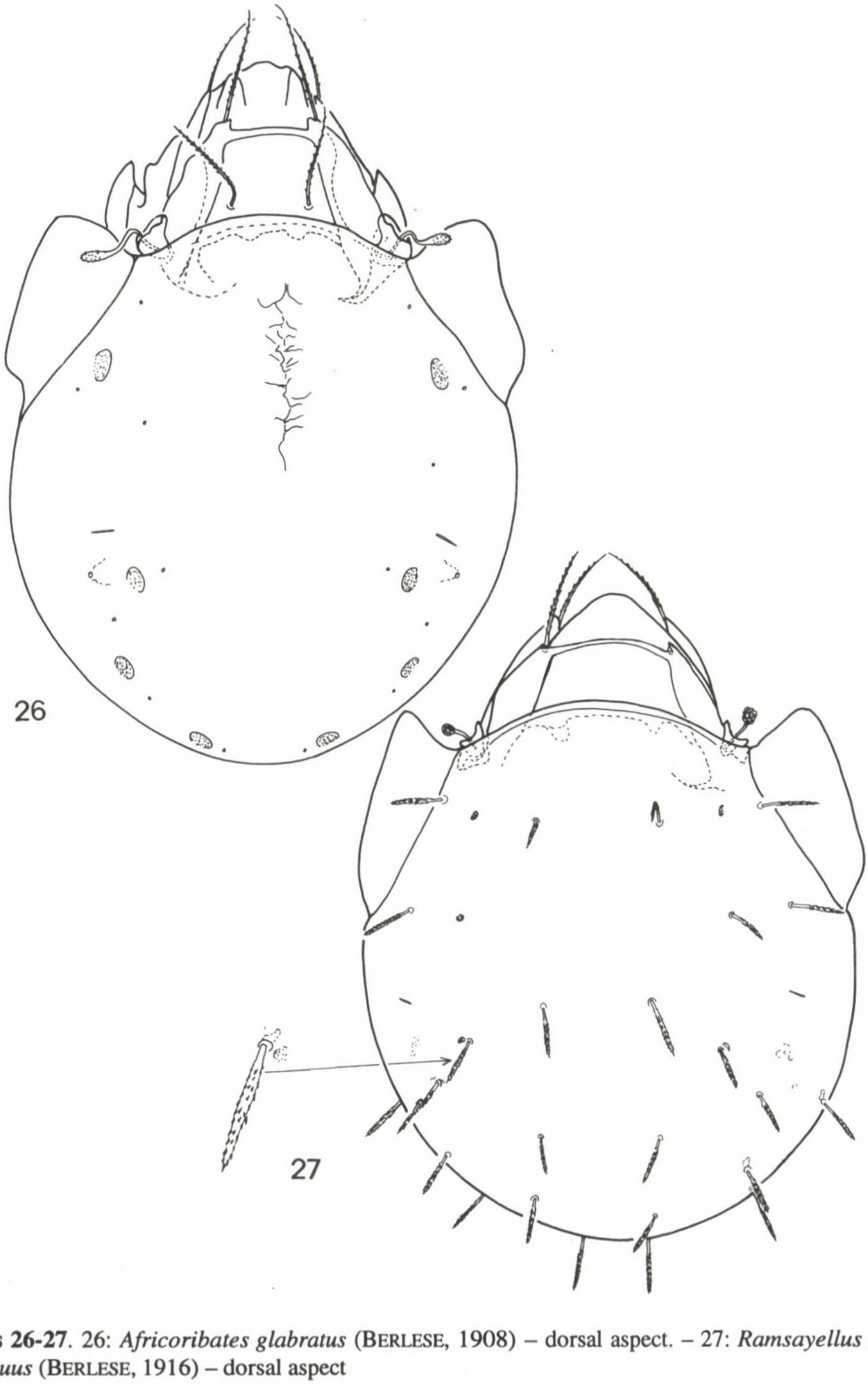


24



25

Figs 24-25. 24: *Annobonozetes latissimus* (BERLESE, 1916) – dorsal aspect. – 25: *Africoribates depilatus* (BERLESE, 1910) – dorsal aspect



Figs 26-27. 26: *Africoribates glabratus* (BERLESE, 1908) – dorsal aspect. – 27: *Ramsayellus conspicuus* (BERLESE, 1916) – dorsal aspect

A single specimen (107/50) from South Africa is present in the collection. It is considered the holotype by monotypy. It may unambiguously be ranged into the genus *Africoribates*.

Complementary morphological characters: Rostrum unified. Lamellae and translamella well developed, lamellar cusps clearly observable, with sharp apices. Sensillus comparatively short, its peduncle arched. Notogaster with ten pairs of alveoli and four pairs small porose areas (Fig. 25). Anogenital setal formula: 6 – 1 – 2 – 3.

Length of body: 570 μm, width of body: 421 μm.

Africoribates glabratus (BERLESE, 1908) comb. n. (Fig. 26)

Peloribates glabratus BERLESE, 1908: 3. – *Peloribates glabratus:* CASTAGNOLI & PEGAZZANO 1985: 164.

There are seven slides in the collection, two of them (74/46, 74/48) labelled "tipico". I designate as lectotype the specimen in slide 74/46. The figure (Fig. 26) was made after the slide 74/47.

Complementary morphological characters: Rostrum waved, a pair of longitudinal crests run backwards from the rostrum. Lamellar cusps long, well protruding over the translamella. Sensillus comparatively long, directed outwards. Notogaster displaying a longitudinal figure medially. All four pairs of poorose areas large, no essential difference among them.

Length of body: 421 μm, width of body: 296 μm.

?Ramsayellus conspicuus (BERLESE, 1916) comb. n. (Fig. 27)

Peloribates conspicuus BERLESE, 1916: 60. – *Peloribates conspicuus* CASTAGNOLI & PEGAZZANO 1985: 86.

The collection contains two slide (164/34, 164/35), one first is labelled "tipico". I consider it – agreeing with BERLESE – as lectotype of this species. The drawing (Fig. 27) was made after the other slide (164/35).

Complementary morphological characters: Rostrum unified, rounded. Lamellae wide, lamellar cusp not separated, only short outer apex observable. Translamella arched anteriorly, before lamellar cusps. Sensillus very short, its head clavate. Notogaster with 13 pairs of short, rigid, mostly straight setae. Some of them slightly dilating. I was able to observable only two pairs of very small porose areas (?), Ap_1 located very near to the insertion of seta *dp*. Six pairs of genital setae observable, all legs tridactylous.

REFERENCES

BERLESE, A. (1892) Acari, Myriapoda, et Scorpiones in Italia reperta.

BERLESE, A. (1902) Specie di Acari nuovi. *Zool. Anz.* **25**: 697-700.

BERLESE, A. (1904) Acari nuovi. Manipulus II. *Redia* **1**: 258-280.

BERLESE, A. (1908) Elenco di generi e specie nuove di Acari. *Redia* **5**: 1-15.

BERLESE, A. (1910) Brevi diagnosi di generi e specie di Acari. *Redia* **6**: 346-388.

BERLESE, A. (1913) Acari nuovi. Manipli VII-VIII. *Redia* **9**: 77-111.

BERLESE, A. (1916a) Centuria prima di Acari nuovi. *Redia* **12**: 19-67.

BERLESE, A. (1916b) Centuria terza di Acari nuovi. *Redia* **12**: 289-338.

BERNINI, F. (1973) Notulae Oribatologicae VII. Gli Oribatei (Acarida) dell'isotto di Basiluzzo (Isole Eolie). *Lav. Soc. It. Biogeogr.* N. Ser. **3**: 355-480.

BERNINI, F. & ARCIDIACONO, R. (1985) Notulae Oribatologicae XXXVI. A catalogue of the Sicilian Oribatids (Acari, Oribatida). *Animalia* **1**(1-3): 165-205.

BERNINI, F., AVANZATI, A. M. & BERNINI, S. (1987) Notulae Oribatologicae. XXXVII. Gli Acari Oribatei del Massicio del Pollino (Italia Meridionale): aspetti faunistici e biogeografici. *Lav. Soc. It. Biogeogr.* **10**: 379-488.

LUXTON, M. (1985) Cryptostigmata (Arachnida: Acari). *Fauna of New Zealand, 7.* Science Information Publishing Centre, DSIR, N. Z. pp. 106.

MAHUNKA, S. (1991) Notes, additions and redescriptions of the Oribatid species of Berlese (Acari). *Acta zool. hung.* **37**(1-2): 27-58.

MAHUNKA, S. (1992) "Pelops" and "Oribates" species in the Berlese-collection (Acari). *Acta zool. hung.* **38**(3-4): 213-260.

MARSHALL, V. G., REEVES, R. M. and NORTON, R. A. (1987) Catalogue of the Oribatida (Acari) of continental United States and Canada. *Mem. Entomol. Soc. Can.* **139:** 1-418.

MICHAEL, A. D. (1908) Unrecorded Acari from New Zealand. *J. Linnean soc. (zool.)* **30**(197): 134-149.

NORTON, R. A. & KETHLEY, J. B. (1989) Berlese's North American Oribatid mites: historical notes, recombinations, synonimies and type designations. *Redia* **62**: 421-499

OUDEMANS, C. (1927) Acarologische Aanteekeningen LXXXVIII. *Ent. Ber.* **7:** 249-268.

PÉREZ-IÑIGO, C. (1974) Acaros Oribatidos de suelos de Espana penninsular e islas Baleares (Acari, Oribatei). Parte V. *EOS* **48:** 367-475.

WUNDERLE, I., BECK, L. & WOAS, S. (1990) Ein Beiträg zur Taxonomie und Ökologie der Oribatulidae und Scheloribatidae (Acari, Oribatei) in Südwestdeutschland. *Andrias* **7:** 15-60.

Received 7 December, 1992; accepted December 1, 1993

Acta Zoologica Academiae Scientiarum Hungaricae 40 (1) pp. 51-63, 1994

SUPPLEMENT TO THE REVISION OF THE GENUS CEROPALES LATREILLE (HYMENOPTERA, CEROPALIDAE), II.

L. MÓCZÁR

H-1114 Budapest, Szabolcska Mihály utca 1, Hungary

Two species are described as new ones: *Ceropales* (*Priesnerius*) *schwarzi* sp. n. (male) (Mali) and *C.* (*Ceropales*) *albitarsa* sp. n. (male) (Senegal). A new key for the subgenera of *Ceropales* and the exact ranging of the two sp. n. as well as of the *C.* (*C.*) *atra* MÓCZÁR, 1991 (female) and *C.* (*C.*) *mochii* MÓCZÁR, 1991 (male) are given in the previously published key of the world species. With 17 original figures.

Key words: Hymenoptera, Ceropalidae, *Ceropales*, taxonomy, distribution

The previously published different fragments of the descriptions concerning the subgenera and published partly as genera of the genus *Ceropales* were summarized. In this way it will be easy to inquer about the exact ranging as well as the relationship of the published and valid 137 species and subspecies up to this time in the large genus *Ceropales*, including two recently published (MÓCZÁR, 1991) and the two new species: *Ceropales* (*C.*) *atra* MÓCZÁR, female, *C.* (*C.*) *mochii* MÓCZÁR, male, *C.* (*Priesnerius*) *schwarzi* sp. n. male and *C.* (*C.*) *albitarsa* sp. n. male. The latter ones were kindly sent me by Dr. RAYMOND WAHIS (Chaudfontaine) and had been collected by different persons partly with Malaise trap in East Africa.

KEY TO THE SUBGENERA

1 Claw of the hind legs rather straight, at most gradually and not rectangularly curved, exceptionally (*C. polychloros* GUSSAKOVSKIJ, 1931) more (45°) bent apically; the same differently developed: without or with a minute tooth (Figs 1-4). Propodeum mostly flat posteriorly, only rarely slightly convex basally in lateral view, surface usually with microscopically fine wrinkles, rarely with coarser clathrate or rugose (♀ ♂). Frons remarkably raised between antennal sockets, surface with microscopically fine and very dense punctures, it seems finely granulate and shining, rarely also with larger punctures (♀ ♂). Inner margin of the hind metatarsus bordered with

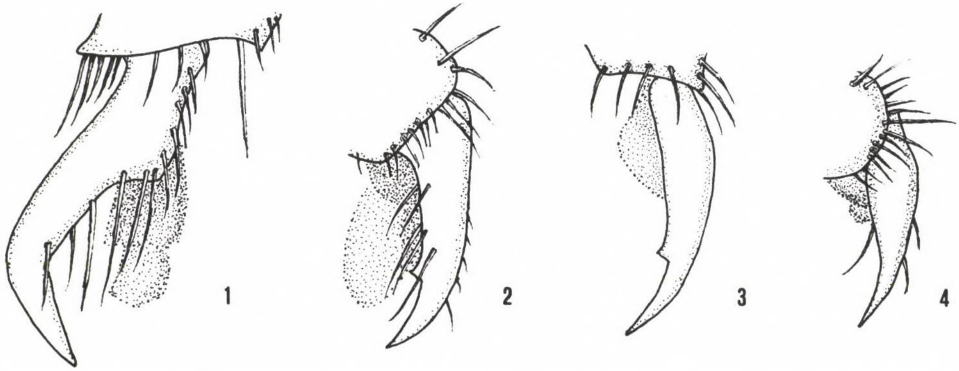
a very fine row of dense short or longer hairs (♂). Metapleural suture at most shallow, only moderately developed (♀ ♂) subgenus **Priesnerius** MÓCZÁR, 1978

– Claw of the hind legs strongly, at least rectangularly curved, uniformly developed (♀ ♂, Fig. 5). Propodeum more or less convex at least basally or conspicuously flat over its entire length (in *helvetica*-group), surface different, mat or shining, granulate or coarsely sculptured (♀ ♂). Frons more or less convex or flat (♀ ♂) 2

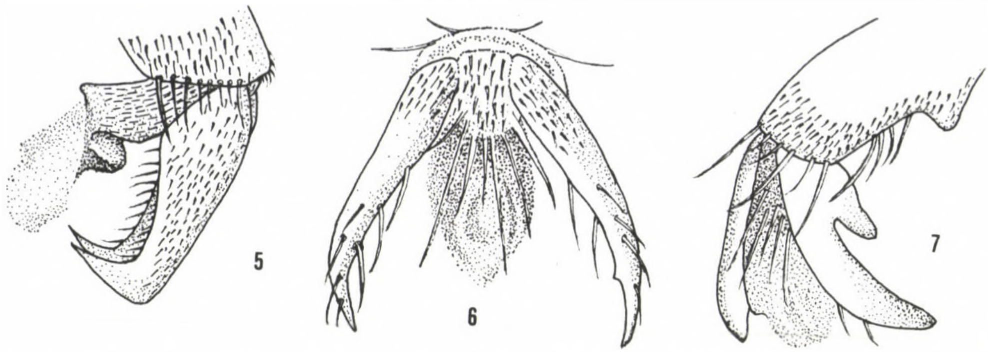
2 Both claws of fore (♀) or middle (♀ ♂) tarsus, as well as outer claw of fore tarsus (♂) with a short, erect and acute subapical tooth (Fig. 6); inner claw of fore tarsus (♂) very deeply split owing to the unusually large, not truncate inner tooth basally (Fig. 7). Sometimes (in ♂ of the *fulvipes*-group) both claws of middle tarsus specialized. Inner side of last tarsal joint of fore leg deeply emarginated (♂) subgenus **Ceropales** LATREILLE s. str.

– Both claws of fore (♀) and middle (♀ ♂) tarsi bifid, with a long, appressed, obliquely truncate subapical tooth; inner claw of fore tarsus (♂) very deeply split owing to the unusual large, not truncate inner tooth basally. Inner side of the last tarsal joint of fore leg deeply emarginated (Fig. 7) 8

3 Propodeum conspicuously flat, rarely concave its entire length, viewed from the side and with deep longitudinal groove medially. Frons usually remarkably flat before antennal sockets and broken in an obtuse-angle at its two-thirds length between antennae and fore ocellus. Scutellum and postscutellum remarkably raised **helvetica**-group



Figs 1-4. Claw of hind leg: 1: *Ceropales (Priesnerius) b. bogdanovi* RADOSZKOWSKI ♂, 2: *C. (P.) nigra* RADOSZKOWSKI ♂, 3: *C. (P.) honorei* PRIESNER ♂, 4: *C. (P.) tichensis* PRIESNER ♀



Figs 5-7. Claws of the subgenus *Ceropales* spp.: 5: hind leg, 6: middle leg, 7: last tarsal joint and inner claw of fore leg

– Propodeum more or less convex basally and flat or only moderately convex in the declivous part. Longitudinal furrow at most short or only impressed medially. Frons usually convex. Scutellum and postscutellum moderately raised 4

4 Postnotum with nearly parallel margins, at most slightly impressed posteriorly in the middle. Propodeum moderately convex on the anterior part or over its entire length. Frons convex, at most rarely slightly broken. Head and thorax mat, coriaceous-granulated **variegata**-group

– Margins of postnotum not parallel. Propodeum strongly or less strongly convex at least basally. Frons usually convex or sometimes slightly broken. Head and thorax usually not mat, at least weakly shining with scattered or dense punctures 5

5 Propodeum strongly or moderately broken or bent on its one-fifth part basally and flat or concav on four-fifths declivous part, viewed from the side; surface smooth, weakly shining or mat basally and more coarsely rugose or rugulose at horizontal and at declivous part, sometimes with longitudinal and transverse wrinkles. Postnotum narrow especially laterally. Abdomen with continuous light bands 6

– Propodeum at most moderately convex on its one-third length and gradually flattened towards abdomen; surface more finely, not coarsely rugose, sometimes with a rough surface. Postnotum broader 7

6 Propodeum roundly curved and smooth, shining basally, declivous part transversally rugulose. Frons shining or subshining with minute punctures

and also with scattered larger punctures. Pronotum, mesonotum usually deeply and densely punctured. Claws of middle tarsi (♂) specialized and unlike one another, as well as tarsal joints 2-4 of fore and middle legs very short and broad, joint 2 of middle legs about as long as broad. At least hind femur, tibia and tarsi ferruginous **fulvipes**-group

– Propodeum mostly strongly broken, laterally often strongly punctured; surface mat basally, largely coarsely rugose on declivous part. Frons mat, convex or hardly broken and distinctly punctured together with mesonotum. Claws normal **ruficornis**-group

7 Propodeum more convex basally in lateral view, only rarely more flat (males of *solskii* RADOSZKOVSKY, 1877 and *erythropoda* GUSSAKOVSKIJ, 1926), surface rather coarsely and irregularly sculptured, often granulate, uneven and more finely granulate only on males and on smaller specimens. Tergite 3 (often also 4) black. Face mat, with dense small adjacent punctures and without noticeably larger punctures, latter present only between ocelli and eye, rarely face also with larger punctures. Flagellum black, at most lower side sometimes dark brownish black. Last abdominal segments (♀) broadly truncate apically **maculata**-group

– Propodeum usually rather flat and only moderately convex, only rarely more convex, in such a case body more extensively yellow; surface finely sculptured, silky shining, covered with short silvery hairs (♀ ♂), rarely mat, uneven. Face with larger and distinct, sometimes with dense punctures, only rarely finer or rather difficult to see owing to dense hairs. Last abdominal segments uniformly pointed apically (♀). Sternite 9 deeply excised apically (♂)

albicincta-group

8 Propodeum mat basally, usually coarsely sculptured, rugose at least basally and often with deep punctures mostly laterally, sometimes only rugulose or coarsely punctured; surface flat or moderately convex only basally in lateral view (♀ ♂). On some species (in America) surface granulated, hardly shining and rugulose beginning only with declivous part (♀ ♂). Frons convex and together with pronotum with deep and dense, often close or very dense punctures; on some species (America) only frons with scattered punctures, pronotum mostly with deep and dense punctures, at least on disc also on the humps and on posterior margin (♀ ♂). Mesonotum with deep and partly dense, close punctures (♀ ♂). Fore (♀) or fore or middle tarsi (♂) shortened on some American species

subgenus **Hemiceropales** PRIESNER, 1969

– Propodeum more or less smooth, shining, rarely polished at least basally and never coarsely-rugose sculptured (♀♂). When propodeum exceptionally mat with coarser surface, then frons finely granulate and unpunctured, albeit declivous part of disc often mat, granulated, rarely rugulose or sometimes deeply punctured postero-laterally (♀ ♂). Pronotal disc usually smooth, shining, often with scattered fine, rarely with deep and only exceptionally with dense punctures in front of humps and along posterior margin (♀ ♂). Frons mostly with very dense, distinct or fine punctures, often together with scattered larger punctures, sometimes finely granulated, rarely smooth, shining, polished (♀♂). Mesonotum with fine dense punctures, but often also with scattered larger and deeper punctures (♀♂). Fore and middle femora, as well as tarsal joints sometimes remarkably short (♂), hind legs always long

subgenus **Bifidoceropales** PRIESNER, 1969

Subgenus **Priesnerius** MÓCZÁR, 1978

A correction is needed in the description of this subgenus (MÓCZÁR, 1988: 121) namely in the line 9 upwards from below: Inner margin of the hind "tibia" correctly "metatarsus". The key to the worlds species (l.c.: 122-128) has to be changed as follows: Couplets 1-17 remain unchanged.

18 Addition to the end of diagnosis: Band of tergite 1 narrowly interrupted. 4.1-5.8 mm

yemeni MÓCZÁR, 1988 (p. 147)

– Orbital groove distinct. Frons with scattered distinct, partly fine punctures. Flagellar joints below brownish yellow. Mandible, labrum and clypeus white entirely, only mandible exceptionally black (♀) or only mandible and clypeus partly black (♂). Middle coxa basally with a round white spot (♀)

19

19 Propodeum distinctly longer than three-fourths of its breadth. Tergite 7 hardly excised apically. Supraclypeal area entirely yellow. Bands of tergites 1-3 hardly or narrowly interrupted medially. 4 mm

schwarzi sp. n. ♂

– Propodeum two-thirds as long as broad. Tergite 7 deeply excised apically. Supraclypeal area yellow (♀) or with black spots (♂) 20

20 (19) remain unchanged

senegalensis senegalensis MÓCZÁR, 1988 (p. 142)
senegalensis mbouri MÓCZÁR, 1988 (p. 144)

Ceropales schwarzi sp. n. ♂

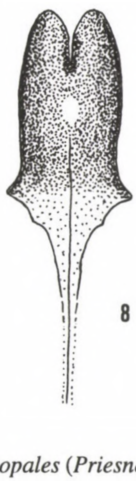
Specimen examined: Holotype ♂ : "MALI: 30 km NE San 6.8.1991 leg. Max Schwarz", "Holotypus Cerop. (Priesn.) ♂ schwarzi sp. n. det. Móczár 1992", (Hym. Typ. No. 3835, Budapest).

Female: unknown.

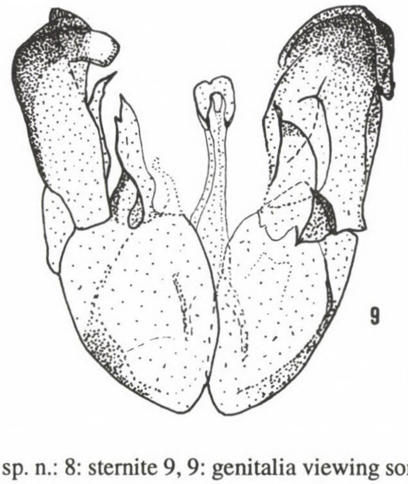
Length: 4 mm.

Colour: black, light colour of body white nearly entirely: inner eye margin extending to ocular sinus, supraclypeal area, a quadrangular large spot nearly between tentorial pit and the narrow brownish-black line on lower margin of clypeus, excepting the short and small longitudinal line apically, lower-lateral margin of clypeus, labrum, excepting the brownish-black spot basally, lower side of antennal joints 1-2, a narrow line at least on upper part of outer eye-margin, posterior margin of pronotum, including pronotal tubercle on hump, tegula, except outer margin, outer margin of humeral plate, a medial spot on scutellum, postscutellum, posterior corner of propodeum, epimeral lobe, just below the origin of the hind wing, a small spot on sternal lobe, broad and laterally sinuate band on tergite 1 hardly, on 2-3 only narrowly interrupted, large spot on 7, nearly the whole lower side of fore coxa, spots on middle and hind coxae apically, apical rings of trochanters, spots on outer side of femora apically, anterior sides of fore and middle tibiae, tarsi, excepting the upper side of the brown last joint of middle leg. Brownish-ferruginous: lower side of flagellum partly basally, largely apically and maxillary palp; lower side of fore and middle tibiae largely, last tarsal joints of fore and middle legs partly as well as with lower side of them distinctly paler ferruginous. Wings hyaline, hardly infuscated only apically. Veins dark, pterostigma light brown. Body, especially lower face, propodeum and ventral side of thorax with short silvery pubescence.

Head slightly broader than long (32: 30, magnified ×24, excluding labrum), gradually narrowed behind eyes. Ocelli in an acute angle, POL:OOL=4:5.5. Frons distinctly bent below ocelli (viewed from the side), surface hardly shining, with some scattered fine and shallow punctures, with a row of distinct punctures along inner eye margin from the ocular sinus to vertex, a short,



8



9

Figs 8-9. *Ceropales* (*Priesnerius*) *schwarzi* sp. n.: 8: sternite 9, 9: genitalia viewing somewhat left narrow and smooth line shine on the place of the frontal sulcus medially. Temple moderately thickened below, orbital groove distinct, nearly half the length of outer eye margin.

Flagellum short, as long as about the length of head and thorax together, excluding propodeum. Flagellar joints 1-4 and 11 longer than broad, joints 5, 9-10 with equal length and breadth, 6-8 shorter than its breadth; length (and breadth) proportions of antennal joints 1-13 = 11(8): 6(6): 9(6): 9(6.5): 9(7): 8(7): 8(8): 7(8): 7(8): 7(8): 8(8): 7(7): 10(6).

Pronotal disc distinctly raised (in lateral view), lateral deepening with some fine and short longitudinal wrinkles. Fine punctures of mesonotum hardly visible, deeper punctures of mesepisternum scattered, shallower than that in *C. s. senegalensis* MÓCZÁR. Scutellum and postscutellum convex, conspicuously raised above the level of thorax. Propodeum flat over its entire length, distinctly longer than three-fourth of its breadth (20:17); surface with microscopically fine wrinkles partly transversely, sulcus broad basally and slender apically, not reaching the middle of segment. Metapleural suture not developed.

Claw of hind leg with a minute tooth. Tergite 7 hardly excised apically. The row of tomentose hairs of hind metatarsus extending shorter than half of joint, erect hairs nearly as long as one-third of the breadth of joint before apex (2:5, magnified ×50). Sternite 9 raised longitudinally, narrowly deeper excised apically (Fig. 8), lateral margins nearly parallel, no spur of tuft of hairs basally, differing to *C. s. senegalensis* MÓCZÁR (Fig. 37, l.c. 159). Genitalia: Fig. 9.

This species reminds of *C. s. senegalensis* MÓCZÁR, 1988, the main differences are given in the key. I have named this species in honour of the collector and of the eminent specialist of the genus *Nomada*, MAXIMILIAN SCHWARZ (Ansfelden bei Linz).

Subgenus **Ceropales** s. str.

The **helvetica**-group

The key of the world species of the *helvetica*-group (♀ ♂) (MÓCZÁR 1989: 11-16) has to be changed as follows:

1 Body and wings largely black or partly brownish-black. Legs black nearly entirely. Outer orbit with an unusual deep, broad and long orbital groove, this reaching beyond the three-quarters length of orbit, surface smooth and polished **atra** MÓCZÁR, 1991 ♀

– Body and legs mainly partly black with light markings, rarely largely ferruginous, wings light coloured, at most partly slightly infuscated. Orbital groove at most shorter, only rarely reaching beyond the half lenght of outer orbit 2

2-22 The same as in key 1-21, remain unchanged, only the reference numbers increase with +1 (1 change to 2 and 21 continued to 22)

23 (in precedling key 22) "Orbital groove... Flagellum... Fore and middle tibiae..." remain unchanged. "Band of tergite 1..." to complete with

"usually". "Tomentose hairs..." and "Femora..." remains unchanged. Confer also the new reference number 27 **maliensis** MÓCZÁR, 1989 ♂

– Distinct orbital groove not developed, only a shining line present. Lower side of flagellum ferruginous at most basally and apically, elsewhere infuscate or brownish-black (except rarely *juncoi* ♂). Tergite 1 usually with continuous white band posteriorly, sometimes with brownish spot medially. Tomentose hairs on hind metatarsus posteriorly mostly as long as half breadth of the joint (♂). Mandible punctured 24

24 (the same as in key 23) remain unchanged, only propodeal "sulcus reaching ('nearly' streak out) to half the length to propodeum" (supplement=) "or longer" **juncoi** GINER, 1945

– All coxae black or brownish, not ferruginous; femora usually extensively ferruginous, brownish or black (♀ ♂). Mandible black (♀ ♂), margin often with white spot (♀). Propodeal sulcus very broad basally. Lower face mostly yellowish 25

25 Vertical side of pronotal disc gradually curved downwards in front. Propodeal sulcus medially broad and longer, similar to a triangle basally, but narrowed suddenly and acute apically (♀ ♂). Head nearly as broad as long (26:27 ♂, 40:40 ♀, without labrum). Mesepisternum with scattered, sometimes with larger, relatively deep punctures. Metapleural suture not (♀) or hardly (♂) developed basally. Lower face white (♀ ♂), with pale brownish spot(s) or sometimes blackish streaks, rarely largely black (♂). Abdominal bands 1 continuous, 2-4 narrowly, rarely hardly, 5 widely interrupted (♀) or 1 only rarely, 2-4 narrowly, rarely hardly, 5 widely interrupted, latter sometimes and 6 black (♂). Sternite 9 deeply excised apically (♂, Fig. 26, MÓCZÁR 1989: 48). Genitalia: Fig. 56-57 (l.c. 57), apical part of paramere conspicuously broadened and with a transverse medial darker line. o 4.4-8, ♂ 3.3-5.8 mm **kriechbaumeri** MAGRETTI, 1884

– Vertical side of disc straight in front. Propodeal sulcus short, reaching about to the one-quarter the length of propodeum, very broad basally and similar to an isosceles triangle. Head distinctly broader than long (32:29). Mesepisternum with partly denser and deeper punctures. Metapleural suture not developed. Lower face entirely white, only mandible black. Abdominal bands 1-2 continuous, 3-4 hardly, 5 narrowly interrupted. Sternite 9 hardly emarginate, nearly straight apically (♂, Fig. 14). Tergite 7 not emarginate apically. Genitalia: Figs 15-17. 4.5 mm **albitarsa** sp. n. ♂

26-28 (in key 24-26) remain unchanged.

26 (in key 24) Head, thorax, usually abdomen, black; legs from trochanters to tarsi ferruginous with white spots. Medial sulcus of propodeum remarkably broad basally. Posterior corners of mesepisternum with a yellowish line (♀) or spot (♂) 27

– Body entirely ferruginous or only partly black 28

27 Flagellum black, only basal joints lighter below. Lower face together with labrum and mandible white (♀) or with ferruginous labrum, mandible and a longitudinal line on clypeus (♂). Medial sulcus extending beyond the middle of propodeum (Fig. 24 in MÓCZÁR, 1989). Middle coxa with a white spot basally (♀). At least fore coxa partly black, middle and hind ones to smaller (♂) or larger (♀) degree black basally; moreover the underside of fore coxa largely, apical margins of middle and hind ones, white. Only abdominal band (4)5 interrupted, 5 rarely black (♀), or 6 with medial spot and 7 largely white (♂). Last tarsal joints of hind leg brownish infuscated, white line of the middle tibia broadly interrupted. Last abdominal segment triangularly elongated (l.c. Fig. 27). ♀ 6.5-8, ♂ 4.7-5.8 mm **lawrencei** ARNOLD, 1937

– Flagellum only apically black, together with mandible ferruginous (♀), the latter rarely with black base (♂). Lower face white, labrum slightly infuscated. Medial sulcus short. Middle coxa without a basal spot. All coxae entirely ferruginous, together with trochanters-tarsi (♀), or black (♂), coxae with apical white streaks and often small black spots basally (♀) or legs partly infuscated (♂). All abdominal bands continuous and broad. Tarsal joints 2-5 of hind leg black basally, joints 5 of middle and hind legs brown, respectively, black apically. Last segment (♀) rather stumpy and with yellowish white streak (l.c. Fig. 28). ♀ 6-6.5, ♂ 4.1-6 mm **maliensis** MÓCZÁR, 1989 ♀ ♂

28 (in key 26) remain unchanged **ferrugo** MÓCZÁR and **dayi** MÓCZÁR, 1989

Ceropales maliensis MÓCZÁR, 1989 Beitr. Ent. 39: 15-16, 37 ♀ ♂.

Specimens examined: 2 ♂. Côte d'Ivoire, 30-35 km N Korghogo 28. II. 1980. Malaise trap 8 J. W. EVERTS, 1 ♂ (Museum Amsterdam). – Senegal, Ndangane, 26. VII. 91, 1 ♂, Coll. A. MOCHI (Museum Budapest).

The characters in the two males differ rather unusually from the allotype, consequenth, it was necessary to place them both in 23 and in 27 couplets of the key. The tomentose hairs, e.g. of hind metatarsus in allotype nearly as long as two-thirds of the breadth of joint, the same in ♂ (Korghogo) 2:5 and in ♂ (Ndangane) 4:5. POL:OOL=5:6.5 in allotype (Mali), 4:7 in Korghogo and 7:8 in Ndangane. The punctures of frons, mesonotum and mesepisternum is rather different. The differences in colour of body appears in key, the ♂ from Korghogo to be found in reference number 23 and the ♂ from Ndangane in 27. Nevertheless the main characters are the same: sternite 9, orbital groove, the detail of genitalia (cf. Figs 63-64 in MÓCZÁR, 1989: 59 and Figs 10-13), as well as the relation of the breadth and length of head (1.12-1.16-1.18×) or of propodeum (1.48-1.33-1.33×).

Therefore I to consider these males as variation within species, probably produced by different microclimatic circumstances.

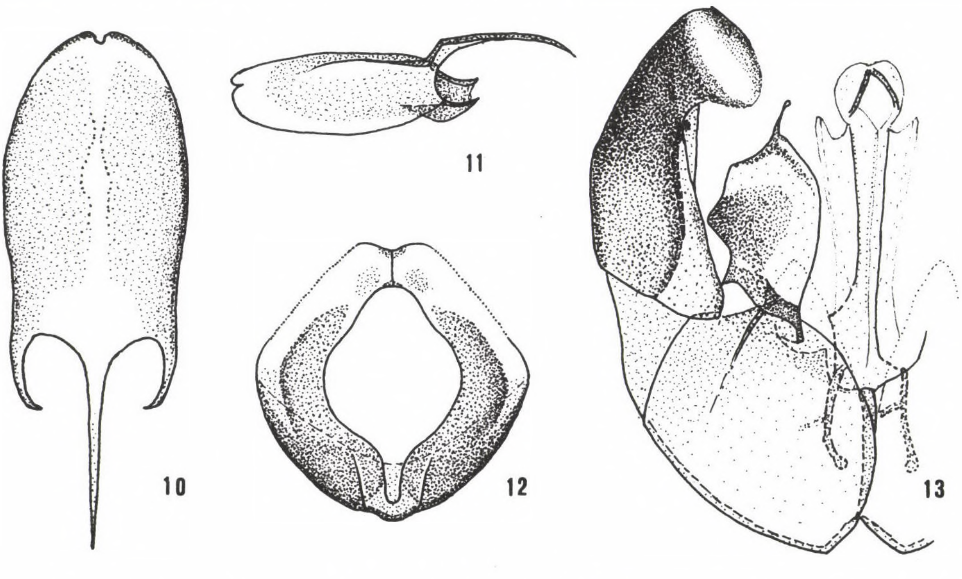
Ceropales albitarsa sp. n. ♂

Specimen examined: Holotype ♂ : "SENEGAL, 25-35 km sud de RICHARD TOLL piege malaise IX. 1939 leg. H.v.d. Velk c.s.", "Holotypus Cerop. (C.) albitarsa sp. n. det. Móczár 1992". (Museum Amsterdam).

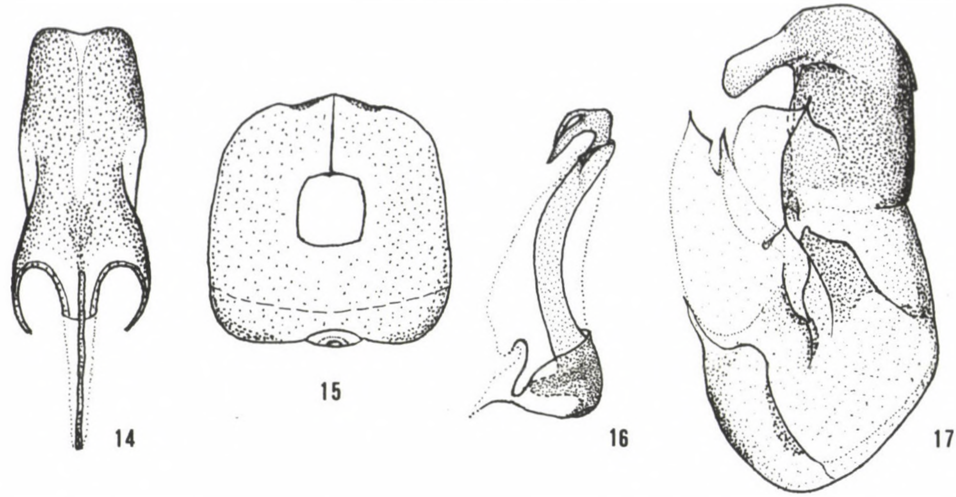
Female: unknown.

Length: 4.4 mm.

Colour: black, light colour of body largely white, partly transparent (probably in consequence of poison). The lanceolate spot in ocular sinus continues downwards and dissolves into the lower face, labrum, a small spot between antennae; narrow streak along outer orbit; the whole pronotal disc reaching narrowly the upper half of tubercle, hump, tegula excepting the hyalin outer margin, humeral plate, a spot on scutellum, postscutellum, lateral corners of propodeum, a minute spot on mesepisternum posteriorly; continuous, narrow and laterally sinuate bands on tergites 1-2, hardly interrupted bands on tergites 3-4, narrowly interrupted on 5, nearly the whole surface on 7;



Figs 10-13. *Ceropales* (*Ceropales*) *maliensis* MÓCZÁR ♂ : 10-11: sternite 9, 12: basal ring, 13: left side of genitalia



Figs 14-17. *Ceropales* (*Ceropales*) *albitarsa* sp. n.: 14: sternite 9, 15: basal ring, 16: penis valve, 17: right part of genitalia seen from inside

gradually smaller spots backwards on coxae, small spots on fore and middle femora apically, outer side of fore and middle tibiae, as well as tarsal joints partly, whole middle metatarsus, excepting a minute pale yellowish spot apically, lastly spurs of middle and hind tibiae, white. Lower side of fore and middle tibiae, and of fore tarsi, middle tarsal joints 2-4 entirely, a spot on hind tibia yellowish, partly yellowish brown. All femora, hind tibia largely brown. Hind tarsal joints pale brownish, with small black rings basally. All ultimate tarsal joints of legs, at least partly, brown. Lower side of antennal joints 1-2 yellowish white. The same of flagellum especially basally and apically, and malar space brownish ferruginous. Labial and maxillary palp pale brownish. Wings hyaline, veins largely, pterostigma brown. Body, especially face, propodeum and ventral side of thorax with silvery pubescence.

Head distinctly shorter than broad (29:32, magnified ×24, in frontal view), remarkably broader than thorax (32:21, measured over hump, in superior view) and gradually narrowed behind eyes. Ocelli in a slight acute angle, separated from each other by two-thirds of the distance between ocellus and eye (4:6). Frons obtuse angularly bent below ocelli (viewed from the side), with scattered and fine, only along eye more distinct and deeper punctures. Frontal sulcus present in a narrow shining line longitudinally. Lower margin of clypeus slightly arcuate, with obtuse-angle lateral corners. Orbital groove not developed, only in a shining line present.

Antenna short as long as the distance of head and thorax together, excluding postscutellum and propodeum. Flagellar joints 1-4, 11 longer than broad, 5 really, 6-10 hardly as long as broad, lenght (and breadth) proportions of antennal joints 1-13= 12(8): 7(6): 10(6): 9(6): 8(7): 8(7): 7(7): 7(7.5): 7(7.5): 7(7.5): 6(7): 6.5(7): 8(6).

Pronotal disc sharply raised, vertical part straight in front (viewed from the side); tubercle and hump moderately elevate, lateral deepening with some short wrinkles. Mesonotum and mesepisternum in some places with deeper and denser punctures. Scutellum and postscutellum conspicuously raised over the level of notum. Propodeum about two-thirds of its breadth (17:23), propodeal sulcus remarkably broad basally, similar to an isosceles triangle, reaching to the one-quarter the lenght of segment; surface flat, hardly concave medially with microscopically fine wrinkles transversely. Metapleural suture not developed.

The row of tomentose hairs of hind metatarsus inside extends nearly farther than half length of joint, the length of erect hairs as long as half the length of joint before the top. Claw of hind leg strongly rectangularly curved (Fig. 5).

Tergite 7 intact, not emarginate apically. Sternite 9 hardly concave apically, slightly convex, after this concave laterally (Fig. 14).

Genitalia: Figs 15-17, without a conspicuously broadened paramere part apically.

The species is near to *C.* (*C.*) *kriechbaumeri* MAGRETTI, 1884, the characteristic differences are presented in the key.

The **albicincta**-group

The key of the world species (♀ ♂) MÓCZÁR, 1987: 141-143) has to be changed as follows:

1-10 remain unchanged.

11 Surface of propodeum more or less rough, with scattered and rather deep punctures especially around spiracles. Lateral deepening of pronotum with 6-7 longitudinal wrinkles. Tergite 1 nearly entirely, 2 partly and slightly laterally ferruginous. Cubital cell 2 nearly quadrangular, lower margin about 1.5 times as long as broad apically (6.4). Flagellum ferruginous, only on joints 1-2 basally and on 13 blackish infuscated. 8.3 mm
mochii MÓCZÁR, 1991 ♂

– Surface of propodeum fine coriaceous or granulate, with shallow scattered punctures around spiracles. Lateral deepening of pronotum at most 3 distinct wrinkles. Abdomen black with yellow bands. Cubital cell 2 oblongformed, lower margin one and seven times as long as broad apically (10:6). Flagellum ferruginous entirely or at most on upper side black 12

12 (in preceding key 11) remains unchanged.

REFERENCES

MÓCZÁR, L. (1978) New species and some remarks on the genus Ceropales Latreille (Hymenoptera, Ceropalidae). *Acta biol. Szeged.* **24**: 115-137.

MÓCZÁR, L. (1978) Revision of Priesnerius gen. n. and notes on Bifidoceropales Priesner (Hymenoptera: Ceropalidae). *Acta zool. hung.* **24**: 349-362.

MÓCZÁR, L. (1986) Revision of the genus Hemiceropales Priesner (Hymenoptera: Ceropalidae). *Acta zool. hung.* **32**: 317-342.

MÓCZÁR, L. (1986) Revision of the fulvipes-, ruficornis-and variegata-groups of the genus Ceropales Latreille (Hym., Ceropalidae). *Acta biol. Szeged.* **32**: 121-136.

MÓCZÁR, L. (1987) Revision of the maculata- and albicincta-groups of the genus Ceropales Latreille (Hymenoptera: Ceropalidae). *Acta zool. hung.* **33**: 121-156.

MÓCZÁR, L. (1988) Revision of the Subgenus Priesnerius Móczár (Hymenoptera: Ceropalidae). *Linzer biol. Beitr.* **20**: 119-160.

MÓCZÁR, L. (1989) Revision of the helvetica-group of the genus Ceropales Latreille (Hym.: Ceropalidae). *Beitr. Ent.* **39**: 9-61.

MÓCZÁR, L. (1990) Revision of the subgenus Bifidoceropales Priesner of the genus Ceropales Latreille (Hymenoptera, Ceropalidae). *Acta zool. hung.* **36**: 59-85.

MÓCZÁR, L. (1991) Supplement to the Revision of the genus Ceropales Latreille, I. (Hymenoptera, Ceropalidae). *Acta zool. hung.* **37**: 67-74, Figs 1-4.

PRIESNER, H. (1966) Studien zur Taxonomie und Faunistic der Pompiliden Österreichs. Teil I. *Naturkundl. J. Linz*: 187-208.

PRIESNER, H. (1969) Studien zur Taxonomie und Faunistic der Pompiliden Österreichs. Teil IV. *Naturkundl. J. Linz*: 77-132.

Received December 29, 1992; accepted December 1, 1993

Acta Zoologica Academiaea Scientiarum Hungaricae 40(1), pp. 65-86, 1994

ADDITIONAL NEW SPECIES AND ANALYSIS OF PHYLOGENETIC RELATIONSHIPS OF ACHAETOTHORAX HEDICKE (DIPTERA: SPHAEROCERIDAE)

A. L. NORRBOM[1] & L. PAPP[2]

[1]*Systematic Entomology Laboratory, USDA, ARS, PSI*
c/o National Museum of Natural History, NHB 168
Washington, D.C. 20560, U.S.A.
[2]*Zoological Department, Hungarian Natural History Museum*
H-1088 Budapest, Baross u. 13, Hungary

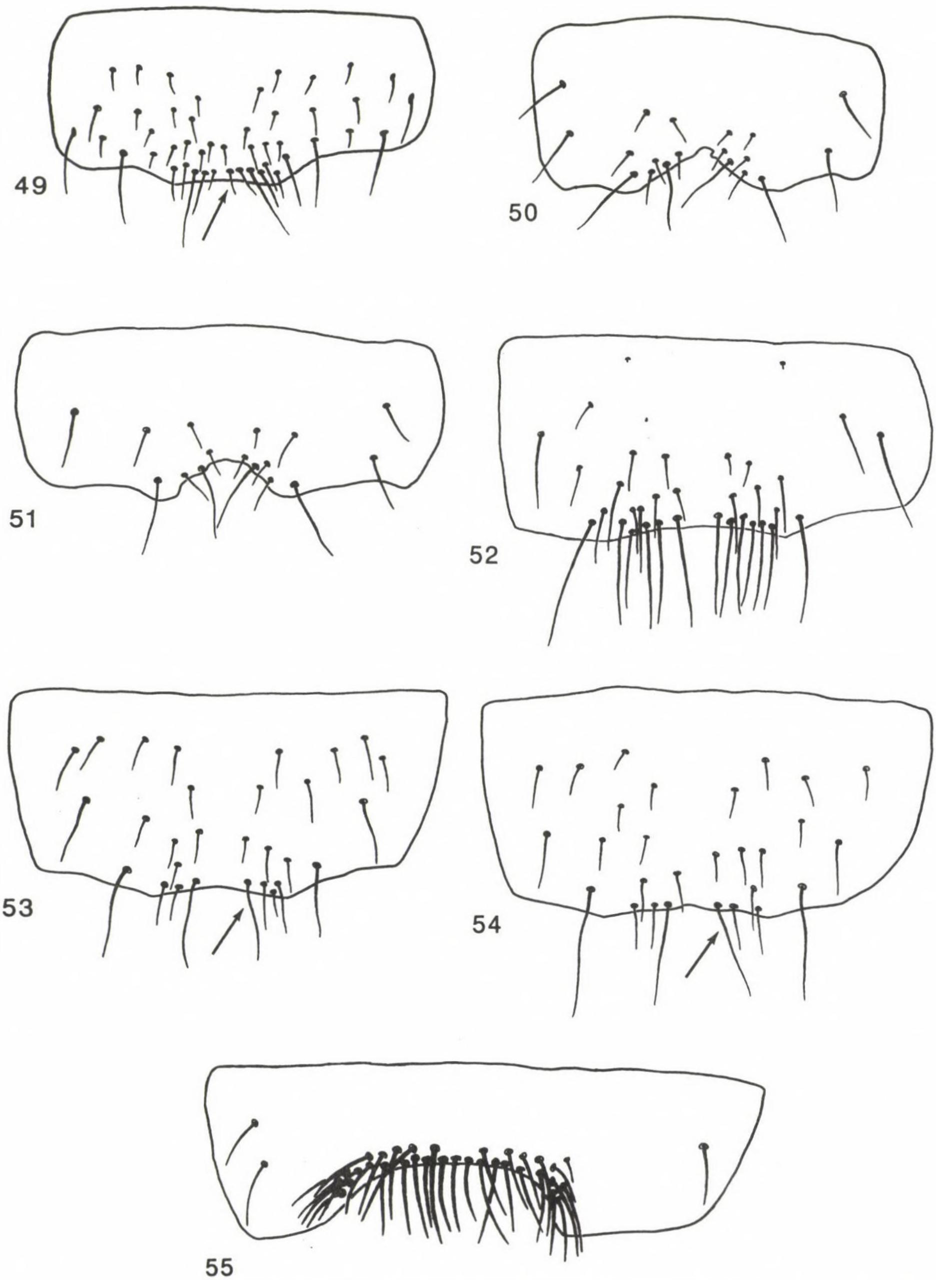
Seven Afrotropical species of *Achaetothorax* HEDICKE are described: *completus* (Zaire, Kenya), *concavus* (Zaire, Uganda), *coninckae* (Zaire), *grootaerti* (Zaire, Uganda), *medialis* (Zaire), *pectinatus* (Zaire), and *whittingtoni* (South Africa). Additional distribution data are provided for *A. acrostichalis* PAPP & NORRBOM, *crypticus* PAPP & NORRBOM, and *rhinocerotis* (RICHARDS), and *A. straeleninus* (RICHARDS) is redescribed. A key to the 16 known species of *Achaetothorax* is provided, and their phylogenetic relationships are analyzed. With 33 original figures.

Key words: *Achaetothorax*, Sphaeroceridae, phylogeny, cladistic analysis, identification key

Achaetothorax HEDICKE is a Paleotropical genus belonging to the tribe Copromyzini. It was partially revised by PAPP & NORRBOM (1992), who recognized eight Afrotropical and one Oriental species. We intended to present an analysis of phylogenetic relationships in that paper, but after it was accepted for publication, we discovered seven more species in additional study material. We therefore deleted the analysis from the original paper and here present a cladistic study of all of the known species, including the seven species described herein.

MATERIALS AND METHODS

Acronyms for institutions where specimens are deposited and references listed by PAPP & NORRBOM (1992) are not repeated here. An additional institution from which specimens were examined is Natal Museum, Pietermaritzburg (NMP). In order to use the figure numbers from PAPP & NORRBOM (1992) in the revised key, we have numbered the figures in this paper starting with the next number (i.e. numbers 1-48 refer to PAPP & NORRBOM (1992), & Numbers 49-80 refer to the present paper). Females of some species (e.g. *grootaerti, straeleninus*,



Figs 49-55. *Achaetothorax* species: male sternite 5: 49 = *completus*, holotype; 50-51 = *concavus*, paratypes, Uganda, Namwamba Valley and Zaire, Nyamuronge Riv., 19; 52 = *coninckae*, paratype, Zaire, Rutshuru, 427; 53-54 = *rhinocerotis*, Tanzania, 13 mi. S of Babati and Zaire, Kivu, 131; 55 = *pectinatus*, paratype, Zaire, Nyamuronge Riv.

and *medialis*) are difficult to distinguish and were identified tentatively on the basis of their association with males.

Phylogenetic relationships were analyzed using the Hennig86 program (FARRIS, 1988; FITZHUGH, 1989). The genus *Norrbomia* PAPP was used as the outgroup to determine character polarities.

TAXONOMY

Achaetothorax acrostichalis PAPP & NORRBOM, 1992
(Figs 17-19, 22-23)

Achaetothorax acrostichalis PAPP & NORRBOM, 1992: 327.

Additional specimens examined. ZAIRE: Kivu, Parc National Albert, Shamuheru (Volc. Nyamuragira), 1843 m, 15.VI.1935, G. F. De Witte, 1433, 1 female (MRAC).

Remarks. The dorsal nonmicrotrichose area of the wing is similar in size to that in *grootaerti*. It extends over the basal 1/4-3/5 of cell *dm* and similar sized areas in the radial cells and cu_1.

Achaetothorax completus NORRBOM & PAPP, sp. n.
(Figs 49, 56-58)

Holotype: male (MRAC) ZAIRE: Kivu, Parc Nat. Albert, Mt. Sesero, near Bitashimwa, 2000 m, bamboo, 2-3.VIII.1934, G. F. de Witte, 514; Vanschuytbroeck det. 1944 A. abyssinica.

Paratypes: 1 ♂ (MNHN), KENYA: Naivasha, Rift Valley, 1900 m, XII, Muséum de Paris Mission de l'Omo, C. Arambourg, P.A. Chappuis & R. Jeannel, 1932-33. 1 ♀ (MRAC), ZAIRE: Kivu, Parc Nat. Albert, N Lake Kivu, Ngoma, 2/6/11.II.1936, H. Damas 113.

Body length (holotype): 2.20 mm, wing length 1.75 mm.

Head: Ocellar seta approximately as long as pedicel seta. Outer vertical seta less than 1/2 as long as inner vertical seta.

Thorax: Prothorax moderately large, collarlike. Posterior margin of scutum without microtrichia between ridges connected to scutellum. Scutellum, in dorsal view, with sides strongly concave and with cornerlike bend lateral to apical seta.

Legs: Fore tarsus entirely dark brown. Male fore basitarsus with dorsal setae 2/3 to 3/4 as long as tarsomere 2. Hind femur anteroventrally with spinelike setae on apical 3/4, posteroventrally with complete row (extended to extreme base, beyond point opposite apex of tibia).

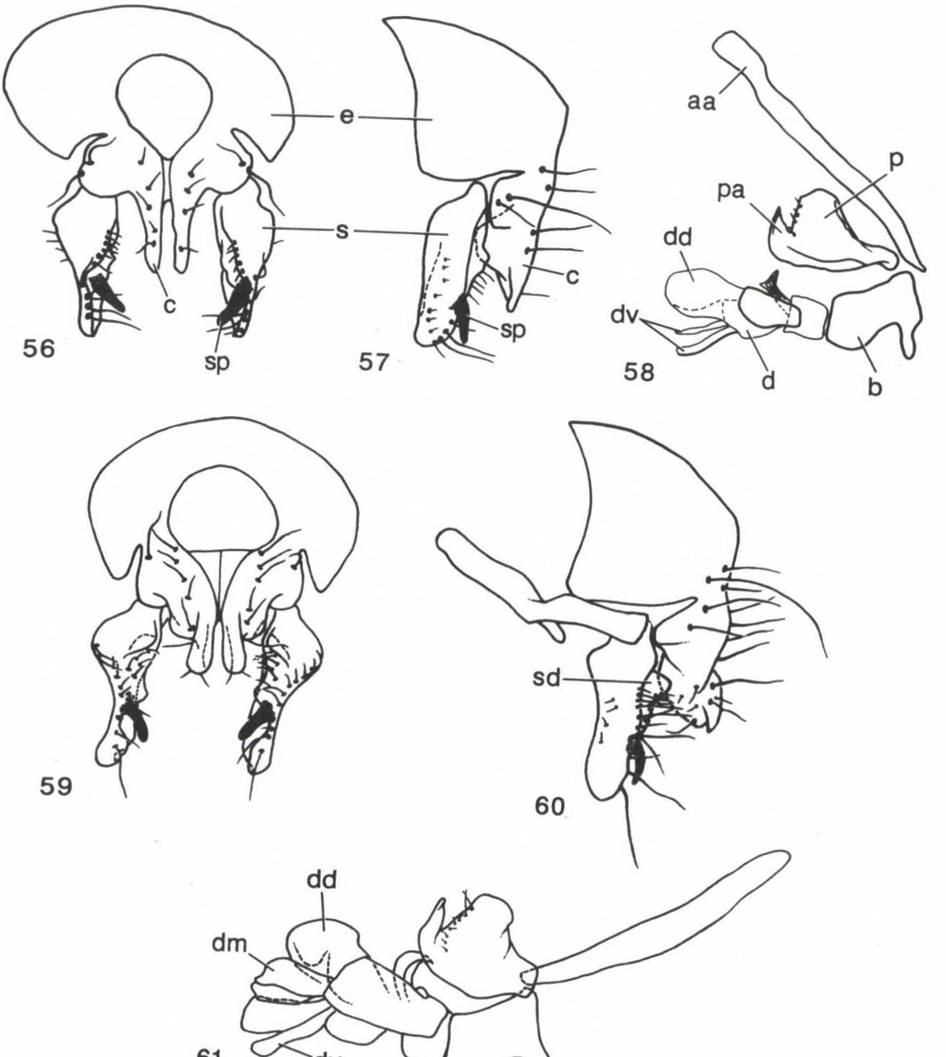
Wing: Dorsally with basal nonmicrotrichose area extended over basal cells, basal 1/2-3/5 of cell *dm* and similar sized areas in radial cells, and anterior 1/2 of basal 1/3 of cell cu_1.

Male abdomen: Sternite 5 (Fig. 49) with weak medial lobe on posterior margin, medial setae in row on lobe small, closely approximated. Cercus, in posterior view (Fig. 56), elongate and slender from base, apex not bilobed; in lateral view (Fig. 57), anteriorly with subapical concave area, apex acute. Surstylus (Fig. 56) with spinelike process slender, but slightly broader than in *abyssinicus*. Paramere (Fig. 58) with apical (i.e. ventral) lobe short, stout and acute. Distiphallus, in lateral view (Fig. 58), with dorsoapical lobe moderate sized and longer than wide, with ventroapical lobe slender, shorter than additional, more ventral, unpaired lobe (with 3 total).

Female abdomen: Sternites 2-5 evenly sclerotized, broad, sternites 3-4 more than 0.85 times as wide as corresponding tergites; sternite 4 undivided.

Remarks. This is one of the most easily recognized species of *Achaetothorax*. It has the most extensive setation of the hind femur and, of the species with entirely dark tarsi, it is the only one that has the sides of the scutellum concave.

Etymology. The specific epithet refers to the complete posteroventral row of spinelike setae on the hind femur.



Figs 56-61. Male genitalia: 56-58 = *completus*, holotype; 59-61 = *concavus*, paratype, Zaire, Kamatembe, 1046; 56, 59 = epandrium, cerci and surstyli, posterior view; 57, 60 = same, left lateral view; 58, 61 = paramere and aedeagus, left lateral view (aa: aedeagal apodeme; b: basiphallus; c: cercus; d: distiphallus; dd: dorsoapical lobe of distiphallus; dm: medioapical lobe of distiphallus; dv: ventroapical lobe(s) of distiphallus; e: epandrium; s: surstylus; sd: dorsal lobe of surstylus; sp: spinelike process of surstylus; p: paramere; pa: apical lobe of paramere)

Achaetothorax concavus NORRBOM & PAPP, sp. n. (Figs 50-51, 59-61)

Holotype male (MRAC): ZAIRE: Kivu, Parc National Albert, Riv.Bishakishaki, Kamatembe, Plaine lave, 2100 m, 7-23.I.1935, G. F. DE WITTE, 1044; VANSCHUYTBROECK det. 1944 A. abyssinica.

Paratypes. 1 ♂ 2 ♀ (MRAC, USNM), same data as holotype except DE WITTE, 1046; 1 ♀ (MRAC), same, except 1045; 5 ♂ 3 ♀ (IRSN, USNM), ZAIRE: Kivu, Parc National Albert, Nyamuronge Riv., near Mugando, 21.IV.1945, G.F. de WITTE, 19. 2 ♂ (BMNH, USNM), UGANDA: Ruwenzori Range, Namwamba Valley, 10100 ft, XII.1934-I.1935, T.H.E. JACKSON.

Additional specimens examined: 1 (without abdomen) (MRAC), same data as holotype except 1046.

Body length 2.05-2.70 mm, wing length 1.75-2.50 mm.

Head: Ocellar seta slightly longer than pedicel seta. Outer vertical seta 1/2 length of inner vertical seta.

Thorax: Prothorax moderately large, collarlike. Posterior margin of scutum without microtrichia between ridges connected to scutellum. Scutellum, in dorsal view, with sides straight or usually slightly concave.

Legs: Male hind trochanter without ventroapical process. Male fore basitarsus with longest dorsal setae subequal in length to tarsomere 2. Fore basitarsus dark brown, tarsomeres 2-5 yellow. Hind femur with spinelike setae on apical 1/2 to 3/5 anteroventrally, on apical 2/5 to 1/2 posteroventrally.

Wing: Dorsally with basal nonmicrotrichose area extended over basal cells, basal 7/8 or all of cell *dm* and similar sized areas in radial cells, and anterior 4/5 of cell cu_1.

Male abdomen: Sternite 5 (Fig. 50-51) with posterior margin deeply concave medially, slightly produced lateral to concave area; margin medially with relatively few setae. Cercus, in posterior view (Fig. 59), with lateral margin strongly mesally incurved at midlength; medial apical lobe concave on mesal side; in lateral view, rounded, with hooklike subapical ridge. Surstylus, in posterior view (Fig. 59), with spinelike process slender, much closer to small medial lobe than to apex; in lateral view (Fig. 60), posterior margin with narrow conical dorsal lobe. Paramere (Fig. 61) with apical lobe short, slightly concave on ventral margin. Distiphallus, in lateral view (Fig. 61), with dorsoapical and ventroapical lobes moderate sized, also with large medioapical lobe.

Female abdomen: Sternites 2-5 evenly sclerotized, broad, sternites 3-4 more than 0.85 times as wide as corresponding tergites.

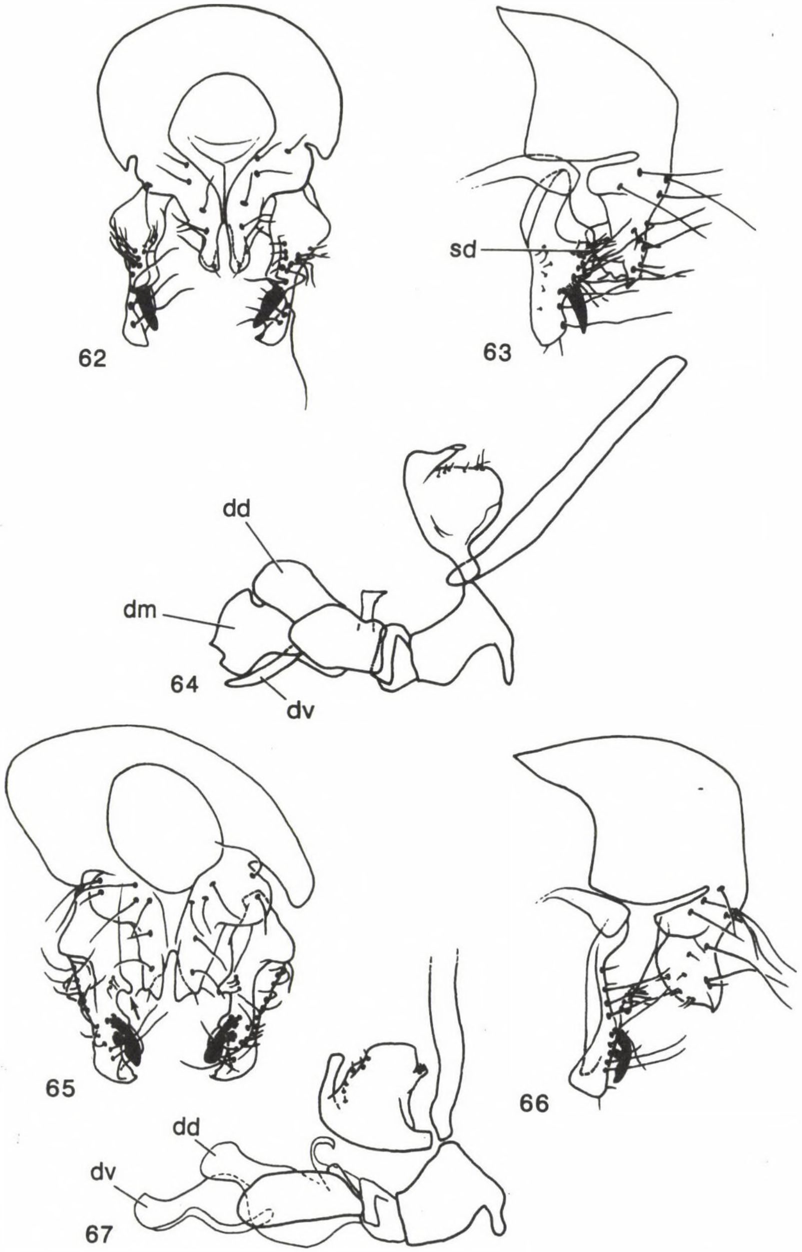
Remarks. The large nonmicrotrichose area on the dorsal side of the wing and the lack of a lobe on the male hind trochanter distinguish this species from *pectinatus* and *trochanteratus*, but examination of male sternite 5 and the genitalia is necessary to recognize *concavus* from its other congeners with a bicolored fore tarsus and short femoral setae. The more strongly concave posterior margin of sternite 5 (Fig. 50-51) and the more rounded dorsal lobe on the surstylus, best seen in lateral view (Fig. 60), are the best characters to distinguish it from *coninckae*, the most closely related species.

Etymology. The specific epithet refers to the concave posterior margin of male sternite 5.

Achaetothorax coninckae NORRBOM & PAPP, sp. n. (Figs 52, 62-64)

Holotype male (MRAC): ZAIRE: Kivu, Rutshuru, 1285 m, 22.V-4.VI.1934, G. F. DE WITTE, 427; VANSCHUYTBROECK det. 1944 *A. abyssinica.*

Paratypes: 2 ♂ 1 ♀ (USNM), same data as holotype; 1 ♀ (MRAC), same, 4.V.1934; 1 ♀ (MRAC), same, 1285 m, VII.1935, DE WITTE, 1671; 1 ♂ (MRAC), same, 1250 m, 4.VII.1935, DE



Figs 62-67. Male genitalia: 62-64 = *coninckae*, paratype, Zaire, Rutshuru, 427; 65-67 = *pectinatus*, paratype, Zaire, Nyamuronge Riv.; 62, 65 = epandrium, cerci and surstyli, posterior view; 63, 66 = same, left lateral view; 64, 67 = paramere and aedeagus, left lateral view (dd: dorsoapical lobe of distiphallus; dm: medioapical lobe of distiphallus; dv: ventroapical lobe of distiphallus; sd: dorsal lobe of surstylus)

WITTE, 1686; 2 ♂ 1 ♀ (MRAC, USNM), ZAIRE: Kivu, Nyongera, near Rutshuru, Butumba, 1218 m, 17.VII.1935, G. F. DE WITTE, 1669; 1 ♀ (MRAC), Rutshuru, Riv. Musugereza, 1100 m, 9.VII.1935, G. F. DE WITTE, 1632.

Body length: 1.85-2.45 mm; wing length: 1.60-1.95 mm.

Head: Ocellar seta equal to slightly longer than pedicel seta. Outer vertical seta less than 1/2 length of inner vertical seta.

Thorax: Prothorax moderately large, collarlike. Posterior margin of scutum without microtrichia between ridges connected to scutellum. Scutellum, in dorsal view, with sides straight or usually slightly concave.

Legs: Male hind trochanter without large ventroapical process. Male fore basitarsus with longest dorsal setae 1.2 times as long as tarsomere 2. Fore basitarsus dark brown, tarsomeres 2-5 yellow. Hind femur with spinelike setae on apical 2/5 to 3/5 anteroventrally, on apical 2/5 to 1/2 posteroventrally.

Wing: Dorsally with basal nonmicrotrichose area extended over basal cells, basal 7/8 or all of cell *dm* and similar sized areas in radial cells, and anterior 4/5 of cell cu_1.

Male abdomen: Sternite 5 (Fig. 52) with posterior margin very slightly concave medially, with row of long setae along concave area. Cercus, in posterior view (Fig. 62), with lateral margin strongly mesally incurved at midlength; medial apical lobe concave on mesal side; in lateral view, rounded, with hooklike subapical lobe. Surstylus, in posterior view (Fig. 62), with spinelike process slender, much closer to small medial lobe than to apex; in lateral view (Fig. 63), posterior margin with broad rounded dorsal lobe. Paramere (Fig. 64) with apical lobe short, strongly concave on ventral margin. Distiphallus, in lateral view (Fig. 64), with dorsoapical and ventroapical lobes moderate sized, also with large medioapical lobe.

Female abdomen: Sternites 2-5 evenly sclerotized, broad, sternites 3-4 more than 0.85 times as wide as corresponding tergites.

Remarks. The large nonmicrotrichose area on the dorsal side of the wing and the lack of a lobe on the male hind trochanter distinguish this species from *pectinatus* and *trochanteratus*, but examination of male sternite 5 and the genitalia is necessary to recognize *coninckae* from its other congeners with a bicolored fore tarsus and short femoral setae. The slightly concave posterior margin of sternite 5 (Fig. 52) and the conical dorsal lobe of the surstylus (Fig. 63) are the best characters to distinguish it from *concavus*, the most closely related species.

Etymology. This species is named for ELIANE DE CONINCK (MRAC), in recognition of the many loans of Afrotropical Copromyzinae made to us.

Achaetothorax crypticus PAPP & NORRBOM (Figs 44-48)

Achaetothorax crypticus PAPP & NORRBOM, 1992: 328.

Additional specimens examined. ZAIRE: Kivu, Parc National Albert, W. Kamatembe, Burunga, 2000 m, 9-20.III.1934, G. F. DE WITTE, 3 ♂ 1 ♀ (MRAC); Kivu, Kalondo, L. Ndaraga, Mokoto, 1750 m, 22-27.III.1934, G. F. DE WITTE, 325, 2 ♂ (MRAC); Kivu, Ngesho, 2000 m, 3-6.IV.1934, G. F. DE WITTE, 334, 1 ♂ (MRAC); Kivu, Parc National Albert, Kitondo, near Gandjo, 2000 m, 7-23.I.1935, G. F. DE WITTE, 1025, 1 ♂ (MRAC).

Remarks. PAPP & NORRBOM (1992) tentatively identified a female from Mozambique as this species, but based on subsequently discovered microtrichial patterns of the wing, it has now been determined as *rhinocerotis*. In *crypticus* and *abyssinicus* (including the syntype ♀), the dorsal bare area extends over at least the basal 3/4 of cell *dm*, and almost to or slightly beyond the level of *dm-cu* in the radial cells, but the posterior 1/4-2/5 of cell cu_1 is microtrichose.

Achaetothorax pectinatus NORRBOM & PAPP, sp. n. (Figs 55, 65-67)

Borborus (Achaetothorax) abyssinica: VANSCHUYTBROECK 1951: 8 (misidentification).

Holotype male (IRSN): ZAIRE: Eala, 1935, J. GHESQUIERE; VANSCHUYTBROECK det. 1950 *A. abyssinica.*

Paratypes. 1 ♂ (USNM), ZAIRE: Kivu, Parc National Albert, Nyamuronge Riv., near Mugando, 21.IV.1945, G.F. de WITTE, 19; 1 ♂ (without abdomen) (MRAC), Parc National Albert, Riv. Bishakishaki, Kamatembe, Plaine lave, 2100 m, 7-23.I.1935, G.F. de WITTE, 1046.

Body length (holotype) 2.29 mm, wing length 2.04 mm.

Head: Ocellar bristle medium length, slightly longer than pedicel bristle. Outer vertical bristle less than 1/3 as long as inner vertical bristle.

Thorax: Prothorax large, collarlike. Posterior margin of scutum with narrow but complete band of microtrichia. Scutellum, in dorsal view, with sides moderately concave.

Legs: Fore basitarsus brown, tarsomeres 2-5 yellow. Male fore basitarsus with dorsal setae short, half as long as tarsomere 2. Male hind trochanter with large ventroapical conical process 1/4-1/3 length of main part of trochanter. Hind femur with spinelike setae on apical 2/5 to 1/2 anteroventrally and posteroventrally.

Wing: Dorsally with basal nonmicrotrichose area extended over cells *br, bm* and *bcu*, usually into base of cell r_{2+3} along vein R_{2+3}, and sometimes slightly into cells dm or cu_1.

Male abdomen: Sternite 5 (Fig. 55) with posterior margin medially concave and ventrally projected, with dense row of long setae. Cercus, in posterior view (Fig. 65), moderately long, slightly tapered at midlength, almost truncate but medial apical corner longer than medial lateral, and margin between them concave; in lateral view (Fig. 66), broad, with hooklike apex. Surstylus with spinelike process divided basally and flared apically; in posterior view (Fig. 65), posterior margin with tabshaped lobe dorsally; in lateral view (Fig. 66), apex broad and truncate. Paramere (Fig. 67) with long slender apical lobe. Distiphallus, in lateral view (Fig. 67), with dorsoapical lobe moderate sized; with ventroapical lobe, elongate, broad basally and apically.

Remarks. This species and *trochanteratus* are the only species of *Achaetothorax* in which the male hind trochanter has an elongate lobe. Males of these two species can be separated by the shape of sternite 5 and various genitalic characters, as indicated in the key. The paratype without an abdomen cannot be identified with certainty and is assumed to be this species based on its distribution.

Etymology. The specific epithet refers to the comblike row of setae on male sternite 5.

Achaetothorax rhinocerotis (RICHARDS) (Figs 7-10, 14-16, 53-54)

Additional specimens examined: MOZAMBIQUE: Lourenço Marqués, 3.VIII.1929, P. LESNE, "bouses", 1 ♀ (MNHN). SOUTH AFRICA: Cape: Bosberg Nature Res., 3 km N Somerset East, 3242'S 2633'E, 850 m, 5.XII.1989, J. & H. LONDT, 1 ♀ (NMP). Natal: Cathedral Peak area, 1.I.1956, B. STUCKENBERG, 1 ♀ (NMP); Ahrens district, near Lilani, III.1962, B. & P. STUCKENBERG, 1 ♀ (NMP). Transvaal: Barberton, 15.V.1913, H. K. MUNRO, 1 ♀ (NMP); Pretoria, 257'S 282'E, from dung of domestic cattle, 15.VI.1986, E. J. WRIGHT, 3 ♂ (NMP, USNM).

Remarks. This species can be recognized by its extensive nonmicrotrichose area on the dorsal side of the wing. It is the only species of *Achaetothorax* in which the posterior margin is entirely bare in cell cu_1. In the radial and medial cells, the bare area extends to or slightly beyond *dm-cu*. The females listed above were determined on the basis of this character. The specimen from Mozambique was tentatively determined by PAPP & NORRBOM (1992) as *crypticus*. The female from Cathedral Peak area, South Africa was reported as *abyssinicus* by HACKMAN (1965).

Achaetothorax grootaerti NORRBOM & PAPP, sp. n.
(Figs. 20-21, 24-25, 68-70)

(partim) *Achaetothorax straeleninus*: PAPP & NORRBOM 1992: 331.

Holotype male (MRAC): ZAIRE: Haut-Zaire, Parc National Garamba, PpK/60/d/8, 18.XII.1951, H. DE SAEGER, 2924.

Paratypes: UGANDA: 2 ♂ 1 ♀ (BMNH, HNHM), Ruwenzori Range, Namwamba Valley, 10100 ft., XII.1934-I.1935, T. H. E. JACKSON. ZAIRE: 2 ♂ (IRSN), Kivu, W. Ruwenzori, Kalonge, XI.1932, VAN HOOF; 5 ♂ 9 ♀ (MRAC, USNM), Kivu, Parc National Albert, S Lake Edward, Tshambi, 975 m, 11.II.1936, L. LIPPENS; 3 ♂ 1 ♀ (MRAC, USNM), same, Kitembo, 925 m, 4.IV.1936; 1 ♂ (MRAC), Park National Albert, Bishakishaki, Riv. Kamatembe, Plaine de lave, 2100 m, 7-23.I.1935, G. F. DE WITTE, 1045; 1 ♂ (MRAC), Parc National Albert, Bugazia, 920 m, 21.V.1935, H. DAMAS, A162; 2 ♂ (MRAC, USNM), ?Haut-Zaire, Parc National Garamba, Ndelele, K.115, 3.XII.1951, H. DE SAEGER, 2842; 1 ♂ (MRAC), Parc National Garamba, Pp.K/55/d/8, 19.XI.1951, H. DE SAEGER, 2768; 1 ♀ (USNM), same data as holotype; 6 ♂ 3 ♀ (CAS, USNM, HNHM), ?Haut-Zaire, Epulu, 950 m, 2.X.1957, E. S. ROSS & R. E. LEECH.

Body length 1.95-3.03 mm, wing length 1.70-2.50 mm.

Head: Ocellar seta equal to or slightly longer than pedicel seta. Outer vertical seta usually less than 3/5 length of inner vertical seta.

Thorax: Prothorax large, collarlike. Posterior margin of scutum without microtrichia, at least medially, sometimes with microtrichia extended mesally to dorsocentral or acrostichal seta. Scutellum, in dorsal view, with sides usually strongly concave.

Legs: Male hind trochanter without large ventroapical process. Fore basitarsus dark brown, tarsomeres 2-5 yellow. Male fore basitarsus with dorsal setae longer than tarsomere 2. Hind femur with spinelike setae on apical 1/2 anteroventrally, on apical 2/5 to 1/2 posteroventrally.

Wing: Dorsally with basal nonmicrotrichose area extended over basal cells, basal 1/3-2/3 of cell *dm* and similar sized areas in radial cells, and anterior 2/3-3/4 of cell cu_1.

Male abdomen: Sternite 5 (Fig. 21) somewhat trapezoidal (especially in normal position, with medial part projected), posterior margin with weak medial concavity, on each edge of latter, cluster of small inclinate setae at extreme margin. Cercus, in posterior view (Fig. 20, 68), short and broad, extreme apex narrowed, in lateral view, apex broadly rounded. Surstylus moderately long, in posterior view (Fig. 20, 68), caudal spinelike process slender, very close to small, mesally projecting medial lobe; apex twisted; in lateral view (Fig. 69), apex slightly expanded. Paramere (Fig. 24) apical lobe concave on ventral margin. Distiphallus, with dorsoapical lobe moderate sized, with ventroapical lobes fused, elongate, in lateral view (Fig. 25, 70), narrow basally, expanded apically.

Female abdomen: Sternites very broad, sternites 3-4 more than 0.90 times as wide as corresponding tergites; sternites 2-4 usually evenly sclerotized.

Remarks. This species is extremely similar to *medialis* and *straeleninus*. Most specimens of *grootaerti* can be distinguished from these species by the smaller size of the dorsal nonmicrotrichose area of the wing, but there is slight overlap in this character, and the differences in surstylus shape, especially the size and location of the spinelike process (see key), are the only reliable diagnostic characters. We believe these three species are distinct because the genitalic differences are consistent in all males dissected and they are maintained in sympatry (*grootaerti* is sympatric with each of the other two species) and thus are not simply variation among geographic populations. *A. straeleninus* is known only from Parc National Garamba in Haut-Zaire, and *medialis* from Parc National Albert in Kivu, whereas *grootaerti* was collected in both parks as well as the Ruwenzori region of Zaire and Uganda. We have also examined females from South Africa (USNM) and Parc National l'Upemba, Shaba Province, Zaire (IRSN) that belong to this complex of species. They resemble *straeleninus* and *medialis* in the size of the nonmicrotrichose area of the wing, but they may represent other species.

Etymology. This species is named for P. GROOTAERT (IRSN), in recognition of the many loans of Afrotropical Copromyzinae made to us.

Achaetothorax medialis NORRBOM & PAPP, sp. n.
(Figs 71-72)

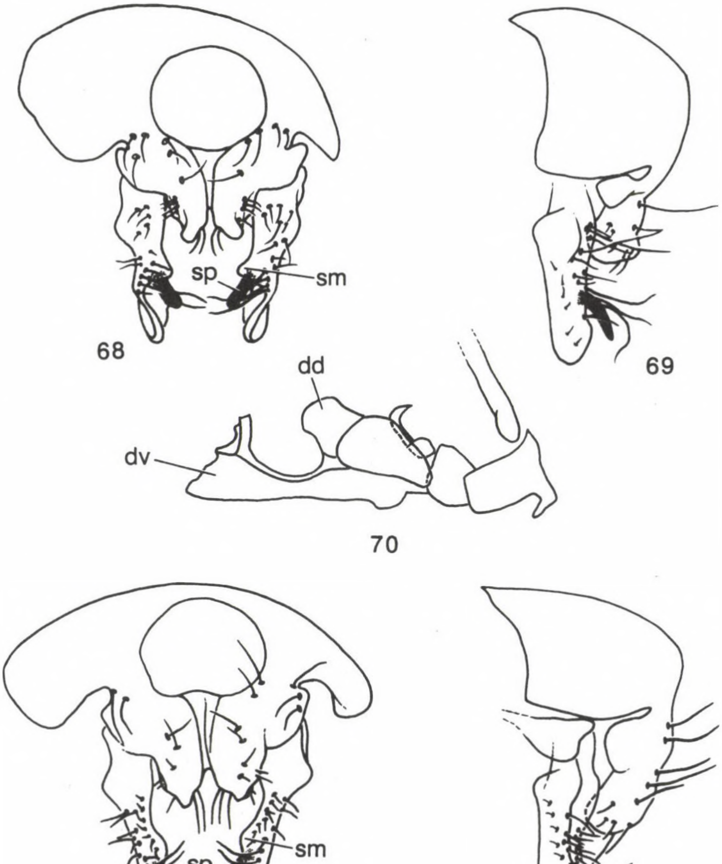
(partim) *Achaetothorax straeleninus*: PAPP & NORRBOM 1992: 331.

Holotype male (MRAC): ZAIRE: Kivu, Parc National Albert, Mt. Sesero, near Bitashimwa, 2000 m, bamboo, 2-3. VIII.1934, G.F. de WITTE, 514.

Paratypes. 9 ♂ 9 ♀ (MRAC, USNM, HMNH), same data as holotype; 1 ♂ 1 ♀ (USNM), ZAIRE: Kivu, Park National Albert, Ngoma, L. BIUNIU, 3-10.IV.1935, H. Damas; 1 ♂ 1 ♀ (USNM), Parc National Albert, S Lake Edward, Kitembo, 925 m, 4.IV.1936, L. LIPPENS; 1 ♀ (MRAC), Parc National Albert, Kanyabayongo (Kabasha), 1760 m, 6.XII.1934, G.F. de WITTE, 872.

Body length 2.08-2.58 mm, wing length 1.70-2.15 mm.

Characters as in grootaerti except as follows:



Figs 68-72. Male genitalia: 68-70 = *grootaerti*, paratype, Zaire, Tshambi; 71-72 = *medialis*, paratype, Zaire, Mt. Sesero, 514; 68, 71 = epandrium, cerci and surstyli, posterior view; 69, 72, same, left lateral view; 70 = aedeagus, left lateral view (dd: dorsoapical lobe of distiphallus; dv: ventroapical lobe of distiphallus; sm: medial lobe of surstylus; sp: spinelike process of surstylus)

Wing: Dorsally with basal nonmicrotrichose area extended over basal cells, basal 2/3-4/5 of cell dm and similar sized areas in radial cells, and anterior 2/3-4/5 of cell cu_1.

Male abdomen: Surstylus long, in posterior view (Fig. 71), caudal spinelike process very stout, separated from small, mesally projecting medial lobe by slightly less than width of process, but closer to lobe than to apex; apex not twisted; in lateral view (Fig. 72), apex slightly expanded.

Remarks. See *grootaerti.* This species and *straeleninus* can be distinguished only by the shape of the surstylus and its spinlike process, as indicated in the key.

Etymology. The specific epithet refers to the shape of the surstylus, which is intermediate between that of *straeleninus* and *grootaerti.*

Achaetothorax straeleninus (RICHARDS, 1980) (Figs 73-74)

Borborus (Achaetothorax) straeleni VANSCHUYTBROECK, 1959b: 57 (preoccupied by *B. straeleni* VANSCHUYTBROECK, 1948, now in *Dudaia*).

Copromyza (Achaetothorax) straelenina RICHARDS, 1980: 616 (nom. n. for *B. straeleni* VANSCHUYTBROECK, 1959).

(part) *Achaetothorax straeleninus*: PAPP & NORRBOM 1992: 331.

Specimens examined. Holotype ♂ (MRAC), ZAIRE: Haut-Zaire, Parc National Garamba, II/gd/8, 13.XII.1951, H. DE SAEGER, 2901; same as holotype, except II/ge/4, 22.V.1951, DE SAEGER, 1778, 1 ♂ 1 ♀ (IRSN); same, except II/fd/17, 14.XII.1951, DE SAEGER, 2910, 1 ♂ (USNM); same, except II/id/9, 31.X.1951, DE SAEGER, 2709, 7 ♂ 3 ♀ (IRSN, USNM); same, except II/id/10, DE SAEGER, 2419, 3 ♂ 2 ♀ (MRAC, HNHM, USNM); same, except Mpaza/9, 23.I.1952, DE SAEGER, 3076, 1 ♂ 5 ♀ (MRAC, HNHM); same, except PpK.9/g/9, 10.IX.1952, H. DE SAEGER, 4044, 1 ♂ (MRAC); same, except Mt. Moyo, 25.IX.1952, DE SAEGER, 4076, 2 ♂ (MRAC, USNM).

Body length 1.95-2.41 mm, wing length 1.66-2.12 mm.

Characters as in *grootaerti* except as follows:

Wing: Dorsally with basal nonmicrotrichose area extended over basal cells, basal 3/4-7/8 of cell *dm* and similar sized areas in radial cells, and anterior 2/3-4/5 of cell cu_1.

Male abdomen: Surstylus long, in posterior view (Fig. 73), caudal spinelike process very stout, equidistant from small, mesally projecting medial lobe and apex; apex not twisted; in lateral view (Fig. 74), apex not expanded.

Remarks. See *grootaerti.* This species and *medialis* can be distinguished only by the shape of the surstylus and its spinelike process, as indicated in the key. We have redescribed this species because the description in PAPP & NORRBOM (1992) was based on a mix of *straeleninus, grootaerti* and *medialis*.

Achaetothorax whittingtoni NORRBOM and PAPP, sp. n. (Figs 77-80)

Holotype male (NMP): SOUTH AFRICA: Natal: Kosi Bay Nat. Reserve, 2632DD, forest & open woodland areas, 30.XI-2.XII.1982, LONDT, BARRACLOUGH & STUCKENBERG.

Body length 2.29 mm, wing length 1.96 mm.

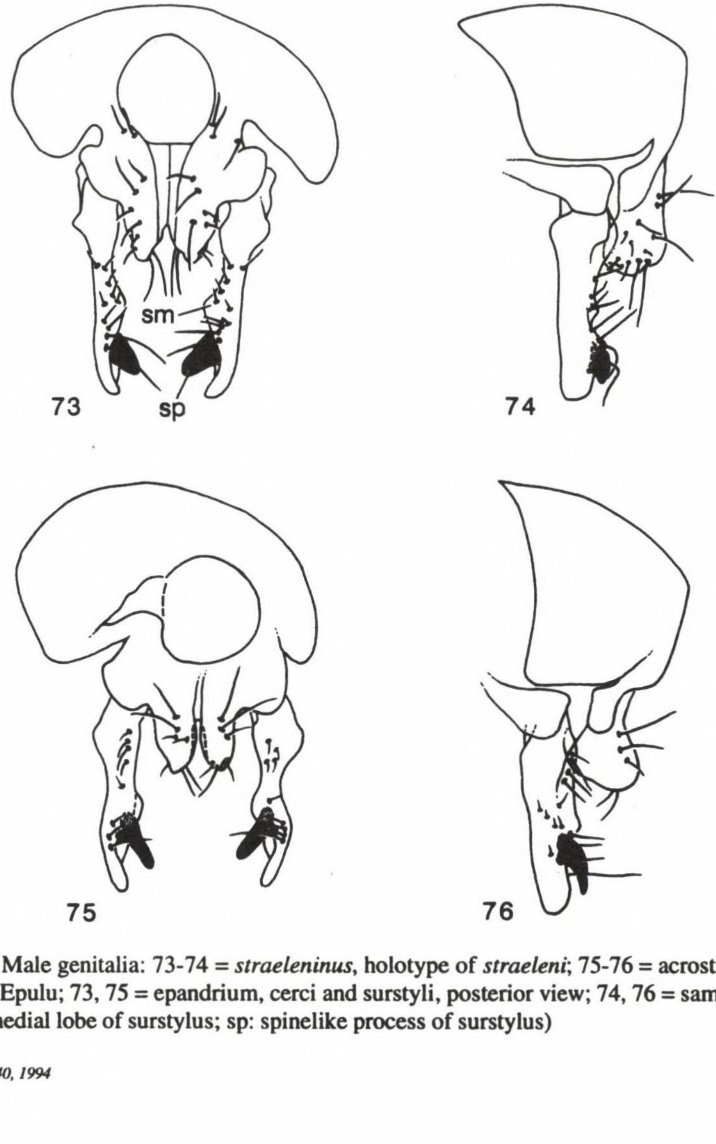
Head: Ocellar seta slightly longer than pedicel seta. Outer vertical seta 1/2 length of inner vertical seta.

Thorax: Prothorax moderately large, collarlike. Posterior margin of scutum without microtrichia between ridges connected to scutellum. Scutellum, in dorsal view, with sides slightly concave.

Legs: Male hind trochanter without ventroapical process. Male fore basitarsus with longest dorsal setae subequal in length to tarsomere 2. Fore basitarsus dark brown except apex, tarsomeres 2-5 yellow. Hind femur with spinelike setae on apical 3/5 anteroventrally, on apical 1/2 posteroventrally. Hind tibia with posteroapical spur ca. as long as width of hind basitarsus.

Wing: Dorsally with basal nonmicrotrichose area extended over cells *br, bm* and *bcu*, into base of cells r_{2+3} and r_1 along vein R_{2+3}, and less than basal 1/5 of cell *dm* and similar sized area in cell cu_1.

Male abdomen: Sternite 5 (Fig. 77) with posterior margin very slightly concave medially; this area with several rows of setae. Cercus, in posterior view (Fig. 78), elongate, slender from base; in lateral view, rounded, with tiny hooklike subapical lobe. Surstylus, in posterior view (Fig. 78), with spinelike process slender, almost midway between small medial lobe and apex; in lateral view (Fig. 79), relatively broad, posterior margin with small broad dorsal lobe. Paramere (Fig. 80) with apical lobe very short. Distiphallus, in lateral view (Fig. 80), with dorsoapical and ventroapical lobes moderate sized, also with large medioapical lobe.



Figs 73-76. Male genitalia: 73-74 = *straeleninus*, holotype of *straeleni*; 75-76 = acrostichalis, paratype, Zaire, Epulu; 73, 75 = epandrium, cerci and surstyli, posterior view; 74, 76 = same, left lateral view (sm: medial lobe of surstylus; sp: spinelike process of surstylus)

Remarks. This species can be distinguished from all other species of *Achaetothorax* by the large size of the posteroapical spur on the hind tibia. This spur, not to be confused with the large ventroapical spur present in most other Copromyzinae, is usually minute in other Copromyzinae. It is no more than half as long as the width of the hind basitarsus in other species of *Achaetothorax*.

Etymology. This species is named for A. E. WHITTINGTON, who kindly sorted and arranged the loan of the Natal Museum Copromyzinae.

KEY TO THE SPECIES OF ACHAETOTHORAX

1 Two rows of acrostichal setae present (at least anterior to transverse suture). Prothorax well developed. Male cercus, in lateral view (Fig. 76), rounded apically, slightly posteriorly projected. Surstylus (gonostylus) (Figs 17, 75) slender, without distinctive lobes and with few long setae. (Zaire) **acrostichalis** PAPP et NORRBOM

– Acrostichal setae absent except prescutellar pair. Prothorax, male cercus, and surstylus variable 2

2 Dorsal and anteroventral setae of hind femur and anteroventral and posteroventral setae of mid femur longer than width of femur. Outer vertical seta normal, at least 3/4 length of inner vertical seta. Surstylus (Figs 35, 39) strongly bilobed, anterior lobe with knobshaped process (male unknown in *malayensis*) 3

– Hind and mid femoral setae shorter than width of femur. Outer vertical seta short, at most 1/2 length of inner vertical seta. Surstylus not strongly bilobed and without knobshaped process 5

3 Legs entirely yellow (at most yellowish brown). Setae on hind tibia notlonger (usually shorter) than width of tibia. Male sternite 5 (Fig. 38) posterior margin with small medial concave area. Paramere (postgonite) (Fig. 37) with apical (i.e. ventral lobe) longer than 1/2 maximal width of paramere (Uganda, Zaire) **flavipes** PAPP et NORRBOM

– At least fore and hind femora and hind tibia mostly redbrown or dark brown. Anterodorsal and posterodorsal setae on hind tibia longer than width of tibia 4

4 Wing with cell br nonmicrotrichose dorsally. Female sternites 3 and 4 normally sclerotized, broad, sternite 4 at least 0.80 times as wide as tergite 4. Male sternite 5 (Fig. 43) posterior margin with quadrate medial lobe. Par-

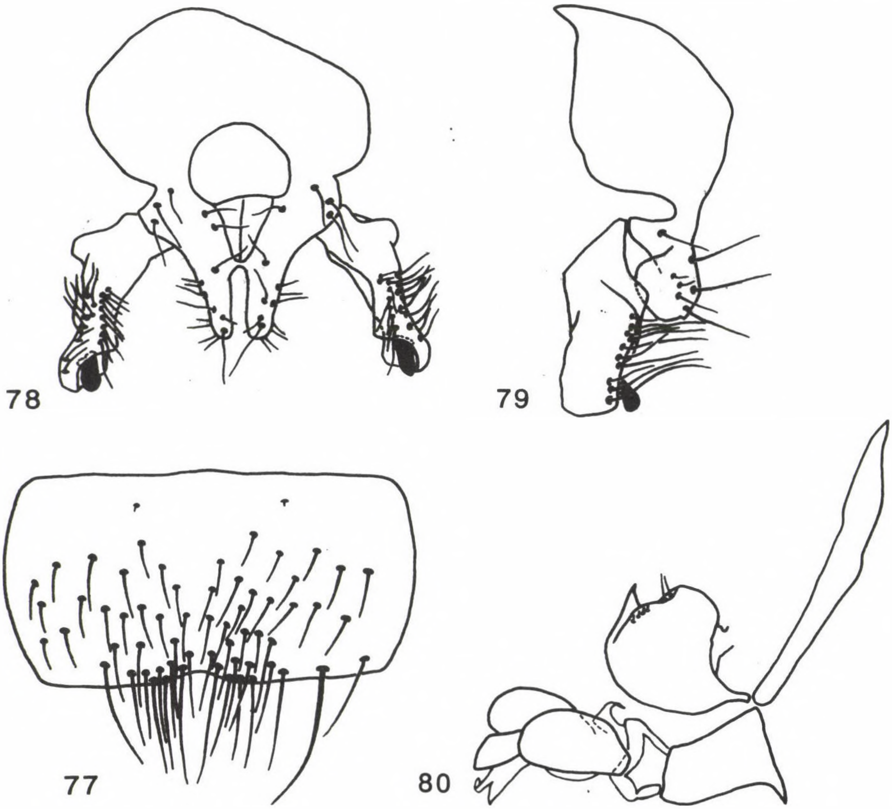
amere (postgonite) (Fig. 42) with apical (i.e. ventral) lobe short, less than 1/4 maximal width of paramere (Kenya, Zaire) **vojnitsi** PAPP et NORRBOM

– Wing with cell br microtrichose dorsally. Female sternites 3 and 4 weakly sclerotized, relatively narrow, sternite 4 less than 0.55 times as wide as tergite 4. Male unknown (Malaysia) **malayensis** PAPP et NORRBOM

5 Fore tarsus usually entirely dark brown, tarsomeres 4-5 occasionally yellowish. Female sternite 4 usually bipartite 6

– Fore tarsomeres 2-5 yellow. Female sternite 4 not bipartite 9

6 Hind femur posteroventrally with complete row of spinelike setae, extended to extreme base, beyond point opposite apex of tibia. Scutellum, in dorsal



Figs 77-80. *A. whittingtoni*, holotype: 77 = male sternite 5, 78 = epandrium, cerci and surstyli, posterior view, 79 = same, left lateral view, 80 = paramere and aedeagus, left lateral view

view, with sides strongly concave. Wing on dorsal side with nonmicrotrichose area extended over basal 1/2-3/5 of cell dm. Male sternite 5 with medial setae (Fig. 49, arrow) in apical row small. Male cercus, in posterior view (Fig. 56), long, slender, simple. Distiphallus (Fig. 58) with dorsoapical lobe longer than wide, paired ventroapical lobe weakly sclerotized. Female sternite 4 undivided (Kenya, Zaire) **completus** sp. n.

– Hind femur posteroventrally with spinelike setae on apical 1/2 or less (anteroventrally, up to apical 4/5 with spinelike setae, but none basal to point opposite apex of tibia). Scutellum, in dorsal view, with sides straight or slightly concave. Wing on dorsal side with nonmicrotrichose area extended over at least basal 3/4 of cell *dm*. Male sternite 5 with medial pair of setae in apical row large. Male cercus, in posterior view, short and broad or bilobed apically. Distiphallus (Figs 10, 12) with dorsoapical lobe large and rounded, paired ventroapical lobe strongly sclerotized. Female sternite 4 bipartite 7

7 Wing on dorsal side with posterior 1/5 or more of cell cu_1 microtrichose. Male sternite 5 (Figs 5, 44-45) with largest, medial pair of setae in row on medial lobe closely approximated. Surstylus (gonostylus) (Figs 6, 46-47) with spinelike process slender. Male cercus (Figs 6, 46-47) bilobed apically. Fore tarsus entirely dark brown 8

– Wing on dorsal side with all of cell cu_1 nonmicrotrichose, including posterior margin. Male sternite 5 with largest, medial pair of setae (Figs 53-54, arrow) in apical row well separated. Surstylus (Figs 8, 14) with spinelike process broad. Male cercus (Figs 8, 14) simple. Fore tarsomeres 4 or 5 often yellowish (Ethiopia, Kenya, Mozambique, South Africa, Tanzania, Zaire, Zimbabwe) **rhinocerotis** (RICHARDS)

8 Male cercus, in posterior view (Fig. 6), with medial apical lobe slightly projected; basal part of posterior side of cercus not concave on medial half. Surstylus, in posterior view (Fig. 6), with basal lobe pronounced (Ethiopia) **abyssinicus** (DUDA)

– Male cercus, in posterior view (Figs 46-47), with medial apical lobe more projected; basal part of posterior side of cercus concave on medial half. Surstylus, in posterior view (Figs 46-47), with basal lobe weak (Tanzania, Uganda, Zaire) **crypticus** PAPP et NORRBOM

9 Male hind trochanter with large conical ventroapical lobe at least 1/4 as long as main part of trochanter. Wing dorsally with nonmicrotrichose basal area at most extended slightly into cells r_{2+3}, *dm* and cu_1. Scutum hind mar-

gin with narrow but complete microtrichose (pruinose) band. Surstylus (Figs 26, 65) with small tabshaped lobe (Fig. 65, arrow) on posterior margin dorsally, and with spinelike process divided basally 10

– Male hind trochanter without ventroapical lobe. Wing dorsally with nonmicrotrichose basal area extended over at least basal 1/3 of cells r_{2+3}, *dm* and cu_1 (except in *whittingtoni*). Scutum hind margin bare medially, microtrichia extended mesally at most to acrostichal seta. Surstylus without tabshaped lobe on posterior margin dorsally, and with spinelike process undivided basally 11

10 Male sternite 5 (Fig. 55) with posterior margin medially concave and ventrally projected, with dense row of long setae. Male cercus, in posterior view (Fig. 65), moderately long, with short mesal apical lobe. Distiphallus (Fig. 67) with dorsoapical lobe moderately broad, ventroapical lobe very long and broad (Zaire) **pectinatus** sp. n.

– Male sternite 5 (Fig. 28) with posterior margin with nonsetose quadrate medial lobe. Male cercus, in posterior view (Fig. 26), long and slender. Distiphallus (Fig. 29) with dorsoapical lobe broad, ventroapical lobe short and slender (Zaire) **trochanteratus** PAPP et NORRBOM

11 Male sternite 5 not trapezoidal and without cluster of small setae on posterior margin. Scutellum, in dorsal view, with sides usually slightly concave. Male cercus, in lateral view (Figs 60, 63), with small hooklike lobe apically. Distiphallus, in lateral view (Figs 61, 64), with broad, dark medioapical lobe, and with ventroapical lobe short 12

– Male sternite 5 (Fig. 21) trapezoidal, with cluster of small setae on posterior margin. Scutellum, in dorsal view, with sides usually strongly concave. Male cercus, in posterior view (Figs 68, 71, 73, 75), with small apical lobe, in lateral view (Figs 69, 72, 74, 76), apex rounded. Distiphallus, in lateral view (Figs 22, 25, 70), without large medioapical lobe, and with ventroapical lobe elongate, narrow basally and expanded apically 14

12 Wing on dorsal side with nonmicrotrichose basal area extended over at least basal 1/3 of cells r_{2+3}, *dm* and cu_1. Hind tibia with posteroapical spur small, at most half as long as width of hind basitarsus. Male cercus, in posterior view (Figs 59, 62), with strong medial constriction in lateral margin. Paramere (Figs 61, 64) with apical lobe moderately long 13

– Wing on dorsal side with nonmicrotrichose basal area at most extended slightly into cells r_{2+3}, *dm* and cu_1. Hind tibia with posteroapical spur large, as long as width of hind basitarsus. Male cercus, in posterior view (Fig. 78), with lateral margin even medially. Paramere (Fig. 80) with apical lobe short **whittingtoni** sp. n.

13 Male sternite 5 (Fig. 52) with posterior margin with very slight medial concave area, margin moderately setose. Surstylus, in lateral view (Fig. 63), with dorsal lobe large and rounded (Zaire) **coninckae** sp. n.

– Male sternite 5 (Figs 50-51) with posterior margin with strong medial concave area, margin sparsely setose. Surstylus, in lateral view (Fig. 60), with dorsal lobe narrow, conical (Uganda, Zaire) **concavus** sp. n.

14 Wing on dorsal side with basal nonmicrotrichose area extended over basal 1/3-2/3 of cell *dm*. Surstylus moderately long; in posterior view (Fig. 68), spinelike process slender, separated from small, mesally projected medial lobe by less than width of process; apex twisted, and in lateral view (Fig. 69), slightly expanded (Uganda, Zaire) **grootaerti** sp. n.

– Wing on dorsal side with basal nonmicrotrichose area extended over basal 2/3 or more of cell *dm*. Surstylus long; in posterior view (Figs 71, 73), spinelike process very stout, separated from small, mesally projectedmedial lobe by slightly less than or more than width of process; apex not twisted, sometimes expanded 15

15 Surstylus, in posterior view (Fig. 73), with spinelike process equidistant from small, mesally projected medial lobe and apex; apex, in lateral view (Fig. 74), not expanded (Zaire) **straeleninus** (RICHARDS)

– Surstylus, in posterior view (Fig. 71), with spinelike process separated from small, mesally projected medial lobe by slightly less than width of process, but closer to lobe than to apex; apex, in lateral view (Fig. 72), slightly expanded (Zaire) **medialis** sp. n.

PHYLOGENETIC RELATIONSHIPS

PAPP & NORRBOM (1992) listed 10 autapomorphies that strongly support the hypothesis that *Achaetothorax* is monophyletic. An additional autapomorphy is the presence on the dorsal side of the wing of a nonmicrotrichose basal area including at least cell *bm* and *bcu*.

To analyze the relationships among the species of *Achaetothorax*, we used *Norrbomia*, its probable sister group, as the outgroup to determine character polarities. The 27 characters used in the analysis are listed with their states in Table 1, and the distributions of the states are shown in Table 2. Some additional characters vary within *Achaetothorax*, but are difficult to use for phylogenetic analysis. For example, the shape of the posterior margin of male sternite 5 varies considerably, but we could not easily arrange these shapes into a transformation series. Additional phylogenetic information may be available in such characters. Other character states, for example, the complete posteroventral row of spinelike setae on the hind femur in completus and the dense row of setae on the posterior margin of male sternite 5 in *pectinatus*, are autapomorphies for individual species. These characters, therefore, are not included in the analysis.

The matrix in Table 2 was analyzed using the implicit enumeration option (ie*) of Hennig86. Three trees of 57 steps in length resulted (consistency index = 0.71, retention index = 0.82). Successive weighting did not reduce the number of

Table 2 Matrix of character state distributions in species of *Achaetothorax*. Numbers refer to characters and states listed in Table 1.

Taxa	Characters																										
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Norrbomia	0	0	0	0	0	0	0	0	0	0	0	0	?	?	0	0	0	0	0	0	0	0	0	0	?	0	0
malayensis	0	1	1	1	0	?	2	1	2	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	0
flavipes	0	1	1	1	0	0	2	1	2	0	1	0	5	0	0	1	1	1	0	0	0	0	0	0	0	0	1
vojnitsi	0	1	1	1	0	0	3	1	2	0	2	0	5	0	0	1	1	0	0	0	0	0	0	0	1	0	1
abyssinicus	1	1	1	1	0	1	0	0	2	0	4	0	3	0	0	0	0	2	0	0	0	1	0	1	2	1	1
crypticus	1	1	1	1	0	1	0	0	2	0	4	0	3	0	0	0	0	2	0	0	0	1	0	1	2	1	1
rhinocerotis	1	1	1	1	0	0	0	0	2	0	4	0	1	0	0	0	0	2	0	0	0	1	0	1	2	1	1
completus	1	1	1	1	1	0	0	0	2	0	3	0	6	0	0	0	0	2	0	0	0	1	0	0	1	0	1
acrostichalis	0	2	0	1	1	0	1	0	1	0	3	1	2	1	0	0	0	2	0	0	1	0	0	0	0	0	1
grootaerti	1	2	1	1	1	1	1	0	1	0	3	1	2	1	0	0	0	2	0	0	1	0	0	0	0	0	1
straeleninus	1	2	1	1	1	1	1	0	1	0	4	1	2	1	0	0	0	2	0	1	1	0	0	0	0	0	1
medialis	1	2	1	1	1	1	1	0	1	0	4	1	2	1	0	0	0	2	0	1	1	0	0	0	0	0	1
trochanteratus	1	2	1	2	1	0	1	0	1	1	2	0	6	0	1	0	0	2	1	0	0	0	0	1	0	0	1
pectinatus	1	2	1	2	1	0	1	0	1	1	2	0	4	0	1	0	0	2	1	0	0	0	0	0	0	?	?
concavus	1	1	1	1	0	0	1	0	1	0	4	0	4	0	0	0	0	2	0	0	0	0	1	0	1	0	1
coninckae	1	1	1	1	0	1	1	0	1	0	4	0	4	0	0	0	0	2	0	0	0	0	1	0	1	0	1
whittingtoni	1	1	1	1	0	0	1	0	1	0	2	0	6	0	0	0	0	2	0	0	0	0	1	0	2	?	?

trees. One of these cladograms, shown in Fig. 81, represents what we consider the most likely hypothesis of phylogenetic relationships among the species of *Achaetothorax*. There are 58 character state changes shown on this tree because we do not know the plesiomorphic state of character 13 (either state 5 or 6 could occur at the base). We have shown state 2 of character 9 occurring twice, in the flavipes group and in the *abyssinicus* group, but it is equally parsimonious for state 2 to be the groundplan condition for *Achaetothorax* (requiring 2 steps at the base of the tree), with reversal to state 1 in the *straeleninus* group. Similarly, character 27 could be interpreted as an autapomorphy for *Achaetothorax* with reversal to the plesiomorphic state in *malayensis*, rather than as independent synapomorphies of *flavipes* + *vojnitsi* and the *abyssinicus* + *straeleninus* groups, as is shown in Fig. 81. The outgroup state for character 25 is unknown, but the analysis interprets state 1 as the groundplan for *Achaetothorax*.

The two other, equally parsimonious trees that resulted from the analysis differed from Fig. 81 only in the relationships within the *flavipes* group. In one of these trees, *vojnitsi* and *malayensis* were reversed in position, whereas in the third tree, these three species formed an unresolved trichotomy. We suspect that *flavipes* and *vojnitsi* are more closely related to each other than to *malayensis*, but this hypothesis is supported mainly by characters of the male (cercus and sursty-

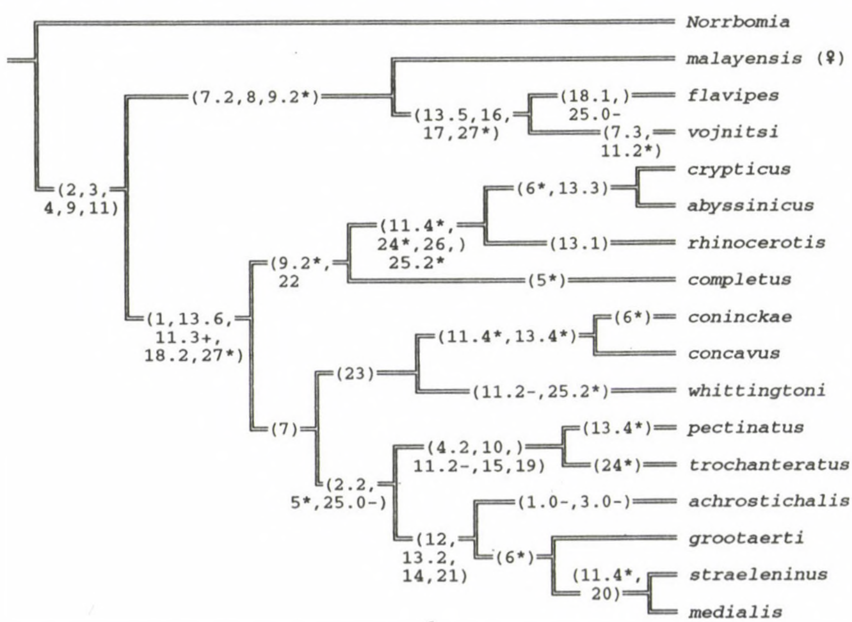


Fig. 81. Hypothesis of cladistic relationships among the species of *Achaetothorax*. Numbers in parentheses refer to characters listed in Table 1; state 1 is assumed for those without a decimal point; other states follow the character number separated by a decimal point. An "*" indicates homoplasy; a "-" indicates reversal; and a "+" indicates an additional step

lus shape) that are unknown for *malayensis*. Until the male of the latter species is discovered, its relationships probably will remain uncertain.

The homology of the posterior processes of the surstylus (character 18) in *Achaetothorax* is uncertain. In *flavipes*, the tip of the posterior lobe has a small dark area (state 1), but whether or not this is homologous with the large, spinelike structure (state 2) found in most species of *Achaetothorax* is unknown; no process is present in *vojnitsi*. This process might be homologous with the bladelike process in *Norrbomia*, but its size and shape (state 2) at least are apomorphic for the *abyssinicus* and *straeleninus* groups (see below). Because of this uncertainty we also ran an analysis of the matrix with character 18 coded as additive, but it produced little difference in tree topology. Again three trees resulted, two of which were the same as those from the initial analysis. The third had *flavipes* as the sister group of *vojnitsi* and *malayensis*, rather than these three species in a trichotomy. An extra step was required, as the length of these trees was 58 steps (ci = 0.70, ri = 0.81).

The *flavipes* group includes three species: *flavipes, vojnitsi,* and *malayensis*. The monophyly of this group is supported mainly by character 8 (femoral setae long). Fore tarsus colour (character 7) is variable and difficult to code in *vojnitsi* and only tentatively is considered a synapomorphy for the group. Other synapomorphies may be discovered in the male genitalia if the male of *malayensis* is found. Relationships among these three species are poorly resolved. Characters 13.5, 16, and 17 could be synapomorphies for the *flavipes* group rather than just for *flavipes* + *vojnitsi* as is shown in Fig. 81. Their significance cannot be resolved until the male of *malayensis* is discovered. Character 27 (female sternites broad) might be a synapomorphy for *flavipes* + *vojnitsi* (with convergence in the *abyssinicus* + *straeleninus* groups), but it can be interpreted as an autapomorphy of *Achaetothorax* that has reversed to the plesiomorphic state in *malayensis*.

The *abyssinicus* group + the *straeleninus* group is the sister group of the *flavipes*. The monophyly of the former two groups is indicated mainly by the reduced outer vertical seta (character 1) and the large spinelike process on the surstylus (character 18, state 2). Characters 11 (wing microtrichia) and 13 (male cercus shape), which are complicated and cause considerable homoplasy on the cladogram, probably are not reliable as synapomorphies at this level. Character 27 (female sternites broad) may be a synapomorphy, but could be interpreted differently (see above).

The *abyssinicus* group includes four species: *abyssinicus, completus, crypticus,* and *rhinocerotis*. The monophyly of this group is indicated by the structure of the distiphallus (character 22), although the extent of hind femoral spines (character 9) may be interpreted as another synapomorphy. Within the group, *abyssinicus* and *crypticus* form the sister group of *rhinocerotis*, and these three species are the sister group of *completus*.

The *straeleninus* group includes nine species that appear to form three subgroups. One of these subgroups includes *acrostichalis, grootaerti, straeleninus,* and *medialis*. Their monophyly is indicated by four synapomorphies, although *acrostichalis*, apparently due to reversal, has the plesiomorphic states of characters 1 and 3, which are synapomorphies at higher levels. The other three species are difficult to distinguish from each other, but the breadth of the spinelike process on the surstylus (character 20) and the larger dorsal nonmicrotrichose area on the wing (character 11.4) suggest that *straeleninus* and *medialis* are more closely related.

A second subgroup of the *straeleninus* group consists of *trochanteratus* and *pectinatus*, whose monophyly is very strongly supported by five synapomorphies. The other subgroup includes *concavus, coninckae,* and *whittingtoni*. Its monophyly is indicated by only one synapomorphy, the presence of a medioapical lobe on the distiphallus (character 23), but it is a complex, well defined character state. Prothorax size (character 2), scutellum shape (character 5), and paramere shape (character 25) are difficult to divide into character states, but by our interpretation suggest that *concavus* + *coninckae* + *whittingtoni* are the sister group of the remainder of the straeleninus group.

Table 1 Characters and character states used in phylogenetic analysis of *Achaetothorax*. State 0 is hypothesized as plesiomorphic, and transformation series are considered linear, unless stated otherwise.

1. Outer vertical seta – 0) well developed; 1) reduced.
2. Prothorax size – 0) small; 1) moderately large; 2) large.
3. Acrostichal setae – 0) at least 2 rows present; 1) absent except prescutellar pair.
4. Scutum, posterior margin – 0) scutum mostly microtrichose; 1) margin without microtrichia or with incomplete band, at least bare between acrostichal setae; 2) margin with complete narrow band of microtrichia.The transformation series is unclear and this was coded as nonadditive.
5. Scutellum, sides in dorsal view – 0) straight to slightly concave; 1)moderately to strongly concave.
6. Male fore basitarsus dorsal setae – 0) short or moderately long; 1) very long.
7. Fore tarsus color – 0) entirely brown; 1) basitarsus brown, remainderyellow; 2) entirely yellow; 3) intraspecifically variable in color. The transformation series is unclear and this was coded as nonadditive.
8. Mid and hind femora with long anteroventral setae – 0) absent; 1) present.
9. Hind femur, anteroventral spinelike setae – 0) without spinelike setae; 1) setose, usually on no more than apical 3/5; 2) setose, usually on at least apical 2/3.
10. Male hind trochanter with elongate apicoventral lobe – 0) absent; 1) present.
11. Wing, dorsal microtrichial pattern – 0) entirely microtrichose; 1) only cells *bm* and *bcu* bare; 2) cell br and sometimes extreme bases of cells r_{2+3}, *dm*, or cu_1 bare; 3) at least basal 1/4 of cell *dm* bare and cells r_1, r_{2+3}, and cu_1 with large basal bare areas; 4) at least 2/3 of cell *dm* bare and cells r_1, r_{2+3}, and cu_1 with correspondingly large bare areas.
12. Male sternite 5 – 0) not trapezoidal, without clusters of setae; 1) trapezoidal, with cluster of small inclinate setae on posterior margin at edge of medial concave area.

13. Male cercus, in posterior view – 1) short, broad, slightly tapered subapically; 2) short, broad, with small medial apical lobe; 3) moderately long, with short mesal apical lobe; 4) with short mesal apical lobe concave on mesal side; 5) elongate, broad, slightly tapered near midlength; 6) elongate, slender from near base. We recognized a variety of states for this character, but found it difficult to arrange them in a transformation series, so this was coded as nonadditive. Because the shape of the cercus varies similarly in *Norrbomia*, we coded no state as plesiomorphic and we were unable to hypothesize the polarity.
14. Male cercus apex, in lateral view – 0) acute or with subapical ridge or concave area; 1) rounded. Both states occur in *Norrbomia* and the polarity of this character is unclear.
15. Surstylus with tabshaped posterodorsal lobe – 0) absent; 1) present.
16. Surstylus with knobshaped lobe – 0) absent; 1) present.
17. Surstylus strongly bilobed – 0) no; 1) yes.
18. Surstylus spinelike process – 0) absent; 1) small; 2) large. The homology of this character is unclear (see discussion). It was coded as nonadditive.
19. Surstylus spinelike process divided basally and flared apically - 0) no (or process absent); 1) yes.
20. Surstylus spinelike process width – 0) slender (or process absent); 1) broad.
21. Distiphallus with ventroapical lobes fused, very long, narrow basally, broad apically (in lateral view) – 0) no; 1) yes.
22. Distiphallus with additional unpaired ventroapical lobe (3 total) - 0) no; 1) yes.
23. Distiphallus with broad medial apical lobe – 0) no; 1) yes.
24. Distiphallus dorsoapical lobe (lateral view) – 0) longer than wide; 1) broad, circular.
25. Paramere, size of gap between main part and apical lobe – 0) large; 1) intermediate sized; 2) small. The shape of the paramere differs in *Norrbomia*, and the polarity of this character is uncertain.
26. Female sternite 4 – 0) undivided; 1) bipartite. Both states occur in *Norrbomia*, but undivided is hypothesized as plesiomorphic for both genera.
27. Female sternite 2-5 width – 0) moderately broad (sternite 4 less than 3/5 width of tergite 4); 1) very broad (sternite 4 more than 3/4 width of tergite 4).

* * *

Acknowledgments – We are grateful to A. E. WHITTINGTON (NMP) and the curators and institutions listed by PAPP & NORRBOM (1992) for the loan of study material. We are also grateful to S. A. MARSHALL, W. N. MATHIS, A. S. MENKE, & N. E. WOODLEY for their reviews of the manuscript.

REFERENCES

FARRIS, J. S. (1988) Hennig86 reference. *Documentation for version* 1.5.

FITZBURGH, K. (1989) Cladistics in the fast lane. *J. N. Y. Entomol. Soc.* **97**: 234-241.

PAPP, L. & NORRBOM, A. L. (1992) Taxonomy of the Paleotropical genus *Achaetothorax* Hedicke (Diptera: Sphaeroceridae). *Acta. zool. hung.* **38**: 321-344.

Received October 16, 1992; accepted December 1, 1993

Acta Zoologica Academiae Scientiarum Hungaricae 40 (1), pp. 87-97, 1994

ADDITIONAL NOTES WITH THE DESCRIPTION OF A NEW SPECIES AND REDESCRIPTION OF TWO MISIDENTIFIED SPECIES (LEPIDOPTERA, NOCTUIDAE)*

Z. VARGA[1] & L. RONKAY[2]

[1]*Zoological Institute, Lajos Kossuth University*
H-4010 Debrecen, Hungary
[2]*Zoological Department, Hungarian Natural History Museum*
H-1088 Budapest, Baross utca 13, Hungary

Designation of the lectotype of *Eugnorisma chaldaica* BOISDUVAL, 1840, with the discussion of the synonymy of *E. chaldaica* with *E. caerulea* WAGNER, 1931. Description of two new species, *E. ignoratum* sp. n. (*chaldaica* auct., nec BOISDUVAL) and *E. cuneiferum* sp. n. (Turkmenistan). With 29 original figures.

Key words: Eugnorisma, revision, check list

INTRODUCTION

The vast material belonging to *Eugnorisma* from various parts of the Palaearctic Region had been treated in the first two parts of the series. Surprisingly, the new collectings in Turkmenistan (1991-1992) have resulted in numerous new insights on the *Eugnorisma* taxa of the Kopet-Dagh Mts and the adjacent desert area and also in the discovery of a new species belonging to the *tamerlana-puengeleri* species-group. Further new, important results were achieved by the detailed survey of the Noctuinae collection of CORTI preserved in the Natural History Museum, Basel.

The most exciting finding was the identification of the type specimen of "*Orthosia*" *chaldaica* BOISDUVAL, 1840. It is labelled with a large, white label in the style being typical for the Guenée collection and bears also the label 'Ex Musaeo Dris BOISDUVAL'. The specimen was collected by KINDERMANN in Sarepta, which agrees with the type locality in the original description, therefore this specimen can be considered as lectotype of the species. It is, however, conspecific with the type of *Agrotis* (*Rhyacia*) *caerulea* WAGNER, consequently some changes should be made in the taxonomy and nomenclature of the species group.

* Revision of the genus *Eugnorisma* BOURSIN, 1940, III

IDENTITY OF EUGNORISMA CHALDAICA (BOISDUVAL, 1840)

Designation of the lectotype of *Orthosia chaldaica*

In the large Noctuinae special collection of A. CORTI, preserved in the Natural History Museum, Basel, there are three male specimens of *E. chaldaica* from Sarepta, Southern Russia. One of these specimens bears the original small label "Ex Musaeo D'ris Boisduval", a collection number label "19", and a large, white label containing the following remarks: "34. Agr. Chaldaica spec. 534, Sarepta, I. Kindermann, ♂, coll. Gerhardt". This specimen was already labelled by CORTI as "Type Chaldaica B." (Figs 1-2). As the number of the specimens representing the type series is unknown, the mentioned and figured specimen from the BOISDUVAL collection should be considered as syntype. Thus, the lectotype designation is necessary. It was realized already by CORTI but he never published this designation, therefore this specimen is designated here as the lectotype of the nominal taxon "*Orthosia chaldaica*" BOISDUVAL.

The second male from the same locality has the collection label of A. GUENÉE and a hand-written remark that this specimen was figured by J. CULOT (Pl. 7, Fig. 2). A rather superficial view of this figure can convince us that also this specimen must belong to the species mentioned generally as *Eugnorisma caerulea* WAGNER. The third specimen from this locality agrees well with the former ones (see Figs 1-4).

This judgement based on the external features was completely confirmed by the dissection of all the three specimens (slides 6315, 6316, 6461. VARGA), therefore the types of the two species mentioned formerly as *chaldaica* and *caerulea* represent the same species. TREITSCHKE, who obviously knew the true *chaldaica* of BOISDUVAL, identified a pair of specimens of this species in his collection (now in HNHM Budapest) as *chaldaica.*

It is a historically important fact, that three contemporaneous great lepidopterists, namely BOISDUVAL, TREITSCHKE and GUENÉE, have regarded the same species as *chaldaica.* A supplementary evidence on the identity of the "true" *chaldaica* of BOISDUVAL is furnished by CULOT. It is worthy to cite the decisive terms from his differential diagnosis (against "*Agrotis" glareosa* ESPER): "La difference se trouve surtout dans le teinte rougeâtre que l'on voit à la ligne subterminale et aux taches orbiculaires et reniformes de *Chaldaica*; cette couleur rougeâtre, bien constante chez le type, permettra donc de separer facilement cette espèce de *Glareosa* dont les ailes superieures sont d'un gris prèsque uniforme. Ajoutours que si l'on rencontre des exemplaires de *Glareosa* plus ou moins rougeâtres, ceux-ci le sont d'un façon assez uniforme, et non par parties tranchées, comme c'est le cas chez *Chaldaica.*"

On the other hand, there are numerous specimens of the second species known as "*chaldaica*" preserved in large old collections (e.g. London, Vienna, Budapest, etc.) also from this area ("Rossia merid."). Possibly the sympatric distribution of the two externally similar species was one of the reasons of the confusion of *chaldaica* with *caerulea*. It is quite evident that even the great lepidopterists of the last century could not separate the two taxa. The fact that *chaldaica* (sensu auctorum) has no junior synonyms (*chaldacica* FREYER, 1840 is only a mispelling by FREYER of the BOISDUVAL name) can serve as an argument for this opinion. The next, taxonomically available name in this group was "*chaldaica* var. *spodia*" PÜNGELER, 1901, which represents also a distinct species occurring partly sympatrically with the two species under discussion.

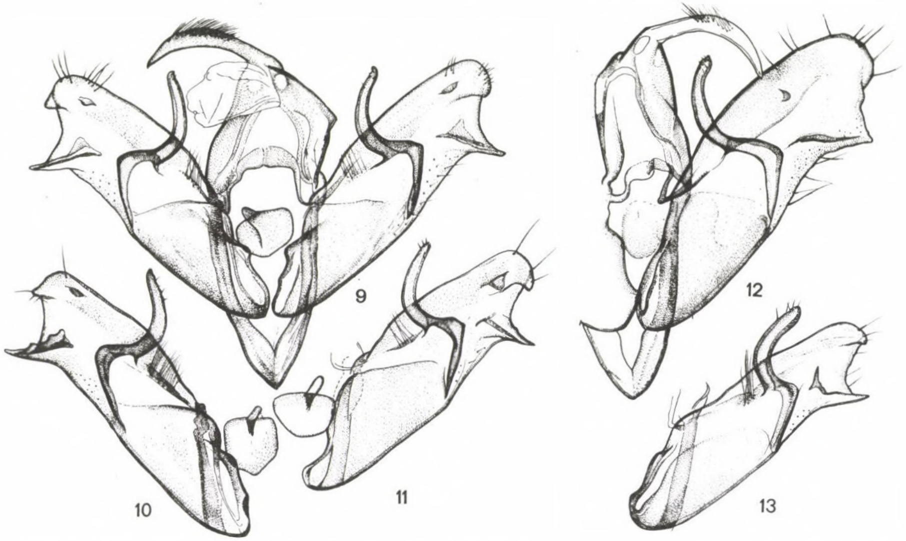
As the subsequent authors of the first half of the twentieth century have also not separated the published infraspecific taxa on species level, BOURSIN (1954) was the first who stated their specific distinctness. He has recognized, described and figured correctly the specific features of the different entities, but, unfortunately, he did not check the types of these taxa. As a consequence of the negligation of the study of the types, he made mistakes in the interpretations of *chaldaica* BOISDUVAL and *spodia* PÜNGELER (the latter problem was discussed in VARGA & RONKAY, 1987, but the former remained as undiscovered also by us).

The designation of the lectotype gives the basis for solving this – probably last – confusion within this species group. As a result of this designation, *caerulea* WAGNER will be considered as junior subjective synonym of *chaldaica* and the species, mentioned regularly as "*chaldaica*", is to be described as new for science. A further advantage of this process is the fall of *buraki* KOCAK, 1983 into synonymy, too, avoiding the a longer controversy for the use of *caerulea* or *buraki* (cf. VARGA & RONKAY, 1987, VARGA *et al.*, 1989, POOLE , 1989, HACKER, 1990, FIBIGER, 1990, FIBIGER & HACKER, 1990). The designation of the lectotype of *chaldaica* cuts the "Gordian knot" and demonstrates that taxonomic studies must precede the nomenclatorical procedures in solving such questions, and often the types have to be checked. One can multiply the number of newly denominated species by some purely technical ("Strandian") tools, but it may be often misleading owing to an insufficient knowledge of the animals themselves.

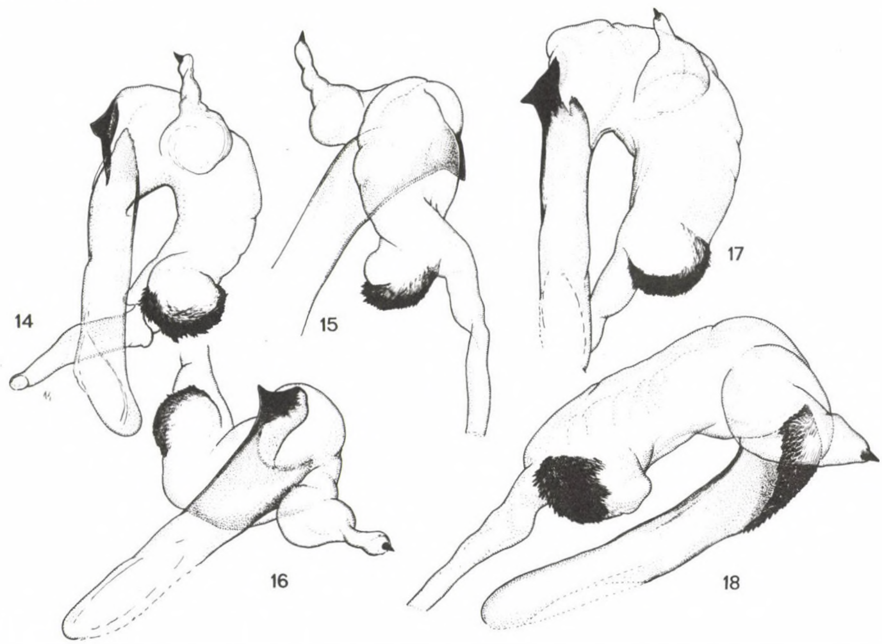
Redescription of *Eugnorisma chaldaica* (BOISDUVAL, 1840)
(Figs 1-4, 9-11, 14-16)

Orthosia chaldaica BOISDUVAL, 1840, Genera and Index Methodicus, p. 140. Type locality: Rossia merid.

Lectotype: male, "Chaldaica"; "34. Agr. Chaldaica, spec. 534. Sarepta 1 Kindermann, 2. coll. Gerhardt"; "19"; "EX MUSAEO Dris Boisduval"; "Type chaldaica B."; "Lectotypus Eugnor-



Figs 9-13. Genital capsula and valvae of *Eugnorisma chaldaica* BOISDUVAL, *E. spodia* PÜNGELER and *E. ignoratum* sp. n. (males) 9 = *E. chaldaica*, lectotype; 10 = *E. chaldaica*, Rossia merid.; 11 = *E. chaldaica*, Sarepta. 12 = *E. ignoratum* sp. n., paratype, Issyk-Kul; 13 = *E. spodia*, Turkmenistan, Firyuza.



Figs 14-18. Aedeagi with everted vesica of *Eugnorisma chaldaica* BOISDUVAL, *E. spodia* PÜNGELER and *E. ignoratum* sp. n. 14 = *E. chaldaica*, lectotype; 15 = *E. chaldaica*, Rossia merid.; 16 = *E. chaldaica*, Sarepta. 17 = *E. spodia*, Turkmenistan; 18 = *E. ignoratum*, paratype, Issyk-Kul

isma chaldaicum (Boisduval, 1840)". Slide No. 6315 VARGA. The lectotype is deposited in the CORTI collection, Natural History Museum, Basel.

Additional material examined: lectotype and paralectotype of *E. caerulea* WAGNER (cf. VARGA & RONKAY, 1987), large series of both sexes from Turkey, Armenia, Azerbaijan and southern Russia. The material studied by us is exhaustively enumerated in parts I-II. of our revision.

External morphology: the external and genitalic features of the species are satisfactorily described and illustrated by VARGA & RONKAY (1987) under the name "*E. caerulea* WAGNER"; the genitalia of the lectotype and of two further specimens are given in Figs 9-11 and 14-16.

The studies of large material of the species from various parts of Asia Minor, Transcaucasia and South Russia shows that there is a continuous range of variation in the main external features, e.g. the ground colour, the filling of the stigmata, the intensity of the reddish suffusion at subterminal line, etc. Thus, it can be stated, besides the perfect specific identity of *chaldaica* and *caerulea*, that the western populations of *chaldaica* cannot represent separate geographic races.

The specific differences of the "true" and the "former" *Eugnorisma chaldaica* are given in connection with the description of the latter, formerly undescribed species, *E. ignoratum* sp. n.

A HITHERTO MISIDENTIFIED EUGNORISMA SPECIES

Eugnorisma ignoratum sp. n.
(Figs 5, 12, 18, 27)

Holotype: female, "Russia merid."; "Coll. E. Frivaldszky", slide No. 6429. VARGA (coll. HNHM Budapest).

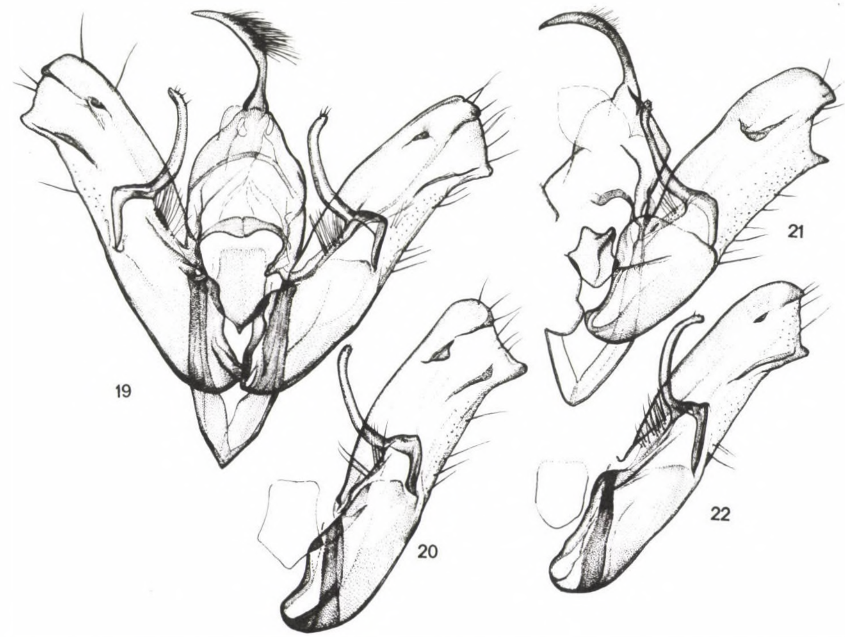
Paratypes: the specimens listed in the paragraph "Examined material" of "*Eugnorisma chaldaica* BOISDUVAL" in the first part of the revision of the genus (1987) are considered as paratypes of the species.

As the description of *E. ignoratum* was already given in details in VARGA & RONKAY (1987) under *E. chaldaica*, we repeat only some important statements, completed with the differential diagnosis against *E. chaldaica*.

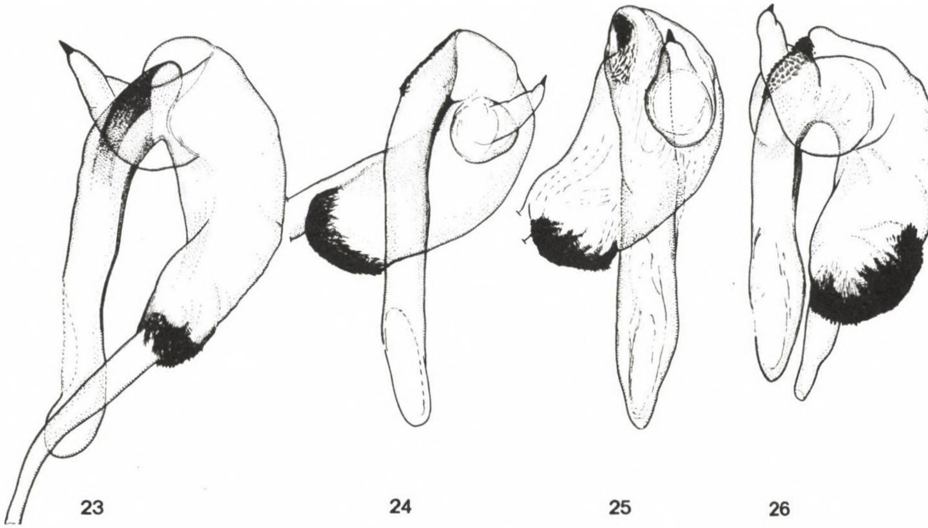
The rosy-grey or pinkish-grey ground colour of the body and the forewings, typical for this species, originates of a fine mixture of grey, reddish and dark brown scales combined by a silky shining. The combination of the (bluish)grey and reddish colours results often in a fine violaceous hue in the basal and medial parts of the forewing. The orbicular spot is more flattened and oblique, the basal intracellular spot is more triangular. The ground colour of the hindwing is not pure white but has a rosy-ochreous sheen and a poor reddish-brownish irroration along the veins and the outer margin. The most characteristic features of the male genitalia are the huge, dentated plate of the carina and the large, ample basal diverticulum of the vesica (Figs 12 and 18); those of the female genitalia are the broad ostium bursae and the twice folded proximal part of ductus bursae (Fig. 27).

E. ignoratum is an easily recognizable species, being clearly distinguishable from *E. tamerlana* and *E. cuneiferum* (described in Chapter IV) by the very different intracellular maculation and the coloration of the hindwing. *E. puengeleri* has more elongated forewing with almost missing reddish suffusion, the hindwing is always of a greyish marginal part, the veins are often covered with darker scales.

E. spodia has no reddish or purplish colour on the forewing and the bronze-golden iridescence of the intracellular black(ish) spots is intensive.



Figs 19-22. Genital capsula and valvae of *Eugnorisma cuneiferum* sp. n., *E. tamerlana* HAMPSON and *E. puengeleri* VARGA & RONKAY (males) 19 = *E. cuneiferum* sp. n., paratype, Turkmenistan, Ipay-Kala; 20 = *E. cuneiferum* sp. n., Turkmenistan, Karayalchi; 21 = *E. tamerlana*, Syr-Darja; 22 = *E. puengeleri*, Alexander Mts.



Figs 23-26. Aedeagi with everted vesica of *Eugnorisma cuneiferum* sp. n., *E. tamerlana* HAMPSON and *E. puengeleri* VARGA & RONKAY. 23 = *E. cuneiferum* sp. n., Turkmenistan, Karayalchi; 24 = *E. cuneiferum* sp. n., Turkmenistan, Ipay-Kala. 25 = *E. puengeleri*, Alexander Mts, 26 = *E. tamerlana*, Syr-Darja

E. ignoratum shows the greatest similarity with *E. chaldaica*, the latter species, however, never has the general reddish-pinkish shade of the forewing: these colours are limited to the filling of the stigmata and the shadow defining the subterminal line, as it was correctly pointed out by CULOT.

The genitalia of the species group are illustrated on Figs 9-29.

As STAUDINGER and BANG-HAAS misidentified *E. ignoratum* in their collections, they issued a large number of specimens – collected mostly in the Tien Shan region (e.g. Issyk-Kul, Semiretshye) by some professional collectors (TANCRÉ, RÜCKBEIL, etc.) – under the name "*chaldaica* B.". Thus, most large, old collections contain specimens of *E. ignoratum*, identified as *E. chaldaica*. As *E. ignoratum* occurs sympatrically with *E. chaldaica* in some of the well-known "classical" localities (e.g. Sarepta, "Rossia merid.", Margelan, "Altai region"), the confusion easily became total.

KOZHANCHIKOV (1937: 240, Fig. 89) had correctly figured the male genitalia of *E. chaldaica* and this fact remained unknown for most European authors. But he considered *E. caerulea* (as "*coerulea*") only as a "geographically limited form" (p. 241) of *E. chaldaica*; in addition, *E. spodia* was not separated by him as a distinct species. Hence, he could not contribute to the solution of the problems discussed above.

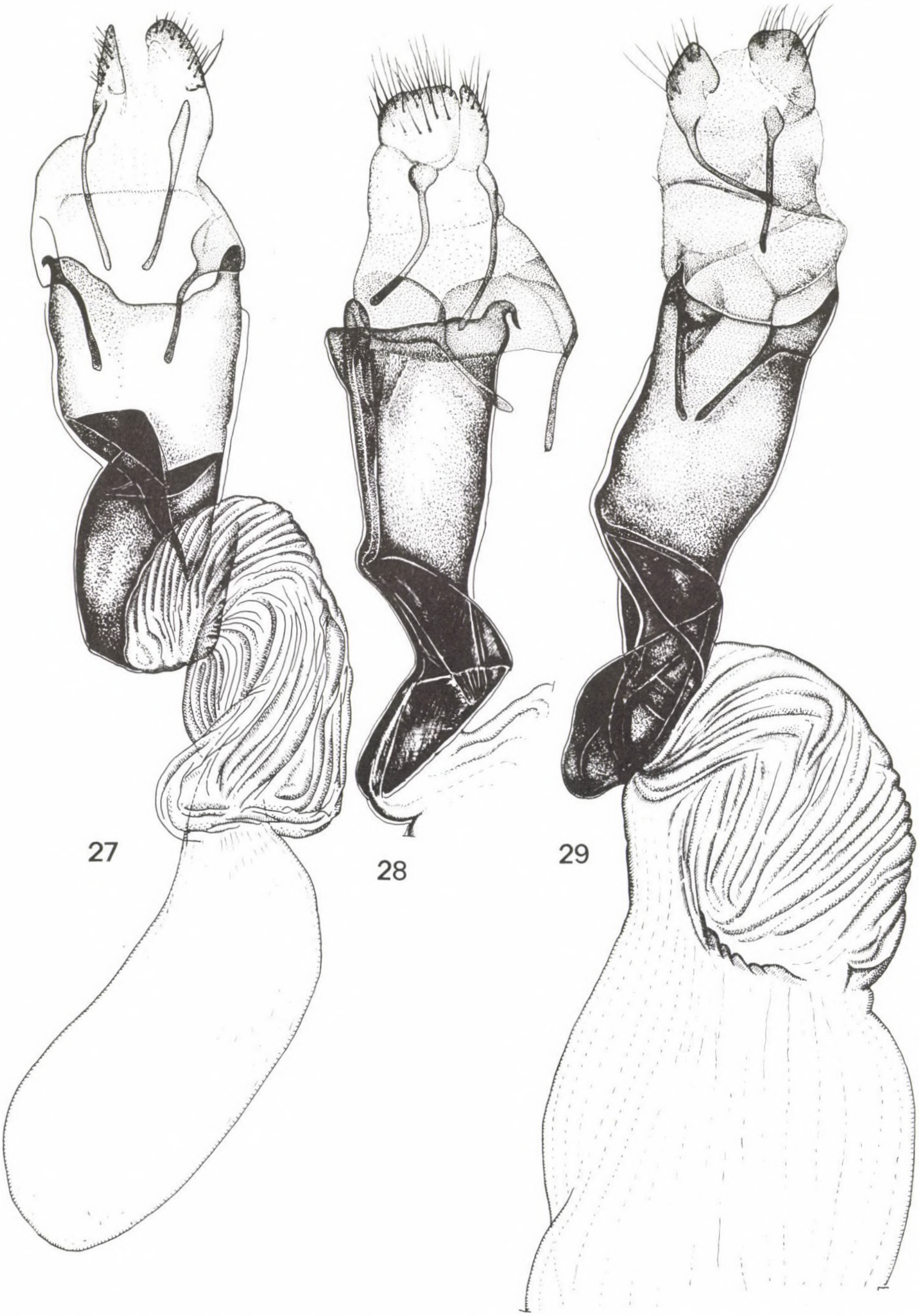
The confusion of the taxa was conserved by the voluminous paper of BOURSIN (1954). He had identified the true *E. spodia* from Ashkhabad as "*coerulea* Wagn." (sic!, slide No. 404 BOURSIN), studied a specimen of *E. puengeleri* from Russian Turkestan as "*spodia* Püngeler" (although the type locality of *E. spodia* is Ashkhabad!) and dissected a male of *E. ignoratum* from "Asia m." (?) from the collection of the MNHN Paris (slide MP 42 BOURSIN) as "*E. chaldaica*". These confounding moments was to be clarified by a partial revision of the photographic documentation of genital slides of CHARLES BOURSIN, preserved in the LN, Karlsruhe.

A NEW SPECIES FROM TURKMENISTAN, RELATED TO *E. TAMERLANA* AND *E. PUENGELERI*

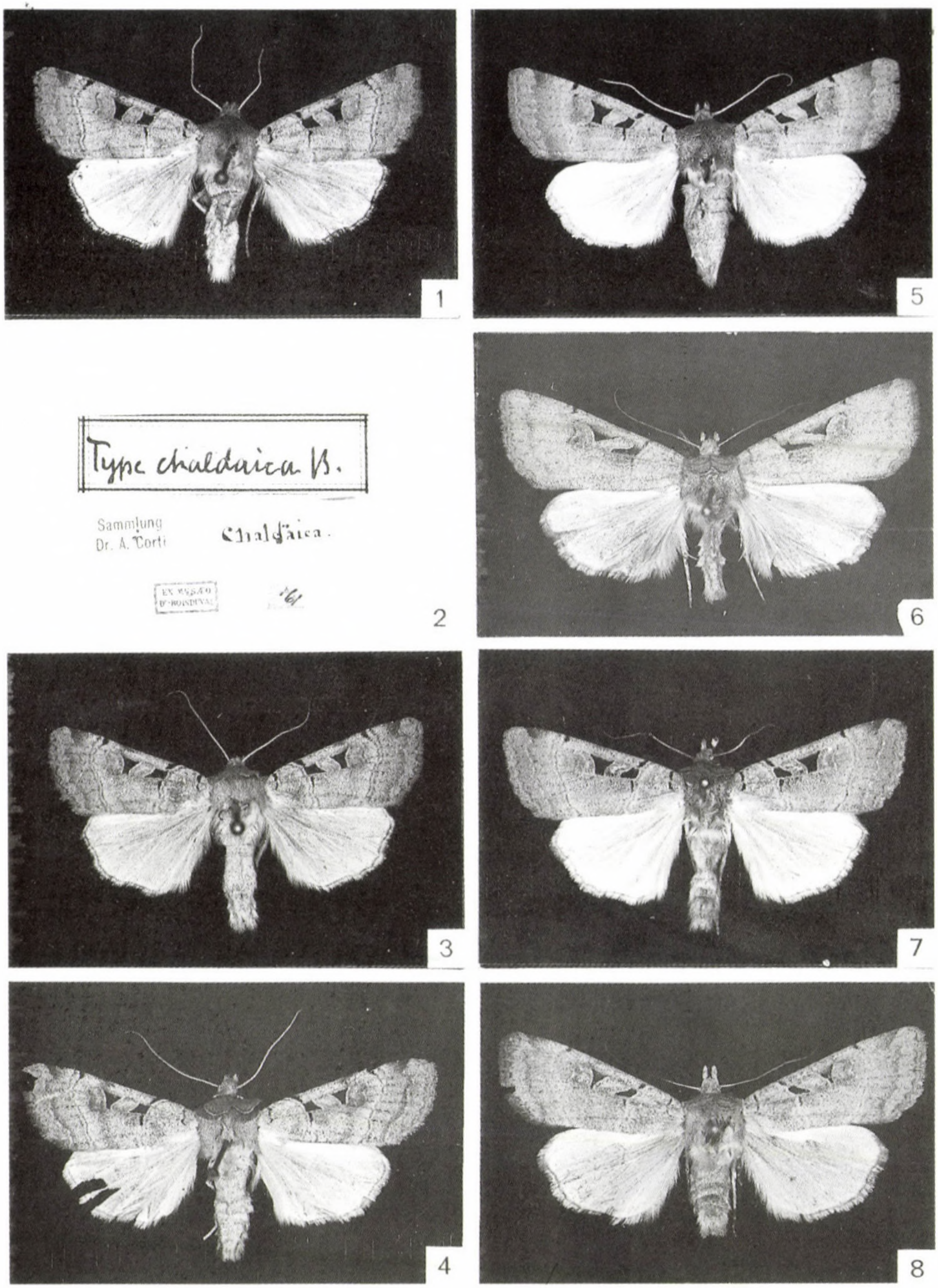
Eugnorisma cuneiferum sp. n.
(Figs 6, 19-20, 23-24, 28-29)

Holotype: female, "USSR, Turkmenia, Kopet-Dagh Mts., 1600 m, 25 km E of Nochur, Karayalchi valley, 57°09'E, 38°21'N, 05.10.1991, No. L36, leg.: A. Podlussány, L. Ronkay and Z. Varga" (coll. HNHM Budapest).

Paratypes: some 120 specimens of both sexes from the same and the following other localities from the Kopet-Dagh Mts, Turkmenistan: Firyuza, 58°05'E, 37°59'N, 600 m, 25-30.09.1991, leg. A. PODLUSSÁNY, L. RONKAY & Z. VARGA; 5 km S of Chuli, 700-800 m, 58°01'E, 37°56'N, 30.09.1991, leg. A. PODLUSSÁNY, L. RONKAY & Z. VARGA; Dushak, 2200-2400 m,



Figs 27-29. Female genitalia of *Eugnorisma ignoratum* sp. n. and *E. cuneiferum* sp. n. 27 = *E. ignoratum* sp. n., holotype, Russia merid. 28-29 = *E. cuneiferum* sp. n., paratypes, Turkmenistan, Karayalchi.



Figs 1-8. 1. *Eugnorisma chaldaica* BOISDUVAL. Lectotype male, Sarepta. 2. The labels of the lectotype. 3. *E. chaldaica* BOISDUVAL, male. Rossia merid., coll. TREITSCHKE (coll. HNHM Budapest). 4. *E. chaldaica* BOISDUVAL, male. Sarepta, coll. GUENÉE (NHM Basel). 5. *E. ignoratum* sp. n. (chaldaica auct.). Holotype female, Rossia merid. 6. *E. cuneiferum* sp. n. Holotype female, Turkmenistan, Karayalchi. 7. *E. puengeleri* VARGA & RONKAY, male. Alexander Mts (coll. NHM Basel). 8. *E. spodia* Püngeler, male. Turkmenistan, Firyuza (coll. VARGA)

57°54'E, 37°57'N, 01-02.10.1991, leg. A. PODLUSSÁNY, L. RONKAY & Z. VARGA; same locality, 7-8.VIII.1992, leg. M. HREBLAY, GY. LÁSZLÓ; Kurkulab, 6 km W Germob, 1000 m, 03.10.1991, leg. A. PODLUSSÁNY, L. RONKAY & Z. VARGA; 20 km E of Nochur, Karayalchi valley, 800 m, 57°12'E, 38°23'N, 04.10.1991, leg. A. PODLUSSÁNY, L. RONKAY & Z. VARGA; 6 km S of Ipay-Kala, 1600 m, 57°07'E, 38°17'N, 16-23.VIII.1992, leg. M. HREBLAY, GY. LÁSZLÓ and G. RONKAY. (coll. the collectors, HNHM Budapest, BMNH London; GY. FÁBIÁN (Budapest), P. GYULAI (Miskolc), B. HERCZIG (Tata), M. FIBIGER (Sorø), H. HACKER (Staffelstein), G. BEHOUNEK (Deisenhofen), E. VARTIAN (Vienna).

Slides 4059, 4064 RONKAY, 6320, 6458 VARGA (males), 4428 RONKAY, 6396, 6431 VARGA (females).

Description: wingspan 33-42 mm, length of forewing 16-21 mm. Head and thorax light ash-grey with dark grey-brownish hair-scales, palpi laterally blackish-brown. Forewing almost unicolorous, light, shining grey, suffused with brownish and ochreous-grey; medial part sometimes with stronger dark irroration. Ante- and postmedial lines double, pale or obsolescent, dark grey-brown. Medial line reduced, subterminal an interrupted, diffuse, slightly waved brownish shadow. Orbicular stigma flattened and oblique, encircled with whitish, its greyish filling sometimes with a fine reddish shade. Reniform paler, its outline incomplete, filled with ground colour; claviform absent or a small patch of brownish scales. Intracellular spots black with some bronze iridescence, basal one typically cuneate, medial one triangular, sometimes with lighter scales on upper part. Terminal line ochreous-whitish, cilia grey. Hindwing shining whitish suffused with ochreous-grey, inner margin with scarce brownish hairs and scales. Veins and marginal area finely covered with brownish-grey, terminal line a row of brownish arches; cilia light grey-brownish. Underside whitish, veins covered with brownish, inner parts of forewing and costal area of hindwing suffused with grey; cellular lunule slightly visible.

Male genitalia (Figs 19-20 and 23-24): uncus slender and moderately long, tegumen high, fultura inferior a moderately elongate, rounded plate with a weakly expressed medial crest, vinculum strong, elongate. Valvae large, elongate, medially slightly dilated. Harpe very long, sword-like; elongate, moderately curved, basal part relatively short and strong. Aedoeagus very long and slender, moderately curved. Carina with a very finely dentate plate. Vesica large and ample, everted ventrally, reflexed to dorsal side, diverticulum large, slightly curved and elongate, with a fine cornutus.

Female genitalia (Figs 28-29): gonapophyses short and weakly sclerotized, ostium bursae well sclerotized, broad and quadrangular, ductus bursae broad and flattened, proximally constricted and characteristically folded. Apex bursae extremely large, ample, moderately curved and rugulose, corpus bursae huge.

The genitalia of both sexes display the general features of the species group *tamerlana – puengeleri – cuneiferum*. The figures are grouped in order to compare the most important specific differences. In the male genitalia the basic configuration is nearly the same as by *E. puengeleri*, but valvae are broader and medially slightly dilated, the harpe has a more even, moderate curving and the diverticulum of the vesica is larger and characteristically arcuate with another orientation than in *E. puengeleri*. The very finely dentate plate of carina is unique in this species group. The differences, compared with *E. tamerlana* are evident in the shape of valvae and aedoeagus, in the size and form of vesica and its diverticulum.

The differences are equally expressed in the female genitalia, too. The folding of the ductus bursae is essentially similar to that of *E. puengeleri*, but the whole organ is broader and larger. Very conspicuous are the huge apex bursae and corpus, which is significantly correlated with the large, curved diverticulum and vesica.

Distribution: the species seems to be endemic to the northern chains of the Kopet-Dagh Mts, Turkmenistan.

* * *

Abbreviations used in this article are: BMHN London – The Natural History Museum, London; HNHM Budapest – Hungarian Natural History Museum, Budapest; LN Karlsruhe – Landessammlungen für Naturkunde, Karlsruhe; MNHN Paris – Museum National d'Histoire Naturelle, Paris; NHM Basel – Naturhistorisches Museum, Basel.

Acknowledgements. We would like to express our special gratitude to Dr. V. M. KORSHUNOV (Ashkhabad) for his valuable help in the organisation of our expeditions in Turkmenistan, for his useful professional and practical advices, to Dr. X. BRANCUCCI and Mr. E. DE BROS for the possibility of studies in the CORTI collection, preserved in Basel Natural History Museum, to Mr. G. EBERT for the possibility of the partial revision of the photographic documentation of the late CH. BOURSIN, preserved in the Natural History Museum, Karlsruhe, and to Dr. K. MIKKOLA for some critical comments and suggestions in nomenclatorical questions.

The research was supported by the OTKA Foundation (No. 3181).

APPENDIX: REVISED CHECKLIST OF THE EUGNORISMA SPECIES

Eugnorisma BOURSIN, 1946

Subg. *Eugnorisma* BOURSIN, 1946

Eugnorisma tamerlana (HAMPSON, 1903) (*Lycophotia*)
E. puengeleri VARGA & RONKAY, 1987
E. ignoratum VARGA & RONKAY, 1992 (nom. nov. pro *E. chaldaica* auct. nec BOISDUVAL)
E. chaldaica (BOISDUVAL, 1840) (*Orthosia*, stat. rev., = *E. caerulea* WAGNER syn. nov.; *E. buraki* KOCAK, 1983)
E. eminens (LEDERER, 1855) (*Graphiphora*)
E. atrabaelbops VARGA, 1975
E. enargiaris (DRAUDT, 1936) (*Xestia*)
E. coryphaea (PÜNGELER, 1900) (*Agrotis*)
E. trigonica (ALPHÉRAKY, 1872) (*Agrotis*)
E. gaurax (PÜNGELER, 1900) (*Agrotis*)
E. deleasma BOURSIN, 1967
E. variago (STAUDINGER, 1882) (*Hiptelia*)
E. insignata (LEDERER, 1853) (*Graphiphora*, type species)
E. conformis (SWINHOE, 1885) (*Agrotis*)
E. asad BOURSIN, 1963

E. semiramis (BOURSIN, 1940) (*Rhyacia*)
E. eucratides (BOURSIN, 1957) (*Eugraphe*)
E. goniophora VARGA, RONKAY & HACKER, 1990
E. glareomima VARGA & RONKAY, 1991
E. fuscisignata (HAMPSON, 1903) (*Richia*)
E. xestioides (HAMPSON, 1903) (*Richia*)
Subg. *Metagnorisma* VARGA & RONKAY, 1987
E. (*M.*) *pontica* (STAUDINGER, 1891) (*Agrotis*)
E. (*M.*) *heuristica* VARGA & RONKAY, 1987
E. (*M.*) *rafidain* (BOURSIN, 1940) (*Rhyacia*)
E. (*M.*) *depuncta* (LINNAEUS, 1761) (*Phalaena Noctua*)
E. (*M.*) *arenoflavida* (SCHAWERDA, 1934) (*Agrotis*)

REFERENCES

BOURSIN, CH. (1946) Trois nouveaux genres paléarctiques de la sous-famille des Agrotinae. *Rev. franc. Lepid.* **1946**: 186.

BOURSIN, CH. (1954) Die "Agrotis"-Arten aus Dr. h.c. H. Höne's China - Ausbeuten (Beitrag zur Fauna Sinica). (Beiträge zur Kenntnis der Agrotidae - Trifinae, LXIX). *Bonn. zool. Beitr.* **5** (3-4): 213-309.

CORTI, F. & DRAUDT, M. (1933) Die Palaearktischen eulenartigen Nachtfalter, Supplement. *In* SEITZ: *Die Gross-Schmetterlinge der Erde.* Alfred Kernen Verlag, Stuttgart.

CULOT, J. (1909-1913) *Noctuelles et Geométres d'Europe.* Vol. I. Repr. ed. 1986, Apollo Books, Svendborg, 220 pp. + pl. 38.

HACKER, H., KUHNA, P. & GROSS, F. J. (1986) 4. Beiträg zur systematischen Erfassung der Noctuidae der Türkei. Beschreibung neuer Taxa, Erkenntnisse zur Systematik der kleinasiatischen Arten und faunistisch bemerkenswerte Funde aus den Aufsammlungen von Gross und Kuhna aus den Jahren 1968-1984 (Lepidoptera, Noctuidae). *Mitt. münchn. ent. Ges.* **76**: 79-141.

KOZHANCHIKOV, I. W. (1937) *Fauna of USSR, XII. 3. Agrotinae.* Nauka, Leningrad.

VARGA, Z. & RONKAY, L. (1987) Revision of genus Eugnorisma Boursin, 1946 (Lepidoptera: Noctuinae). *Acta Zool. Hung.* **33** (1-2): 187-262.

VARGA, Z., RONKAY, L. & YELA, J. L. (1990) Revision of the Genus Eugnorisma Boursin, 1946, Part II. (Lepidoptera: Noctuidae). *Acta Zool. Hung.* **36** (3-4) : 331-360.

VARGA, Z. & RONKAY, L. (1991) Taxonomic studies on the Palaearctic Noctuidae (Lepidoptera) I. New taxa from Asia. *Acta Zool. Hung.* **37** (3-4): 263-312.

Received January 10, 1993; accepted December 1, 1993

ACTA ZOOLOGICA ACADEMIAE SCIENTIARUM HUNGARICAE

An international journal of animal taxonomy and ecology

Instruction to authors

Submission of a paper implies that it has not been published previously, that is not under consideration for publication elsewhere, and that if accepted for the Acta Zoologica Hungarica, the authors will transfer copyright to the Hungarian Academy of Sciences/the Hungarian Natural History Museum as is customary. Articles and illustrations become the property of the HAS/HNHM.

Papers must be in English with British spelling, and be original contributions in the field of animal taxonomy, systematics, zoogeography and ecology. All manuscripts must be submitted to one of the editors (editor, assistant editor).

Entire manuscripts must be submitted on IBM compatible floppy disk and in duplicate printed copies and the author should retain a copy. In the case of multiple authors, the corresponding author should be indicated. Series of numbered papers will not be considered.

Manuscripts must be printed with double spacing (including the reference list), and with wide margins (30-35 mm) on the left side of the paper only. Authors are requested to keep their communications as concise as possible. Footnotes should be avoided or minimized, and italics should not be used for emphasis. A running head of not more than 30 letters should be supplied.

The manuscript should contain the following information:

Title. This should be followed by the name and full address of the author(s). Where possible, the fax and/or E-mail number of the corresponding author should be supplied with the manuscript, for use by the publisher.

Abstract. This should be a brief summary of the contents and conclusions of the paper, and should not be longer than 200 words and should not contain references.

Key words. No more than five (exceptionally 6) key word entries should be provided for rapid scanning of the contents of the paper and used for compiling the index.

Introduction. This should contain a brief survey of the revelant literature and the reasons for doing the work.

Materials and Methods. Sufficient information should be given to permit repetition of the experimental or field work. The technical description of methods should be given only when such methods are new.

Results. These should be presented concisely. Only in exceptional cases will it be permissible to present the same set of results in both table and a figure. The results section should not be used for discussion.

Discussion. This should be separate from the results section and should deal with the significance of the results and their relationship to the object of the work (and, this is the place of the identification key in taxonomical revisions).

Acknowledgements. (at most in 10 lines)

References. In principle the Harvard system is to be followed. References should be detailed in the following order: authors' names and initials, date of publication (in parentheses), the title of the article, the name of the journal as abbreviated in the World List of Scientific Periodicals (4th edn 1963), the volume, and the first and last pages of the article, e.g.

Norrbom, A. L. and Kim, K. C. (1985) Taxonomy and phylogenetic relationships of Copromyza Fallén (s.s.) (Diptera: Sphaeroceridae). *Ann. Entomol. Soc. Am.* **78**: 331-347.

For books the author's names, date of publication, title, edition, page reference, publisher's name and the place of publication should be given, e.g.

Hinton, H. E. (1981) *Biology of insect eggs*, vol. 2. Pergamon Press, New York.

or

McAlpine, J. F. (1981) Morphology and terminology, adults, pp. 9-63. *In* McAlpine *et al.* (eds) *Manual of Nearctic Diptera*, vol. 1. Agriculture Canada, Ottawa.

In the text references should be given as Marshall (1992) or (Marshall, 1992). When a citation includes more than two authors, e.g. Grey, Black and White, the paper should be referred to in the text as Grey et al., provided that this not ambiguous. If papers by the same author(s) in the same year are cited, they should be distinguished by the letters, a, b, c, etc., e.g. Marshall (1992a).

References to papers "in press" must mean that the article has been accepted for publication. References to "personal communications" and unpublished work are permitted in the text only: references to papers in preparation or submitted are not permissible.

All necessary **illustrations** should accompany the manuscript, but should not be inserted in the text. All photographs, graphs and diagrams should be numbered consecutively in Arabic numerals in the order in which they are referred to in the text. Glossy photographs or positive prints should be sent unmounted wherever possible and should be kept to a minimum. Figures should be of good quality. Explanation of lettering and symbols should be given in the figure caption and only exceptionally in the figures. Lettering and symbols to appear on the illustration should be of sufficient size to allow for considerable reduction where necessary (usually proper for a 50% reduction in size). Scales must be indicated on micrographs, not by magnifications in the legends. Figure size must not exceed 24×30 cm. On the back of each illustration should be indicated the author's name, the figure number (in Arabic numerals), and the top of the illustration, where this is not clear. Halftones should be included only when they are essential. Details and quotation of publication of colour plates should be made to the editors. The following symbols should be used on line drawing: ● ■ ❍ ❑ ▲ ◆ ♦ etc.

Legends to figures should be typed on a separate sheet. They should give sufficient data to make the illustration comprehensible without reference to the text.

Tables and appendices should be constructed so as to be intelligible without reference to the text, numbered in Arabic numerals and typed on separate sheets. Every table should be provided with an explanatory caption and each column should carry an appropriate heading. Units of measure should always be indicated clearly (metric units are preferred). All tables and figures must be referred to in the text.

Only standard **abbreviations** should be used. Arbitrary abbreviations and jargon will not be accepted.

The Latin names should be given for all species used in the investigation, although taxonomic affiliation and authority need not be provided in the title.

Page proofs will be sent to the author (or the first-mentioned author in a paper of multiple authorship) for checking. Corrections to the proofs must be restricted to printers' errors. Any substantial alterations other than these may be charged to the author. Authors are particularly requested to return their corrected proofs as quickly as possible in order to facilitate rapid publication. Please note that authors are urged to check their proofs carefully before return, since late corrections cannot be guaranteed for inclusion in the printed journal.

Fifty reprints free of charge will be sent to the first author; extra copies of the issue (at a specially reduced rate) can be ordered on the form which will accompany the proofs. These should be returned to: The Editorial Office of the Acta Zoologica, Hungarian Natural History Museum, Budapest, Baross u. 13, H-1088, Hungary

The **page charge** required from authors outside Hungary is 15 USD per printed page. Authors of papers exceeding 16 printed pages are asked to pay 40 USD (or HUF equivalent) for each such page i.e. all costs of publication (irrespective of their nationality).

FOR FURTHER INFORMATION PLEASE CONTACT US

The Editorial Office of the Acta Zoologica
H-1088 Budapest, Baross u. 13, Hungary
Fax: (36)-(1)-1138820.
E-mail: h7962per@huella.bitnet.

Nyomtatta és kötötte a Dabas-Jegyzet Kft.
Felelős vezető: Marosi György ügyvezető igazgató
Munkaszám: 94-0089

Eureco '95

7th EUROPEAN ECOLOGICAL CONGRESS

ECOLOGICAL PROCESSES
Current Status and Perspectives

Budapest, Hungary, 20-25 August 1995

Organized by European Ecological Federation, Biological Section of Hungarian Academy of Sciences and Hungarian Biological Society

Plenary Session themes are: Scaling problems in Ecology; Ecophysiology; Food webs; Mechanisms and constraints of organization; Ecological problems of sustainable development

Topics suggested for afternoon sessions include: Landscape ecology; Isolation and fragmentation; Role of disturbance; Invasions; Ecosystem manipulation and restoration; Impact assessment and ecological monitoring; Ecotoxicology; Behavioural ecology; Modeling of ecological processes; Population dynamics; Competition, coexistence and community organization; Plant-soil interaction; Mutualism; Freshwater ecology; Microbial ecology; Succession; Paleoecology; Biogeography; Biosphere processes and global change

Suggested workshops include: Pan-European problems in ecological research; Diversity of ecological concepts and terminology; Long term research and compatibility of database; Computer demonstrations; Cost-benefit analysis in reproduction of birds; Root ecology; Role of herbivores in controlling vegetation structure; Ecology of social insects

The organizing committee would welcome additional suggestions for sessions topics and workshops which should be sent as soon as possible and not later than July 1st 1994 to the first address indicated below. The Congress language will be English.

If you are interested in attending the 7th European Ecological Congress, please send an expression of interest, together with an indication of whether you are intending to offer a paper or poster (listing preferred session topic), to the first address indicated below as soon as possible and not later than July 1st 1994. The second announcement including full information on the registration, submission of abstracts, accommodation arrangements, excursions and social events will be sent out by October 1994.

For further information and queries please contact

Dr. LÁSZLÓ GALLÉ
Department of Ecology, JATE University
Szeged, P.O.Box 659, H-6701, Hungary
Phone/Fax: 36 62 310319

Dr. PAUL GILLER
Department of Zoology
University College, Cork, Ireland
Phone: 353 21 276871/ Fax: 353 21 270671

CONTENTS

HU ISSN 1217–8837

Typeset: Pars Ltd., Budapest.
Printed by Dabas Jegyzet Ltd., Hungary

Acta Zoologica

Academiae Scientiarum Hungaricae

VOLUME 40 - NUMBER 2 - 1994

HUNGARIAN NATURAL HISTORY MUSEUM, BUDAPEST

ACTA ZOOLOGICA ACADEMIAE SCIENTIARUM HUNGARICAE

AN INTERNATIONAL JOURNAL OF ANIMAL TAXONOMY AND ECOLOGY

Acta Zoologica Academiae Scientiarum Hungaricae is published quarterly from February 1994 (other issues in May, August and November) by the Hungarian Natural History Museum and the Biological Section of the Hungarian Academy of Sciences with the financial support of the Hungarian Academy of Sciences.

Acta Zoologica Academiae Scientiarum Hungaricae 40 (2), pp. 99-107, 1994

INFLUENCE OF AGE AND DOMINANCE STATUS OF MALE AND FEMALE GREAT TITS ON LAYING DATE, CLUTCH SIZE AND EGG DIMENSIONS

A. BÁLDI[1] & T. CSÖRGŐ[2]

[1]*Ecological Research Group, Hungarian Natural History Museum*
H-1088 Budapest, Baross u. 13, Hungary
[2]*Department of General Zoology, Eötvös L. University*
H-1088 Budapest, Puskin u. 3. Hungary

We recorded breeding biology of the Great Tit (*Parus major*) in a Hungarian black alder forest in relation to the age and dominance status of males and females. Our results suggest that there is no significant interactions between age and dominance of both males and females. The age and dominance of males have no significant influence on clutch and egg sizes, but there may be an effect on laying date. The influence of age and dominance of females is much more pronounced, with dominance status being more important than age.

Key words: Great Tit, *Parus major*, breeding biology, social dominance, age, sex

INTRODUCTION

The variation in clutch and egg sizes of hole-nesting passerine birds has been studied on the large scale (geographical variations, e.g., JÄRVINEN, 1989, SASVÁRI & ORELL, 1992, SOLER & SOLER, 1992), and on the local scale (variations between habitats, e.g., BALEN, 1973, LEMEL, 1989, JÄRVINEN, 1993). Three main factors might affect clutch and egg sizes in birds with biparental care: (1) environmental quality, (2) male quality, and (3) female quality (SLAGSVOLD & LIFJELD, 1990). The importance of habitat (e.g., BALEN, 1973, ISENMANN, 1987, LEMEL, 1989) and female quality (SLAGSVOLD & LIFJELD, 1990, JÄRVINEN, 1991) have already been shown for the Great Tit. However, little is known about the influence of male quality (SLAGSVOLD & LIFJELD, 1990).

Habitat quality might have only a minor influence on variations of breeding biology when the study area is only in one habitat. GOODBURN (1991) showed that the effect of territory quality is weak (but see HÖGSTEDT, 1980). Therefore the observed variations in our study area can be attributed mainly to the quality of parents.

The effects of quality of parents can be studied in experiments based on handicapped individuals, and under natural situation, where quality can be attributed to such factors as dominance or age. We used dominance in this study to measure the quality of parents, based on their residency status. Dominance and age also correlates, however residency seems to be the main factor determining dominance-hierarchy (KREBS, 1982, SANDELL & SMITH, 1991, BÁLDI & CSÖRGŐ, 1993).

Our questions were as follows:

(i) Are there any differences in laying date, clutch and egg sizes of male and female Great Tits between: (a) dominant and subdominant, (b) adult and one-year-old individuals?

(ii) Do males or females have more influence on clutch and egg size variations?

(iii) Which factor explains more variation, age or dominance?

STUDY AREA AND METHODS

The study was conducted in the Ócsa Landscape Conservation Area, about 30 km from Budapest in Central Hungary (47°15'N, 19°15'E). The study area is situated in a small (7 ha) black alder (*Alnus glutinosa*) forest fragment. At the beginning of 1986, 100 nest boxes with an entrance diameter of 32 mm were evenly distributed within the forest (BÁLDI, 1991).

The diameter of the tree trunks at breast height was about 15-25 cm. Surrounding the forest fragment was a heterogeneous landscape consisting of mainly marshes, reeds, and various willow bushes (*Salix alba, S. cinerea, S. caprea*). Therefore we can assume that the number of natural holes were negligible, although in the surrounding area a few single old trees were left, which may have provided some more natural holes.

We measured breeding biological parameters in 1986, 1988, 1989 and 1990. The females were weighted to the nearest 0.1 g. Only females that were measured 0-10 days after the clutch was completed were included in the analysis. The length and breadth of eggs were measured only for the first clutches. We measured the maximum egg length (EL) and breadth (EB) of each egg and computed the volume of eggs (EV) using the formula developed by OJANEN *et al.* (1978):

$$EV = 0.042 + 0.46 \times EL \times EB^2$$

This equation accounts for the 97% of the overall variance in egg volume (OJANEN *et al.*, 1978).

The clutch means were used as sampling units to avoid over-emphasizing large clutches (OJANEN *et al.*, 1978, JÄRVINEN & PRYL, 1989).

Both males and females were separated according to age (1 year-old and older birds), and dominance status. We considered a bird dominant if it was captured in the preceding and/or following winter(s) of the breeding. These tits were recaptured almost without exception as roosting birds in winter. Those birds were considered subdominant, which were registered only as breeding birds. This method to establish dominance order is based on our observations, which showed, that resident birds in winter used to breed within the restricted area used for roosting in winter (BÁLDI, unpublished data). Resident birds are dominant over the immigrants and floaters (KREBS, 1982, SANDELL & SMITH, 1991, BÁLDI & CSÖRGŐ, 1993). KOIVULA *et al.*, (1993) argued, that age-dependent dominance is most likely the prior residency advantage of the adults.

We analysed the influence of the mate, too. We used data from 26 pairs, of which five were supposed to have pairbond, i.e. they were not captured in the given breeding season at the same nest, but were mated in other breeding seasons.

For statistical procedures the programs NPAR TESTS MANN-WHITNEY and ANOVA were applied from the SPSS/PC+ (NORUSIS, 1986).

RESULTS

Age and dominance used to correlate, therefore the possible interactions between them were evaluated. Table 1 and 2 show that the interaction between age and dominance of both males and females are almost never significant, which means that the grouping variables age and dominance can be tested individually (NORUSIS, 1986). The exception is the weight of the females, which is jointly affected by dominance and age, therefore we excluded from the analysis.

Table 1. ANOVA for two-way interactions between age and dominance of the male Great Tits. If there is no significant interactions, the grouping variables age and dominance can be tested individually. (*: p<0.05)

	N	mean square	F	p
first egg laying	25	52.572	1.930	0.179
clutch size	26	4.669	2.009	0.170
egg length	16	0.041	0.091	0.769
egg breadth	16	0.003	0.017	0.898
egg volume	16	0.001	0.057	0.815
wing length of mates	24	3.667	0.999	0.330
weight of mates	14	12.257	6.776	0.026 *
male wing length	23	0.080	0.028	0.869
male weight	19	0.011	0.015	0.903

Degree of freedom = 1

Table 2. ANOVA for two-way interactions between age and dominance of the female Great Tits. If there is no significant interactions, the grouping variables age and dominance can be tested individually. (*: p<0.05)

	N	mean square	F	p
first egg laying	28	19.484	0.652	0.427
clutch size	49	0.004	0.002	0.965
egg length	39	0.023	0.095	0.759
egg breadth	39	0.000	0.001	0.974
egg volume	39	0.001	0.063	0.803
female wing length	44	2.856	0.827	0.369
female weight	25	7.449	4.394	0.048 *
wing length of mates	23	0.841	0.324	0.576
weight of mates	19	0.010	0.018	0.895

Degree of freedom = 1

Table 3. Comparison of breeding biology and male and female biometry based on the distinction of dominant and subdominant males. D: dominant: SD: subdominant. (Two-tailed probabilities of the Mann-Whitney U-tests are given.)

	status	N	average	SD	U	p
first egg laying	D	18	12.94	3.93	49.5	0.411
	SD	7	16.57	8.58		
clutch size	D	19	8.79	1.55	58.5	0.636
	SD	7	8.57	1.51		
egg length	D	12	18.24	0.635	14.5	0.248
	SD	4	17.78	0.608		
egg breadth	D	12	13.58	0.445	19.5	0.583
	SD	4	13.48	0.236		
egg volume	D	12	1.617	0.130	19.0	0.544
	SD	4	1.550	0.036		
wing length of mates	D	18	73.9	2.03	47.0	0.634
	SD	6	74.3	1.21		
male wing length	D	18	77.1	1.66	31.5	0.299
	SD	5	76.2	1.64		
male weight	D	13	17.99	0.91	37.5	0.895
	SD	6	17.12	0.37		

There were no significant differences between dominant and subdominant males in the date of laying, clutch and egg sizes, wing length, weight, and wing length and weight of mates (Table 3). Similar results were obtained when adult and one-year-old males were compared (Table 4). The egg sizes were significantly greater in dominant females than in subdominants, and the weight of pairs of dominant females tend to be higher than that of subdominants (Table 5). Female wing lengths were significantly greater in adults than in one-year-old individuals (Table 6), but egg lengths showed only a weak significant difference.

DISCUSSION

Neither age nor dominance influenced the starting of breeding. However, PERRINS (1979) found that the date of laying of individual female Great Tits was affected by their age; young birds tended to lay a few days later than experienced birds (see also JÄRVINEN, 1991). ENOKSSON (1993) observed similar trend in the Nuthatch (*Sitta europaea*).

Table 4. Comparison of breeding biology and male and female biometry based on the distinction of adult (AD) and one-year-old (1Y) males. (Two-tailed probabilities of the Mann-Whitney U-tests are given.)

	age	N	average	SD	U	p
first egg laying	AD	14	15.23	6.65	55.0	0.226
	1Y	11	12.27	3.74		
clutch size	AD	14	8.93	1.27	69.5	0.445
	1Y	12	8.50	1.78		
egg length	AD	8	18.23	0.609	25.0	0.461
	1Y	8	18.03	0.701		
egg breadth	AD	8	13.44	0.466	21.0	0.245
	1Y	8	13.68	0.301		
egg volume	AD	8	1.582	0.132	21.0	0.248
	1Y	8	1.617	0.104		
wing length of mates	AD	13	74.0	1.63	66.5	0.768
	1Y	11	74.0	2.15		
male wing length	AD	13	77.2	1.74	45.0	0.201
	1Y	10	76.4	1.51		
male weight	AD	9	17.94	0.98	41.5	0.774
	1Y	10	17.96	0.57		

We compared our results with experimental data from the literature. We assumed that being young or subdominant is a 'handicap', because both the lack of experience and subordered status negatively influence survival in relation to old and dominant birds. Handicapping through feather removal or weight increase also negatively affects survival.

Clutch sizes did not vary between either dominant – subdominant or adult – one-year-old birds. SLAGSVOLD & LIFJELD (1990) also found that female Great Tits did not adjust their clutch size after handicapping, but their body mass decreased. In our study we did not detected any difference in body mass. Maybe the strategy of Great Tits in this Central-European habitat is similar to that of the Starlings (*Sturnus vulgaris*), where neither clutch size, nor body mass is reduced, but a reduced food provisioning to nestlings was the response to handicapping (WRIGHT & CUTHILL, 1989).

We also evaluated the indirect effect of mates on breeding phenological parameters. We did not found any relevant differences, however, the sample sizes were low.

The quality of males, both age and dominance seems to be irrelevant for clutch and egg sizes. The same result was obtained for Pied Flycatchers (*Ficedu-*

Table 5. Comparison of breeding biology and female and male biometry based on the distinction of dominant and subdominant females. D: dominant, SD: subdominant. (Two-tailed significances of the Mann-Whitney U-tests are given; *: $p<0.05$; **: $p<0.001$)

	status	N	average	SD	U	p
first egg laying	D	11	12.18	4.60	67.0	0.211
	SD	17	14.94	5.75		
clutch size	D	17	8.94	1.64	259.0	0.653
	SD	33	8.85	1.35		
egg length	D	12	18.56	0.36	48.5	0.000 **
	SD	28	17.89	0.52		
egg breadth	D	12	13.63	0.34	131.5	0.278
	SD	28	13.55	0.33		
egg volume	D	12	1.650	0.09	93.0	0.027 *
	SD	28	1.577	0.10		
female wing length	D	17	74.7	1.90	175.0	0.180
	SD	27	73.9	1.96		
wing length of mates	D	11	77.2	1.66	49.0	0.280
	SD	12	76.6	1.68		
weight of mates	D	7	17.57	0.65	23.0	0.107
	SD	12	18.18	0.77		

la hypoleuca, SLAGSVOLD & LIFJELD, 1988), Blue (*P. caeruleus*) and Coal Tits (*P. ater*, SLAGSVOLD & LIFJELD, 1990), and Nuthatches (ENOKSSON, 1993). SLAGSVOLD & LIFJELD (1990) argued that females of subordinated males are unable to assess male quality.

BJÖRKLUND (1990) found that the female reproductive success in the Common Rosefinch (*Carpodacus erythrinus*) was irrespective of males. On the other hand, GOODBURN (1991) showed that quality of male Magpies (*Pica pica*) accounted for over 70% of a pair's breeding success through the different provisioning of males to their mates and their chicks.

The question arising is: what is the role of males in the Great Tits? Our knowledge is poor (SLAGSVOLD & LIFJELD, 1990), however, PERRINS & MCCLEERY (1985) showed that the age of males affected the number of fledged and surviving young and laying date, but not clutch size. Our results also indicate differences in laying date (e.g. 3.63 d between dominant and subdominant males, however, not significant) and small deviation in clutch size (e.g. 0.22 egg between dominant and subdominant males).

Age and dominance act independently in most cases. We are not able to compare the effect of age and dominance for the males, because there were not

Table 6. Comparison of breeding biology and female and male biometry based on the distinction of adult (AD) and one-year-old (1Y) females. (Two-tailed probabilities of the Mann-Whitney U-tests are given; *: p<0.05)

	age	N	average	SD	U	p
first egg laying	AD	14	13.71	6.74	79.5	0.393
	1Y	14	14.00	3.92		
clutch size	AD	25	9.16	1.43	222.5	0.113
	1Y	24	8.50	1.35		
egg length	AD	20	18.26	0.46	132.5	0.105
	1Y	19	17.93	0.64		
egg breadth	AD	20	13.59	0.34	170.0	0.571
	1Y	19	13.54	0.32		
egg volume	AD	20	1.618	0.10	159.0	0.384
	1Y	19	1.578	0.11		
female wing length	AD	22	74.9	1.92	151.0	0.029*
	1Y	22	73.5	1.77		
wing length of mates	AD	11	76.4	1.61	46.5	0.215
	1Y	12	77.3	1.63		
weight of mates	AD	7	18.00	0.65	35.5	0.581
	1Y	12	17.93	0.86		

significant differences. The age of females was less important than dominance status. Maybe the correlation between age and dominance is the underlying reason for results in many studies, where 'age effect' was showed, but evaluations were made only for age, but not for dominance (see JÄRVINEN, 1991). In our study dominance was defined after residency status, therefore the confusing effect of cases, for example, being one-year-old, but dominant or adult, but subordinated was excluded. This effect is clearly seen, regarding the low significance levels in Table 4, where adult – one-year-old distinctions were made, and the much stronger significances on the same variables in Table 3, where dominant-subdominant groups were evaluated.

The low number of samples on male Great Tits, and the lack of significant relationships, reflects the need for focused studies on the role of males in reproduction (see also SLAGSVOLD & LIFJELD, 1990).

Acknowledgements – We are indebted to J. LEMEL, É. LUDVIG, J. SWENSON and an anonymous reviewer for reading the manuscript and making valuable comments. We thank J. BÁLDI and several members of the Hungarian Ornithological and Nature Conservation Society who participated in the field work. A. BÁLDI was supported by the Foundation for the Hungarian Sciences of the Hungarian Credit Bank.

REFERENCES

BÁLDI, A. (1991) The effect of nestboxes on bird species diversity and on the breeding density of the Great Tit (*Parus major* L., 1758) in different habitats. *Aquila* **98**: 141-146.

BÁLDI, A. & CSÖRGŐ, T. (1993) Social dominance in the resident part of a Great Tit (*Parus major*) population in winter. *Ornis Hung.* **3**: 7-12.

BALEN, J. H. VAN (1973) A comparative study of the breeding ecology of the Great Tit (*Parus major*) in different habitats. *Ardea* **61**: 1-93.

BJÖRKLUND, M. (1990) Mate choice is not important for female reproductive success in the Common Rosefinch (*Carpodacus erythrinus*). *Auk* **107**: 35-44.

ENOKSSON, B. (1993) Effects of female age on reproductive success in European Nuthatches breeding in natural cavities. *Auk* **110**: 215-221.

GOODBURN, S. F. (1991) Territory quality or bird quality? Factors determining breeding success in the Magpie *Pica pica*. *Ibis* **133**: 85-90.

HÖGSTEDT, G. (1980) Evolution of clutch-size in birds: adaptive variation in relation to territory quality. *Science* **210**: 1148-1150.

ISENMANN, P. (1987) Geographical variation in clutch-size: the example of the Blue Tit (*Parus caeruleus*) in the Mediterranean area. *Vogelwarte* **34**: 93-99.

JÄRVINEN, A. (1989) Clutch-size variation in the Pied Flycatcher *Ficedula hypoleuca*. *Ibis* **131**: 572-577.

JÄRVINEN, A. (1991) A meta-analytic study of the effect of female age on laying-date and clutch-size in the Great Tit *Parus major* and the Pied Flycatcher *Ficedula hypoleuca*. *Ibis* **133**: 62-66.

JÄRVINEN, A. (1993) Spatial and temporal variation in reproductive traits of adjacent northern Pied Flycatcher *Ficedula hypoleuca* populations. *Ornis Scand.* **24**: 33-40.

JÄRVINEN, A. & PRYL, M. (1989) Egg dimensions of the Great Tit *Parus major* in southern Finland. *Ornis Fennica* **66**: 69-74.

KOIVULA, K., LAHTI, K., ORELL, M. & RYTKÖNEN, S. (1993) Prior residency as a key determinant of social dominance in the willow tit (*Parus montanus*). *Behav. Ecol. Sociobiol.* **33**: 283-287.

KREBS, J. R. (1982) Territorial defence in the Great Tit (*Parus major*): do residents always win? *Behav. Ecol. Sociobiol.* **11**: 185-194.

LEMEL, J. (1989) Habitat distribution in the Great Tit *Parus major* in relation to reproductive success, dominance, and biometry. *Ornis Scand.* **20**: 226-233.

NORUSIS, M. J. (1986) *SPSS/PC+ for the IBM PC/XT/AT.* SPSS Incorporation, Chicago, 326 pp.

OJANEN, M., ORELL, M. & VÄISÄNEN, R. A. (1978) Egg and clutch sizes in four passerine species in north Finland. *Ornis Fennica* **55**: 60-68.

PERRINS, C. M. & MCCLEERY, R. H. (1985) The effect of age and pair bond on the breeding success of Great Tits *Parus major*. *Ibis* **127**: 306-315.

PERRINS, C. M. (1979) *British Tits*. Collins, London, 304 pp.

SANDELL, M. & SMITH, H. G. (1991) Dominance, prior occupancy, and winter residency in the Great Tit (*Parus major*). *Behav. Ecol. Sociobiol.* **29**: 147-152.

SASVÁRI, L. & ORELL, M. (1992) Breeding success in a North and a Central European population of the Great Tit *Parus major. Ornis Scand.* **23**: 96-100.

SLAGSVOLD, T. & LIFJELD, J. T. (1988) Ultimate adjustment of clutch size to parental feeding capacity in a passerine bird. *Ecology* **69**: 1918-1922.

SLAGSVOLD, T. & LIFJELD, J. T. (1990) Influence of male and female quality on clutch size in tits (*Parus* spp.). *Ecology* **71**: 1258-1266.

SOLER, M. & SOLER, J. J. (1992) Latitudinal trends in clutch size in single brooded hole nesting bird species: a new hypothesis. *Ardea* **80**: 293-300.

WRIGHT, J. & CUTHILL, I. (1989) Manipulation of sex differences in parental care. *Behav. Ecol. Sociobiol.* **25**: 171-181.

Received December 20, 1993; accepted March 16, 1994

Eureco '95

7th EUROPEAN ECOLOGICAL CONGRESS

ECOLOGICAL PROCESSES

Current Status and Perspectives

Budapest, Hungary, 20-25 August 1995

Organized by European Ecological Federation, Biological Section of Hungarian Academy of Sciences and Hungarian Biological Society

Plenary Session themes are: Scaling problems in Ecology; Ecophysiology; Food webs; Mechanisms and constraints of organization; Ecological problems of sustainable development

Topics suggested for afternoon sessions include: Landscape ecology; Isolation and fragmentation; Role of disturbance; Invasions; Ecosystem manipulation and restoration; Impact assessment and ecological monitoring; Ecotoxicology; Behavioural ecology; Modeling of ecological processes; Population dynamics; Competition, coexistence and community organization; Plant-soil interaction; Mutualism; Freshwater ecology; Microbial ecology; Succession; Paleoecology; Biogeography; Biosphere processes and global change

Suggested workshops include: Pan-European problems in ecological research; Diversity of ecological concepts and terminology; Long term research and compatibility of database; Computer demonstrations; Cost-benefit analysis in reproduction of birds; Root ecology; Role of herbivores in controlling vegetation structure; Ecology of social insects

The organizing committee would welcome additional suggestions for sessions topics and workshops which should be sent as soon as possible and not later than July 1st 1994 to the first address indicated below. The Congress language will be English.

If you are interested in attending the 7th European Ecological Congress, please send an expression of interest, together with an indication of whether you are intending to offer a paper or poster (listing preferred session topic), to the first address indicated below as soon as possible and not later than July 1st 1994. The second announcement including full information on the registration, submission of abstracts, accommodation arrangements, excursions and social events will be sent out by October 1994.

For further information and queries please contact

Dr. LÁSZLÓ GALLÉ
Department of Ecology, JATE University
Szeged, P.O.Box 659, H-6701, Hungary
Phone/Fax: 36 62 310319

Dr. PAUL GILLER
Department of Zoology
University College, Cork, Ireland
Phone: 353 21 276871/ Fax: 353 21 270671

Acta Zoologica Academiae Scientiarum Hungariae 40 (2), pp. 109-123, 1994

POLYOMMATINE LYCAENIDS OF THE OREAL BIOME IN THE NEOTROPICS, PART I: THE THECLINE-LIKE TAXA (LEPIDOPTERA: LYCAENIDAE)

ZS. BÁLINT[1] and K. JOHNSON[2]

[1]*Zoological Department, Hungarian Natural History Museum*
H-1088 Budapest, Baross utca 13, Hungary
[2]*American Museum of Natural History*
Central Park West at 79th Street, New York, 10024–5192, USA

The genus *Nabokovia* HEMMING (=*Pseudothecla* NABOKOV) is revised and the new genus *Polytheclus* erected to contain two groups of thecline-like Polyommatinae from the high Andes of South America. *Nabokovia* contains trans-Andean type species *N. faga* (DOGNIN) and new species *N. ada* (Coquimbo, Chile). *Polytheclus* contains new type species *P. cincinnatus* and *P. sylphis* (DRAUDT) both poorly known from high montane Peru. Lacking detailed morphological study, the taxa have been historically considered congeneric in *Nabokovia*. Structures of the two genera, however, differ drastically and question a common phylogenetic origin. Evidence from morphological structures and geographic distributions suggest both *Nabokovia* and *Polytheclus* are of lowland Neotropical origin and have secondarily invaded the oreal biome. With 20 original photos and 16 original figures.

Key words: biogeography, Eumaeini, Polyommatinae, Andes, austral South America, *Nabo kovia*

INTRODUCTION

Recent literature has emphasized that knowledge of high Andean Neotropical representatives of the tribe Polyommatinae SWAINSON, 1827 is rather scanty, with little biological and ecological data available, taxonomy poorly elucidated, and numerous entities undescribed (DESCIMON, 1986; FIEDLER, 1991).

The seminal paper on Neotropical polyommatine taxonomy was written by NABOKOV (1945). Seven new genera were introduced, two revised and restricted, and some new synonymies and new combinations established. ELIOT's (1973) work relied mostly on NABOKOV and little new information was added concerning taxonomy and phylogeny of the Neotropical polyommatine lycaenids of the oreal biome. BRIDGES (1988) bibliographic work included most of the polyommatine literature to date but inculcated some errors due to reliance on secondary sources.

The first author is preparing a worldwide catalogue of the *Polyommatus*–section (sensu ELIOT, 1973). While studying polyommatine material in European museums he noted that taxonomic studies are urgently needed concerning the

Central Asian Polyommatinae (cf. BÁLINT, 1992) and apparent high Andean counterparts in the New World. Numerous entities are undescribed and a higher classification is needed considering both Old and New World components. In numerous recent publications, the second author has primarily pursued elaboration of Neotropical Theclinae. However, South American sources provided high montane materials irrespective of identification to the Theclinae and Polyommatinae and this provided a unique opportunity for studying the latter. In addition, JOHNSON (JOHNSON *et al.*, 1988, 1992) had also reviewed the Antillean polyommatine taxonomy of NABOKOV and discovered several new species during field work in Hispaniola. With assemblage of samples from nearly all major New and Old World institutional sources providing a unique opportunity for study, the authors decided to initiate a series elaborating all the polyommatine lycaenids of the Neotropical Realm.

Below we consider the systematic position and taxonomic compositon of thecline-like taxa (e.g. *Nabokovia* HEMMING, 1961 = *Pseudothecla* NABOKOV, 1945 and its relatives) adding some preliminary comments on the zoogeography and phylogeny of these high Andean segregates, as the first part of the planned series.

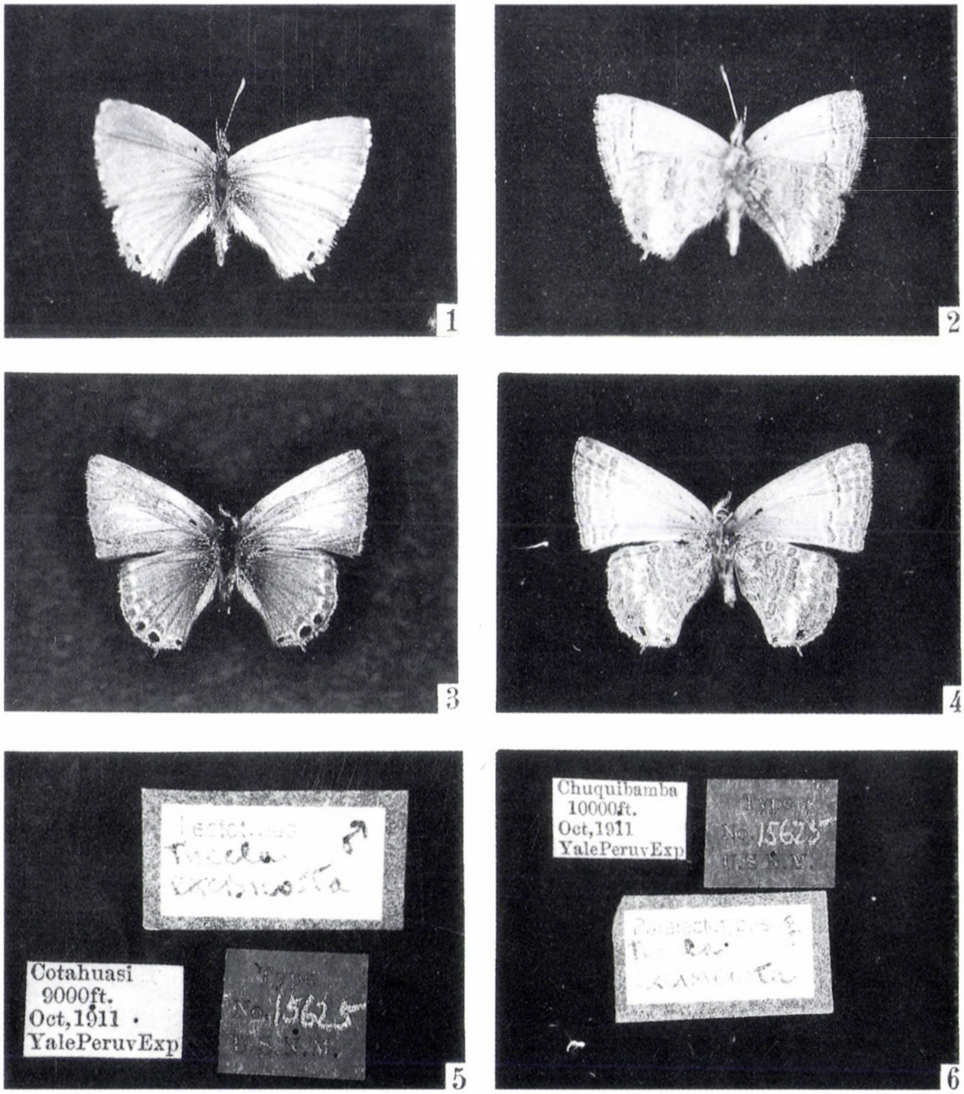
MATERIALS AND METHODS

Material examined included specimens from the Allyn Museum of Entomology, Florida Museum of Natural History (AME); American Museum of Natural History (AMNH); Carnegie Museum of Natural History (CMNH); Field Museum of Natural History (FMNH); Instituto Entomología, Universidad Metropolitana de Ciencias de la Educación (Santiago, Chile) (UMCE); Instituto Miguel Lillo (Tucumán, Argentina) (IML); Museo Nacional de Historia Natural (Santiago, Chile) (MNHNC); Muséum National d'Histoire Naturelle (Paris, MNHN); Natural History Museum, London, United Kingdom (NHML); University of California, Davis (UCD) and Zoologische Museum der Humbolt Universität zu Berlin (ZMH).

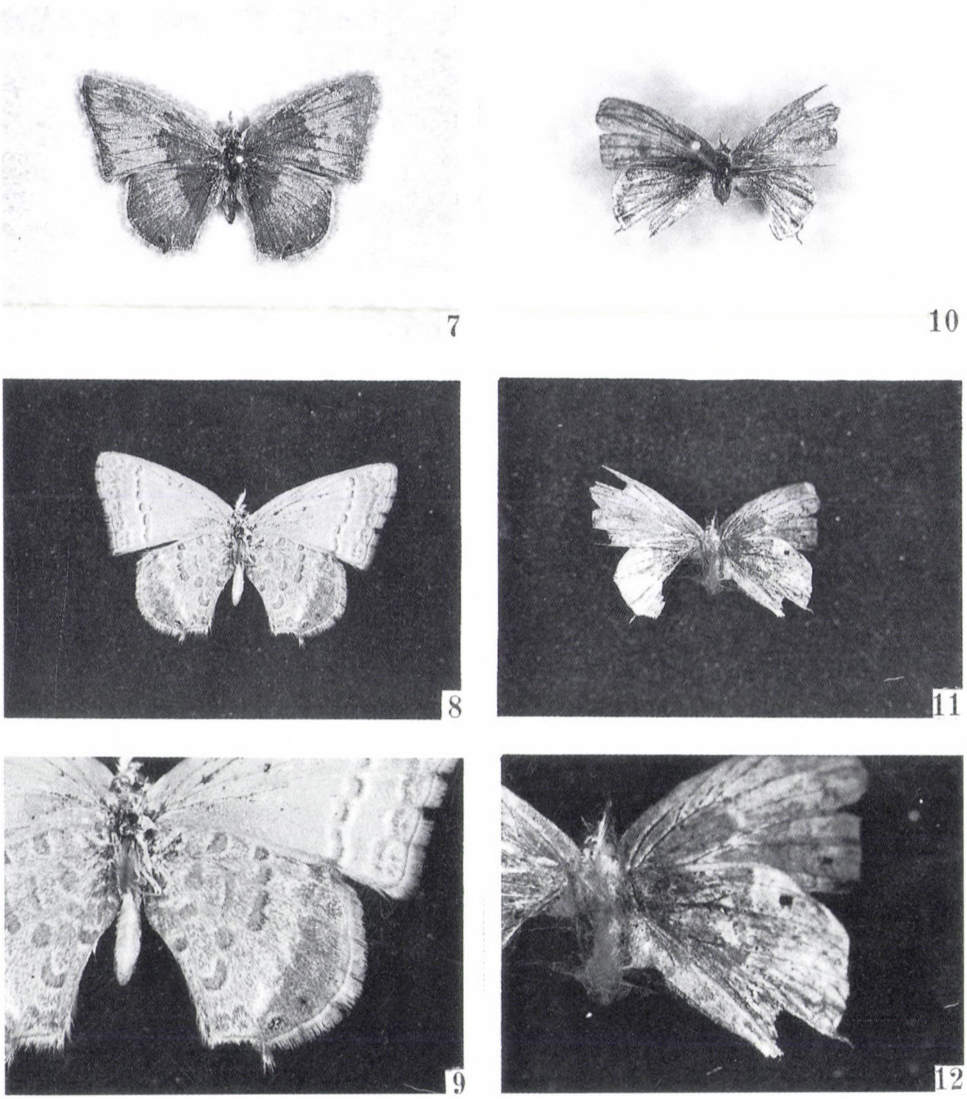
In addition, materials from private collections of LUIS PEÑA, PEDRO MAZRY and the late JOSÉ HERRERA G. (Santiago, Chile); ROBERT C. EISELE and BRUCE EISELE (Jujuy, Argentina); HENRI DESCIMON (Marseille, France) and ARTHUR M. SHAPIRO (Davis, California, USA) were also consulted. Some material from these latter sources has been redeposited as voucher specimens at the AMNH and AME as indicated herein. Dissected material is deposited as reported in the individual taxonomic entries.

Terminology is based on SCOTT (1990), NABOKOV (1944) and MATTONI (1989); nomenclatural sources are HEMMING (1967) and BRIDGES (1988).

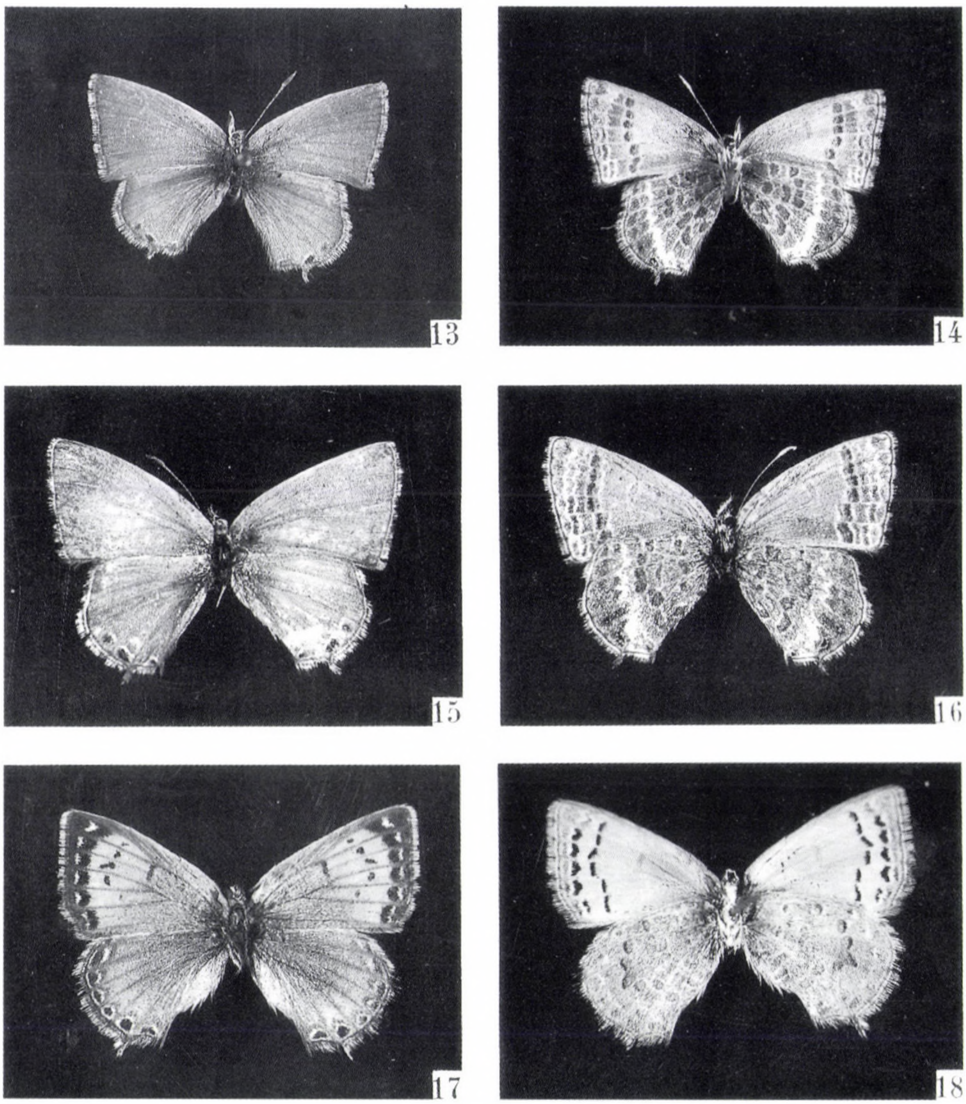
Figs 1-6. "*Thecla exscisicosta*": 1 = lectotype. – 2 = ditto, ventral. – 3 = paralectotype, female. – 4 = ditto, ventral. – 5 = labels of lectotype. 6 = labels of paralectotype



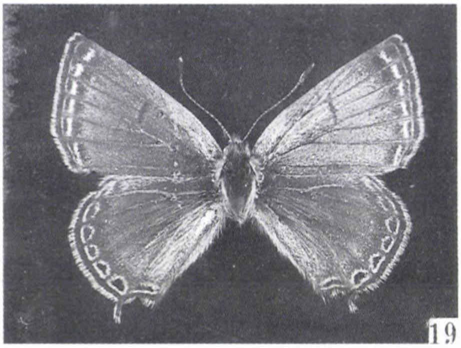
Figs 7-12. *Nabokovia* taxa: 7 = *N. faga*, male, Cuzco, Peru. – 8 = ditto, ventral. – 9 = ditto, enlarged hindwing. – 10 = *N. ada*, Holotype. – 11 = ditto, ventral. – 12 = ditto, enlarged hindwing

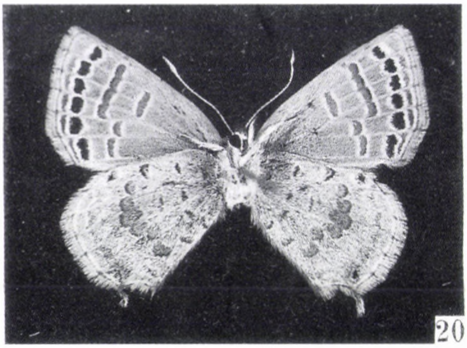


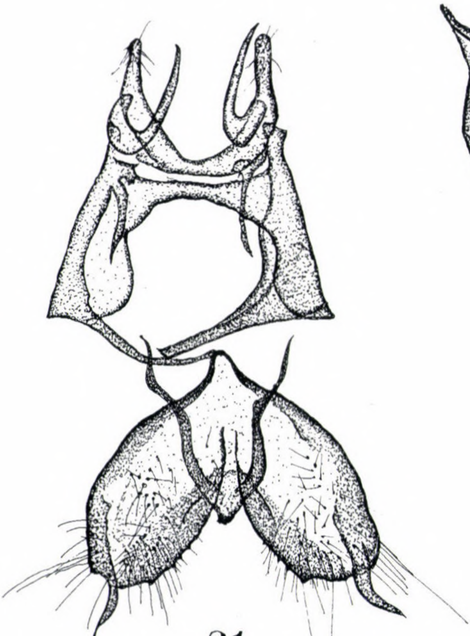
Figs 13-18. *Nabokovia* and *Polytheclus* taxa: 13 = *N. faga*, male, Chachapoyas, Peru. – 14 = ditto, ventral. – 15 = *N. faga*, male, Jureo, Peru. – 16 = ditto, ventral. – 17 = *P. sylphis*, male, Tarma, Peru. – 18 = ditto, ventral. – 19 = *P. cincinnatus*, holotype. – 20 = ditto, ventral



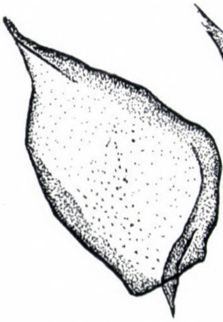
Figs 19-25. Male genitalia of *Nabokovia faga* (Jureo, Peru) and *N. ada* (holotype): 21 = *N. faga*, aedoeagus removed. – 22 = *N. faga*, right valva. – 23 = *N. ada*, right valva. – 24 = *N. faga*, aedoeagus, lateral view. – 25 = *N. ada*, aedoeagus, lateral view. – 26 = *N. faga*, aedoeagus, lateral view. – 27 = *N. ada*, aedoeagus, lateral view



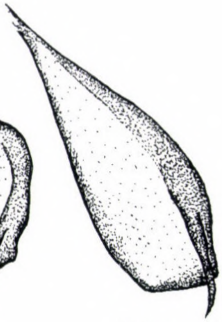




21



22



23

24

25

Synonymies and combinations are considered as "new" if not contained in the latter mentioned two works.

Abbreviations for institutions are as noted above. Further abbreviations used in the descriptive texts are: forewing (FW), hindwing (HW), wings' dorsum (DW), wings' ventrum (VW), forewing dorsum (DFW), hindwing dorsum (DHW), forewing ventrum (VFW), hindwing ventrum (VHW).

SYSTEMATIC PART

Nabokovia HEMMING, 1960
(Figs 1-16, 21-30, 35)

Short taxonomic history – Described originally as monotypic genus *Pseudothecla* by NABOKOV (1945), including mention of *Thecla excisicosta* DYAR (1913) as a probable synonym of *faga* (but with no confirmation of this statement in the subsequent literature).

The heterogenity of the Neotropical taxa of "*Scolitantides*" sensu DRAUDT (1921) was pointed out and clarified by NABOKOV (1945). DRAUDT had included both *faga* and a new species, *Scolitantides sylphis* DRAUDT, in *Scolitantides* (HÜBNER, [1819]; type species the Palaearctic *Lycaena orion* PALLAS, 1771). NABOKOV transferred entities from *Scolitantides* into either *Pseudothecla* or another new genus, *Pseudolucia*, noting (NABOKOV 1945:11, footnote 1) that DRAUDT's *Scolitantides sylphis* might be congeneric with *faga* but that he had been unable to confirm this.

The name *Nabokovia* was introduced by HEMMING (1960) as a replacement name for NABOKOV's *Pseudothecla*, which was a homonym of *Pseudothecla* STRAND 1910 (type: *Thecla lunulata* ERSCHOFF, 1874) (HEMMING 1967).

LAMAS & PÉREZ (1983) listed two *Nabokovia* species, suggesting that the genus is polytypic.

Type species: *Thecla faga* DOGNIN 1895, by original designation (HEMMING, 1960).

Synopsis of species: 1. *Nabokovia faga* (DOGNIN, 1893) (= *Thecla excisicosta* DYAR, 1913, syn. n.) – 2. *Nabokovia ada* BÁLINT and JOHNSON, sp. n.

Diagnosis of the genus: Eyes smooth, palpi hairy, body normal polyommatine.

Wing: FW with veins 11 and 12 free. FW with straight costal margin, pointed apex, outer margin wide and straight, inner margin slightly concave; tornus pointed. HW anal margin straight and long, anal angle well marked, apex almost pointed, vein *1A+2A* tailed.

Pattern: Normal brown polyommatine on DW and VFW forewing, but modified on VHW. Sexes similar. DW brown with very narrow black margin. Fringes checkered. HW tailed with few marginal black spots. VFW with suffused postmedian area appearing darker than median area. VHW with suffusive white band and few small iridescent marginal scales. Median area not polyommatine.

Male genitalia: Uncus more or less digitate and directed caudad, gnathos long and slender, tegumen normal polyommatine with appendix angular is (suspensorium sensu ELIOT, 1973); juxta with thick branches, undulate, curved conspicuously, valva wide and relatively short with narrow but long rostellum, aedeagus with remarkable sclerotized alulae.

Female genitalia: Comprised of a membranous saclike corpus bursae (sensu KLOTS 1970) constructing caudally to a terminal sclerotized element, latter being simple and tubelike and opening ventrally along approximately the terminal two-thirds of its length. Sclerotized terminal structures do not lend well to terminology for polyommatine female genitalia used by NABOKOV (1945: 53) in that differentially sclerotized terminal regions, respectively "henia" and "fibula" sensu NABOKOV, are not readily recognizable.

Distribution (Fig. 35): In the oreal biome of the Andes, from southern Ecuador to central Chile (Coquimbo Region).

Etymology: Gender feminine, the genus renamed after its desciber by HEMMING (1960). Hereafter, to further honor Vladimir NABOKOV as the first reviewer of Neotropical polyommatine lycaenids, we make a general practice of naming new Neotropical polyommatines after fictional characters of NABOKOV's novels and other names associated with him.

Nabokovia faga (DOGNIN, 1893)
(Figs 1-9, 13-16, 21-22, 24, 26, 28-30)

Diagnosis: FW margin very straight, comparable only to *N. ada* of Chile, HW with short tail at vein *CuA2* flanked costad by black lunules usually limited to cell *CuA2* or *CuA2/l*. VHW less mottled than congeners, with narrow yellow-white lines mottled over yellow or yellow-brown ground and usually a prominent postmedial white stripe and/or dark brown submarginal color. Male genitalia differing from *N. ada* by stout "flat-faced" mentum, produced width at Bayard's angulation and shorter, ventrally arched, rostellum.

Additional descriptive notes: DFW, DHW ground color brown, lunules along HW margin black; VFW ground yellow-orange basad of black postmedial band, VHW ground yellow-brown to tawny, mottled lines white to cream, postmedial band white to cream when apparent, submargin often darker brown than rest of wing.

Distribution (Fig. 35): In the oreal biome of the Andes south from Loja district (southern Ecuador) throughout Peru, Bolivia to northern Chile (Tarapaca Prov.) and northern Argentina (Jujuy Prov.).

Holotype: male: "Loja, Equateur; *Thecla Faga* Dgn., Typ; I/94, dans nom.; Lycaenid allied to *Scolitantides* (?also described by Stgr.?), Hamilton Druce, avril 1908; J. J; Joicey Coll., B.M; 1929-435; *Thecla faga* DOGNIN, det P. Ackery; Deposited in NHML (drawer 29A-927).

Biology: The species is to be found in dry scrub-steppe habitats at elevations 2500-4000 m. The adults were collected in January, February, April, July, October and November. The flight period in W Peru is at the second half of the dry season. The butterflies often visit moist ground, sunbathing on rocks or stones. Their flight is low and zigzagged (LAMAS & PÉREZ 1983).

Larval foodplant and the nectar sources of the adults are unknown.

Remarks: Synonym – Two syntype specimens of *Thecla excisicosta* DYAR, 1913 were examined (Figs. 1-6). The male is designated here as lectotype, its data: "Cotahuasi, 9000 ft., Oct, 1911, Yale Peruv Exp; Type No 15626, USNM (red label); Lectotype, male, *Thecla excisicosta*, (verso:) des. by ZS. BÁLINT, 1992, X. 26., Budapest". Further remaining specimens (2 males and 3 females) are paralectotypes (see DYAR 1913). The types are preserved in the collection of USNM. They are identical both in markings and genitalic characters with *faga*, so NABOKOV's question concerning the status of *excisicosta* (NABOKOV, 1945: 11), accepted as a synonym by various authors (BRIDGES, 1988) is confirmed.

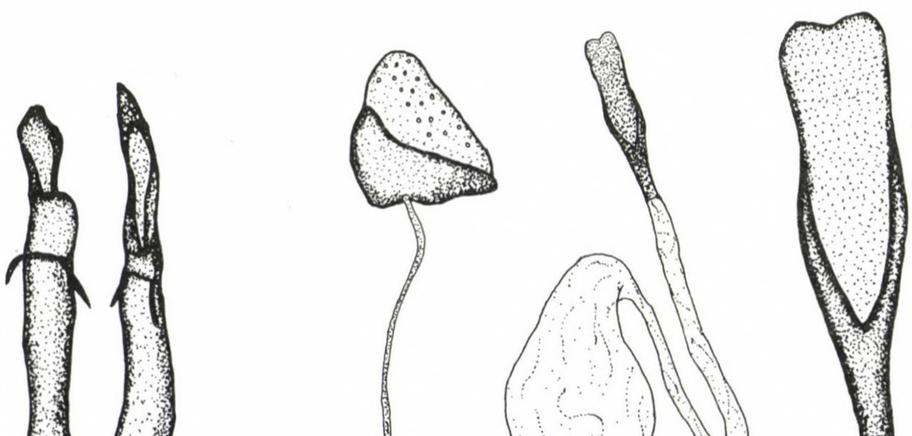
Sex recognition: Sexes of *N. faga* can be discriminated by abdominal shape and a tendency for the female to show more DHW marginal black lunules (Fig. 3).

Intraspecific variation: Wing pattern variation mostly involves the degree of expression in the suffusive white postmedial HW band and/or darker brown ground suffusion along the HW submargin. In genitalia, males show differences in extent of the "flat-faced" mentum generally independent of geographic area and similar minor random variation in the extent of production along Bayard's angulation, occasionally specimens showing more of a hump along the angulation's dorsum. In females some interpopulation variation occurs in the expanse of the sclerotized ductal element beneath its ventral opening and in the length and amount of sculpturing of the postvaginal lobe.

General: NABOKOV's Plate 2 drawing of a single male genitalia is somewhat simplified compared to structures requiring comparison within this genus. We prefer illustrating the outer lateral view of the valvae where the "flat-faced" shape typifying the mentum of *N. faga* can readily be seen compared to the elongate and incised habitus of *N. ada* described below. In using NABOKOV's terminology concerning valval structure we extrapolate from the structures he named on his schematic drawing of Plate 6, MOZ 3.

NABOKOV (1945: 55) limited his genitalic study to a single Peruvian male (AMNH) and, noting the unusual facies of the species, did not comment on its habitus in as much detail as for other genera of his study.

Material examined (all specimens were dissected except MNHN): Argentina, Jujuy Prov., Dept. Tilcara, ascending Cerro Amarillo nr. Huacalera, circa 3500-4000 m, in scrub-steppe, 1 February 1991, AMNH expedition, 1 male (AMNH); San Juan Prov., 10 km, S. Los Berros, 30 October 1991, leg. J. HERRERA, 1 female (AMNH). – Bolivia: La Paz, Bolivia, 3000 m, Garlepp, 1 male (NHML). – Chile: Tarapacá Reg., Tarapacá Prov., Camarones, 23 November 1950, leg. L. PEÑA, 1 male (FMNH); Tarapacá Reg., Arica Prov., Belén, 3,850 m., 26 October 1952 (FMNH, male); Tarapacá Reg., Arica Prov., Codpa, 27 January 1992, leg. E. PEÑA, 1 female (AMNH); 2 April 1975, leg. J. HERRERA, 1 male (AMNH); Tarapacá Reg., Arica Prov., 11 km. E. Azapa, 20 January 1992, 1 female (AMNH); Tarapacá Reg., Parinacota Prov., Zapahuira, Parinacota, 3400 m., 3 February 1992, 1 male (AMNH). – Peru: Pérou, 1 male (NHML); Pérou, Dépt. Amazonas



26 27 28 29 30

Figs 26-30. Female genitalia of *Nabokovia faga* (Jujuy, Argentine): 28 = Papillae anales, lateral view. – 29 = Genitalia from corpus bursae to terminal sclerotized element, ventral view. – 30 = Terminal sclerotized element, enlarged, ventral view

(Chachapoyas), M. de Mathan, 1889, 5 males (NHML); Iures, Peru, 2.500 m, 2.00, dry country, (SIMONS), 1 male (NHML); Oroyo, 22 July 1914, leg. H. S. PARRISH, 1 female (AMNH); Huancayo, 26 July 1914, leg. H. S. PARRISH, 1 male (AMNH); Peru [1053], leg. E. I. HUNTINGTON, 1 female (AMNH); Cuzco, 3500 m., leg. FASSL, 1 male (AMNH); Cuzco, 3500 m., leg. FASSL, 2 males, 3 female (MNHN); Dept. Cusco, Tambo Machay, 4 July 1984, leg. S. P. COURTNEY and P. STERN, 2 males (UCD); Dept. Arequipa, Reserva Aguadas Blanca, 4000 m., 12-13 July, 1984, leg. S. P. COURTNEY and P. STERN, 1 male (UCD); Dept. Cuzco, Ccapana, 11,000 ft., 6-12 April 1947, leg. PALLISTER, four males (AMNH); male, 2 females: Tarma, Peru (HOFFMANN) (NHML); Peru, Cuzco, 4000 m, 1 male 2 females (NHML).

Genitalia preparation are NHML slides Brit. Mus. No. 19105, 19106, 19107 (all males), and glycerin vials on remaining specimens all deposited as the respective adults.

Nabokovia ada sp. n.
(Figs 10-12, 23, 25, 27)

Diagnosis: DFW similar to *N. faga*. DHW with lunule at cell *CuA2* enlarged and ground fuscous; VFW similar to *N. faga* but VHW with medial area coalesced into brown band paralleled by postbasal brown patch. Male genitalia differing from *N. faga* by extended and dorsally incised mentum, minimal width along Bayard's angulation and elongate, terminally angulate, rostellum.

Additional descriptive notes: Forewing length 0,9 mm. DFW, DHW ground color fuscous, lunules at DHW margin black; VFW ground dull tawny basad of black postmedial band, VHW ground cream with bands dull brown lined with crisper white, limbal area around lunule grizzled tawny brown. Male genitalia, in addition to characters of valvae noted above, show an elongate distal point of suprazonal sheath compared to *N. faga*.

Distribution (Fig. 35): Currently known only from the Coquimbo Region, Chile.

Holotype: male, Coquimbo Reg., Totoralillo, 4 November 1952, leg. R. WAGENKNECHT, deposited FMNH by L. PEÑA.

Remarks. With its succinctly banded and patched VHW pattern (Fig. 11), this species stands out immediately from *N. faga*. When L. PEÑA donated the eventual holotype, the single known specimen of the taxon, to the FMNH he added a label reading "unic. specim." Series of Chilean polyommatines given by PEÑA to the FMNH contain numerous specimens marked either as "unic." or in groups as "sp.?" indicating PEÑA recognized numerous of these as possibly undescribed species (many, in fact, are undescribed species of *Pseudolucia* NABOKOV, 1945). DAVID MATUSIK (FMNH) brought these labels to our attention and culled such material from the FMNH for our study. The holotype of *N. ada*, along with some other specimens, suffers from a kind of "dry rot" typical of Argentine/Chilean specimens apparently left to alternating dry and humid conditions before eventual mounting. These specimens are very fragile and the damage to the VHW apparent in *N. ada* holotype photograph occurred after its being shipped about in this study. There is one extant photograph of both VHW's before this damage showing the bilateral symmetry of the distinctive VHW markings.

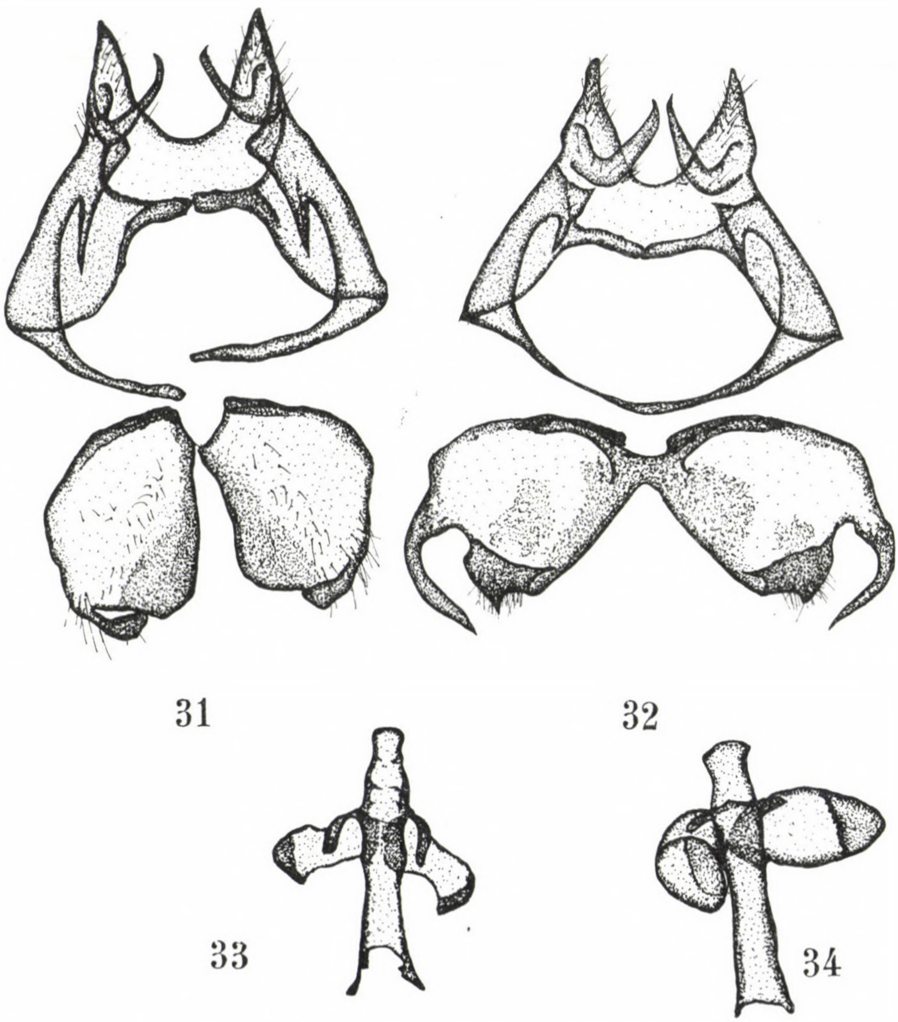
The type locality is a well known area of endemism amongst Chilean Lepidoptera. *N. ada* seems to be the southern sister species of *N. faga*. Similar distribution disjunctions have been shown in *Tatochila* and *Hypsochila* (*Pieridae*) (SHAPIRO, 1991) and *Pontirama* and *Heoda* (*Theclinae*) (JOHNSON, 1992*a*; JOHNSON, MILLER and HERRERA, 1992).

Etymology: Gender feminine. The name *ada* being one of NABOKOV's most well-known female characters (from his novel of the same name).

Polytheclus gen. n.

(Figs 17-20, 31-34, 36)

Short taxonomic history: DRAUDT [1921] described *Scolitantides sylphis* and placed it amongst "*Scolitantides*". Most probably he followed BUTLER (1881), who arranged two Neotropical polyommatine species with orange suffu-



31 32 33 34

Figs 31-34. Male genitalia of *Polytheclus* taxa: 31 = *P. sylphis*, male, Tarma, Peru, aedoeagus removed. – 32 = *P. cincinnatus*, holotype, aedoeagus removed. – 33 = *P. sylphis*, aedoeagus, lateral view. – 34 = *P. cincinnatus*, aedoeagus, lateral view sion on their DFW into *Scolitantides*. This character was presumed as the common feature of all the *Scolitantides* sensu DRAUDT taxa. Because he lacked specimens, NABOKOV (1945) was unable to revise the status of "*S. sylphis*"; however, he noted that it should be examined as a possible member of *Pseudothecla*.

BRIDGES (1988) listed *faga* as the single *Nabokovia* species and placed the taxon *sylphis* immediately after *Nabokovia* with a question mark.

LAMAS & PÉREZ (1983) listed *sylphis* along with *Nabokovia faga excisicosta* (most probably following NABOKOV's note).

Type species: *Polytheclus cincinnatus* sp. n.

Synopsis of species: 1. *Polytheclus cincinnatus* sp. n., 2. *Polytheclus sylphis*

Polytheclus sylphis (DRAUDT, [1921]) **comb. n.**

Diagnosis of the genus: Eyes smooth, palpi hairy, body normal polyommatine.

Wing: FW with veins 11 and 12 free. Wing – FW with slight convex costal margin, apex slightly pointed, outer margin convex, inner margin straight, tornus angular. HW anal margin very straight, anal angle pointed, apex rounded, vein *1A+2A* tailed.

Pattern: Normal blue polyommatine on DW and VFW, but modified on VHW. DFW blue with discoidal line, black and white submarginal markings. DHW similar, no discoidal line, but tailed. Fringes white (type 5). VFW with strong postmedian spots and submarginal markings. VHW with suffused basal and discoidal spots; postdiscal spots brown creating a stippled stripe.

Male genitalia: With pointed but strong uncus, strongly curved gnathos, rostellum and tegumen well developed, valva wide and robust with large rostellum. Aedeagus with large sagum. Juxta commonplace.

Female unknown.

Distribution (Fig. 36): Known only from Peru.

Etymology: Gender masculine. The name indicates the strange appearance of the genus: very close to polyommatine lycaenids in the structure of the genitalia (*Polyommatus - Poly*), but also superficially resembling the hairstreak lycaenids (*Thecla - Theclus*).

Polytheclus cincinnatus sp. n.
(Figs 19-20, 32, 34)

Diagnosis: Comparable only to *P. sylphis* from E. Peru, but without orange postmedian suffusion on DW. DFW postmedian black spots absent. Markings more developed on RW. Male genitalia differing from *P. sylphis* by large rostellum of valva.

Additional descriptive notes: Superficially resembling a hairstreak. Forewing length: 12.0 mm. (holotype), 11.0 mm. (Paratype). Body typical of *Polyommatus* (ELIOT 1973, HIGGINS 1976). Eyes black, depilous. FW shining violescent blue with well marked black discoidal line and white and black straight submarginal line in each cell. Margin bordered by a distinct light blue and a stronger black line. DHW similar but without discoidal line, submarginal lunules cap formed. HW with short tail. DFW with light brown discoidal and postmedian spots, submarginal spots larger and black. DHW ash gray with indistinct markings. Postmedian spots produced and closely adjacent. Small distinct black spot with iridescent scales in cell *CuA2*.

Male genitalia: With robust but pointed uncus and strongly curved gnathos; tegumen usual polyommatine with appendix angularis; valva wide and robust with convex costa and strongly developed rostellum; anal part with a sclerotized formation; aedeagus with well visible alulae and strongly developed gnathos. Juxta commonplace.

Female unknown.

Distribution (Fig. 36): Peru, west of the Andes.

Holotype, male, labelled "Chosica, W. Peru, 2000' (A. M. Moss).", "Pupa, No.", "Rothschild Bequest, B. M. 1939–I.", "Holotype, *Polytheclus cincinnatus*, det. ZS. BÁLINT, Budapest, 1992. I.", "slide BM – 17543"; Paratype, male, same data as holotype (exception: Slide BM – 17544). The type specimens are deposited in the butterfly collection of NHML (drawer 29A–927).

Slides: Brit. Mus. No. 17543, 17544 (NHML).

Biology: According to LAMAS & PÉREZ (1983) the species inhabits the same biotope as *N. faga*, but also occur at a higher elevation. The behaviour of adults is similar to that of *N. faga*.

The larval hostplant and nectar sources of imagines are unknown.

Etymology: Gender masculine. The name *Cincinnatus* being the character- "invitee" in NABOKOV's Invitation to a Beheading; also referring, by denotation, to the "curled" (MARCHANT & CHARLES, 1956) appearance of the emphatic and closely adjacent spots of the hindwing underside.

Remarks. This new species is easily distinguished from its sister, *P. sylphis*, by the following superficial characters. Dorsal: The postmedian area of *sylphis* is orange on both of the wings. The hindwing has a row of postmedian spots. The submarginal black-capped spots are stronger, the white elements weaker. Ventral: The FW discoidal spot of *sylphis* is suffused while on *cincinnatus* it is emphatic. The postmedian spots of *sylphis* are small, black-coloured and wavy but in *cincinnatus* large, brown, and in different arrangement across the wing. The markings of the hindwing are strongly suffused on *sylphis*, while on *cincinnatus* these are more produced and closely adjacent. The line of postmedian spots are broken in *sylphis* but in *cincinnatus* nearly continuous. The black spot in cell *CuA2* is missing in *sylphis*. The FW outer margin on *sylphis* is straight with a break at *CuA2*, while that of *cincinnatus* is more or less convex. The HW inner margin of *sylphis* is undualte while that of *cincinnatus* is straight.

We could locate only a single collection date for this newly described entity, the one mentioned by LAMAS & PÉREZ (1983). These authors identified *P. cincinnatus* as *Nabokovia sylphis* giving a good figure of a male specimen collected in Parque Nacional Huascarán (Ancash).

Polytheclus sylphis (DRAUDT, [1921]) **comb. n.**
(Figs 17-18, 31, 33)

Diagnosis: Comparable only to *P. cincinnatus* from W. Peru, but DW with orange postmedian suffusion. DFW with postmedian black spots. Markings pale on VW. Male genitalia differing from *P. sylphis* by smaller rostellum of valva and less pointed uncus.

Additional descriptive notes: DFW lighter shining violescent blue with well marked black discoidal line and white and black straight submarginal line in each cell. Postmedian spots well marked. Margin bordered by a distinct light blue and a stronger black line. Both wings with postmedian orange suffusion. DHW similar but without discoidal line, submarginal lunules capped. HW with short tail. DFW with light brown discoidal and postamedian spots, submarginal spots larger and black. DHW ash grey with indistinct markings. Postmedian spots suffusive and quite disjunct. Small distinct black spot with iridescent scales in cell *CuA2*.

Male genitalia: Similar to that of *cincinnatus* with robust but less pointed uncus and strongly curved but more slender gnathos; tegumen usual polyommatine with appendix angularis; valva wide and more robust with waved and strongly convex costa and less developed rostellum; aedeagus with well visible alulae and strongly developed sagum. Juxta commonplace.

Female unknown.

Distribution (Fig. 36): Currently known only from E. Peru: Cuzco (type locality), Tarma.

The holotype is preserved in the Senckenberg Museum in Frankfurt am Main (Germany) (DR. LAMAS, pers. comm.), not examined.

Biology: Unknown.

Material examined: 1 male labelled "Tarma, Peru (Hoffman)", and "Rothschild Bequest, B. M. 1939–I." (NHML). – Slide: Brit. Mus. No. 17542 (NHML).

Etymology: Assumed by us as from "Sylph" - an imaginary being inhabiting the air (MARCHANT & CHARLES 1956).

Remark. This taxon is extremely rare, only two existing specimens being known (holotype and the male of NHML). Even in the large collection of Museo de Historia Natural (Lima) there is no *sylphis* material (LAMAS, pers. comm.).

DISCUSSION

Phylogenetic considerations

In spite of the fact that the general genitalic structure of *N. faga* and *N. ada* are polyommatine-like, they are rather strange and do not fit well in the omnibus *Polyommatus*-section sensu ELIOT (1973). NABOKOV (1945: 45) has already recognized that *faga* is rather curious amongst the "Plebejinae" species.

1. The juxta has a different, undulate, shape and is connected to the anal part of the valvae [as in the mainly African tribe *Lycaenesthini* TOXOPEUS, 1929 (Polyommatinae SWAINSON, 1827) (cf. STEMPFFER, 1967: Figs 164–170) and the *Cupidopsis*-section (also African) sensu ELIOT (1973) (cf. STEMPFFER, 1967: Figs 202–207)] and not at the connection of the tegumen and valvae as can be seen generally in Holarctic and even high Andean "true" Polyommatinae.

2. The shape of the uncus and the gnathos resembles that of the *Castalius*-section sensu ELIOT (cf. STEMPFFER, 1967: Fig. 188), as well as the pantropical genus *Chilades* MOORE, 1881 (cf. STEMPFFER, 1967: 212–215).

3. The shape of the valve is also reminiscent of *Castalius* (cf. STEMPFFER, 1967: Figs. 179a and 180).

As also noted above, the female genitalia also depart from the normal polyommatine configurations illustrated briefly by NABOKOV. Respective, terminally sclerotized "fibula" and "henia" structures are not apparent and the terminal element rather more contiguously tubelike as in many Theclinae.

Polytheclus taxa also show a distinctive genitalic habitus:

1. The shape of the uncus and the gnathos is *Lycaeides*-like but also resembles that of *Zizula*-section.

2. The shape of the valvae looks very primitive and not easily comparable to other polyommatine lycaenids.

3. The aedeagus has a strong sagum (like some other Neotropical polyommatine genera [*Hemiargus* lineage and *Pseudolucia*]) which appears to buttress the aedeagus by providing a strongly sclerotized membranous connection between the alulae and the tegumen. Similar elements can be observed in species of the *Tarucus*-section.

Although current diagnoses of the *Polyommatus*-section are rather sketchy, they mainly fit mostly Holarctic polyommatines. In contrast, all the characters listed above recall more primitive sections of the tribe Polyommatini (see ELIOT, 1973) or even the closely related tribe Lycaenesthini. Tentatively, this suggests that *Nabokovia* and *Polytheclus* may well be excluded from the *Polyommatus*-section. If so, to follow the higher classification proposed by ELIOT (1973) the genera *Nabokovia* and *Polytheclus* would need a distinct section in the tribe Polyommatinae. This would not be unique among the subfamily, however, since there are several monotypic polyommatine sections in ELIOT's higher lycaenid classification and all of them are tropical (mainly African with a few Holotropical or Oriental exceptions).

Relationship of Nabokovia *and* Polytheclus

A sister group relationship between *Polytheclus* and *Nabokovia* is readily suggested by superficial characters (tailed hindwing and the peculiar pattern elements). The loss of iridescent blue scales in more recent groups is a well known phenomenon among the polyommatine lycaenids (e.g. *admetus*-group in *Polyommatus*; *vogelii* in *Plebeius*; *aquilo*-group in *Agriades*, etc.) suggesting that *Nabokovia* is a relatively recent segregate. However, the genitalic structures are more problematic in interpretation.

1. The alulae of the aedeagus is present and well developed in both genera but *Polytheclus* has a very strong sagum which is absent in *Nabokovia*.

2. The aedeagus terminus is pointed in *Nabokovia* while in *Polytheclus* it is obtuse.

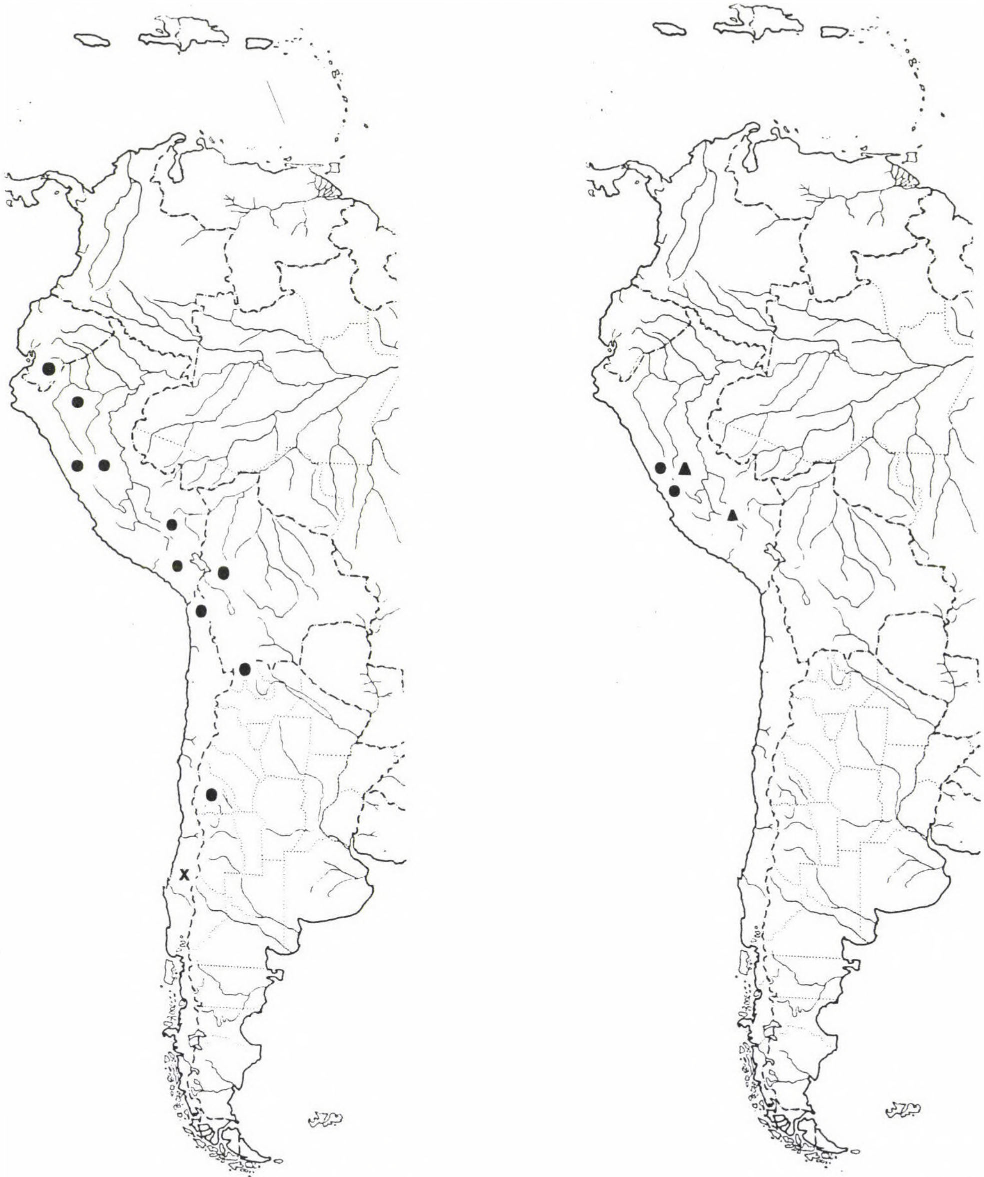
3. The uncus and gnathos are much slender in *Nabokovia* than in *Polytheclus*.

4. The shapes of the valvae are also very different, with the rostellum suggesting a distinct form and origin.

These conditions suggest it is still uncertain whether *Nabokovia* and *Polytheclus* are actual phylogenetic sister groups or whether they have evolved with a convergent wing pattern from different polyommatine ancestors. These questions can probably be resolved when enough taxa of the Neotropical Realm have been enumerated to allow reliable numerical cladistic studies.

Biogeographic considerations

DESCIMON (1986) (rather courageously from a synthetic reading of the literature) suggested that the Holarctic stock is the overwhelming faunistic element in the high Andes. SHAPIRO (1991) came to the same conclusion investigating Argentine pierids but reemphasized the question of connections with the tropical biota by calling attention to the results of the second author concerning the high Andean elfins (Eumaeine, Theclinae) (JOHNSON, 1990, 1992*a*). JOHNSON (1990,



35 36

Figs 35-36. 35 = Distribution of *Nabokovia* taxa: *N. faga*, filled circle; *N. ada*, cross. – 36 = Distribution of *Polytheclus* taxa: *P. sylphis*, triangle; *P. cincinnatus*, filled circle

1992*a*) monographed eleven genera of Andean Theclinae belonging to the tribe Eumaeini (sensu ELIOT, 1973) which superficially resemble some montane Holarctic taxa. His study also included twelve Neotropical and Nearctic outgroup genera and was further buttressed by a monograph of the Palaearctic elfin-like Theclinae (JOHNSON, 1992*b*). The Neotropical infratribe shared no significant structural characters with the Holarctic infratribe and showed outlying disjuncts only as far north as montane Costa Rica. The Holarctic infratribe showed populations extending southward only to Guatemala. The eleven upland Neotropical genera shared all their major structural characters with lowland

JOHNSON emphasized, however, that there are other Neotropical Eumaeini with superficially similar Holarctic counterparts still needing to be studied. For instance, JOHNSON, MILLER and HERRERA (1992) described two high Andean sister segregates of the larger, worldwide, *Strymon* HÜBNER grade of Theclinae. Members of this large grade, though often differing greatly in wing habitus, show a common structural ground plan so simplified that apomorphic characters are often hard to distinguish. Thus, if one considered this entire grade as congeneric, one could draw a conclusion that the Neotropical elements are part of the larger worldwide (including Holarctic) clade. However, the authors showed that the most recognizable relative of the high Andean segregates was the *S. bubastus-columella-eurytulus* complex. This complex is entirely Neotropical, including the Antilles.

All the genitalic characters discussed above recall primitive sections of the tribe Polyommatini (see ELIOT, 1973) or even another closely related tribe (the Lycaenesthini). These entities are mainly African, suggesting a tropical link. Thus, it is reasonable to summarize here, from the available distributional data and the discussed characters, that *Nabokovia* and *Polytheclus* are most probably a tropical or subtropical phenomenon invading oreal territories in South America. The adaptation to oreal xeromontane conditions (see VARGA, 1975) is a hard evolutionary step from tropical habitats (DESCIMON, 1986: 521) but in some cases it could be successful. This is represented well by the *Pseudochrysops-Cyclargus-Hemiargus-Echinargus* lineage which is widely distributed both in the neotropical lowlands and high mountain regions (NABOKOV, 1945; JOHNSON and MATUSIK, 1992; BÁLINT, in print).

We cannot yet hope to convincingly explain the evolution of the above discussed two thecline-like polyommatine lycaenid genera. The available material is very small and the oreal biome in the Neotropical Realm only very roughly explored. However, we hope our subsequent revisions treating Neotropical polyommatine lycaenids will offer an expanded data base to further explore the recent suggestions of a purely tropical origin for some oreal lineages.

Renewed effort to enumerate many poorly known (and often widely undescribed) high Andean and Austral butterfly faunas opens a new opportunity for exploring the incredibly interesting biohistory of oreal Neotropical America.

* * *

Acknowledgements – For access to material examined we thank the following curators and workers – AME: L. D. MILLER and J. Y. MILLER; AMNH: F. H. RINDGE; CMNH: J. E. RAWLINS; FMNH, D. MATUSIK, A. NEWTON; IML: Z. A. DETOLEDO, R. EISELE; MNHNC: J. HERRERA G., L. PEÑA; NHML: D. VANE-WRIGHT, P. ACKERY, C. SMITH; UCD: A. M. SHAPIRO; UMCE: late J. HERRERA G., R. CORTES; ZMH: H. J. HANNEMANN, E. MEY; USNH: R. K. ROBBINS. Private collectors H. DESCIMON, R. C. EISELE, B. EISELE, D. MATUSIK, P. MAZRY, L. PEÑA and A. M. SHAPIRO added invaluable material. Dr. G. LAMAS (Lima, Peru) offered editorial advice along with information concerning location of Neotropical polyommatine types. Dr. A. VOJNITS (Budapest), along with his general encouragement, aided in documentation and photography of slides and specimens. Dr Z. VARGA (Debrecen, Hungary), similarly enthusiastic, offered important editorial suggestions. Support from Brothers of TAIZÉ Community (France) enabled much of the research of the first author in France and England. G. WARREN WHITAKER (Pelham Manor, New York, USA), practicing attorney and avid student of V. NABOKOV, kindly agreed to provide etymological backgrounds from NABOKOV's literary works for the duration of our studies. L. PEÑA has unflagingly pursued additional specimens for us in all the groups of Polyommatinae in Chile. Many of the new taxa we will describe owe wholely to his work.

LITERATURE

BÁLINT, ZS. (1992) New taxa of the Polyommatus section (sensu ELIOT, 1973) from Central Asia. Studies on Central Palearctic Lycaenids II. (Lepidoptera, Lycaenidae). *Linneana Belgica* **13**(8): 423-445.

BRIDGES, C. (1988) *Catalogue of Lycaenidae & Riodinidae (Lepidoptera: Rhopalocera).* Published by the author, Urbana, Illinois. 811 pp.

BUTLER, A. G. (1881) List of butterflies collected in Chili by Thomas Edmonds, Esq. *Trans. ent. Soc. Lond.* **29** (4): 449-486.

DESCIMON, H. (1986) Origins of Lepidopteran faunas in the high tropical Andes, pp. 500–532. *In* VUILLEUMIER, F. and M. MONASTERIO (eds) *High Altitude Tropical Biogeography*. Oxford University Press, New York.

DRAUDT, M. (1921) Die amerikanischer Tagfalter. Lycaenidae and Grypocera. *In* SEITZ, A. (ed.) *Großschmetterlinge der Erde 5*. pp. 744-999.

DYAR, H. G. (1913) Results of the Yale Peruvian expedition of 1911. Lepidoptera. *Proc. U. S. natn Mus* **45** (2006): 627-649.

ELIOT, J. N. (1973. The higher classification of the Lycaenidae (Lepidoptera): a tentative arrangement. *Bull. Br. Mus. nat. Hist.* (*Ent.*). **28** (6), 505 pp., pl. 6., 162 figs.

FIEDLER, K. (1991) Systematic, evolutionary, and ecological implications of myrmecophily within the Lycaenidae (Insecta: Lepidoptera: Papilionoidea). *Bonner zoologische Monographien* **31**, 210 pp., tabls 19.

HEMMING, A. F. (1960) *Annotations lepidopterologicae. Stabilitas, nominum securitas scientiae.* Parts 1, 2. London, Hepburn & Sons Ltd., 37-72 pp.

HEMMING, A. F. (1967) The generic names of the butterflies and their type-species. *Bull. Br. Mus. nat. Hist. (Ent.)* **Suppl. 9**, 509 pp.

HIGGINS, L. G. (1976) *The Classification of European Butterflies.* Collins, London, 320 pp., 402 figs.

JOHNSON, K. (1990) *Penaincisalia*, a new genus of "elfin"-like butterflies from the high Andes (Lepidoptera: Lycaenidae). *Pan-Pacific Entomol.* **66** (2): 97-125.

JOHNSON, K. (1992*a*) Genera and species of the Neotropical "elfin"-like hairstreak butterflies (Lepidoptera, Lycaenidae, Theclinae). *Reports, Mus. Nat. Hist. Univ. Wisconsin* (Stevens Point) **22**: vol. 1, 1-135; vol. 2, 136-279.

JOHNSON, K. (1992*b*) The Palaearctic elfin butterflies. *Neue Entomol. Nachr.* **29:** 1-144.

JOHNSON, K. and D. MATUSIK, (1988) Five new species and one new subspecies of butterflies from the Sierra de Baoruco of Hispaniola. *Ann. Carnegie Museum* **57** (10): 221-254.

JOHNSON, K. and D. MATUSIK (1992) Additions to the Hispaniola fauna, pp. 3-5. *In* JOHNSON, K. (ed.) *Taxonomic additions to recent studies of Neotropical butterflies. Reports, Mus. Nat. Hist. Univ. Wisconsin* (Stevens Point) **23**: 1-20.

JOHNSON, K., MILLER, L. D. and J. HERRERA (1992) Eiseliana and Heoda, high Andean and austral genera of the Neotropical Eumaeini (Lepidoptera, Lycaenidae). *Acta Entomol. Chilena* **17**: 107-146.

KLOTS, A. (1970) Lepidoptera genitalia. *In* Tuxen, ??. *Taxonomists Glossary of Genitalia of Insects.* Munksgaard, Copenhagen, 359 pp.

LAMAS, G. M. and J. E. PÉREZ (1983) Las Mariposas del Parque Nacional Huascarán (Ancash, Perú) y su Medio Ambiente: Sector Llanganuco. *Bol. de Lima* **5**(30): 27-37.

MARCHANT, J. R. V. and J. F. CHARLES (1956) *Cassell's Latin Dictionary.* Funk & Wagnalls Company, New York, 927 pp.

NABOKOV, V. (1944) Notes on the morphology of the genus *Lycaeides* (Lycaenidae, Lepidoptera). *Psyche* **51**: 104–139.

NABOKOV, V. (1945) Notes on neotropical Plebejinae (Lycaenidae, Lepidoptera). - *Psyche* **52** (1-2): 1-61, pls 9.

SCOTT, J. A. (1990) Adult structure and function, pp. 108–151 *In* Kudrna, O. (ed.) Butterflies of Europe, Volume 2, *Introduction to Lepidopterology.* Aula-Verlag, Wiesabaden.

SHAPIRO, A. M. (1991) The Zoogeography and Systematics of the Argentine Andean and Patagonian Pierid Fauna. *J. Res. Lepid.* **28**(3): 137–238, IV pls., 24 figs.

STEMPFFER, H. (1967) The genera of the African Lycaenidae (Lepidoptera: Rhopalocera). *Bull. Br. Mus. nat. Hist. (Ent.)* **Suppl. 10**: 3-322, 1 pl., 348 figs.

VARGA, Z. (1975) Zoogographische Gliederung der palaearktischen Orealfauna, pp. 263–268. *In Verhandl. 6. Int. Symp. Entomofauna.* Mitteleur., Lunz am See. Junk Publishers, The Hague.

Received November 23, 1993; accepted December 1, 1993

The Fauna of the Bükk National Park

VOLUME I

Edited by
S. MAHUNKA and L. ZOMBORI

The seventh part of the series "Natural History of the National Parks of Hungary" comprises a collection of papers written by thirty-seven Hungarian and foreign experts. This is the first volume which discusses a large share of the scientifically elaborated material deriving from the territory of the Bükk National Park (North Hungary).

The book opens with a preface written by Dr. J. Tardy, deputy secretary of state, who gives his "Reflections on nature conservation in Hungary, 1993", followed by an editorial Introduction having a detailed list of all the larger administrative and also minor locality names, some of which are amply shown in a map. The volume proper is divided into two sections: Mollusca and Arthropoda. The latter, by far the biggest section, is a collection of scientifically highly valuable contributions on the following groups of animals: Mallophaga (4 pp), Heteroptera (4 pp), Homoptera (8 pp), Coleoptera (80 pp), Lepidoptera (162 pp), Diptera (82 pp), Siphonaptera (6 pp), Hymenoptera (42 pp), Acari (5 pp). The book closes with an Index to Authors.

The volume published by the Hungarian Natural History Museum in 1993.

ISBN 963 7093 206. Soft bound, 456 pages with several figures and tables. Price: 50 US dollars excl. p. & p.

Order should be sent

to the Hungarian Natural History Museum, Library
H-1088 Budapest, Baross u. 13, Hungary
Fax: (36)-(1)-113-8820

Acta Zoologica Academiae Scientiarum Hungaricae 40 (2), pp. 125-131, 1994

DISTRIBUTION AND HOST PLANTS OF ROOT-KNOT NEMATODES (MELOIDOGYNE) IN HUNGARY*

DABAJ, K. H., JENSER, G. and K. FARKAS

Institute of Plant Protection, Hungarian Academy of Sciences, H-1525 Budapest Pf. 102

Root-knot nematodes, *Meloidogyne* species are widely distributed in all the surveyed cultivated areas, especially in the sandy soil regions in Hungary. *Meloidogyne hapla* was the most dominant species in all the tested fields on several cultivated plants and weeds. While *M. incognita* was the most dominant in greenhouses and plastic tunnels and caused severe damages to vegetable-crops, e.g. cucumber, tomato, capsicum and ornamental plants such as carnation. *M. arenaria* and *M. thamesi* were seldom found on some plants. *M. javanica* was not detected in any of the surveyed fields.

Key words: Nematoda, *Meliodogyne*, host plants, distribution, Hungary

INTRODUCTION

Meloidogyne hapla CHITWOOD, 1949, *M. incognita* (KOFOID & WHITE, 1919) CHITWOOD 1949, *M. arenaria* (NEAL, 1889) CHIWOOD 1949 and *M. thamesi* CHITWOOD, 1952 are listed in the Hungarian fauna (ANDRÁSSY, 1972; JÁVOR, 1974; BUDAI, 1980; ANDRÁSSY & FARKAS, 1988). The damage of *M. hapla* in the surroundings of Szeged was published by BUDAI (1978, 1979*a*). *M. incognita* is the most common species in greenhouses and plastic tunnels (DABAJ & JENSER, 1987). *M. thamesi* was first recorded by BUDAI (1980) in combinations with *M. arenaria* on tomato plants in sandy soils in the Danube–Tisza Mid-Region in plastic tunnels. *M. javanica* listed by ANDRÁSSY (1972).

There are few information about the economic importance of the root-knot nematodes in Hungary on cultivated crops (BENEDEK, 1971; FARKAS & DELLEI, 1973; BUDAI, 1979*a*, 1979*b*; FARKAS & MÉSZNER, 1984). At the same time there are insufficient data on the distribution and host range of *Meloidogyne* species.

MATERIAL AND METHODS

About 500 root and soil samples of vegetables, fruit trees, ornamentals and weed plants were collected from different places of cultivated areas, e.g. on

* This study was supported by the Hungarian National Scientific Research Fund (OTKA, No. 1436).

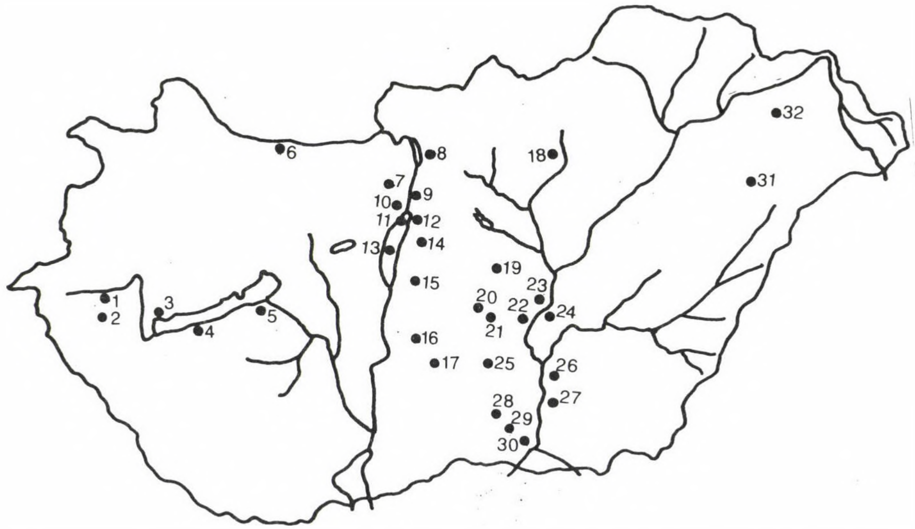


Fig. 1. Distribution of root-knot nematodes in Hungary. 1 – Zalaegerszeg, 2 – Bak, 3 – Keszthely, 4 – Boglárlelle, 5 – Enying, 6 – Komárom, 7 – Nagykovácsi, 8 – Vácrátót, 9 – Budapest, 10 – Csillagtelep, 11 – Csepel, 12 – Soroksár, 13 – Szigetcsép, 14 – Gyál, 15 – Apajpuszta, 16 – Csengőd, 17 – Kiskőrös, 18 – Kompolt, 19 – Cegléd, 20 – Miklóstelep, 21 – Kecskemét, 22 – Lakitelek, 23 – Tiszakécske, 24 – Cserkeszőlő, 25 – Kiskunfélegyháza, 26 – Szentes, 27 – Hódmezővásárhely, 28 – Forráskút, 29 – Zsambó, 30 – Szeged, 31 – Debrecen, 32 – Nyíregyháza

fields, in greenhouses and under plastic tunnels, during the period from July till October in three successive years (1986-1988).

The degree of infestation on the surveyed plants was determined by reason of the root-knot galls index (GI) and egg-masses index (EI) which was estimated according to TAYLOR & SASSER (1978), 0-5 scale (No galls, no egg-masses = 0; 1-2 galls and/or egg-masses = 1; 3-10 = 2; 31-100 = 4 and more than 100 galls and/or egg-masses = 5).

Ten to fifteen mature females were dissected out from the root tissues of the infected host plants. Perineal patterns were prepared in 45% lactic acid, according to TAYLOR & NETSCHER technique (1974).

Males and second stage juvenils (J_2) were temporarily prepared from most of the specimens for identifying the nematode species using the keys of EISENBACK *et al.* (1981) & JEPSON (1987).

Table 1. *Meloidogyne* species, locations, host plants and galls/egg-masses index in Hungary

Meloidogyne sp.	Locations	Host plants	Galls/egg-masses index
M. arenaria	Budapest	tomato	5/5
	Boglárlelle	capsicum	5/5
	Kecskemét	tomato	5/5
	Nyíregyháza	tomato	5/5
	Szeged	capsicum	5/5
M. hapla	Apajpuszta	alfalfa	5/5
	Budapest	bean	5/5
		Paeonia sp.	5/5
		radish	3/2
		Salvia sp	5/4
		sugar beet	5/5
		tomato	5/5
	Boglárlelle	carrot	5/4
		parsley	5/5
		Prunus cerasifera L.	3/2
	Cegléd	bean	5/5
		capsicum	5/5
		carrot	5/5
		Chrysanthemum sp.	5/5
		Convolvulus sp.	5/5
		parsley	5/5
		tomato	5/5
	Csillagtelep	carrot	5/4
	Debrecen	bean	5/5
		Calendula sp.	5/5
		capsicum	5/5
		carrot	5/5
		Chrysanthemum sp.	5/5
		horse radish	5/5
		parsley	5/5
		tomato	5/5
	Enying	lettuce	3/3
	Gyál	carrot	5/5

Table 1 (continued)

Meloidogyne sp.	Locations	Host plants	Galls/egg-masses index
	Kecskemét	*Anthirrhinum* sp.	5/5
M. hapla		cabbage	5/5
		capsicum	5/3
		carrot	5/5
		Chrysanthemum sp.	5/5
		grapevine	2/2
		Tagetes	3/2
	Keszthely	tomato	5/5
	Kiskőrös	grapevine	4/4
	Kompolt	alfalfa	5/5
	Lakitelek	alfalfa	5/5
		carrot	4/3
		Chenopodium album L.	5/5
		garlic	3/2
		grapevine	2/2
		parsley	5/5
		Solanum nigrum L.	5/5
		tomato	5/5
	Miklóstelep	alfalfa	5/5
		Asclepias syriaca L.	2/1
		Ballota nigra L.	2/1
		Chenopodium album L.	5/5
		Convolvulus arvensis L.	5/5
		Fagopyrum esculentum Moch	1/0
		Galinsoga parviflora Cav.	5/5
		grapevine	5/5
		Melandrium album (Mill.) Garcke	2/1
		Portulaca oleracea L.	5/5
		Solanum nigrum L.	5/5
		Taraxacum officinale Weber	2/1
	Nyíregyháza	carrot	3/2
	Soroksár	carrot	5/3
		capsicum	5/5
		Ficus carica	5/5

Table 1 (continued)

Meloidogyne sp.	Locations	Host plants	Galls/egg-masses index
M. hapla	Soroksár	garlic	3/1
		parsley	5/5
		watermelon	5/3
	Szeged	carrot	5/5
	Tiszakécske	capsicum	5/5
		tomato	5/5
	Vácrátót	alfalfa	5/5
		chard	5/4
		lettuce	5/5
		Mentha sp.	5/5
	Zalaegerszeg	carrot	5/5
		capsicum	5/5
		Galinsoga parviflora Cav.	5/5
		tomato	5/5
	Zsombó	capsicum	5/5
M. incognita	Csillagtelep	*Ficus decorata* L.	5/5
	Forráskút	capsicum	5/5
		carnation	5/5
	Kecskemét	cucumber	5/5
	Keszthely	capsicum	5/5
	Nagykovácsi	potato	5/5
	Soroksár	*Acacia* sp.	3/2
		carnation	5/5
		Ficus carica L.	5/5
		Ficus decorata L.	5/5
	Szeged	tomato	5/5
	Szentes	tomato	5/5
	Zsombó	carnation	5/5
M. thamesi	Boglárlelle	capsicum	5/5
	Szeged	carnation	5/5

RESULTS AND DISCUSSION

The detailed data of the investigations are summarized in the Table 1.

Meloidogyne hapla has been found frequently in all the surveyed areas. It occurred in high population densities on sandy soil, e.g. in the Danube–Tisza Mid-Region and in the Nyírség. It has been detected frequently on alfalfa, bean, carrot, grapevine, horse radish, capsicum, parsley, tomato as well as on cabbage, garlic and watermelone. It proved to be dangerous to the different varieties of *Vitis vinifera* and *Vitis vinifera* × *Seyve-Villard* cultivated on ownroot in sandy soil. DABAJ *et al.* (1989) found a very high population density of *M. hapla* in grapevine field, 1005 J_2/100 g soil. According to our observations the susceptibility of the *Vitis vinifera* and *Vitis vinifera* × *Seyve-Villard* varieties and hybrids is high variable (DABAJ *et al.*, 1991). This is the explanation of the great differences between the values of galls and egg masses indexes refering to the grapevine in Table 1. The damage should be considered in the growing of alfalfa and carrot.

There are some weed plants frequently infected by *M. hapla* like *Portulaca oleracea, Convolvulus arvensis, Solanum nigrum, Galinsoga parviflora*.

M. arenaria and *M. thamesi* were found on sugar beet, capsicum and tomato in low frequency.

M. incognita occurred only in the greenhouses, in plastic tunnels and in their close surroundings.

M. javanica was not detected in any of the surveyed areas.

REFERENCES

ANDRÁSSY, I. (1972) A Magyarországról eddig kimutatott szabadon élő fonálférgek (Nematoda) jegyzéke. *Állatt. Közlem.* **59**: 161-171.

ANDRÁSSY, I. & FARKAS, K. (1988) *Kertészeti növények fonálféreg kártevői.* Agronematologiai Kézikönyv. Budapest, 419 pp.

BENEDEK, I. M. (1971) Kölcsönhatás a növényi parazita fonálférgek és a kórokozók között. *Növényvédelem* **7**: 450-454.

BUDAI, CS. (1978) A gyökégubacsképző fonálférgek (Meloidogyne Goeldi) elterjedése a Szegedi Fűszerpaprika Termesztő Tájkörzetben. *Növényvédelem* **14**(8): 379-381.

BUDAI, CS. (1979*a*) Spread of, and damage caused by the root-knot nematode, Meloidogyne hapla in the red pepper growing area of Szeged. *Acta Phytopath. Acad. Sci. Hung.* **14**(3-4): 543-548.

BUDAI, CS. (1979*b*) Damage caused by root gall nematodes in the vegetable forcing-bed. *Kertgazdaság* **11**(4): 48-54.

BUDAI, CS. (1980) Új kártevő faunánkban: a Melodogyne thamesi (Chitwood, 1952) gyökérgubacsképző fonálféreg. *Növényvédelem* **16**: 117-118.

DABAJ, K. H. & JENSER, G. (1978) Meloidogyne (Nematoda) fajok magyarországi előfordulásának adatai. Növényvédelmi Tudományos Napok, Február 24-25, 1978, Budapest.

DABAJ, K. H. & JENSER, G. (1990) Some weed host-plants of the Northern root-knot nematode Meloidogyne hapla in Hungary. *Nematol medit.*. **18**: 139-140.

DABAJ, K. H., JENSER, G. & LEHOCZKY, J. (1991) Investigation on the population density of Meloidogyne hapla Chitwood on grapevine (Vitis vinifera and Vitis vinifera×Seyve-Villard) hybrids. *Acta Agronomica Hungarica* **40**(3-4): 355-358

DABAJ, K. H., LEHOCZKY, J. & JENSER, G. (1989) *A Meloidogyne hapla Chitwood gubacs-fonálféreg kártétele újratelepített szőlőben.* Növényvédelmi Tudományos Napok, Február 21-22, 1989, Budapest.

EISENBACK, J. D., HIRSCHMANN, H., SASSER, J. N. & TRIANTAPHYLLOU, A. C. (1981) *A guide to the four most common species of root-knot nematodes (Meloidogyne spp.) with a pictorial key.* Coop. Publ. Deps. Plant Pathol. Genet., North Caroline State Univ., and US Agency Int. Dev. Raleigh, N.C., 48 pp.

FARKAS, K. & DELLEI, A. (1973) Saintoulis lonantha nematologiai vizsgálata. *Növényvédelem* **9**: 202-207.

FARKAS, K. & MÉSZNER, K. (1984) Nematological study on Paeonia lactiflora Pallas. *Növényvédelem* **20**(5): 202-207.

JÁVOR, I. (1974) *Kis nematológia.* Budapest, 142 pp.

JEPSON, S. B. (1978) *Identification of root-knot nematodes (Meloidogyne species).* C.A.B. International Oxon, UK. 265 pp.

TAYLOR, D. P. & NETSCHER, C. (1974) An improved technique for preparing perineal patterns of Meloidogyne spp.. *Nematologica* **20**(2): 268-269.

TAYLOR, A. L. & SASSER, J. N. (1978) *Biology, identification and control of root-knot nematodes (Meloidogyne species).* International Meloidogyne Project. A Coop. Publ. Dep. Plant Pathol. North Caroline State Univ. and US Agency Int. Dev. NC Graphics, 111 pp.

Received February 15, 1993; accepted December 1, 1993

Acta Zoologica Academiae Scientiarum Hungaricae 40 (2), pp. 133-156, 1994

BRACONIDAE (HYMENOPTERA) FROM KOREA, XV.*

J. PAPP

Zoological Department, Hungarian Natural History Museum
H-1088 Budapest, Baross utca 13, Hungary

Thirty-six braconid species representing the subfamily Alysiinae are reported from northern Korea. Nine species are described as new to science: *Aphaereta tricolor* sp. n., *Hylcalosia adsimilis* sp. n., *Idiasta pallida* sp. n., *Synaldis distenta* sp. n., *S. fuscoflava* sp. n., *S. hirsuta* sp. n., *S. nigriceps* sp. n., *S. sincera* sp. n., and *S. vestigata* sp. n. Twenty-two alysiine species are new to the fauna of Korea. The braconid material serving for the present elaboration is deposited in the Hungarian Natural History Museum, Budapest. With 44 original figures.

Key words: Hymenoptera, Braconidae, Alysiinae, new species, Korea

LIST OF THE SPECIES

Thirty-six species of Braconidae belonging to the subfamily Alysiinae are reported from northern Korea (i.e. the Democratic People's Republic of Korea). The braconid material was collected by the staff-members of the Hungarian Natural History Museum (Budapest) during the collecting trips to North Korea in the years 1970-1988. Further details concerning the participants of the trips are presented in the previous two papers of my series (PAPP 1990, 1992)

The subfamily Alysiinae is represented by 12 genera; in the subsequent faunistic enumeration the genera as well as the species are listed in alphabetic order, the number of the respective species within the genera are indicated in brackets: *Alysia* LATREILLE (6 species), *Aphaereta* FOERSTER (6 species), *Asobara*'FOERSTER (1 species), *Cratospila* FOERSTER (1 species), *Dapsilarthra* FOERSTER (1 species), *Hylcalosia* FISCHER (1 species), *Idiasta* FOERSTER (2 species), *Orthostigma* RATZEBURG (2 species), *Pentapleura* FOERSTER (1 species), *Phaenocarpa* FOERSTER (4 species), *Synaldis* FOERSTER (10 species) and *Tanycarpa* FOERSTER (1 species). The nine new species are indicated in the abstract. Collecting data are presented for every species in an abbreviated form, i.e. only the collecting numbers ("No.") are given after the species names, the detailed collecting data (name of the Korean localities, dates etc.) are listed separately be-

* Zoological Collectings by the Hungarian Natural History Museum in Korea, No. 116.

fore the faunistic enumeration. Where necessary the faunistic contributions are completed with taxonomic as well as zoogeographic notes.

Below the collecting numbers are enumerated in an increasing sequence of the numerals completed with the locality names, collecting time, etc.:

No. 15. Prov. South Phenan: NE Outskirts of Pyongyang, 22 May 1970 – Singled on river bank.
No. 28. Prov. South Phenan: Sa-gam po, about 30 km N of Pyongyang, 24 May 1970. – Netting and beating on lakeside forest edge and undergrowth.
No. 112. Prov. Kengi: Bagyon san, San-chon tong, about 20 km SE from Kaesong, 8 June 1970. – Netted from plants.
No. 136. Prov. South Pyongan: Pyongyan, Pyongyan Hotel garden, 3 August 1971. – Singled material at lamp.
No. 137. Prov. South Pyongan: Pyongyan, city park between river Te-dong and Pyongyan Hotel, 4 August 1971. – Netting in grass and bushes of the park.
No. 140. Prov. South Pyongan: Mang-yong-dae, 25 km W from Pyongyan, 5 August 1971. – Netting on rudimental vegetation.
No. 144. Prov. South Pyongan; Pyongyan, Pyongyan Hotel garden, 5-6 August 1971. – Taken with Malaise-trap.
No. 145. Prov. South Pyongan: De-sang san, 12 km NE from Pyongyan, 7 August 1971. – Netting the grass and shrub levels of a coniferous forest.
No. 150. Same as No. 144, 7-8 August 1971.
No. 164. Prov. South Pyongan: Sa-gam, 45 km N from Pyongyan, 12 August 1971. – Netting on shrubs, weeds and grass of a riverside.
No. 169. Prov. South Pyongan: Chang-lyong san, 50 km N of Pyongyan and 15 km E of Sa-gam, 13 August 1971. – Singled material from ruderal vegetation and bushes on slope facing SW.
No. 182. Prov. South Pyongan: Pyongyan, Nung-ra do (an island in the river Te-dong), 17 August 19711. – Netting in the grass and shrubs of the park.
No. 188. Prov. South Pyongan: Pyongyan, Pyongyan Hotel garden, 18 August 1971. – Taken with Malaise trap.
No. 189. Same as No. 188, 19 August 1971.
No. 193. Prov. Ryang-gang: Hyesan Hotel garden, 23 August 1971. – Taken with Malaise trap.
No. 206. Prov. Ryang-gang: Chann-pay plateau, Samjiyon, 1700 m, 27 August 1971. – Singling in *Larix-Betula* forest along a pathway.
No. 218. Same as No. 206, 28 August 1971. – Taken with Malaise-trap in *Larix-Betula* forest.
No. 225. Same as No. 144, 31 August 1971.
No. 227. Same as No. 137, 1 September 1971.
No. 229. Same as No. 188, 1 September 1971.
No. 234. Same as No. 188, 2 September 1971.
No. 237. Same as No. 188, 4 September 1971.
No. 243. Same as No. 188, 6-7 September 1971.
No. 261. Kaesong: Mts Pakyon, 20-21 km NE from Kaesong both sides of and near to the road between Kaesong and Pakyon popo, 11 September 1971. – Singled on bushy and grass vegetation.
No. 263. Kaesong: Mts Pakyon, Pakyon popo, 500 m, 27 km NE from Kaesong, 9-12 September 1971. – Taken with soil trap baited with beer in a deciduous forest.
No. 266. Prov. South Pyongan: Pyongyan, garden of the Embassy of the Hungarian People's Republic, 16-18 June 1975. – Taken with Malaise-trap.
No. 267. Same as No. 145, 18 July 1975, 17-18^{h}.
No. 273. Prov. South Pyongan: Nampo, 19 July 1975, 11-13.30^{h}. – Netting in the shrub level of a *Robinia-Castanea* wood.
No. 274. Same as No. 266, 18-20 July 1975.

No. 281. Prov. Ryang-gang: Chann-pay plateau, 24 km NW of Samjiyon along the road to Mt. Paekdu, 2000 m, 24 July 1975. – Netting in more or less devastated clearings of *Larix-Betula* forest.

No. 282. Prov. Ryang-gang: Chann-pay plateau, Samjiyon, 1700 m, 24 July 1975, 16-18.30^h, sunny weather with cloudy sky, 22-24°C. – Netted in shrubby and grass vegetation of *Larix-Betula* forest.

No. 285. Same as No. 282, cloudy weather with full moonlight. – Singled material at MV-lamp.

No. 329. South Pyongan: Pyongyan, room of Hotel Tae-dong on the fifth floor, 9 August 1975, 21-22^h. – Taken at MV-lamp.

No. 331. Prov. Pyong-sung: Bek-sung-li, Zamo san, 60 km NE of Pyongyan, 1-10 August 1975. – Taken with pitfall trap baited with salty beer in a sweet chestnut wood in a nature conservancy field.

No. 332. De-Sang san, 10 km NE of Pyongyan, 1 July 1977. – Confined, rather stony area. Coniferous wood (*Pinus densifolia*) mixed with some *Acer* sp., undergrowth very sparse.

No. 343. Tesson, water basin, about 35 km SW of Pyongyan, 4 July 1977. – In the neighbourhood of a coniferous wood mixed with *Robinia* trees; netted in the grass and shrub levels of the wood.

No. 346. Sa Gam, Water basin and inundation area of a river, about 30-40 km N of Pyongyan, 5 July 1977. – In the neighbourhood of a mixed coniferous-*Robinia* wood. Netted in the grass and shrubby vegetation (*Salix*) on the bank of the river.

No. 347. Same as No. 346, netted in the grass vegetation of a wood.

No. 371. Mt. Paekdu: wooded environs of the Samjiyon Hotel, 18 July 1977. – Taken with Malaise-trap set up about 2 km N of the hotel on the left of the road to Explosion Lake.

No. 372. Same as No. 371, netted in the grass vegetation of the road indicated.

No. 374. Same as No. 371, 19 July 1977. – Netted in shrubby and gras vegetation about 16 km E of the hotel, at the edge of a coniferous wood growing on the left side of the road to Musan.

No. 376. Same as No. 371, 19 July 1977. – Netted in the grass vegetation of the wooded surroundings of Samjiyon Hotel.

No. 423. North Hwanghe Prov.: Sariwon, 28 September 1978. – Collected at mixed light in a window of the hotel, 20-22^h.

No. 488. Kangwon Prov.: Kumgang san, 12 October 1978. – Swept material mainly from *Dryopteris*-like species, a rather cold, windy day.

No. 505. Same as No. 488, 18 October 1978, 12 km from rest-house along serpentine road to Kwinyon-am Rock. – Singled material from forest litter accumulated by the roadside, *Quercus* and *Acer* sp.

No. 940. North Pyongan prov.: Myohyang san, 23 May 1985. – Warm, sunny forenoon. Specimens collected mainly by singling, also sweeping the sparse vegetation in mixed wood around the hotel.

No. 961. Pyongyang City, 30 May 1985. – Warm, stuffy forenoon, about 24°C. Collected in the Botonggang Park by sweeping the much degraded vegetation.

No. 962. Pyongyang City: Lyongak san, 30 May 1985. – Pleasant night. Collected at a blended light (250 W) fed by a Honda generator.

No. 992. Ryanggang Prov.: Samjiyon, 4 June 1985. – Warm afternoon, temperature about 22°C. Singled and swept along the footpath in a *Larix* forest, some 300 m from the hotel.

No. 999. Same as No. 992, 5 June 1985. – Warm, sunny of about 24°C. Collecting in a *Larix-Betula* forest on the way to Mt. Paekdu. The material was collected by using a sweeping net.

No. 1353. Ryanggang Prov.: Mt. Paekdu-milyong, 1500 m, 27 June 1988. – Cloudy warm afternoon. Dark and dense largely untouched *Larix olgensis* forest mixed many *Betula pendula*. Rich underwood along a booklet. Sweeping and singling from the vegetation.

No. 1355. Ryanggang Prov.: NW of Samjiyon, 31 km on Mt. Paekdu road, 2000 m, 28 June 1988. – Cloudy, cool day. *Larix olgensis* forest (not mixed with *Betula pendula*), with rather poor underwood, not far from the borderline. Sweeping and singling from vegetation.

ALYSIINAE

Alysia (Alysia) brachycera THOMSON, 1895 – In Europe known from Norway, Sweden, Finland and Russia (Sankt Petersburg), in North America frequent both in the countries Canada and the U.S.A. (WHARTON 1986: 467-468). New to the fauna of Korea. – Locality: 1 ♂ : No. 1353.

Alysia (Alysia) lucia HALIDAY, 1838 – Locality: 1 ♀ : No. 285.

Alysia (Subgenus?) **nigritarsis** THOMSON, 1895 – My specimens (2 ♀♀ + 7 ♂♂) agree well with the redescription given by WHARTON (1986: 478-479) except the following features: (1) ovipositor subapically without dorsal notch (a feature of the subgenus *Anarcha*; WHARTON, contrarily, says that "subapical node of dorsal valve very weak (Fig. 33)", thus he ranged this species in the subgenus *Alysia*); this subgeneric discrepancy is indicated above with question-mark; (2) first tergite 2.3 times (♀) and 2.3-2.4 times (♂) as long as broad at hind; (3) antenna with 32 (♀) and 39 (1 ♂), 41 (1 ♂), 44 (1 ♂), 47 (1 ♂), 48 (2 ♀♀) antennomeres. – Reported from Sweden and Central Ural Mts in Russia. New to the fauna of Korea. – Localities: 1 ♂ : No. 281. 6 ♂♂: No. 282. 2 ♀♀: No. 376.

Alysia (Anarcha) sophia HALIDAY, 1838 – In Europe reported from a few countries, in Russia from the central region of her European part (FISCHER 1967*b*: 129-132, TOBIAS 1986: 107, WHARTON 1988: 44). New to the fauna of Korea. – The single Korean female specimen deviates from the redescriptions (l. c.) in the following respects: (1) first tergite somewhat quadratic, just longer than broad behind; beyond pair of spiracles faintly broadening; (2) *n. rec.* clearly antefurcal; (3) antenna with 43 antennomeres; (4) metasoma, except black first tergite, brown. – Locality: 1 ♀ : No. 282.

Alysia (Anarcha) tipulae (SCOPOLI), 1764) – In Europe frequent, reported from eastern Siberia in Russia (TOBIAS 1986: 108) nearest to Korea. New to the fauna of Korea. – Locality: 1 ♂ :No. 1353.

Alysia (Alysia) truncator NEES, 1814 – A Holarctic though sporadically distributed species. New to the fauna of Korea. – Locality: 1 ♀ : No. 1355.

Aphaereta brevis TOBIAS, 1962 – Hitherto known sporadic in the western Palaearctic Region (Hungary, Russia: European part, Afghanistan). New to the fauna of Korea. – The only deviating feature of my Korean specimen is the fully yellow colour of meso- and metasoma, the ground colour of the nominate form is black with brownish or yellowish pattern. – Locality: 1 ♀ : No. 331.

Aphaereta difficilis NIXON, 1939 – Distributed and frequent in the western Palaearctic Region. New to the fauna of Korea, in Korea also frequent. – Localities: 1 ♀: No. 15. 1 ♀: No. 136. 2 ♀♀ + 1 ♂: No. 137. 1 ♀ + 1 ♂ : No. 140. 1 ♀ : No. 145. 11 ♀ : No. 150. 1 ♀ : No. 169. 2 ♀♀ + 1 ♂ : No. 182. 2 ♀♀: No. 188. 1 ♀ : No. 189. 7 ♀♀ + 5 ♂♂ : No. 225. 3 ♀♀ + 6 ♂♂: No. 227. 1 ♀ : No. 229. 4 ♀♀ : No. 234. 2 ♀♀ : No. 235. 1 ♀ : No. 237. 3 ♀♀ : No. 266. 1 ♀ : No. 267. 1 ♀ : No. 274. 1 ♀ : No. 331. 4 ♀♀: No. 347. 1 ♂ : No. 961.

Aphaereta falciger GRAHAM, 1960 – Known from four countries in Europe (Ireland, England, Germany, Austria). New to the fauna of Korea. – Localities: 1♀ : No. 329. 3 ♀♀ : No. 343. 1 ♀ : No. 347. 1 ♀ : No. 423.

Aphaereta minuta (NEES, 1812) – Localities: 1 ♀ : No. 136. 1 ♀ : No. 164. 1 ♀ : No. 193. 6 ♀♀ + 9 ♂♂ : No. 225. 2 ♀♀ + 3 ♂♂ : No. 227. 2 ♀ : No. 235. 2 ♀♀ : No. 243. 1 ♀ : No. 261. 1 ♀ : No. 263. 1 ♂ : No. 273. 1 ♂ : No. 347.

Aphaereta scaptomyzae FISCHER, 1966 – Its localities were listed in Germany, Austria, Hungary, Moldavia and Russia (Sankt Petersburg). New to the fauna of Korea. – Locality: 1 ♀ : No. 225.

Aphaereta tricolor sp. n.: for description see below.

Asobara rufescens (FOERSTER, 1862) – Recognized recently to represent a valid species closely related to. *A. tabida* (NEES) (VET *et al.*, 1984). Known from Germany and the Netherlands. New to the fauna of Korea. Supposedly widely distributed in the Palaearctic Region. – Localities: 1 ♀ : No. 193. 1 ♂ : No. 332. 1 ♂ : No. 347.

Cratospila circe (HALIDAY, 1838) – Distributed in the western Palaearctic Region, eastwards as far as Caucasus Mts. New to the fauna of Korea. – Localities: 1 ♀ : No. 218. 1 ♂ : No. 961.

Dapsilarthra balteata (THOMSON, 1895) – Sporadic to frequent in the western Palaearctic Region. New to the fauna of Korea. – Locality: 1 ♂ : No. 282.

Hylcalosia adsimilis sp. n.: for description see below.

Idiasta dichrocera KÖNIGSMANN, 1960 – Widely distributed in the Palaearctic Region, nearest to Korea found in Barnaul, West Siberia (TOBIAS 1986: 156). New to the fauna of Korea. – Locality: 2 ♀♀ + 1 ♂ : No. 347.

Idiasta pallida sp. n.: for description see below.

Orthostigma longicorne KÖNIGSMANN, 1969 – In Europe reported from several countries, its easternmost distribution is in the Ural Mts. New to the fauna of Korea. – Locality: 1 ♀ : No. 206.

Orthostigma sordipes (THOMSON, 1895) – My specimens were compared to females (2 ♀) taken in the Netherlands and identified by VAN ACHTERBERG. – Known only in Netherlands, Denmark and Bohemia. New to the fauna of Korea. – Localities: 1 ♀ + 2 ♂♂ : No. 961. 1 ♂ : No. 962.

Pentapleura pumilio (NEES, 1812) – A Holarctic species, in the eastern Palaearctic Region reported first by me from Mongolia (PAPP 1991: 219). New to the fauna of Korea. – Locality: 1 ♀ : No. 999.

Phaenocarpa angustiptera PAPP, 1968 – Described from Slovakia by me, reported from Lithuania (TOBIAS 1986: 143). New to the fauna of Korea. – Deviating features of one female specimen (loc. No. 281): (1) mesonotum behind and scutellum rugulose, (2) *n. par.* issuing rather from *n. rec.* Localities – 2 ♀♀ : No. 281. 1 ♂ : No. 371. 1 ♂ : No. 372. 2 ♀♀ + 1 ♂ : No. 374.

Phaenocarpa eunice (HALIDAY, 1838) – Reported sporadic from Europe (Ireland, England, Romania, Moldavia) and Russia (Baykal region). New to the fauna of Korea. – Locality: 1 ♂ : No. 281.

Phaenocarpa picinervis (HALIDAY, 1838)– A frequent species distributed in the Holarctic Region. New to the fauna of Korea. Localities – 1 ♂ : No. 112. 1 ♀ : No. 229. 1 ♂ : No. 346. 22 ♀ + +9 ♂♂ : No. 347.

Phaenocarpa ruficeps (NEES, 1814) – Localities: 1 ♀ : No. 505. 1 ♀ : No. 940.

Phaenocarpa ruficeps var. **testacea** (NEES, 1814) – Localities: 1 ♀ : No. 28. 2 ♂♂ : No. 347.

Synaldis concolor (NEES, 1812) – Localities: 3 ♂♂ : No. 376. 1 ♀ : No. 992.

Synaldis distenta sp. n.: for description see below.

Synaldis distracta (NEES, 1834) – Locality: 1 ♀ : No. 376.

Synaldis fuscoflava sp. n.: for description see below.

Synaldis hirsuta sp. n.: for description see below.

Synaldis nigriceps sp. n.: for description see below.

Synaldis reducta (TOBIAS, 1962) – Described from Russia (Sankt Petersburg region), reported from Austria. New to the fauna of Korea. – Locality: 1 ♀ + 4 ♂♂ : No. 376.

Synaldis sincera sp. n.: for description see below.

Synaldis trematosa FISCHER, 1967 – Described and hitherto known only from its type locality in Michigan (Arenac Co.), U.S.A. New to the fauna of Korea (and the eastern Palaearctic Region). – My two female specimens match in all respects with the original description (FISCHER 1967*c*: 474–476). – Locality: – 2 ♀♀ + 4 ♂♂ : No. 144.

Synaldis vestigata sp. n.: for description see below.

Tanycarpa gracilicornis (NEES, 1812) – Hitherto known in Europe (in several countries) and North America (Canada). It seems a Holarctic species. New to the fauna of Korea. – Locality:1 ♀ : No. 488.

DESCRIPTION OF THE NEW SPECIES

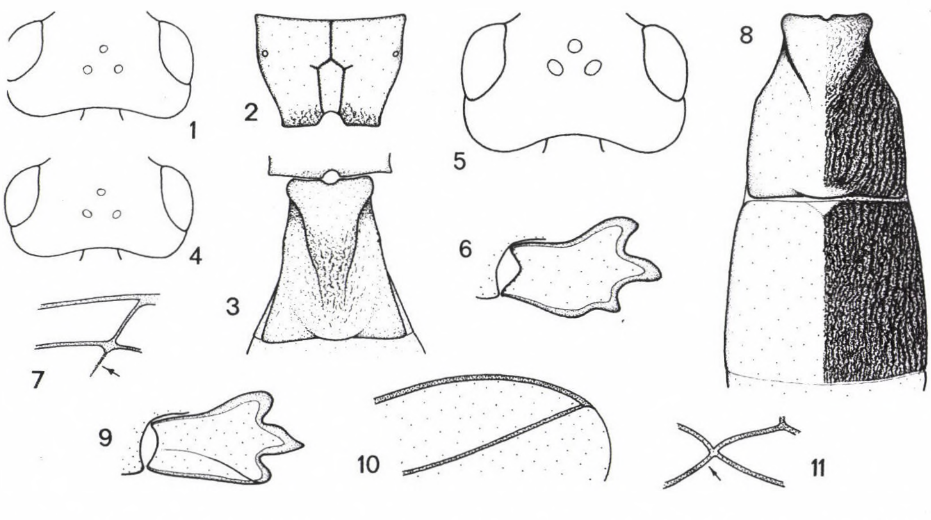
Aphaereta tricolor sp. n.
(Figs 1-3)

Holotype ♀. – Body 1.7 mm long. Head in dorsal view (Fig. 1) 1.8 times as broad as long, eye twice as long as temple, latter rounded. Ocelli small and round, POL:OD:OOL as 4:3:9. Eye in lateral view nearly round, somewhat higher than wide and 1.75 times as wide as temple. Mandible in outer side somewhat more than twice as long as broad between teeth 1 and 3, tooth 2 pointed, teeth 1 and 3 rounded. Head polished. – Antenna about one-fourth longer than body. Second flagellomere 1.33 times as long as first flagellomere and eight times as long as broad apically, penultimate flagellomere four times as long as broad.

Mesosoma in lateral view 1.37 times as long as high. Mesonotal dimple round and deep, pair of notauli reaching it, notauli evenly deep and smooth. Prescutellar furrow crenulated. Mesosoma polished. Propodeum smooth and shiny, anteriorly with a medio-longitudinal keel diverging about middle and forming posteriorly an areola, around lunule surface rugulose (Fig. 2) – Hindfemur five times as long as broad about middle. Hind tibia and tarsus equally.

Fore wing about one-sixth longer than body. Vein *r1* somewhat longer than width of pterostigma, *r3* 3.45 times as long as *r2* and reaching tip of wing. *N. rec.* twice as long as *d.*

First tergite (Fig. 3) slightly longer than broad at hind, pair of spiracles before middle of tergite, pair of converging keels merging into sculpture posteriorly. First tergite medially (i.e. between



Figs 1–11. – Figs 1–3. *Aphaereta tricolor* sp. n.: 1 = head in dorsal view, 2 = propodeum, 3 = first tergite. – Fig. 4. *Aphaereta brevis* TOBIAS: head in dorsal view. – Figs 5–8. *Hylcalosia adsimilis* sp. n.: 5 = head in dorsal view, 6 = mandible, 7 = middle part of hind wing with interstitial *n. rec.* (↑), 8 = tergites 1–2 with indication of sculpture. – Figs 9–11. *Idiasta pallida* sp. n.: 9 = mandible, 10 = distal end of right fore wing, 11 = middle part of fore wing with interstitial *n. rec.* (↑)

keels) rather longitudinally rugulose-uneven, laterally uneven to smooth, shiny; further tergites shrivelled owing to weak sclerozity. Ovipositor sheath as long as hind basitarsus.

Body tricoloured. Head blackish brown, clypeus brown. Scape and pedicel yellow, flagellum darkening brownish. Mandible yellow, palpi pale yellow, tegula yellow. Mesosoma and metasoma rusty brown, propodeum somewhat darker. Legs yellow, last (or fifth) tarsal segments brownish. Wings hyaline, pterostigma and vein opaque brownish.

The single female paratype agrees in every respect with the holotype.

♂ and host unknown.

Type material. Holotype ♀ + 1 ♂ paratype: Korea, Prov. South Pyongan, Pyongyan, city park, 1 September 1971, leg. S. HORVATOVICH et J. PAPP, No. 227. – Types are deposited in the Hungarian Natural History Museum (Zoological Department), Budapest, Hym. Typ. Nos 7546 (holotype) and 7547 (paratype).

Etymology. The species name "tricolor" refers to the tricoloured body of the new species.

With the help of TOBIAS's key (1986: 149-150) to the European species of the genus *Aphaereta* the new species, *Aphaereta tricolor* sp. n., runs to *A. brevis* TOBIAS, 1962 (European part of Russia, Afghanistan, Korea). Taking into consideration the original description of TOBIAS's species (1962: 88-89) the two species are differentiated by the following features keyed below:

1 (2) Notauli long, reaching mesonotal dimple before prescutellar furrow. Temple in dorsal view rounded, i.e. head between eyes and temple (close behind eyes) equally broad, eye twice as long as temple (Fig. 1). First tergite slightly longer than broad behind, i.e. its two sides relatively strongly diverging posteriorly (Fig. 3). Body tricoloured: head blackish brown, meso- and metasoma rusty brown, legs yellow **A. tricolor** sp. n.

2 (1) Notauli short, i.e. restricted to declivous fore part of mesonotum. Temple in dorsal view strongly rounded, i.e. head between eyes slightly broader than between temples, eye three times as long as temple (Fig. 4). First tergite 1.5 times as long as broad behind, i.e. its two sides relatively less strongly diverging posteriorly. Ground colour of body black with more or less brownish to yellowish pattern, legs also yellow **A. brevis** TOBIAS

Hylcalosia adsimilis sp. n.
(Figs 5–8)

Holotype ♀. – Body 3 mm long.

Head in dorsal view (Fig. 5) transverse, 1.72 times as broad as long, eye 1.63 times as long as temple, latter rounded. Ocelli relatively large, fore ocellus round, hind pair of ocelli elliptic, POL:OD:OOL as 4:4:10. Eye in lateral view almost round, i.e. somewhat higher than wide, temple half as wide as eye. Length of maxillar palp 1.35 times as long as height of head, reaching hind coxa. Head polished, face and frons below rugose. Mandible (Fig. 6) 1.45 times as long as broad, middle tooth less pointed, between teeth 1 and 2 incised. – Antenna longer than body, left antenna with 48 antennomeres (right antenna apically broken, with 42 antennomeres); first flagellomere

0.75 times as long as second flagellomere, length of first and second flagellomeres 2.4 and 4 times their width, respectively.

Mesosoma in lateral view 1.44 times as long as high. Notauli short, restricted to declivous fore part of mesonotum, finely crenulated. Mesonotal groove linearform and extended on posterior two-thirds of mesonotum. Precoxal sulcus present on anterior three-fourths of mesopleuron, rugose. Mesonotum, scutellum and mesopleuron polished. Propodeum rugose, on its horizontal (or upper) part with a short, rather indistinct carina. – Legs: Fore tarsus 1.37 times as long as fore tibia. Hind femur 4.5 times as long as broad somewhat distally; length of hind femur, tibia and tarsus as 3:4:4; length of hind tibial spurs 0.2 times and 0.17 times as long as hind basitarsus; hind basitarsus just shorter than hind tarsal segments 2-4.

Fore wing somewhat longer than body. Pterostigma 3.6 times as long as wide, issuing radial vein distally from its middle, *r1* half as long as width of pterostigma; proportional length of *r1*:*r2*:*r3* as 3:14:55, *cuqu1* one-third longer than *r2*; *n. rec.* just postfurcal; nervulus interstitial, *d* 1.4 times as long as *n. rec.* – *N. rec.* of hind wing interstitial (Fig. 7).

Carapace as long as head and mesosoma together. First tergite (Fig. 8) 1.19 times as long as broad behind, pair of spiracles before middle of tergite, tergite itself more broadening anteriorly than posteriorly from spiracles. Pair of moderately converging carinae not uniting medially and merging into longitudinal striation. Second tergite subquadrate, hardly wider before its hind end than long medially, striate with rugose elements, medially granulate to finely striate-rugose. Third tergite granulate-rugose, shorter than second tergite. Second suture smooth, shiny. Ovipositor sheath 0.45 times as long as fore wing or somewhat longer than hind tibia.

Ground colour of body rusty brown. Blackish: mesonotum, mesopleuron, mesosternum, metapleuron and third tergite. Temple rusty. Mandible brownish yellow. Scape and pedicel brownish yellow, flagellum blackish brown. Palpi and legs yellow, hind tibia and tarsus brownish. Wings subhyaline, pterostigma and veins opaque brownish yellow.

♂ and host unknown.

Type material. Holotype ♀ : Korea, Kumgang-san, Rükhaam, taken with Malaise-trap, 10-12 July 1977, leg. DELY et DRASKOVITS, No. 358. – Holotype is deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym. Typ. No. 7548.

Etymology. The species name "*adsimilis*" refers to the deceptive similarity to its related species.

Distribution: Korea.

Hitherto five *Hylcalosia* species are known from the Eastern Palaearctic and Oriental Region. For these species keys were constructed by VAN ACHTERBERG (1983: 83) and BELOKOBYLSKIJ (1992: 144-146); my new species, *H. adsimilis* sp. n., is nearest to *H. hemiflava* VAN ACHTERBERG, 1983 and to *H. sutchanica* BELOKOBYLSKIJ, 1992. The six species are keyed following the keys by the two authors mentioned:

1 (4) Temple in dorsal view at least as long as eye. Tergites 2-3 either of equal length or third tergite somewhat shorter than second tergite (Figs 26 and 28 in VAN ACHTERBERG 1983: 86 and 88).

2 (3) Temple in dorsal view 1.6 times as long as eye (Fig. 21 in VAN ACHTERBERG 1983: 86). Second tergite quadrate, its median length equal to its maximum width (Fig. 26 l.c.). Fore tarsus 1.7 times as long as fore tibia (Fig. 20 l. c.) ♂ : 6.1 mm. – Burma **H. ruficeps** (CAMERON, 1910)

3 (2) Temple in dorsal view as long as eye (Fig. 35 in VAN ACHTERBERG 1983: 88). Second tergite transverse, its median length two-thirds of its maximum width (Fig. 28 l.c.). Fore tarsus 1.3 times as long as fore tibia. ♀ : 5.3-7.2 mm. – Japan **H. maetoi** VAN ACHTERBERG, 1983

4 (1) Temple in dorsal view distinctly shorter than eye, i.e. eye usually 1.6-1.7 times as long as temple (Fig. 5; Fig. 12 in VAN ACHTERBERG 1983: 84; Figs 1:1 and 2:1 in BELOKOBYLSKIJ 1992: 145, 147). Third tergite distinctly shorter than second tergite (Figs 1:9 and 2:8 in BELOKOBYLSKIJ l.c.) except *H. hemiflava* VAN ACHTERBERG.

5 (6) Notauli complete, i.e. reaching hind end of mesonotum; median dimple of mesonotum long, i.e. extending anteriorly up to declivous part of mesonotum (Fig. 10 in VAN ACHTERBERG 1983: 84). *N. rec.* of hind wing far antefurcal (Fig. 4 l.c.). Mesosoma and tergites 1-2 brownish yellow. ♀ : 4.1 mm. – Indonesia (Sumatra or Sulawesi)
H. hemiflava VAN ACHTERBERG, 1983

6 (5) Notauli not complete, i.e. extending at most anterior half of mesonotum; median dimple of mesonotum short, i.e. restricted to hind half to third of mesonotum (Figs 1:10 and 2:9 in BELOKOBYLSKIJ 1992: 145, 147). *N. rec.* at most just antefurcal. Mesosoma and tergites 1-2 rusty brown.

7 (8) Notauli extending anterior half of mesonotum (Fig. 1: in BELOKOBYLSKIJ 1992: 145). First tergite distinctly broadening posteriorly, about one-sixth broader behind than long medially (Fig. 1:9 l.c.). *N. rec.* of hind wing just antefurcal. ♀ : 2.1-3 mm. – Far East of Russia
H. hymaenei BELOKOBYLSKIJ, 1992

8 (7) Notauli restricted to declivous part of mesonotum (Fig. 2:9 in BELOKOBYLSKIJ 1992: 147). First tergite less distinctly broadening posteriorly, at least as long as broad behind (Fig. 8; Fig. 2:8 l.c.). *N. rec.* interstitial (Fig. 7).

9 (10) Metanotum with a medio-longitudinal keel. First tergite somewhat longer than, i.e. 1.19 times as long as broad behind, spiracle situated near to its middle; second tergite subquadrate, hardly wider before its hind end than long medially; second tergite striate with rugose elements, medially finely striate-rugose (Fig. 8), third tergite granulate rugose. Legs yellow. ♀ : 3 mm. – Korea **H. adsimilis** sp. n.

10 (9) Metanotum without a medio-longitudinal keel. First tergite as long as broad behind, spiracle situated at its anterior third; second tergite transverse, one-third wider before its hind end than long medially (Fig. 2:8 in

BELOKOBYLSKIJ 1992: 147). Tergites 2-3 weakly rugose with rather transverse elements. Legs brownish. ♀ : 2.6-2.7 mm. – Far East of Russia
H. sutchanica BELOKOBYLSKIJ, 1992

Idiasta pallida sp. n.
(Figs 9-12)

Holotype ♀ . – Body 2.4 mm long. Head in dorsal view transverse, 1.93 times as broad as long, eye 2.3 times as long as temple, latter rounded. Ocelli small and oval, POL:OD:OOL as 5:5:10. Eye nearly round, one-fifth higher than wide and twice as wide as temple. Mandible (Fig. 9) 1.6 times as long as broad between teeth 1 and 3, incised between teeth 1-2 and 2-3. Head polished. Antenna longer than body, with 32 antennomeres. Second flagellomere distinctly twice as long as first flagellomere, first flagellomere 3.3 times, second flagellomere 7.6 times and penultimate flagellomere 2.6 times as long as broad.

Mesosoma in lateral view 1.25 times as long as high. Pronope present. Notauli short and restricted to declivous part of mesonotum. Mesonotal dimple short linearform. Prescutellar furrow with fine crenulae. Precoxal furrow wide and crenulated. Mesonotum, scutellum and mesopleuron polished. Propodeum areolate-rugose, its upper or horizontal part almost smooth, medio-longitudinal keel distinct. Legs: Fore tarsus 1.4 times as long as fore tibia. Hind femur 5.4 times as long as broad apically, proportional length of hind femur, tibia and tarsus as 38:50:55; hind basitarsus as long as hind tarsal segments 2-3.

Forewing about as long as body. Pterostigma 3.63 times as long as wide distally, issuing radial vein clearly distally from its middle, *cuqu1* one-fourth longer than *r2*, *r3* reaching tip of wing (Fig. 10). *N. rec.* interstitial (Fig. 11) and as long as *d.* – Hind wing: nervellus issuing from middle of *n. med.*

Metasoma somewhat shorter than head and mesosoma together. First tergite (Fig. 12) 1.56 times as long as broad behind, pair of spiracles before middle of tergite, tergite beyond spiracles less broadening; pair of converging keels not unifying and merging into longitudinal striation of tergite. Tergites polished. Hypopygium behind truncate; ovipositor sheath somewhat longer than metasoma or as long as hind tibia and basitarsus together.

Ground colour of body brownish yellow; head blackish, face medially rusty brown, clypeus and mandible brownish yellow. Antenna darkening brownish yellow to blackish, flagellomeres 16-26 pale yellow. Palpi yellow. Legs and sternites yellow. Wings weakly and evenly fumous, veins yellowish brown, basally rather brown.

Female paratypes (2 ♀♀). – Similar to the holotype. Head in dorsal view 1.8-1.82 times as broad as long. Antenna with 33 antennomeres (antenna of 1 ♀ damaged); second flagellomere 2.36 times as long as broad apically and 2.1 times as long as first flagellomere; 18-28 flagellomeres pale yellow (1 ♀). First tergite 1.6-1.63 times as long as broad behind. Ground colour of body yellow (1 ♀).

♂ and host unknown.

Type material. – Holotype ♀: Korea, Prov. South Pyongan, Zamo-san, 60 km NE from Pyongyan, 2 September 1971, leg. S. HORVATOVICH et J. PAPP, No. 231. – Paratypes (2 ♀♀): 1 ♂ : Korea, Prov. Gang-von, district On-dzong, Kumgang-san, near Hotel Gosong, 250 m, 5 August 1975, leg. J. PAPP et A. VOJNITS, No. 318. 1 ♀ : Korea, Prov. South Pyongyang, Lake Taesong-ho, 13 September 1979, leg. H. STEINMANN et T. VÁSÁRHELYI, No. 528.

Types are deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym Typ. Nos. 7549 (holotype) and 7550-7551 (paratypes).

Etymology. The species name "*pallida*" refers to the brownish yellow colour of the body.

Distribution: Korea.

The new species, *Idiasta pallida* sp. n., runs to *I. brevicauda* TELENGA, 1935 (Azerbaidzhan) with the help of KÖNIGSMANN's (1960: 627–628) and TOBIAS's key (1986: 150–152) to the Palaearctic species of the genus *Idiasta.* The two species are separated by the following features keyed:

1 (2) Notauli short, restricted to declivous part of mesonotum. Antenna with 32-33 antennomeres, second flagellomere distinctly twice as long as first flagellomere; flagellomeres 16-26 or 18-28 (i.e. 11 flagellomeres) pale yellow. First tergite 1.5-1.6 times as long as broad behind (Fig. 12). Radial vein reaching tip of wing (Fig. 10), *n. rec.* interstitial (Fig. 11) **I. pallida** sp. n.

2 (1) Notauli long, extending to disc of mesonotum too though not uniting in mesonotal dimple. Antenna with 29 antennomeres, second flagellomeres just 1.5 times as long as first flagellomere; flagellomeres 18-23 (i.e. 6 flagellomeres) pale yellow. First tergite twice as long as broad behind. Radial vein approaching tip of wing, *n. rec.* antefurcal (Tafel 15: Abb. 3 in KÖNIGSMANN 1960: 653). Ovipositor sheath shorter than metasoma. Ground colour of body black **I. brevicauda** TELENGA

From among the *Idiasta* species distributed in India and Burma the new species seems to be allied to *I. burmensis* BHAT, 1979; on the basis of BHAT's key (1979) to the Indian *Idiasta* species as well as of the original description of *I. burmensis* the new species is distinguished by the following features keyed:

1 (2) Antenna with 32-33 antennomeres, flagellum with a pale ring. In dorsal view temple not protruding beyond eyes, i.e. head between eyes and between temples equally broad. First tergite less long and less slender, 1.5-1.6 times as long as broad behind (Fig. 12). Ground colour of body brownish yellow, head brownish black to blackish **I. pallida** sp. n.

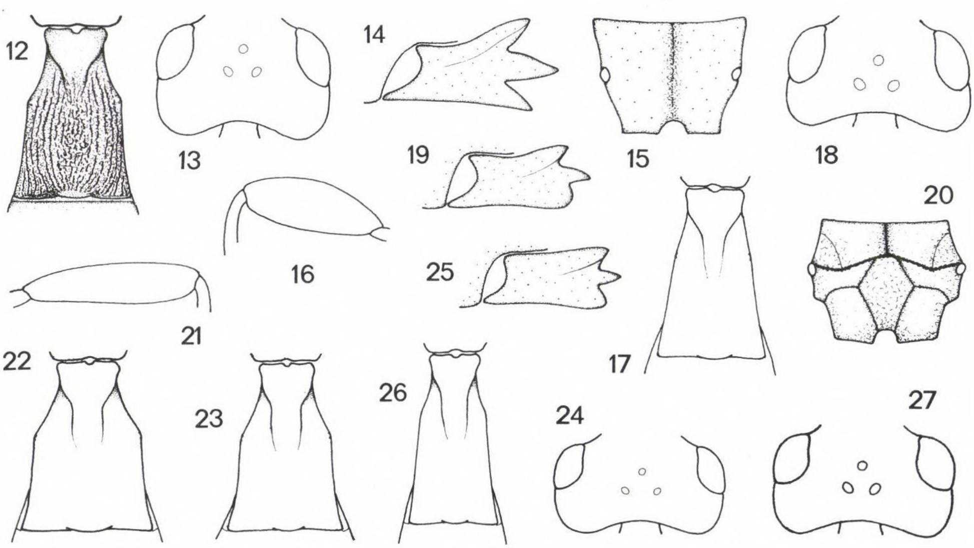
2 (1) Antenna with 22 antennomeres, flagellum without light coloured ring. In dorsal view temple protruding beyond eyes, i.e. head between temples somewhat broader than between eyes. First tergite long and slender, twice as long as broad behind. Ground colour of body blackish brown **I. burmensis** BHAT

Synaldis distenta sp. n. ♀
(Figs 13-17)

Holotype ♀. – Body 1.8 mm long. Head in dorsal view (Fig. 13) less transverse, 1.54 times as broad as long, eye somewhat longer than temple, latter rounded. Ocelli small elliptic, POL:OD:OOL as 4:3:7. Mandible in outer view (Fig. 14) nearly 1.6 times as long as broad between teeth 1 and 3, all three teeth pointed, between teeth 1–2 and 2–3 incised. – Antenna short, about as long as head, mesosoma and one–third of metasoma, with 16 antennomeres. First flagellomere 1.4 times as long as second flagellomere and 2.3 times as long as broad apically, middle flagellomeres 1.5 times and penultimate flagellomere twice as long as broad.

Mesosoma in lateral view 1.42 times as long as high. Mesonotal dimple distinct, i.e. less deep and just linearform. Prescutellar furrow with fine crenulation. Propodeum polished and with a hardly distinct medio–longitudinal keel, along keel rugulose, pair of spiracles medially and close to lateral margin of propodeum (Fig. 15). – Legs: Hind femur thick (Fig. 16), three times as long as broad somewhat distally from its middle. Middle and fore femora also three times as long as broad. – Forewing somewhat longer than body, *r3* twice as long as *r1–2* and slightly arched.

First tergite 1.5 times as long as (Fig. 17) broad behind, pair of spiracles before middle of tergite, tergite itself evenly broadening posteriorly, pair of keels merging into sculpture posteriorly. First tergite rather longitudinally rugulose, laterally uneven, further tergites polished. – Hypopygium behind truncate somewhat convex, ovipositor sheath weakly curved upwards, as long as first tergite or hind tarsal segments 1–2.



Figs 12–27. – Fig. 12. *Idiasta pallida* sp. n.: first tergite. – Figs 13–17. *Synaldis distenta* sp. n.: 13 = head in dorsal view, 14 = mandible, 15 = propodeum, 16 = hind femur, 17 = first tergite. – Figs 18–23. *Synaldis fuscoflava* sp. n.: 18 = head in dorsal view, 19 = mandible, 20 = propodeum, 21 = hind femur, 22–23 = first tergite, female (22) and male (23). – Figs 24–26. *Synaldis distracta* (NEES): 24 = head in dorsal view, 25 = mandible, 26 = first tergite. – Fig. 27. *Synaldis hirsuta* sp. n.: head in dorsal view

Ground colour of body blackish brown (head + mesosoma) and brown (metasoma), propodeum also brown, first tergite brownish yellow. Scape and pedicel yellowish, flagellum darkening greyish–brownish. Palpi, tegulae and legs yellow. Wings hyaline, pterostigma and veins brownish.

♂ and host unknown.

Type material. Holotype ♀: Korea, Prov. Gang-von, district On-dzong, Kumgang-san, along Okru dong, 250–300 m, 7 August 1975, leg. J. PAPP et A. VOJNITS, No. 324. – Holotype is deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym. Typ. No. 7552.

Etymology. The species name "*distenta*" refers to the thickened femora.

Distribution: Korea.

Considering the unusually thickened hind femur (i.e. three times as long as broad) the new species, *Synaldis distenta* sp. n., stands nearest to *S. globipes* FISCHER, 1962 (Croatia: Istria) and *S. lacessiva* FISCHER, 1975 (Austria). The three species are differentiated by the following features keyed below:

1 (4) Mesonotum with a distinct dimple. Hind margin of mesopleuron smooth, i.e. not crenulated. Propodeum polished, with a medio longitudinal keel.

2 (3) In dorsal view temple bulged, i.e. head between temples somewhat broader than between eyes. Lower or third tooth of mandible rounded (Abb. 23 in FISCHER 1975: 321). First tergite twice as long as broad behind. Antenna with 15 antennomeres, first flagellomere 1.5 times as long as broad apically ♀ : 1.5 mm **S. lacessiva** FISCHER, 1975

3 (2) In dorsal view temple (Fig. 13) not bulged, rounded, i.e. head between temples as broad as between eyes. Lower or third tooth of mandible pointed (Fig. 14). First tergite (Fig. 17) 1.46 times as long as broad behind. Antenna with 16 antennomeres, first flagellomere 1.4 times as long as broad apically. ♀: 1.8 mm **S. distenta** sp. n.

4 (1) Mesonotum without dimple, i.e. entirely polished. Hind margin of mesopleuron finely crenulated. Propodeum uneven with smooth and shiny fields, with a faintly distinct areola on its vertical hind part, its medio-longitudinal keel restricted basally (to its horizontal part). Temple in dorsal view not bulged. Antenna with 15 antennomeres. First tergite twice as long as broad behind. ♀: 1.6 mm **S. globipes** FISCHER, 1962

On the basis of FISCHER's key (1967*c*: 433) to the Nearctic species of the genus *Synaldis* the new species runs to *S. acutidens* FISCHER, 1967 (USA), their common features are as follows: (1) less transverse head, (2) all three teeth of mandible pointed, (3) propodeum polished and with a medio-longitudinal keel, (4) hind femur thick, (5) ovipositor sheath as long as first tergite. The two species are separated by a few and rather hardly recognizable features keyed:

1 (2) First tergite (Fig. 17) 1.5 times as long as broad behind. Prescutellar furrow finely crenulated. Hind femur three times as long as broad somewhat distally from its middle (Fig. 16) **S. distenta** sp. n.

2 (1) First tergite twice as long as broad behind. Prescutellar furrow smooth. Hind femur 3.5 times as long as broad distally from its middle. (Abb. 2 in FISCHER 1967: 434) **S. acutidens** FISCHER

Synaldis fuscoflava sp. n.
(Figs 18–23)

Holotype ♀. – Body 2.5 mm long. Head in dorsal view (Fig. 18) transverse, 1.74 times as broad as long, temple indistinctly broadening, i.e. head between temples a bit broader than between eyes, eye 1.6 times as long as temple. Ocelli small, somewhat elliptic, POL:OD:OOL as 5:4:8-9. Mandible in outer view (Fig. 19) clearly twice as long as broad between teeth 1 and 3, teeth 1 and 2 pointed, tooth 3 rounded, between teeth 1 and 2 somewhat more incised than between teeth 2 and 3. – Antenna somewhat shorter than body, with 19 antennomeres. First flagellomere three times as long as broad apically, middle flagellomeres about 1.6 times as long as broad, penultimate flagellomere twice as long as broad.

Mesosoma in lateral view 1.3 times as long as high. Mesonotal dimple distinct, i.e. deep and linearform. Prescutellar furrow smooth. Propodeum (Fig. 20) with a strong transverse keel, anteriorly of it (or horizontal part of propodeum) smooth and shiny, only laterally uneven, posteriorly of it (or vertical part of propodeum) areolate rugo–rugulose, areolation indistinct, medio–longitudinal keel anteriorly distinct. – Legs: Hind femur four times as long as broad (Fig. 21). – Forewing as long as body. Veins *r3* distinctly twice as long as *r1–2*.

First tergite (Fig. 22) broad, 1.32 times as long as broad behind, pair of spiracles before middle of tergite, tergite itself slightly more broadening from base to spiracle than beyond spiracles; pair of keels merging about middle of tergite into longitudinal rugo–striation. Further tergites polished. Hypopygium small and behind truncate, ovipositor sheath as long as half hind tibia.

Body brownish yellow; frons, vertex, occiput and temple brown, lateral lobe of mesonotum also brown, metasoma yellowish. Scape and pedicel yellow, flagellum darkening yellowish brown to brown. Palpi, tegula and legs yellow. Wings hyaline, pterostigma and veins brownish.

Description of the male paratype (1 ♂). – Similar to the female holotype. Body 2.4 mm long. Head in dorsal view 1.74 times as broad as long. Antenna about one–third longer than body, with 23 antennomeres. First tergite (Fig. 23) 1.5 times as long as broad behind, beyond spiracle subparallel–sided, 1.53 times broader at hind than at base. Ground colour of body brown, head and mesonotum blackish brown. Palpi, tegula and legs yellow.

Host unknown.

Type material. – Holotype ♂: Korea, Prov. South Pyongan, Desang-san, 12 km NE from Pyongyan, 7 August 1971, leg. S. HORVATOVICH et J. PAPP, No. 145. – 1 ♂ paratype: Korea, Prov. South Pyongan, Mangyongdae, 5 August 1971, leg. S. HORVATOVICH et J. PAPP, No. 140.

Types are deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym. Typ. Nos 7553 (holotype) and 7554 (paratype).

Etymology. The species name "*fuscoflava*" refers to the corporal ground colour of the new species.

Distribution: Korea.

With the help of FISCHER's key (1970*a*: 24–26) to the European species of the genus *Synaldis* the new species, *Synaldis fuscoflava* sp. n., runs to *S. distracta* (NEES, 1834) (Palaearctic Region). The two species are distinguished by a few though clear-cut features keyed below:

1 (2) In dorsal view eye 1.6 times as long as temple (Fig. 18). First tergite broad, 1.3–1.5 times as long as broad behind, longitudinally striate-rugose (Figs 22–23). Antenna with 19–23 antennomeres. Transverse keel of propodeum strong (Fig. 20). Mandible see in Fig. 19. Ground colour of body brownish yellow, head + mesosoma more or less dark. **S. fuscoflava** sp. n.

2 (1) In dorsal view eye as long as or a bit longer than temple (Fig. 24). First tergite less broad, twice as long as broad behind, rugose (Fig. 26). Antenna with 16–20 antennomeres. Transverse keel of propodeum less strong. Mandible see in Fig. 25. Ground colour of body black, at most with brown(ish) suffusion. **S. distracta** (NEES)

The new species seems to be related to *S. liliputana* FISCHER, 1967 (Nearctic Region: U.S.A.) (see FISCHER's key 1967*c*: 433 and 440), they are distinguished by the following features:

1 (2) First tergite 1.3–1.5 times as long as broad behind, twice as broad behind as basally (Figs 22–23). Propodeum with a distinct and strong transverse keel (Fig. 20). Tooth 1 of mandible pointed, tooth 3 relatively less rounded (Fig. 19). Ground colour of body brownish yellow, head and mesosoma more or less dark. **S. fuscoflava** sp. n.

2 (1) First tergite twice as long as broad behind, 1.7 times as broad behind as basally. Propodeum with a less distinct, i.e. weak transverse keel. Tooth 1 of mandible slightly less pointed, tooth 3 relatively more rounded. Ground colour of body dark brown. **S. liliputana** FISCHER

The new species is related to *S. nigriceps* sp. n., in several respects they are very similar to each other, however, a few features differentiate them specifically, further contributions see at this species.

Synaldis hirsuta sp. n.
(Figs 27–31)

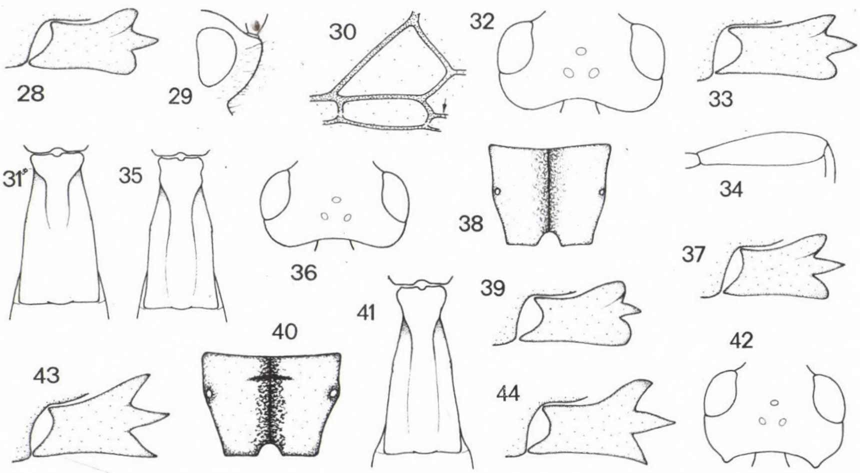
Holotype ♀. – Body 2.1 mm long. Head in dorsal view (Fig. 27) transverse, 1.73 times as broad as long, eye 1.36 times as long as temple, latter rounded. Ocelli small and almost round, distance between fore and hind ocelli one–fifth longer than POL, POL:OD:OOL as 4:3:11. Mandible in outer view 1.75 times as long as broad between teeth 1 and 3, middle tooth pointed, upper and lower teeth rounded (lower one more rounded than upper one), faintly incised between teeth 1–2 and 2–3 (Fig. 28). Face and clypeus with unusual dense and long hairs (Fig. 29). – Antenna about as long as body, with 18 antennomeres. First flagellomere three times as long as broad apically, middle flagellomeres distinctly twice as long as broad and penultimate flagellomere 2.33 times as long as broad.

Mesosoma in lateral view 1.44 times as long as high. Mesonotal dimple distinct, deep and linearform, mesonotum with dense and long hairs similar to those of face. Prescutellar furrow subcrenulated. Propodeum on its anterior horizontal part uneven to smooth, on its vertical part rugose–rugulose with a faint five–sided middle areola. – Legs: Hind femur 4.8 times as long as broad distally. – Forewing: veins *r3* somewhat more than twice as long as *r1–2*. Discal cell relatively wide (Fig. 30), *n. bas* 2.75 times as long as *n. rec.*; *n. par.* issuing below from outer side of subdiscal cell (Fig. 30).

First tergite (Fig. 31) twice as long as broad behind, pair of spiracles just before middle of tergite, tergite itself evenly broadening posteriorly; pair of converging keels short, merging into rugosity about middle of tergite. First tergite rather longitudinally rugose, laterally rugulose to uneven, further tergites polished. – Hypopygium behind truncate, ovipositor sheath and ovipositor curving upwards and about as long as hind tarsal segments 1–3.

Ground colour of body brown to dark brown, head blackish brown. Clypeus, mandible and scape + pedicel yellowish, flagellum darkening yellowish to brown, dark brown. Palpi, tegula and legs yellow. First tergite brownish yellow. Wings hyaline, pterostigma and veins brownish.

Description of the male paratype (1 ♂). – Similar to the holotype. Body 2.1 mm long. Head in dorsal view transverse, 1.71 times as broad as long. Antenna somewhat longer than body, with 25 antennomeres. Hind femur five times as long as broad. Head and mesosoma blackish brown, metasoma brown, first tergite brownish yellow.



Figs 28–44. – Figs 28–31. *Synaldis hirsuta* sp. n.: 28 = mandible, 29 = anterior half of head in lateral view with hairs, 30 = discal and subdiscal cells of fore wing with indication of *n. par.* (④), 31 = first tergite. – Figs 32–35. *Synaldis nigriceps* sp. n.: 32 = head in dorsal view, 33 = mandible, 34 = hind femur, 35 = first tergite. – Figs 36–38. *Synaldis sincera* sp. n.: 36 = head in dorsal view, 37 = mandible, 38 = propodeum. – Figs 39–41. *Synaldis vestigata* sp. n.: 39 = mandible, 40 = propodeum, 41 = first tergite. – Figs 42–43. *Synaldis reducta* (TOBIAS): 42 = head in dorsal view, 43 = mandible. – Fig. 44. *Synaldis nitidula* (MASI): mandible

Host unknown.

Type material. – Holotype ♀: Korea, Mt Pektusan, environs Samziyon. Hotel, wood: netting in grasses, 18–20 July 1977, leg. DELY et DRASKOVITS, No. 374. – paratype: Korea, Prov. Ryang–gang, Chann–pay plateau, Mt Pektusan, Mudobong, 2100–2200 m, 25 July 1975, leg. J. PAPP et A. VOJNITS, No. 288.

Types are deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym. Typ. Nos 7555 (holotype) and 7556 (paratype).

Etymology. The species name "*hirsuta*" refers to the unusually hairy face and mesonotum.

The new species, *Synaldis hirsuta* sp. n., stands nearest to *S. sulcata* FISCHER, 1962 (Croatia, Tunisia) considering their pubescent face; the two species differ from each other by the following features keyed:

1 (2) Head in dorsal view 1.7 times as long as broad; head behind eye not broadening, i.e. between temples as broad as between eyes; eye 1.36 times as long as temple (Fig. 27). Antenna with 18 antennomeres; first flagellomere three times and middle flagellomeres clearly twice as long as broad. Fore wing: *n. bas.* 2.75 times as long as *n. rec.,* first discal cell relatively wide; *n. par.* issuing below middle of subdiscal cell (Fig. 30)
S. hirsuta sp. n.

2 (1) Head in dorsal view twice as broad as long; head behind eye broadening, i.e. between temples broader than between eyes; eye as long as temple. Antenna with 17 antennomeres; first flagellomere about twice and middle flagellomeres about 1.5 times as long as broad. Fore wing: *n. bas.* twice as long as *n. rec.,* thus first discal cell relatively less wide; *n. par.* issuing from middle of subdiscal cell (Abb. 21 in FISCHER 1962: 20).
S. sulcata FISCHER

Synaldis nigriceps sp. n. ♀
(Figs 32–35)

Holotype ♀. – Body 1.7 mm long. Head in dorsal view (Fig. 32) transverse, 1.8 times as broad as long, eye almost twice as long as temple. Ocelli small and elliptic, distance between fore and hind ocelli one-fourth longer than POL, POL:OD:OOL as 3:3:7. Mandible (Fig. 33) twice as long as broad between teeth 1 and 3, teeth 1 and 2 pointed, tooth 3 rounded, between teeth 1 and 2 incised. – Antenna as long as body, with 17 antennomeres. First flagellomere clearly three times as long as broad apically, middle flagellomeres clearly twice as long as broad, penultimate flagellomere twice as long as broad.

Mesosoma in lateral view 1.25 times as long as high. Mesonotal dimple distinct, i.e. deep and short linearform. Prescutellar furrow smooth. Propodeum quite similar to that of *S. fuscoflava* sp. n. (cf. Fig. 20). – Legs: Hind femur four times as long as broad distally (Fig. 34). – Forewing as long as body. Veins *r3* distinctly twice as long as *r1–2.*

First tergite (Fig. 35) twice as long as broad behind, pair of spiracles at middle of tergite, tergite itself moderately broadening from base to spiracle, beyond spiracle subparallel-sided; pair of keels almost reaching hind end of tergite. First tergite longitudinally rugulose uneven, further tergites polished. Hypopygium small and behind truncate somewhat convex, ovipositor sheath in lateral view somewhat curved upwards and as long as hind tarsal segments 1–3 or one-fourth shorter than hind tibia.

Ground colour of body yellow to brownish yellow, head blackish with brownish suffusion on face and clypeus. Scape, pedicel and flagellomeres 1–2 yellow, rest of flagellum darkening brownish yellow to brownish. Palpi, tegula and legs yellow. Wings hyaline, pterostigma and veins brownish.

Description of the female paratypes (2 ♀♀). – Similar to holotype ♀. Body 1.7–1.8 mm long (1.7: 1 ♀, 1.8: 1 ♀). Head in dorsal view 1.71 (1 ♀) and 1.8 times (1 ♀) as broad as long. Antenna with 17 antennomeres (1 ♀), flagellum of second female (loc. No. 144) damaged (right antenna with 12 and left antenna with 13 antennomeres). First tergite 1.9 times (1 ♀) and twice (1 ♀) as long as broad behind.

♂ and host unknown.

Type material. – Holotype ♀ : Korea, Prov. South Pyongan, Lyongak–san, 14 km W from Pyongyan, 11 August 1971, leg. S. HORVATOVICH et J. PAPP, No. 160. – Paratypes (2 ♀♀): 1 ♀ : Korea, South Pyongan, Pyongyan, Hotel garden, taken with Malaise trap, 5–6 August 1971, leg. S. HORVATOVICH et J. PAPP, No. 144. 1 ♀ : same locality and collectors as No. 144, 31 August 1971, No. 225.

Types are deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym. Typ. Nos 7557 (holotype) and 7558–7559 (paratypes).

Etymology. The species name "*nigriceps*" refers to the blackish coloured head.

Distribution: Korea.

From among the Palaearctic species of the genus *Synaldis* the new species, *Synaldis nigriceps* sp. n., stands nearest to *S. distracta* (NEES, 1834) (Palaearctic Region), with the help of FISCHER's key (1970*a*: 24–26) it runs to this species. The distinctive features between them are little and rather difficult to recognize disregarding their colour:

1 (2) In dorsal view temple half or a bit more than half as long as eye (Fig. 32). First tergite beyond spiracles subparallel-sided, pair of keels reaching near to hind end of tergite (Fig. 35), surface of tergite rugulose to uneven, subshiny. Body yellow to brownish yellow, head blackish. **S. nigriceps** sp. n.

2 (1) In dorsal view temple as long as or a bit shorter than eye (Fig. 24). First tergite more or less evenly broadening posteriorly, pair of keels reaching beyond middle of tergite (Fig. 26), surface of tergite rugose. Body black, at most with brownish suffusion **S. distracta** (NEES)

The new species agrees in several respects with *S. fuscoflava* sp. n. (colour of body, proportional length of flagellomeres, sculpture of propodeum etc.), however, they are differentiated by a few specific features disclosed below:

1 (2) In dorsal view temple not broadening behind eye (Fig. 32). Antenna with 17 antennomeres. First tergite twice as long as broad behind. Hind femur relatively more broadening distally (Fig. 34) **S. nigriceps** sp. n.

2 (1) In dorsal view temple a bit broadening behind eye (Fig. 18). Antenna with 19 antennomeres. First tergite 1.3 times as long as broad behind (Fig. 22). Hind femur relatively less broadening distally (Fig. 21) **S. fuscoflava** sp. n.

With the help of FISCHER's key (1967*c*: 433 and 440) to the Nearctic species of the genus *Synaldis* the new species seems to stand nearest to *S. exitiosae* FISCHER, 1967 (U.S.A.), on the basis of the original description *S. exitiosae* differs from my species in the following features:

1 (2) Head in dorsal view equally broad between eyes and temples (Fig. 32). Antenna with 17 antennomeres, first flagellomere three times as long as broad apically. Mesonotal dimple distinct, deep and short linearform. Propodeum without areola (cf. Fig. 20). Hind femur four times as long as broad (Fig. 34). Ground colour of body yellow to brownish yellow, head blackish **S. nigriceps** sp. n.

2 (1) Head in dorsal view broader between eyes than between temples. Antenna with 14-15 antennomeres. First flagellomere twice as long as broad apically. Mesonotal dimple very small and rather indistinct. Propodeum with a faint five-sided areola. Hind femur about three times as long as broad. Ground colour of body brown **S. exitiosae** FISCHER

Synaldis sincera sp. n. ♀
(Figs 36–38)

Holotype ♀. – Body 1.3 mm long. Head in dorsal view (Fig. 36) transverse, 1.75 times as broad as long, eye almost twice as long as temple. Ocelli small and elliptic, POL:OD:OOL as 3:2:7. Mandible in outer view (Fig. 37) 1.8 times as long as broad between teeth 1 and 3, tooth 2 pointed, teeth 1 and 3 rounded, between teeth 1–2 and 2–3 incised. – Antenna about as long as body, with 15 antennomeres, first flagellomere 1.28 times as long as second flagellomere and four times as long as broad apically, middle flagellomeres 2.8 times and penultimate flagellomere 2.4 times as long as broad.

Mesosoma in lateral view 1.5 times as long as high. Mesonotal dimple absent, prescutellar furrow smooth. Propodeum (Fig. 38) uneven to smooth and shiny, with a medio–longitudinal weak keel and along its surface relatively widely rugulose-subrugulose. – Legs: Hind femur 3.8 times as long as broad slightly distally from its middle. – Forewing one-fifth longer than body. Veins *r3* somewhat more than twice as long as *r1–2,* latter vein unusually hardly arched.

First tergite (cf. Fig. 31) twice as long as broad behind. Pair of spiracles at middle of tergite, tergite itself from base to spiracles moderately broadening, beyond spiracles subparallel; pair of keels merging into sculpture about middle of tergite. First tergite longitudinally uneven to subrugulose-rugulose antero-posteriorly, further tergites polished. Hypopygium truncate behind, ovipositor sheath as long as hind tibia.

Ground colour of body brown, first tergite brownish yellow, prosternum light brownish. Scape and pedicel yellowish, flagellum darkening yellowish to brownish and brown. Palpi, mandible, tegula and legs yellow. Wings hyaline, pterostigma and veins brownish.

♂ and host unknown.

Type material. – Holotype ♀ : Korea, Kumgang san, Lake Sam–Il, netting in grasses, 10 July 1977, leg. DELY et DRASKOVITS, No. 357. – Holotype is deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym. Typ. No. 7560.

Etymology. The species name "*sincera*" (=clear) refers to the evident relationship to *S. parvicornis* THOMSON.

Distribution: Korea.

The new species, *Synaldis sincera* sp. n., seems to be closely related to *S. parvicornis* THOMSON, 1895 (Europe) considering their antenna with 15–16 antennomeres, smooth propodeum, mesosoma 1.5 times as long as high, first tergite twice as long as broad, mesonotal dimple absent and smooth prescutellar furrow. The two species differ from each other by the following features keyed below:

1 (2) Head in dorsal view transverse, 1.75 times as broad as long, temple distinctly shorter than eye (Fig. 36). Propodeum without areola (Fig. 38). Flagellomeres almost three times as long as broad. Ovipositor sheath as long as hind tibia. Ground colour of body brown. Body 1.3 mm long
S. sincera sp. n.

2 (1) Head in dorsal view, subcubic, 1.6 times as broad as long, temple distinctly longer than eye (Abb. 18 in FISCHER 1962: 18). Propodeum with a faint areola. Flagellomeres at most 1.5 times as long as broad. Ovipositor sheath very short. Ground colour of body black. Body 1.6 mm long
S. parvicornis THOMSON

Synaldis vestigata sp. n. ♀
(Figs 39–41)

Holotype ♀ . – Body 2.1 mm long. Head in dorsal view (cf. Fig. 32) transverse, 1.82 times as broad as long, eye almost twice as long as temple, latter rounded. Ocelli small, somewhat elliptic, POL:OD:OOL as 5:4:8. Mandible in outer view (Fig. 39) 1.7 times as long as broad between teeth 1 and 3, tooth 2 relatively short and pointed between, teeth 2 and 3 somewhat incised, teeth 1 and 3 round. – Antenna somewhat shorter than body, with 19 antennomeres. First flagellomere three times as long as broad, middle flagellomeres just twice and penultimate flagellomere somewhat attenuating and twice as long as broad.

Mesosoma in lateral view 1.5 times as long as high. Mesonotal dimple distinct, i.e. deep and linearform. Prescutellar furrow smooth. Propodeum polished, with a medio-longitudinal keel, along keel rugose; medio-anteriorly with a short transverse keel (Fig. 40). – Legs: Hind femur four times as long as broad distally. – Forewing: Veins *r3 2.5 times as long as r1–2.*

First tergite long (Fig. 41), 2.14 times as long as broad behind, evenly broadening posteriorly, pair of its keels subparallel and reaching hind end of tergite. First tergite rugulose, further tergites polished. Hypopygium small and behind truncate; ovipositor sheath somewhat longer than first tergite or as long as hind tarsal segments 2–4.

Body brownish black, first tergite brownish yellow. Scape and pedicel yellowish brown, flagellum darkening brown to blackish brown. Mandible yellowish, palpi yellow. Tegula brown. Legs yellow, hind tibia and tarsus dark. Wings hyaline, pterostigma and veins opaque brownish-greyish.

Description of the female paratypes (4 ♀♀). – Body 1.9–2.1 mm long (1.9: 1 ♀, 2: 2 ♀♀, 2.1: 1 ♀). Head in dorsal view 1.83–1.9 times as broad as long (1.83: 2 ♀♀, 1.89: 1 ♀. 1.9: 1 ♀). Antenna with 17–18 antennomeres (17: 1 ♀, 18: 3 ♀♀). First tergite 1.9–2.1 times as long as broad behind (1.9: 1 ♀, 2: 2 ♀♀, 2.1: 1 ♀). Body blackish (2 ♀♀) and metasoma brown to dark brown (1 ♀).

♂ and host unknown.

Type material. – Holotype ♀: Korea, Pyongyang City, Botongyang Park, 30 May 1985, leg. A. VOJNITS et L. ZOMBORI, No. 961. – Paratypes (4): 1 : Korea, Prov. South Pyongan, Pyongyan, Hotel garden, taken with Malaise–trap, 5–6 August 1971, leg. S. HORVATOVICH et J. PAPP, No. 144. 1 : Korea, Desang san, 10 km NE from Pyongyan, swept in grasses, 1 July 1977, leg. DELY et DRASKOVITS. 1 : Korea, Kangwon Prov., Kumgang san, 27 May 1985, leg. A. VOJNITS et L. ZOMBORI, No. 951. 1 ♀: same data as for holotype.

Types are deposited in the Hungarian Natural History Museum (Zoological Department), Budapest; Hym. Typ. Nos 7561 (holotype) and 7562–7565 (paratypes).

Etymology. The species name "*vestigata*" refers to the transverse keel restricted to medio–anteriorly of propodeum, i.e. the transverse keel is present only "in vestige".

Distribution: Korea.

Considering the polished propodeum with a medio-longitudinal keel the new species, *Synaldis vestigata* sp. n., is allied with three species: *S. lacessiva* FISCHER, 1975 (Austria), *S. nitidula* (MASI, 1933) (Italy) and *S. reducta* (TOBIAS, 1962) (Austria, Russia). On the basis of their descriptions *S. reducta* seems to stand nearest to the new species, the distinctive features of the two species are disclosed as follows:

1 (2) Occiput without tubercle (cf. Fig. 32). Teeth 1 and 3 of mandible apically rounded (Fig. 39). Veins *r3* clearly twice as long as *r1-2*. Mesosoma in lateral view 1.5 times as long as high. Propodeum medio-anteriorly with a short transverse keel (Fig. 40). First flagellomere three times as long as broad apically **S. vestigata** sp. n.

2 (1) Occiput with a pair of tubercles (Fig. 42). Teeth 1 and 3 of mandible apically pointed (Fig. 43). Veins *r3* 1.5 times as long as *r1-2*. Mesosoma in lateral view 1.4 times as long as high. Propodeum without transverse keel. First flagellomere twice as long as broad apically **S. reducta** THOMSON

The species *S. lacessiva* and *S. nitidula* differ from the new species in a few and easily recognizable features which are tabulated below:

1 (2) Head in dorsal view transverse (cf. Fig. 32), 1.8-1.9 times as broad as long. Antenna with (17-)18-19 antennomeres, first flagellomere three times as long as broad apically, flagellomeres about twice as long as broad. Hind femur four times as long as broad. Teeth 1 and 3 of mandible rounded (Fig. 39) **S. vestigata** sp. n.

2 (1) Head in dorsal view less transverse, 1.5-1.6 times as broad as long. Antenna with 15-18 antennomeres, first flagellomere at most twice as long as broad apically, flagellomeres rather subcubic. Hind femur at most 3.7 times as long as broad. Tooth 1 or teeth 1 and 3 pointed.

3 (4) Temple in dorsal view bulged, i.e. head between temples broader than between eyes. First flagellomere 1.5 times as long as broad apically. Hind femur three times as long as broad. Tooth 1 of mandible pointed, tooth 3 rounded (Abb. 23 in FISCHER 1975: 321) **S. lacessiva** FISCHER, 1975

4 (3) Temple in dorsal view not bulged, i.e. head between temples and eyes equally broad. First flagellomere twice as long as broad apically. Hind femur 3.5-3.7 times as long as broad. Teeth 1 and 3 of mandible pointed (Fig. 44) **S. nitidula** (MASI, 1933)

With the help of FISCHER's key (1967*c*: 433) to the Nearctic species of the genus *Synaldis* the new species runs to *S. rotundidens* FISCHER, 1967 (U.S.A), the distinctive features between them are disclosed in a key below:

1 (2) Head in dorsal view 1.8-11.9 times as broad as long, temple broadening behind eye (cf. Fig. 32). Antenna with 17-19 antennomeres. Mesonotal dimple deep and linearform, i.e. distinct. Tegula brown **S. vestigata** sp. n.

2 (1) Head in dorsal view 1.6 times as broad as long, temple slightly broadening behind eye. Antenna with 22 antennomeres. Mesonotal dimple shallow and round, i.e. hardly distinct. Tegula yellow **S. rotundidens** FISCHER

REFERENCES

ACHTERBERG, C. VAN (1983) A revision of the genus Hylcalosia Fischer (Hymenoptera: Braconidae, Alysiinae). *Zool. Med.* **57** (8): 81–90.

BELOKOBYLSKIJ, S. A. (1992) Finding of the genus Hylcalosia (Hymenoptera, Braconidae, Alysiinae) of the USSR and descriptions of two new species from the South of the Far East. *Zool. Zh.* **71**(5): 143-149.

BHAT, SH. (1979) Indian species of Idiasta FOERSTER (Hymenoptera: Braconidae: Alysiinae). *Oriental Ins.* **12**(4) (1978): 473–479.

FISCHER, M. (1962) Das Genus Synaldis FOERSTER (Hymenoptera, Braconidae). *Mitt. Zool. Mus. Berlin* **38**(1): 1–21.

FISCHER, M. (1966*a*) Über gezüchtete Braconiden aus Europa (Hymenoptera). *Zschr. angew. Zool.* **58**(4): 323–339.

FISCHER, M. (1966*b*) Die nearktischen Aphaereta–Arten (Hymenoptera, Braconidae). *Reichenbachia* **6**(21): 155–173.

FISCHER, M. (1966*c*) Studien über Alysiinae (Hymenoptera, Braconidae). *Ann. Naturhist. Mus. Wien* **69**: 177–205.

FISCHER, M. (1967*a*) Seltene Alysiinae aus verschiedenen Erdteilen. *Ann. Naturhist. Mus. Wien* **70**: 109–138.

FISCHER, M. (1967*b*): Revision der burgenländischen Arten der Gattungen Synaldis, Aphaereta und Alysia (Hymenoptera, Braconidae, Alysiinae). *Wiss. Arbeiten Bgld.* **38**: 92–135.

FISCHER, M. (1967*c*) Die nearktischen Arten der Gattung Synaldis FOERSTER (Hymenoptera, Braconidae, Alysiinae). *Polskie Pismo Ent.* **37**(3): 431–478.

FISCHER, M. (1970*a*) Die Alysiini der Steiermark (Hymenoptera, Braconidae). *Mitt. Abt. Zool. Bot. Landesmus. "Joanneum" Graz* **34**: 1–44.

FISCHER, M. (1970*b*) Zur Kenntnis der europäischen Phaenocarpa–Arten mit besonderer Berücksichtigung der Fauna Niederösterreichs (Hymenoptera, Braconidae, Alysiinae). *Zschr. angew. Zool.* **57**: 409–498.

FISCHER, M. (1971) Untersuchungen über die europäischen Alysiini mit besonderer Berücksichtigung der Fauna Niederösterreichs (Hymenoptera, Braconidae). *Polskie Pismo Ent.* **41**(1): 19–160.

FISCHER, M. (1975) Alysiinen–Wespen aus der Umgebung von Hüttenberg in Kärnten (Hymenoptera, Braconidae, Alysiinae). *Carinthia II* **165**(85): 303–342.

KÖNIGSMANN, E. (1960) Revision der paläarktischen Arten der Gattung Idiasta. 3. Beitrag zur systematischen Bearbeitung der Alysiinae (Hymenoptera: Braconidae). *Beitr. Ent.* **10**(5–6): 624–654.

PAPP, J. (1968) A survey of the Phaenocarpa FOERSTER species of the Carpathian Basin, Central Europe (Hymenoptera, Braconidae: Alysiinae). *Beitr. Ent.* **18**: 569–603.

PAPP, J. (1990) Braconidae (Hymenoptera) from Korea, XII. *Acta zool. hung.* **36**(1–2): 87–119.

PAPP, J. (1991) Braconidae (Hymenoptera) from Mongolia, XI. *Acta. zool. hung.* **37**(3–4): 217–224.

PAPP, J. (1992) Braconidae (Hymenoptera) from Korea, XIV. *Acta zool. hung.* **38**(1–2): 63–73.

TELENGA, N. A. (1935) Beiträge zur Kenntnis der Tribus Alysiini (Braconidae, Hymenoptera) aus USSR. *Konowia* **14**: 186–190.

TOBIAS, V. I. (1962) Contribution to the fauna of the subfamily Alysiinae (Hymenoptera, Braconidae) of the Leningrad region. *Proc. Zool. Inst.* **31**: 81–137. [In Russian with English title.]

TOBIAS. V. I. (1986) 27. order Hymenoptera, family Braconidae (1). *Key to the Insects of the European Part of the USSR* 3 Hym. **4**: 1–501. [In Russian.]

VET, L. E. M., JANSE, Ch., ACHTERBERG, C. VAN & ALPHEN, J. J. M. VAN (1984) Microhabitat location and niche segregation in two sibling species of Drosophila parasitoids: Asobara tabida (NEES) and A. rufescens (FOERSTER) (Braconidae: Alysiinae). *Oecologia* **61**: 182–188.

WHARTON, R. A. (1980) Review of the Nearctic Alysiini (Hymenoptera, Braconidae) with discussion of generic relationships within the tribe. *Univ. Calif. Publ. Entom.* **88**: I–XI + 1–112.

WHARTON, R. A. (1986) The braconid genus Alysia (Hymenoptera): a description of the subgenera and a revision of the subgenus Alysia. *Syst. Entom.* **11**: 453–504.

WHARTON, R. A. (1988) The braconid genus Alysia (Hymenoptera): a revision of the subgenus Anarcha. *Contr. Amer. Entom. Inst.* **25**(2): 1–69.

Received November 21, 1992; accepted December 1, 1993

Acta Zoologica Academiae Scientiarum Hungaricae 40 (2), pp. 157-170, 1994

ON THE TAXONOMY OF THE GENUS OSTHELDERA NYE, 1975 (LEPIDOPTERA, NOCTUIDAE, CUCULLIINAE)

L. RONKAY[1] and Z. VARGA[2]

[1]*Zoological Department, Hungarian Natural History Museum*
H-1088, Budapest, Baross u. 13., Hungary
[2]*Zoological Institute, University Kossuth Lajos, H-4010 Debrecen, Egyetem tér 1., Hungary*

The taxonomic relationships and the zoogeography of the genus are discussed, three new species, *O. minna* sp. n. (Turkmenistan, Afghanistan), *O. persa* sp. n. (Iran, Fars) and *O. arne* (Turkey, Hakkari) are described. With 38 original figures.

Key words: Noctuidae, Cuculliinae, *Ostheldera*, new species, zoogeography

INTRODUCTION

The genus *Pfeifferella* was erected by OSTHELDER in 1933 by a monotypy based on the newly described species, *gracilis* OSTHELDER, 1933, discovered in the Taurus Mts. Later this species was recorded from various places of Turkey and also from Iran and Tadjikistan (Mts Hissar). NYE (1975) clarified that the name *Pfeifferella* is already preserved for a Protozoan genus (*Pfeifferella* LABBÉ, 1899), therefore the OSTHELDER's name is a homonym. He proposed *Ostheldera* as a replacement name for the genus. The second species of the genus, *O. kondara* was described only recently (VARGA & RONKAY, 1991) and it was noted that an *Ostheldera* species – identified by BOURSIN as *O. gracilis* – occurs in East Afghanistan, being closer to *O. kondara* than to *O. gracilis*, therefore the previous records of *gracilis* became as dubious.

The study on the materials of some large collections and the new expeditions to South-East Turkey and Turkmenistan revealed that the genus is rather widespread from Central Turkey to the Hissaro-Pamir mountain system, represented by allopatric taxa which are interpreted here, on the basis of their external and genital features, as distinct species.

The characterization of the genus, the discussion of its phylogenetic connections, zoogeography and the descriptions of three new species are given in the following chapters.

DIAGNOSIS OF THE GENUS

External morphology: small or medium-sized species, wingspan 28-37 mm, length of forewings 12-17 mm. Head small, frons smooth, with roughly hairy ridges. Palpi short, porrect, eyes large, globular, with long, overhanging cilia. Antennae of males widely bipectinate with long, bar-like branches, axis of it covered smoothly with large scales. Antennae of females finely bipectinate with short branches. Thorax rather strong, collar large, pro- and metathoracic tufts well-developed, tegulae more or less distinct. Legs short, tibiae roughly hairy. Abdomen short, gracile, in females often curved caudally, covered mostly by scales and some scarce hairs only; anal tuft reduced, dorsal crest and coremata absent. Forewing elongated with apex often pointed, outer margin slightly arcuate and finely crenulate. Ground colour pale ochreous- or brownish grey, sometimes dark fumous grey, wing pattern simple, orbicular and reniform stigmata present, encircled with darker grey and filled with whitish-ochreous, claviform usually absent. Transverse lines diffuse or obsolescent, subterminal sometimes stronger, defined by fine dark arrowheads and/or lines on veins. Dark patch of tornus regularly present, often conspicuous; cilia brown-grey, finely spotted with whitish at veins. Hindwing significantly smaller, rounded, whitish or grey(ish), veins covered with brownish; inner margin partly covered with long, dark grey-brown hairs.

Male genitalia (Figs 1-18): uncus short, flattened, sclerotized, finely and shortly setose; distal part most often dilated, forming a heart-shaped apical third. Tegumen low, broad, strong, penicular lobes small, hairy. Fultura inferior large, calycular of subrectangular, lateral edges usually sclerotized; vinculum short, V-shaped. Valva elongated, margins more or less parallel, cucullus with weak corona and less pointed apex. Sacculus very short, rounded, clàvus reduced to a setose surface. Harpe relatively short, digitiform or wedge-shaped, oblique or straight, apex often acute; basal plate usually with a sclerotized proximal edge. Aedeagus short, cylindrical, distal end beak-shaped. Vesica short with globular basal and conical lateral part, basal half bears a smaller amount (8-25) rather short, pointed cornuti.

Female genitalia (Figs 19-22): ovipositor long, acute, papillae weakly sclerotized but apophyses long, strong. Ostium bursae membranous, cup-shaped, with fine, sclerotized proximal edge and a small ligula; ductus bursae short, membranous, finely wrinkled. Cervix bursae ovoid, flattened, gelatinous, corpus bursae elliptical or elongated-sacculiform, bearing two small signa.

ZOOGEOGRAPHY

The genus has a scattered area from the arid mountain ranges of Asia Minor (Taurus and Antitaurus Mts) through the Zaghros Mts and the Kopet-Dagh to the Hissaro-Pamir system. All known taxa are clearly allopatric, although the edges of the (known) areas sometimes not far from each other (e.g. *O. gracilis* and *O. arne*).

The genus can be considered, by distribution pattern of the species, as a member of the late autumnal complex connected to sclerophyllous and scrub forests of the SE Mediterraneum and the western part of Asia. The genus is geographically separated into eastern and western groups of species which display a conspicuous parallelism with the geographical division of the genus *Lophoterges* HAMPSON, 1906 (but the latter genus has a specialized West Palaearctic – south Mediterranean lineage, too, while *Ostheldera* has not penetrated into Europe).

PHYLOGENY

The genus contains two allopatric groups of species which are clearly separable by genital features (shape and sclerotization of fultura inferior, size and number of cornuti, rate of ovipositor and bursa copulatrix, and, especially, the structure of signa – see Figs 1-22); the differences in the external features (e.g. pectination of antennae of males at apical part, presence and strength of tornal streak, partly the coloration of hindwing which may be much lighter, often white(ish)) are less conspicuous and sometimes more or less overlapping.

The genus shows an allopatric speciation – no sympatric taxa are known, the supposed barriers are the valleys between the larger mountain systems.

Ostheldera, regarding to the main configuration of the genital structures – especially those of the males – and some further external morphological features (e.g. structure of head with palpi, proboscis and antennae, pubescence of thorax and abdomen, coloration and shape of wings) and life historical moments, display close relationships with *Asteroscopus* BOISDUVAL, 1829 (cf. KOVÁCS, 1966; SZÉCSÉNYI, 1985; RONKAY & VARGA, 1986 – Figs 6-25).

The most important apomorphies of *Ostheldera* are the followings:

(1) bipectinate antennae in both sexes,

(2) presence of a rather short, usually wedge-shaped harpe with lack of any processus at ventral edge of sacculus,

(3) short, distally broadened, sclerotized uncus,

(4) large, calycular or subrectangular fultura inferior,

(5) vesica short, with globular basal and conical lateral part, basal half bears a smaller amount (8-25) rather short, pointed cornuti

(6) very long, weakly sclerotized ovipositor with long apophyses,
(7) ostium bursae membranous, with a fine, arcuate or lyriform, sclerotized bar,
(8) cervix bursae a flattened, gelatinous plate,
(9) bursa copulatrix with two small, sclerotized, ovoid or subuliform signa.

Asteroscopus and *Ostheldera* can be considered, based on the discussed apomorphies, as sister-groups since the genus *Brachionycha* represents the outgroup of this generic complex; the former combination of *Asteroscopus* and *Brachionycha* into the same genus is not correct. The differences in the life history (autumnal versus spring period of flight) support also this statement. The genus *Ostheldera* remained restricted to the Central Asian arid-xeromontane biochores while *Asteroscopus* became more expansive, invading the most territory of Europe, including the far north places, the areas of the two genera have only a very small overlap.

BIONOMICS

All the species belonging to the genus are autumnal ones, inhabiting semiarid or arid, mountainous areas. Their main habitats are narrow rocky gorges, deep stream valleys, montane slopes with scattered shrubby vegetation. The imagines have a special flying activity, as both sexes appearing at light only in the late night period.

The early stages of the species are poorly known, the species occurring in the Hissar Mts – *O. kondara*, but published under the name *O. gracilis* – is mentioned as a species connected to Rosaceae (DEGTYAREVA, 1963).

Abbreviations – BIN – Biological Institute, Russian Academy of Sciences, Novosibirsk; BMNH – The Natural History Museum, London (formerly British Museum, Natural History); HNHM – Hungarian Natural History Museum, Budapest; ZIN – Zoological Institute, Russian Academy of Sciences, St. Petersburg; ZSM – Zoologische Staatssammlung, Munich

TAXONOMY

Ostheldera gracilis (OSTHELDER, 1933)
(Figs 1-5, 19, 23-25)

Mitt. münchn. ent. Ges. **23**: 54 (*Pfeifferella*)

Type material examined: holotype male, "Syria, Taurus, Marasch, 7-900 m, 4.IX.29, Einh. Slr. leg.", "Coll. Osthelder", "*Pfeifferella gracilis* Osth. ♂ Type" (pinkish label with black margins), slide 4185 Ronkay (coll. Osthelder, ZSM); three female paratypes from the same locality (coll. ZSM).

Additional material examined: 3 males, 1 female, Turkey, Prov. Malatya, 1000 m, Yesilyurt, Gündüz Bey, (vic. of Malatya), 38°18'E, 38°15'N, 13.09.1989, leg. G. Ronkay and Z. Varga (coll.

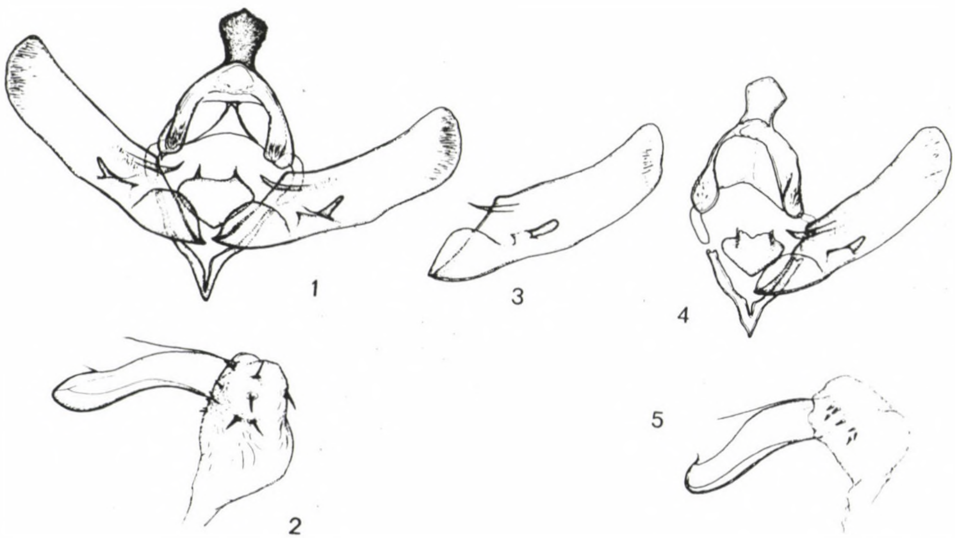
the collectors and HNHM), 5 males, 2 females, Turkey, Ankara, Cubuk Barage, 24-25.09.1968, leg. Friedel (ZSM).

Slide Nos 2718 HACKER, 3398 RONKAY (males), 4492 RONKAY (female).

Diagnosis: wingspan 28-31 mm, length of forewing 12-15 mm. Head and thorax light ashy grey, palpi laterally covered with darker brown hair-scales. Collar with ochreous basal part, tegulae marked with blackish margins, metathoracic tuft large, blackish-brown. Abdomen more brownish, with some scarce grey hairs only. Forewing light grey with some bluish shade, sometimes with more or less intensive brownish-greyish irroration, especially in median area. Orbicular and reniform stigmata well-defined, outlined with dark brown lines and an incomplete whitish-ochreous annulus; their filling lighter than ground colour. Basal area with some fine blackish lines along veins, antemedial line oblique, diffuse, slightly sinuous; claviform spot absent or represented by an obsolete, small ring. Postmedial line diffuse, sinuous, greyish, defined outwards by a straight, dark grey stripe running from costa to vein m2. Subterminal line interrupted, represented usually by some small red-brown spots. Dark streak of tornus conspicuously marked, blackish. Terminal line fine, black, cilia grey spotted with whitish-ochreous. Hindwing small, shining white(ish), costal margin and sometimes veins covered finely with grey. Terminal line often dark grey, marginal suffusion absent or narrow, pale greyish; cilia whitish, often with some darker scales at middle. Pubescence of inner margin only partly greyish. Underside patternless whitish, forewing suffused with grey, shadows of transverse lines rarely present.

The females have much longer and broader forewings with generally darker greyish ground colour of and more obsolete pattern, hindwings with intensive dark grey suffusion.

Male genitalia (Figs 1-5): uncus distally broadened and rounded with pointed, triangular tip. Fultura inferior calycular with deeply arcuate dorso-lateral margins and broad apical incision. Harpe short, oblique, without acute tip, its basis with a sclerotized proximal protuberance directed to sacculus. Basal half of vesica more or less globular, armed with about a dozen of short, pointed cornuti, distal half of vesica partly inflated, membranous.



Figs 1-5. *Ostheldera gracilis* OSTHELDER, male genitalia. 1-2 = holotype, Turkey, Marash, 3 = Turkey, Ankara, 4-5 = Turkey, Malatya (aedeagi in lateral view)

Female genitalia (Fig. 19): Ovipositor and posterior gonapophyses very long, ostium bursae wide, its sclerotized edge arcuate; ligula small. Ductus bursae short, membranous, cervix bursae relatively large, elliptical, flattened. Corpus bursae pyriform, relatively short, signa small, subuliform.

The species differs from all the other known taxa of the genus by the clear white hindwing and the oblique, short and less pointed harpe of the males and the small, pyriform bursa copulatrix of the females, bearing fine, short signa.

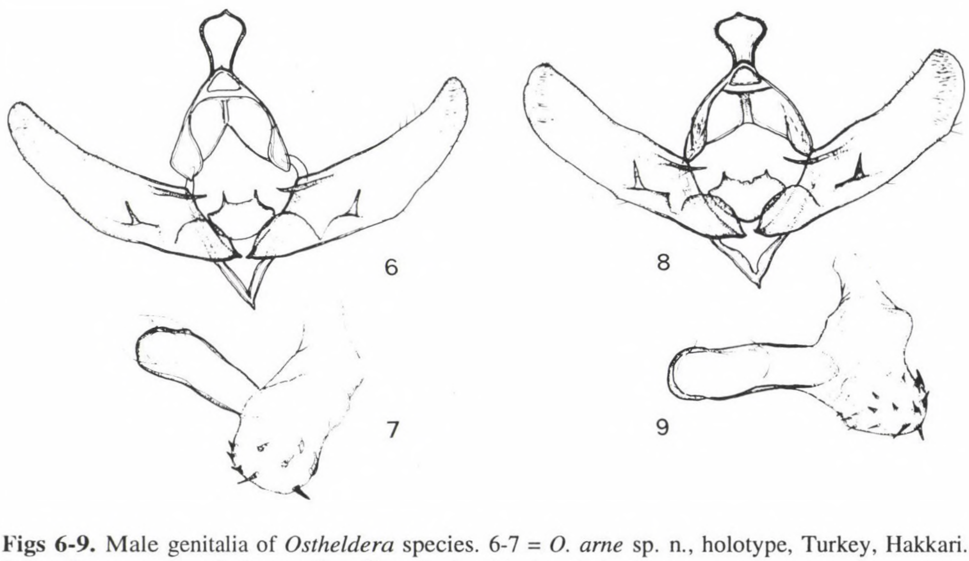
Distribution: Central and Eastern Turkey towards to the eastern edges of the Taurus Mts.

Ostheldera arne sp. n.
(Figs 6, 7, 26)

Holotype: male, "Tr. Hakkari, 5 km south of Hakkari, 1800 m, 12.10.1986, leg. A. Moberg, J. Hillman", slide No. 4417 RONKAY (coll. M. FIBIGER, Sorø).

Additional specimens are preserved in the collections of P. A. MOBERG and J. HILLMANN.

Description: wingspan 30 mm, length of forewing 14 mm. Head and thorax dark grey mixed with some whitish hair-scales, collar with more ochreous basal and apical edges. Tegulae marked with blackish lines, metathoracic tuft large, dark fumous grey. Forewing rather broad and high forming a wide triangular shape with apex pointed. Ground colour dark fumous grey with some brownish shade, parts of basal and medial areas irrorated with blackish-grey. basal area with an ochreous patch at costa, veins defined with short blackish lines. Median area narrow, antemedial line slightly sinuous, arcuate, postmedial line sinuous, defined by a pale ochreous shadow. Orbicular and reniform stigmata well- marked, encircled with dark grey and ochreous annuli and filled with brownish; orbicular small, flattened, reniform large, ovoid. Postmedial line sinuous, grey,



Figs 6-9. Male genitalia of *Ostheldera* species. 6-7 = *O. arne* sp. n., holotype, Turkey, Hakkari. 8-9 = *O. persa* sp. n., holotype, Iran, Fars (aedeagi in dorsal view)

slightly defined by whitish on outer side; dark patch at costa rather diffuse, its outer edge arcuate. Subterminal line obsolete, dark line of tornus well-visible, short, does not reach postmedial line. Terminal line whitish, cilia dark grey spotted with whitish. Hindwing relatively large, rounded, suffused with grey-brown, covering almost entirely the whitish ground colour. Discal spot absent, terminal line dark brown, base of cilia whitish, outer part broadly brown. Underside of forewing unicolorous, fumous grey, costa and cilia spotted with whitish. Hindwing lighter, irrorated strongly with grey-brown.

Male genitalia (Figs 6-7): uncus distally broadened with rounded apex and small, triangular tip. Tegumen low, broad, rather strong, fultura inferior calycular, apical part deeply incised. Valva elongated, distal half strongly tapering, cucullus conical with apex pointed. Harpe fine, thin, relatively long and pointed. Vesica with semiglobular basal part, bearing about ten small, short cornuti, medial part slightly inflated, distal third conical.

Female genitalia: unknown.

The new species differs from the other members of the *gracilis*-line by its broader forewings, essentially darker hindwings and distally strongly tapering valvae forming an elongated, more or less triangular cucullus. The harpe of *O. arne* is fine, straight and longer than that of *O. gracilis*.

Distribution: SE Turkey: Hakkari.

The new species is dedicated to Mr. P. ARNE MOBERG, one of the best explorers of the Turkish Noctuidae fauna, one of the discoverers of the species.

Ostheldera persa sp. n.
(Figs 8, 9, 27, 28)

Holotype: male, "2.XI.50, c. 5500 ft, Hunaifagan, Fars, PERSIA, E.P. Wiltshire", "♂ *Pfeifferella gracilis*" (underside of the label). Slide No. 4454 RONKAY, coll. WILTSHIRE, BMNH.

Paratype: female, Iran, Fars, Pireh Zan, 7000 ft, 4.X.1950, E. P. Wiltshire, slide No. 4486 RONKAY (coll. WILTSHIRE, BMNH).

Description: Wingspan 28-34 mm, length of forewing 12-15 mm. As the species is externally very close to *O. gracilis*, the differential features are mentioned here only which are as follows: as compared with *O. gracilis, O. persa* has the pectination of the male antennae is longer and finer, branches at apical part are less shortened, the orbicular and reniform stigmata narrower, their outlines are defined more conspicuously. The hindwing of the male is a bit darker greyish, the brownish covering of the costal part consisting of brown scales and hairs is significantly stronger.

Male genitalia (Figs 8-9): uncus distally strongly broadened, rounded, with apex finely pointed. Tegumen wide, low, fultura inferior large, calycular, with finely sclerotized lateral edges. Valvae rather long with margins parallel, cucullus wide, apex more or less rounded. Sacculus very short, "clavus" a small, setose field. Harpe long, straight, wedge-shaped with apex acute, its base a long, sclerotized bar. Vesica short, semiglobular, bearing about a dozen of short, thorn-like cornuti.

Female genitalia (Fig. 20): ovipositor and posterior gonapophyses very long, ostium bursae with an arcuate, sclerotized margin and a small ligula. Ductus bursae short, membranous, finely wrinkled, cervix bursae elongated and flattened, gelatinous. Corpus bursae elongated sacculiform, constricted at posterior third. Signa long, narrow, wedge- shaped.

The new species differs from the most similar *O. gracilis* by the external features mentioned in the description. The specific features of the genitalia of *O. persa* are the more broadened uncus, the straight and pointed harpe (male) and the more elongated, larger bursa copulatrix bearing about two times longer and more sclerotized signa (female). The second species of the *gracilis*-line, *O. arne* has broader wings with darker coloration, less broadened uncus and different shape of valvae (see Figs 6-9).

Distribution: The species is known only from Farsistan.

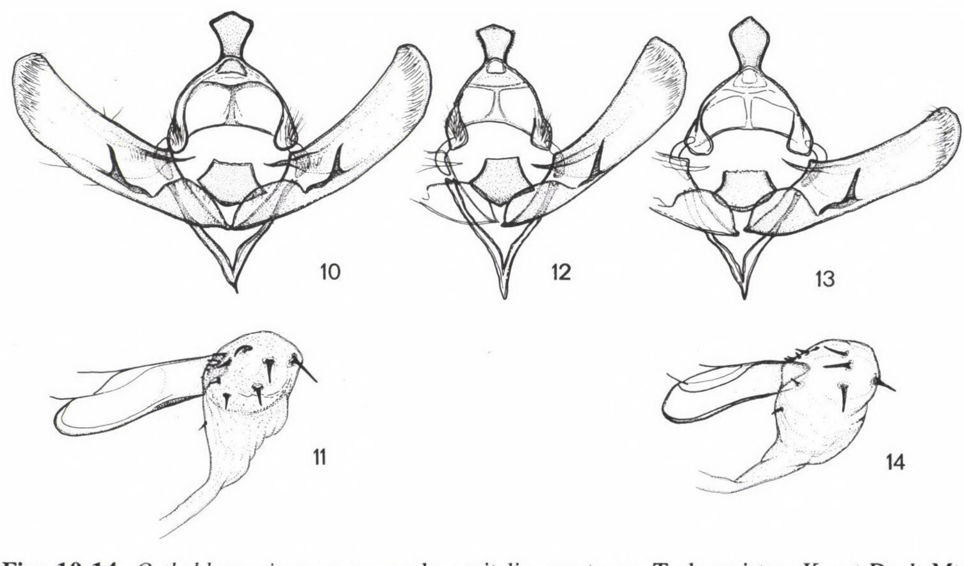
Ostheldera minna sp. n.
(Figs 10-14, 22, 29-33)

Holotype: male, "USSR, Turkmenia, Kopet-Dagh Mts., 1000 m, Kurkulab, 6 km SW of Germob, 57°50'E, 38°04'N, 03.10.1991, No L34, leg. A. Podlussány, L. Ronkay & Z. Varga" (coll. HNHM, Budapest).

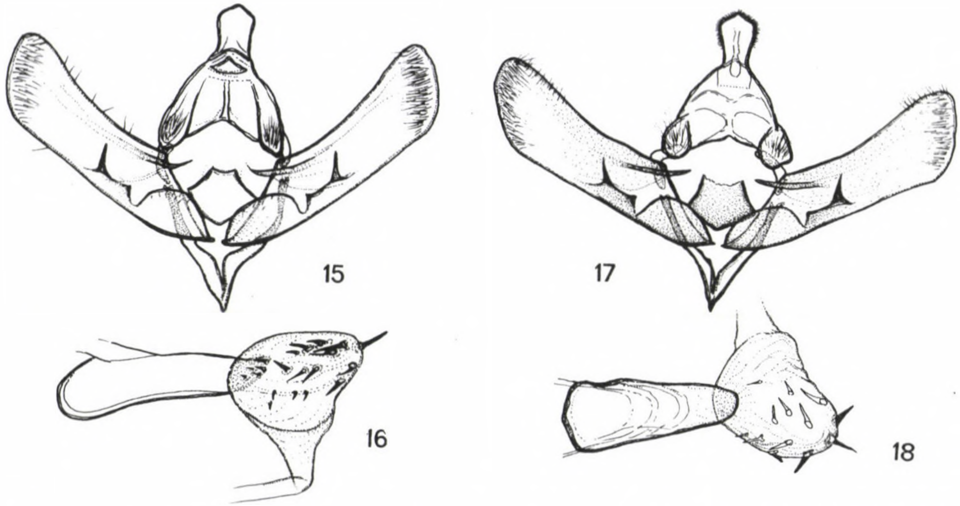
Paratypes: 14 males, 1 female, from the same locality and data; 3 males, "Turkmenistan, Kopet-Dagh Mts, 700-800 m, 5 km S of Chuli, 58°01'E, 37°56'N, 30.09.1991, leg. A. Podlussány, L. Ronkay and Z. Varga" (coll. HNHM, BMNH, HACKER, H., Staffelstein, HREBLAY, M., Érd, Hungary, RONKAY, G., Budapest & VARGA, Z., Debrecen).

Slide Nos 4202, 4493, 4494 RONKAY (males), 4485 RONKAY (female).

Description: wingspan 28-32 mm, length of forewing 12-15 mm. Forewings narrow with apex pointed, ground colour light, slightly ochreous slate-grey, in one of the colour forms less marked, nearly unicolorous with obsolete transverse lines and slightly visible stigmata, in other cases with intensive, dark brown irroration, sharper stigmata and more distinct transverse lines, partly defined by greyish and whitish. Dark streak of tornus fine, long but less conspicuous; terminal line very fine, whitish, costa at apical part and cilia more or less strongly spotted with whitish.



Figs 10-14. *Ostheldera minna* sp. n., male genitalia. paratypes, Turkmenistan, Kopet-Dagh Mts (aedeagi in lateral view)



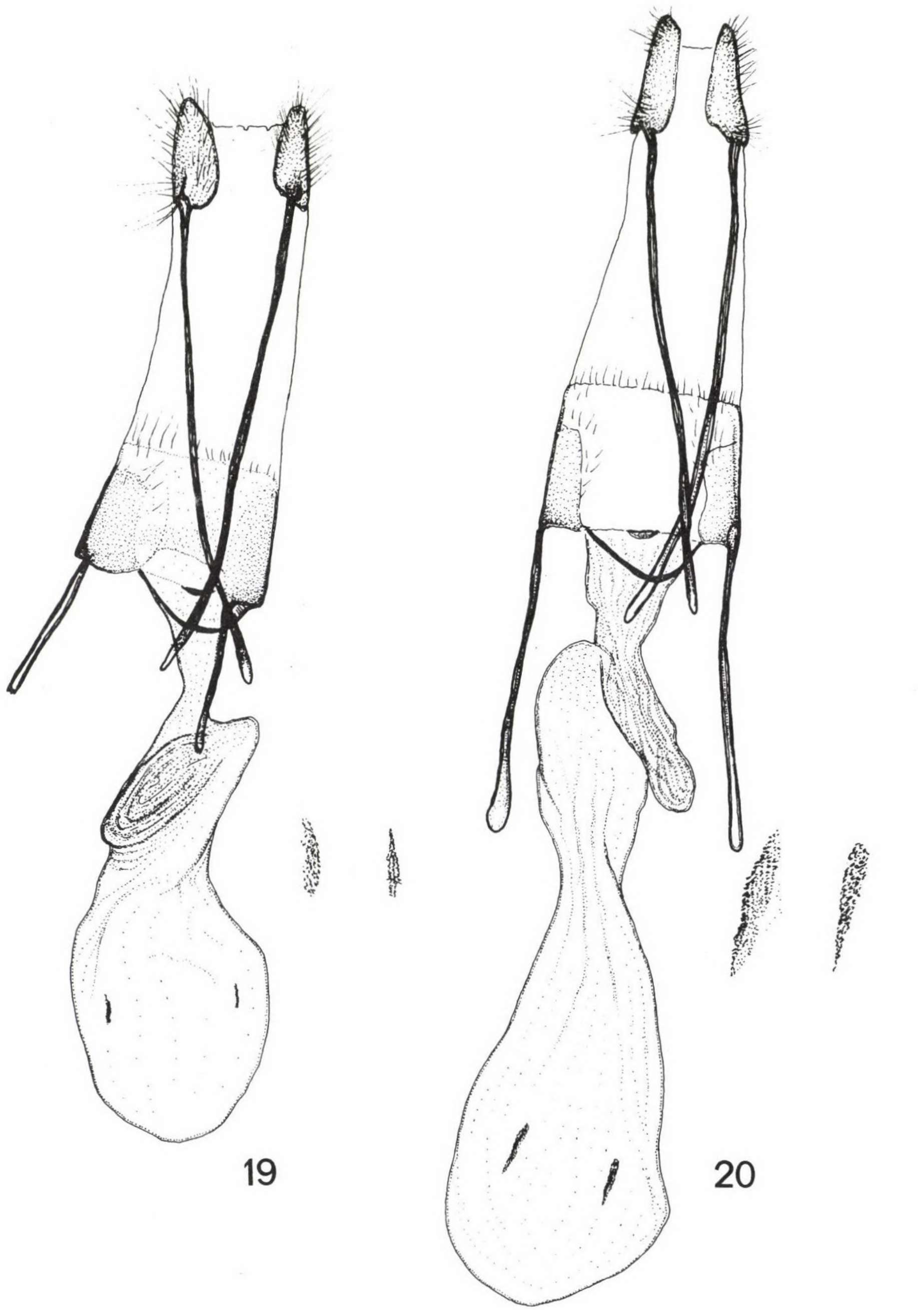
Figs 15-18. *Ostheldera kondara* VARGA & RONKAY, male genitalia. 15-16 = Tadjikistan, Hissar, Ramit (aedeagus in lateral view), 17-18 = Hissar, Kondara (aedeagus in dorsal view)

Hindwing nearly unicolorously suffused with brown-grey, marginal area – in dark forms – often significantly darker but with lighter, nearly whitish-grey basal third. Terminal line dark brown, inner part of cilia spotted with brown. Underside pale, unicolorous brown-grey, cellular lunule of hindwing usually well-discernible, that of forewing obsolete or deleted; inner part of hindwing in some cases somewhat lighter. Wings of female much more elongated, markings diffuse and pale, slightly darker than ground colour, distal part of abdomen characteristically curved ventrally.

Male genitalia (Figs 10-14): uncus short, distally broadened, with a flattened triangular apical part. Tegumen low and wide, fultura inferior shield-like with almost straight dorso-lateral edges and apical part. Valva elongated, finely arcuate, costal and ventral margins more or less parallel; cucullus elongated with apex rounded. Sacculus relatively long, harpe strong, long and acute, its basal part sclerotized, extending proximally far to edge of sacculus. Vesica with basal part globular, bearing about a dozen of variably long, spiniform cornuti; distal part conical, membranous.

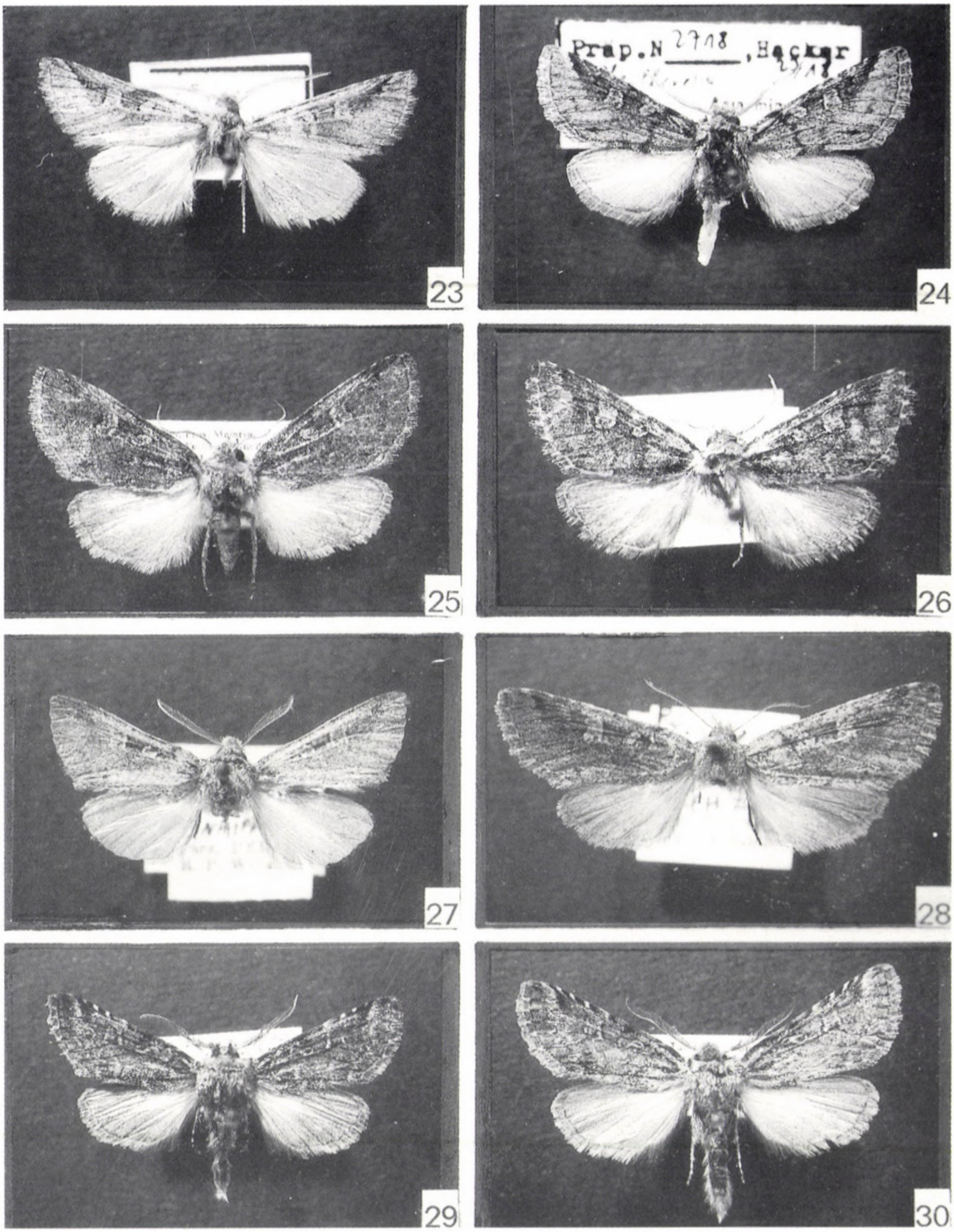
Female genitalia (Fig. 22): Ovipositor long, gonapophyses long, strong. Ostium bursae relatively narrow, its sclerotized edge lyrifom, ligula small. Ductus bursae narrow, elongated, cervix bursae small, flattened. Corpus bursae long, more or less tubular, anteriorly slightly dilated, bearing two patch-like signa.

The new species differs externally from *O. gracilis* and *O. persa* by its grey-brownish hindwing of the males and the stronger dark grey pubescence along the inner margin of the hindwing. The third species of the *gracilis*-line, *O. arne* has broader wings and darker coloration that those of *O. minna*. In the configuration of the genitalia, *O. minna* differs from the members of the *gracilis*-line by the shape of the fultura inferior, the strength of the harpe and the size and number of cornuti in vesica (males, see Figs 1-14), and the shape and size of bursa copulatrix and the signa (females, see Figs 19-20, 22).

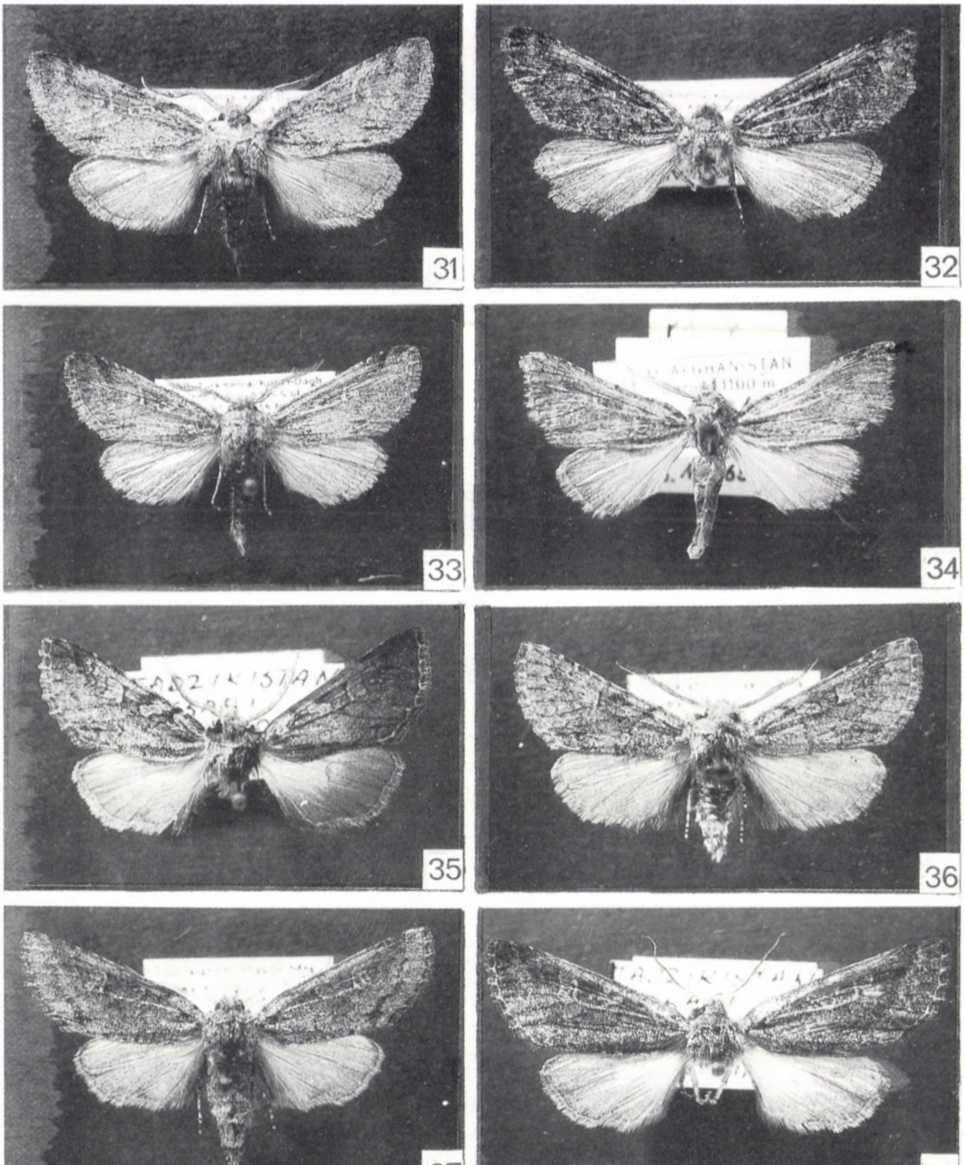


Figs 19-20. Female genitalia of *Ostheldera* species. 19 = *O. gracilis* OSTHELDER, Turkey, Malatya, 20 = *O. persa* sp. n., paratype, Iran, Fars

Figs 23-30. *Ostheldera gracilis* OSTHELDER (23 holotype male, Marash, 24 male, Ankara, 25 female, Malatya). – Fig. 26. *Ostheldera arne* sp. n., holotype male, Hakkari. – Figs 27-28. *Ostheldera persa* sp. n. (27 holotype male, 28 paratype female, Iran, Fars). – Figs 29-30. *Ostheldera minna* sp. n. (29 paratype male, 30 holotype male, Turkmenistan, Kopet-Dagh)



Figs 31-38. *Ostheldera minna* sp. n. (31-32 male paratypes, 33 female paratype, all from Turkmenistan, Kopet-Dagh). – Fig. 34. *Ostheldera* sp., male, Afghanistan, Sarobi. – Figs 35-38. *Ostheldera kondara* VARGA & RONKAY (35-36 males, 37-38 females, Tadjikistan, Hissar Mts)



O. minna is closely related to *O. kondara* forming a common lineage, being separated from the *gracilis*-line; their main specific differences are the following:

minna	*kondara*
smaller in size (wingspan 28-32 mm)	larger in size (wingspan 31-37 mm)
forewings narrower	forewings broader
hindwing dark grey with strong dark pubescence along inner margin	hindwing lighter grey, pubescence along inner margin of hindwing less conspicuous
uncus distally strongly broadened	uncus without strong dilatation at apical third
harpe longer and stronger, its basal plate strongly sclerotized	harpe shorter, its basal plate less sclerotized
vesica with smaller amount of cornuti, being usually finer and shorter	vesica with more numerous and larger cornuti
ostium bursae narrower, its sclerotized bar lyriform	ostium bursae wider, its sclerotized bar longer, arcuate
bursa copulatrix with signa more inequal	bursa copulatrix with signa nearly equally long

Distribution: The species is known from two localities lying in the Central Kopet-Dagh.

The new species is dedicated to Dr. MINNA A. DARICHEVA, the dedicated specialist of the Noctuidae fauna of the Turkmenian desert and semi-desert territories.

Ostheldera kondara VARGA & RONKAY, 1991 (Figs 15, 18, 21, 35-38)

Acta zool. hung. **37**(3-4): 283.

Type material examined: holotype male and paratype female, Tadjikistan, Hissar Mts, Kondara, 18.09.1979, coll. BIN Novosibirsk.

Additional material examined: 21 specimens from the same locality, collected at the end of September-first part of October, 1980-1989, (coll. HNHM, ZIN St. Petersburg, G. Ronkay); 1 male, 1 female, Tadjikistan, Hissar, Ramit, 20.IX.1988, leg. R. Lindt (coll. Mus. Univ. Helsinki).

Slide Nos 3430 (holotype), 4201, 4499 RONKAY (males), 3437, 4284 RONKAY (females).

Diagnosis: the characterization of the external morphology of the species given in the original description was based on the two type specimens of the newly discovered taxon. The study of the larger series originating from the type locality and its close vicinity revealed that the female paratype is a teratological specimen, the female of the species is fully winged and similar in appearance to the males. On the other hand, the species has a remarkable variation in size and the coloration and pattern of the forewings extending from the nearly patternless, dark fumous grey forewing

Figs 21-22. Female genitalia of *Ostheldera* species. 21 = *O. kondara* VARGA & RONKAY, Hissar, Ramit, 22 = *O. minna* sp. n., paratype, Turkmenistan, Kopet-Dagh

to the well-marked, ochreous-grey or pale brownish grey ones (see Figs 2, 35-38). The wingspan of the female specimens examined is between 34-37 mm with the average 36 mm, the length of the forewings is between 15-17 mm.

The most important features of the male genitalia are the following (Figs 15-18): uncus short, distally only slightly widened, apically finely pointed. Fultura inferior shield-like with more or less straight margins, dorso-lateral edges only slightly arcuate (see Figs). Valvae distally weakly broadened, cucullus broad with rounded apex. Harpe long, straight, wedge-shaped, relatively strongly sclerotized. Basal part of vesica more or less globular bearing about 15-20 cornuti, distal part elongated, conical.

The typical features of the female genitalia (Fig. 21) are the long but weak ovipositor with relatively strong apophyses, the arcuate sclerotized ribbon at the proximal part of ostium bursae, the long, narrow, bursa copulatrix forming a more or less globular anterior third and the two, rather broad-ovoid signa.

The easternmost known species of the genus differs from its closest relative, *O. minna* sp. n. in several morphological details discussed in the diagnosis of the preceding species.

Distribution: The species is known from the central part of the Hissar Mts (Kondara, Ramit).

Remarks. A peculiar male specimen (Figs 2, 34) from East Afghanistan, Sarobi (1100 m, 10.10.1961, leg. G. Ebert) is preserved in the collection of ZSM, identified by BOURSIN as *O. gracilis*. The specimen is unfortunately damaged and worn and its genital slide (MM 765 BOURSIN, = N 865 ZSM) is missing (possibly present in the slide collection of the late CH. BOURSIN). As it is a dark hindwinged moth with longer pectination of the antennae, it should belong to the *minna-kondara* group but its satisfactory identification, without the knowledge of its genital characterictics, is impossible.

* * *

Acknowledgements. – The authors are indebted to Dr M. A. DARICHEVA and Dr V. M. KORSHUNOV (Ashkhabad), Dr I. L. SUKHAREVA (St. Petersburg), M. R. HONEY (London), H. HACKER (Staffelstein), Dr W. DIERL and H. LEHMANN (Munich), M. FIBIGER (Sorø), A. PODLUSSÁNY, G. RONKAY (Budapest), M. HREBLAY (Érd, Hungary), A. V. NEKRASOV (Moscow), Dr K. MIKKOLA and J. KULLBERG (Helsinki), P. A. MOBERG and J. HILLMANN (Stockholm) for their kind help.

The research was supported by the OTKA Foundation, Budapest (OTKA 3181).

REFERENCES

DEGTYAREVA, V. I. (1963) Materialen über höhere Schmetterlinge – Schädlinge an Bäumen und Sträuchern der Rosaceen-Familie im Hissargebirge. *Trudi Zoologii i Parasitologii* **24**: 74-85.

DRAUDT, M. (1934-38) Die palaearktischen eulenartige Nachtfalter. *In* SEITZ, A. (ed.) *Die Gross-Schmetterlinge der Erde* I. 3, Supplement, Alfred Kernen Verlag, Stuttgart.

HACKER, H. (1990) Die Noctuidae Vorderasiens (Lepidoptera). *Neue ent. Nachr.* **27**: 1-707.

KOVÁCS, L. (1966) Data to the knowledge of Hungarian Macrolepidoptera. I. *Annls hist.-nat. Mus. natn. hung.* **58**: 453-468.

NYE, I. W. B. (1975) *The Generic Names of the Moths of the World. Vol. 1. Noctuoidea (part): Noctuidae, Agaristidae and Nolidae.* London, Trustees of the British Mus. (N.H.), 568 pp.

OSTHELDER, L. (1933) Lepidopteren-fauna von Marasch in türkisch Nordsyrien, Noctuidae. *Mitt. münchn. ent. Ges.* **23**: 45-107.

POOLE, R. W. (1989) *Noctuidae*. Lepidopterorum Catalogus, New Series, Fasc. 118., parts I-III., Brill, Leiden.

RONKAY, L. & Z. VARGA (1986) New taxonomic data for some groups of Palaearctic Cuculliinae (Lepidoptera: Noctuidae) I. *Folia ent. hung.* **47**(1-2): 149-161.

SZÉCSÉNYI, L. (1985) The description of the female of Brachionycha syriaca decipulae Kovács, 1966 (Lepidoptera: Noctuidae). *Folia ent. hung.* **46**(2): 169-172.

VARGA, Z. & L. RONKAY (1991) Taxonomic studies on the Palaearctic Noctuidae (Lepidoptera). I. New taxa from Asia. *Acta zool. hung.* **37**(3-4): 263-312.

Received March 16, 1993; accepted December 1, 1993

Acta Zoologica Academiae Scientiarum Hungaricae 40 (2), pp. 171-184, 1994

CONIOPTERYGIDAE FROM THE AFROTROPICAL REGION (NEUROPTERA)

GY. SZIRÁKI

Zoological Department, Hungarian Natural History Museum
H-1088 Budapest, Baross utca 13, Hungary

Forty-seven male specimens belonging to nine species of Coniopterygidae were found in Neuroptera materials collected in three tropical countries of Africa. *Coniopteryx (Xeroconiopteryx) brevicornis* sp. n., *C. (X.) endroedyi* sp. n., *C. (X.) ghanana* sp. n., *C. (X.) kisi* sp. n., *C. (X.) laticaudata* sp. n., *C. (X.) tropica* sp. n., *C. (X.) vojnitsi* sp. n. and *Coniopteryx (Coniopteryx) longistylus* sp. n. are described as new species. With 43 original figures.

Key words: *Coniopteryx, Semidalis*, new species, distribution, Afrotropical Region

In the insect material collected between 1967 and 1992 by Dr. SEBESTYÉN ENDRŐDY-YOUNGA in Ghana, by Dr. ANDRÁS VOJNITS in Tanzania and by Dr. OTTÓ MERKL in Kenya I have found 47 coniopterygid males. Examination of these materials showed, that they belong to nine species, and eight of them are hitherto undescribed ones. (Examination of the female specimens in the same materials needs more knowledge on the female internal genitalia of this neuropterous family. Therefore it will be carried out later.)

Coniopteryx (Xeroconiopteryx) vojnitsi sp. n.
(Figs 1-6)

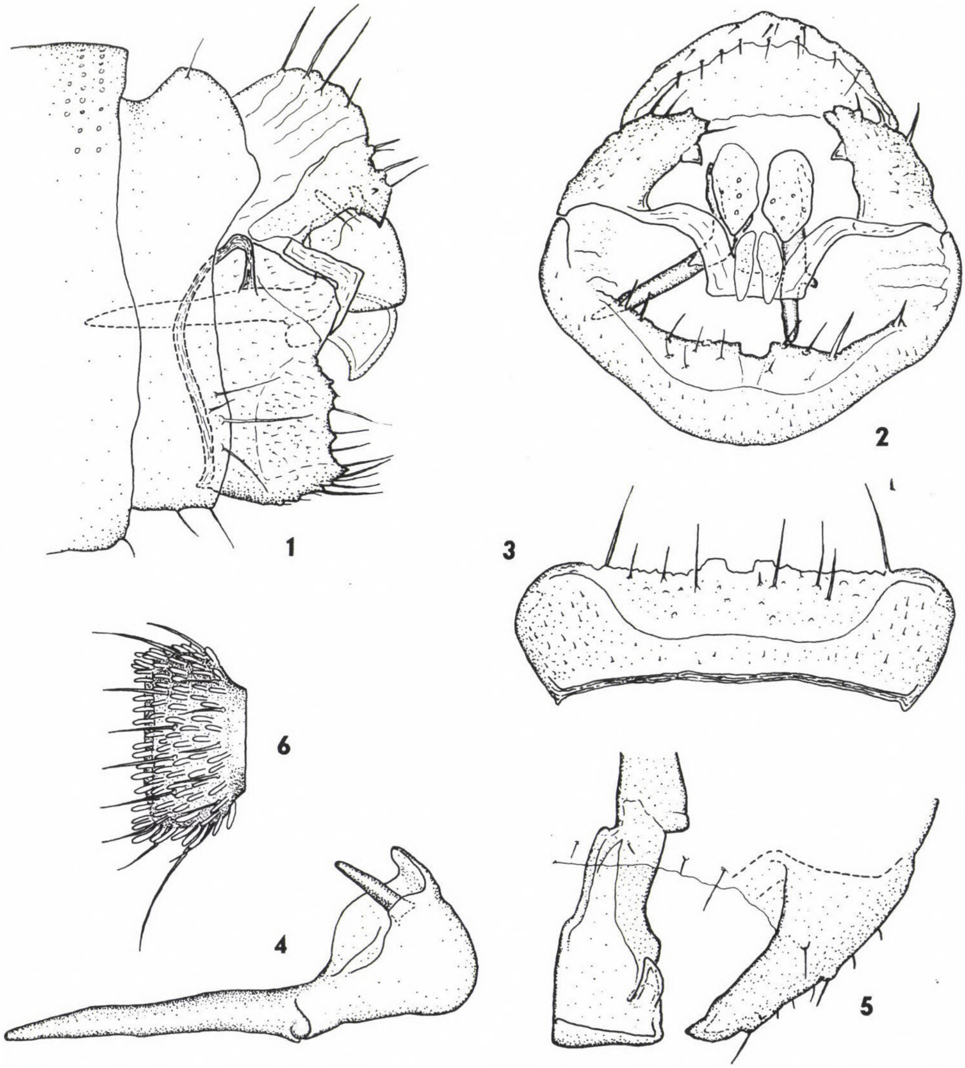
Holotype: male, Tanzania, Arusha, suburb, collected at 160W MV lamp, February 11, 1988, leg. A. VOJNITS – deposited in the Hungarian Natural History Museum, Budapest.

Structure of frons and palpi normal. Vertex and frons pale yellowish brown. Genae dorsally yellowish brown, on other parts dark brown. Eyes black. Antennae dark brown, pedicel as long as broad, basal flagellar segments about twice as broad as long. Setae present on flagellar segments and pedicel, ordinary hairs in two regular whorls. Scale-like hairs on whole surface of pedicel and flagellar segments. End of flagellum is broken. – Thorax yellowish brown with brown sutures and shoulder spots.

Length of fore wing 2.0 mm, of hind wing 1.7 mm. Wing membrane fuscous brown.

Male terminalia: as Figs 1-5. Hypandrium in lateral view about twice as high as broad. Apodeme along anterior margin ventrally complete. Processus terminalis small, with very small median apical incision. Processus lateralis short, irregularly rounded. Gonarcus bent downwards and inwards, and has a ventrally situated, stout apical thorn. This thorn invisible from above. Gonarcus seems to be slender in dorsal view. Its surface covered by coarse warts. Styli unforked, forming an arch below parameres. Processus ventralis of paramere small. Processus apicalis in lateral view broad and bifurcated. Its sail-shaped inner side with a rounded anterior part. The proximally situated dorsal projection is a moderately strong tooth, while the distal one is a shell-like structure. Penis consists of two broad sclerits.

As regards the hitherto described species – because of the similarities in structure of parameres and in shape of hypandrium – *C. vojnitsi* resembles to the *Coniopteryx bicuspis* TJEDER, 1957 and *C. stuckenbergi* TJEDER, 1957. Otherwise, *C. vojnitsi* is rather close to *C. brevicornis* sp. n., *C. ghanana* sp. n., *C. endroedyi* sp. n. and *C. tropica* sp. n..



Figs 1-6. *Coniopteryx vojnitsi* sp. n.: 1 = male terminalia, lateral view, 2 = male terminalia, caudal view, 3 = hypandrium, ventral view, 4 = paramere, lateral view, 5 = gonarcus and processsus apicalis, dorsal view, 6 = fifth antennal segment

Differentiation of these species from each other, and from the already described species will be given at the description of *C. tropica*.

Etymology – I dedicate this new species in honour of Dr. ANDRÁS VOJNITS, lepidopterist of the Hungarian Natural History Museum.

Coniopteryx (Xeroconiopteryx) brevicornis sp. n.
(Figs 7-12)

Holotype: male, Tanzania, Arusha, suburb, collected at 160W MV lamp, February 12, 1988, leg. A. VOJNITS – deposited in the Hungarian Natural History Museum, Budapest.

Structure of frons and palpi normal. Colour of vertex and frons pale yellowish brown. Genae dorsally yellowish brown, on other parts dark brown. Eyes black. Antennae 1.1 mm, 28 segmented, medium brown. Pedicel as long as broad. The lentil-shaped basal flagellar segments almost three times as broad as long. Setae present on flagellar segments and pedicel, ordinary hairs in two irregular whorls. Scale-like hairs on whole surface of pedicel, on large part of first flagellar segment and on the apical part of the other flagellar segments. – Thorax greyish brown, with dark brown sutures and shoulder spots.

Length of fore wing 1.7 mm, of hind wing 1.3 mm. Wing membrane light brown.

Male terminalia: as Figs 7-11. Hypandrium in lateral view about twice as high as broad. Apodeme along anterior margin ventrally complete. Processus terminalis small, with very shallow median apical incision. Processus lateralis indistinct. Gonarcus bent downwards and inwards with a ventrally situated, short, but stout apical thorn. This thorn invisible from above. Gonarcus seems to be slender, and rather long in dorsal view. Its surface with prominent coarse warts. Styli unforked, forming an arch below parameres. Processus ventralis of parameres distinct. Processus apicalis dorsally has two short, and a moderately long, tooth-like projections. Inner side of processus apicalis slightly sinuous proximally. Penis consists of two hooked sclerits.

Because of the similarities in the structure of male genitalia, *C. vojnitsi* and the other five species, listed in connection with *C. vojnitsi* may be regarded as related ones. Differential diagnosis is given at the description of *C. tropica*.

The main distinctive characteristics of *C. brevicornis*: 1. Presence of scale-like hairs on the whole surface of pedicel and on the apical part of flagellar segments. – 2. The very broad, lentil-shaped basal flagellar segments. – 3. Characteristic shape and structure of gonarcus. – 4. Three dorsal projections on processus apicalis of parameres.

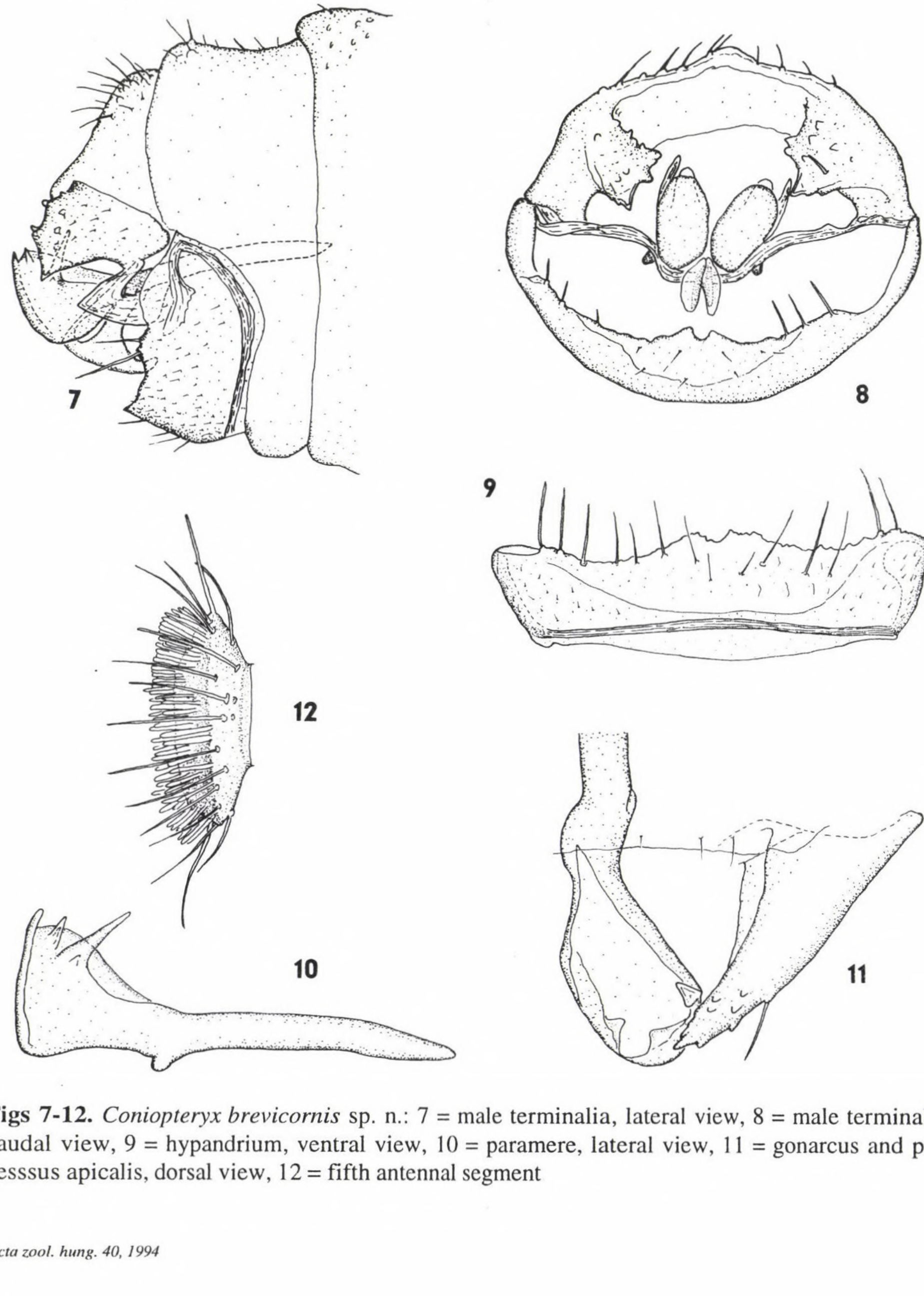
Coniopteryx (Xeroconiopteryx) endroedyi sp. n.
(Figs 13-17)

Holotype: male, Ghana, Kwadaso, Ashanti region, collected by light trap with UV light, April 28, 1969, leg. S. ENDRŐDY-YOUNGA – deposited in the Hungarian Natural History Museum, Budapest. – Paratypes: 9 males, same data as holotype. – 9 males, same locality and collector as holotype, May 5, 1969 – deposited in the Hungarian Natural History Museum, Budapest.

Frons and palpi normal. Head dark brown. Eyes black. Antennae 1.0-1.3 mm, 24-28 (mostly 26-27) segmented, dark brown. Pedicel as long as broad, basal flagellar segments more than twice as broad as long. Setae present on flagellar segments and pedicel, ordinary hairs in two irregular whorls. Scale-like hairs on whole surface of pedicel and flagellar segments (including the apical segment). – Thorax yellowish brown with dark brown shoulder spots.

Length of fore wing 1.7-2.0 mm (mostly 1.8-1.9 mm), of hind wing 1.3-1.6 m (mostly 1.4-1.5 mm). Wing membrane light brown.

Male terminalia: as Figs 13-17. Hypandrium in lateral view about one and a half times as high as broad. Apodeme along anterior margin ventrally complete. Processus terminalis small. Median apical incision very shallow. Processus lateralis has an angular dorsal corner. Caudal edge of



Figs 7-12. *Coniopteryx brevicornis* sp. n.: 7 = male terminalia, lateral view, 8 = male terminalia, caudal view, 9 = hypandrium, ventral view, 10 = paramere, lateral view, 11 = gonarcus and processsus apicalis, dorsal view, 12 = fifth antennal segment

processus terminalis and processus lateralis irregularly serrated. Gonarcus rather short, subtriangular, with acute apical spine. Styli unforked, forming an arch below parameres. Parameres rather slender, with well developed processus ventralis. Processus apicalis moderately broad with two dorsal projections, and with a proximal lobe. The caudally situated dorsal projection nail-like, the other tooth-shaped. Penis consists of two rather broad sclerits.

Related species: *C. vojnitsi* and the other five species listed in connection with *C. vojnitsi*. Differential diagnosis is given at description of *C. tropica*.

The main distinctive characteristics of *C. endroedyi*: 1. Presence of scale like hairs on the whole surface of pedicel and flagellum. 2. The rather slender parameres with long processus ventralis. 3. The described structure of processus apicalis.

Etymology – I dedicate this *Coniopteryx* species in honour the collector, Dr. SEBESTYÉN ENDRŐDY-YOUNGA.

Coniopteryx (Xeroconiopteryx) ghanana sp. n. (Figs 18-22)

Holotype: Male, Ghana, Kwadaso, Ashanti region, collected by light trap with UV light, April 28, 1969, leg. S. ENDRŐDY-YOUNGA – deposited in the Hungarian Natural History Museum, Budapest. – Paratypes: 8 males, same data as holotype – 11 males, same locality and collector as holotype, May 5, 1969 – 1 male, same locality and collector as holotype, September 29, 1969 – deposited in the Hungarian Natural History Museum, Budapest.

Frons and palpi normal. Head light brown. Eyes black. Antennae 1.6-1.8 mm, 32-36 (mostly 33-35) segmented, light brown. Pedicel as long as broad, basal flagellar segments twice as broad as long. Setae present on flagellar segments and pedicel, ordinary hairs in two whorls. Scale-like hairs on whole surface of pedicel and flagellar segments (including the apical segment). – Thorax light brown, with dark brown sutures and shoulder spots.

Length of fore wing 1.8-2.2 mm (mostly 2.0 mm), of hind wing 1.3-1.8 mm (mostly 1.5-1.6 mm). Wing membrane light brown.

Male terminalia: as Figs 18-22. Hypandrium in lateral view about twice as high as broad. Apodeme along the anterior margin ventrally often incomplete or weakened, but also may be complete. Processus terminalis wide, short, with rather even caudal edge. Median apical incision shallow. Processus lateralis short, rounded. Gonarcus short, triangular, with acute apical spine. Styli unforked, forming an arch below parameres. Parameres rather stout, with well developed processus ventralis. Processus apicalis relatively slender; only its tooth-like dorsal projection prominent. The caudally situated, nail-like projection short, the proximal lobe indistinct. The penis consists of two hooked sclerits.

Related species: *C. vojnitsi* and the other five species lised in connection with *C. vojnitsi*. Differencial diagnosis is given at the description of *C. tropica*.

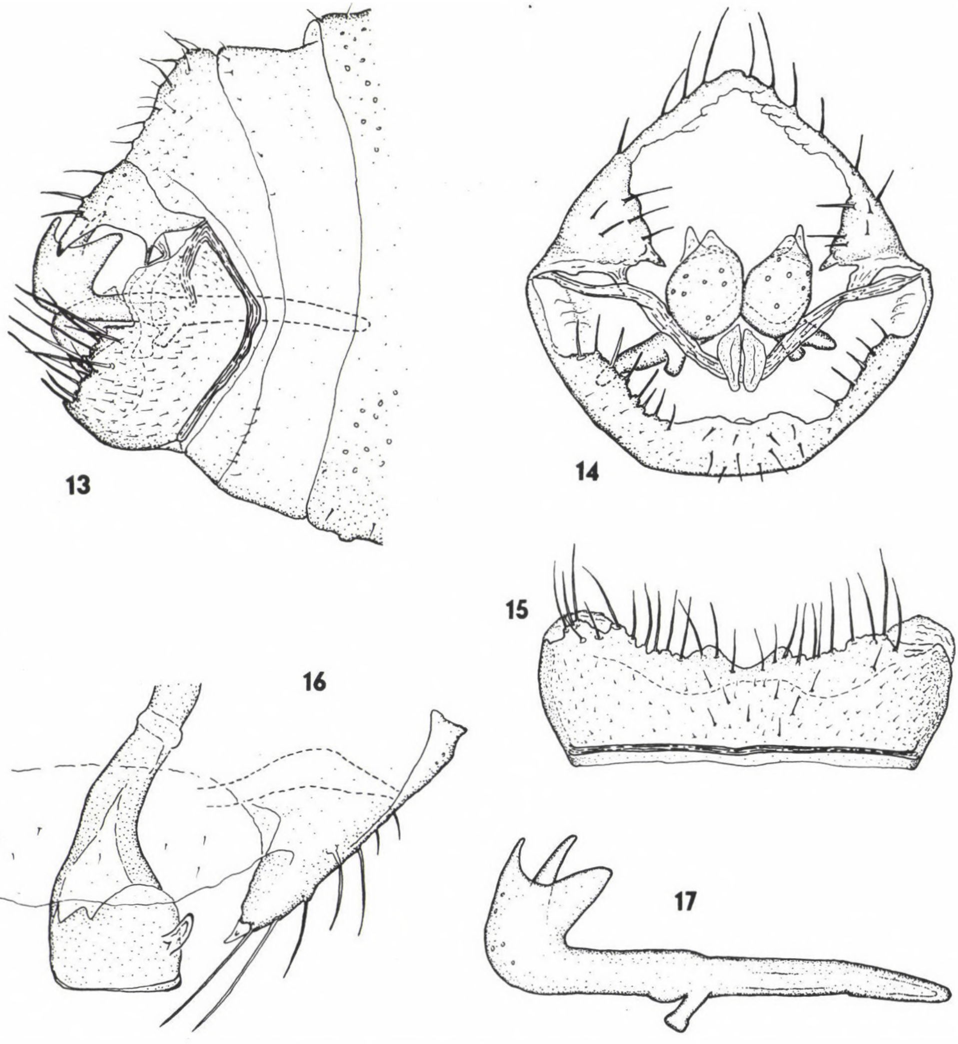
The main distinctive characteristics of *C. ghanana*: 1. Relatively long antennae. – 2. Scale-like hairs on the whole surface of pedicel and flagellum. – 3. Stout paramere with relatively slender processus apicalis.

Coniopteryx (Xeroconiopteryx) tropica sp. n. (Figs 23-27)

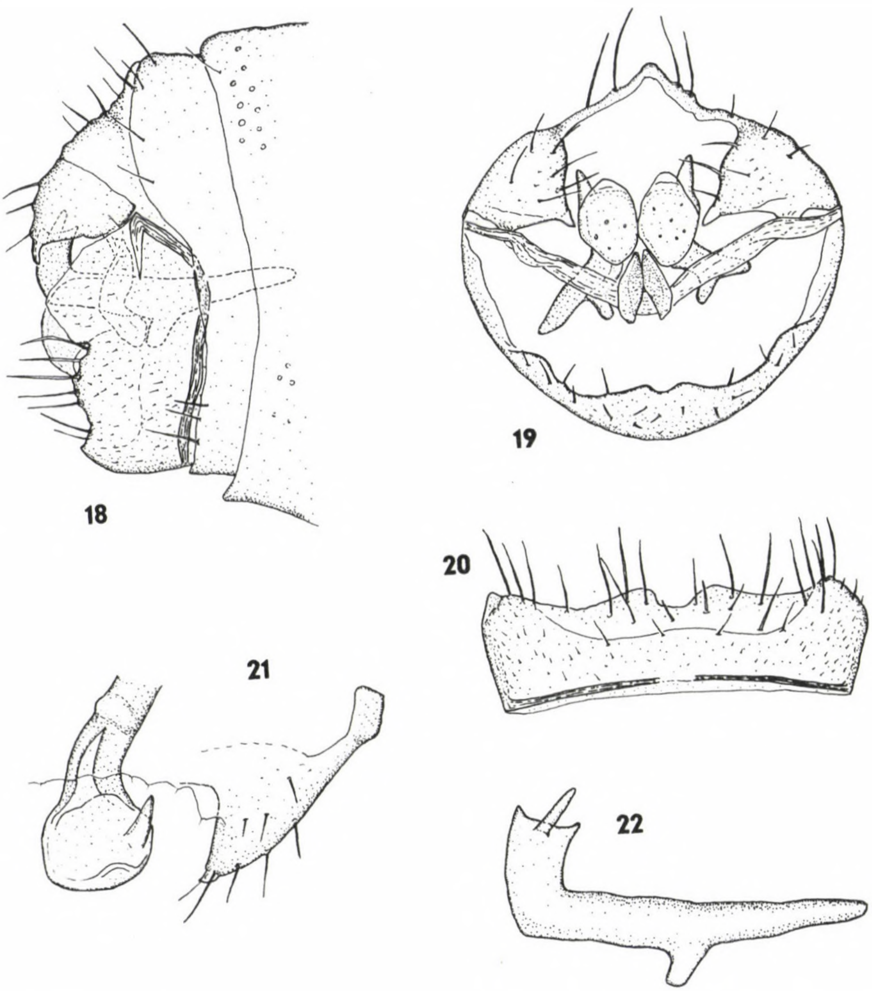
Holotype: male, Ghana, Kwadaso, Ashanti region, collected by light trap with UV light, April 28, 1969, leg. S. ENDRŐDY-YOUNGA – deposited in the collection of the Hungarian Natural History Museum, Budapest.

Frons and palpi normal. Head dark brown. Eyes black. Antennae 1.3 mm, 31 segmented, dark brown. Pedicel slightly longer than broad. Basal flagellar segments almost twice as broad as long. The apical flagellar segments situated tightly to each others (because of an artifical effect?). Setae present on flagellar segments and pedicel, ordinary hairs in two whorls. Scale-like hairs on whole surface of pedicel and flagellar segments (including the apical segment). – Thorax medium brown, with dark brown shoulder spots.

Length of fore wing 2.1 mm, of hind wing 1.6 mm. Wing membrane fuscous brown.



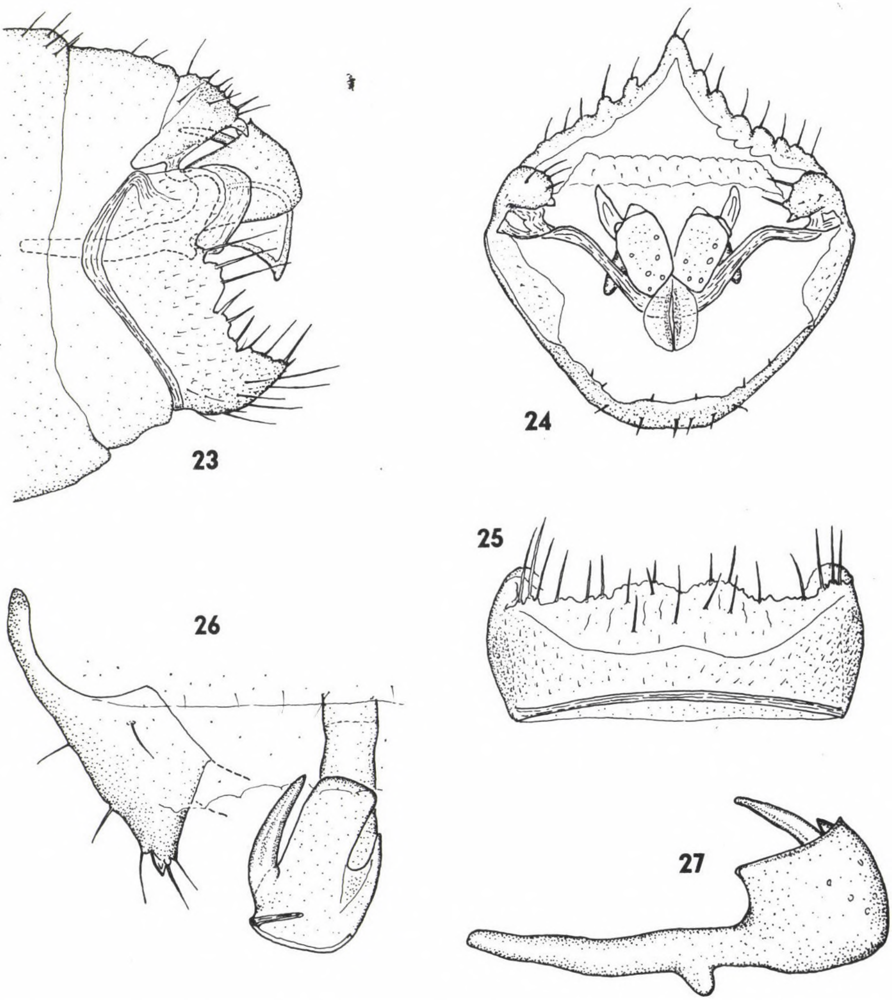
Figs 13-17. *Coniopteryx endroedyi* sp. n. holotype: 13 = male terminalia, lateral view, 14 = male terminalia, caudal view, 15 = hypandrium, ventral view, 16 = gonarcus and processsus apicalis, dorsal view, 17 = paramere, lateral view



Figs 18-22. *Coniopteryx ghanana* sp. n., holotype: 18 = male terminalia, lateral view, 19 = male terminalia, caudal view, 20 = hypandrium, ventral view, 21 = gonarcus and processus apicalis, dorsal view, 22 = paramere, lateral view

Male terminalia: as Figs 23-27. Hypandrium in lateral view about twice as high as broad. Apodeme along the anterior margin ventrally strong, complete. Processus terminalis in lateral view rather prominent. Median apical incision very shallow. Processus lateralis indistinct. Posterior edge of hypandrium irregularly serrated. Gonarcus short, trianguler, with small, acute apical spine. Styli unforked, forming an arch below parameres. Parameres rather short, with thin proximal part and well developed processus ventralis. Processus apicalis very broad with two short, plate-like projections, and with a long tooth dorsally. The proximal lobe large. The penis consists of two rather broad sclerits.

Related species: *C. bicuspis*, *C. stuckenbergi* and the four new *Coniopteryx* species described above (*C. vojnitsi*, *C. brevicornis*, *C. endroedyi* and *C. ghanana*).



Figs 23-27. *Coniopteryx tropica* sp. n.: 23 = male terminalia, lateral view, 24 = male terminalia, caudal view, 25 = hypandrium, ventral view, 26 = gonarcus and processsus apicalis, dorsal view, 27 = paramere, lateral view

The main distinctive characteristics of *C. tropica*: 1. Scale-like hairs present on whole surface of pedicel and flagellum – 2. Paramere with slender proximal part and very broad processus apicalis. – 3. Described structure of processus apicalis.

Differentiation of *C. bicuspis*, *C. stuckenbergi* and the five above described new *Coniopteryx* species:

All of the five new *Coniopteryx* species differs from the *C. bicuspis*, *C. stuckenbergi* and from the other members of *C. bicuspis* species-group (MEINANDER, 1981) by the presence of scale-like hairs on the whole surface of pedicel.

C. vojnitsi and *C. brevicornis* differs from the other three new species by the peculiar morphological features of their gonarcus (e.g. by the position and shape of the stout apical thorn and by the extremely verrucose surface). On the other hand, these two species are easily distingushable from each other by their quite different flagellar segments.

C. endroedyi, *C. ghanana* and *C. tropica* are closely related species. *C. tropica* differs from the two others by the peculiar parameres, with weakly developed proximal part and very strong, broad processus apicalis, having three dorsal projections.

Finally, *C. endroedyi* and *C. ghanana* differs from each other by the number of antennal segments (*C. endroedyi*: no more than 28, *C. ghanana* more than 31), and by the described and figured shape of hypandrium and parameres.

Coniopteryx (Xeroconiopteryx) kisi sp. n.
(Figs 28-33)

Holotype: male, Ghana, Kwadaso, Ashanti region, collected by light trap with UV light, May 5, 1969, leg. S. ENDRŐDY-YOUNGA – deposited in the Hungarian Natural History Museum, Budapest.

Frons and palpi normal. Head dark brown. Eyes black. Antennae 1.4 mm, 26 segmented, dark brown. Pedicel slightly broader than long, basal flagellar segments twice as broad as long. Setae present on flagellar segments and pedicel; moreover, there is short, straight seta dorsally on the scape as well. Ordinary hairs situated rather irregularly on the antennal segments. Scale like hairs on the apex of pedicel and flagellar segments. – Thorax dark brown, with blackish shoulder spots. Legs dark brown.

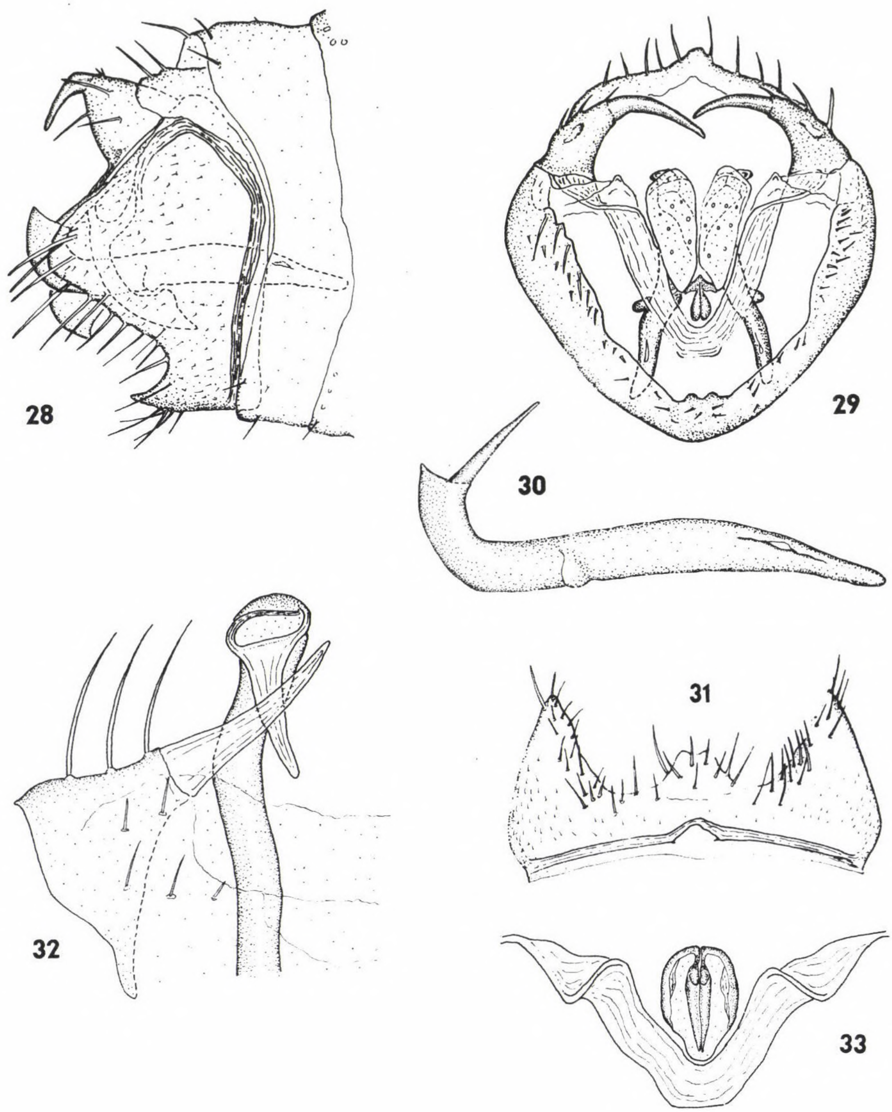
Length of fore wing 1.6 mm, of hind wing 1.3 mm. Wing membrane dark brown.

Male terminalia: as Figs 28-33. Hypandrium in lateral view about one and a half times as high as broad, strongly chitinized. Apodeme along the anterior margin ventrally complete, medially bent backwards. Processus terminalis narrow, rather short. Median apical incision indistinct. Processus lateralis long, rounded triangular. Gonarcus weell chitinized, triangular and has a very large, acute tooth apically. Styli unforked, forming an arch below parameres. This arch curved forewards medially. There is a chitinized knob dorsally of styli, emerging from a membraneous structure. Parameres long, strong, with short, but distinct processus ventralis. Processus apicalis slender, with a caudally situated, very short, nail-like projection, and with a very strong tooth. Penis is a ventrally split (in caudal view fungiform) sclerite.

C. kisi belongs to the *Coniopteryx (Xeroconiopteryx) loipetsederi* species-group (MEINANDER, 1972), and it is close to *Coniopteryx (Xeroconiopteryx) atlantica* OHM, 1963.

The main distinctive characteristics of *C. kisi*: 1. Processus lateralis of hypandrium rounded, while in case of *C. atlenica* acute. – 2. Processus apicalis slender (in *C. atlantica* broad). – 3. The caudally situated dorsal projection of processus apicalis very short and the tooth-shaped projection extremely large. (In case of *C. atlantica* the caudally situated dorsal projection relatively large, and the tooth-shaped one only moderately long.)

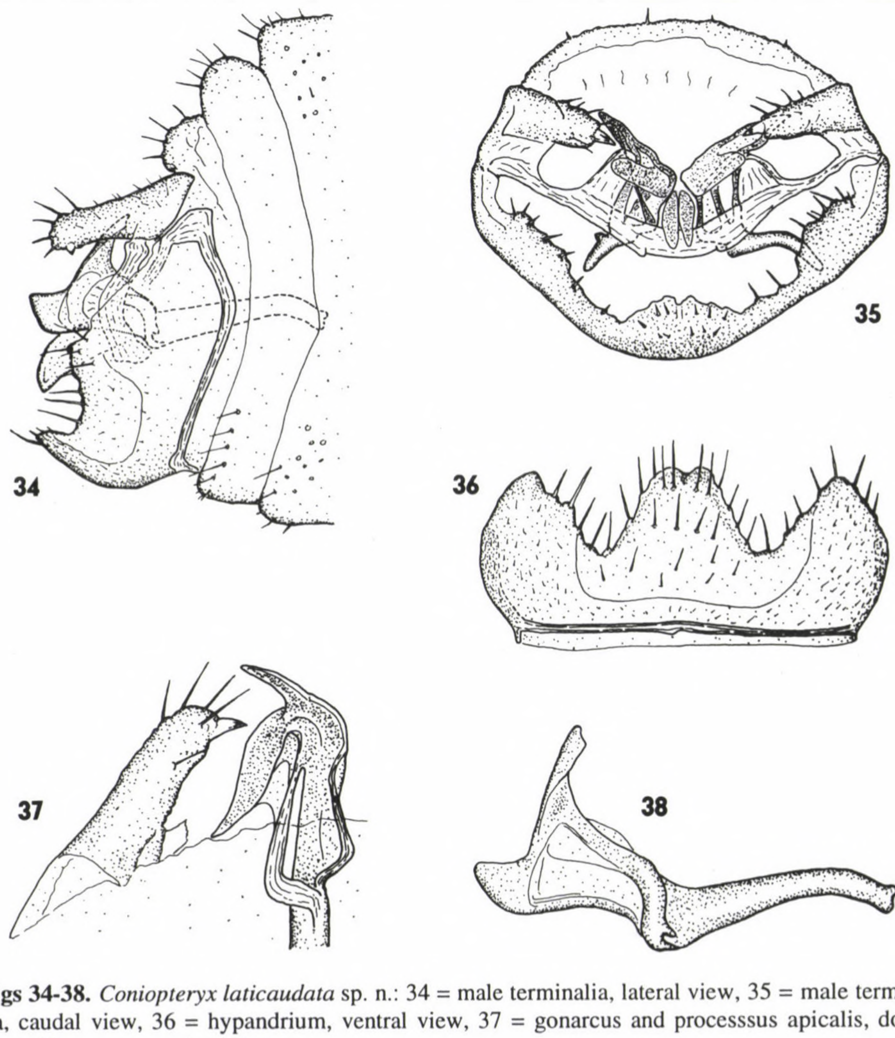
Etymology – I dedicate this new species in honour of Professor Dr BÉLA KIS, the excellent neuropterologist and versatil entomologist.



Figs 28-33. *Coniopteryx kisi* sp. n.: 28 = male terminalia, lateral view, 29 = male terminalia, caudal view, 30 = paramere, lateral view, 31 = hypandrium, ventral view, 32 = gonarcus and processsus apicalis, dorsal view, 33 = penis and styli, ventral view

Coniopteryx (Xeroconiopteryx) laticaudata sp. n.
(Figs 34-38)

Holotype: male, Ghana, Kwadaso, Ashanti region, collected by light trap with UV light, May 5, 1969, leg. S. ENDRŐDY-YOUNGA – deposited in the Hungarian Natural History Museum, Budapest.



Figs 34-38. *Coniopteryx laticaudata* sp. n.: 34 = male terminalia, lateral view, 35 = male terminalia, caudal view, 36 = hypandrium, ventral view, 37 = gonarcus and processsus apicalis, dorsal view, 38 = paramere, lateral view

Frons and palpi normal. Interantennal frontal edge of vertex is rather prominent. Colour of vertex and of dorsal part of genae yellowish brown. Other parts of head light brown. Eyes black. Antennae 1.1 mm, 26 segmented, light brown. Pedicel slightly longer than broad, basal flagellar segments twice as broad as long. Setae present on flagellar segments and pedicel. Ordinary hairs of flagellar segments in two irregular whorls. Scale-like hairs on whole surface of pedicel, and on apical part of flagellar segments. This type of hairs in case of this new species shorter on the pedicel than on flagellar segments. – Thorax light brown, with medium brown shoulder spots.

Length of fore wing 1.8 mm, of hind wing 1.5 mm. Wing membrane linght brown.

Male terminalia: as Figs 34-38. Hypandrium in lateral view (at the processus lateralis) twice as high as broad. Apodeme along the anterior margin ventrally complete. Processus terminalis very strong, broad, with a little median apical incision. Processus lateralis short, rounded. Gonarcus long, rather slender, with acute apical spine. Styli forked. Its outer branch broad, weakly chitinized, and medially seems to be connected to the parameres. Inner branch form an arch below the parameres. Proximal part of parameres distinctly curved. Processus ventralis short. Processus apicalis large. Its anterior part consists of rather slender, strongly chitinized bars, mostly with chitine sheet between them. Posterior part of processus apicalis has two large, very outstanding projections, from which the caudally situated is shorter than the other. Penis consists of two rather strong, acute, bill-shaped sclerits.

Because of the obvious similarities of their male genitalia (i.e. the very peculiar structure and shape of parameres, the bifurcated structure of styli and the strong, alongated, bill-like penis) *C. laticaudata* – together with *Coniopteryx (Xeroconiopterys) aequatoriana* MONSERRAT, 1989 – belongs to the *C. (X.) crassicornis* species-group (MEINANDER, 1982). (This group hitherto was regarded as a monotypic one, MEINANDER 1992.)

The main distinctive characteristics of *C. laticaudata*: 1. Processus terminalis strong. – 2. Scale like hairs present on whole surface of the normally developed pedicel. (In case of *C. crassicornis* only the apical part, while in case of *C. aequatoriana* the ventral part of pedicel covered by this type of hairs; moreover in case of *C. aequatoriana* the shape of pedicel modified.) – 3. The subcaudally situated dorsal projection of processus apicalis is extremely large, while in case of the two other species the caudally situated dorsal projection is longer than that in subcaudal position.

Because of the figured and described features of pedicel and male genitalia, I suppose that the coniopterygid reported from Equatorial Guinea as *C. crassicornis* (MONSERRAT 1989) may be conspecific with the *C. laticaudata* sp. n.

Coniopteryx (Coniopteryx) longistylus sp. n.
(Figs 39-43)

Holotype: male, Ghana, Kwadaso, Ashanti region, collected by light trap with UV light, April 28, 1969, leg. S. ENDRŐDY-YOUNGA – deposited in the Hungarian Natural History Museum, Budapest.

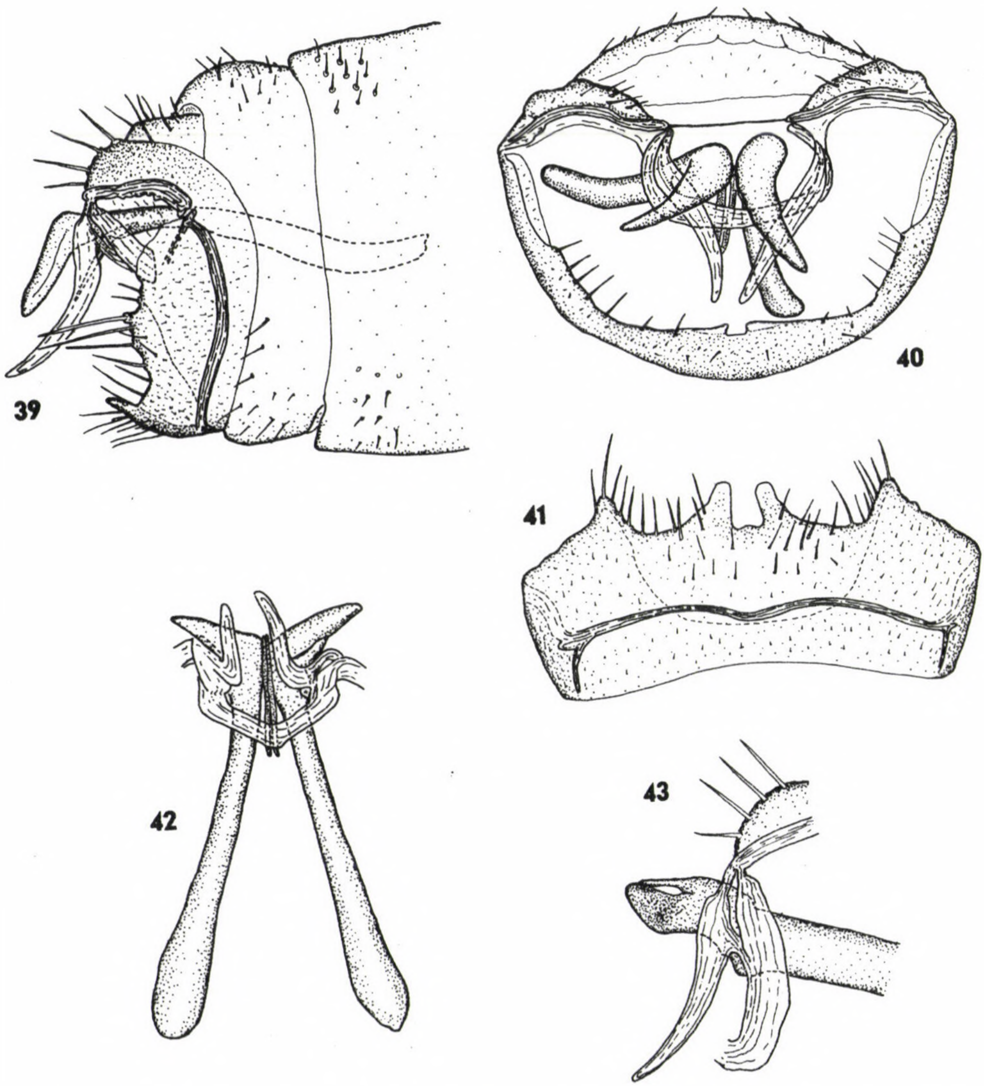
Frons and palpi normal. Head medium brown. Eyes black. Antennae 1.2 mm, 26 segmented, light brown. Pedicel as long as broad, basal flagellar segments almost twice as broad as long. Setae present on flagellar segments and pedicel. Ordinary hairs in two whorls on flagellar segments. Scale-like hairs on the apical part of flagellar segments and almost on the whole surface of pedicel. – Thorax brown with dark brown shoulder spots.

Length of fore wing 1.9 mm, of hind wing 1.5 mm. Wing membrane light brown.

Male terminalia: as Figs 39-43. Hypandrium in lateral view about twice as high as broad. Apodeme well separated from the anterior margin and ventrally complete. Processus terminalis narrow, acute. Median apical incision rather deep and narrow. Processus lateralis very short, serrated. Gonarcus well chitinized, caudally connected only by a weak membraneous slat. Gonarcus and proximal part of hypandrium in lateral view seems to be syncleritous. Styli forked. Above the bifurcation there is a narrow vertical split. Outer branches of styli very long and curved backwards.

Inner branches form an arch below the parameres. Parameres long with short processus ventralis which seems to be connected with the inner branch of styli. Caudal part of parameres bent downwards and has a narrow split subapically. Processus apicalis absent. Penis is a slender, slightly curved, ventrally split sclerite.

Male genitalia of *C. longistylus* (as the long paramere with a curved downwards apical part, but without processus apicalis) resembles in some respect to the Afrotropical *Coniopteryx* (*Conio-*



Figs 39-43. *Conioteryx longistylus* sp. n.: 39 = male terminalia, lateral view, 40 = male terminalia, caudal view, 41 = hypandrium, ventral view, 42 = male internal genitalia, ventral view, 43 = stylus, distal part of paramere and end of gonarcus, caudo-lateral view (slightly from below)

pteryx) riomunica MONSERRAT, 1989, and by the structure of styli even to the *C.* (*C.*) *tagalica* (BANKS, 1937) from the Philippines (*C. tineiformis* species group-sensu MEINANDER 1981).

The main distinctive characteristics of *C. longistylus*: 1. Processus lateralis short. (In case of *C. riomunica* prominent.) – 2. Apodeme of hypandrium well separated from anterior margin. – 3. Outer branch of styli long and bent backwards. (In *C. riomunica* it curved forward.) – 4. Paramere without processus apicalis.

Semidalis scotti Esben-Petersen, 1928 – Material: 1 male specimen, Kenya, Mt Elgon National Park, 2740 m, bamboo (*Arundinaria alpina*) thicket, sweeping from the vegetation, January 20, 1992, leg. O. Merkl. – Distribution: Two previous records were published, both from the Ethiopian highlands (Esben-Petersen 1928, Meinander 1976).

REFERENCES

ESBEN-PETERSEN, P. (1928) Neuroptera and Embidiina from Abyssinia and Somaliland. *Ann. Mag. Nat. Hist.* (10) **1**: 442-450.

MEINANDER, M. (1972) A revision of the family Coniopterygidae (Planipennia). *Acta Zool. Fennica* **136**: 1-357.

MEINANDER, M. (1976) Coniopterygidae from Africa (Neuroptera). *Notulae Entomol.* **56**: 85-88.

MEINANDER, M. (1981) A review of the genus Coniopteryx (Neuroptera, Coniopterygidae). *Ann. Ent. Fennica* **47**: 97-110.

MEINANDER, M. (1992) A review of the family Coniopterygidae (Insecta: Neuroptera). *In*: CANARD M., ASPÖCK H. & MANSELL M. W. (eds): *Current research in neuropterology*. Proceedings of the Fourth International Symposium on Neuropterology. Bagnéres-de-Luchon, France, 1991. Toulouse, France, 1992: 255-260.

MONSERRAT, V. (1989) Contribution al conocimento de los Coniopterygidos de Rio Muni (Guinea Ecuatorial) (Neuropteroidea, Planipennia: Coniopterygidae). *Ann. Mus. Civ. Storia Naturale Genova* **87**: 157-181.

Received January 21, 1993; accepted December 1, 1993

Acta Zoologica Academiae Scientiarum Hungaricae 40 (2), pp. 185-187, 1994

DOLERUS THARGITAI SP. N. FROM TRANSYLVANIA (HYMENOPTERA, SYMPHYTA: TENTHREDINIDAE)*

L. ZOMBORI

Department of Zoology, Hungarian Natural History Museum
H-1088 Budapest, Baross utca 13, Hungary

A new *Dolerus* species is described from the Carpathian Basin and compared to its nearest ally: *D. subarcticus* HELLÉN, 1955.

Key words: Hymenoptera, Symphyta, *Dolerus thargitai*, Transylvania

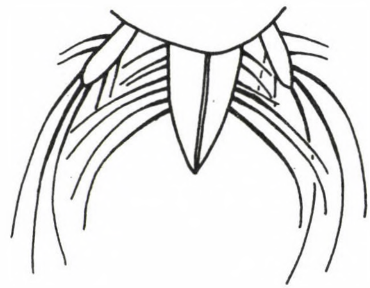
With the support of the Hungarian National Scientific Research Fund extensive studies are carried out in collaboration with Romanian partners into "The History of Symphyta in the Carpathian Basin and the northern part of the Balkan Peninsula". The researches include both field work and the identification and checking of old museum materials.

In the course of a spring collecting in the eastern parts of Transylvania (Hargita Mts) several specimens of a new sawfly species were found whose description is given hereunder.

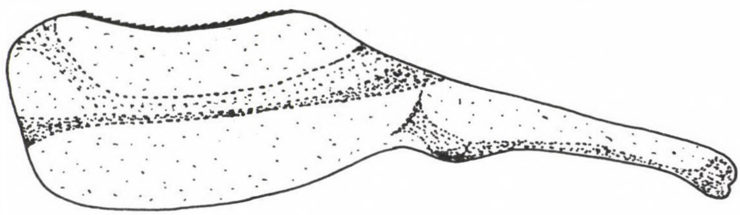
Dolerus thargitai sp. n.

Female. Almost entirely black with only faint indications of reddish brown on the middle abdominal segments. Head black with silvery pubescence. Length of a hair is about the diameter of front ocellus. Cephalic punctures small and very dense on frons, elsewhere larger and rough, partly confluent on vertex. Labrum triangulate in front, somewhat reflexed at apex. Front margin of clypeus trapezoidally excised to about half depth. Anterior tentorial pits deep sitting in the bottom of a large basin. Superior tentorial pits insignificant, at most a small polished wart on either sides. Length of malar space just falling short of interantennal distance. Occipital suture sharp throughout to top of head. Lateral furrows of postocellar area weakly arcuate, shallow. Thorax all black, clothed in similar hairs as on head. Mesopleuron with large crater-like, irregular punctures lending the surface a honeycomb-like appearance. Mesosternum finely punctate, shining. Pronotum densely punctate. Mesonotum shining with distinct, regular punctures. Anterior half of prescutal suture of mesonotum shallow, posterior half very deep. Mesoscutellum very roughly punctate. Mesopostscutellum somewhat transversely shagreened, shining. Brownish yellow chencri large, one is about as wide as the distance between the two. Metascutellum smooth, very weakly shagreened. Wings slighly fumous. Fore legs black, inner tibial spur laminate, bifid at apex. (Right middle leg missing, only coxa intact.) Hind legs with long reddish brown inner spur, length of latter surpassing the big-

* Supported by the Hungarian National Scientific Research Fund, No. 3179/91



1



2

Figs 1-2. *Dolerus thargitai* sp. n. 1: abdominal apex of female to show setation of sawsheath and cerci, 2: penis valve

gest width of tibia (last two tarsal joints missing on both hind legs). Abdomen black, poorly shining. Tergites smooth and shining without any transverse sculpture. First tergite with a large, deep cleft in the middle. Hind margin of second tergite dark reddish brown, as are tergites 3 and 4. Fifth tergite dark brownish suffused. Other tergites black. Basic sternites with brownish suffusion, apical ones black. Cerci long with long setae, those on apex being much longer than length of cercus. The two sides of sawsheath gradually approximating each other and end in a sharp point in dorsal view. Bilateral setae somewhat bent at apex, pointing outward, tips much farther from one another than length of a seta (Fig. 1). Length: 8.5 mm.

Male. Black and highly similar to female. Dark reddish brown are more or less the middle segments of the abdomen and even darker the hind side of all femora (in some paratype specimens entirely black). Eighth tergite in the middle with a low shining keel-like elevation, especially at its posterior half. Penis valve as depicted in Fig. 2. Length 7–8.5 mm.

Holotype: female "TRANSYLVANIA Csíkszentkirály Borsáros 1992.V.26 leg. Podlussány". Paratypes: 3 females and 6 males with exactly the same data as for holotype; 3 males "TRANSYLVANIA Csíkszentkirály Borsáros 1992.V.26 leg. Zombori"; 3 males "TRANSYLVANIA Kérulyfürdő Tolvajos-patak 1992.V.26 leg. Zombori". Types are deposited in the Hungarian Natural History Museum.

The two type-localities: Csíkszentkirály (Sîncraieni) and Kérulyfürdő (Baile Chirui) are some 20 km apart, as the crow flies (some 25 km on the road). The former lies by the upper reaches of the river Olt, in a very cold recess of the Alcsík basin (Ciuc). The latter in the Hargita Mts (Muntii Harghita), at an elevation of about 600 metres, close to a forester's lodge along a trickle of water.

The new species comes close to *Dolerus subarcticus* HELLÉN, 1955, but there are significant differences in size, colour and structure. The length of *thargitai* sp. n. varies between 7 and 8.5 mm, abdominal segments 3–4 faintly marked with reddish brown, the front margin of clypeus trapezoidally excised, postocellar furrows distinct, inner hind tibial spur about as long as the width of tibial apex. On the other hand, the length of *subarcticus* is between 5.5 and 7 mm, abdominal segments 2–5 entirely red, front margin of clypeus quadrangularly excised, postocellar furrows are practically non-existent, while the inner hind tibial spur is clearly shorter than apical width of hind tibia.

The new species is also near to *Dolerus pullulus* ZHELOCHOVTSEV, 1928 found in the northern regions of Finland and Russia. But *thargitai* sp. n. has no shining spot on either sides of the postocellar area and the abdominal segments 2–6(7) of *pullulus* are red, i.e. even more extensively so than in *subarcticus*. Peculiarly enough the penis valve of *thargitai* and *pullulus* seems to be identical, at most somewhat more elongated in the former and more robust in the latter.

Derivation of specific name: from Thargitaos, the legendary ancestral king of the Scythians, father of three sons, Scythes being the youngest one of them. The name of the Transylvanian mountain range Hargita (Harghita) is most likely derived from the mythical name of king Thargitaos.

REFERENCES

HELLÉN, W. (1955) Studien über paläarktische Dolerinen (Hym., Tenthr.). *Notul. ent.* **35**: 97–107.

ZHELOCHOVTSEV, A. N. (1928) 7. Über paläarktische Dolerinae. *Zool. Anzeiger.* **79** (3-4): 105–112.

Received January 24, 1994; accepted March 28, 1994

Acta Zoologica Academiae Scientiarum Hungaricae 40 (2), pp. 189-193, 1994

FORUM

The aim of this section is to initiate discussion on issues of general interest among zoologists. Forum articles represent personal views only. Polemic answers and new articles are welcome.

AFTER 40 YEARS THE QUESTION REMAINS: WHY WORSHIP TYPES?*

F. ZUMPT's question posed 40 years ago has not been adequately answered, because much of the methodology of taxonomy, including the type-concept codified in the Intl Code Zool. Nomencl., compel taxonomists to adopt a 19th century attitude to their work. The methods we apply create a conflict of interest:

1. Type-specimens of doubtful status, and often poor condition, enshrined by inadequate descriptions have to be studied; their accessibility is frequently misunderstood by fellow taxonomists, i.e. it is assumed that the duty of curators is to send all types on demand.

2. Curators, for their part, are expected to worship types for their salary, consequently they do not readily loan them, not only for fear of damage during transportation, but because of the high risk of damage or destruction caused by taxonomists performing 'genital preparations'. The former concept of types as "the property of science" proves to be an unattainable ideal.

It is proposed that all future descriptions of new species are validated only by depicting differentiating characters in an identifiable way to avoid later re-examinations.

The above problems of methodological nature requiring a new consensus of taxonomists. Therefore I would propose that an ad hoc committee be formed [by the Council of the International Congresses of Entomology] with the commitment to consider proposals for a radical reform of the Code in accordance with our task to serve the biological sciences of the 21st century.

Forty years after ZUMPT's (1953) original thoughts – to the dishonour of insect taxonomy – we have to pose this question in similar circumstances. In that

* This text is based on an oral presentation at the XVIII International Congress of Entomology, Vancouver, Canada, 1988

paper ZUMPT stressed the importance of the holotype specimens in taxonomic work, "no taxonomic revision of a group is possible without checking the types...". Subsequently he made complaints about the situation that holotypes were not obtainable in numerous cases. Even when their locations are known, a "worship of types" by museums, institutes and private persons results in regulations which make it impossible for them to be lent out". If one cannot receive them by mail, one can hardly visit personally all those museums where the types necessary for a revisory work are preserved. If so, one must risk creating new synonyms, there is no other alternative.

ZUMPT considered the practice of designation of a neotype if needed as a proper answer to the "worship of type" problem: "A species whose status cannot be determined is ... in a far more pitiable condition than one for which it has been necessary to create a neotype". The questions which arise in connection with the importance of types have been widely stressed in the literature. The lack of time [space] forces me not to quote them, although the views of numerous authors during the last twenty-five years have prompted the present article.

Before listing my proposals to reduce the dependency upon types, let me first attempt to group entomologists according to their present day attitude to type specimens in order to show that their attitude is dependent upon their circumstances.

Entomologists may be divided into five groups, with the first three characterized by interdependence with each other.

1. Taxonomists without responsibility for important collections. In order to conduct their research they need to borrow types from museums and institutions, and having 'collected' a number of specimens proceed to dismember them for genitalia preparations. Their object is to describe as many new species as they can. However, they have a problem because they rely on the goodwill of the next group.

2. The second group is formed by the curators who are not primarily taxonomists. They have a feeling, and we may consider this as a genuine feeling, that they are obliged to worship types in their collection for their salary. If they spend most of their working time answering requests from colleagues working elsewhere, picking out specimens from a huge collection, using their microscope to sort and select specimens for loan and not for their own scientific study, and the institution has to settle considerable bills for shipping specimens abroad, it is not surprising if administrators become annoyed and are not satisfied with the present situation after reading minute books showing losses of types through damage. This group, as guardians of type material, will be more concerned with their preservation and so must necessarily take a different view to the first group.

3. The third group consists of biological specialist e.g. geneticists, physiologists etc., who are not taxonomists and who cannot understand our preoccupa-

tion with types, who belittle the work of curation, and yet always expect to have correct identifications of the animals they study. Whilst I shall not refer to this group again in the present article, they form a large proportion of 'entomologists' in the broad sense and their influence is not inconsiderable.

The other two groups are formed of confused people:

4. The fourth group is that of the schizophrenoid curators, including the present author, who take care of large collections but are also working taxonomists who themselves have to borrow types from other institutions. It is a matter of course, that they are predisposed to pose questions of this kind. As regards me, I think, former concepts of types as "the property of science" can no longer be supported. On one hand, I believe, some rules (recommendations) of the present Code (I.T.Z.N., 1985) are too feeble in respect of the requirements of valid descriptions, but on the other, some other rules (recommendations) are too rigid; for instance, uniform rules for fixing, labelling and preservation of types, moreover, the holotype-concept cannot be upheld for all animal groups.

5. The last group is in all probability the largest one, and consists of those people in applied entomology who are not familiar with nomenclatorial problems, including problems with types, but wo are deeply concerned with the stability of names and are threatened by a kind of Sword of Damocles, when sudden changes of names are proposed by apparently library-bound taxonomists, the reasons for which are completely mysterious to them.

I have spent more than eighteen years on the staff of the Hungarian Natural History Museum and four years at a university of applied natural sciences and although I have always been willing to cooperate with applied entomologists of the agricultural, veterinary and medical sciences, I can say in good faith that in each institution the approach to entomology is entirely different.

It is general knowledge that taxonomy worked without the type concept in the first one-hundred year period of the Linnaean nomenclature. The second centennial up to the present produced an overall application of this concept making the most of the advantages of the objective nature of preserved animal remains. Some taxonomists say that much of the current methodology of taxonomy, including the type-concept codified in the I.C.Z.N. compel taxonomists to adopt a 19th century approach (cf. BALOGH and PAPP, 1988) when the type-concept was borne. Well, I am very well aware of the anachronistic nature of our daily work, compared to the developments achieved in numerous other fields of human knowledge. Indeed, a present-day reviser of an insect group often has to do much of the work left undone by his predecessors by (a) widening the reference base of names published in old and inadequate descriptions and (b) describing new species. But why should the present stage of knowledge on an insect group like flies mean that we are unable to use earlier information based on a poorly preserved insect specimen or set of specimens in an objective way? Since our present methods are the result of many developments in techniques, not only current abilities but our potential has become more than enough to produce descriptions in a standard way which should avoid later re-examinations.

I am inclined to think I am lucky that I have been working on the taxonomy of the lesser dung flies (Sphaeroceridae) with some Canadians, Americans and a Czech for 20 years publishing descriptions with drawings on a standard that we could largely do this business without exchanging i.e. re-examining type-specimens. Acarologists have from the beginning almost obligatorily figured their new species, this way condensing a vast amount of information into small space and elaborated a code system for location and names of various setae.

Summarily, I believe, the type-concept is only useful when little is known about the species. Is there anybody in recent times, who has been in need of studying the types of *Musca domestica, Stomoxys calcitrans, Drosophila melanogaster, Leptinotarsa decemlineata* or *Cimex lectularius.*

Proposed solutions, in lieu of a summary, or, *how to change the Code to reach the golden age* when type-specimens will become as they actually are: useful and precious tools but only tools for science.

1. It must be accepted by all that the ownership of the type-specimens of insect and other animal species and the responsibility to keep their original state of preservation, belong exclusively to those individuals, institutes, museums, provinces or states, which have spent money for their collection, preparation and preservation.

2. It is only the availability for inspection at its normal place of storage which should be the right of any member of the scientific community. Therefore only the owners have the right to give permission for any change to the state of preservation of type-specimens and it must remain a case of conscience for the curator involved whether permission be granted for dissection, or even non-invasive methods e.g. microtomography etc. Similarly the decision to despatch types to other workers must remain the prerogative of the owner.

3. It is proposed that all future descriptions of new species and revisions be valid only by depicting differentiating characters in an identifiable way to avoid later repeated re-examinations.

4. The present articles codifying rules (recommendations) for type-specimens should be expanded to include rules for forming (fixing) reference bases.

Though an original description of a "new" species is the first step to the knowledge of that species, it does not necessarily follow that it is the most important step, or even important at all. The author acts only as a representative of the whole mankind, but being a pioneer only, he or she does not deserve more honour by printing his or her name after the name of the species for centuries to come than subsequent scientists who make that piece of knowledge usable for mankind by widening the reference base for that given species. It is proposed that the name hunters be discouraged by new articles, e.g. replacement names be registered with the name of the I.C.Z.N. or the journal of its publication and not on the author, and, that replacement name could possibly be put on the Official List of Specific/Generic Names in Zoology in the normal course of procedure.

5. Even if we adhere strictly to the concept of uniform zoological nomenclature, we should at the same time settle rules for allowing methods for handling and of fixing type-specimens specific for animal groups.

6. Every new rule should promote the stability of nomenclature with special regard to names in ordinary use in applied sciences. Thus, a reasonable reform of the Code should accompany a preservation of all the useful rules for stability in the present Code.

I am convinced that all the problems mentioned in are of a methodological nature requiring a new consensus of taxonomists. Consequently, I invite you all to correspond with colleagues on this matter that through discussion we might produce better nomenclatorial rules (see TUBBS, 1994) in order to serve the biological sciences of the 21st century.

Acknowledgement – I am grateful to Mr DAVID HENSHAW (Waltham Abbey, England, U.K.) for improving the English of the manuscript and for his useful comments.

REFERENCES

BALOGH, J. & PAPP, L. (1988) How to avoid unprofitable debate on systematics among taxonomists. *Opuscula zool. Bpest* **23**: 83-92.

International Trust for Zoological Nomenclature (1985) International Code of Zoological Nomenclature. Third edition adopted by the XX General Assembly of the International Union of Biological Sciences.

TUBBS, P. K. (1994) 4th Edition of the International Code of Zoological Nomenclature. *Biology International* **28**: 35-36.

ZUMPT, F. (1953) Why worship types? *Revista Ecuatoriana de Entomologia y Parasitologia* **1**(3): 87-89.

Received March 21, 1994

L. PAPP
Zoological Department, Hungarian Natural History Museum
H-1088 Budapest Baross utca 13., Hungary

ACTA ZOOLOGICA
ACADEMIAE SCIENTIARUM HUNGARICAE

An international journal of animal taxonomy and ecology

Instruction to authors

Submission of a paper implies that it has not been published previously, that is not under consideration for publication elsewhere, and that if accepted for the Acta Zoologica Hungarica, the authors will transfer copyright to the Hungarian Academy of Sciences/the Hungarian Natural History Museum as is customary. Articles and illustrations become the property of the HAS/HNHM.

Papers must be in English with British spelling, and be original contributions in the field of animal taxonomy, systematics, zoogeography and ecology. All manuscripts must be submitted to one of the editors (editor, assistant editor).

Entire manuscripts must be submitted on IBM compatible floppy disk and in duplicate printed copies and the author should retain a copy. In the case of multiple authors, the corresponding author should be indicated. Series of numbered papers will not be considered.

Manuscripts must be printed with double spacing (including the reference list), and with wide margins (30-35 mm) on the left side of the paper only. Authors are requested to keep their communications as concise as possible. Footnotes should be avoided or minimized, and italics should not be used for emphasis. A running head of not more than 30 letters should be supplied.

The manuscript should contain the following information:

Title. This should be followed by the name and full address of the author(s). Where possible, the fax and/or E-mail number of the corresponding author should be supplied with the manuscript, for use by the publisher.

Abstract. This should be a brief summary of the contents and conclusions of the paper, and should not be longer than 200 words and should not contain references.

Key words. No more than five (exceptionally 6) key word entries should be provided for rapid scanning of the contents of the paper and used for compiling the index.

Introduction. This should contain a brief survey of the revelant literature and the reasons for doing the work.

Materials and Methods. Sufficient information should be given to permit repetition of the experimental or field work. The technical description of methods should be given only when such methods are new.

Results. These should be presented concisely. Only in exceptional cases will it be permissible to present the same set of results in both table and a figure. The results section should not be used for discussion.

Discussion. This should be separate from the results section and should deal with the significance of the results and their relationship to the object of the work (and, this is the place of the identification key in taxonomical revisions).

Acknowledgements. (at most in 10 lines)

References. In principle the Harvard system is to be followed. References should be detailed in the following order: authors' names and initials, date of publication (in parentheses), the title of the article, the name of the journal as abbreviated in the World List of Scientific Periodicals (4th edn 1963), the volume, and the first and last pages of the article, e.g.

Norrbom, A. L. and Kim, K. C. (1985) Taxonomy and phylogenetic relationships of Copromyza Fallén (s.s.) (Diptera: Sphaeroceridae). *Ann. Entomol. Soc. Am.* **78**: 331-347.

For books the author's names, date of publication, title, edition, page reference, publisher's name and the place of publication should be given, e.g.

Hinton, H. E. (1981) *Biology of insect eggs*, vol. 2. Pergamon Press, New York.

or

McAlpine, J. F. (1981) Morphology and terminology, adults, pp. 9-63. *In* McAlpine *et al.* (eds) *Manual of Nearctic Diptera*, vol. 1. Agriculture Canada, Ottawa.

In the text references should be given as Marshall (1992) or (Marshall, 1992). When a citation includes more than two authors, e.g. Grey, Black and White, the paper should be referred to in the text as Grey et al., provided that this not ambiguous. If papers by the same author(s) in the same year are cited, they should be distinguished by the letters, a, b, c, etc., e.g. Marshall (1992a).

References to papers "in press" must mean that the article has been accepted for publication. References to "personal communications" and unpublished work are permitted in the text only: references to papers in preparation or submitted are not permissible.

All necessary **illustrations** should accompany the manuscript, but should not be inserted in the text. All photographs, graphs and diagrams should be numbered consecutively in Arabic numerals in the order in which they are referred to in the text. Glossy photographs or positive prints should be sent unmounted wherever possible and should be kept to a minimum. Figures should be of good quality. Explanation of lettering and symbols should be given in the figure caption and only exceptionally in the figures. Lettering and symbols to appear on the illustration should be of sufficient size to allow for considerable reduction where necessary (usually proper for a 50% reduction in size). Scales must be indicated on micrographs, not by magnifications in the legends. Figure size must not exceed 24×30 cm. On the back of each illustration should be indicated the author's name, the figure number (in Arabic numerals), and the top of the illustration, where this is not clear. Halftones should be included only when they are essential. Details and quotation of publication of colour plates should be made to the editors. The following symbols should be used on line drawing: ● ■ ○ ❑ ▲ ◆ ♦ etc.

Legends to figures should be typed on a separate sheet. They should give sufficient data to make the illustration comprehensible without reference to the text.

Tables and appendices should be constructed so as to be intelligible without reference to the text, numbered in Arabic numerals and typed on separate sheets. Every table should be provided with an explanatory caption and each column should carry an appropriate heading. Units of measure should always be indicated clearly (metric units are preferred). All tables and figures must be referred to in the text.

Only standard **abbreviations** should be used. Arbitrary abbreviations and jargon will not be accepted.

The Latin names should be given for all species used in the investigation, although taxonomic affiliation and authority need not be provided in the title.

Page proofs will be sent to the author (or the first-mentioned author in a paper of multiple authorship) for checking. Corrections to the proofs must be restricted to printers' errors. Any substantial alterations other than these may be charged to the author. Authors are particularly requested to return their corrected proofs as quickly as possible in order to facilitate rapid publication. Please note that authors are urged to check their proofs carefully before return, since late corrections cannot be guaranteed for inclusion in the printed journal.

Fifty reprints free of charge will be sent to the first author; extra copies of the issue (at a specially reduced rate) can be ordered on the form which will accompany the proofs. These should be returned to: The Editorial Office of the Acta Zoologica, Hungarian Natural History Museum, Budapest, Baross u. 13, H-1088, Hungary

The **page charge** required from authors outside Hungary is 15 USD per printed page. Authors of papers exceeding 16 printed pages are asked to pay 40 USD (or HUF equivalent) for each such page i.e. all costs of publication (irrespective of their nationality).

FOR FURTHER INFORMATION PLEASE CONTACT US
The Editorial Office of the Acta Zoologica
H-1088 Budapest, Baross u. 13, Hungary
Fax: (36)-(1)-1138820.
E-mail: h7962per@huella.bitnet.

SUBSCRIPTION INFORMATION

Orders should be addressed to

Editorial Office of the Acta Zoologica
Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13, Hungary

Typeset: Pars Ltd., Budapest.
Printed by Dabas Jegyzet Ltd., Hungary

CONTENTS

HU ISSN 1217–8837

Acta Zoologica

Academiae Scientiarum Hungaricae

VOLUME 40 - NUMBER 3 - 1994

HUNGARIAN NATURAL HISTORY MUSEUM, BUDAPEST

ACTA ZOOLOGICA
ACADEMIAE SCIENTIARUM HUNGARICAE

AN INTERNATIONAL JOURNAL OF ANIMAL TAXONOMY AND ECOLOGY

Acta Zoologica Academiae Scientiarum Hungaricae is published quarterly from February 1994 (other issues in May, August and November) by the Hungarian Natural History Museum and the Biological Section of the Hungarian Academy of Sciences with the financial support of the Hungarian Academy of Sciences.

Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 195-201

ON THE GENUS *DITYLOMORPHULA*, WITH DESCRIPTION OF A NEW SPECIES FROM KENYA (COLEOPTERA: OEDEMERIDAE)

X. A. VÁZQUEZ

Departament de Biologia Animal, Unitat d'Artròpodes, Facultat de Biologia Universitat de Barcelona, Diagonal, 645, 08028 Barcelona, Spain

The genus *Ditylomorphula* ŠVIHLA, known hitherto from western Africa, is defined on the basis of material from eastern and southern Africa. The presence of a medial projection at the apical emargination of the male sternite IX is considered as an apomorphic character state shared by *Ditylomorphula*, *Ditylomorphus* ŠVIHLA, *Chitona* SCHMIDT, *Pseudolycus* GUÉRIN, *Eopselaphus* ŠVIHLA, *Copidita* LECONTE, *Rhinoplatia* HORN, and *Thelyphassa* PASCOE. In addition, *D. merkli* sp. n. from Kenya is described. The shape of the male genitalia suggest that it is closely related to some undescribed southern African species.

Key words: new species, *Ditylomorphula,* Coleoptera, Afrotropics

The knowledge of Afrotropical Oedemeridae is poor. Several new species were described by CASTELNAU (1840), GERSTAECKER (1871, 1873), RITSEMA (1875), HAROLD (1879), KARSCH (1881), FAIRMAIRE (1883, 1885, 1896), and GESTRO (1892). BLAIR (1926) revised the Southern African species. PIC (1906, 1914, 1922*a*, 1922b, 1930, 1935, 1939, 1950, 1952*a*, 1952*b*, 1953) added most species descriptions, all lacking relevant data. Recently, ŠVIHLA (1984, 1985, 1987, 1991) resumed the study of Afrotropical Oedemeridae.

THE GENUS *DITYLOMORPHULA*

The genus *Ditylomorphula* was erected by ŠVIHLA (1985) based on *D. bicoloripes* (PIC, 1922), and six further unnamed species from western Africa. However, I have examined specimens from eastern and southern Africa which represent several species. Thus, *Ditylomorphula* seems to be a widespread Afrotropical genus.

The species of this genus occurring in western Africa have similar habitus and coloration, while the species of the remaining areas have a rather different habitus and are more diverse in colour patterns.

On the basis of the material that I have examined, the genus *Ditylomorphula* can be defined by the following characters (see also ŠVIHLA, 1985):

– body slender

- both mandibles bifid at apex
- last segment of maxillary palpi securiform to cultriform
- eyes vaulted, small to very large
- antennae filiform exceeding well elytral midlength, the last segment narrowed from its midlength to apex
- pronotum more or less cordiform, with shallow anterolateral depressions
- claws simple, thickened basally only
- elytra parallel-sided or weakly widened posteriorly
- male pygidium rounded or shallowly emarginate at apex, last sternite rounded, truncate or slightly emarginate
- last sternite slightly to moderately shorter than pygidium in male, weakly shorter than pygidium in female
- male sternite IX with strong, bifid medial projection at apical emargination
- tegminite laminar
- parameres usually pubescent and rounded in cross section, but may be almost glabrous and/or flat in cross section
- basal apodeme of median lobe concave, with small, unpigmented crest
- apical region of median lobe toothed dorsally, with one or two pairs of teeth or several denticles
- bursa copulatrix relatively small, as long as or only slightly longer than spermatheca

The male genitalia of all examined species have a medial projection at apical emargination of sternite IX. This structure appears to be a true synapomorphy of *Ditylomorphula* ŠVIHLA and *Ditylomorphus* ŠVIHLA (Afrotropical), *Chitona* SCHMIDT (Palaearctic and Afrotropical), *Pseudolycus* GUÉRIN (Madagascarian and Australian), *Eopselaphus* ŠVIHLA (Oriental and Madagascarian), *Copidita* LECONTE and *Rhinoplatia* HORN (Nearctic; see ARNETT, 1951), and *Thelyphassa* PASCOE (New Zealand and southern Polynesia; see HUDSON, 1975). Possibly some other genera which sternite IX has not been described yet, belongs also to this group.

The highly variable number of dorsal teeth of the median lobe, the different characters of parameres and the rather dissimilar habitus of the examined species is conspicuous, suggesting paraphyly within the examined, and mostly undescribed species of *Ditylomorphula.* One of these species, from Kenya, is described below.

Ditylomorphula merkli sp. n.

Holotype, ♂: Kenya, Mt. Elgon Nat. P., near Chepnyalil Cave, dry evergreen montane forest, 2500 m / at light, No. 509, 24-28.I.1992, O. Merkl & G. Várkonyi. Paratypes: 1 ♂, 4 ♀♀; same data as the holotype. Holotype and paratypes are deposited in the Hungarian Natural History Museum, Budapest.

Male (Fig. 1)

Length: 10.5-10.7 mm. Head, pronotum and elytra brown, the latter usually slightly paler, yellowish. Apices of mandibles and maxillary palpi piceous. Antennae piceous with each segment narrowly brownish basally and apically. Femora yellowish with piceous apical third, tibiae and tarsi piceous. Abdomen testaceous with yellowish apical segment. Thoracic sternites yellowish. Body clothed with flavous, thin, recumbent, moderately dense and long pubescence.

Head slightly elongate (HW/HL=1.3-1.4), somewhat broader than pronotum (HW/PW=1.1). Punctation dense, moderately large and deep, between punctures strongly microsculptured. Eyes medium-sized, rather vaulted, shallowly sinuate. Frons between eyes distinctly broader than between antennal pits (FWE/FWA=1.4-1.5). Interocular area broad (FWE/EYW=1.8-2.0). Maxillary palpi (Fig. 13) large, elongate, last segment cultriform, widest subbasally, its outer margin somewhat emarginate preapically. Antennae very long, slender, reaching apical fifth of elytra, segment I 2.5× as long as segment II, segment III 1.9-2.1× as long as II, segments III-V gradually increasing, segments V-XI gradually decreasing in length, segment XI slightly shorter than X and somewhat emarginate in middle.

Pronotum moderately cordiform, narrow, longer than wide (PL/PW=1.2). Anterolateral depressions shallow but distinct, mediobasal one hardly visible. Disc with a longitudinal, short, narrow, superficial sulcus medially. Discal surface rather densely and coarsely punctate.

Elytra weakly widened posteriorly, elongate (EL/EW=3.1-3.2), with four moderately prominent costae. Surface densely, rugosely punctate and strongly microsculptured. Pubescence longer and thicker than that on pronotum and head.

Legs long and slender, tarsi slender, segment I about 1.5x as long as segment II in protarsi, about twice in mesotarsi, about 2.5x in metatarsi.

Terminalia. Pygidium (Fig. 11) somewhat emarginate at apex. Last sternite (Fig. 11) rounded apically, approximately as long as 3/4 length of pygidium. Sternite VIII (Fig. 5). Sternite IX (Figs 8-9) with minute denticles at medial projection. Tergite IX (Fig. 10). Tegminite (Fig. 2). Parameres (Figs 6-7) as long as 2/5 length of tegmen, slender, densely pubescent, barely divergent towards apex. Median lobe (Figs 3-4) straight, slender, elongate, with a single pair of preapical teeth, ostium situated far from teeth, gonoporus sclerotized; basal apodeme concave, with a small, unpigmented crest, supporting sclerite attached into the concavity of basal apodeme.

Female

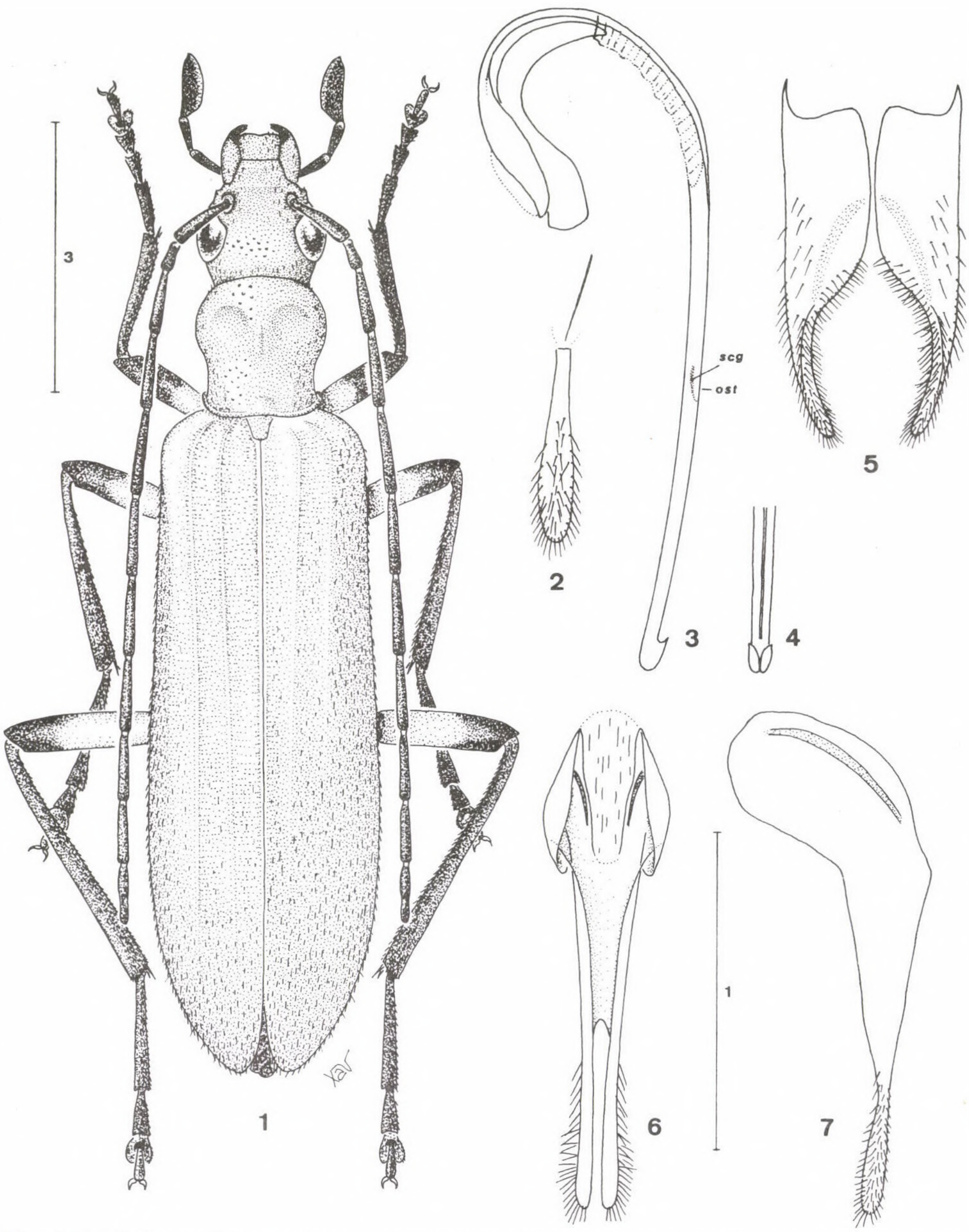
Length: 12.2-12.5 mm. Head slightly longer (HW/HL=1.2-1.3), narrower than or as broad as pronotum (HW/PW=0.9-1.0). Eyes hardly smaller (FWE/FWA=1.3-1.4; FWE/EYW=1.9-2.2). Maxillary palpi (Fig. 14) smaller, not elongate, last segment securiform, widest behind middle. Antennae shorter, reaching apical fourth of elytra, segment I 2.4-2.9x as long as segment II, segment III 1.8-2.2x as long as II. Pronotum less elongate (PL/PW=1.1-1.2). Elytra occasionally more elongate (EL/EW=3.1-3.3).

Terminalia. Last sternite (Fig. 12) rounded apically, slightly sinuate at sides. Pygidium (Fig. 12) barely emarginate at apex, slightly longer than last sternite. Bursa copulatrix relatively small, subspherical, spermatheca about as long as or slightly shorter than bursa, spermathecal gland comparatively short (Fig. 15).

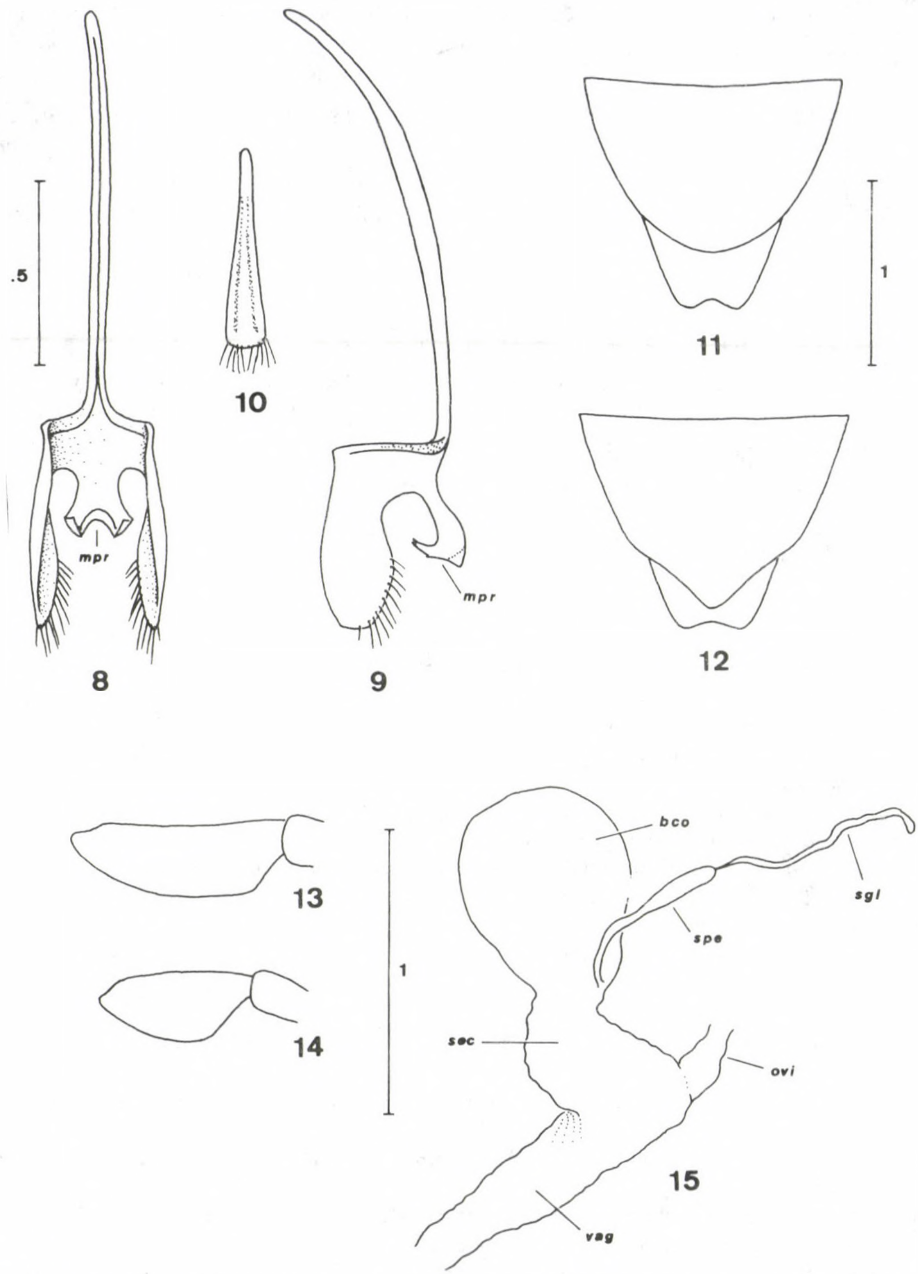
The new species is named in honour of Dr OTTÓ MERKL, Hungarian Natural History Museum, Budapest.

Diagnosis

The two species of *Ditylomorphula*, *D. bicoloripes* (PIC) and *D. merkli* sp. n., have very different male genitalia suggesting far relationship. According to the shape of the male genitalia, *D. merkli* sp. n. is closely related to some undescribed species from southern Africa (VÁZQUEZ, unpublished).



Figs 1-7. *Ditylomorphula merkli* sp. n.: 1 = habitus of male, 2 = tegminite, 3 = median lobe, lateral view, 4 = apex of median lobe, dorsal view, 5 = male sternite VIII, 6 = tegmen in ventral, 7 = lateral view. Scales in mm. (*ost*: ostium; *scg*: sclerotized gonoporus)



Figs 8-15. *Ditylomorphula merkli* sp. n.: 8 = male sternite IX in ventral, 9 = same, lateral view, 10 = male tergite IX, 11 = last abdominal segment of male, 12 = same, female, 13 = last segment of maxillary palpi of male, 14 = same, female, 15 = female internal copulatory organs. Scales in mm (*bco*: bursa copulatrix; *mpr*: medial projection; *ovi*: oviduct; *sec*: seminal canal; *sgl*: spermathecal gland; *spe*: spermatheca; *vag*: vagina)

The males of two species may be distinguished by the following key (the female of *D. bicoloripes* (PIC) is unknown):

1 Median lobe multidentate. Parameres short, as long as 1/5 length of tegmen **D. bicoloripes** (PIC)

– Median lobe with a single pair of preapical teeth. Parameres longer, as long as 2/5 length of tegmen **D. merkli** sp. n.

Remarks. The specimens of *D. merkli* are rather homogeneous in external characters but the shape of the pronotum and the discal depressions are somewhat variable and the longitudinal furrow may be almost obsolete. However, the pronotum in oedemerids usually presents intraspecific variation. The elytral colouration is occasionally not paler than that of head and pronotum.

Acknowledgements – My thanks are due to Dr OTTÓ MERKL of the Hungarian Natural History Museum for the loaned material.

List of abbreviations

EL – length of elytra from humeral line to apex
EW – width of elytra across humeri
EYW – dorsal width of eye
FWA – minimum width of frons between antennal pits
FWE – minimum width of frons between eyes
HLl – length of head from proximal edge of eyes to proximal margin of labrum
HW – width of head comprising eyes
PL – maximum length of pronotum
PW – maximum width of pronotum

REFERENCES

ARNETT, R. H., Jr. (1951) A revision of the Nearctic Oedemeridae (Coleoptera). *Amer. Midl. Natur.* **45**(2): 257-391.

CASTELNAU, F. L. N. C., LAPORTE DE (1840) *Histoire naturelle des Insectes Coléoptères. Tome deuxième.* Ed. P. Duménil, Paris, p. 252.

BLAIR, K. G. (1926) The Oedemeridae of South Africa with notes on some other African Oedemeridae (Coleoptera). *Ann. South Afr. Mus.* **23**: 353-375.

FAIRMAIRE, L. (1883) Description de deux Coléoptères nouveaux. *Bull. Soc. Entom. Fr.* **1883**: 70-71.

FAIRMAIRE, L. (1885) Note sur les Coléoptères recueillis par M. Laligant à Obock. *Ann. Soc. Entom. Fr.* **6**(5): 435-462.

FAIRMAIRE, L. (1896) Descriptions de Coléoptères recueillis par le Dr. Ch. Martin à Obock, Djibouti et Aden. *Bull. Soc. Entom. Fr.* **1896**: 223-225.

GERSTAECKER, A. (1871) Beitrag zur Insektenfauna von Zanzibar. *Arch. Naturgesch.* **37**(1): 68.

GERSTAECKER, A. (1873) Oedemeridae. In: *Baron Carl Claus von der Decken's Reise in Ost-Afrika in den Jahren 1859-1865.* **3**(2): 217. C. F. Winter'sche Verlag. Leipzig und Heidelberg.

GESTRO, R. (1892) Di alcuni Coleotteri raccolti nel paese dei Somali dall'Ing. L. Bricchetti Robecchi. *Ann. Mus. Civ. Stor. Nat. Genova, Ser. 2* **12**: 747-790.

HAROLD, E., von (1879) Bericht über die von den Herren A. v. Homeyer und P. Pogge in Angola und im Lunda-Reiche gesammelten Coleopteren. *Col. Hefte* **16**: 1-224.

HUDSON, L. (1975) A systematic revision of the New Zealand Oedemeridae (Coleoptera, Insecta). *J. R. Soc. N. Z.*. **5**(3): 227-274.

KARSCH, F. (1881) Ueber von Herrn Prof. R. Greef auf den Guinea-Inseln gesammelte Coleopteren. *Sber. Ges. Naturf. Freunde Berlin* **1881**: 55-67.

PIC, M. (1906) Habitats et descriptions de divers Coléoptères paléarctiques. *Echange* **22**(256): 25-27.

PIC, M. (1914) Coléoptères exotiques en partie nouveaux (suite). *Echange* **30**(357): 67-68.

PIC, M. (1922*a*) Coléoptères exotiques en partie nouveaux (suite). *Echange* **38**(407): 19-20.

PIC, M. (1922*b*) Nouveautés diverses. *Mél. Exot.-Entom.* **35**: 1-32.

PIC, M. (1930) Nouveautés diverses. *Mél. Exot.-Entom.* **55**: 1-36.

PIC, M. (1935) Coléoptères oedémérides nouveaux. *Rev. Fr. Entom.* **2**(2): 98-102.

PIC, M. (1939) Mission scientifique de l'Omo. Coleoptera. XVIII. *Mem. Mus. Hist. Nat. Paris* **9**: 153-170.

PIC, M. (1950) Diversités entomologiques. *Divers. Entom.* **6**: 1-16.

PIC, M. (1952*a*) Missione biologica Sagan-Omo diretta del Prof. Edoardo Zarattari. Coléoptères nouveaux. *Riv. Biol. Colon., Rome* (1951) **11**: 25-36.

PIC, M. (1952*b*) Coléoptères nouveaux du Congo belge. *Ann. Mus. Congo belg. (Sér. 8), Sci. Zool.* **12**: 1-47.

PIC, M. (1953) Coléoptères nouveaux africains. *Atti Mus. Stor. Nat. Trieste* **19**: 93-109.

RITSEMA, K. (1875) *Sessinia phthysica*, Congo. *Tijdschr. Ent.* **18**: 134-138.

ŠVIHLA, V. (1984) Insects of Saudi Arabia. Coleoptera: Fam. Oedemeridae (Part 2). *Fauna of Saudi Arabia* **6**: 260-266.

ŠVIHLA, V. (1985) Revision of the generic classification of the Old World Oedemeridae (Coleoptera). *Acta Mus. Natn. Pragae* **41**B(3-4): 141-238.

ŠVIHLA, V. (1987) Contribution to the knowledge of the Old World Oedemeridae (Coleoptera). *Annot. Zool. Bot.* **181**: 1-27.

ŠVIHLA, V. (1991) Contribution to the knowledge of the Old World Oedemeridae (Coleoptera). *Annot. Zool. Bot.* **202**: 1-14.

Received January 10, 1994; accepted June 1, 1994

Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 203-218

APYSTOMYIIDAE, A NEW FAMILY OF ASILOIDEA (DIPTERA)

NAGATOMI, A. and N. LIU

Entomological Laboratory, Faculty of Agriculture
Kagoshima University, Kagoshima 890, Japan

Apystomyiidae, a new family of the Asiloidea, contains *Apystomyia elinguis* MELANDER, 1950 (from California and Mexico) only, which is different considerably in many characteristics from the members of Bombyliidae, Hilarimorphidae and Scenopinidae (including the Proratinae). Unfortunately the immature stages of Apystomyiidae are still unknown. With 31 figures.

Key words: new family, Diptera, Asiloidea, Apystomyiidae

There was some reluctance to install a new family whose phylogenetic position is still vague. However, because the taxon is so distinct, it will be inevitable that someone will do it sooner or later.

Apystomyia was originally placed in the Bombyliidae as a member of the subfamily Proratinae. Recently, the genera of Proratinae except *Apystomyia,* that is, *Acaenotus, Alloxytropus, Caenotoides, Caenotus, Jackhallia* and *Prorates* have been removed to the Scenopinidae (YEATES, 1992; NAGATOMI, LIU & YANAGIDA, 1994). Thus, *Apystomyia* stands alone now and will represent an independent family. What is the most closely related family of Apystomyiidae? Regrettably, it has not yet been determined.

This paper is dedicated to Dr N. L. EVENHUIS (Bishop Museum) who prepared the specimens of *Apystomyia* and urged us to study them. Dr EVENHUIS also critically read the manuscript. Without his help and encouragement, the preparation of this paper would not have been possible. We are much indebted to Dr P. H. ARNAUD, Jr. and the late Dr A. L. MELANDER, the collectors of the material upon which the present paper is based. Sincere thanks are also expressed to Mr K. YANAGIDA and Miss K. MOROI (Kagoshima University) for their aid in many ways.

Apystomyiidae fam. n.

Type genus: *Apystomyia* MELANDER, 1950.

Eyes of male contiguous and with upper facets larger than lower facets; eyes of female widely separated; female frons wider toward vertex and wider than one eye; female frons and face making a staircase just above antenna; face markedly wider below. Antennal segments 1–2 short and not longer than wide; segment 1 much smaller than segment 2; flagellum compressed, elongate oval, longer than preceding segments 1+2, with thin short apical style having terminal minute spine. Proboscis fleshy and short. Palpus 1-segmented, small, thin, and with apical portion swollen. Thorax strongly humped and with scattered long strong hairs; scutellum with strong marginal hairs (which are 12 or so in male and 6 in female); pleura bare. Thickening of costa ending at apex of vein M_1; vein R_5 ending above and vein M_1 ending at wing apex; vein R_4 rather vertical and short; 2nd posterior cell with long basal petiole; petiole of anal cell conspicuously long; 1st and 2nd basal cells small; discal cell long and with apical part quadrate; 4th posterior cell and axillary cell very large and the latter strongly arched posteroproximally; alula well devoloped but small. Female mid leg normal, but male mid tibia with a spinelike ventral process before apex and mid basitarsus dilated ventrally at apical portion. Tibial spurs and empodium absent. Mid coxal prong absent. Male abdomen gradually tapering apically. Female abdominal segment 4 trapezoid and abruptly narrower than segments 1–3, and segments 5–8 narrow.

The Apystomyiidae (including one genus and species only) may be distinguished from the Scenopinidae (including the genera of Proratinae), Therevidae, Bombyliidae, Hilarimorphidae and the genus *Heterotropus* (which may also represent an independent family) as shown in the key modified from NAGATOMI, LIU & YANAGIDA (1994).

KEY TO APYSTOMYIIDAE AND ITS RELATED TAXA BY EXTERNAL CHARACTERS

(partly modified from NAGATOMI, LIU & YANAGIDA, 1994)

1 Three veins arising from apical portion of 2nd basal cell ... 2

– Four veins arising from apical portion of 2nd basal cell ... **Therevidae**

2 (1) Vein M_1 ending at wing margin distinctly below wing apex, but if not, then vein M_2 always present ... 3

– Vein M_1 ending at wing margin above or at wing apex or ending at vein R_5, and vein M_2 absent (exceptionally vein M_1 incomplete or ending at wing margin distinctly below wing apex, but in the latter case vein M_4 absent as well as vein M_2 ... **Scenopininae** (Scenopinidae)

3 (2) Eye with posterior margin not indented; occiput flattened; eye with lower facets much smaller than upper facets (in *Acaenotus* upper most facets nearly equal in size to lower facets and distinctly smaller than median facets); tibiae without seriate spines; vein R_{4+5} branched; vein M_2 present; anal cell petiolate; anal lobe of wing well developed (after MELANDER, 1950; HALL, 1972; HULL, 1973; YEATES & IRWIN, 1992; YEATES, 1992) 4

– Some of the characters above absent 7

4 (3) Vein R_5 ending at wing margin distinctly below wing apex; thickening of costa continuous around wing margin

– Vein R_5 ending at wing margin at or above wing apex; thickening of costa ending at apex of vein R_4, R_5 or M_1 6

5 (4) Proboscis shorter than face; antennal flagellum abruptly widened near base or around middle and with style stout *Caenotus* (Scenopinidae: Proratinae)

– Proboscis longer than face; antennal flagellum rather gradually tapering apically and with style thin *Heterotropus* (neither Scenopininae + Proratinae nor Bombyliidae + Hilarimorphidae)

6 (4) Vein R_4 rather vertical and short; vein M_1 ending at wing apex; anal lobe of wing strongly arched posteroproximally; male mid tibia with a spine-like ventral process before apex and basitarsus dilated ventrally at apical portion (missing in female) **Apystomyiidae**

– Vein R_4 rather horizontal and longer; vein M_1 (or M_{1+2}) ending at wing margin distinctly below wing apex; anal lobe of wing not strongly arched posteroproximally; male mid tibia and basitarsus normal as in female **Proratinae** (excluding *Caenotus*) (Scenopinidae)

7 (3) Discal cell absent; vein R_{4+5} and M_{1+2} rather similarly forked, each fork not longer than its stem (Fig. 40) (after MCALPINE, 1981) **Hilarimorphidae**

– Discal cell usually present (Figs 36, 37), but if not (Figs 38, 39), then R_{4+5} and M_{1+2} not similarly forked (after MCALPINE, 1981) **Bombyliidae**

Genus *Apystomyia* MELANDER

Apystomyia MELANDER, 1950: Pan-Pacific Ent. 26: 146. Type species: *Apystomyia elinguis* MELANDER, 1950 from California (by original designation).

HULL (1973: 229-230) gave a detailed description of *Apystomyia* based on one paratype male.

Apystomyia, a monotypic genus, is easily separated from the genera of Proratinae as shown in the key (couplet 6) modified from NAGATOMI *et al.* (1994).

The characters mentioned in the family diagnosis are repeated below for coherence.

Male

Head: Eyes contiguous; upper facets larger than lower facets; eye margin to antenna may have a longitudinal polished part; face markedly wider below; occiput swollen, except flat upper part (if it is not due to abdominal condition of the specimen); antenna shorter than distance from antenna to median ocellus; antennal segments 1–2 short and not longer than wide; segment 1 much smaller than segment 2; antennal flagellum compressed, elongate oval, longer than preceding segments 1+2, with thin short apical style having terminal minute spine; proboscis fleshy and short; palpus 1-segmented, small and thin, with apical portion swollen; paired long strong hairs present on frontal triangle and ocellar triangle; lower occiput with a cluster of dense strong hairs.

Thorax: Mesonotum strongly humped, and with scattered long strong hairs (except anterior part); scutellum with 12 (or so) marginal strong hairs; pleura bare; prosternum joined with proepisternum.

Wing: Two submarginal cells, 4 posterior cells and discal cell present; vein R_5 ending above and vein M_1 ending at wing apex; vein R_4 rather vertical and short; 2nd submarginal cell wide and short; 2nd posterior cell with long basal petiole; petiole of anal cell conspicuously long; 1st and 2nd basal cells small; discal cell long and with apical part quadrate; 4th posterior cell and axillary cell very large and the latter strongly arched posteroproximally; alula well developed but small; thickening of costa ending at apex of vein M_1; costa black setose up to end of vein M_1; calypter, alula and anal lobe of wing with white fringe.

Legs: Mid tibia with a spine-like ventral process before apex and mid tarsomere 1 dilated ventrally at apical portion; mid tarsomere 1 about as long as tarsomere 2 and shorter than fore and hind tarsomere 1; one seta standing closely together with ventral process on mid tibia; longer erect hairs present on posterior surfaces of fore and mid femora, anterior and posterior surfaces of hind femur and dorsal surface of each tibia; empodium absent.

Abdomen: Tapering posteriorly; roughly twice as long as mesonotum + scutellum; tergum 2 without mid-posterior modified setose patch.

Female

Similar to male except as follows.

Head: Eyes widely separated; frons wider toward vertex and wider than one eye; frons and face making a staircase just above antennae; lower occiput and gena developed below eye; lower occiput without a cluster of dense strong hairs; frons (except lower and lateral parts) with some (8 or so) strong hairs; vertex and upper occiput also with strong hairs.

Thorax: Hairs on mesonotum and scutellum may be shorter and less abundant than in male and the marginal strong hairs on scutellum may become 6 in number.

Wing: MELANDER (1950) wrote, 'wings subhyaline, not milky, posterior veins more or less like anterior'.

Legs: Mid leg normal (mid tibia without a spine-like ventral process; mid tarsomere 1 longer than tarsomere 2 and not dilated ventrally); hairs on femur and tibia shorter than in male.

Abdomen: Segment 4 trapezoid and abruptly narrower than segments 1–3; segments 5–8 narrow; posterior borders of segments 4–7 pale in color; segments 1–4 with minute pile or nearly bare; segments 5–8 shorter pilose.

Apystomyia elinguis MELANDER
(Figs 1–31)

Apystomyia elinguis MELANDER, 1950, Pan-Pacific Ent. 26: 147.

Type locality: California.

Male

Head (Figs 2–3): Head and its appendages dark brown to black; head except appendages shining; ocellar triangle and frontal triangle each with a pair of longer black hairs; vertex, occiput, gena and face with black hairs which are longer on lower occiput and gena and are dense on lower occiput; area above occipital foramen bare; antennal segment 3 pale tomentose; ocellar triangle 0.9 times as long as wide; antennal segments 1, 2, 3 and style from inner view ? : 100: 300 : 100 and their relative widths viewed from the side ? : 150 : 175 : 25 [head is crushed in specimen on hand and each part is not measured].

Thorax: Shining black; mesonotum and scutellum with sparse erect black hairs; rest of thorax bare.

Wing (Fig. 4): Membrane whitish grey; veins whitish grey, except for veins C (up to before end of vein R_5) and Sc which are dark brown; halter dark brown; basal petiole of 2nd posterior cell 4.0 times as long as r-m crossvein and petiole of anal cell 4.3 times as long as m-cu crossvein (between discal and anal cells).

Legs (Fig. 5): Dark brown to black; hind tarsus pale in color, but tarsomere 5 and apices of tarsomeres 1–2 dark brown to black; legs pale gray pollinose; coxa and femur with pale pile which may change into black on fore and mid coxae; hairs are longer and erect on posterior surfaces of fore and mid femora and anterior and posterior surfaces of hind femur; relative lengths of segments (excluding coxa and trochanter) of fore leg 300 : 313 : 100 : 50 : 38 : 25 : 44, of mid leg 275 : 338 : 75 : 88 : 38 : 25 : 44, of hind leg 338 : 375 : 100 : 69 : 38 : 25 : 44 and in hind leg viewed from the side relative widths of femur, tibia, and tarsomeres 1–3, 50 : 31 : 25 : 19 : 25.

Abdomen: Dark brown to black, and pale gray pollinose; abdomen above and below with short sparse white pile which becomes longer on sides of dorsum (long and dense on sides of terga 1–3).

Length: Body 2.8 mm; wing 2.3 mm; fore basitarsus 0.20 mm.

Female

Similar to male except as follows:

Head (Figs 6–15): Frons, vertex, and upper occiput with strong longer black hairs; lower occiput without a cluster of dense strong hairs; hairs on face and gena shorter than in male; ocellar triangle 0.8 times (N=2) as long as wide; antennal segment 3, 1.2–1.7 times (N=4) as long as wide and 2.5–2.8 times (N=2) as long as style (minus spine); [head is crushes in specimens on hand and each part is not measured].

Thorax: See generic diagnosis.

Wing: See generic diagnosis; basal petiole of 2nd posterior cell 3.7–6.0 times (N=3) as long as r-m crossvein and petiole of anal cell 5.6–7.0 times (N=3) as long as m-cu crossvein.

Legs: See generic diagnosis; tarsus wholly brown to dark brown; hairs on legs wholly black; relative lengths of segments of fore leg 289 (271-314) : 275 (275-300) : 100 : 41 (36-43) : 29 : 29 : 43, of mid leg 286 (271-314) : 297 (271-329) : 100 : 66 (57-71) : 38 (29:43) : 29 : 45 (43-50), of hind leg 347 (329-371) : 382 (343-429) : 105 (100-114) : 71 : 41 (36-43) : 29 : 43, and in hind leg viewed from the side relative widths of femur, tibia and tarsomeres 1–3, 61 (57-71) : 40 (36-43) : 29 : 26 (21-29) : 21; (N=4).

Abdomen (Figs 26-27): See generic diagnosis; pile on abdomen black.

Length: Body 2.2–2.7 mm (N=4); wing 1.9–2.3 mm (N=3); fore basitarsus 0.18 mm (N=4).

Distribution. North America (California) and Mexico.

Specimens examined (1 ♂, 4 ♀♀): CALIFORNIA: 1 ♂ (paratype), 1 ♀, Wrightwood, 24, v. 1945, A. L. MELANDER; 1 ♀, Camp Angelus, 26. v. 1947, A. L. MELANDER. MEXICO: 2 ♀♀, B. Calif., Sierra, San Pedro Martir, Rancho Viejo, el. 7,000 ft., 13. vi. 1953, P. H. ARNAUD, Jr.

MELANDER (1950: 147-148) wrote, 'Holotype and allotype: Wrightwood, on the north slope of San Gabriel Mountains, California, May 24, 1945. The specimens were discovered in sweepings from vegetation along the small stream which later disappears in Sheep Creek Canyon. Paratypes: Five males, six females: with the types, and Sheep Creek Canyon, same day; Camp Angelus and Sugarloaf Mountain in the San Bernardino Mountains, May to July; and near Keene Camp on Mount San Jacinto, June 7, 1942. The specimens from Sugarloaf Mountain were found along the overflow from a small spring at elevation about 7,000 feet. The species seems to be subalpine and attracted to moisture. *Apystomyia,* Greek, literally, a fly of which nothing is known; *elinguis*, Latin, without a tongue.'

MOUTHPARTS AND GENITALIA OF *APYSTOMYIA ELINGUIS*

Female mouthparts (Figs 6-15)

Labrum somewhat longer than wide, about as long as cibarial pump, wider basally, and truncate at apical margin; hypopharynx nearly as long as labrum and subtriangular; epipharynx shorter than labrum, longer than wide and rectangular; cibarial pump somewhat wider than labrum, about as long as wide, and with lateral margins convex outward; palpus 1-segmented, nearly as long as cibarial pump, thin, with apical portion widened and rounded at apex; lacinia thin and about as long as palpus; labellum roughly as long as or longer than cibarial pump and theca respectively, and with ventral outer part sclerotized.

Specimen examined: MEXICO: 2 ♀♀, B. Calif., Sierra, San Pedro Martir, Rancho Viejo, el. 7,000 ft., 13. vi. 1953, P. H. ARNAUD, Jr.

The mouthparts of *Apystomyia elinguis* (♀) are similar to those of *Hilarimorpha* sp. (♂) (see Figs 440-443 in NAGATOMI and SOROIDA, 1985) by having labrum + cibarial pump and labellum + theca each comparatively short, but may be distinguished from the latter by having the labrum truncate apically.

Regrettably no comparison has been made concerning the structure of mouthparts between *Apystomyia* and the members of Scenopinidae (Scenopininae + Proratinae) and primitive *Cyclorrhapha* (Platypezidae, Lonchopteridae, Ironomyiidae, Sciadoceridae and Phoridae).

Male genitalia (Figs 16-25)

The male genitalia of *Apystomyia elinguis* are peculiar. Cercus wide, narrowed and rather rounded apically. Sternum 10 wide and rather pentagonal. Tergum 9 bifurcate except large basal part and transverse median band (or with posterolateral part protruding apically and pointed, and with ventral median bridge at base of sternum 10). Fused gonocoxites rather semicircular in ventral view, and concave at posterior margin. Gonostylus in lateral view triangular and longer than wide. Phallus single-lobed, cylindrical with a short apical tooth directed ventrally, and with anterolateral ventral process. Dorsal bridge situated at the base of phallus and consisting of anterior transverse bar and paired lateral bar directed anteriorly. Aedeagal apodeme stick-like and somewhat wider apically. Tergum 8 much shorter than sternum 8. Abdominal segments 7–8 are compressed laterally in the specimen examined, but it is certain that this condition is not normal but accidental.

Specimen examined: California: 1 ♂, Wrightwood, 24. v. 1945, A. L. MELANDER.

Apystomyia is different in the structure of male genitalia from the genera of Proratinae as indicated below. From *Caenotus:* distiphallus single-lobed; sternum 9 absent; fused gonocoxites not bifurcate; paired tergum 9 contiguous at mid-dorsal base. From *Alloxytropus, Caenotoides* and *Prorates:* distiphallus single-lobed, short and wide; gonocoxal apodeme, hanging-bell phallus and cord-like phallus entirely absent.

The male genitalia of *Apystomyia* differ markedly from those of *Hilarimorpha* (Hilarimorphidae) in the following respects: tergum 9 (except basal part) divided into two processes; paired gonocoxites entirely fused, without mid-longitudinal ventral furrow and without posterolateral long stout process; phallus with anterolateral long ventral process and without rectangular large ventral plate directed anteriorly; dorsal bridge consisting of mid-posterior transverse bar and lateral longitudinal bars; connecting lateral sclerite is absent between free dorsal and ventral plates which exist in *Hilarimorpha.*

Paired endophallic sclerites are absent in *Hilarimorpha, Caenotoides, Prorates, Alloxytropus,* etc. and appears to be also so in *Apystomyia.* However, it appears that the basiphallus (= basal part of endophallus) is present in *Apystomyia* (as well as in the genera of Proratinae) but absent in *Hilarimorpha.* For male genitalia of *Hilarimorpha,* see NAGATOMI (1982) and NAGATOMI *et al.* (1991).

Female genitalia (Figs 28-31)

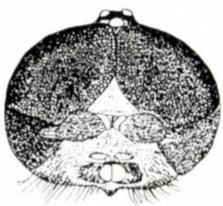
Terga 6–8 rectangular; sterna 6–8 narrower than terga 6–8, rectangular and distinctly longer than wide; intersegmental membrane between segments 6 & 7 and that between 7 & 8 rather long. Cercus elliptical and longer than wide. Tergum 9 (or tergum 9+10) rectangular and wider than long. Acanthophorites entirely absent. Sternum 10 elliptical and wider than long. The genital furca is indistinguishable or absent.

Specimen examined: CALIFORNIA: 1 ♀, Wrightwood, 24. v. 1945, A. L. MELANDER.

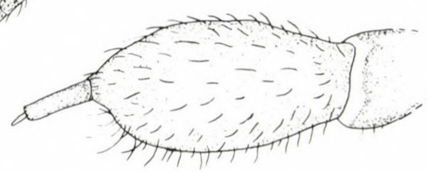
The female terminalia of *Apystomyia* are different markedly from those of *Acaenotus, Alloxytropus, Caenotoides, Caenotus,* and *Prorates* (Scenopinidae:

Figs 1–3. *Apystomyia elinguis*, male: 1 = lateral view, 2 = head, anterior view (from HULL, 1973), 3 = antennal flagellum and apical portion of segment 2, inner view. Note that a pair of strong hairs on frons and ocellar tubercle are omitted in Fig. 2

1



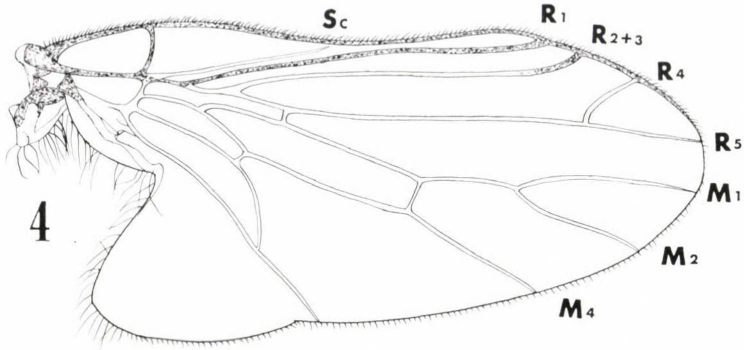
2



3

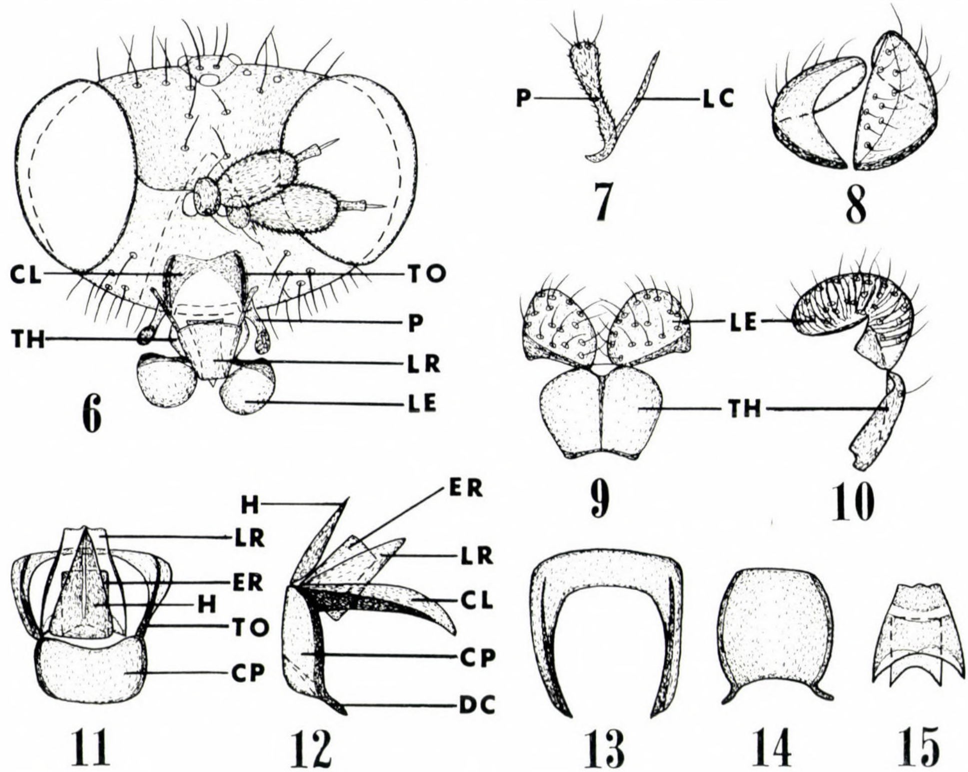
Figs 4–5. *Apystomyia elinguis*, male: 4 = wing, 5 = mid tibia (apical portion) and tarsomeres 1–2, posterior view

4

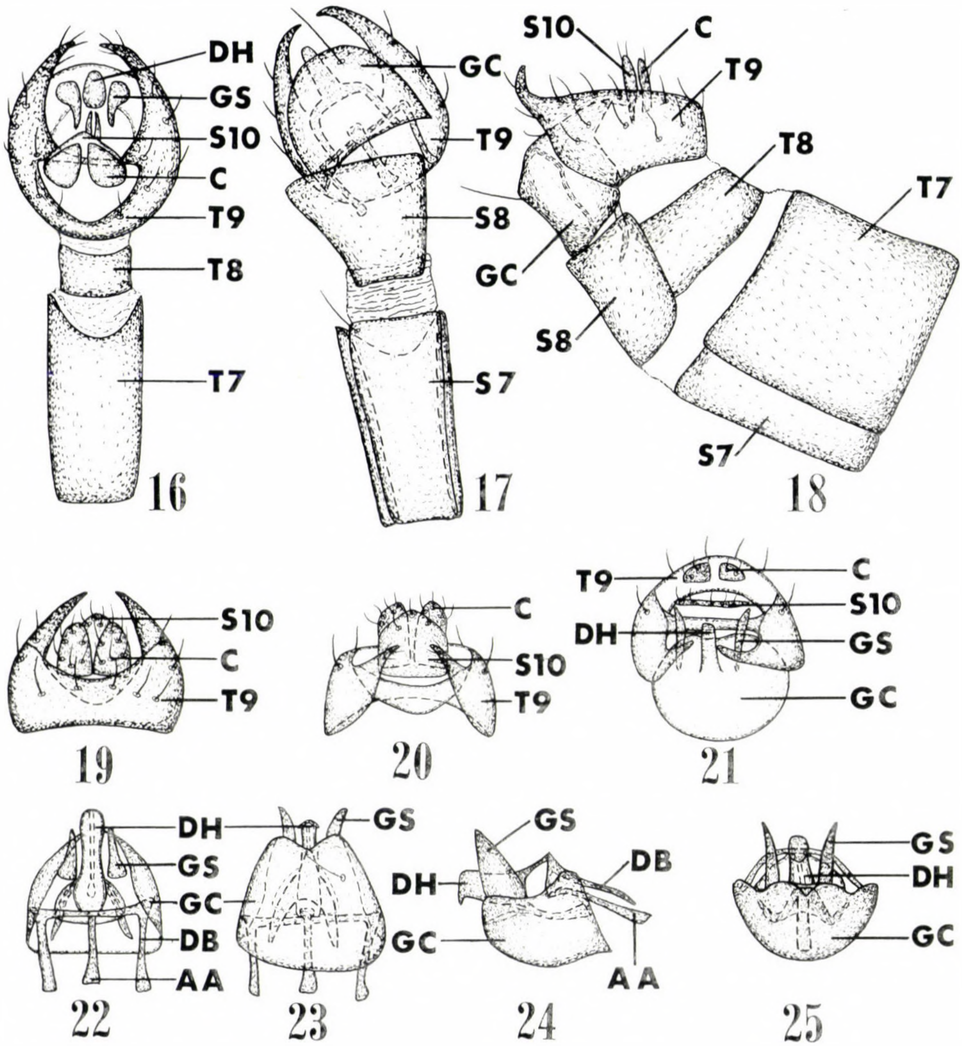


5

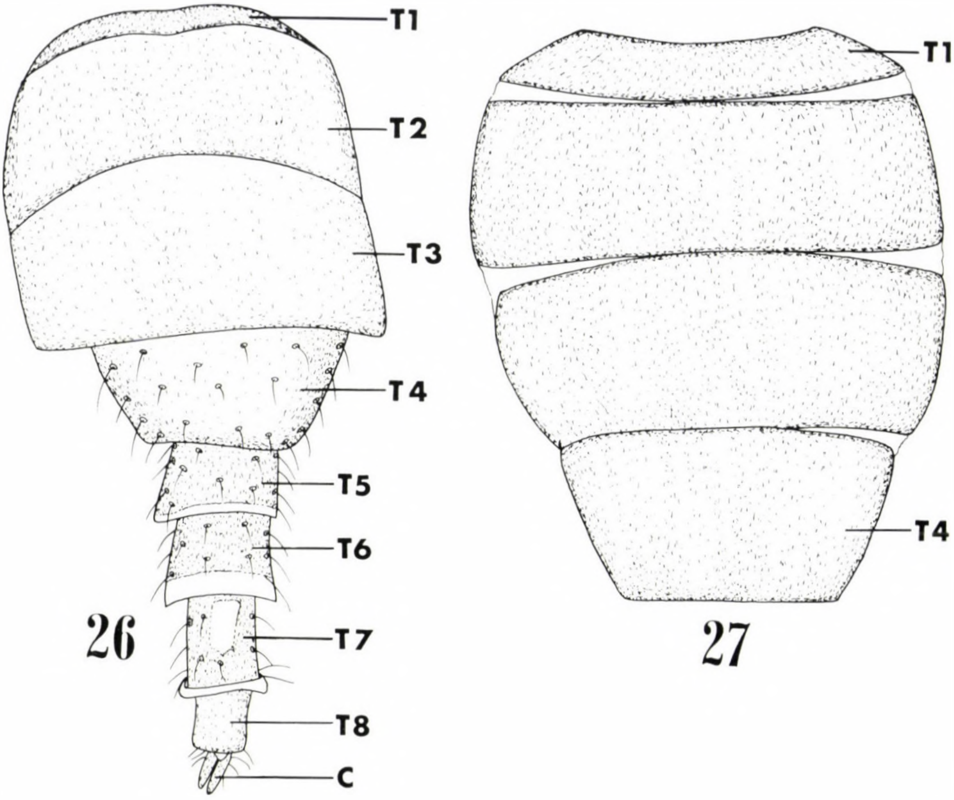
Figs 6–15. Female mouthparts of *Apystomyia elinguis* [macerated in KOH solution]: 6 = head, anterior view, 7 = palpus and lacinia, 8 = labella, anterior view, 9–10 = theca and labella, ventral and lateral views, 11–12 = labrum, hypopharynx, cibarial pump, etc., ventral and lateral views, 13 = torma+clypeus, anterior view, 14 = cibarial pump, ventral view, 15 = labrum and epipharynx, dorsal view (CL: clypeus, CP: cibarial pump, DC: dorsal cornu, ER: epipharynx, H: hypopharynx, LC: lacinia, LE: labellum, LR: labrum, P: palpus, TH: theca, TO: torma)



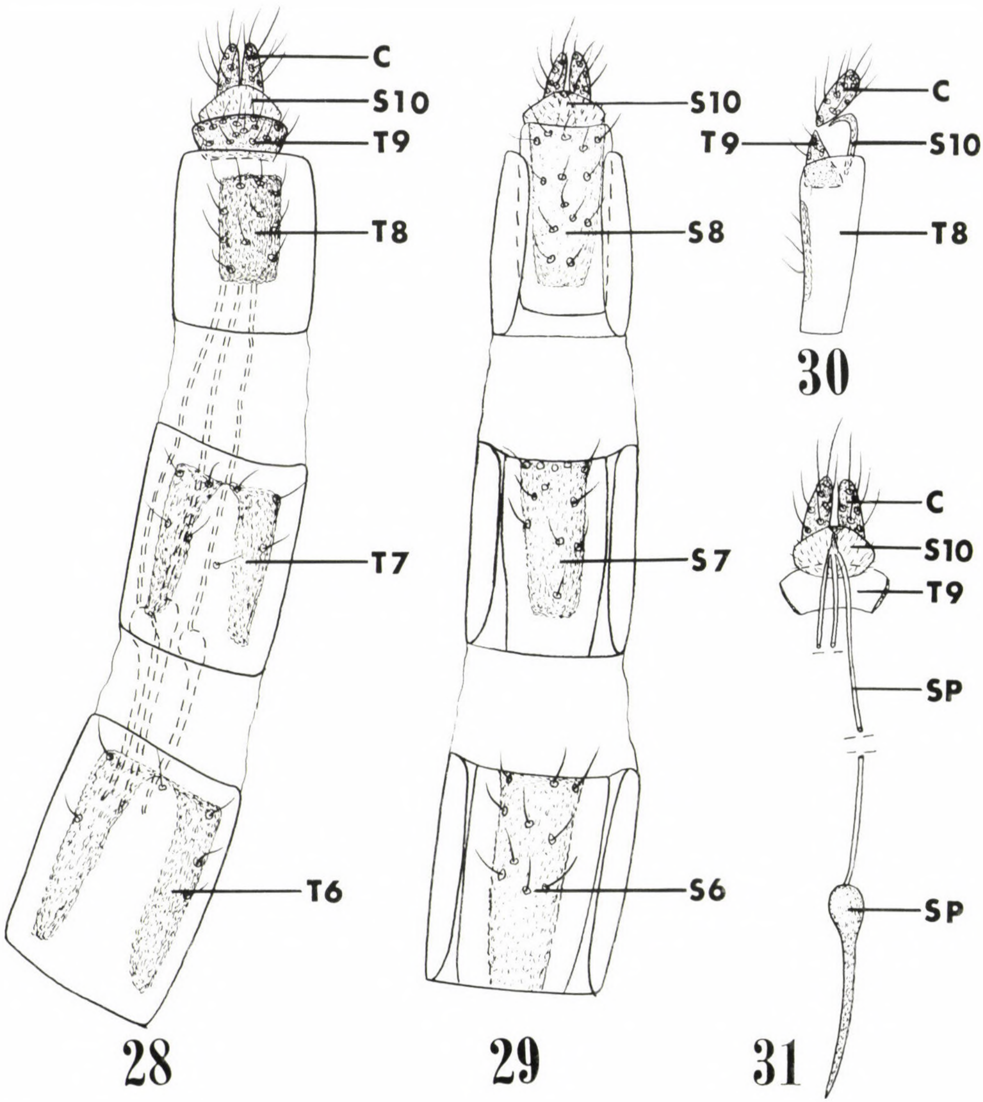
Figs 16–25. Male terminalia of *Apystomyia elinguis* [macerated in KOH solution]: 16–18 = dorsal, ventral and lateral views, 19–20 = tergum 9, cerci and sternum 10, dorsal and ventral views, 21 = apex of terminalia, posterior view, 22–25 = gonocoxites, gonostyli, dorsal bridge and aedeagus, dorsal, ventral, lateral and posteroventral views (AA: aedeagal apodeme, C: cercus, DB: dorsal bridge, DH: distiphallus, GC: gonocoxite, GS: gonostylus, S7–S8: sterna 7–8, S10: sternum 10, T7–T9: terga 7–9



Figs 26–27. Female abdomen of *Apystomyia elinguis*: 26 = dorsal view, 27 = terga 1–4, dorsal view [macerated in KOH solution] (C: cercus, T1–T8: terga 1–8)



Figs 28–31. Female terminalia of *Apystomyia elinguis* [macerated in KOH solution]: 28–29 = dorsal and ventral views, 30 = tergum 8, tergum 9, sternum 10 and cercus, lateral view, 31 = tergum 9, sternum 10, cerci and spermathecae, ventral view (C: cercus, S6–S8: sterna 6–8, S10: sternum 10, SP: spermathecae, T6–T9: terga 6–9)



Proratinae) by having the following characters: segment 4 trapezoidal and abruptly narrower than segmentsf 1–3; segments 6–8 narrow; intersegmental membrane between segments 6 and 7 and that between 7 and 8 rather long; tergum 9 (or 9+10) without a row of stout spines and without paired anterolateral sclerites running ventrally; sternum 10 elliptical and wider than long.

For female genitalia of Scenopinidae (Scenopininae + Proratinae), see YEATES (1992), NAGATOMI, LIU & YANAGIDA (1994) and NAGATOMI, LIU & EVENHUIS (1994).

Apystomyia is also different markedly from *Hilarimorpha* (Hilarimorphidae) in the structure of female terminalia. *Hilarimorpha* '[Abdomen] in female gradually tapered, then abruptly narrowed behind segment 7' (after WEBB, 1981: 604); sternum 8 evenly rounded posteriorly, about as long as tergum 8 + tergum 9, and usually somewhat wider than tergum 8; sternum 10 (= sternum 9 in NAGATOMI, 1982) semicircular or subtriangular; genital furca distinct. For female terminalia of *Hilarimorpha,* see WEBB (1974, 1981).

The female terminalia of *Apystomyia* are like those of *Cyclorrhapha*, because genital furca is indistinguishable or absent. However, this resemblance has resulted from the parallel development without doubt.

Spermatheca (Fig. 31)

The number of spermatheca is three. Spermathecal duct is long, thin and appears to have no armature. Spermathecal capsule is markedly elongate, with base widened and with apical portion gradually tapering toward end. Genital furca is indistinguishable or absent.

Specimen examined: CALIFORNIA: 1 ♀, Wrightwood, 24. v. 1945, A. L. MELANDER.

In the Scenopinidae (Scenopininae + Proratinae), the spermatheca are two in number and genital furca is distinct.

A COMPARISON BETWEEN APYSTOMYIIDAE AND OTHER RELEVANT FAMILIES

The orthorrhaphous Brachycera may be divided into six groups (see WOODLEY, 1989; NAGATOMI, 1992; YEATES, 1992). A comparison between each of these six groups and the Apystomyiidae is given below.

1. Stratiomyioidea + Xylophagoidea + Tabanoidea + Nemestrinoidea

In Apystomyiidae, (1) antennal flagellum is 2-segmented; (2) tibial spurs are entirely absent; (3) empodium is absent; (4) female cercus is 1-segmented. Many of the characters above are possessed by several taxa of the primitive orthorrhaphous Brachycera, especially Nemestrinidae and Acroceridae. However, no one will doubt that the Apystomyiidae does not belong to the group above.

2. Heterotropus

For diagnosis and systematic position of the genus *Heterotropus* LOEW, 1873, see YEATES & IRWIN (1992) who wrote, 'Evidence is presented that the genus [= *Heterotropus*] does not belong in the Bombyliidae. Adult morphology suggests that they are primitive members of the Asiloidea, and may be the sister-group to the remaining asiloids. Larval morphology is discussed in relation to the synapomorphies of the Asiloidea.'

Heterotropus is easily distinguished from *Apystomyia* and the genera of Proratinae by the external characters as shown in the key of this paper (couplets 4 and 6). The male and female genitalia of *Heterotropus* (see YEATES & IRWIN, 1992) differ conspicuously from those of *Apystomyia*. *Apystomyia* must be separated at family level from *Heterotropus*.

3. Bombyliidae + Hilarimorphidae

Apystomyia was relegated to either Heterotropinae (*Heterotropus* + Proratinae) or Proratinae (which does not include *Heterotropus*). Recently it was shown that *Heterotropus* possibly represents an independent family isolated from the Bombyliidae (see YEATES & IRWIN, 1992), and that the Proratinae (except for *Apystomyia*) belongs to the Scenopinidae (see YEATES, 1992 and NAGATOMI, LIU & YANAGIDA, 1994).

MELANDER (1950: 146) wrote, 'This enigmatical little fly [= *Apystomyia elinguis* MELANDER, 1950] does not seem to be related to any other genus, and its assignment to the Heterotropinae [= *Heterotropus* + Proratinae] is made because it does not confirm with any other subfamily or family. Superficially the neuration is of the same pattern as *Prorates,* that is, the same veins and cells are present, but the proportions and dimensions of vein sections are so wholly dissimilar that the resemblance can at best be only coincidental.'

HULL (1973: 222) wrote, 'While I leave these flies all within the subfamily Heterotropinae, it is entirely possible that flies like *Caenotus* COLE and *Apystomyia* MELANDER, and others, should be placed in a separate family. I leave them in the Bombyliidae because there is so little difference in the venation from that of certain other bombyliids, with the exception that some of these genera have a forked fourth vein.'

According to these two authorities, it may safely be concluded that *Apystomyia* does not belong to the Bombyliidae.

The exact position of *Hilarimorpha* is uncertain. But judging from the shape of antennal flagellum and the structure of male genitalia, this genus is apparently most closely related to the Bombyliidae as an independental family. The male genitalia and female terminalia of *Apystomyia* differ markedly from those of *Hilarimorpha* as discussed in the foregoing chapter. *Apystomyia* is similar somewhat in wing venation to *Hilarimorpha* but is different from it in the following points: discal cell present; petiole of anal cell very long; axillary cell strongly arched posteroproximally. The antennal shape of *Apystomyia* is similar to those of *Hilarimorpha* (Hilarimorphidae), *Caenotus* and *Prorates* of Proratinae (Scenopinidae) and some genera of Bombyliidae.

4. Therevidae + Scenopinidae

Apystomyia was originally placed in the Proratinae. Recently, the genera of Proratinae (except for *Apystomyia*) have been removed to the Scenopinidae from the Bombyliidae as already mentioned.

Apystomyia differs from the genera of Proratinae by having the external characters as shown in the key (couplet 6).

The male genitalia of *Apystomyia* are similar to those of the Proratinae by having the following characters: (1) male tergum 9 divided into two parts along mid-line; (2) gonocoxites completely fused with each other ventrally, with dorsally folded part narrow and confined to border; (3) dorsal bridge (in aedeagus) consisting of a median junction or transverse bar and paired lateral longitudinal bars, and U or V shaped (this character state is absent in *Caenotus*).

If *Apystomyia* belongs to the Proratinae, then gonocoxal apodeme and hanging-bell phallus in *Apystomyia* are supposed to be atrophied and absent, but U-shaped dorsal bridge is still existent. *Apystomyia* is highly specialized in various parts which may include male genitalia.

However, *Apystomyia* deviates from the synapomorphic characters for Scenopinidae (Scenopininae + Proratinae) in the following respects: (1) distiphallus single-lobed; (2) spermatheca three in number; (3) genital furca indistinguishable; (4) abdominal tergum 2 without modified setose patch at mid-posterior part (this is so in *Caenotoides*).

To assume secondary development may be easy in characters (1), (3) and (4) but may be difficult in character (2).

Apystomyia will be at once distinguished from the members of Therevidae and no mention will be necessary in this respect.

5. Asilidae + Apioceridae + Mydidae

Apystomyia apparently bears no resemblance to the members of Asilidae + Apioceridae + Mydidae and may easily be separated at family level from them.

Regrettably, we have had no chance to study the Apioceridae personally. WOODLEY (1989: 1388) wrote, 'Unfortunately, I have not found one conclusive autapomorphic character that can be used to define the apiocerids as a monophyletic group. In fact, they are possibly no more than plesiomorphic mydids.'

6. Vermileonidae + Apsilocephalidae + Empidoidea + Cyclorrhapha

For the grounds on which the four taxa above are put together, see NAGATOMI *et al.* (1991) and NAGATOMI (1992). The most important character for it is the shape of antennal flagellum which is not sporadically spread but widely or prevalently distributed in the Empidoidea and primitive Cyclorrhapha having a number of genera and species. Each of four taxa above is distinctive and *Apystomyia* cannot be fused with any of them.

Nevertheless, the male genitalia of *Apystomyia, Atelestus* (Empidoidea) and *Callotarsa* (Cyclorrhapha: Platypezidae) are similar in general appearance to one another. This was pointed out by WIEGMANN *et al.* (1993). However, this resemblance is not profound but superficial and has no phylogenetical significance, judging from Fig. 2 in WIEGMANN *et al.* (1993). For details in the male genitalia of *Atelestus* and some genera of Platypezidae, see HENNING (1976).

However, it is curious that the wing form and venation of *Apystomyia* are very similar to those of Platypezidae (see Figs 2–19 in KESSEL, 1981), although in *Apystomyia* vein R_4 is present. The female terminalia of *Apystomyia* look like those of Cyclorrhapha, because the genital furca is indistinguishable or absent. Yet, it is certain that *Apystomyia* is far apart phylogenetically from the Platypezidae.

SYSTEMATIC POSITION OF APYSTOMYIIDAE

To which family is the Apystomyiidae most closely related, Bombyliidae, Hilarimorphidae or Scenopinidae? It remains undetermined, but will be clarified when the immature stages are found.

In relation to the genera of Proratinae (Scenopinidae), *Apystomyia* has the following apomorphic characters: antennal segment 1 short and inconspicuous; vein R_4 rather vertical and short; vein R_5 ending at wing margin before wing apex; vein M_1 ending at wing apex; vein M_2 arising from vein M_1; anal lobe of wing strongly arched posteroproximally; thickening of costa ending at apex of vein M_1; male mid tibia with a spine-like ventral process before apex and mid tarsomere 1 dilated ventrally at apical portion; female abdominal segment 4 trapezoidal and abruptly narrower than segments 1–3, and segments 6–8 narrow; genital furca indistinguishable or absent.

Apart from apomorphy or plesiomorphy, *Apystomyia* is markedly different from the genera of Proratinae by having the distiphallus single-lobed, spermatheca three in number, genital furca absent, and abdominal tergum 2 without modified setose patch (this is exceptionally so in *Caenotoides* of Proratinae).

Apystomyia looks like some Cyclorrhapha by having the following characters: frons and ocellar triangle have some strong hairs; female frons and face makes a staircase just above antennae (which is never a ptilinum, however); wing form and venation is very similar to those of Platypezidae, although vein R_4 is present; male genitalia are similar in general appearance to those of *Atelestus* (Empidoides) and *Callotarsa* (Platypezidae) (see Fig. 2 in WIEGMANN *et al.*, 1993); genital furca is absent. However, it is evident that *Apystomyia* does not belong to the Cyclorrhapha.

The following three monophyletic relationships are conceivable: (1) Vermileonidae + Apsilocephalidae + Empidoidea + Cyclorrhapha; (2) Apystomyiidae + Empidoidea + Cyclorrhapha; (3) Apystomyiidae + Cyclorrhapha. One of us (NAGATOMI) still believes that (1) above is more probable. More evidence is needed in this respect and a key to solution is to find the immature stages.

The immature stages are unknown in Apystomyiidae (*Apystomyia*), Hilarimorphidae (Hilarimorpha), Proratinae (*Acaenotus, Alloxytropus, Caenotoides, Caenotus, Jackhallia* and *Prorates*) and Apsilocephalidae (*Apsilocephala, Clesthentia* and *Clesthentiella*).

Dr N. L. EVENHUIS (on February 9, 1994) wrote to us, 'The first instar larvae can be collected by collecting gravid females and decapitating them and forcing them to lay eggs on culture medium. The eggs hatch and first instar larvae come out. This had been done successfully for other groups of flies such as Tachydromiinae by Canadian workers. I have wanted to do this for bee flies such as *Mythicomyia* because knowledge of the larvae is important to the phylogeny of the group. I have been able to collect females, but getting them to lay eggs was difficult.'

CRITIQUE TO SINCLAIR *ET AL.* (1994) ON THE POSITION OF *APYSTOMYIA, HILARIMORPHA* AND *APSILOCEPHALA*

Sinclair *et al.* (1994) but *Apystomyia, Hilarimorpha* and *Apsilocephala* in the Therevidae as *incertae sedis* on the following two grounds: 'Gonostyli retracted anteriorly to subapical position on the gonocoxites'; 'Lateral ejaculatory processes (= endophallic sclerites) retracted, within base of phallus or absent.'

However, the characters above seem to have no significant value. In *Apystomyia* and *Apsilocephala,* the position of gonostylus may be apical rather than subapical. The subapical position of gonostylus is due to the extension of posterior gonocoxite and the difference between "apical" and "subapical" is not definite according to the member within Bombyliidae or Therevidae + Scenopinidae, because the degree of "subapical" is gradual.

The endophallic sclerites are absent in *Apystomyia, Hilarimorpha,* Scenopinidae (Scenopininae + Proratinae), and some Therevidae, but present in *Apsilocephala* et al., Bombyliidae and some Therevidae. The sclerites may be larger on the whole in the Bombyliidae, but it is difficult to see the reduced or absent sclerites as a synapomorphic character state for Therevidae + *Apystomyia* + *Hilarimorpha* + *Apsilocephala*.

SINCLAIR *et al.* (1994) wrote, 'The phallus of *Hilarimorpha* is very similar to *Henicomyia* COQUILLETT [Therevidae] (IRWIN & LYNEBORG; 1981, Fig. 208).' However, we see no likeness whatever in the structure of phallus between them. *Henicomyia* has one of the typical male genitalia of Therevidae, although anterior margin of phallus is deeply V-shaped in dorsal or ventral view. The phallus forms on body (in which dorsal and ventral plates are wholly fused with each other) and is entirely isolated from gonocoxites in *Henicomyia,* but consists of dorsal horizontal, ventral horizontal, and lateral vertical plates and is fused with gonocoxites at anterolateral ends of dorsal plate in *Hilarimorpha* (see Fig. 48. in NAGATOMI *et al.*, 1991*b*).

The male genitalia of *Hilarimorpha* (Figs 1–3 in NAGATOMI, 1982 and Figs 47-51 in NAGATOMI *et al.*, 1991*b*) is similar to those of Bombyliidae in the following respects: (1) in dorsal plate of phallus, anterior margin U (or V) shaped and anterolateral end fused with gonocoxite; (2) fused gonocoxites with a longitudinal ventral ditch along mid line. The Bombyliidae is a large family having numerous genera and the characters (1) and (2) above each disappears in several genera, probably occurring secondarily. The character (2) is apparently synapomorphic for Bombyliidae + Hilarimorphidae.

There is a possible synapomorphic character state for *Apsilocephala* + *Clesthentia,* that is, the male sternum 10 is bilobed posteriorly or concave at middle of posterior margin (see Figs 4–5 and 18 in NAGATOMI *et al.*, 1991*b*). It is still believed to us that the assignment of Apsilocephalidae (including *Apsilocephala, Clesthentia* and *Clesthentiella*) is neither Bombyliidae + Hilarimorphidae nor Therevidae + Scenopinidae.

SINCLAIR *et al.* (1994) showed subepandrial sclerite (see Figs 16*b*, 17 & 19) in *Apsilocephala, Caenotus* (Scenopinidae: Proratinae), and *Scenopinus,* but the sclerite in *Caetonus* certainly belongs to sternum 10 (see Figs 84, 92 & 100 in NAGATOMI, LIU & YANAGIDA, 1994).

The male tergum 10 in *Scenopinus glabrifrons* (see Figs 14–16 in NAGATOMI, LIU & EVENHUIS, 1994) is identical with the subepandrial sclerite in *Scenopinus fenestralis* in SINCLAIR *et al.* (1994). It is uncertain to us at present whether or not the male "tergum 10" in *Scenopinus glabrifrons* and the female "sternum 11" in the Proratinae (see Figs 162, 168 and 175 in NAGATOMI, LIU & YANAGIDA, 1994) represent true tergum 10 and sternum 11.

The origin is unknown to us concerning the subepandrial sclerite in *Apsilocephala,* that in *Scenopinus* and the female genital furca in the orthorrhaphous Brachycera. They will serve as muscle attachment.

It is also uncertain to us whether the surstylus in Empidoidea is originated from tergum 10 or is resulted from the posterolateral extension of tergum 9. On the other hand, it is almost certain that the surstylus in *Apsilocephala* is homologous with posterolateral extension of tergum 9 in *Clesthentia*.

One of us (NAGATOMI) still holds the following idea: *Apsilocephala* (as well as *Clesthentia* and *Clesthentiella*) does not belong to Therevidae + Scenopinidae and is the most closely related extant outgroup of Empidoidea + Cyclorrhapha; *Hilarimorpha* is more similar phylogenetically to the Bombyliidae rather than to Therevidae + Scenopinidae; the nearest extant relative of *Apystomyia* is vague.

REFERENCES

HALL, J. C. (1972) New North American Heterotropinae (Diptera: Bombyliidae). *Pan Pac. Ent.* **48**: 37-50.

HENNIG, W. (1976) Das Hypopygium von *Lonchoptera lutea* Panzer und die phylogenetischen Verwadtschaftsbeziehungen der Cyclorrhapha (Diptera). *Stuttgarter Beitr. Naturk., (A)* **283**: 1-63.

HULL, F. M. (1973) Bee flies of the world. The genera of the family Bombyliidae. *Bull. U. S. Natl. Mus.* **286**: 1-687.

KESSEL, E. L. (1987) Platypezidae. *In* MCALPINE, J. E. et al. (eds): *Manual of Nearctic Diptera, Vol. 2.* Monograph Can. Dep. Agric. Res. Branch, No. 28. pp. 681-688.

MCALPINE, J. F. (1981) Key to families-Adults. *In* MCALPINE, J. F. et. al. (eds): *Manual of Nearctic Diptera Vol. 1.* Monograph Can. Dep. Agric. Res. Branch, No. 27. pp. 89-124.

MELANDER, A. L. (1950) Taxonomic notes on some smaller Bombyliidae (Diptera). *Pan Pac. Ent.* **26**: 139-156.

NAGATOMI, A. (1982) Genitalia of Hilarimorpha (Diptera, Hilarimorphidae). *Kontyû, Tokyo* **50**: 544-548.

NAGATOMI, A. (1992) Notes on the phylogeny of various taxa of the orthorrhaphous Brachycera (Insecta: Diptera). *Zool. Sci.* **9**: 843-857.

NAGATOMI, A., LIU, N. & YANAGIDA, K. (1994) Notes on the Proratinae (Diptera: Scenopinidae). *South Pac. Study* **14**:

NAGATOMI, A., LIU, N. & EVENHUIS, N. L. (1994) The genitalia of *Scenopinus glabrifrons* (Diptera, Scenopinidae). *Jap. J. Ent.* **62**: 1-12.

NAGATOMI, A., SAIGUSA, T., NAGATOMI, H. & LYNEBORG, L. (1991*a*) The systematic position of the Apsilocephalidae, Rhagionempididae, Protempididae, Hilarimorphidae, Vermileonidae and some genera of Bombyliidae (Insecta, Diptera). *Zool. Sci.* **8**: 593-607.

NAGATOMI, A., SAIGUSA, T., NAGATOMI, H. & LYNEBORG, L. (1991*b*) The genitalia of the Apsilocephalidae (Diptera). *Jap. J. Ent.* **59**(2): 409-423.

NAGATOMI, A. & SOROIDA, K. (1985) The structure of the mouthparts of the orthorrhaphous Brachycera (Diptera) with special reference to blood-sucking. *Beitr. Ent.* **35**: 263-368.

SINCLAIR, B. J., CUMMING, J. M. & WOOD, D. M. (1994) Homology and phylogenetic implications of male genitalia in Diptera-Lower Brachycera. *Ent. Scand.* **24** (in print)

WEBB, D. W. (1974) A revision of the genus Hilarimorpha (Diptera: Hilarimorphidae). *J. Kansas Ent. Soc.* **47**: 172-222.

WEBB, D. W. (1981) Hilarimorphidae. *In* MCALPINE et al. (eds): *Manual of Nearctic Diptera, Vol. 1*. Monograph Can. Dep. Agric. Res. Branch, No. 27. pp. 603-605.

WIEGMANN, B. M., MITTER, C. & THOMPSON, F. C. (1993) Evolutionary origin of the Cyclorrhapha (Diptera): tests of alternative morphological hypotheses. *Cladistics* **9**: 41-81.

WOODLEY, N. E. (1989) Phylogeny and classification of the "orthorrhaphous" Brachycera. *In* MCALPINE, J. F. and WOOD, D. M. (eds): *Manual of Nearctic Diptera, Vol. 3*. Monograph Can. Dep. Agric. Res. Branch, No. 32. pp. 1371-1395.

YEATES, D. K. (1992) Towards a monographic Bombyliidae (Diptera): the removal of the Proratinae (Diptera: Scenopinidae). *Amer. Mus. Nov.* **No. 3051**. 30 pp.

YEATES, D. K. & IRWIN, M. E. (1992) Three new species of *Heterotropus* Loew (Diptera: Bombyliidae) from south Africa with descriptions of the immature stages and a discussion of the phylogenetic placement of the genus. *Amer. Mus. Nov.* **No. 3036.** 25 pp.

Received May 2, 1994; accepted June 1, 1994

Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 219-229

MORPHOLOGY OF THIRD INSTAR LARVA AND PUPARIUM OF THREE HELEOMYZID SPECIES (DIPTERA: HELEOMYZIDAE)

L. PAPP

Department of Zoology, Hungarian Natural History Museum
H–1088 Budapest, Baross utca 13, Hungary

Third instar larvae and puparia of three common heleomyzid species – *Suillia pallida* (FALLÉN), *Suillia univittata* (VON ROSER) and *Heleomyza captiosa* GORODKOV – are described and illustrated. Some remarks on the family characteristics of heleomyzid larvae and on the requirements for usable larval descriptions are given. With 21 original figures.

Key words: Heleomyzidae, developmental stages, larva, puparium

In the course of the preparatory works for the new *Manual of European/Palaearctic Diptera*, where larval morphology is one of the priorities, also heleomyzid larvae were studied. It was found that most of the illustrations published earlier are too small, inadequate, not detailed enough and in some cases even misleadingly poor. Larvae and puparia of three common species had been found in the collection of the Department of Zoology, Hungarian Natural History Museum, which were studied, described and illustrated. Summarily, a list is given of those features, which are thought to be shared characters for all heleomyzids.

HENNIG's (1952) compilation of the literature on the developmental stages of Diptera is still an important handbook for all but obviously he could not be more accurate than the original publications; otherwise the original figures published first in that volume are indeed better. FERRAR's (1987) *magnum opus* on the breeding habits and immatures stages of cyclorrhaphan Diptera is a storehouse of information for dipterists and applied entomologists, however it is still not detailed enough to give a reliable distinction of heleomyzid larvae from those of the other families. GILL and PETERSON's (1987) otherwise excellent work is without any figure for larvae; the description of larva and puparium is a description of those of a concrete species, *Pseudoleria crassata* GARRETT. SMITH (1989) published another useful compilation for the immature stages of British flies. When describing larvae below, no direct comparisons are made with figures published hitherto in order to avoid useless criticism.

The larvae and puparia described below are preserved in 70% ethyl alcohol and kept in a refrigerator at 5°C in the Department of Zoology, Hungarian Natural History Museum, Budapest (some of them were not killed in boiling water and so darkened later). Preparations were made by sodium-hydroxide, or only muscles were removed from cephalopharyngeal skeletons.

Suillia pallida (FALLÉN, 1820)
(Figs 1-5, 20)

Third instar larva

Body (Fig. 1) largely cylindrical, slightly S-curved in profile but head much ventrally curved, so head segment ventral or subventral to first thoracic segment; colour white but blackened (tanned) secondarily in some collection specimens; borders of segments well defined. Body length 3.0-3.5 mm after the second moult, 8.0-10.5 mm in the wandering phase.

Antennomaxillary lobes rather low; antennal sensory papilla two-segmented, dark, conical, somewhat higher than wide; maxillary sensory papilla just above oral opening, button-like flat, brown; oral ridges not well discernible.

Cephalopharyngeal skeleton (Fig. 4)

Mandibles (mouth hooks) comparatively short, basal part robust, apical digitiform part subbasally with very small serrate denticles (not visible in profile); dental sclerite rather small; labial sclerite small, short and lightly pigmented, anteroventrally seen between anterior fork of hypopharyngeal sclerite; hypopharynx comparatively very short, though H-shaped as in *S. univittata*, both cranial and caudal arms extremely short and thick with blunt apex; parastomal bar less elongate than in *S. univittata*, apex dorsally curved; pharyngeal sclerite robust; dorsal bridge extended cranially (Fig. 4); dorsal cornu rather short with a deep though very thin incision (in some specimens appearing closed caudally); ventral cornu robust, high with a subdorsal hole; pharyngeal sclerite with a short ventroapical process placed medially to ventral arms of hypopharynx (apex not visible in profile).

Cuticle smooth without small spinules dorsally. Flat area around posterior spiracles covered with flat papillae.

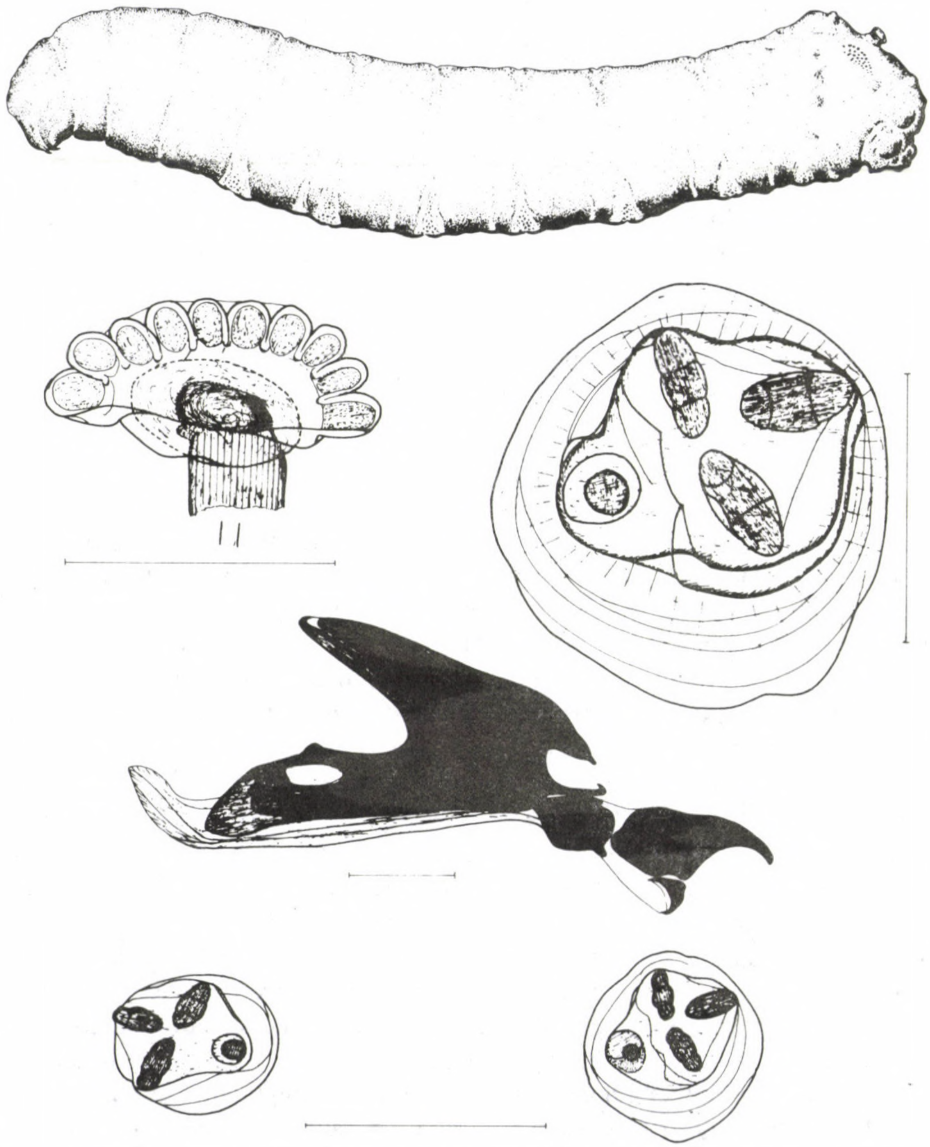
Creeping welts on anterior ventral margins of all but first (i.e. 2 to 7) abdominal segments, no such welts on thoracic segments. Spinules of welts minute. One pair of large triangular dark (brown or black) subanal pads; they are with an oblique transverse furrow medially.

Anterior spiracles (Fig. 2) less high than in *S. univittata*, i.e. less fan-shaped, each with 10 large openings.

Posterior spiracles (Figs 3, 5) widely separated on short conical processes, with a narrow brown rim. Spiracular hairs not observed.

Puparium (Fig. 20)

Dark brown, barrel-shaped, 5.2 mm long, its diameter at the middle 2.1 mm; anterior spiracle are most cranial; posterior (supraanal-subdorsal) part flat or



Figs 1-5. Third instar larva of *Suillia pallida* (FALLÉN): 1 = habitus in lateral view, 2 = anterior spiracle, 3 = right posterior spiracle, 4 = cephalopharyngeal skeleton laterally, 5 = posterior spiracles in caudal view. Scales: 0.1 mm for Figs 2, 3, 0.2 mm for Figs 4, 5

even concave, this part is characterized by 8 small protuberances of the third instar larva, being somewhat more pronounced than in the larva.

Material studied (all collected by Z. Bratek if not otherwise stated): 1 L3: Budapest, Normafa, 91. X. 12., *T. aestivum*; 2 L3: [Budapest], Farkasvölgy, XI. 30., *T. brumale*; 1 L3: [Budapest], Csúcshegy, 9.91., leg. K. I., *T. excavatum*; 3 L3: Aszód, V1, 91. X. 20., *T. brumale*; 1 L3: ibid., 91. X., *T. rapaeodorum*; 1 young L3: Szendehely, 92. XI. vége [end of], Albert, *Tuber excavatum*; 3 young L3: Bag, 92. VIII. 1., *Tuber aestivum*; 3 L3: Tardosbánya, 91. X. 18., *T. aestivum*; 3 darkened L3 + 4 young L3, 1 L2: Tahi, 91. XI. 19., *T. aestivum*; 1 L3: ibid., *T. brumale*; 4 young L3: Hollád, 91. IX. 12., *T. rapaeodorum*; 3 L3: Máriabesnyő, 91. XI. 17., *T. rapaeodorum*; 4 darkened L3 + 2 young L3, 1 P: ibid., XI. 30..

Remark. The larva of *Suillia pallida* has repeatedly been mentioned or even described in the literature (for details see NIZI (1963)). However, e.g. SÉGUY's (1934) figure, mentioned also by HENNIG (1952), is not proper for the identification of this species.

Suillia univittata (VON ROSER, 1840)
(Figs 6-10)

Third instar larva

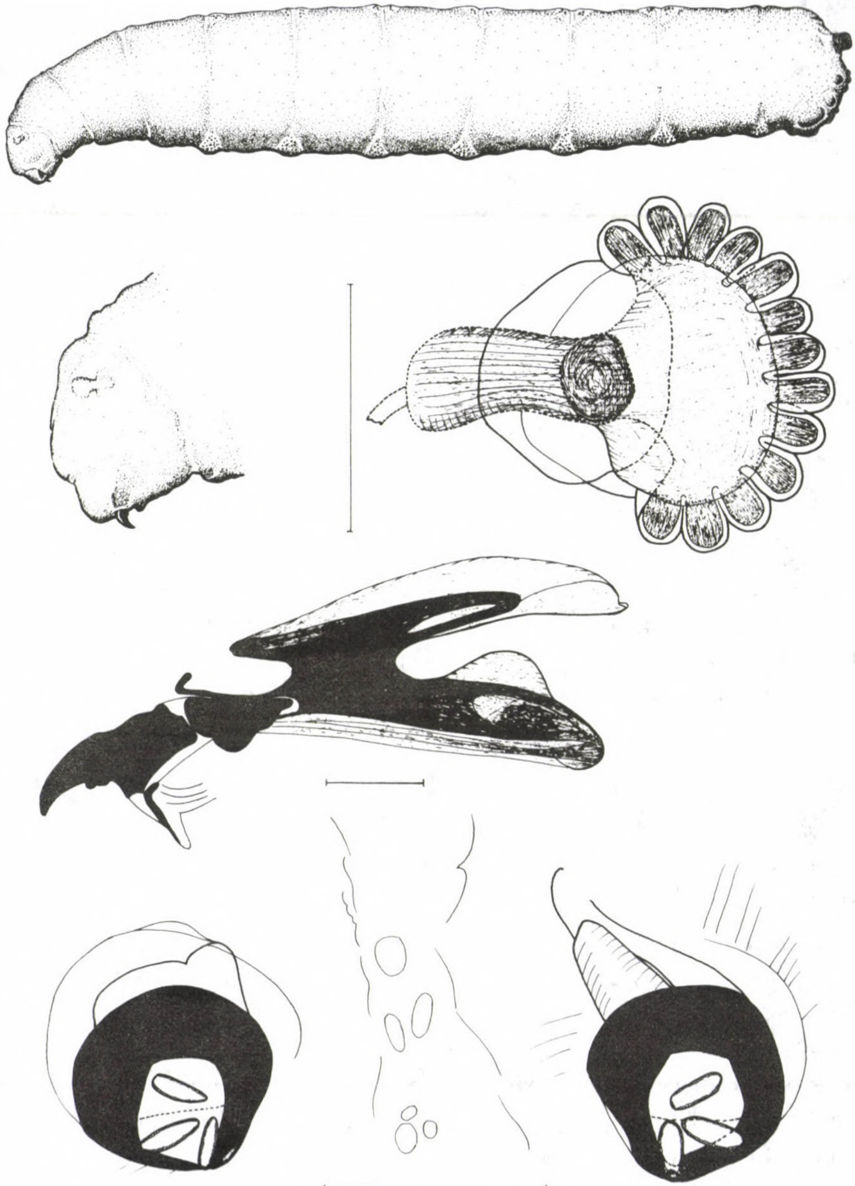
Body (Fig. 6) silky white, yellow in the wandering phase; cylindrical and straight but head segment and prothoracic segment ventrally curved (Fig. 7), mouth hooks directed ventrally or even caudoventrally. Body length ca. 4 mm after the second moult and 11.0 to 14.0 mm when full-grown.

Antennomaxillary lobes conical but not high; antennal sensory papilla yellow, conical; maxillary sensory papilla concolorous with its surroundings, on a distinct bulbous projection; oral ridges transverse, rather weak.

Cephalopharyngeal skeleton (Fig. 9)

Mandibles (mouth hooks) with 2 small ventral teeth each; dental sclerite thin, peg-like and directed caudoventrally (Fig. 9); labial sclerite not visible in profile, comparatively small, placed medially just behind the base of mouth hooks; hypopharynx with cranial arms short and very broad, caudal arms less broad but still robust; parastomal bar long and thin, apex dorsally curved (Fig. 9); dorsal bridge rather thin; ocular depression V-shaped; dorsal cornu large, figures in literature *all* missed its bigger yellow part, which is as well sclerotized as dark part, the latter with a long hole; ventral cornu robust, high with a weakly sclerotized lobuliform dorsal extension and with a weakly and unevenly sclerotized large subapical spot; body of pharyngeal sclerite with a thin cranioventral process.

Cuticle smooth and transparent.



Figs 6-10. Third instar larva of *Suillia univittata* (VON ROSER): 6 = habitus in lateral view, 7 = cephalic and prothoracic segments laterally, 8 = anterior spiracle, 9 = cephalopharyngeal skeleton, 10 = posterior spiracles in caudal view. Scales: 0.1 mm for Fig. 8, 0.2 mm for Figs 9, 10

Creeping welts on anterior ventral margins of all but first abdominal segments (segments 2-7). Spinules of welts colourless or at most yellow. Flattened area around posterior spiracles bordered by 10 small warts: 4 of them dorsal, and 6 ventral to spiracles. Subanal pads less large than in *S. pallida* and light brown only, each divided into two by a deep oblique furrow, all lateral and medial lobes dentiform with apex craniad; there is a pair of auricular lobes caudally to subanal pads.

Anterior spiracles (Fig. 8) on a thick fleshy projection, comparatively long fan-shaped, seldom with 12, usually with 13 or 14 large openings (CIAMPOLINI et SÜSS (1983) depicted anterior spiracles with 13 and 14 openings; DARVAS *et al.* (1989 wrote on 12 to 18 openings but their Fig. 2 is with 13 or 14 openings).

Posterior spiracles (Fig. 10) widely separated (cf. Figs 17 and 19 of CIAMPOLINI et SÜSS (1983) who depicted a deformed larva); posterior spiracles on more or less conical projections, whose apical part black and heavily sclerotized.

Puparium

Light brown, length ca. 6 mm, posterior spiracles more ventrally placed than in the larva.

Material studied: 12 L3: Kaposvár, 1970. V. 6. – fokhagyma [garlic] [leg. Tóthné Vilmos Viola]; 21 L3: ibid., fokhagymából [from garlic], "Suillia lurida Meig."

Remark. None of the illustrations published hitherto on the larvae of garlic fly is wholly reliable for reasons mentioned above (for bibliographic data see references here and those of NIKOLOVA (1962) and CIAMPOLINI et SÜSS (1983).

Heleomyza captiosa GORODKOV, 1962
(Figs 11-19, 21)

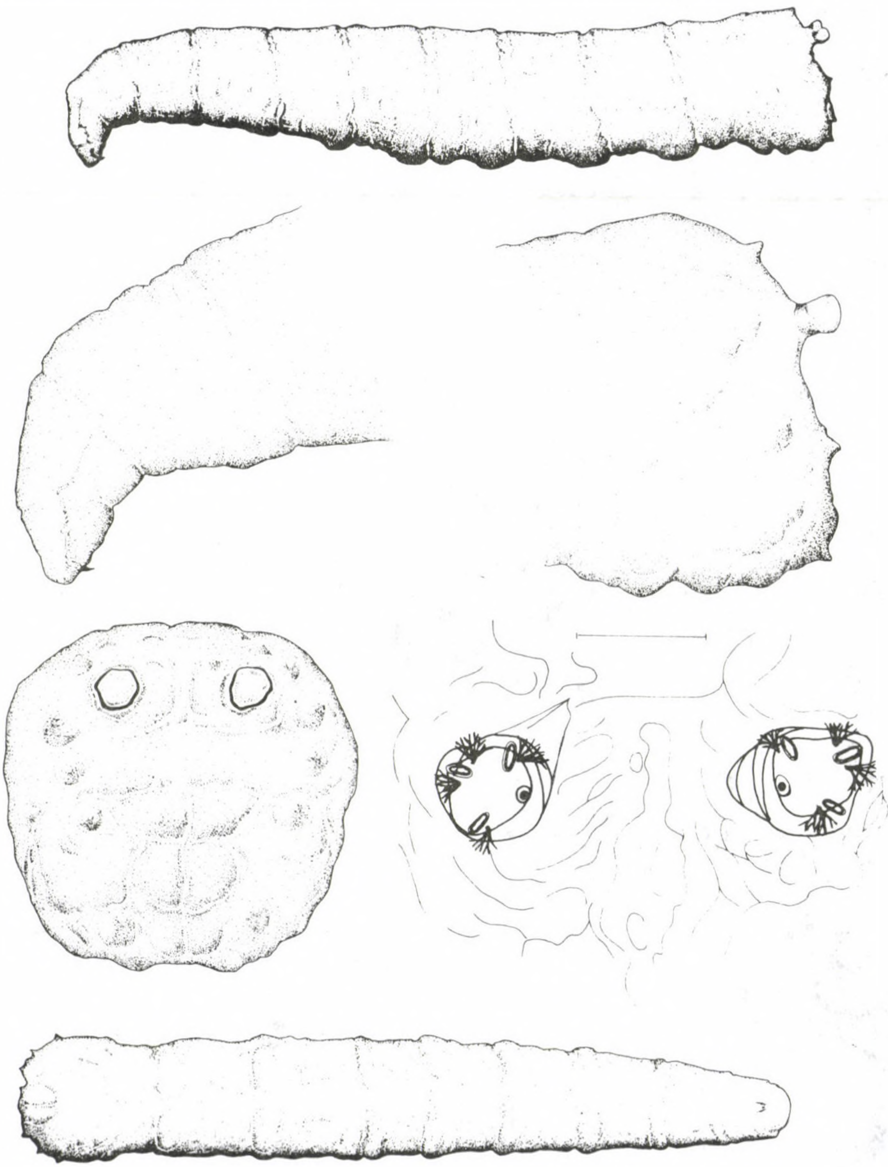
Third instar larva

Body (Fig. 11) subcylindrical, head and prothoracic segments much ventrally curved (Fig. 12), thoracic segments narrowed, borders of segments clear through annular constrictions. Body length 9-10 mm when full-grown.

Antennomaxillary lobes (dorsally and laterally to mouth hooks) rather large, lobate rather than conical; antennal sensory papilla pointed and brown (higher than broad); maxillary sensory papilla flat and colourless; oral ridges discernible but indistinct.

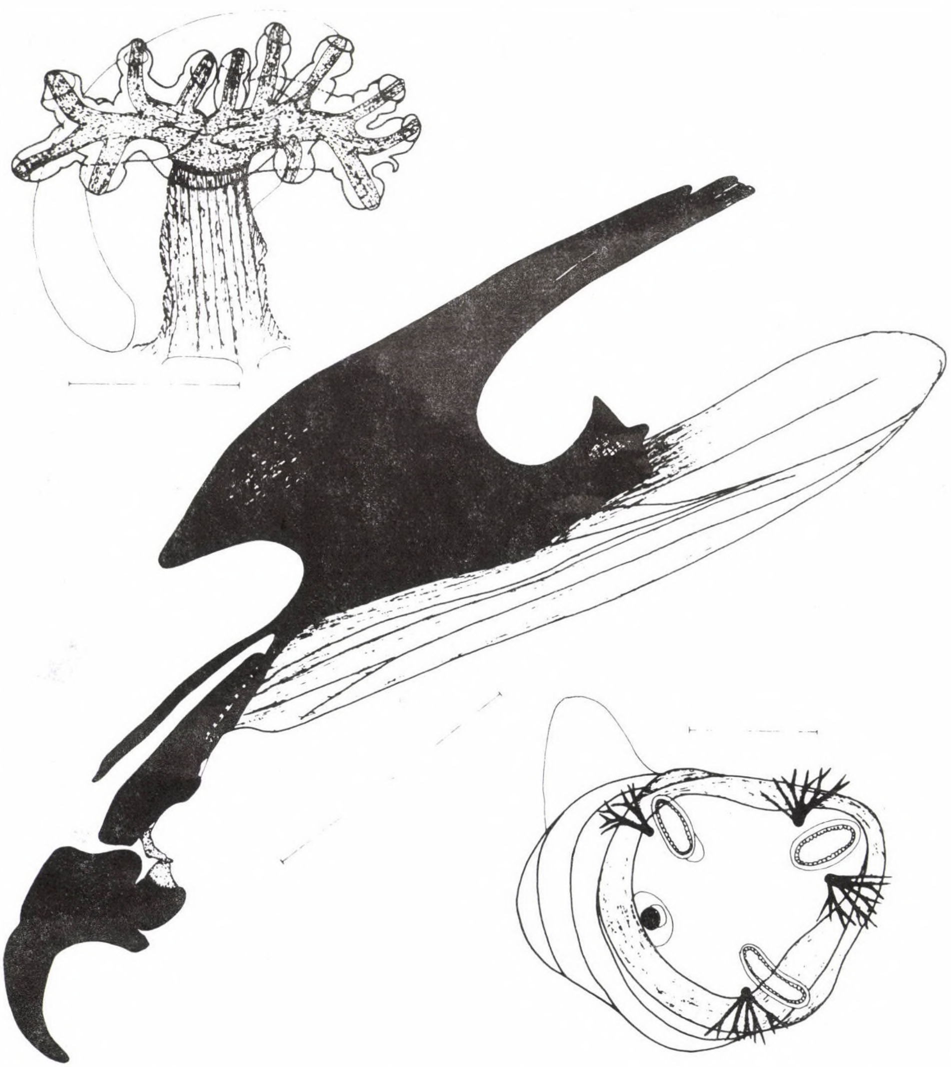
Cephalopharyngeal skeleton (Fig. 18)

Mandibles (mouth hooks) long without additional processes but with a sharp ventrobasal projection, basal part centrally weakly sclerotized; dental sclerite comparatively small subquadrate; labial sclerites reduced to very thin (weakly sclerotized and coloured) intricate lamellae; hypopharynx long and not high, H-shaped with cranial arms thick and with blunt apex, caudal arms narrower with almost pointed apex; parastomal bar extremely long and very thin;



Figs 11-16. Third instar larva of *Heleomyza captiosa* GORODKOV: 11 = habitus in lateral view, 7 = cephalic and thoracic segments laterally, 13 = abdominal end laterally, 14 = posterior spiracles and last segment caudally, 15 = posterior spiracles in caudal view, 16 = habitus in ventral view. Scale: 0.2 mm

dorsal bridge rather weakly sclerotized, trapezoidal; body of pharyngeal sclerite cranioventrally with a pair of very long processes, their apex extended more cranially than middle of ventral arms of hypopharynx; ocular depression comparatively very large and only yellow pigmented; dorsal cornu very long and narrow with a deep though narrow incision (Fig. 18); dark part of ventral cornu short with a dorsal process;

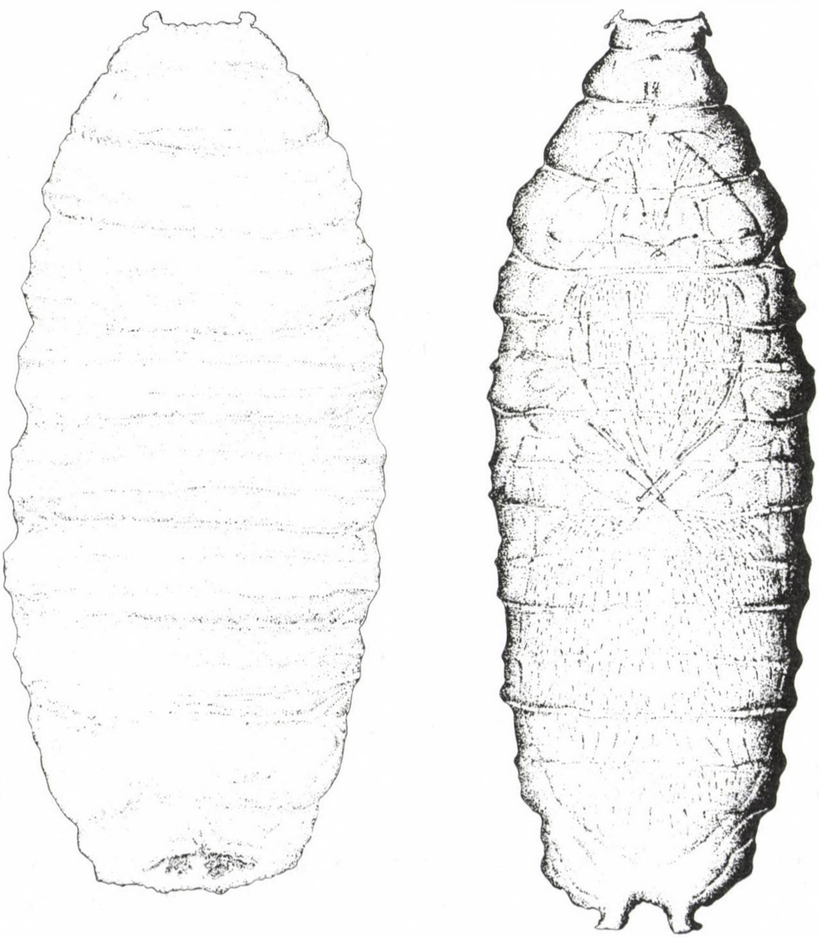


Figs 17-19. Third instar larva of *Heleomyza captiosa* GORODKOV: 17 = anterior spiracle, 18 = cephalopharyngeal skeleton in lateral view, 19 = right posterior spiracle in caudal view. Scales: 0.1 mm for Fig. 17, 0.2 mm for Figs 18, 19

Cuticle smooth, no papillae ventrally to posterior spiracles contrarily to *S. pallida*.

Creeping welts on anterior ventral margins of abdominal segments: first segment with small welts only (Figs 11, 16). Spinules on welts colourless. Subanal pads completely divided by a sagittal furrow but halves without a transverse or oblique furrow. Flat area around posterior spiracles bordered by 10 very small though pointed warts (Fig. 14), warts absent dorsomedially.

Anterior spiracles (Fig. 17) bilobed, 5-6 dorsal plus 7 ventral openings on bulbous projections (cf. LOBANOV's (1970) Fig. 4).



Figs 20-21. Puparia in dorsal view. 20 = *Suillia pallida* (FALLÉN), 21 = *Heleomyza captiosa* GORODKOV with pharate imago

Posterior spiracles (Figs 13, 15, 19) on rather long subcylindrical, brown pigmented and well sclerotized processes (cf. LOBANOV's (1970) Fig. 5); these processes widened laterally at apex, i.e. they are with a sharp lateral edge (Fig. 15) and a darker rim. Each spiracle with two pairs of digitate intraspiracular hairs (Figs 15, 19): one of them lateral to the unpaired opening, the other one mesad to paired openings.

Puparium (Fig. 21)

Light brown, less broad than that of the *Suillia* species, borders of segments definite, thoracic part narrowed, anterior spiracles placed craniolaterally. Lateral projection of posterior spiracles even more pronounced than on the larva. Pupal shell transparent (under stronger light).

Material studied: 2 L3, 10 P: Austria, Tirol, Obergurgl, felhalmozott trágya (nem friss), 5×5×10 cm [= accumulated cow-barn dung, not fresh, from a cube of 5×5×10 cm], 18 July 1974, leg. Bajza Zs. – Papp L.

Remark. I do not think all the differences found in the morphology of *H. captiosa* to LOBANOV's figures of *H. serrata* are true specific differences. LOBANOV's (1970) figures are too small and less accurate (e.g. that of the dorsal and ventral cornu of his Fig. 1).

Although larvae of only a few heleomyzid species have been studied hitherto, and, rather numerous illustrations published are unsiutable for comparison, some characteristics still seem to define the family Heleomyzidae. They are e.g.: 1) body cylindrical and straight except for the ventrally curved head and prothoracic segments, or slightly S-shaped in lateral view; 2) thoracic segments without creeping welts; 3) subanal pads distinct but flat; 4) anterior spiracles short, more or less fan-shaped with comparatively large openings; 5) posterior spiracles (with or without intraspiracular hairs) on cylindrical projections, whose cuticle tend to be well sclerotized; 6) cephalopharyngeal skeleton with a long parastomal bar; 7) dorsal cornu with a hole or with an incision caudally; 8) ventral cornu with a subcaudal hole or at least less sclerotized on a subcaudal spot.

I do not think the above descriptions to be faultless but I am convinced that there is no use of publishing figures less precise and drawn in lower magnification as published here. The cyclorrhaphan larvae possess not much less numerous external morphological features (incl. those of the cephalopharyngeal skeleton) than the imagoes of the same species. However, several larval features are much smaller compared to the body size, and, since the proportion of the known larvae is still very low in a majority of the families, one cannot be too refined or precise enough when producing descriptions and figures of the formerly unknown larvae.

Acknowledgements – I am very grateful to Dr ALBERT SZAPPANOS (Kecskemét) for his excellent illustrations. It is my agreeable duty to express my sincere thanks to Mr ZOLTÁN BRATEK (Department of Plant Physiology, Eötvös Loránd University, Budapest) also here for his donation of larvae and puparia of *Suillia pallida* to our Department.

REFERENCES

CIAMPOLINI, M. et SÜSS, L. (1983): Nuovi reperti sulla mosca dell'aglio, *Suillia univittata* (von Roser) (Diptera Heleomyzidae). *Boll. Zool. agr. Bachicolt. II* **17**: 19-38.

DARVAS, B., VILMOS, V. T. and PAPP, L. (1989) A fokhagymalégy, Suillia univittata von Roser (Dipt., Heleomyzidae) kártétele Magyarországon [Damage of the garlic fly (Suillia univittata von Roser) (Dipt., Heleomyzidae) in Hungary]. *Növényvédelem* **25**(4): 166-171.

GILL, G. D. and PETERSON, B. V. (1987) Chapter 89. Heleomyzidae, pp. 973-980. *In* MCALPINE, J. F. et al. (eds): *Manual of Nearctic Diptera*, Vol. 2. Research Branch, Agriculture Canada, Ottawa. Agric. Can. Monogr. 28.

HENNIG, W. (1952) Die Larvenformen der Dipteren. Eine Übersicht über die bisher bekannten jugendstadien der zweiflügeligen Insekten. 3. Teil. Akademie Verlag, Berlin, 628 pp.

LOBANOV, A. M. (1970) O morfologii vzroslykh lichinok Helomyzidae (Diptera) ["In morphology of lost [last] instar larvae of Helomyzidae (Diptera)"]. *Zool. Zhurn.* **49**(11): 1671-1675.

NIKOLOVA, W. (1962) On the morphology of the preliminary stages of the garlic-fly Suillia (Helomyza) lurida Meig. *Izv. nauch. Inst. Zasht. Rast.* **2**: 5-14.

NIZI, G. (1963) Studio morfo-biologico sulla *Suillia pallida* Fall. *Note Appunti sper. Ent. agr.* **10**: 27-57.

SÉGUY, E. (1934) *28. Diptères (Brachycères) (Muscidae Acalyptratae et Scatophagidae)*. Faune de France, Lechevalier, Paris, **28**, IV+832 pp.

SMITH, K. G. V. (1989) An introduction of the immature stages of British flies. Diptera larvae with notes on eggs, puparia and pupae. *In* DOLLING, W. R. and ASKEV, R. R. (eds): *Handbook for the Identification of British Insects,* Vol. 10, Part 14: 1-280.

Received May 16, 1994; accepted July 1, 1994

NEW IN THE SERIES

Catalogue of Palaearctic Diptera

edited by Á. SOÓS and L. PAPP

Volume 13

Anthomyiidae–Tachinidae

The Catalogue contains the basic taxonomic, nomenclatorial and distribution data of all species occurring in the Palaearctic Region with the fundamental morphological features for the majority of the fly groups.

Volume 13 lists the names of 460 genera, 38 subgenera and 2389 species assigned to three families. Furthermore, 672 synonymous generic and 2477 specific names, 1807 emendations, errors, nomina dubia and doubtful genera and species are listed. The period of the Catalogue extends from 1758 to 31 December, 1982.

Contents: Explication to distribution. Type-species designations in Volume 13. New name proposed in Volume 13. Families: Anthomyiidae (Á. DELY-DRASKOVITS). Rhinophoridae (B. HERTING). Tachinidae (B. HERTING and Á. DELY-DRASKOVITS). Bibliography. Index.

December 15, 1993. 624 pages
US$ 85.00 plus US$ 5.00 for package and postage
(and an extra US$ 5.00 if you want it air mail)
ISBN 963 70 9321 4

Order should be sent

to the Hungarian Natural History Museum, Library
Baross u. 13., Budapest, H–1088 Hungary
Fax: (36)-(1)-1138820

Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 231-240

POLYOMMATINE LYCAENIDS OF THE OREAL BIOME IN THE NEOTROPICS, PART III: DESCRIPTIONS OF THREE NEW SPECIES (LEPIDOPTERA, LYCAENIDAE)

ZS. BÁLINT[1] and G. LAMAS[2]

[1]*Zoological Department, Hungarian Natural History Museum*
H-1088 Budapest, Baross utca 13, Hungary
[2]*Museo de Historia Natural, Universidad Nacional Mayor de San Marcos*
Apartado 14-0434, Lima–14, Peru

The descriptions of three new polyommatine lycaenid species are given from the high Andean regions of Peru: *Itylos pasco* (type locality: department Pasco, Lima-Huánuco), *Madeleinea huascarana* (type locality: department Ancash, Parque Nacional Huascarán, Quebrada Llanganuco) and *Madeleinea cobaltana* (type locality: department Junín, Ondores). The discovery of these three new taxa underlines the importance of the Peruvian Andes in speciation. With 10 original figures.

Key words: Andes, diversity, Itylos, Madeleinea, Peru

INTRODUCTION

NABOKOV (1945), the first modern reviser of neotropical Polyommatinae, treated only about a dozen available species names in his seminal work concerning high Andean and Austral faunas. Reviewing NABOKOV's results four decades later, DESCIMON (1986) emphasized that further investigations were necessary because NABOKOV's synoptic work was obviously incomplete (DESCIMON 1986, Table 2). SHAPIRO (1991: 141), in a thorough analysis of Argentinian Pieridae, noted the importance of discerning the remaining diversity of Lycaenidae and Hesperiidae in the high Andean and Austral regions.

Recently, the senior author provided an overall picture of polyommatine diversity in Latin America (BÁLINT 1993*a*, 1993*b*) including the results of numerous contemporaneous species descriptions by him and other authors. According to this report, the species diversity of the Neotropical Polyommatinae appeared much higher than previously assumed. In fact, the author made clear that work on regional faunas was actually only beginning.

The junior author, pursuing extensive fieldwork in numerous regions of Peru, has discovered several polyommatine entities new to science. Some of these had already been noted, but not formally described (e.g. LAMAS and PÉREZ

1983, Figs 37-46). In addition, the butterfly collections of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos (Lima, Peru) [MUSM], in the care of the junior author, includes samples of other Neotropical Polyommatinae either recently described or important to the continuing analysis of polyommatine taxa in the region (BÁLINT 1993*a*, 1993*b*; BÁLINT and JOHNSON 1993). Accordingly, the present paper describes some of these entities.

MATERIALS AND METHODS

Collections. The material examined is housed mainly in the butterfly collection of MUSM. For comparative purposes, other historical and recently collected materials at the American Museum Natural History, New York (AMNH), Hungarian Natural History Museum, Budapest (HNHM) and Natural History Museum, London (NHM) have been examined.

Genitalia dissections. Drawings of genital structures were prepared using conventional binocular microscopy. Dissections are stored in glycerin vials deposited at the relevant institutions based on the number sequence of the senior author.

Terminology. Morphological terminology follows SCOTT (1986) for genitalia, and MATTONI (1989) for wing and fringe patterns, in a manner consistent with recent revisionary work by the senior author and colleagues (BÁLINT, *loc. cit.* and BÁLINT and JOHNSON 1994*a*, 1994*b*). This includes, for brevity, the abbreviations "DFW, DHW" and "VFW, VHW" (for dorsal fore- and hindwings, ventral fore- and hindwings, respectively) and etymological use of various names originating in V. NABOKOV's literary works.

DESCRIPTIONS OF NEW TAXA

Itylos pasco BÁLINT and LAMAS, sp. n.
(Figs 1-2, 7)

Diagnosis: Superficially most similar to *I. pnin* BÁLINT, 1993 but VHW postmedian band more prominent. Male genitalia fitting the clade including *I. pnin* and *I. titicaca* (WEYMER, 1890) but with male genital uncus and gnathos long and slender (more like *I. titicaca*), aedeagus short and with large bulbous vesica (comparable only with *I. pnin*), juxta curiously X-shaped. Currently known only from high Andean habitats in Peru.

Description: Antennae checkered, club below brownish grey. Wings (Figs 1-2). FW costal margin slightly convex, outer margin long (compared with *I. pnin*). DFW, DHW with ground deep purple, blackish margin very wide in FW apical area (similar to *I. titicaca*). Veins covered with black scales; fringe long and checkered (type 5). VFW ground rufous brown with reduced polyommatine markings. Discoidal and postmedian spots brown with white halos. Submarginal pattern indistinct, apex with suffusion of greyish scales. VHW pattern most similar to *I. pnin*. VHW ground ash grey covered with rufous shade; ce Sc+R1 darker brown subbasal; postmedian spot with halo. Postmedian spot dark brown; row of white crescents occurring from ce M1 to anal margin but becoming indistinct in anal area, postmedian section somewhat lighter; submarginal pattern indistinct and hardly visible. FW length: 8.00 mm (holotype).

Male genitalia (Fig. 7): Uncus and gnathos long and slender (cca. equal with valval length), gnathos broken in right angle at 1/5 length, basal part very week, juxta V-shaped with small, ring-shaped process, apex very short and widened out from base, valval shape rounded with very strongly developed anal and apical processi, anal area heavily sclerotized, aedeagus short, vesica strong, three times the length of aedeagus.

Female: unknown.

Type material: Holotype, male, labelled as: "Peru, PA, km 300, Carret. Lima-Huánuco, 4300 m, 31.V.'78., G. Lamas", genitalia dissection 396, gen. prep. No. BÁLINT, deposited in MUSM.

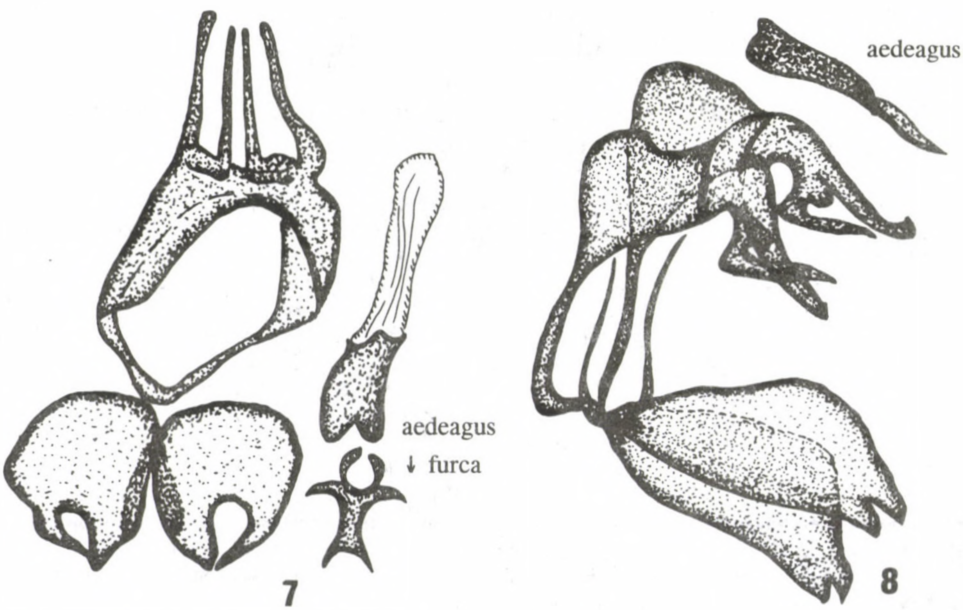
Type locality: Peru, department Pasco, km 300 carretera Lima-Huánuco, 4300 m (Fig 10).

Distribution: Spatial – the primary type specimen was collected in high elevation, above 4000 m. Temporal: known only from type data.

Biology: Unknown.

Remarks: This new taxon is quite outstanding and could be confused only by workers unfamiliar with the recently described *I. pnin*. Wing shape, pattern and morphological characters distinguishing the new species are summarized in Table 1. Phylogenetically, *I. pasco* fits well into the character transformation series previously recognized within *Itylos* (BÁLINT and JOHNSON 1994*b*) with *I. pasco* appearing to be the sister species of *I. pnin* and these two the sister couplet of *I. titicaca*.

Etymology: Noun, in apposition, used to signify the region (Peruvian department) of the type locality.



Figs 7-8. Male genitalia of *Itylos pasco* sp. n. and *Madeleinea huascarana* sp. n.. 7 = *Itylos pasco* sp. n. holotype, aedeagus removed and furca; 8 = *Madeleinea huascarana* sp. n. holotype, aedeagus removed

Table 1. Characters typifying the taxa *I. titicaca, I. fumosa, I. pnin* and *I. pasco*.

	I. titicaca	*I. fumosa*	*I. pnin*	*I. pasco*
DW ground	violet blue with distinct black margin	deep dark blue with wide black margin	luminous blue with suffused black margin	deep purple with wide black margin
VHW postmedian band	waved and continuous	straight and continuous	straight and interrupted	waved and interrrupted
Uncus of male genitalia	long, straight and narrow	short and bulbous	long, straight and thick	long, slightly curved and narrow
Gnathos of male genitalia	relatively strong and almost as long as uncus	short with half uncus length	strong, almost as long as uncus	narrow and almost as long as uncus
Aedeagus of male genitalia	suprazonal part almost with same length as subzonal	suprazonal part with 1/3 length of subzonal	subzonal part with 1/3 length of suprazonal	subzonal part with 2/5 length of suprazonal

Madeleinea huascarana BÁLINT and LAMAS, sp. n.
(Figs 3-4, 8)

Diagnosis: Superficially resembling *M. lolita* BÁLINT, 1993 but HW pseudotail (cf. BÁLINT and JOHNSON 1994*b*, *lolita*-group) at 1A+2A but not as prominent and spots of VHW pattern more coalescent than in *M. lolita*. Male genitalia similar to *M. lolita* but with more curved and slightly convex valval costa. Currently known only from high Andean habitats in Peru.

Description: Antennae checkered but below almost unicolorous white, tip of club rufous brown. Wings (Figs 3-4). FW costal margin straight, outer margin relatively long. DFW, DHW ground deep violet blue with indistinct black marginal border (very wide at FW apex), veins covered with black scales. Fringes long, checkered (type 3). VFW ground greyish in basal, subbasal, marginal and apical areas, brownish in median area. Discoidal and postmedian spots brown with greyish white halos. Submarginal area almost with no pattern. VHW pattern resembles *M. lolita* and *M. koa* (DRUCE 1876) most but DW ground between M2 and M3 brown, large whitish polyommatine spot present in ce M3–ce CuA2. End of veins 1A+2A with brown pseudotail. Anal area white, fringes on HW prominently white, only slightly checkered on dorsal view. FW length: 11.00 mm (holotype), 10-12 mm (n=10, paratypes).

Genitalia (Fig 8). Uncus slender and long 4/7 length of valva, gnathos also slender and strongly bent in a right angle close to its base, basal part very strong; tegumen and vinculum of typical polyommatine shape but juxta long (cca. equal to uncus length) and pointed; valva of typical polyommatine shape but costa slightly convex, apex with strong process; aedeagus relatively short, suprazonal area about half the length of the subzonal part, vesica strong and long (same length as the suprazonal element) and anally sclerotized.

Female wing morphology. Wings coloured and patterned as in male, but on upperside light violet blue, with wider dark marginal borders.

Female genitalia. Not examined.

Table 2. Characters typifying the taxa *M. koa*, *M. lolita* and *M. huascarana*

	M. koa	*M. lolita*	*M. huascarana*
VHW postmedian band	distinct, more or less continuous, curved	continuous, but zigzagged, well patterned	interrupted, indistinct
Aedeagus of male genitalia	suprazonal part not strongly sclerotized, slightly shorter or equal to subzonal length	suprazonal part strongly sclerotized, vesica weak	suprazonal part strongly sclerotized, vesica strong

Type material: Holotype, male, labelled as: "Peru, An., P. N. Huascarán, Qbda., Llanganuco, Chinancocha 3850 m, 28.III.'81, E. Pérez", genitalia dissection 397, gen. prep. No. BÁLINT, deposited in MUSM. Paratypes, all from Peru, Ancash, Parque National Huascarán, 3 males: Camino al Portachuelo, 3900-4700 m, 24.i.81, 29.iii.81. (E. Pérez); 2 males: Quebrada Demanda, 3875-4100 m, 5.vii.80, 20.iv.81 (E. Pérez); 2 males, 2 females: Chinancocha, 3850 m, 6.vii.81 (E. Pérez); 1 male: Bosque Polylepis, 3450-3850 m, 10.ix.80 (E. Pérez); all deposited in MUSM.

Type locality: Peru, Ancash, Parque Nacional Huascarán, Quebrada Llanganuco, Chinancocha, 3850 m (Fig. 10).

Distribution: Spatial – specimens were observed in high elevations between 3400 and 4700 m. Temporal – specimens known from the dry and wet seasons (probably flies all year round).

Biology: Some brief data concerning the habitats and ecology of the species are given by LAMAS and PÉREZ (1983).

Remarks: This new species is relatively outstanding; it can be confused with its sister *M. lolita* or the sympatric *M. koa* by workers not familiar with diversity of the group. Wing shape, pattern and morphological characters distinguishing the new species are summarized in Table 2. Phylogenetically, *M. huascarana* and *M. lolita* appear to form a strong sister pair in *Madeleinea*. Their immediate sister group is sympatric and synchronic, containing *M. koa* in Peru and two new Ecuadorian species being described by BÁLINT and JOHNSON (1994*c*).

Etymology: Noun, in apposition, used to signify the region of Huascarán.

Madeleinea cobaltana BÁLINT and LAMAS, sp. n. (Figs 5-6, 9)

Diagnosis: FW costal margin straight and outer margin longer than in *M. pacis* and appearing slightly convex; DW cobalt blue with a strong metallic shade, DFW with prominent discoidal spot and wide marginal border; VW resembling most *M. pacis* but with a wider postmedian band; female genitalia showing a more pointed and heavily sclerotized fibula than in *M. pacis*.

Description: Wings (Figs 5-6). DW ground cobalt blue with strong metallic hue; black margin widened at apex. DFW showing discoidal line, DHW with small marginal spot in cell CUA2. Fringes checkered (type 4). VFW ground drab, suffused with bluish-gray scales at base, discoidal and postmedian spots large and darker drab, halos shiny white; submarginal and marginal areas slightly darker with polyommatine markings barely visible; VHW pattern typical of *Madeleinea* and most resembling *M. pacis*; dark elements darker drab; apical postbasal spots merged, pseudovitta absent; postmedian spots merged in a very wide wavy band; subbasal and postmedian area shiny white; margin darker with small spot in ce CUA2. FW length: 11,0 mm. (holotype), 11.0 mm (paratype).

Genitalia (Fig. 9). Ductus bursae strongly corrugate; henia strong, more or less quadrate shaped in dorsal view, fibula pointed in lateral view, papilla anales with sclerotized edge, eighth tergite with short but very strong apodeme.

Male: unknown, but the possible male of this species is a badly rubbed specimen (in MUSM) from Junín, Tarma, 3700 m, collected ix.48 by F. BLANCAS.

Type material: Holotype, female, labelled as: "Peru, Ju., Ondores, 4080 m, 30.I.87, O. Karsholt", genitalia dissection 398, gen. prep. No. BÁLINT, deposited in MUSM. Paratype, female, labelled as: "34 mi E of La Oroya on road to Tarma, ±4200 m, 22.I.1975, PRE [P. R. Ehrlich]", genitalia dissection 379, gen. prep. No. BÁLINT, deposited in AMNH. Another female paratype (FW = 10 mm): Junín, Pachachaca, 4000 m, 22.v.79 (G. Lamas) (in MUSM).

Type locality: Peru, Junín, Ondores, 4080 m.

Distribution: Spatial – known only from central Peru at very high elevations above 4000 m. Temporal – found during the wet season (January to May).

Biology: Unknown.

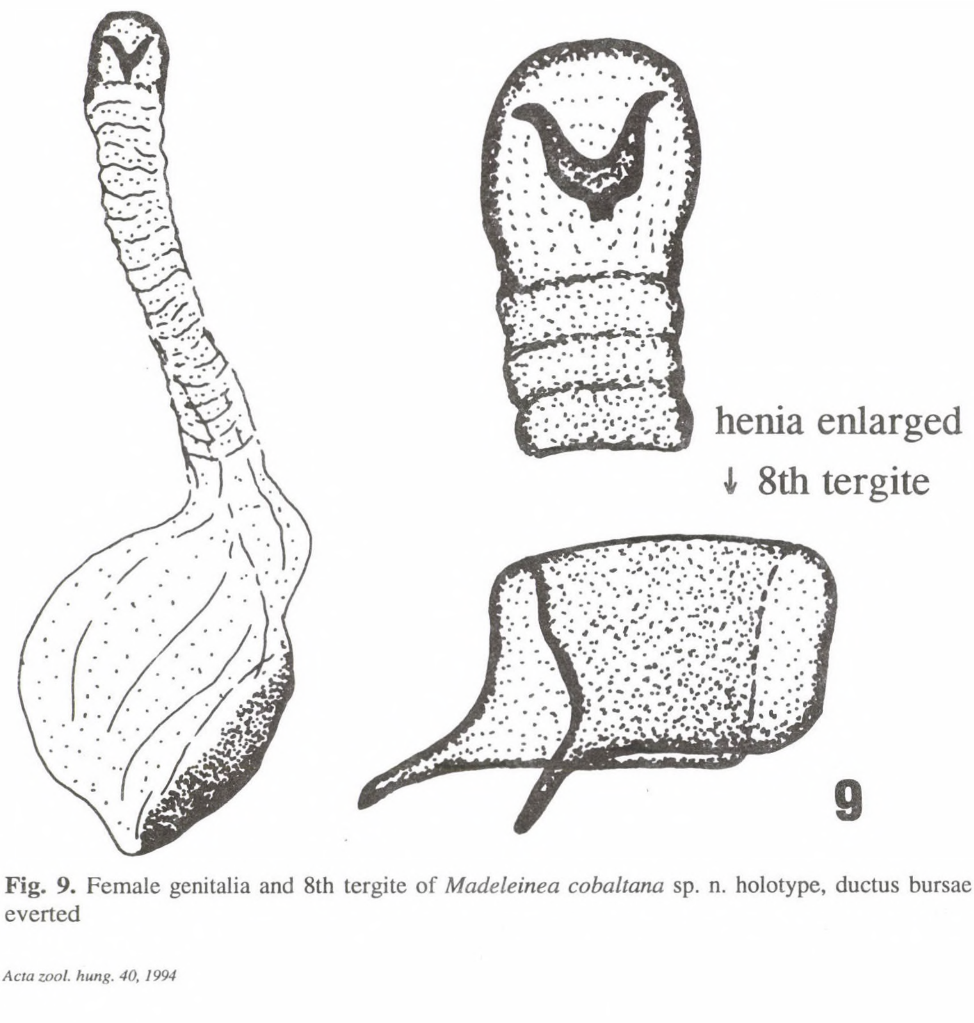


Fig. 9. Female genitalia and 8th tergite of *Madeleinea cobaltana* sp. n. holotype, ductus bursae everted

Table 3. Characters typifying females of *M. pacis, M. pelorias* and *M. cobaltana*

	M. pacis	*M. pelorias*	*M. cobaltana*
DW ground	deep violet blue	gleaming greenish blue	gleaming cobalt blue
VHW postmedian spots in ce M1-M2	equal in size or spot in M2 somewhat larger, both rounded	spot in M2 always larger, both quadrate	M2 always larger, both very big
Henia of female genitalia (in ventral view)	edges bent twice	edges curved and waved	gently curved

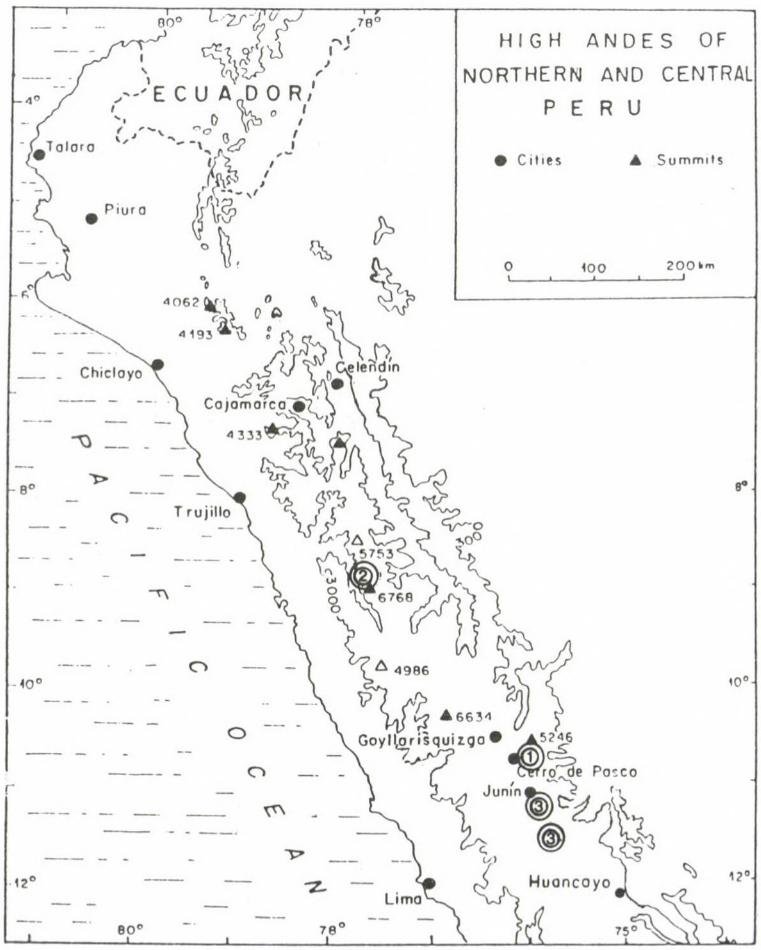


Fig. 10. Distribution of *Itylos pasco* sp. n. (1), *Madeleinea huascarana* sp. n. (2) and *M. cobaltana* sp. n. (3)

Remarks: This species could be confused only with its sister *M. pacis* or the more poorly known *M. pelorias*, all belonging to the same species group (BÁLINT and JOHNSON 1994*c*). Wing shape, pattern and morphological characters distinguishing the new species are summarized in Table 3. Phylogenetically, *M. cobaltana* appears to be the sister species of *M. pacis*, forming with *M. moza* (STAUDINGER, 1894) and *M. pelorias* (WEYMER, 1890), a monophyletic group in the genus. *M. cobaltana, M. pacis* and *M. pelorias* are very distinct in their wing morphology compared to *M. moza* but the genitalic structures suggest close kinship. The sister group in *Madeleinea* is comprised of widespread *M. koa* and a sister pair of species from the high Andean region of Ecuador. Of these, only *M. koa* is sympatric and synchronic with taxa of the *moza*-group [at least as can be surmised from currently available collection records and literature data (cf. BÁLINT and JOHNSON 1994*c*)].

Etymology: a noun, gender feminine, originating from the name of a Zemblan mountain resort called "Kobalt" in NABOKOV's "Pale Fire"; also indicating the dorsal ground colour of the taxon.

DISCUSSION

Diversity in the high Andean polyommatine fauna of South America was estimated in the past as quite insignificant in number (cf. FIEDLER 1991: 110). LARSEN (1991: 213), in fact, suggested that there was probably no autochtonous polyommatine genus in the region. The reality is quite different and a far higher taxon number is indicated (cf. BÁLINT 1993*a*, Table 2; BROWN 1993, Table 2). At least two genera formerly considered as typical "*Polyommatus*"-like polyommatines are most probably Andean endemic entitites (cf. BÁLINT and JOHNSON 1994*a* and 1994*b*). At the species level, BÁLINT and JOHNSON (1993) showed that a number of superficially similar "sibling" species in Chile differ obviously in morphological traits; similar studies in other areas of ecological complexity suggest polyommatine "sibling" diversity may be more the rule than the exception (BÁLINT and JOHNSON 1994*d*). Yet, in spite of this, polyommatine species numbers still pale in comparison to the vast faunas of other lycaenid butterfly groups in the ecologically varied Neotropical Realm (FIEDLER 1991: 110, BROWN 1993: 46).

The present paper has added three new polyommatine species to the fauna recognized for high Andean Peru. The three new species belong to two of the most "well known" genera of the Neotropical "blue butterflies", already reviewed in some detail by NABOKOV (*Itylos* as *Parachilades*, *Madeleinea* as *Itylos*; NABOKOV 1945: 6-10 and 38-43) and listed by DESCIMON (1986) and BRIDGES (1988).

The genus *Itylos* DRAUDT, 1921 whose four taxa form a well interpretable transformation series, is most probably an autochtonous entity of the high Andes. It was mistakenly placed amongst the genera of ELIOT's *Polyommatus*-section (BÁLINT and JOHNSON 1994*b*) basically because of poor knowledge of its morphology. The *Nabokovia*-section (BÁLINT and JOHNSON 1994*a*) is another example of the unique polyommatine entities inhabiting the high Andes.

The genus *Madeleinea* BÁLINT, 1993 shows holarctic relationships in its wing habitus and internal morphology, as previously noted by NABOKOV (1945: 39). The phylogenetic and biogeographic problems which emerge during elaboration of this genus recall those of another partly oreal Neotropical entity, the pierid genus *Colias* SWAINSON, 1827 (cf. SHAPIRO 1991: 179-183).

Description of the three Peruvian entities treated in the present paper underlines once again the importance of the Peruvian high Andes in speciation (cf. SHAPIRO 1991: 186). According to FJELDSÅ (1988 and 1993) this speciation partly occurred in *Polylepis* woodlands which are not homogenous but, instead, form a habitat mosaic. *M. huascarana* and *M. koa*, as well as at least two taxa of the high Andean endemic *Nabokovia*-section [*N. faga* (DOGNIN, 1895) and *Eldoradina cyanea* (BALLETTO, 1993)] are linked to the vegetation of *Polylepis* forests (LAMAS and PÉREZ 1983: 36). The discovery of further representatives of these genera is highly probable because the high Andean fauna is yet unexplored as whole.

* * *

Acknowledgements – For access to neotropical polyommatine material the senior author is indebted to the following persons: Messrs PHILIP R. ACKERY and CAMPBELL R. SMITH (NHM) and Drs KURT JOHNSON and FREDERICK H. RINDGE (AMNH).

REFERENCES

BÁLINT, ZS. (1993*a*) A Catalogue of Polyommatine Lycaenidae (Lepidoptera) of the Xeromontane Oreal Biome in the Neotropics As Represented in European Collections. *Rep. Mus. Nat. Hist. Univ. Wisc. (Stevens Point) 29*, 36 pp, 123 figs, 2 pls.

BÁLINT, ZS. (1993*b*) Comments and additions concerning the recent "catalogue" of neotropical polyommatine Lycaenidae. *Rep. Mus. Nat. Hist. Univ. Wisc. (Stevens Point) 42*, 4 pp.

BÁLINT, ZS. and K. JOHNSON (1993) New species of Pseudolucia Nabokov from Chile and Patagonia (Lepidoptera: Lycaenidae, Polyommatinae). *Rep. Mus. Nat. Hist. Univ. Wisc. (Stevens Point) 27*, 25 pp, 6+ [52] figs, 1 pl.

BÁLINT, ZS. and K. JOHNSON (1994*a*) Polyommatine lycaenids of the oreal biome in the neotropics, part I.: The Thecline-like taxa (Lepidoptera: Lycaenidae). *Acta zool. hung.* **40**(2): 109-123.

BÁLINT, ZS. and K. JOHNSON (1994*b*) Polyommatine lycaenids of the oreal biome in the neotropics, part II.: The *Itylos* section (Lepidoptera: Lycaenidae). *Annls hist.-nat. Mus. natn. hung.* **86**: 53-77.

BÁLINT, ZS. and K. JOHNSON (1994*c*) Synopsis of the High Andean Polyommatine Genus Madeleinea Bálint, 1993 (Lepidoptera: Lycaenidae). *Rep. Mus. Nat. Hist. Univ. Wisc. (Stevens Point)* (in press)

BÁLINT, ZS. and K. JOHNSON (1994*d*) Taxonomic investigations on Argentine Pseudolucia Nabokov, 1945 (Lepidoptera: Lycaenidae). *Rep. Mus. Nat. Hist. Univ. Wisc. (Stevens Point)* (in print)

BRIDGES, C. A. (1988) *Catalogue of Lycaenidae & Riodinidae (Lepidoptera: Rhopalocera).* C. A. Bridges, Urbana, Illinois, pp. 811.

BROWN, K. S. (1993) Neotropical Lycaenidae: an overview. *In* T. R. New (ed.) *Conservation Biology of Lycaenidae (Butterflies).* Occasional Paper of the IUCN Species Survival Commission No. 8: 45-61.

DESCIMON, H. (1986) Origins of Lepidopteran Faunas in the High Tropical Andes. *In* F. VUILLEUMIER and M. MONASTERIO (eds): *High Altitude Tropical Biogeography.* Oxford University Press, New York-Oxford, pp. 500-532.

ELIOT, J. N. (1973) The higher classification of the Lycaenidae (Lepidoptera): a tentative arrangement. *Bull. Brit. Mus. Nat. Hist. (Ent.)* **28**: 371-505, 162 figs, 6 pls.

FIEDLER, K. (1991) Systematic, evolutionary, and ecological implications of myrmecophily within the Lycaenidae (Insecta: Lepidoptera: Lycaenidae). *Bonner Zoologische Monographien* **31**: 1-210 pp, 19 tbls.

FJELDSÅ, J. (1988) Status of birds of the steppe habitats of the Andean zone and Patagonia. *In* P. D. GORIUP (ed.) *Ecology and conservation of grassland birds.* Cambridge, U. K., International Council for Bird Conservation (Tech. Publ. 7), pp. 81-95.

FJELDSÅ, J. (1993) The avifauna of the Polylepis woodlands of the high Andean highlands: the efficiency of basing conservation priorities on patterns of endemism. *Bird Conservation International* **3**: 37-55.

LAMAS, G. y J. E. PÉREZ (1983) Las mariposas del Parque Nacional Huascarán (Ancash, Peru) y su medio ambiente: Sector Llanganuco. *Bol. de Lima* **5**(30): 27-37.

LARSEN, T. B. (1991) *The Butterflies of Kenya and Their Natural History.* Oxford University Press, Oxford, xxii+490+i, 64 pls., 19+4 figs, 7 tbls.

MATTONI, H. T. (1989) The Euphilotes battoides complex: recognition of a species and description of a new subspecies. *J. Res. Lepid.* **27**(3–4): 173–185.

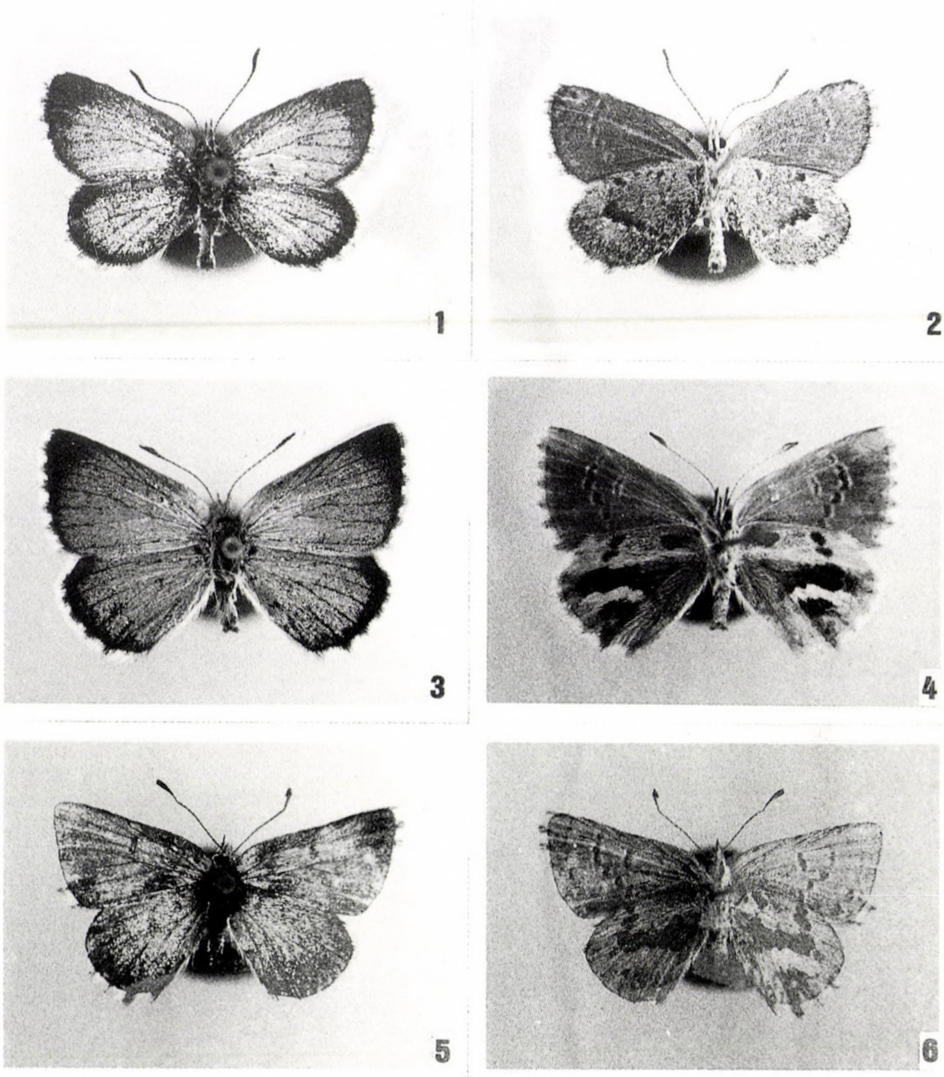
NABOKOV, V. (1945) Notes on neotropical Plebejinae (Lycaenidae). *Psyche* **51**: 1-61.

SCOTT, J. A. (1990) Adult structure and function. *In* O. KUDRNA (ed.) *Butterflies of Europe, Vol 2. Introduction to Lepidopterology.* Aula-Verlag, Wiesbaden, pp. 108-151.

SHAPIRO, A. M. (1991) The Zoogeography and Systematics of the Argentine Andean and Patagonian Pierid Fauna. *J. Res. Lepid.* **28**(3): 137-238, 4 pls, 24 figs.

Received May 2, 1994; accepted July 1, 1994

Figs 1-6. 1 = *Itylos pasco* sp. n. holotype male, dorsal. 2 = same, ventral. 3 = *Madeleinea huascarana*, sp. n. holotype male, dorsal. 4 = same, ventral. 5 = *M. cobaltana* sp. n. holotype female, dorsal. 6 = same, ventral



Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 241-252

NEW TAXA OF THE TRIBE ORTHOSIINI, IV. (LEPIDOPTERA, NOCTUIDAE)

M. HREBLAY

H-2030 Érd, Somfa u. 15, Hungary

Descriptions of *Orthosia* (*Orthosia*) *manfredi* sp. n. from Morocco, *Egira fatima* sp. n. and *E. tibori* sp. n. from Turkey are given. With 55 figures.

Key words: *Orthosia, Egira*, taxonomy, new species, W Palaearctic region

INTRODUCTION

As a result of two Hungarian lepidopterological expeditions carried out in Morocco and in Turkey, three formerly undescribed species of the tribe Orthosiini have been recognized. They may be present in several collections, one of them might be identified as *Orthosia* "*incerta*" in Moroccan materials (and mentioned as *incerta* in some literature, e.g. RUNGS, 1981) and the other two species can be confused with *E. conspicillaris* (LINNAEUS, 1758) and *E. anatolica* (HERING, 1933), with which they may occur sympatrically in S and SE Turkey.

A. The Orthosia incerta *species-group (* Orthosia *s. str.)*

The characterization of the incerta species-group (*Orthosia* s. str.) is given by HREBLAY, 1994. The synopsis of the Palaearctic species belonging to this group and the newly discovered *O. manfredi* sp. n. is the following:

Orthosia incerta (HUFNAGEL, 1766)
O. manfredi sp. n.
O. picata (BANG-HAAS, 1912)
O. faqiri HREBLAY & PLANTE, 1994
O. feda HREBLAY & PLANTE, 1994
O. reshoefti HREBLAY, 1994
O. ariuna HREBLAY, 1991
O. evanida (BUTLER, 1879)
O. perfusca SUGI, 1986
O. aoyamensis (MATSUMURA, 1926)

Orthosia incerta (HUFNAGEL, 1766)
(Figs 1-3, 7-8)

Examined material: big series from Hungary; Spain: Prov. Malaga: 1 ♂, Ronda, 600 m, 17. IV. 1987, leg. S. Ortner; 2 ♂, Prov. Jaen, Roblehondo, 20. III. 1986; 2 ♂, 2 ♂; Prov. Jaen, Linarejos, 27. IV., 10 V. 1986. Turkey: Prov. Ankara, 3 ♂, 1300 m, Dütözü köyü, 32°30'E, 40°13'N, 30. III. 1990, leg. M. Hreblay & V. Markó; Prov. Adiyaman: 1 ♂, 25 km E of Gölbasi, Güneykas, 37°42'N, 37°55'E, 9. IV. 1990 leg. M. Hreblay & V. Markó; Prov Elazig: 5 ♂, Lake Hazar Gölü, 1300 m, 20 km, NW of Maden, 39°27'E, 38°32'N, 7. IV. 1990 leg. M. Hreblay & V. Markó; Prov. Agri: 9 ♂, 4 ♀, 5 km E of Sarican, 1800 m, 42°39'E, 39°49'N, 12-15. VI. 1991, leg. M. Hreblay. Azerbaijan: Adzharia: 1 ♂, Xinrish, 600 m, 10. IV. 1981; 1 ♀, Mt. Talysh, Aurora, 100 m, 22. IV. 1980, leg Danilevsky. Russia: 8 ♂, N Caucasus, Stavropol, 14. IV. 1988. leg. Tikhanov; 6 ♂, Altai Mts, Barnaul, 20. V. 1984, leg. Schintlmeister. Turkmenistan: Kopet-Dagh Mts: big series from 6 km S of Ipay-Kala, 1600 m, 8-12. IV. 1993, 57°07'E, 38°17'N, leg. M. Hreblay, Gy. M. László & A. Podlussány; 1 ♂, Firyuza, 400-600 m, 15-19. IV. 1991, 58°05'E, 37°59'N; 1 ♀, 5 km, S of Chuli, 700-800 m, 58°01'E, 37°56'N, 18. IV. 1991, leg. G. Csorba, Gy. Fábián, B. Herczig, M. Hreblay & G. Ronkay. Kazakhstan: 2 ♂, Temerlik River, 1000 m, 27. IV. 1991; 1 ♀, Alakol See, 400 m, 30. V. 1986; 1 ♂, Dzhungaria, Lepsinak, 700 m, 26. V. 1984, leg. Danilevsky. Mongolia: Central aimak: 5 ♂, Tsagaan Davaa, 1400-1600 m, 20 km NW of Bayan Tsadmani, 106°05'E, 48°17'N, 5-6. V. 1990, leg. Gy. Fábián, M. Hreblay, L. Peregovits & G. Ronkay. China: Prov. North Yuennan: 1 ♂, Likiang, 9. V. 1935, leg. H. Höne; Slide Nos HREBLAY 2002, 2003, 2006, 2009, 2018, 2020, 2210, 2211, 2680, 2681, 2703, 2794, 2795, 2983, 2984, 2986, 3808, 5413, 5432, 5433, 6319, 6320, 6321, 6322 males, 2679, 2688, 2774, 2796, 3494, 3809, 4270, 6323, 6324 females, (coll. M. HREBLAY; J. L. YELA; Museum Alexander Koenig, Bonn; Hungarian Natural History Museum, Budapest, (= HNHM)).

Orthosia manfredi sp. n.
(Figs 4-6, 9-10, 46-47)

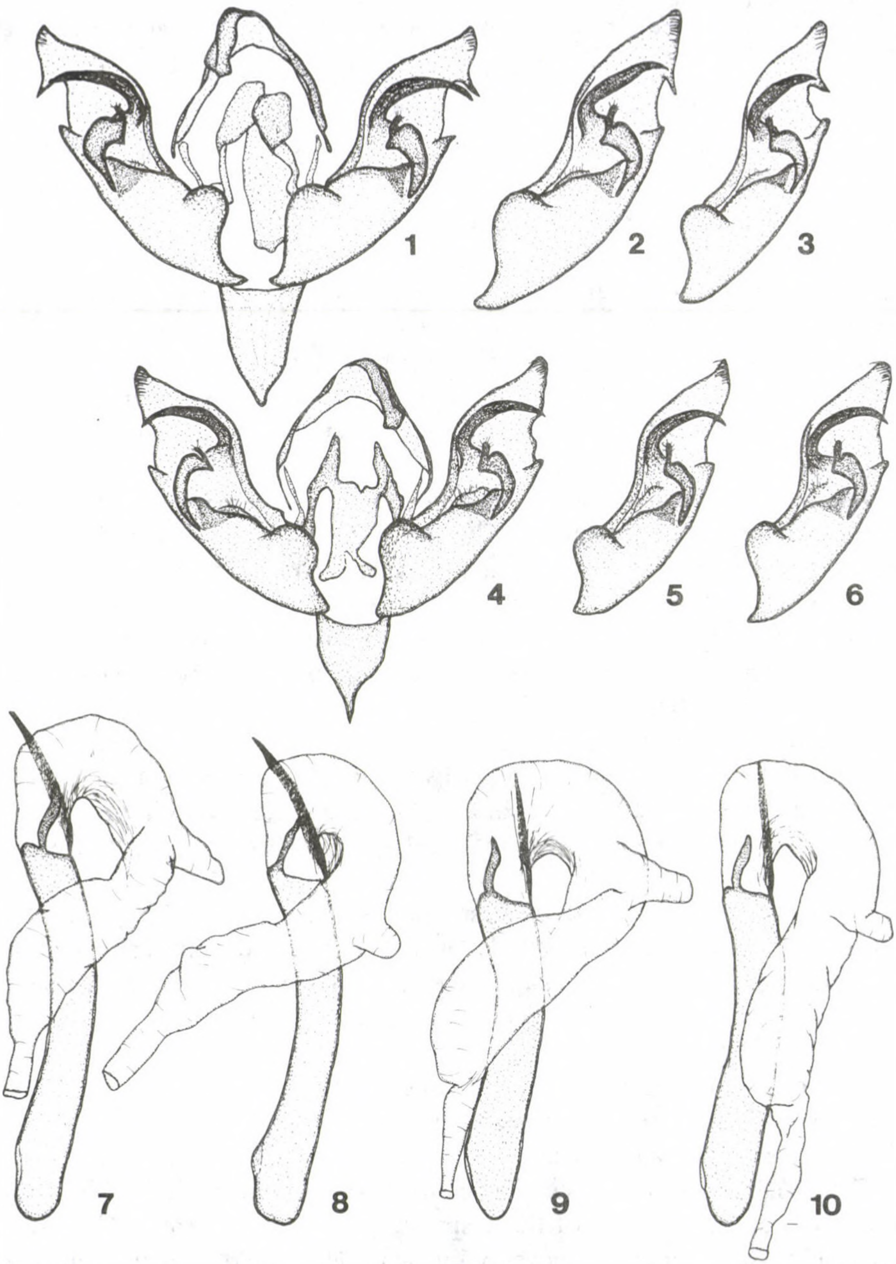
Holotype: male, "Morocco, Middle-Atlas Mts 6 km SE Azrou, 1500 m, 5°10'W, 33°25'N, 17. IV. 1994, leg. Gy. M. László"; slide HREBLAY N: 6024 (coll. M. HREBLAY). Paratypes: 4 males with the same dates; 1 ♂, Morocco, Middle-Atlas, Ifrane, 28. IV. 1967, leg. Y. de Lajonquière. Slide Nos HREBLAY 6022, 6057, 6058 (coll. HNHM, B. HERCZIG, M. HREBLAY, J. PLANTE, G. RONKAY).

External morphology (male): Wingspan 37-38 mm. The new species is very similar externally to *O. incerta*, from which it can be separated only by the examination of the genitalia.

Male genitalia (Figs 4-6, 9, 10): Uncus scaphoidal, tegumen narrow. Apical arm of fultura inferior sclerotized, vinculum long, pointed. Sacculus long, sclerotized, clavus big, rounded. Valva relatively small, cucullus pointed, pollex absent; shape of harpe and ampulla is typical of the group. Aedeagus cylindrical, long, straight; thorn of carina not reaching over the basal curve of vesica and projected into the axis of the aedeagus.

Female unknown.

Diagnosis: the distinctive genital characters of *O. manfredi* and *O. incerta* are the following: the valvae of *O. manfredi* are smaller, weaker than those of *O. incerta*, the pollex is absent (the only member of the species-group having no pollex!), the aedeagus is shorter, more straight, and the thorn of carina does not reach over the recurving basal tube of the vesica.



Figs 1-10. Valvae of *Orthosia* (*Orthosia*) *incerta*, 1 = Hungary, 2 = Russia, Altay Mts, 3 = Spain; 4-6 = Valvae of *O.* (*O.*) *manfredi* sp. n. from Morocco, Azrou, 4 = holotype, 5-6 = paratypes; 7-8 = Aedeagi of *O.* (*O.*) *incerta*, 7 = Hungary; 8 = Spain; 9-10 = Aedeagi of *O.* (*O.*) *manfredi* sp. n., 9 = paratype; 10 = holotype

Distribution: The species is known from the type locality (Azrou and Ifrane), the Middle Atlas Mts in Morocco.

Derivatio nominis: The new species is dedicated to Mr GYULA M. ["Manfred"] LÁSZLÓ, the collector of the species.

B. The Egira conspicillaris *species-group (*Egira *s. str.)*

The genus *Egira* DUPONCHEL, 1844, belongs in the tribe Orthosiini. The phylogenetic relationships between the genera of this tribe are not clarified yet. These genera had been classified on the basis of the external morphology of the species but the comparison of the genital structure of them (both the male and the female) suggests that the revision of the whole tribe and a new grouping of the genera are needed.

Some features of the male genitalia (e.g. helical vesica with cornuti field on the terminal diverticulum) display the closer relationship between the genera *Egira* and *Perigrapha*, the proximal diverticulum of the vesica, being typical for the *Egira* (s. str.) species is also present in some *Perigrapha* species.

The members of the genus *Egira* can be found in the Holarctic region but no real Holarctic species is known. The majority of the species are distributed through the Nearctic region. The genus contains about thirty species but only seven are reported from the Palaearctic. The Palaearctic taxa of the genus mentioned formerly as *Egira* can be divided, by the characteristics of the genitalia, into four different species-groups, one of them is still to be removed from *Egira* (the *saxea*-group, see below).

The *conspicillaris*-group is distributed from Europe to the Central Asian mountains (to the Pamir Mts). The other two species-groups are known from the southern Himalayan range and N Thailand; they were transferred from *Crateres-tra* HAMPSON, 1905, and *Perigrapha* LEDERER, 1857, by HREBLAY (1994, in print).

The *saxea*-group contains two East Palaearctic species, "*E.*" *saxea* (LEECH, 1889) and "*E*". *acronyctoides* (WILEMAN, 1914). These two taxa cannot belong to the genus *Egira* on the ground of some external and genital features. These are the following:

– relatively wide forewing,
– dark brown hindwing without well-marked veins,
– large, equally sclerotized ostium and ductus bursae,
– helical apex bursae and vesica.

These features show closer connections with some species of the genus *Perigrapha*, but the antennae of these species-groups are different. The closest relatives of the *saxea*-group supposedly live in the Nearctic region; the transfer of the taxa of the *saxea*-group into known Nearctic genera or the description of a separate genus requires more detailed studies of the North American genera of the tribe Orthosiini.

THE PALAEARCTIC TAXA OF THE GENUS EGIRA DUPONCHEL, 1844

Species-group: *conspicillaris*
- *Egira conspicillaris* (LINNAEUS, 1758)
- *E. tibori* sp. n.
- *E. fatima* sp. n.
- *E. anatolica* (HERING, 1933)
- *E. servadeii* (BERIO, 1982)

Species-group: *subterminata*
- *E. subterminata* (HAMPSON, 1905)

Species-group: *draudti*
- *E. draudti* (HACKER, 1993)

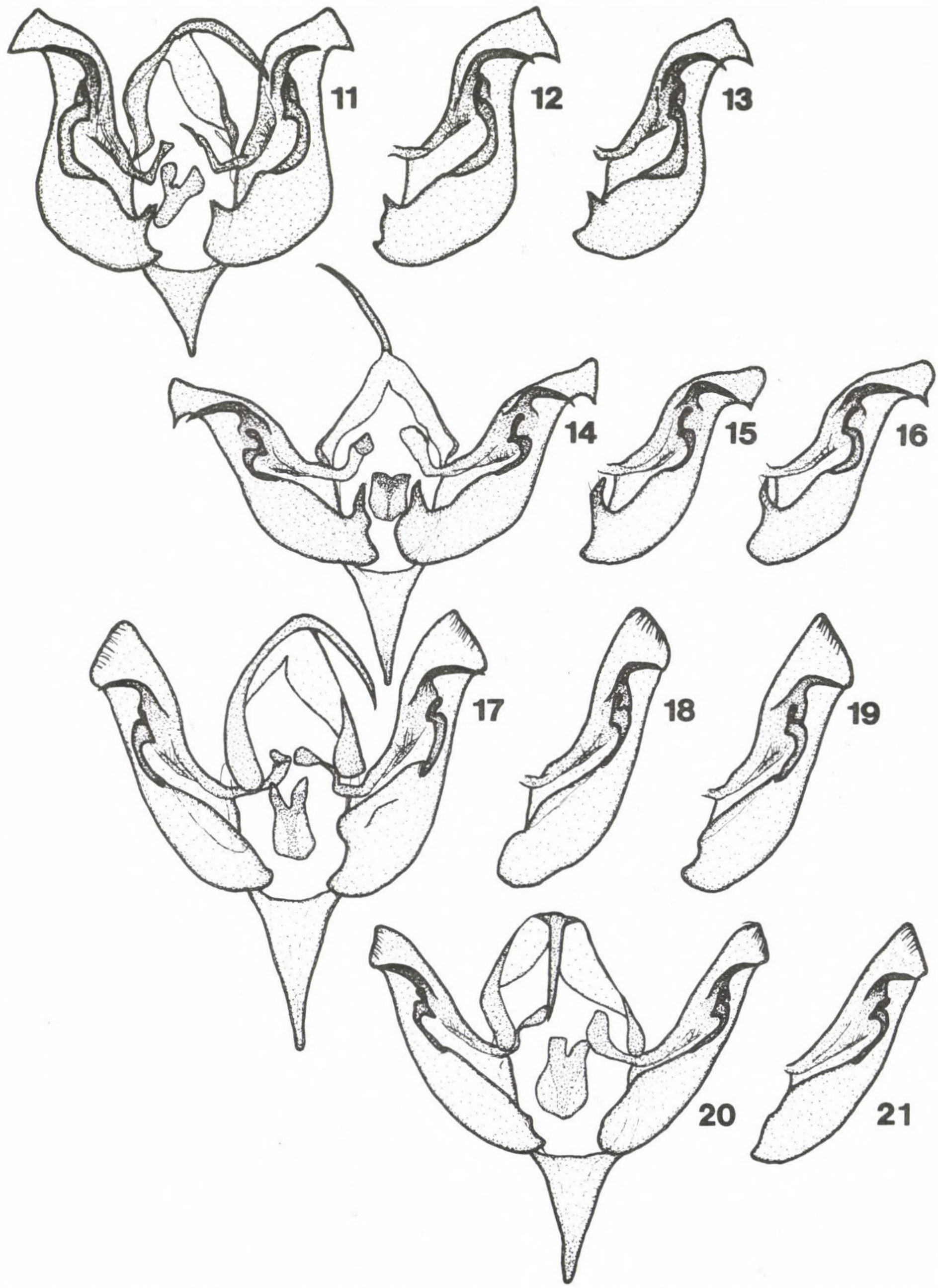
Egira fatima sp. n.
(Figs 14-16, 24, 25, 31-35)

Holotype: male, "Turkey, Prov. Maras, 1 km N of Kahramanmaras 36°52'E, 37°39'N, 900 m, 5. IV. 1994, leg. Csővári & Hreblay", slide HREBLAY N.: 6014. (coll. M. HREBLAY).

Paratypes: Turkey: 10 ♂, 6 ♀, with the same data as the holotype. Prov. Icel: 3 ♂, 1 ♀, 8 km W of Sipaheli, 33°25'E, 36°10'N, 400 m, 4. IV. 1994, leg. Csővári & Hreblay. Prov. Adiyaman: 1 ♂, 1 ♀, 8 km N of Gölbasi, 37°43'E, 37°49'N, 800 m, 10. IV. 1994, leg. Csővári & Hreblay; 2 ♂, 2 ♀, 25 km E of Gölbasi, Güneykas, 37°42'N, 37°55'E, 9. IV. 1990, leg. Hreblay & Markó; 3 ♂, 5 km E Maltepe, 1400 m, 37°46'E, 37°50'N, 19. IV. 1990, leg. B. Herczig & G. Ronkay. Prov. Urfa: 1 ♀, 2 km N of Halfeti, 38°03'E, 37°38'N, 400 m, 6-7. IV. 1994, leg. Csővári & Hreblay. Prov. Elazig, 2 ♂, Hazar Gölü, 1300 m, 39°27'E, 38°32'N, 20. IV. 1990, leg. B. Herczig & G. Ronkay. Prov. Bitlis: 1 ♂, 38°21'N, 42°05'E, valley of Basor, 3,5 km N of Unaldi, 15 km NE of Sarikonak, 1400 m, 29. IV. 1987, leg. H.-P. Schreier. Prov. Hakkari: 28 specimens, 37°29'N, 43°06'E, Tanin daglari, 3 km E of Mutluca, 0,5 km E of Basharan köy, 23. IV. 1987; 26 specimens, 37°29'N, 43°42'E, Cilo Dagi, 1330 m, 5 km N of Agacsiz, 28. IV. 1987; 9 specimens, 37°30,5'N, 43°44'E, valley of Zap, 7 km E-NE of Agacdibi, 1300 m, 27. IV. 1987; 24 specimens, 37°31'N, 43°45,5'E, Cilo Dagi, 1400 m, 5 km E-NE of Agacdibi, 26. IV. 1987; 14 specimens, 37°25,5'N, 42°49,5'E, Ortasu, valley of Cay, 4 km SE of Uludere, 9 km E-NE of Ortabag, 1000 m, 22. IV. 1987, leg. H.-P. Schreier. Slide Nos HREBLAY 2300, 6004, 6012, 6065, 6073 males, 6095, 6096 females (coll. G. BEHOUNEK, T. CSŐVÁRI, H. HACKER, B. HERCZIG, M. HREBLAY, G. RONKAY, P. SCHREIER, H. THÖNY, HNHM, Budapest).

Description: wingspan 34-37 mm (males), 33-35 mm (females); forewing relatively short, broad. Ground colour of body and forewing grey or brown-grey, wing pattern very contrasting. Crosslines diffuse, waved, terminal line consisting of blackish arches. Marginal field dark, apex light grey. Stigmata well-marked, reniform brown, darkened, its outline incomplete: proximal part a sharp black line, apical third absent outerly. Orbicular small, round, marked with black; claviform a conspicuous, blackish arrowhead. Cilia dark grey-brown, spotted with white(ish) at ends of veins. Hindwing whitish, irrorated variably by brownish scales. Veins and discal spot marked with brown, crossline represented by a row of dark spots on veins; terminal line also dark, cilia whitish. Underside: crosslines and discal spots diffuse, more or less visible on both wings; cilia whitish, darker on forewing.

Male genitalia (Figs 14-16, 24, 25): uncus long, slender, tegumen high, narrow, fultura inferior almost quadratic; vinculum elongated, pointed, V-shaped. Valva rather short, cucullus with



Figs 11-21. 11-13 = Valvae of *Egira tibori* sp. n. from Turkey, 11 = paratype P. Icel, 12 = holotype, P. Maras, 13 = paratype, P. Maras; 14-16 = Valvae of *E. fatima* sp. n. 14 = holotype, 15-16 = paratypes, P. Maras; 17-19 = Valvae of *E. anatolica*, 17-18 = P. Maras, 19 = Croatia, Istria; 20-21 = Valvae of *E. servadeii* from Tajikistan, Chorog

apex pointed, pollex short, wide triangle; sacculus long, clavus strong, digitiform. Harpe long, curved, its basal part strong, bar-like. Ampulla thick, angled close to its base. Aedeagus cylindrical, slightly arcuate, spinulose fields of carina regularly well developed. Main tube of vesica helicoid armed with two short, broad-based cornuti and with three diverticula. Proximal one bifid with unequally long arms: proximal arm about three times as long as distal one; both bearing short, strong, bulbed cornuti. Medial diverticulum very small, membranous; terminal diverticulum rather short, with a cornuti field consisting of long spinules.

Female genitalia (Fig. 31): ovipositor short, weak; gonapophyses short, fine. Ostium bursae with a sclerotized ring and a large, stronger plate; ductus bursae granulosely sclerotized, angled strongly at middle. Cervix bursae large, slightly curved, apical part with somewhat stronger sclerotization. Corpus bursae elongated, bearing four ribbon-like signa.

Diagnosis: *Egira fatima* is the smallest species of the group the forewing of which is the shortest and broadest; the wing pattern is the most contrasting as compared with the relatives. The new species has the smallest clasping apparatus, differing from the related *E. conspicillaris, E. anatolica* and *E. servadeii* in almost all details: it has the smallest harpe, cucullus, fultura and pollex, most slender uncus and strongest clavus. The aedeagus with vesica of *E. fatima* is similar to those of *E. conspicillaris* but having only two cornuti on the main tube, the bifid diverticulum has strongly unequal arms and the cornuti fields of carina and the terminal diverticulum are more developed. The aedeagus of *E. anatolica* and *E. servadeii* are longer, narrower; the basal diverticulum of the vesica, being bifid in the preceding two species, is separated into two distinct, long diverticula, bearing significantly longer cornuti. The female genitalia of the related species are often very similar, those of *E. fatima* can be separated from the other taxa by its stronger sclerotization of the ostium bursae and the more angled ductus bursae.

Distribution: The species is known from S Turkey, from Prov. Icel to Prov. Hakkari.

Egira tibori sp. n.
(Figs 11-13, 22, 23, 29, 36-39)

Holotype: male, "Turkey, P. Maras, 1 km N of Kahramanmaras 36°52'E, 37°39'N, 900 m, 5. IV. 1994, leg. Csővári & Hreblay"; Slide No. HREBLAY: 6011; (coll. M. HREBLAY).

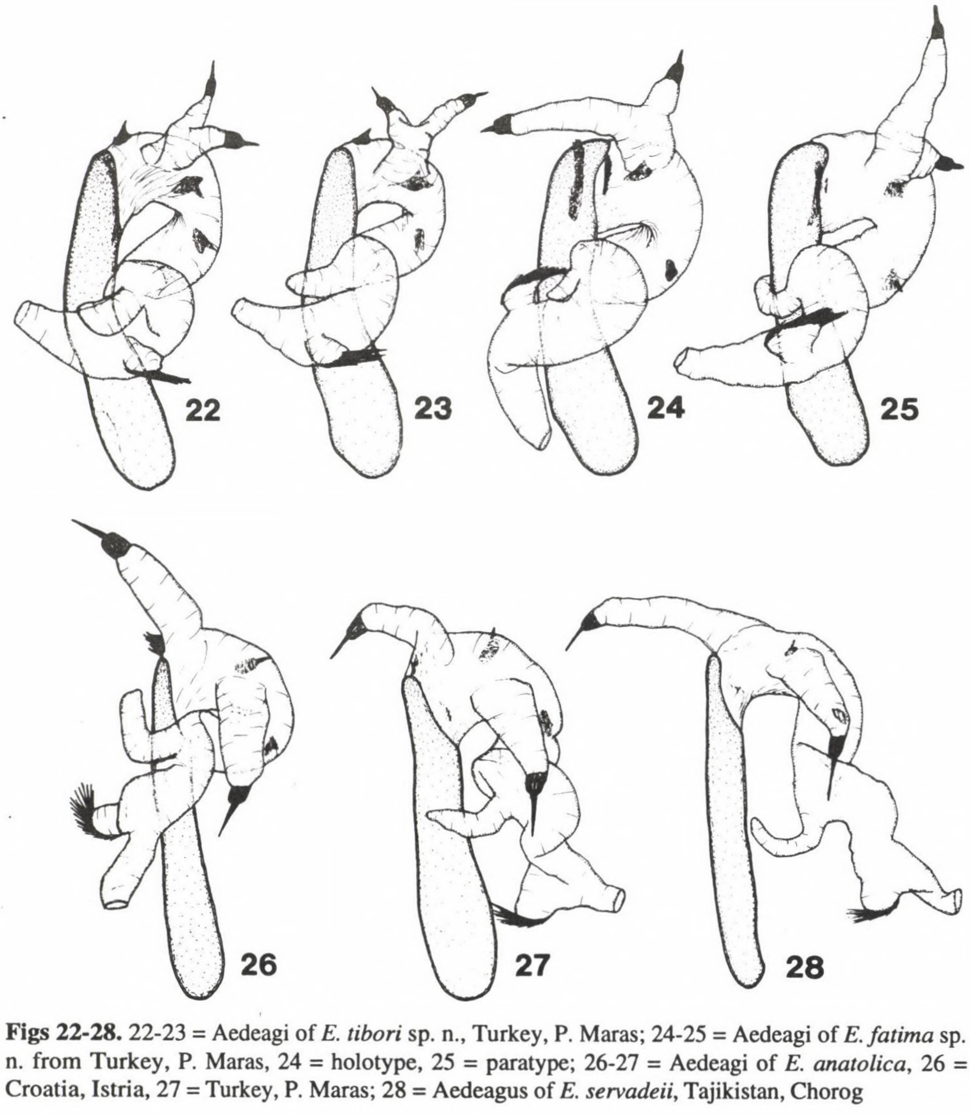
Paratypes: Turkey: 15 ♂, with the same data as the holotype; Prov. Icel: 14 ♂, 8 km W of Sipaheli, 33°25'E, 36°10'N, 400 m, 4. IV. 1994; Prov. Burdur: 1 ♂, 10 km SE of Bucak, 30°38'E, 37°23'N 800 m, 3. IV. 1994; Prov. Bilecik: 24 ♂, 3 km E of Vezirhan, 30°04'E, 40°15'N, 150 m, 2. IV. 1994, leg. Csővári & Hreblay; Prov. Adana: 1 ♂, 5 km W of Damlama, 37°09'N, 34°47'E, 15. IV. 1990, leg. M. Hreblay & V. Markó;

Slide Nos HREBLAY: 5963, 5965, 6007, 6063, 6384, 6385, 6387, 6389, 6390 males; (coll. T. CSŐVÁRI, M. HREBLAY).

Description: (male): Wingspan 33-39 mm. The new species is very similar externally to the other West Palaearctic *Egira* species, especially to *E. conspicillaris*; the examination of the genitalia is necessary for the correct identification.

Male genitalia (Figs 11-13, 22, 23): uncus long, slender, tegumen high, narrow, fultura inferior a reversed pear-shaped; vinculum elongated, pointed, V-shaped. Valva rather short, cucullus with apex pointed, pollex a wide triangle; sacculus short, clavus apically acute. Harpe long, curved, its basal part strong, bar-like. Ampulla thick, angled close to its base. Aedeagus cylindrical, slightly arcuate, spinulose fields of carina regularly weakly developed. Main tube of vesica helicoid, armed with three short, broad-based cornuti and with three diverticula. Proximal one bifid with almost equally long arms, both bearing short, strong, bulbed cornuti. Medial diverticulum very small, membranous; terminal diverticulum rather short, with a cornuti field consisting of long spinules.

Diagnosis: the distinctive genital characters of *E. tibori* sp. n. and *E. conspicillaris* are the following: the clavus of *E. tibori* sp. n. more pointed, than that of *E. conspicillaris*; the proximal diverticulum of the vesica of *tibori* is bifid. The

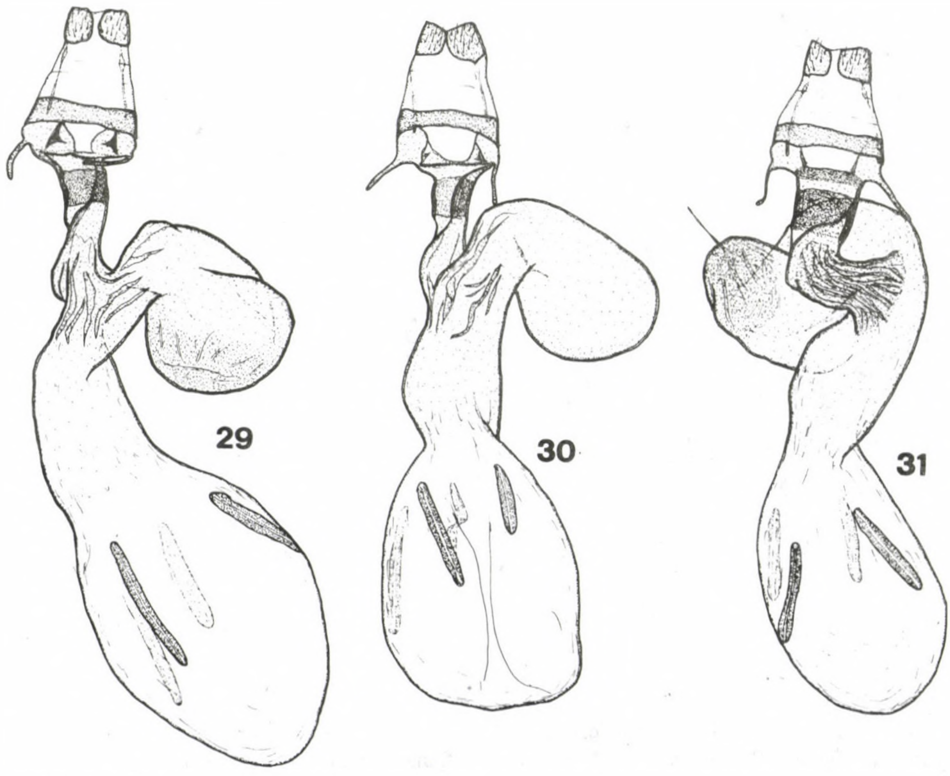


Figs 22-28. 22-23 = Aedeagi of *E. tibori* sp. n., Turkey, P. Maras; 24-25 = Aedeagi of *E. fatima* sp. n. from Turkey, P. Maras, 24 = holotype, 25 = paratype; 26-27 = Aedeagi of *E. anatolica*, 26 = Croatia, Istria, 27 = Turkey, P. Maras; 28 = Aedeagus of *E. servadeii*, Tajikistan, Chorog

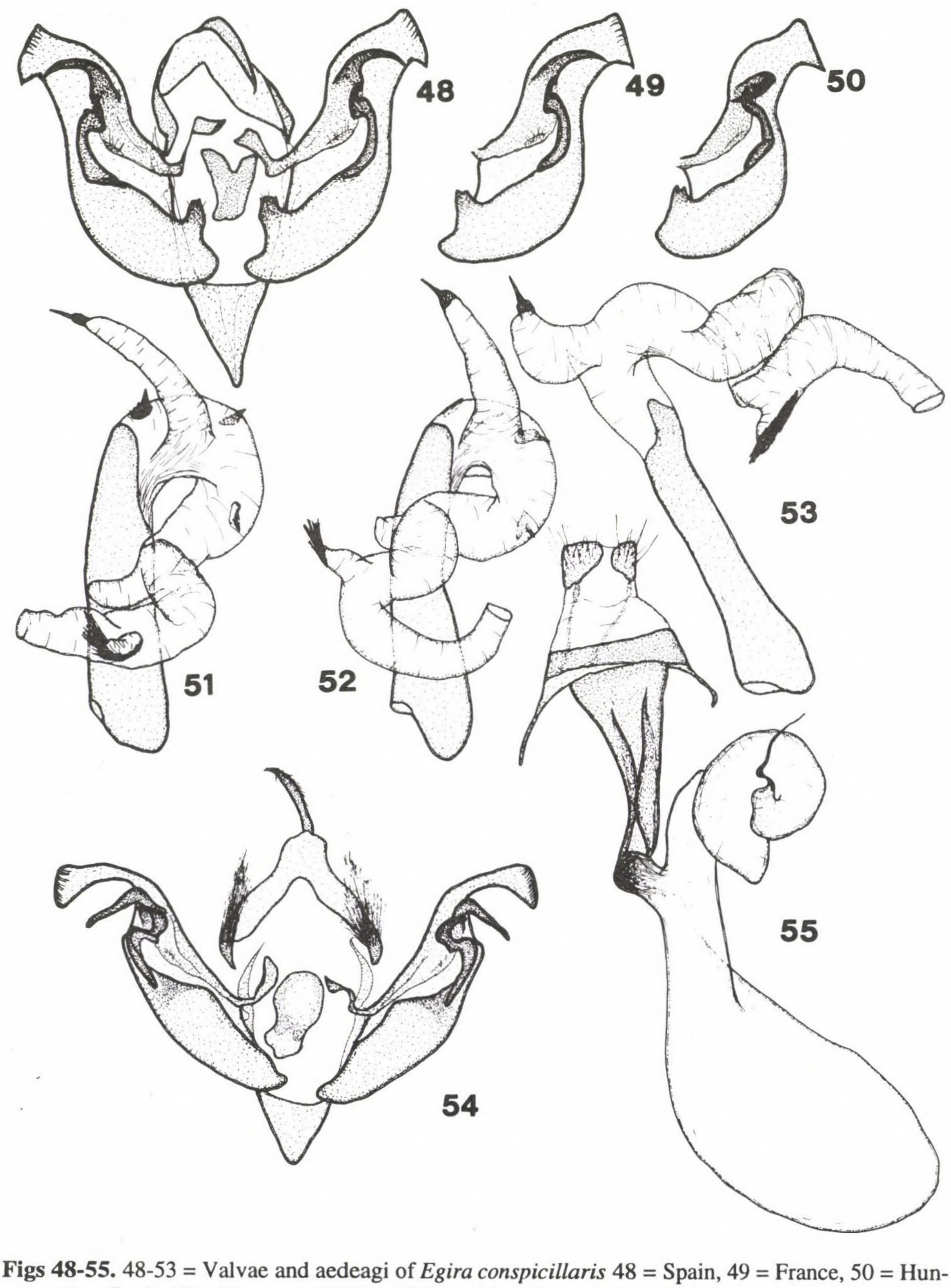
proximal diverticulum of conspicillaris is not bifid, but twice longer than of that of *tibori*.

The identification of the females of this species-group is often doubtful even by the study of the genitalia: the possible differences in the cervix bursae cannot be clearly observed on the genital slides. Further investigations on the blown female genitalia preparations preserved on concentratred alcohol are needed for the final decision; till then the separation of the females of *E. conspicillaris* and *E. tibori* remains uncertain. In view of the above problem, no female specimens are selected into the type-series nor diagnosis of the female genitalia is given.

Derivatio nominis: The new species is dedicated to Mr Tibor CSŐVÁRI, the collector of the species.

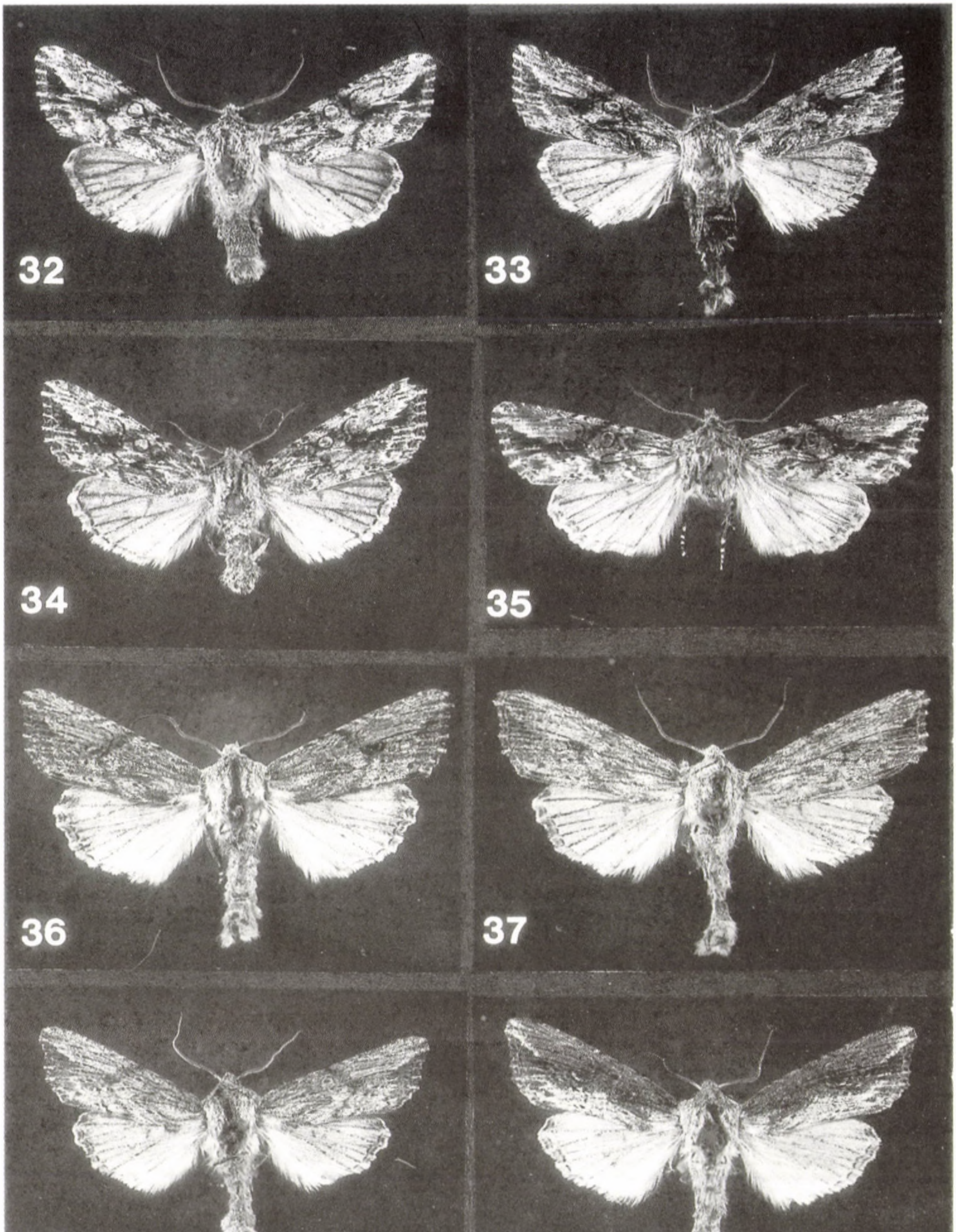


Figs 29-31. Female genitalia of *Egira* species. 29 = *conspicillaris*, Hungary, 30 = *anatolica*, Turkey, P. Maras, 31 = *fatima* sp. n., Turkey, P. Maras

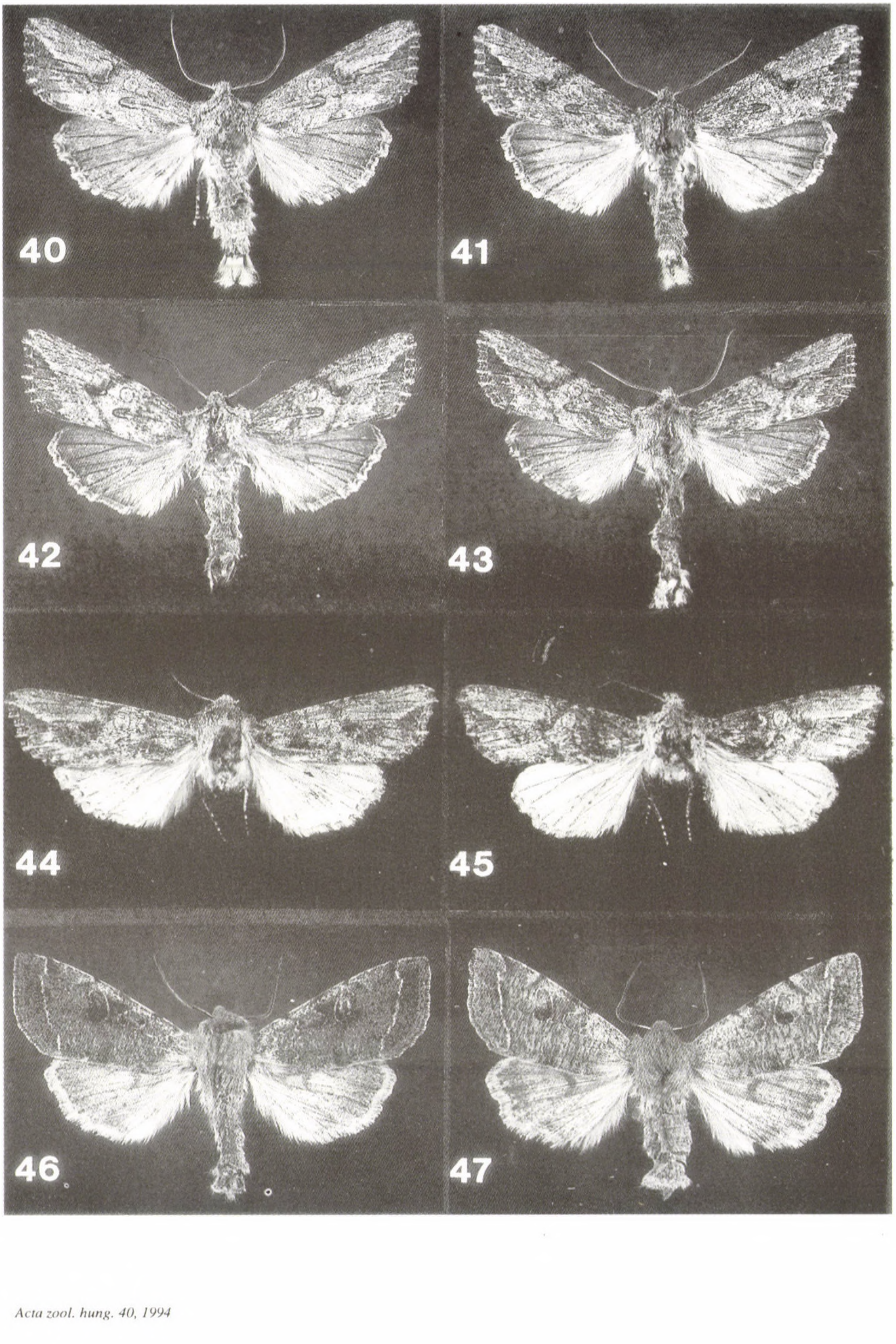


Figs 48-55. 48-53 = Valvae and aedeagi of *Egira conspicillaris* 48 = Spain, 49 = France, 50 = Hungary, 51 = Spain, 52 = Hungary; 53-55 = Male and female genitalia of "*E.*" *saxea*, Japan

Figs 32-39. 32-35 = *Egira fatima* sp. n., 32 = holotype, 33 = paratype, male, Turkey, P. Maras, 34 = paratype female, P. Maras, 35 = paratype, male, Turkey, P. Hakkari; 36-39 = *E. tibori* sp. n. paratypes, Turkey, P. Maras



Figs 40-47. 40-43 = *Egira anatolica* males, Turkey, P. Maras; 44-45 = *E. servadeii* males, Tajikistan, Chorog; 46-47 = *Orthosia* (*Orthosia*) *manfredi* sp. n., Morocco, Azrou, 46 = holotype, 47 = paratype, male



Egira conspicillaris (LINNAEUS, 1758)
(Figs 48-52)

Examined material: 15 ♂, 10 ♀, Hungary, Budaörs, leg. M. Hreblay; 1 ♂, 4 ♀, Hungary, Érd, 26. IV. 1994; leg. M. Hreblay; 2 ♂, 2 ♀, Spain, Prov Teruel, Albarracin, 24. V. 1962, leg. De Laever; 1 ♂, Spain, Prov. Gerona, E-Pyreneus Mts, Llansa, 120 m, 12. IV. 1993, leg. A. E. Rau; 1 ♀, 2 ♂, France, Nice, 12. IV. 1923; 1 ♀, France, Sardinia, Mts Gennargentu, Belvi, 700 m, 31. V. 1975, leg. L. Gozmány; 1 ♂, Italia, Sicilia, Taormine, 8. IV. 1914, leg. Schmidt; 1 ♂, Bosnia, Sarajevo, 25. IV. 1950, leg. J. Fodor; 1 ♂, Macedonia, Strumica, 3. IV. 1973; 2 ♂, Turkey, Prov. Ankara, 10 km W of Kizilcahama ♂, Eskice, 32°35'E, 40°26'N, 14. IV. 1994, leg. T. Csővári & M. Hreblay.

Slide Nos HREBLAY: 2601, 6340, 6367, 6368, 6369, 6373, 6374, 6375, 6376, 6377 males, 6041, 6042, 6370, 6371, 6372 females; (coll. T. Csővári, M. HREBLAY, HNHM).

Egira anatolica (HERING, 1933)
(Figs 17-19, 26, 27, 30, 40-43)

Examined material: Turkey: Prov. Maras: 7 ♂, 7 ♀, 1 km N of Kahramanmaras 36°52'E, 37°39'N, 900 m, 5. IV. 1994, leg. Csővári & Hreblay; Prov. Icel: 1 ♂, 5 ♀, 8 km W of Sipaheli, 33°25'E, 36°10'N, 400 m, 4. IV. 1994, leg. Csővári & Hreblay; Prov. Adana: 1 ♂, 5 km W of Damlama, 37°09'N, 34°47'E, 15. IV. 1990, leg Hreblay & Markó; Prov. Urfa: 1 ♂, Birecik, valley of Euphrat, 350 m, 37°52'E, 37°13'N, 5. IV. 1990, leg. Hreblay & Markó, 1 ♀, 2 km N of Halfeti, 38°03'E, 37°38'N, 400 m, 6-7. IV. 1994, leg. Csővári & Hreblay; Prov. Adiyaman: 2 ♂, 25 km E of Gölbasi, Güneykas, 37°42'N, 37°55'E, 9. IV. 1990, leg. Hreblay & Markó. Azerbaijan: 2 ♂, 1 ♀, Transcaucasia, Nakhichevan, Buzgov, 600 m, 1. V. 1985. Turkmenistan: a large series from the Kopet-Dagh Mts, 6 km S of Ipay-Kala, 1600 m, 8-12. IV. 1993, 57°01'E, 38°17'N, No. L86, leg. M. Hreblay, Gy. M. László, A. Podlussány.

Slide Nos HREBLAY 2602, 2707, 6002, 6005, 6013, 6015, 6016, 6017, 6018, 6066, 6074, 6076, 6383 males, 6964, 5966, 6003, 6008, 6010 females, (coll. T. CSŐVÁRI, B. HERCZIG, M. HREBLAY, L. NÉMETH, G. RONKAY, S. SIMONYI, HNHM Budapest).

Egira servadeii BERIO, 1982
(Figs 21, 22, 28, 44, 45)

Examined material: 2 ♂, Tajikistan, Chorog, 2000 m,
Slide Nos HREBLAY 2603, 6075 males, (coll. M. HREBLAY).

"*Egira*" *saxea* (LEECH, 1889)
(Figs 53-55)

Examined material: 1 ♂, 1 ♀, W Japan, 30 km, N of Kyoto, Hirogava, 600 m, 24. IV. 1981, leg. S. Kinoshita.

Slide Nos HREBLAY 6338 male, 6339 female, (coll. HNHM)

Acknowledgements – The author would like to express his thanks to Dr B. HERCZIG (Tata), Mr GY. M. LÁSZLÓ (Gödöllő), Mr L. NÉMETH (Tapolca), Mr G. RONKAY, Mr T. CSŐVÁRI, Mr S. SIMONYI (Budapest), Mr J. PLANTE (Martigny), Mr H. THÖNY (Ingolstadt), Mr G. BEHOUNEK (Deisenhofen), Mr H. HACKER (Staffelstein), Mr H.-P. SCHREIER (Giesfeld), Dr J. L. YELA (Seville) for the loan of the important material and for the reviewing of the paper. Many thanks to Dr L. RONKAY (Budapest) for the consultation and Mr A. KEVE (Budapest) for the photographs.

The research was supported by the OTKA Fund (No. 3181).

REFERENCES

BERIO, E. (1982) Egira servadeii, n. sp. del Pamir (Lepidoptera Noctuidae Hadeninae). *Mem. Soc. ent. ital., Genova* **60**: 61-62.

BOURSIN, CH. (1966) Eine neue Conisania Hps. aus Sining, nebst Synonymie-Notizen (Beiträge zur Kenntnis der "Noctuidae- Trifinae"). *Z. Wien. ent. Ges.* **51**: 154-159.

HACKER, H. (1990) Die Noctuidae Vorderasiens (Lepidoptera). *N. ent. Nachr., Marktleuthen* **27**: 4-700.

HREBLAY, M. (1991) Neue Taxa aus der Gattung Orthosia Ochsenheimer, 1816 (s. l.) (Lepidoptera, Noctuidae). *Acta zool. hung.* **37**: 193-203.

HREBLAY, M. (1991) Neue Taxa aus der Gattung Orthosia Ochsenheimer, 1816 (s. l.) (Lepidoptera, Noctuidae) II. *Acta zool. hung.* **39**: 7-90.

HREBLAY, M. (1994) Neue Taxa aus der Gattung Orthosia Ochsenheimer, 1816 (s. l.) (Lepidoptera, Noctuidae) III. *Acta zool. hung.* **40**: 21-27.

HREBLAY, M. (1994) Neue paläarktische Taxa aus der Gattung Perigrapha Lederer, 1857. (Lepidoptera, Noctuidae). *Esperiana* **5** (in print)

PARENZAN, P. (1982) Segnalazione di alcune specie di Nottuidi nuove per le fauna Italiana, e descrizione di due nuove sottospecie (Lepidoptera – Noctuidae). *Entomologica, Bari*, **17**: 127-147.

POOLE, R. W. (1989) *Lepidopterum Catalogus, Noctuidae*. I.-III. Brill, Leiden etc., pp. 1314.

RUNGS, CH. E. E. (1981) Catalogue Raisonné des Lépidoptéres du Maroc. Tome II. *Travaux de l'Institut Scientifique, Rabat, Série Zoologie* **40**: 224-583.

Received June 8, 1994; accepted July 20, 1994

Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 253-263

NEW TAXA OF THE GENUS HIMALISTRA HACKER & RONKAY, 1993 (LEPIDOPTERA, NOCTUIDAE)

HREBLAY, M., J. PLANTE and L. RONKAY

[1]*H-2030 Érd, Somfa u. 15, Hungary*
[2]*2, Rue des Prés de la Scie, CH-1920 Martigny, Switzerland*
[3]*Department of Zoology, Hungarian Natural History Museum*
H-1088 Budapest, Baross u. 13, Hungary

Descriptions of three new species and a new subspecies of the genus *Himalistra*, *H. tahiricola* sp.n. (NE Turkey), *H. caesia* sp. n. (N Pakistan), *H. nivea* sp. n. (N Pakistan) and *H. fusca fumata* ssp. n. (N Pakistan), with the complete checklist of the genus and biogeographical considerations are given. With 26 figures.

Key words: new species, *Himalistra*, Xylenini, Noctuidae

INTRODUCTION

The genus was erected for a group of species of the tribe Xylenini (the former "Cuculliinae" part of the late autumnal-early spring species complex) having a *Conistra*-like appearance but a very unique type of genitalia of both sexes (HACKER & RONKAY, 1993). The members of the genus are considered as characteristic elements of the Central Asian high mountains, especially to the western Himalayan region where the major part of the formerly known taxa are distributed, including the type-species, *H. eriophora* PÜNGELER, the most widespread taxon of the group (RONKAY, VARGA & BEHOUNEK, 1991; HACKER & RONKAY, 1993).

The investigations on the early spring fauna of the north-western parts of this region, including the huge massives of the Karakoram and the southern Hindukush are resulted in the discovery of three, formerly unknown taxa of *Himalistra*.

Surprisingly, two females of a further, undescribed *Himalistra* species was found in the material of the early spring (mid-May) collectings of a Hungarian collector, CS. SZABÓKY made in the rocky gorge eastwards from the Tahir Pass, the "classic" locality in north-east Turkey. This is the westernmost refuge of several noctuid species belonging to such groups, the core area of which is typically Central Asiatic. These are, for example, the only known population of *Dasypolia* (*Dasymixis*) *diva*, or the westernmost (yet undescribed) *Dasypolia* (*Cteipolia*) species (RONKAY & VARGA, 1990). The subsequent attempts for collecting this moth in the late autumnal period (mid-October 1992, 1993) were successful, producing a series of about a dozen of specimens of both males and females.

The descriptions of the newly discovered taxa and the comments on their distribution and bionomics are given in the following sections.

SYSTEMATIC PART

General distribution

A Central Asian-West Himalayan genus, with a disjunct exclave in North-East Turkey. The species are regularly stenochorous, being restricted to a smaller region, only one, relatively widespread species is known, occurring from the western Tien Shan to Chinese Turkestan and from the Tajik Pamir Mts to the Pakistani Himalayas. The stenochorous taxa have three well defined centres of distribution: the major part of them occurs in the West-Himalayan region, two species are endemic to the Pamir and one is known only from NE Turkey.

The ranges of the two related genera, containing externally often highly similar species, *Himalistra* and *Estagrotis* have only a small overlap in the south-western Himalaya but the *Himalistra* taxa prefer the more xerothermic and continental western Himalayan and Central Asian mountains while *Estagrotis* is typical for the more humid and often partly subtropical monsoonic forests of the southern Himalaya and the south-eastern edges of the Tibetan plateau.

Bionomics

The imagines of the *Himalistra* species are on the wing in late autumn and early spring, being active often during the winter period. The males can also overwinter but most of the specimens collected in the spring are females. They occur in the humid, medium high and high forest zones between 1500-3500 m, one species (*H. eriophora*) is recorded from rather low and less humid parts of the Tien Shan massif.

The eastern Turkish species occurs in deep rocky gorges with streams bordered by sparse gallery forest-like vegetation. The known specimens were collected by light and seem not to attracted to the sugar bait. The moths fly regularly late at night, often even in frosty weather.

CHECKLIST OF THE GENUS

Himalistra HACKER & RONKAY, 1993
eriophora eriophora (PÜNGELER, 1901)
eriophora perspicua (PÜNGELER, 1925)
nekrasovi HACKER & RONKAY, 1993
tahiricola RONKAY & HREBLAY sp. n.
caesia HREBLAY & PLANTE sp. n.
nivea HREBLAY & PLANTE sp. n.
delicata (RONKAY, VARGA & BEHOUNEK, 1991)
carnea (HAMPSON, 1907)
fusca HACKER & RONKAY, 1993
fusca fumata HREBLAY & PLANTE ssp. n.
extera HACKER & RONKAY, 1993
arcessita HACKER & RONKAY, 1993
dentata (HAMPSON, 1894) comb. n.

Himalistra tahiricola RONKAY & HREBLAY sp. n.
(Figs 1-4, 17-18, 23)

Holotype: male, "Turkey, Prov. Agri, 5 km E of Sarican, 1800 m, 19-21.X.1992, 42°39'E, 39°49'N, leg. M. Hreblay & G. Ronkay".

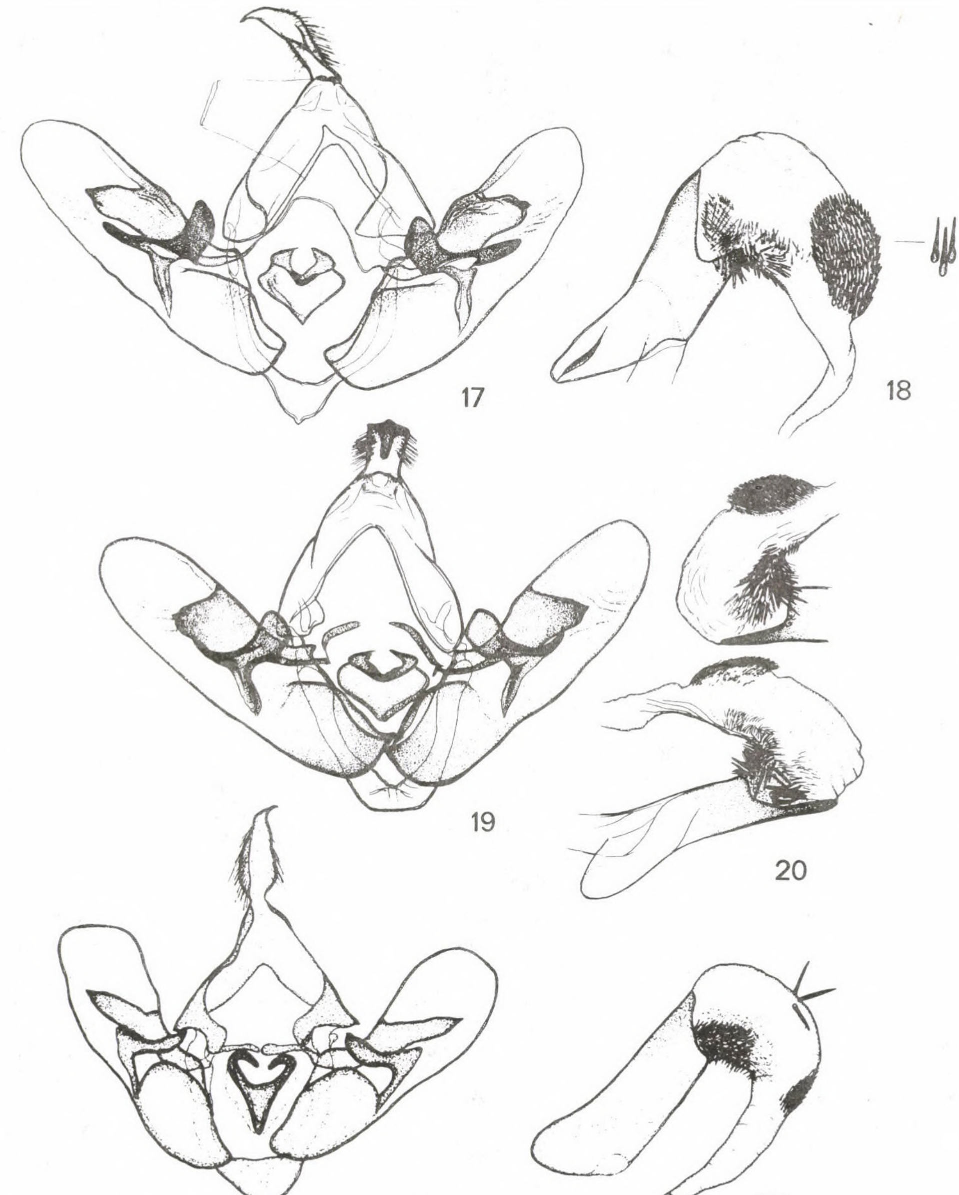
Slide No. HREBLAY 3735. Coll. M. HREBLAY (Érd, Hungary)

Paratypes: 10 specimens from the same locality: two females, 17. May 1992, leg. Cs. Szabóky (coll. SZABÓKY, Budapest); 2 males, 2 females, 19-21 October 1992, leg. M. Hreblay and G. Ronkay (coll. the collectors and HNHM Budapest); 4 males, 16-17. October 1993, leg. Gy. Fábián, B. Herczig, Gy. László and K. Szeőke (coll. the collectors).

Slide Nos 3688 HREBLAY; 4269, 4270 RONKAY (females).

Description: wingspan 37-39 mm, length of forewing 17-18 mm. Head and thorax dark olive-brown or olive-grey, mixed with some dark brown and greyish hairs, lateral side of palpi dark brown; abdomen a bit more greyish. Forewings elongate and narrow with apex finely pointed. Ground colour dark, shining olive-grey with strong brown-grey and ashy grey irroration, sometimes with a green-greyish shade. Transverse lines well defined, broadly double, sinuous, dark grey, filled with whitish-grey or pale olive-grey, costal spots dark, conspicuous; medial line a diffuse, dark grey shadow. Orbicular and reniform stigmata encircled partly with darker grey, filled with olive-grey, reniform with a plumbeous-grey spot at lower third. Subterminal obsolescent, sinuous, marked by some diffuse dark triangles at apical part. Terminal line dark grey, cilia orange-olive, spotted with dark greyish. Hindwing dark grey-brown, inner part only slightly lighter, transverse line and discal spot poorly visible or absent. Terminal line brown, cilia yellowish with darker inner line. Underside of wings pale ochreous-grey, medial part of forewing with intensive darker irroration.

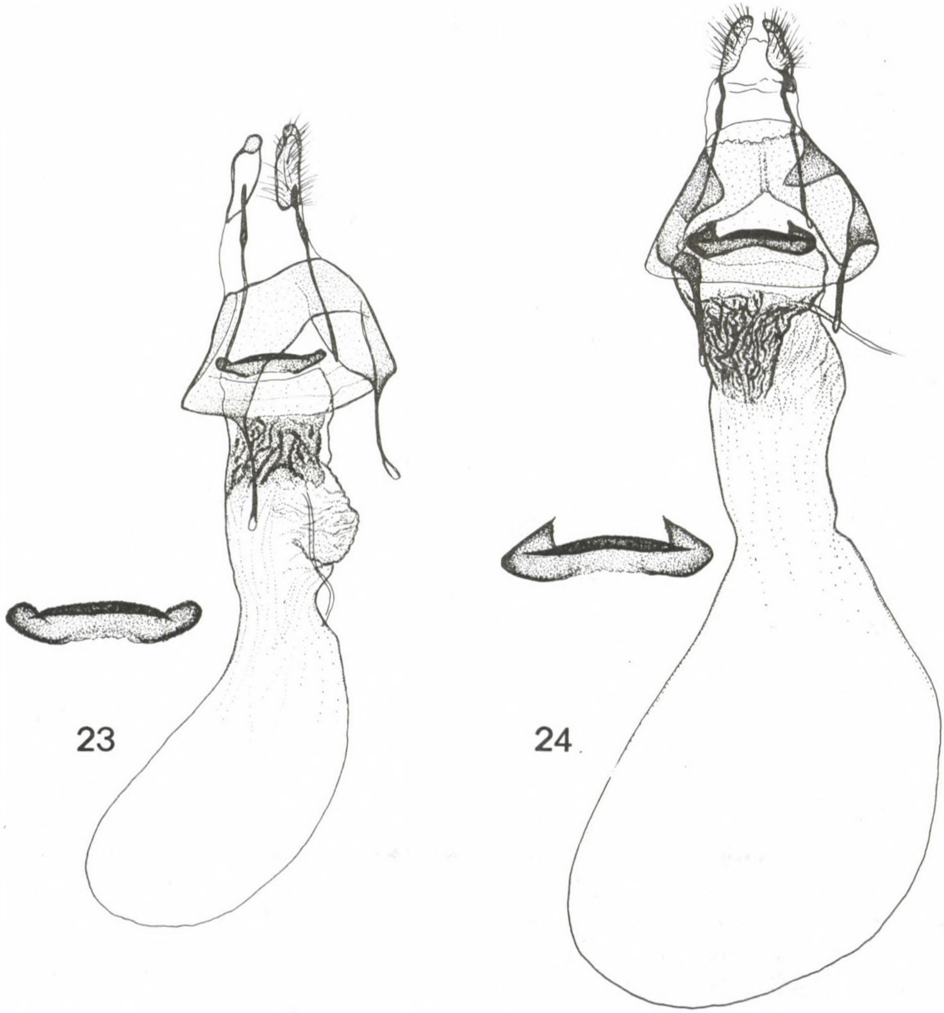
Male genitalia (Figs 17-18): Uncus short and wide, strong, apical third strongly tapering and curved. Tegumen high, fultura inferior calycular with heavily sclerotized inner arch. Vinculum short and broad, U-shaped. Valvae elongated-elliptical, apical part rounded. Sacculus short, clavi reduced. Harpe strong, basal part strenghtened bearing a long, horn-like lateral extension. Distal part of harpe a flattened, rather broad and moderately long, apically rounded bar. Costal plate rela-



Figs 17-22. 17-18 = *H. tahiricola* sp. n.: holotype male; 19-20 = *H. nekrasovi* HACKER & RONKAY: holotype male (after HACKER & RONKAY, 1993); 21-22 = *H. nivea* sp. n., paratype male

tively short, broad, its margins more or less straight, ventral angle with a small, erected, pointed process. Aedeagus short, cylindrical, ventral extension of carina elongated, beak-like, dorsal extension much shorter. Vesica tubular, short, broad at base, distally tapering and recurved dorsally. Basal part with numerous, variably long cornuti, terminal field of cornuti consisting of long spines.

Female genitalia (Fig. 23): Ovipositor short, posterior papillae anales weak, long, anterior ones short, broader. Ventral plate of ostium bursae a broad, short, sclerotized plate, medial part double, posterior edges rounded. Ductus bursae very short, broad, margins almost parallel; inner surfaces with granulosely sclerotized, short crests and folds. Cervix bursae membranous, small, wrinkled, corpus bursae a spacious, elliptical sac, constricted at apical third.

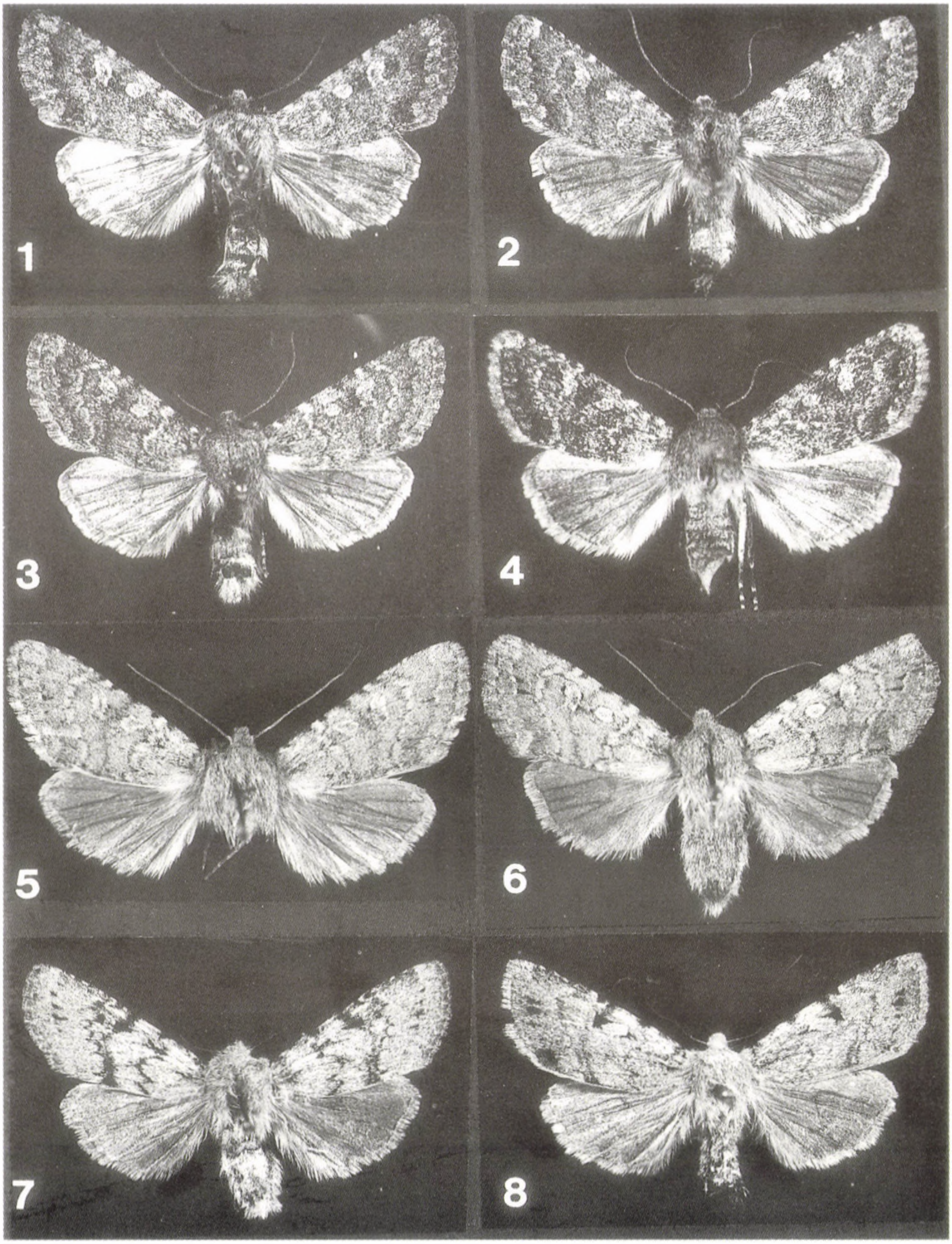


Figs 23-24. 23 = *H. tahiricola* sp. n.: paratype female; 24 = *H. nekrasovi*: paratype female

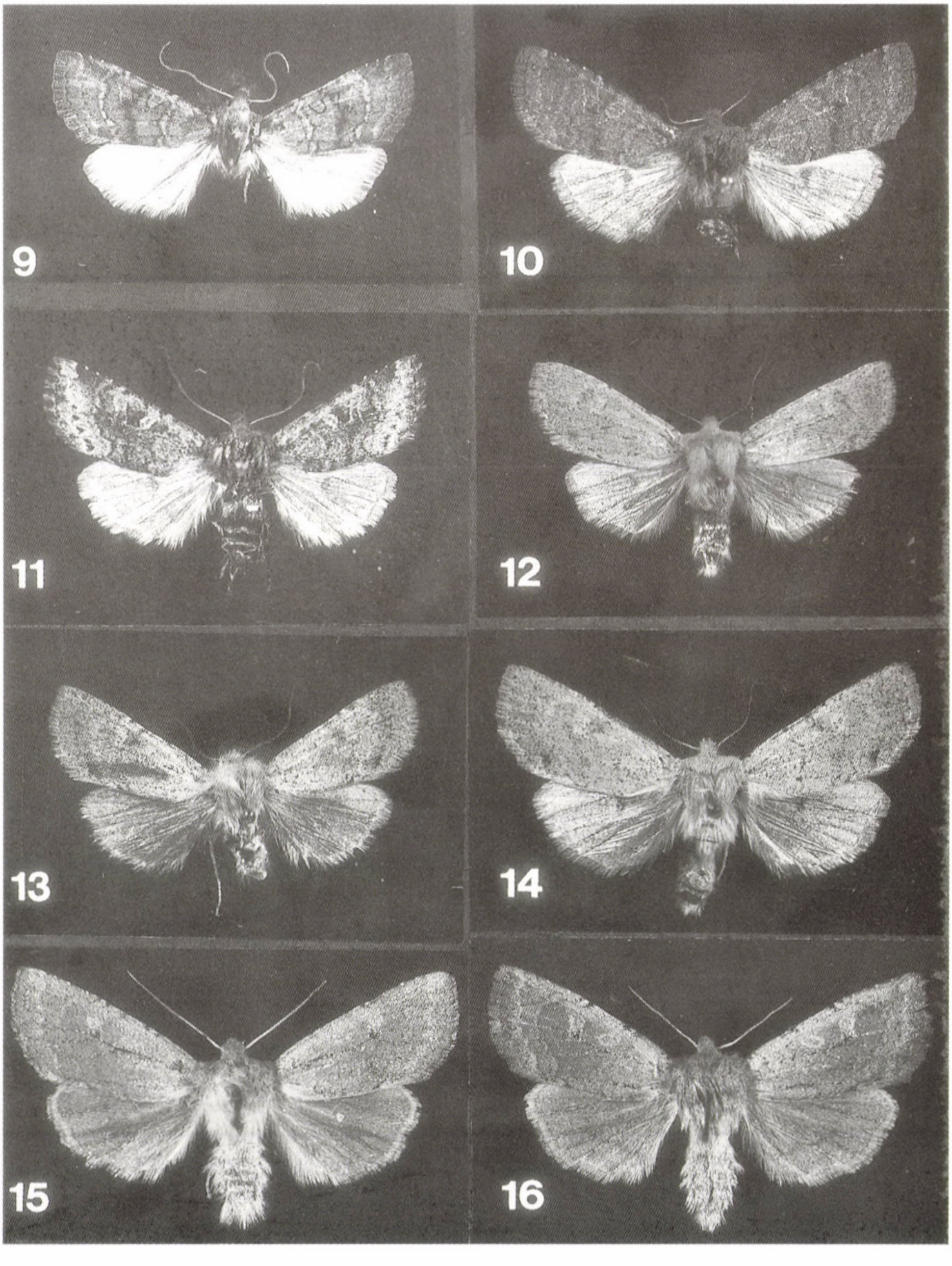
H. tahiricola is the allopatric sibling species of *H. nekrasovi*, their external appearance and the genital configuration of both sexes are very similar (see Figs 1-6, 17-20, 23, 24). The distinctive features of the two species are as follows:

tahiricola	*nekrasovi*
smaller in size (wingspan 37-39 mm, length of forewing 17.5-18 mm)	larger in size (wingspan 41-43 mm, length of forewing 18-19 mm)
forewings narrower, outer margin less convex	forewings broader, outer margin more convex
forewing ground colour much darker, olive-grey, variegated strongly with dark grey, brownish and ashy grey	forewing ground colour paler, shining ochreous-olive, darker irroration reduced or less expressed
stigmata smaller, their outlines more obsolete (or absent), orbicular spot without darker centre	stigmata larger, their outlines always present, often sharp, orbicular spot with darker grey centre
ante- and postmedial crosslines stronger, broader, their filling more conspicuous (ochreous- or whitish grey)	ante- and postmedial crosslines paler, their filling not or only slightly lighter than ground colour
arrowheads of subterminal line much more indistinct, regularly small greyish triangles	arrowheads of subterminal line sharp, black(ish)
cilia of forewing strongly spotted	cilia of forewing not or only slightly spotted
hindwing darker, almost unicolorous grey-brown	inner area of hindwing less dark
darker suffusion of forewing underside stronger	darker suffusion of forewing underside pale greyish
uncus narrower	uncus broader
shape of harpe different, not mushroom- or drumstick-like but with lateral margins almost parallel, apical third not dilated; distal basal extension broader, more flattened	shape of harpe different, mushroom- or drumstick-like, apical third strongly dilated; distal basal extension narrower, more acute
costal plate narrower, more elongated	costal plate broader, less elongated

Figs 1-8. 1-4 = *H. tahiricola* sp. n.: 1 = holotype, 2 = paratype male, 3-4 = paratype females; 5-6 = *H. nekrasovi* HACKER & RONKAY: 5 = holotype, 6 = paratype female; 7-8 = *H. caesia* sp. n.: 7 = holotype, 8 = paratype



Figs 9-16. 9 = *H. fusca* HACKER & RONKAY, paratype male; 10-11 = *H. fusca fumata* ssp. n.: 10 = holotype, 11 = paratype; 12-14 = *H. nivea* sp. n.: 12 = holotype, 13 = paratype male, 14 = paratype female; 15-16 = *H. delicata* RONKAY, VARGA & BEHOUNEK: 15 = male, Pamir, Khorog, 16 = female, same locality



extensions of carina of aedeagus thicker, broader	ventral extension of carina of aedeagus slender, long, dorsal one reduced
terminal cornuti field of vesica larger, cornuti stronger	terminal cornuti field of vesica smaller with finer, spiculiform cornuti
ostial plate broader, stronger, posterior edges triangular, acute	ostial plate narrower, weaker; posterior edges smaller, apically rounded
proximal part of ductus bursae strongly tapering	margins of ductus bursae almost parallel.

Distribution. The new species is known only from the type-locality, the deep rocky gorge below the Tahir Pass, Karasu-Aras Mts, NE Turkey.

Himalistra caesia HREBLAY & PLANTE sp. n. (Figs 7-8, 25)

Holotype: female, "N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, Nr. 7, 31.V.-1.VI. 1992, leg. M. Hreblay & G. Csorba (coll. J. PLANTE).

Paratype: 1 female, "N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, Nr. 7, 31. V. – 1. VI. 1992, leg. M. Hreblay & G. Csorba. Slide No. HREBLAY 3350 (coll. M. HREBLAY).

Description: wingspan 39-40 mm, length of forewing 18 mm. Ground colour of head, thorax and forewings shining, light grey, lateral side of palpi and eye lashes black. Ante- and postmedial lines strongly sinuous, simple, dark grey, medial line a diffuse, broader stripe, costal spots well-visible dark triangles. Dark streak of submedian fold long, fine, blackish. Orbicular and reniform stigmata large, partly encircled by blackish, with a conspicuous black patch between them. Subterminal line obsolete, pale, arrowheads represented by dark grey triangles; cilia whitish-ochreous. Hindwing almost uniformly darkened, brown(ish), shadow of discal spot somewhat darker; cilia dark grey. Underside of both wings pale ochreous grey, inner area of forewing strongly, hindwing scarcely irrorated with brown; transverse line less visible, discal spot of hindwing sharp, small.

Female genitalia (Fig. 25): ovipositor short, weakly sclerotized, apophyses posteriores long, slender, apophyses anteriores very short. Ostium bursae sclerotized, dorsal plate broad but short, ventral plate weaker, reverse U-shaped. Ductus bursae relatively long, wrinkled, covered densely by fine spiculi on inner surface. Cervix bursae weakly sclerotized, short, without spiculi; corpus bursae sacculiform, membranous.

Male unknown.

The new species belongs, in spite of its conspicuously different coloration, to the *eriophora-nekrasovi*-group. It is easily separable from the related taxa by its light grey forewings and simple crosslines. The female genitalia of the group is characterizable by the lack of spiculi in the cervix bursae, the specific differences are found in the sclerotization of the ostium and the length and shape of ductus bursae. *H. caesia* has the configuration of these parts more similar to those of

H. nivea sp. n. than to the members of the *nekrasovi-tahiricola* species-pair (see the Figs 23-26). The distinctive features of *H. caesia* and *H. nivea* are as follows:

caesia	*nivea*
larger in size (39-40 mm)	smaller in size (34-38 mm)
forewing shining, light grey	forewing whitish with fine ochreous or rosy tinge
wing pattern stronger, transverse lines sharper, stigmata encircled partly with blackish, arrowheads present, etc.	wing pattern obsolete, transverse lines very pale, double, outlines of stigmata and arrowheads absent or deleted
hindwing darker, brown(ish)	hindwing light, whitish
ovipositor broader	ovipositor narrower
dorsal plate of ostium broader, ventral plate more quadratic	dorsal plate of ostium arcuate, narrower, ventral plate liguliform
ductus bursae broader	ductus bursae narrower

Distribution. The species was found only in the northernmost Himalaya, in the Nanga Parbat massif (N Pakistan). The collecting site is located in the higher coniferous zone mixed with some deciduous trees (e.g. *Betula, Populus*) and patches of montane grasslands.

Himalistra nivea HREBLAY & PLANTE sp. n. (Figs 12-14, 21-22, 26)

Holotype: female, "N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, Nr. 7, 31. V. – 1. VI. 1992, leg. M. Hreblay & G. Csorba (coll. J. PLANTE).

Paratypes: 9 specimens, "N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, Nr. 7 and 10, 31. V. – 1. VI. and 5. VI. 1992, leg. M. Hreblay & G. Csorba.

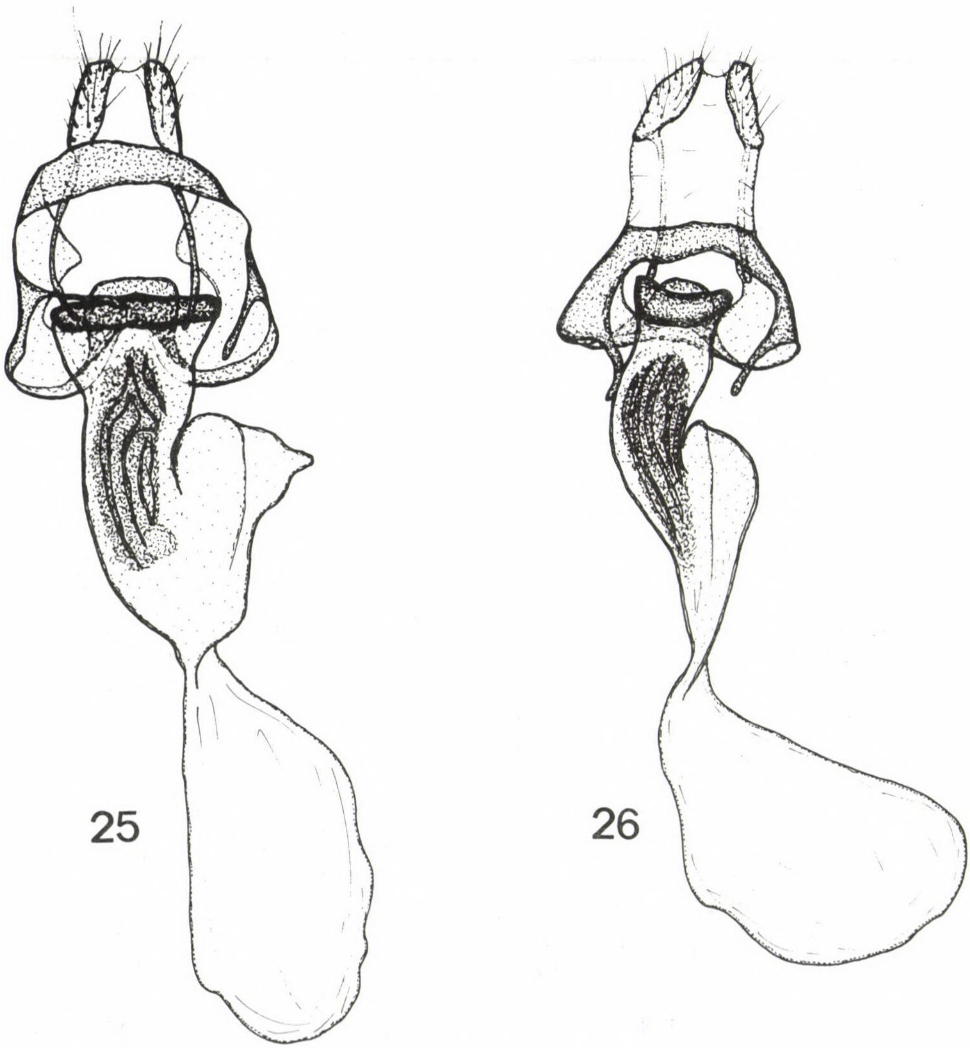
Slide Nos HREBLAY 3347 (male), HREBLAY 3348 (female), in coll. HREBLAY, PLANTE and HACKER.

Description: wingspan 34-38 mm, length of forewing 14-17 mm. Head and thorax whitish-ochreous, side of palpi only slightly darker. Forewing whitish with greasy shine, irrorated with some brownish scales and an ochreous or rosy shade. Elements of wing pattern reduced, crosslines and stigmata indistinct, only a few darker markings between stigmata and at tornus can be seen. Hindwing whitish, scarcely irrorated with brown, veins darker; discal spot sometimes sharp. Underside whitish with a few greyish scales, discal spots of both wings may present.

Male genitalia (Figs 21-22): uncus short, broad, beak-like with hooked tip. Fultura inferior a strong plate with characteristic shape: a narrow triangle with long, curved apical arms. Valvae moderately long, apical part less differentiated; sacculus short, rounded. Harpe relatively long, narrow, slightly arcuate, distal extension of basal plate short, triangular. Costal plate very narrow, strong, apex erected, acute. Aedeagus relatively long, thick, ventral extension of carina short. Vesica a short, broad, recurved tube, basal field of cornuti large, consisting of smaller spinules. Medial part with three stronger cornuti (number of these cornuti most probably variable), terminal cornuti field small, spinules small, fine.

Female genitalia (Fig. 26): ovipositor rather narrow, short. Dorsal plate of ostium arcuate, broad and short, ventral plate strong, hat-shaped ("liguliform"). Ductus bursae narrow, covered densely by short spiculi on inner surface; corpus bursae elliptical, membranous.

Distribution. The species is known from the type locality only which is the same as that of *H. caesia*.



Figs 25-26. 25 = *H. caesia* sp. n. paratype female, 26 = *H. nivea* sp. n. paratype female

The new species belongs to the *eriophora-nekrasovi* species-group, related closely to *H. caesia*. This is the only known whitish species of the genus; the specific differences are discussed under the preceding species.

Himalistra fusca fumata HREBLAY & PLANTE ssp.n.
(Figs 10-11)

Holotype: female, "N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, Nr. 7, 31. V. – 1. VI. 1992, leg. M. Hreblay & G. Csorba". Slide No. HREBLAY 3351 (coll. M. HREBLAY).

Paratypes: 5 specimens, "N-Pakistan, 10 km SW of Astor, Rama, 3000 m, 35°20'N, 74°46'E, Nr. 7 and 10, 31. V. – 1. VI. and 5. VI. 1992, leg. M. Hreblay & G. Csorba (coll. M. HREBLAY and J. PLANTE). Slide Nos HREBLAY 3354, 3391 (females)

Distribution: N Pakistan (NW Himalaya).

The northern subspecies of *H. fusca* differs from nominotypic population (Fig. 9) by its significantly darkened hindwing with sharper discal spots and transverse lines.

Acknowledgements. The authors are indebted to Mr G. BEHOUNEK (Deisenhofen), Mr G. CSORBA (Budapest), Mr GY. FÁBIÁN (Budapest), Mr H. HACKER (Staffelstein), Dr B. HERCZIG (Tata), Mr GY. M. LÁSZLÓ (Gödöllő), Mr A. V. NEKRASOV (Moscow), Mr G. RONKAY (Budapest), Mr FAQIR SHAH (Islamabad), Mr CS. SZABÓKY (Budapest), Dr K. SZEŐKE (Székesfehérvár) and Mr H. THÖNY (Ingolstadt) for their kind help in the preparation of the paper and/or in the field work.

The research was supported by the National Scientific Research Fund ("OTKA No. 3181").

REFERENCES

HACKER, H. & RONKAY, L. (1990): Systematik und Faunistik der Noctuidae (Lepidoptera) des himalayanischen Raumes. 5. Liste der *Cucullia* Schrank, 1802, *Agrochola* Hübner, [1821] und *Autophila* Hübner [1823]-Arten mit Beschreibung neuer Taxa. *Esperiana* **1**: 377-392.

HACKER, H. & RONKAY, L. [1992](1993): Beschreibungen neuer Taxa der Spätherbst – Noctuidae – Fauna Zentralasiens und des Himalayaraumes (Cucullinae sensu Hampson) (Lepidoptera). *Esperiana* **3**: 193-221.

HAMPSON, G. F. (1906): *Catalogue of the Lepidoptera Phalaenae in the British Museum*, Vol. VI. British Museum Tr., London, pp. + plates.

HAMPSON, G. F. (1907): *Catalogue of the Lepidoptera Phalaenae in the British Museum*, Vol. VII. British Museum Tr., London, pp. 709 + plates.

PÜNGELER, R. (1901): Neue palaearctische Heteroceren. *Dt. ent. Z. Iris* **14**: 177-191.

PÜNGELER, R. (1925): Neue palaearctische Makrolepidopteren. *Dt. ent. Z. Iris* **39**: 231-233.

POOLE, R. W. (1989): *Noctuidae. Lepidopterorum Catalogus,* New Series, Fasc. 118, parts I-III. Brill, Leiden, pp. 1314.

RONKAY, L. & Z. VARGA (1990): Taxonomic and zoogeographical studies on the subfamily Cuculliinae (Lepidoptera, Noctuidae). Part II. *Esperiana* **1**: 471-497.

RONKAY, L., VARGA. Z., & BEHOUNEK, G. (1991): Two new Cuculliinae (Lepidoptera: Noctuidae) species from the Pamir with taxonomic remarks and discussions on some Cuculliinae genera. *Entomofauna* **12**(8): 105-116.

WARREN, W. (1910-1911): Noctuidae. ("Die eulenartigen Nachtfalter"). *In* SEITZ, A. (ed.) *Die Gross-Schmetterlinge der Erde*, III. Alfred Kernen Verlag, Stuttgart.

Received June 7, 1994; accepted July 20, 1994

BOOK REVIEW

T. Jermy and Klára Balázs (eds.) (1993): *Handbook of Agricultural Entomology* (A növényvédelmi állattan kézikönyve). Volumes 4/A and 4/B, Akadémiai Kiadó, Budapest, pp. 830. [in Hungarian]

About 20 years ago a small group of agricultural entomologists, mainly members of the Plant Protection Institute (Hungarian Academy of Sciences), Budapest, undertook the significant task to summarize the results of Hungarian agricultural entomology in a handbook series, planned to six volumes. The volumes were then written and the manuscripts completed; the first volume appeared in 1988 (Nemathelminthes, Annelida, Mollusca, Crustacea, Isopoda, Diplopoda, Collembola, Lepismatoidea, Orthopteroidea, Psocoptera, Thysanoptera, Heteroptera), followed by the second volume in 1989 (Homoptera: Auchenorrhyncha, Aphidoidea, Coccoidea, Aleurodoidea). The third volume (Coleoptera) appeared in 1990 and – because of its size – it had to be printed in two parts. Now, after so many years after its completion, the fourth volume of the series (Lepidoptera) appeared as well, divided into two parts from the same reason.

The manuscript of the last volume has been finished in its original form by the end of the 'seventies, the material and figures referring to description, phenology, population dynamics, distribution, significance of each species were based mostly on the knowledge and data of that period. As the main biological features of Lepidoptera had hardly changed during three decades, this would reduce by no means the usefulness of the volume; unfortunately the literature citations stopped also at the early eighties. Only one part of the volume (the chapter dealing with leaf miner moths) could be revised in the early 'nineties before printing.

The volume of 830 pages deals with Lepidoptera of practical or potential significance, both as agricultural or horticultural pests, comprising 374 species in total; the descriptions begin with the ones showing primitive features (like Hepialidae) and finish with the family of Nymphalidae. The species are treated to an extent corresponding to their significance, so the important ones are described in more details. In some cases the data are more exhaustive than it would be proportional to the practical significance of the species in question. This is explained by the sorrowful fact that one of the main authors of the volume, Dr G. Reichart, a well known and esteemed lepidopterologist had deceased before the appearance of the volume and the parts written by him were kept unabridged for his memory.

A special value of this detailed and beautifully illustrated series is its "Hungarian" feature. Each species treated gives at the same time a faunistical information on its occurrence in Hungary. Besides the presentation of earlier data of historical value, published by earlier authors, this volume contains also many observations not published yet elsewhere.

It is to be hoped for that the series commenced will be continued and completed by the coming Hungarian entomologist generations and present volumes will have to be edited again within a few years in an enlarged and amplified form; at the present, however, the conscientious work of the authors has to be appreciated and acknowledged.

Dr L. Szalay-Marzsó

Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 265-271

NEW EUPITHECIA, GYMNOSCELIS AND CHLOROCLYSTIS SPECIES FROM AFRICA AND ARABIA (LEPIDOPTERA, GEOMETRIDAE: LARENTIINAE)

A. M. VOJNITS

Department of Zoology, Hungarian Natural History Museum
H-1088 Budapest, Baross utca 13, Hungary

Four *Eupithecia*, two *Chloroclystis* (sensu PROUT, 1915) and one *Gymnoscelis* are described: *Eupithecia cretosa* sp. n., *E. millesima* sp. n., *E. depasta* sp. n., *E. sublata* sp. n., *Chloroclystis decimana* sp. n., *Ch. onusta* sp. n., *Gymnoscelis silvicola* sp. n.

Key words: *Eupithecia, Chloroclystis, Gymnoscelis*, Africa, Arabia, taxonomy

INTRODUCTION

The essential problem – of a validity beyond the scope of the present work – is the interconnection of the Southwest Palaearctic and Ethiopian Regions. What sort of a barrier did the Sahara represent during the preceding periods – if indeed it was a barrier at all? At which time did the species and species groups arrive in southern areas and what became of them afterwards? Earlier investigations had already shown that certain high mountains of East Africa harbour species of a Palaearctic character. However, it is for the first time now that we have successfully shown from West Africa a species of a group heretofore considered typically Palaearctic.

TAXONOMY

A number of papers have been published on the *Eupithecia* CURTIS, *Chloroclystis* HÜBNER and *Gymnoscelis* MABILLE fauna of East Africa, primarily by PROUT (1915) and FLETCHER (1958, 1963, 1978), but also other authors have submitted new records (HERBULOT, 1983). French workers have treated mainly West Africa; the communications are generally brief and contain only the descriptions of some new species or data. As to the Arabia Peninsula principally WILTSHIRE (1985) have recently published relevant records.

Not all of the species described below fit into genera established so far, therefore – and also because certain genera are not unequivocally interpretable – I use, at least provisonally, their generic designation *Chloroclystis* (sensu PROUT, 1915).

Eupithecia cretosa sp. n.
(Figs 1, 9, 14, 19)

Derivations of specific name: cretosus (= chalky).

Diagnosis (Fig. 1). Stature medium, wing sligthly elongated, mottled whitish. Eye hemisphaerical. Labial palp sligthly ascending, yellow, shorter than diameter of eye. Antenna sensely ciliate, cilia extremely short (male). Alar expanse of fore wings 11-12 mm. Fore wing an isosceles triangle, costa and termen finely arched; apex obtuse, tornus rounded. Hind wing reaching to tornus of fore wing. Basic colour of wing grey, basal and terminal areas of fore wing darker, while the stripe decurrent in middle of narrow median field between the whitish and broad ante– and postmedians is nearly black. Submarginal stripe disjointed, yellowish white. Hind wing greyish yellow, the stripes broad and grey. Discal spot of both fore and hind wings fading into pattern. Cilia of fore wing striated dark grey-yellowish grey, of the hind wing light yellowish grey-grey. Underside of wings sericeous, grey, pattern elements yellowish grey, also discal spots well distinguishable.

Male genitalia (Figs 9, 14, 19). Uncus monoapical. Valva ear-shaped, apex elongate. Ampullae four times longer than broad, apically clavate, with some medium long bristles terminally. Vinculum rounded. Aedoeagus short, small, cylindrical, with irregular ribbon-like and lamellar chitinous formations and a very characteristic row of thick spondyles resembling a part of a vertebra. Base of sternite VIII concave, terminally considerably inclinate.

Female unknown.

Biology. First stages and foodplant unknown. The series was captured in December.

Distribution. East Africa: Tanzania; Kilimanjaro. Locus typicus: Shira Plateau, 4000 m.

Specific differences. Rather resembling *Eupithecia subscriptaria* PROUT, but while the discal spots of this latter are markedly conspicuous in every wing, they are absent of hardly discernible in the new species.

Material examined. Holotype male: "Tanzania, Kilimandjaro Shira Plateau, 4000 m, 27-28. dec. 1975 Moller Andersen leg." "gen. prep. No. 14781 ♂ det. A. Vojnits". Paratypes: eight males with the same data. Holotype deposited in the Zoological Museum, Copenhagen, paratypés in the same institute and in the Hungarian Natural History Museum.

Slides. Nos 14774, 14775, 14776, 14778, 14779, 14780, 14781, 14782 (males), gen. prep. A. Vojnits.

Eupithecia millesima sp. n.
(Figs 2, 10, 15)

Derivation of specific name: millesimus (= the thousandth).

Diagnosis (Fig. 2). Relatively small in stature, wings broad, of rather light colours. Eye hemisphaerical. Labial palp ascendent, shorter than diameter of eye, yellow. Antennae of the single known specimen missing. Alar expanse of fore wings 16 mm, wing an isosceles triangle. Costa and dorsum straight, termen definitely convex; apex slightly pointed, tornus obtuse. Hind wing relatively wide. Basic colour of fore wing yellowish brown, stripes disjointed into spots, yellowish white; entire pattern marbled. Hind wing white, stripes well discernible only near tornus. Cilia short, yellowish brown on fore wing, yellowish white on hind wing. Underside of fore wing brownish white, of hind wing yellowish white; pattern elements obsolescent, brownish white.

Male genitalia (Figs 10, 15). Uncus apparently bifid, but actually terminating in a peculiar, widening tube. Valva wide and short, wing-shaped. Ampulla elongate, five times longer than wide, its entire length densely covered with bristles. Vinculum flattened. Aedoeagus rather large, clavate, with chitinous laths. Sternite VIII unknown (lost during dissection).

Female unknown.

Biology. First stages and foodplant unknown. The single known specimen was collected in January.

Distribution. East Africa: North Kenya. Locus typicus: Isiolo.

Specific differences. The new species resembles *Eupithecia resacta* PROUT to a certain degree, but it is essentially lighter in coloration, and the two species can easily be distinguished from each other by the white hind wings of millesima.

Material examined. Holotype male: "Isiolo Kenya 12.1.1934 Dr. Benson" "gen. prep. No. 14783 ♂ det. A. Vojnits". Holotype deposited in the Zoological Museum, Copenhagen.

Slide. No. 14783 (male), gen. prep. A. Vojnits.

Eupithecia depasta sp. n.
(Figs 3, 11, 17, 20)

Derivation of specific name: depastus (= depastured).

Diagnosis (Fig. 3). Starure small, wings rounded. Eye hemisphaerical, large. Labial palp porrect, striated brown-white, shorter than diameter of eye. Male antenna densely ciliate, cilia shorter than half diameter of shaft. Cilia of female 1/3-1/4 of diameter of shaft. Alar expanse of fore wing 14 mm. Costa and dorsum of fore wing finely arcuate; apex and tornus obtuse. Hind wing small, rounded, but tornus expressed. Basic colour of fore and hind wings fuscous, stripes yellowish. Discal spots of both wings dark brown, elongate. Cilia short, striated dark brown-yellowish brown. Underside of wings fuscous, stripes light yellowish white; discal spot of fore wing conspicuous, hardly discernible on hind wing.

Male genitalia (Figs 11, 17, 20). Uncus bifid. Valva broad, auriculate, apex rounded. Ampulla relatively large and broad, thrice longer than wide; its clavately thickened termination densely setose, otherwise with merely sparse setae. Vinculum flattened. Aedoeagus broad, cylindrical, with short, arcuate or twisted chitinous formations. Sternite VIII large and long, basally excised, its heavily sclerotised digitate parts long, terminally angulate or recurrent.

Female unknown.

Biology. First stages and foodplant unknown. The single known specimen was collected in October.

Distribution. Found in West Africa. Locus typicus: Gambia.

Specific differences. Externally a typically Palaearctic species, belonging in the minusculata-opisthographata group. Best distinguishable by the genitalia, especially the aedoeagus. Sternite VIII is also different.

Material examined. Holotype male: "Gambia 18-23/10-76 H.K.J." "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. No. 14770 ♂ Dr. A. Vojnits". Holotype deposited in the Zoological Museum, Copenhagen.

Slide. No. 14770 (male), gen. prep. A. Vojnits.

Eupithecia sublata sp. n.
(Figs 4, 23)

Derivation of specific name: sublatus (= elevated).

Diagnosis (Fig. 4). Wing relatively broad, of just about medium stature, basic colour dark. Eye large and protruding, almost sphaerical. Labial palp brown, equal to diameter of eye. Female antenna densely ciliate, cilia short, their length not reaching 1/3 of diameter of shaft. Length of fore wing between base and apex 10-11 mm. Basic colour of fore wing a sericeous dark fuscous, with the transverse stripes coalescent into the basic colour; discal spot minute, black. Cilia medium long, striated brown-greyish brown. Underside of wings grey, pattern elements yellowish grey, well discernible.

Male unknown.

Female genitalia (Fig. 23). Bursa copulatrix pear-shaped, its fundus padded by densely situated chitinous spines. Antrum sclerotized. Both anterior and posterior apophyses relatively short. Papillae anales elongate.

Biology. First stages and foodplant unknown. Type-specimens collected in September.

Distribution. Found in East Africa, Tanzania. Locus typicus: Tukuyu, Manow, 1800 m.

Specific differences. Resembling *Eupithecia celatisigna* WARREN, but this latter is lighter and displays a heavier pattern. As to its external morphology, it looks like *E. absinthiata* CLERCK of small stature, dark colour and of unusually narrower wing. The bursa copulatrix itself resembles in many respects that of *E. extraversaria* HERRICH-SCHÄFFER, but it has manifestly nothing to do with it.

Material examined. Holotype female: "Tanzania, Tukuyu, Manow, 1800 m, 25.vi.1979 M. Stoltze leg." "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. No. 14786 ♀ det. A. Vojnits". Paratype one female, Tanzania, Mt. Rungwe, SW, 1800 m, 20.VII. 1980, leg. M. Stoltze and N. Scharff. Holotype deposited in the Zoological Museum Copenhagen, paratype in the Hungarian Natural History Museum, Budapest.

Slides. Nos 14786, 14789 (females), gen. prep. A. Vojnits.

Chloroclystis decimana sp. n.
(Figs 5-6, 12, 16, 21, 24)

Derivation of specific name: decimanus (= of a tithe).

Diagnosis (Figs 5-6). Medium stature, wings broad, pattern dominated by the postmedian stripe. Eye hemisphaerical, strikingly large, protruding. Labial palp porrect, mottled brown and white, shorter than diameter of eye. Male antenna densely ciliate, length of cilia not or just reaching half diameter of shaft; those of female about 1/3-1/4. Distance between base and apex of fore wing 9,5 mm (males) or 9 mm (females). For wing broad, costa and dorsum slightly arcuate, dorsum longer than termen; apex and tornus obtuse. Hind wing triangular. All type-specimens worn. Basic colour of wings marbled brown, antemedian stripe obsolescent, postmedian stripe wide, light, nearly white. Cilia medium long, striated brown-brownish yellow. Underside of fore wing a dark, that of hind wing a lighter, sericeous brownish yellow, pattern elements just discernible, yellow.

Male genitalia (Figs 12, 16, 21). Uncus elongate. Valva wide, short, both ventrum and dorsum thickened. Vinculum flattening. Aedoeagus long, thin, containing a double, long and thin, chitinous cornutus. Sternite VIII basally wide, multiply arcuate, its two long and narrow arms X-shaped.

Female genitalia (Fig. 24). Bursa copulatrix elongate, sclerotized, its wall densely covered by minute chitinous spines. Antrum sclerotized, widening. Both anterior and posterior apophyses short. Papillae anales rice-shaped.

Biology. First stages and foodplant unknown. The type series was collected in September.

Distribution. East Africa, Tanzania. Locus typicus: Mts Usambara, Amani, 900 m.

Specific differences. Closely allied to *Ch. muscosa* WARREN, but easily separable on the basis of the light basic colour of muscosa, while both pairs of wings of the new species are a marbled brown. The configuration of the genitalia also displays differences, but they also reveal their close relationship.

Material examined. Holotype male: "Tanzania, East Usambara Mts, Amani 900 m 01.ix.1981 M. Stoltze N. Scharff leg. Zool. Museum Copenhagen" "gen. prep. No. 19188 ♂ det. A. Vojnits". Paratypes: 2 males and 6 females with the same data. Holotype deposited in the Zoological Museum, Copenhagen, paratypes in the same institut and in the Hungarian Natural History Museum, Budapest.

Slides. Nos 16000, 16001 (males), 15976, 15999, 16003, 19188, 19190, 19199, 19209 (females), gen. prep. A. Vojnits.

Chloroclystis onusta sp. n.
(Figs 7, 25)

Derivation of specific name: onustus (= burdened).

Diagnosis (Fig. 7). Stature medium, wings broad. Eye large, hemisphaerical. Labial palp porrect, brown irrorated with whitish scales, as long as diameter of eye. Antenna extremely densely ciliate, cilia shorter than half diameter of shaft. Alar expanse of fore wings 18,5 mm. The single known specimen is rather worn. Basic colour brown, basal and terminal areas yellowish, median field greyish. Transverse stripes expressed, yellowish, wide and crenate. Discal spot dark, minute. Cilia of fore wing rubbed off, those of hind wing striated white and grey. Underside of wing greyish chalky white; median field and transverse stripes of fore wing grey.

Male unknown.

Female genitalia (Fig. 25). Bursa copulatrix consisting of a smaller, sacculiform and a larger sphaerical portion, its walls padded by sparser or denser fields of chitinous spines. Both anterior and posterior apophyses short. Papillae anales elongate.

Biology. First stages and foodplant unknown. The single known specimen was collected in April.

Distribution. Saudi Arabia. Locus typicus: Djidda, Northern Creek.

Specific differences. Concerning externals, the new species greatly resembles *Chloroclysta decimana* VOJNITS, but the genitalic configuration of the female is different (that of the male is unknown).

Material examined. Holotype female: "Saudi Arabien Djidda, Northern Creek iv. 1979 U. Seneca Nielsen leg" "ZOOL. MUSEUM DK COPPENHAGEN" "gen. prep. No. 14784 ♀ det. A. Vojnits". Holotype deposited in the Zoological Museum, Copenhagen.

Slide. No. 14784 (female), gen. prep. A. Vojnits.

Gymnoscelis silvicola sp. n.
(Figs 8, 13, 18, 22, 26)

Derivation of specific name: silvicolus (= inhabiting woods).

Diagnosis (Fig. 8). Stature small, wings relatively broad. Eye large, almost sphaerical. Labial palp porrect, about as long as diameter of eye. Male antenna rather thick, densely ciliate. Cilia short. Female antenna displaying some additional isolated cilia longer than the rest. Distance between base and apex of fore wing 7-8 mm. Basic colour rufous brown, transverse stripes bordered black; terminal field with yellowish spots; fore wing therefore appearing as definitely mottled. Cilia short, rufous brown. Pattern on underside of wings marked: basic colour grey, pattern elemenrts light or – oppositely – dark grey.

Male genitalia (Figs 13, 18, 22). Uncus broadly flattened. Valva narrow, apex slightly arcuate, dorsum thickened. Vinculum wide, incised. Aedoeagus small, short, cylindrical, with two groups of conspicuous cornuti. Base of sternite VIII arcuate, its sclerotized arms long, straight, terminally clavate. Tergite VIII essentially wider, consisting of two distinct parts.

Female genitalia (Fig. 26). Bursa copulatrix elongate, padded with extremely densely situated chitinous spines. Both anterior and posterior apophyses rather short, papillae anales squat.

Biology. First stages and foodplant unknown. The known specimens was captured in September.

Distribution. East Africa, Tanzania. Locus typicus: East Usambara Mts, Amani, 900 m.

Specific differences. Resembling to a considerable degree the Palaearctic species *Gymnoscelis pumilata* HÜBNER, though the differences are unequivocal; the species *Gymnoscelis cressata* WARREN differs even more extensively.

Material examined. Holotype male: "Tanzania, East Usambara Mts, Amani 900 m, 01.ix.1981 M. Stoltze N. Scharff leg. Zool. Museum, Copenhagen" "gen. prep. No. 19207 ♂ det. A. Vojnits". Paratypes: 1 male and 2 females with the same data. Holotype deposited in the Zoological Museum, Copenhagen, paratypes in the same institut and in the Hungarian Natural History Museum, Budapest.

Slides. Nos 19184, 19207 (males), 19200, 19206 (females), gen. prep. A. Vojnits.

* * *

Acknowledgements. I am greatly indebted to Dr N. P. KRISTENSEN (Copenhagen), for his permission to study the specimens preserved in the Zoological Museum, as also to Mr M. R. HONEY (London), for making it possible to examine the material in the Natural History Museum.

The research was supported by the National Scientific Research Fund (No. 3181), Budapest.

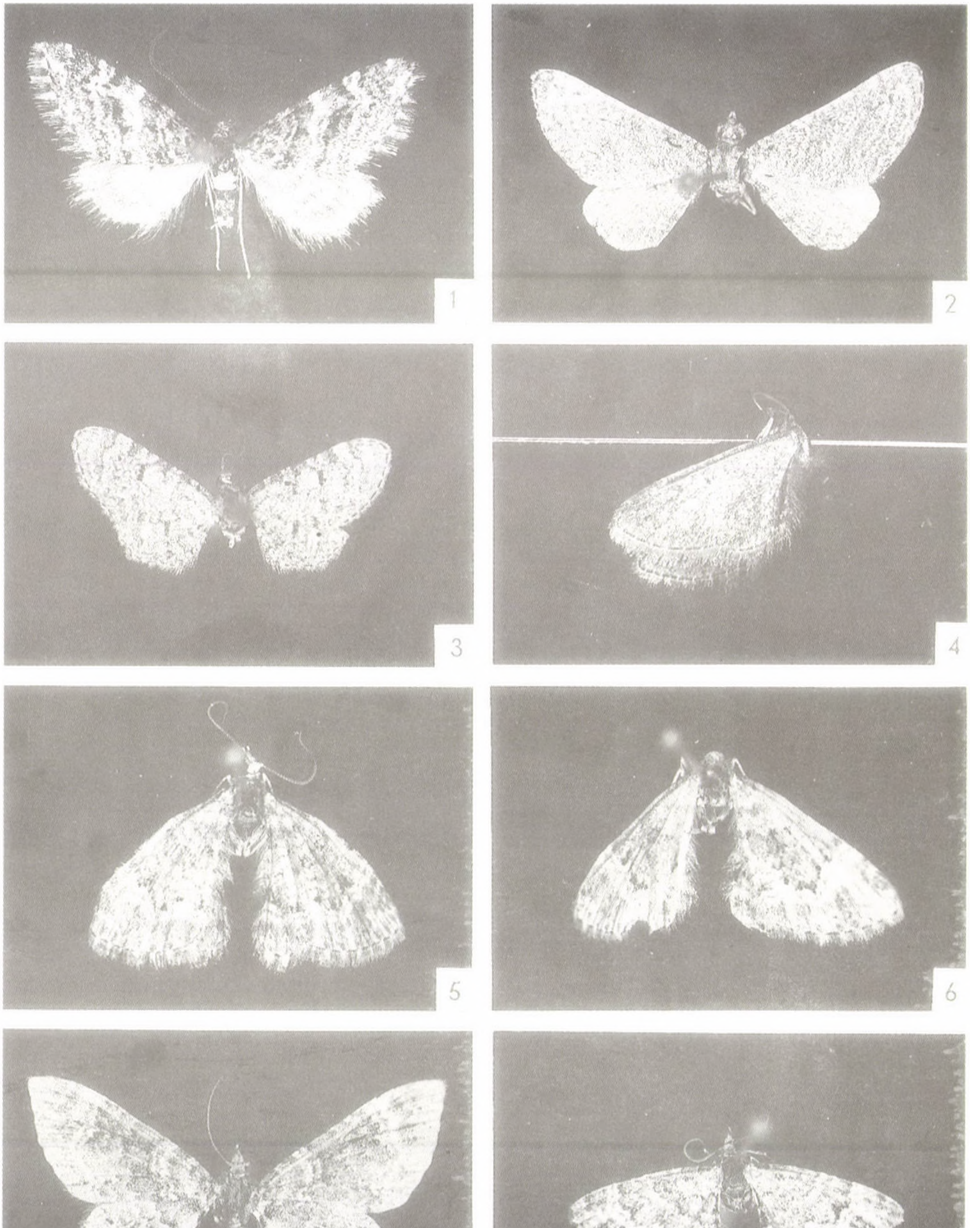
REFERENCES

FELTCHER, D. S. (1958) New species of African Geometridae. *Proc. R. ent. Soc. Lond.* **25**: 29-42.

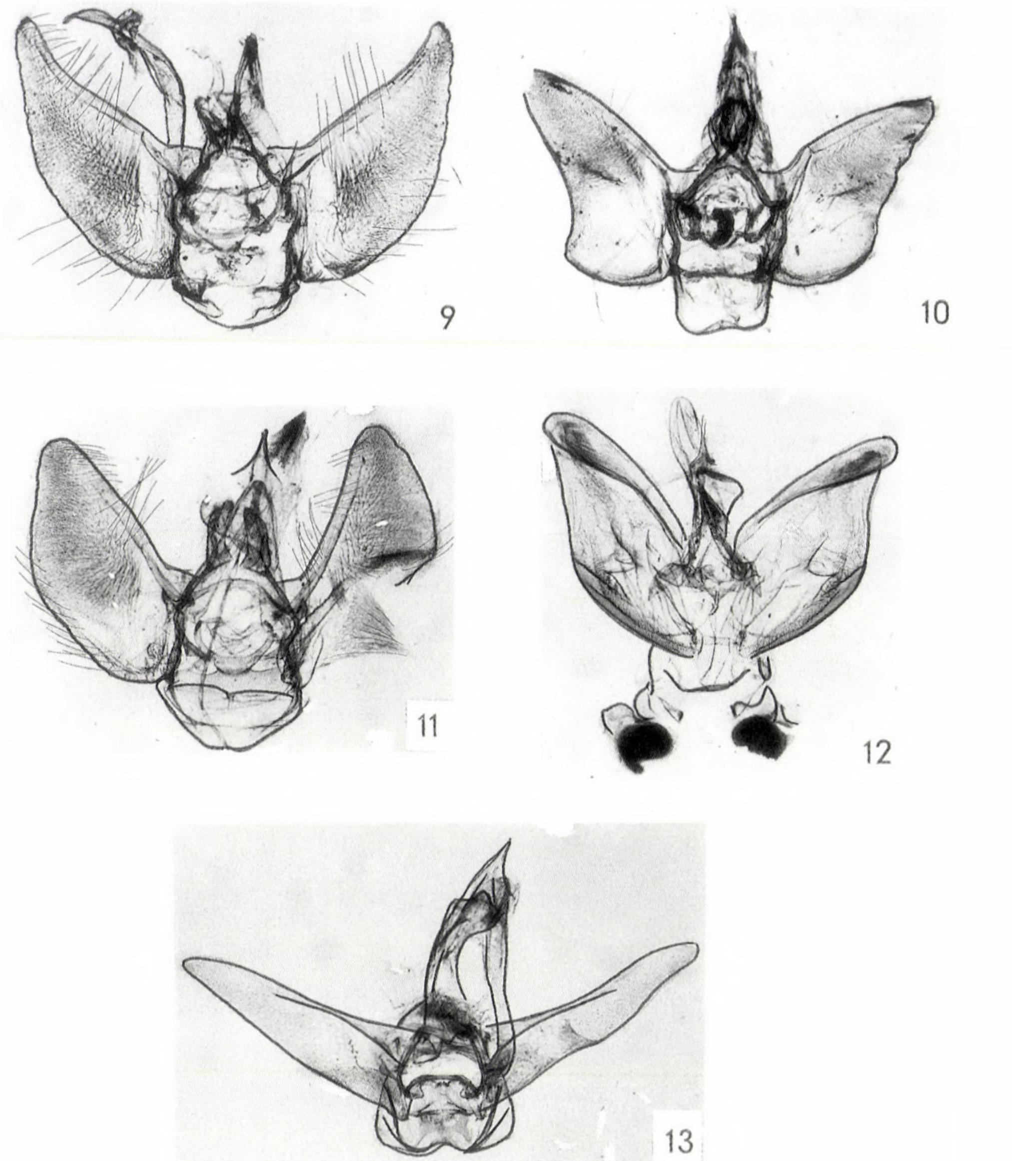
FELTCHER, D. S. (1963) Geometridae. *Explor. Parc natn. Albert (2).* **15**(1): 1-66.

FELTCHER, D. S. (1978) Geometridae (Lepidoptera) collected by dr. J. Szunyoghy in Tanzania. *Annls hist.-nat. Mus. natn. hung.* **24**: 41-105.

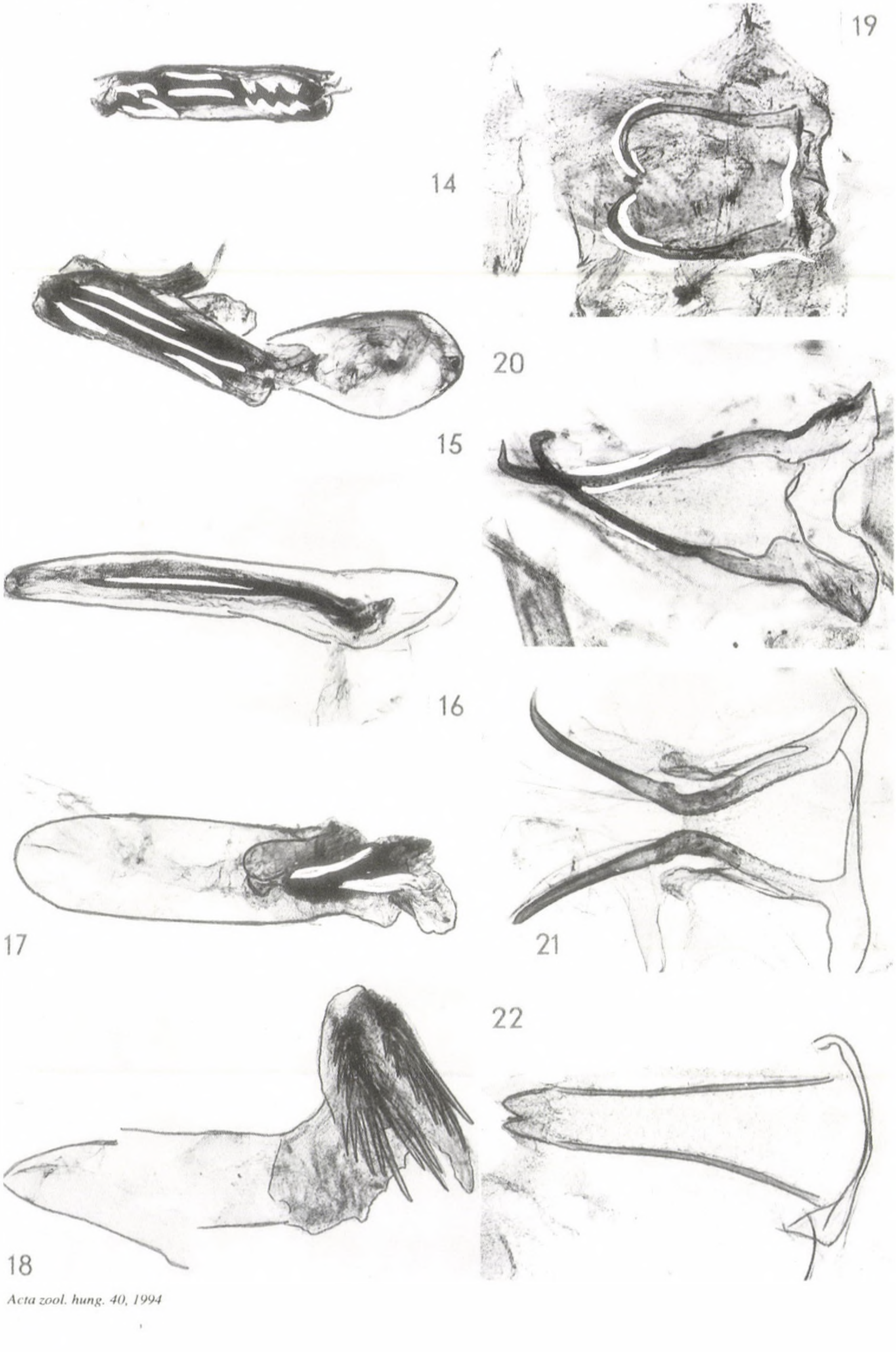
Figs 1-8. 1 = *Eupithecia cretosa* sp. n. paratype male, 2 = *E. millesima* sp. n. holotype male, 3 = *E. depasta* sp. n. holotype male, 4 = *E. sublata* sp. n. holotype female, 5 = *Chloroclystis decimana* sp. n. paratype male, 6 = *Ch. decimana* sp. n. paratype female, 7 = *Ch. onusta* sp. n. holotype female, 8 = *Gymnoscelis silvicola* sp. n. paratype male.



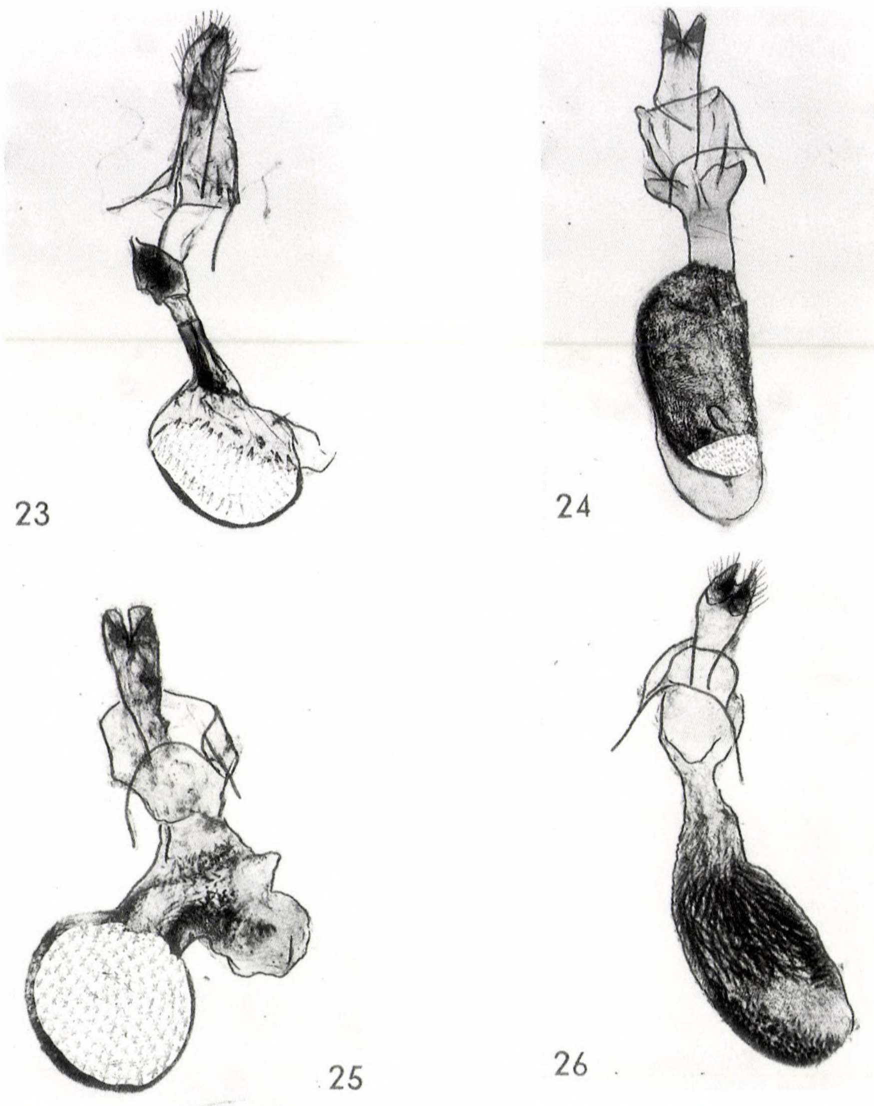
Figs 9-13. Male genitalia of 9 = *Eupithecia cretosa* sp. n., 10 = *E. millesima* sp. n., 11 = *E. depasta* sp. n., 12 = *Chloroclystis decimana* sp. n., 13 = *Gymnoscelis silvicola* sp. n.



Figs 14-22. Aedoeagus of 14 = *Eupithecia cretosa* sp. n., 15 = *E. millesima* sp. n., 16 = *Chloroclystis decimana* sp. n., 17 = *Eupithecia depasta* sp.n., 18 = *Gymnoscelis silvicola* sp. n. Sternite VIII of 19 = *Eupithecia cretosa* sp.n, 20 = *E. depasta* sp. n., 21 = *Chloroclystis decimana* sp. n., 22 = *Gymnoscelis silvicola* sp. n.



Figs 23-26. Female genitalia of 23 = *Eupithecia sublata* sp. n., 24 = *Chloroclystis decimana* sp. n., 25 = *Ch. onusta* sp. n., 26 = *Gymnoscelis silvicola* sp. n.



HERBULOT, C. (1983) Missions de M. P.-C. Rougeot en Ethiopie et en Republique de Djibouti. Lepidoptera Geometridae 2. *Bull. Soc. Lin. Lyon.* **52**: 10-21.

PROUT, L. B. (1915) Die palaearktischen spannerartigen Nachtfalter. In SEITZ, A. *Die Gross-Schmetterlinge der Erde*. Alfred Kernen Verlag, Stuttgart.

WILTSHIRE, E. P. (1985) Middle East Lepidoptera XLIV. Eupithecia penultimaria sp. n. (Geometridae) from central Iraq. *Entomologist's Gazette* **36**: 263-268.

Received June 1, 1994; accepted July 1, 1994

The Fauna of the Bükk National Park

VOLUME I

Edited by
S. MAHUNKA and L. ZOMBORI

The seventh part of the series "Natural History of the National Parks of Hungary" comprises a collection of papers written by thirty-seven Hungarian and foreign experts. This is the first volume which discusses a large share of the scientifically elaborated material deriving from the territory of the Bükk National Park (North Hungary).

The book opens with a preface written by Dr. J. Tardy, deputy secretary of state, who gives his "Reflections on nature conservation in Hungary, 1993", followed by an editorial Introduction having a detailed list of all the larger administrative and also minor locality names, some of which are amply shown in a map. The volume proper is divided into two sections: Mollusca and Arthropoda. The latter, by far the biggest section, is a collection of scientifically highly valuable contributions on the following groups of animals: Mallophaga (4 pp), Heteroptera (4 pp), Homoptera (8 pp), Coleoptera (80 pp), Lepidoptera (162 pp), Diptera (82 pp), Siphonaptera (6 pp), Hymenoptera (42 pp), Acari (5 pp). The book closes with an Index to Authors.

The volume published by the Hungarian Natural History Museum in 1993.

ISBN 963 7093 206. Soft bound,
456 pages with several figures and tables.
Price: 50 US dollars excl. p. & p.

Acta Zoologica Academiae Scientiarum Hungaricae 40 (3), pp. 273-288

FURTHER ORIBATID SPECIES FROM THE COMORO ISLANDS (ACARI: ORIBATIDA)*

S. MAHUNKA

Department of Zoology, Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13., Hungary

Five oribatid (Acari) species are described as new to science from the Comoro Islands. One of them, *Comororibula truncata* gen. et sp. n. (Haplozetidae), is representing also a new genus. With 30 original figures.

Key words: Acari, Oribatida, taxonomy, new taxa, Comoro Islands

I have been working on the Ethiopian and Oriental oribatids and the relation of these faunas for a long time. The present study is a part of this research project, of which the main goals and reasons I already outlined in my earlier publications (e.g. MAHUNKA 1993, 1994*a*, 1994*b*).

In this part I describe five species from the Comoro Islands which are all new to science. For one species a new genus (*Comororibula* gen. n., family Haplozetidae) had also to be established. This material was collected by Dr T. PÓCS, the renown bryologist. Herewith I should like to thank him for allowing me to study the interesting samples. In the description the morphological terms follow the author's earlier papers (see above).

DESCRIPTION OF THE NEW TAXA

PHTHIRACARIDAE PERTY, 1841

Kakophthiracarus mwali sp. n.
(Figs 1-5)

Measurements. – Length of aspis: 136-158 μm, length of notogaster 250-299 μm, height of notogaster: 152-213 μm.

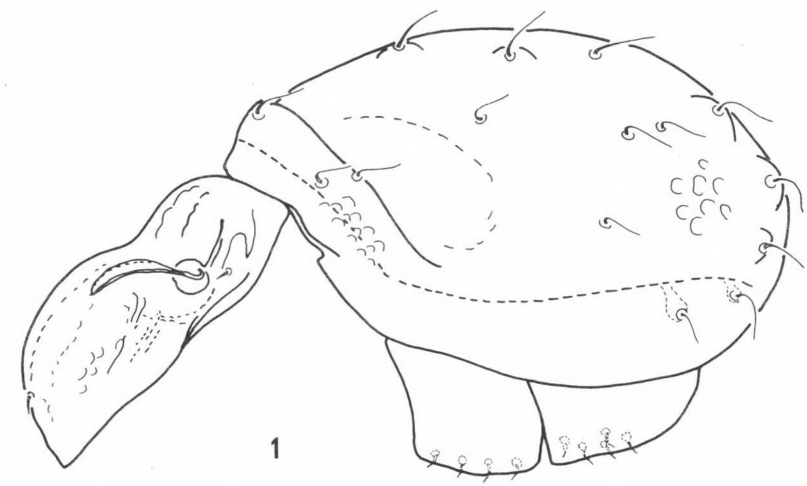
Integument: The usual cerotegument layer present, mostly the whole body surface is covered by a layer in which filaments and other parts of detritus are embedded being thickest in the concave humeral region.

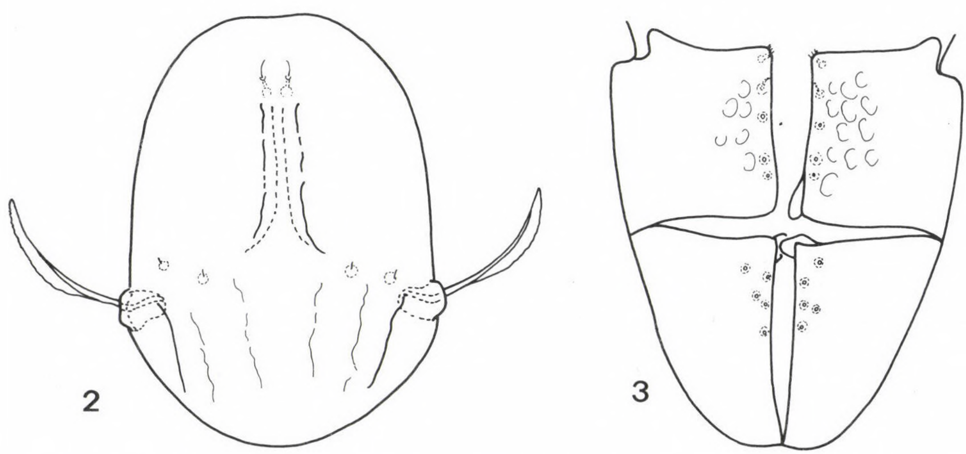
Aspis: Median crista protruding from the outline of the aspis, behind it a transversal hollow present. They are well observable in lateral aspect (Fig. 1). Lateral carina and lateral rim absent.

* Supported by the National Scientific Research Fund (OTKA 3165)

Prodorsal surface – with the exception of the lateral part in front of the bothridium – ornamented by alveoli, lateral part with some fine lines. On the basal part of the aspis some strong longitudinal ribs also visible. Rostral, lamellar and interlamellar setae very short, spiniform. Sensillus directed forwards, with gradually broadened, asymmetrically lanceolate head, its dorsal surface spiculate, or irregularly roughened (Fig. 2).

Notogaster: Anterior part of notogaster with a well developed thick colar and some clearly protruding tubercles. Only 15 pairs of short, simple notogastral setae present, setae $c_1 - c_3$ arising on the collar, the last two pairs close to each other. Setae e_2 and h_2 also conspicuously near to each





Figs 1-3. *Kakophthiracarus mwali* sp. n.: 1 = body in lateral aspect, 2 = aspis in dorsal aspect, 3 = anogenital region

other, the reduced alveoli of seta f_2 located between them. The alveoli of seta f_1 not observable and I was unable to find the lyrifissures. All notogastral setae simple, thin, slightly flagellate.

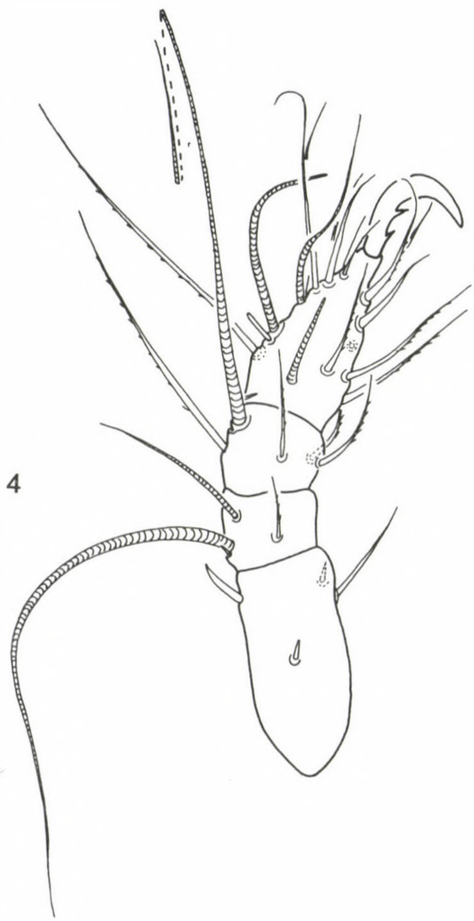
Ventral regions: The surface of the genito-aggenital plates areolate, all nine pairs of minute genital setae arranged in one row along the paraxial margin of the genital plates (Fig. 3). All five pairs of ano-adanal setae also minute, three pairs of them located marginally.

Legs: Seta *d* on femur I arising near to the anterior margin of the joint, slightly curved inwards. Seta v'' much shorter, than v' and spiniform. The setal formulae of the legs are:

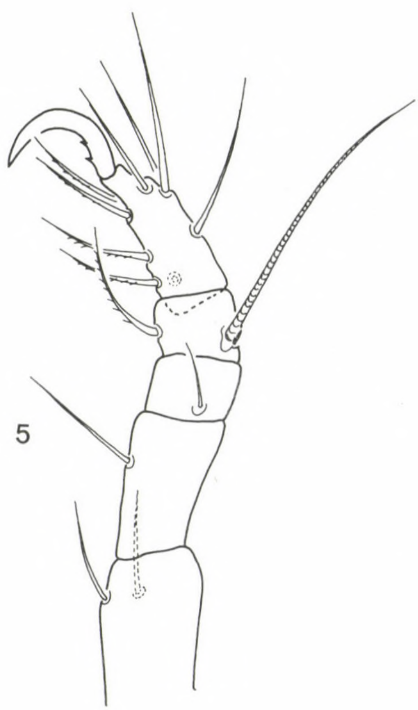
I: 1 – 4 – 2+2 – 5+1 – 16+3 – 1 (Fig. 4)
IV: 2 – 1 – 1 – 2+1 – 10 – 1 (Fig. 5)

Material examined: Holotype (1488-HO-1994): Comoro Islands, Mwali (Moheli) Island. Secondary lowland rainforest near Miringoni village on the SSW slope of the main mountain

4



5



Figs 4-5. *Kakophthiracarus mwali* sp. n.: 4 = leg I, 5 = leg IV

range, at 230-400 m. 30. 08. 1992. Leg. Dr. T. PÓCS. 4 ex.: paratypes from the same sample. Holotype and 3 paratype: HNHM*, 1 paratype: MHNG**.

Derivatio nominis: After the collecting place (Island Mwali, formerly Moheli).

Remarks: On the basis of the tuberculate notogaster, the simple notogastral setae and the minute ano-adanal setae inserted very near to each other, no doubt, that the new species belongs to the genus *Kakophthiracarus* Mahunka, 1992. It is clearly distinguishable from all other related taxa by the position of setae c_2 and c_3, and setae e_2 and h_3.

EUPHTHIRACARIDAE JACOT, 1930

Microtritia altissima sp. n.
(Figs 6-12)

Measurements. – Length of aspis: 174-218 µm, length of notogaster: 293-365 µm, height of notogaster: 228-294 µm.

Aspis: Dorsal outline of the aspis evenly convex in lateral aspect (Fig. 7), surface ornamented by irregular, but mostly symmetrical spots basally (Fig. 9). Aspis with one, but conspicuously strong lateral carina. Lateral rim short, not reaching to the rostrum. Setae of aspis very short and fine, interlamellar setae shortest of all, exobothridial setae minute. Sensillus finely, gradually widening distally, acute, without bristles or cilia.

Notogaster: Notogaster with the usual fine and short notogastral setae, all curved anteriorly (Fig. 6). Insertion of setae f_1 also present. Four pairs of lyrifissures were observable. A well-developed fissura terminalis present, behind it a median pore (consisting of 3-4 smaller pores, resembling a small porose area) clearly visible (Fig. 10).

Anogenital region: Four pairs of genital setae, one of them arising in front of tectum *kag* (Fig. 8). All anal and adanal setae well developed, three pairs of anal and three pairs of adanal setae simple, short and setiform, setae ad_1 and ad_2 slightly longer than the anal setae.

Legs: Legs monodactylous with reduced chaetotaxy. Legs setal formulae:

I: 1 – 2 – 2+2 – 5+1 – 14+3 – 1 (Fig. 11)
IV: 1 – 1 – 0 – 2+1 – 8 – 1 (Fig. 12).

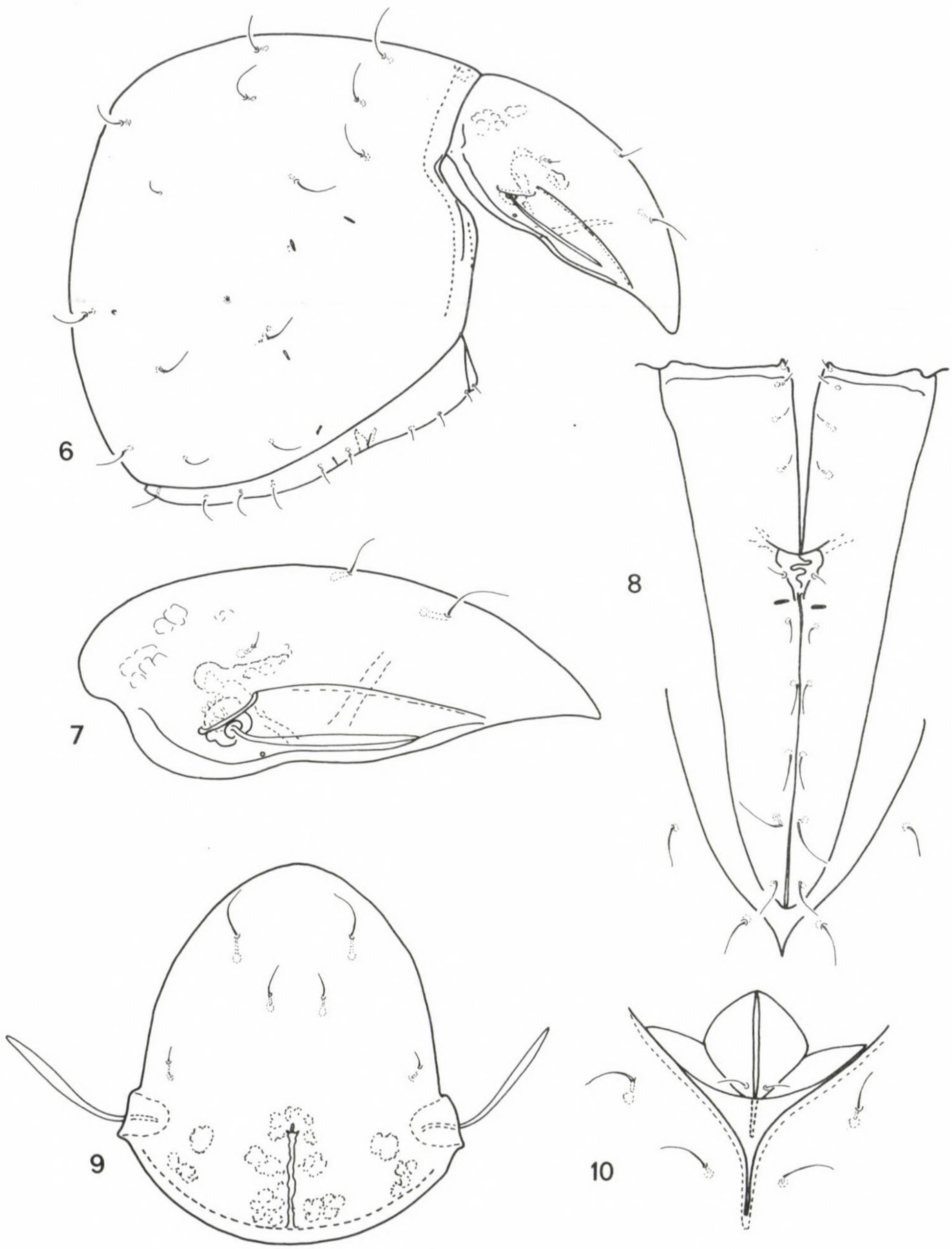
Material examined: Holotype (1489-HO-1994): Comoro Islands, Mwali (Moheli) Island. Secondary lowland rainforest near Miringoni village on the SSW slope of the main mountain range, at 230-400 m. 30. 08. 1992. Leg. Dr. T. PÓCS. 12 ex.: paratypes from the same sample. Holotype and 11 paratype: HNHM, 1 paratype: MHNG.

Derivatio nominis: After the form of the notogaster.

Remarks: On the basis of the presence of fissura terminalis and the shape of the sensillus the new species belongs to the relationship of *M. incisa* MÄRKEL, 1964, however, it is distinguished from it and from all other *Microtritia* species

* HNHM = deposited in the Hungarian Natural History Museum, Budapest, bearing the identification number of the specimens in regular use in the Collection of Arachnida

** MHNG = deposited in the Muséum d'Histoire naturelle, Genève



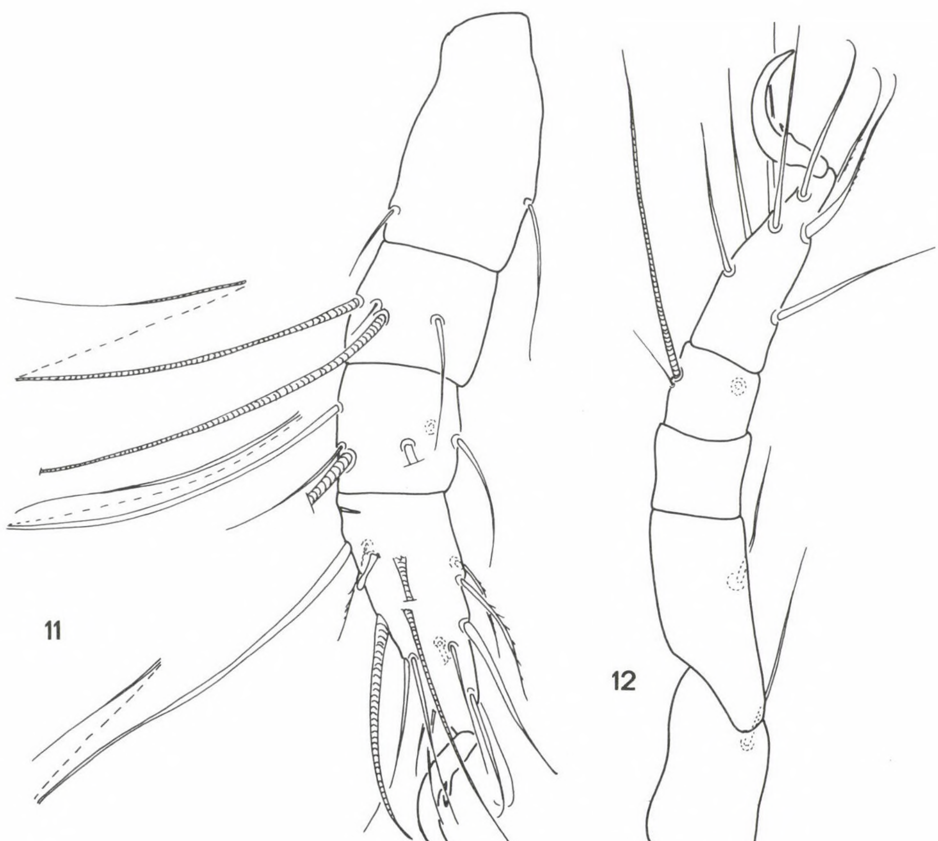
Figs 6-10. *Microtritia altissima* sp. n.: 6 = body in lateral aspect, 7 = aspis in lateral aspect, 8 = anogenital region, 9 = aspis in dorsal aspect, 10 = fissura terminalis

by the conspicuously high (in lateral aspect) notogaster, and from the M. incisa by the ratio and the distance of the prodorsal setae (Märkel, 1964: fig. 13b).

HAPLOZETIDAE GRANDJEAN, 1936

Comororibula gen. n.

Diagnosis: Family Haplozetidae. Rostrum wide, in dorsal aspect appears rounded medially, but rostral apex straight in lateral aspect. Lamella and sublamella well developed, prolamella, translamella absent. Lamellar seta arising on the lamellar end, rostral seta on a small tubercle. Sensillus capitate, its peduncle short. Median part of notogaster protruding anteriorly, this part straight medially. Pteromorphae large, movable. Ten pairs of short notogastral setae, four pairs of small sacculi and five pairs of lyrifissures well observable. The subcapitulum, chelicerae and palps are normal for the family. Apodemes short, epimeral borders hardly and only partly observable. Epimeral setal



Figs 11-12. *Microtritia truncata* sp. n.: 11 = leg I, 12 = leg II

formula: 3 – 1 – 3 – 3. Only three pairs of genital setae present, anogenital setal formula: 3 – 1 – 2 – 3. Circumpedal carina reaching to the lateral margin of the ventral plate. All legs tri- and heterodactylous. Tarsi of legs I and II truncate, longitudinally compressed, suddenly narrowing in lateral view (Fig.16). Solenidium φ_2 arising on a narrow, distal projection. Legs' setal formulae are normal for the family.

Type species: *Comororibula truncata* sp. n.

Remarks: The new genus resembles the genus *Incabates* HAMMER, 1961 (see LEE 1993), however, this latter has four pairs of genital setae. This number of the genital setae was heretofore unknown in this group (SEL: see BALOGH & BALOGH 1992: 118) of haplozetids Oribatida.

Comororibula truncata sp. n.
(Figs 13-19)

Measurements. – Length of body: 257-324 μm, width of body: 153-200 μm.

Integument: Cerotegument layer was not observable, cuticle seems to be smooth.

Prodorsum: The whole prodorsum conspicuously wide. Lamella well developed, without lamellar cusps. Peduncle of sensillus very short, gradually dilated distally, head distinctly spiculate. All prodorsal setae ciliate, setae *ex* minute. Rostral setae arising laterally, far from each other (Fig. 13), ratio among them *in* > *le* > *ro*.

Notogaster: Pteromorphae short longitudinally, broad, nearly triangular in lateral view (Fig. 15). Dorsosejugal suture between bothridia straight. All ten pairs of setae visible, but all very short and fine. Lyrifissures *im* long, lying mostly transversally. All four pairs of sacculi small, clearly rounded.

Lateral part of podosoma: The tubercle of the rostral seta well developed. Carina *kf* observable, behind it the surface granulate. Area porosa lamellaris well visible, situated tangentially to lamella (Fig. 15).

Ventral regions: Coxisternal region framed laterally by a sharp line. Pedotecta I and II-III, and discidium well protruding laterally (Fig. 14). All epimeral setae fine and short. Setae on the ventral plate also fine and short, among the adanal setae setae ad_3 arising in preanal position. Lyrifissures *iad* observable near to the anal apertures, in paraanal position.

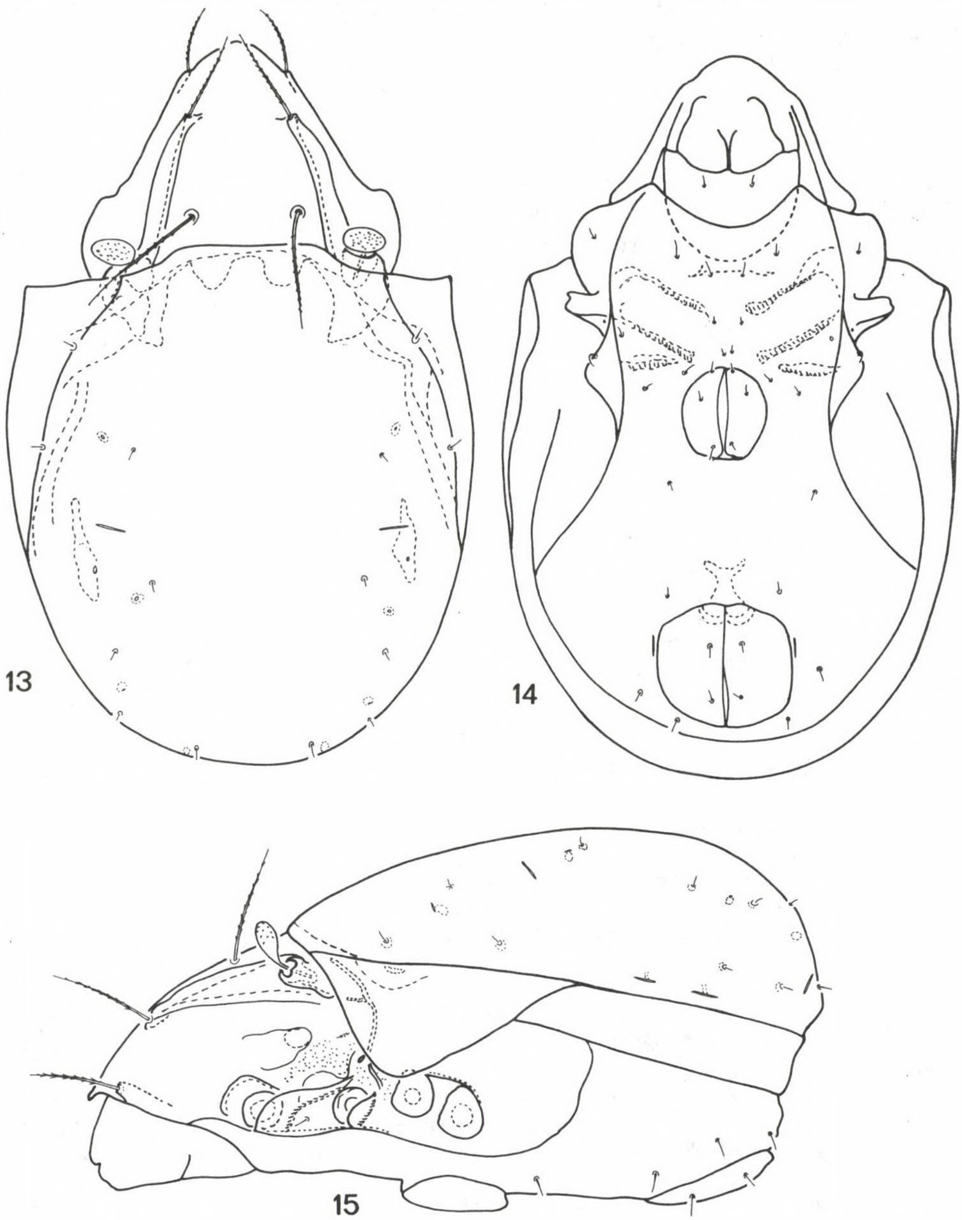
Legs: Femora of legs II-IV broad, each with a well-developed blade-like formation ventrally (Fig. 19), and some wrinkles transversally. Solenidia φ_1 of all tibiae conspicuously long, filiform. Legs setal formulae:

I: 1 – 5 – 2+1 – 4+2 – 18+2 – 3 (Figs 16, 18)
IV: 1 – 2 – 2 – 3+1 – 12 – 3 (Fig. 17)

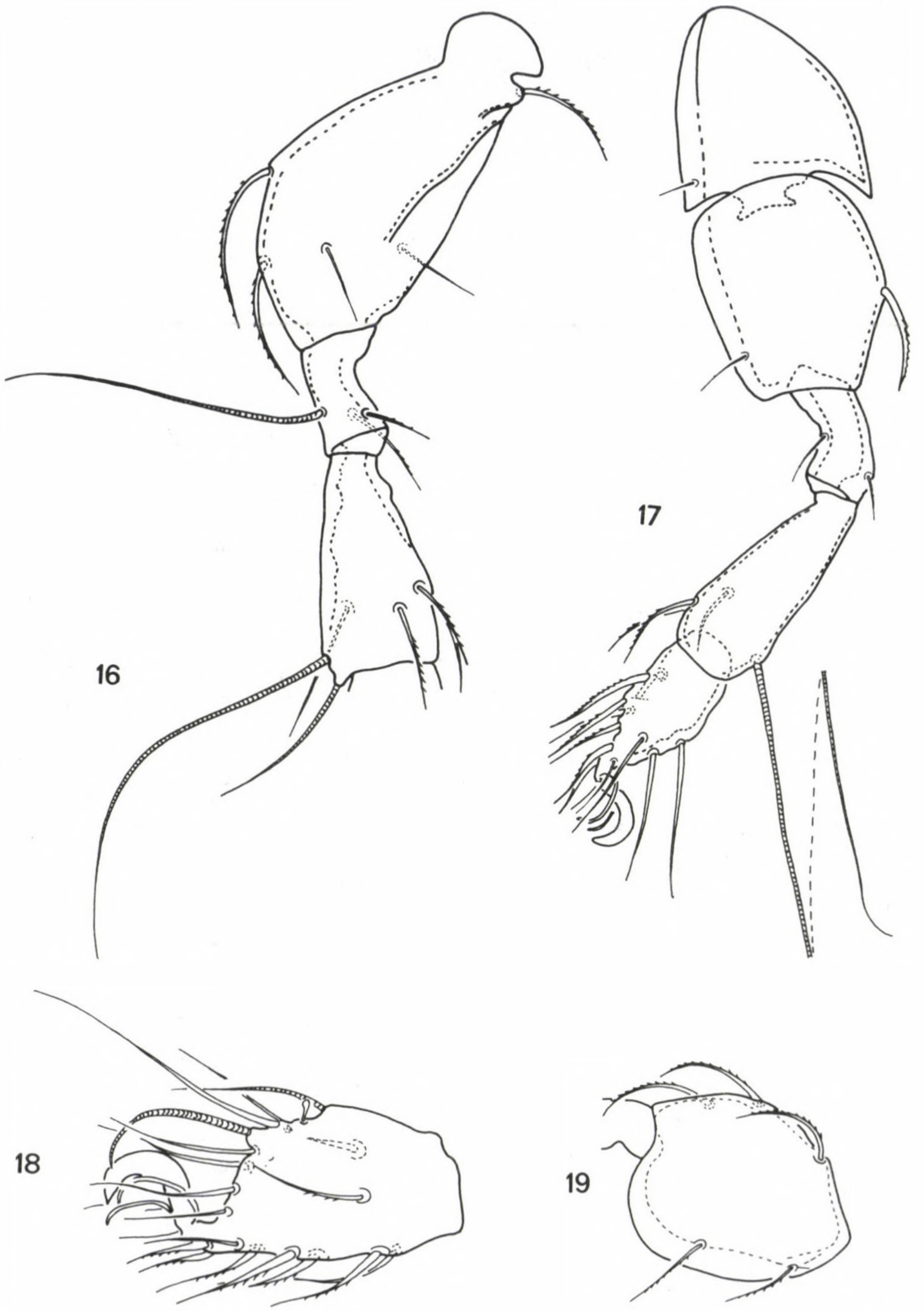
Material examined: Holotype (1490-HO-1994): Comoro Islands, Mwali (Moheli) Island. Secondary lowland rainforest near Miringoni village on the SSW slope of the main mountain range, at 230-400 m. 30. 08. 1992. Leg. Dr T. PÓCS. 3 ex.: paratypes from the same sample. Holotype and 2 paratype: HNHM, 1 paratype: MHNG.

Derivatio nominis: The name of this species was given after the form of the rostrum and the dorsosejugal region of the notogaster.

Remarks: See the remarks after the generic diagnosis.



Figs 13-15. *Comororibula truncata* sp. n.: 13 = body in dorsal aspect, 14 = body in ventral aspect, 15 = body in lateral aspect



Figs 16-19. *Comororibula truncata* sp. n.: 16 = femur genu and tibia of leg I, 17 = leg IV, 18 = femur of leg II, 19 = tarsus of leg I

GALUMNIDAE JACOT, 1925

Dimidiogalumna comoroensis sp. n.
(Figs 20-25)

Measurements. – Length of body: 353-403 µm, width of body: 288-305 µm.

Integument: A thin cerotegument layer present, mostly visible on the ventral surface, consisting of small granules.

Prodorsum: Rostrum conical, slightly beak-shaped in lateral aspect (Fig. 25). Prodorsal surface convex behind the rostrum. Lamellar lines (L) strong, well protruding from the surface, sublamellar lines absent. Lamellar setae arising outside of the lamellar lines (L). Ratio of prodorsal setae: $ro > le > in$, the latter one minute (Fig. 20). Peduncle of sensillus long, its head clavate, well barbed.

Notogaster: Dorsosejugal suture present. Surface finely roughened, sculpture consisting of fine wrinkles. Pteromorphae striated, medially some stronger and laterally many finer lines observable laterally (Fig. 23). Three pairs of large porose area present, *Aa* elongated, A_1 absent, A_2 and A_3 rounded, both large. Ten pairs of alveoli, median pore also observable, lyrifissures *im* located mediallly (Fig. 20).

Lateral part of podosoma: The shape of ridges *T* and *E* are shown in Fig. 25 .

Gnathosoma: Mentum with strong transversal wrinkles anteriorly (Fig. 22). Its outline well excavated anteromedially. Palpal setal formula O – 2 – 1 – 3 – 9+1. Solenidium ω_1 and eupathidium *acm* conspicuously long.

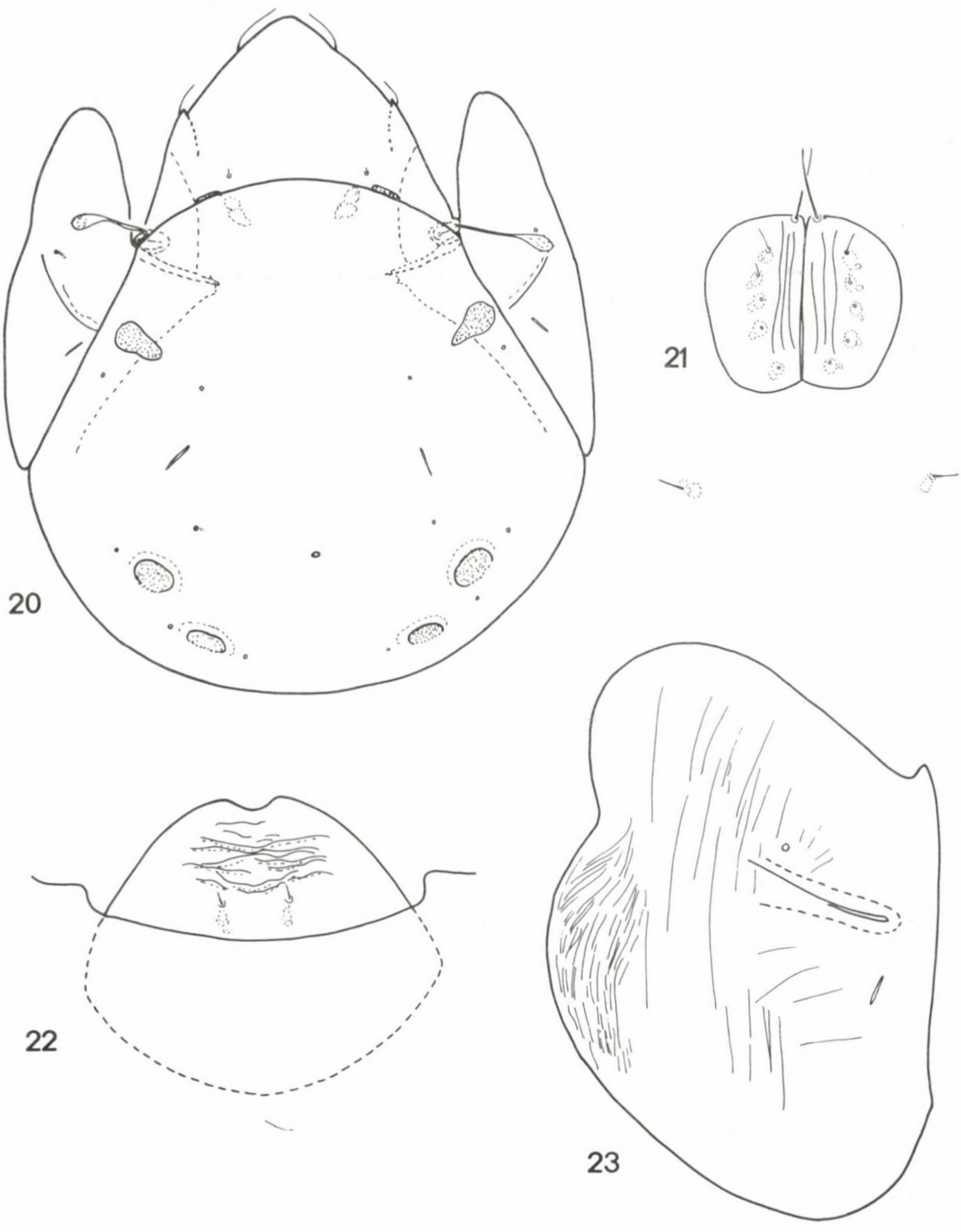
Ventral regions: Epimeral surface distinctly granulated. Some larger spots in the median region also observable. Genital plates (Fig. 21) with some strong longitudinal crests (striate), genital setae ordered in one, arched longitudinal row. Setae g_1 much longer than the others. Anal plates with a strong, longitudinal median keel, anal setae arising among them (Fig. 24). Anal setae minute, thin, adanal ones represented only by their alveoli. Lyrifissure *iad* in adanal position, Area porosa postanalis well developed.

Legs: All legs are tridactylous and heterodactylous, the lateral claws are smaller and thinner than the median one. ω_2 of the leg I situated behind the ε, and *seta ft''* arising near to each other. Some ventral setae of tarsi strong, pectinate.

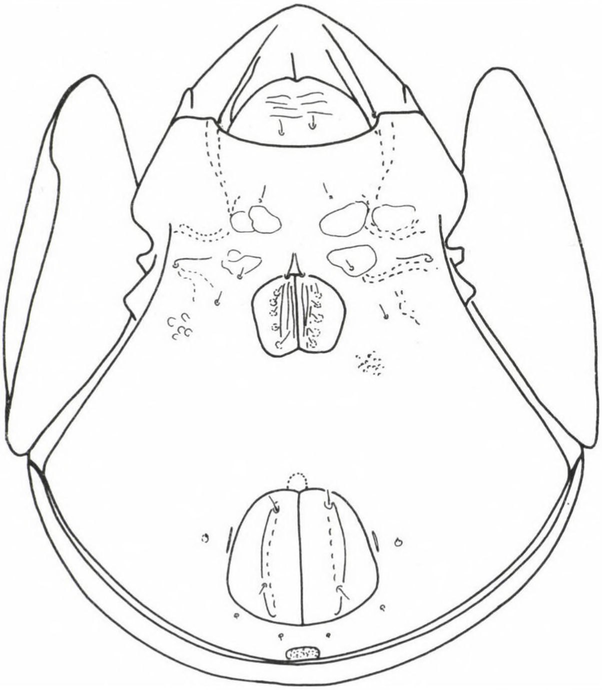
Material examined: Holotype (1491-HO-1994): Comoro Islands, Mwali (Moheli) Island. Secondary lowland rainforest near Miringoni village on the SSW slope of the main mountain range, at 230-400 m. 30. 08. 1992. Leg. Dr T. PÓCS. 3 ex.: paratypes from the same sample. Holotype and 2 paratype: HNHM, 1 paratype: MHNG.

Derivatio nominis: After the collecting place (Comoro Islands).

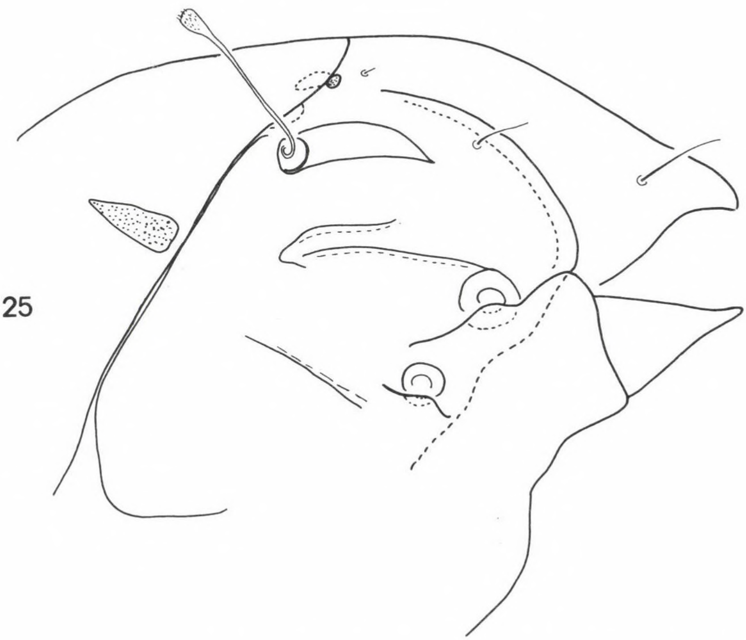
Remarks: The genus *Dimidiogalumna* was heretofore known only in its type species (*D. villiersensis* ENGELBRECHT, 1972) described from South Africa. The new species fits well into this genus and it is distinguished from the type species by the number and form of the porose areae of the notogaster and by the sculpture of the mentum and the genital and anal plates.



Figs 20-23. *Dimidiogalumna comoroensis* sp. n.: 20 = body in dorsal aspect, 21 = genital plates, 22 = mentum, 23 = pteromorpha

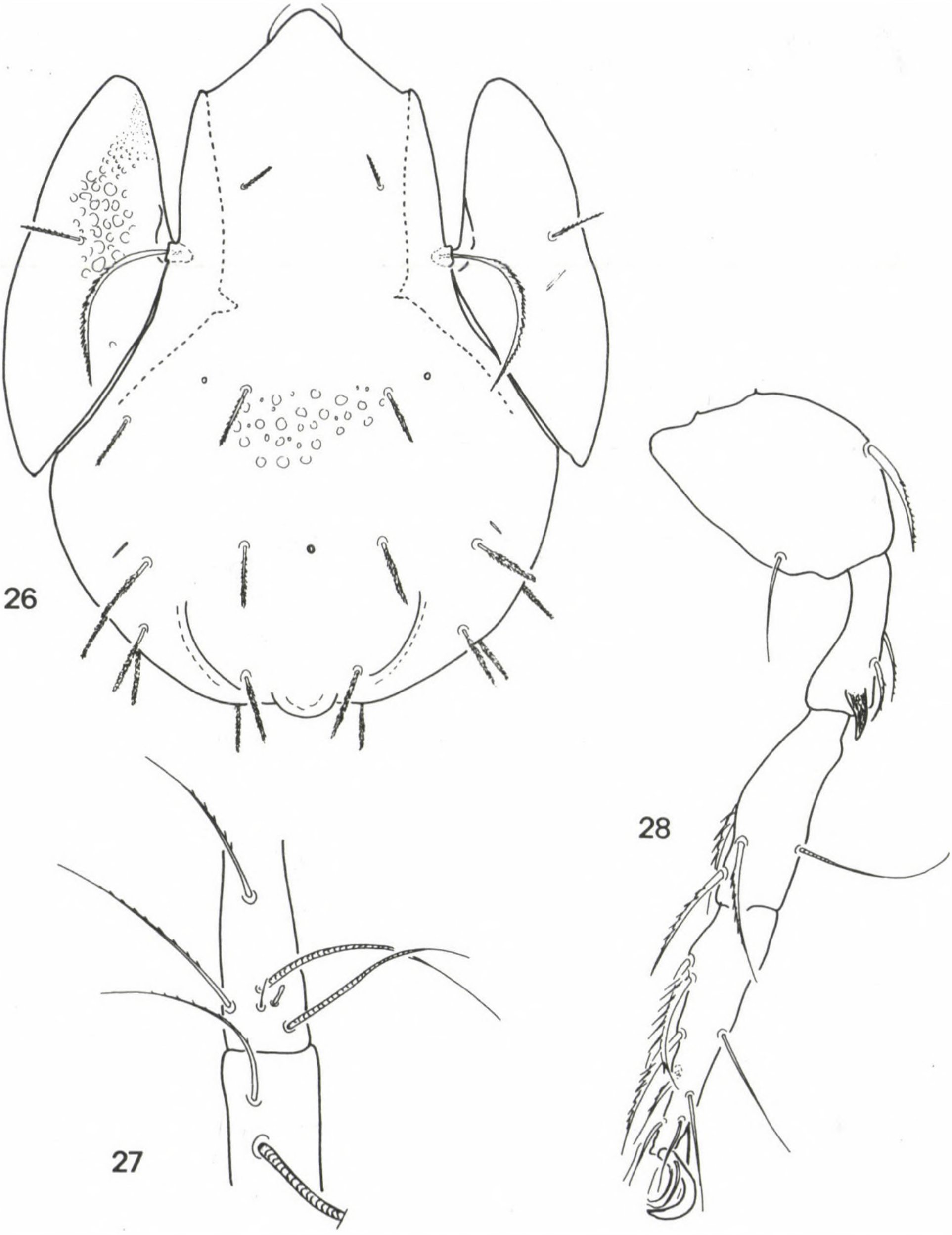


24

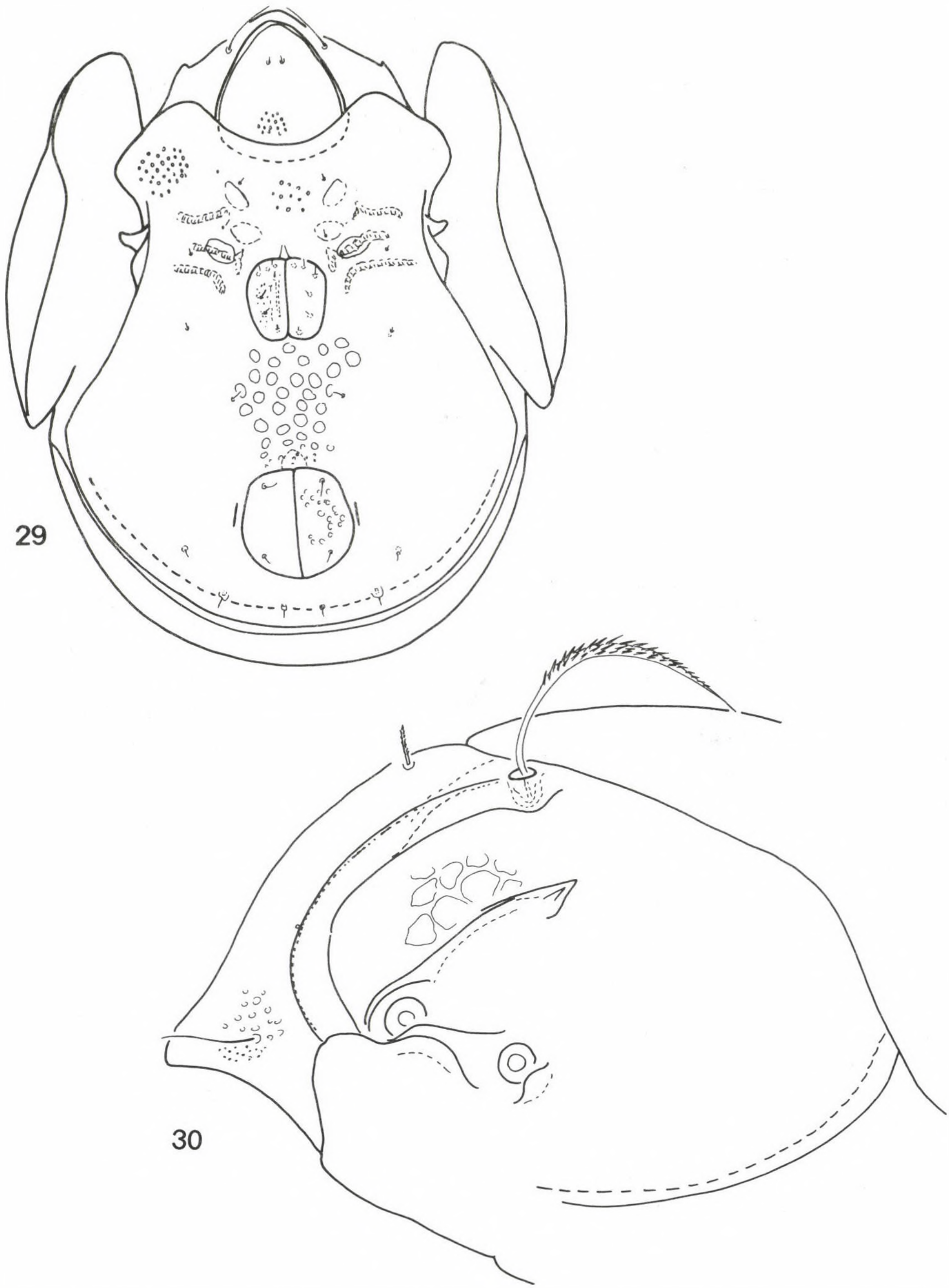


25

Figs 24-25. *Dimidiogalumna comoroensis* sp. n.: 24 = body in ventrtal aspect, 25 = podosoma in lateral aspect



Figs 26-28. *Pilizetes tuberculatus* sp. n. 26 = body in dorsal aspect, 27 = solenidial group of leg I, 28 = leg IV



29

30

Figs 29-30. *Pilizetes tuberculatus* sp. n.: 29 = body in ventral aspect, 30 = podosoma in lateral aspect

Pilizetes tuberculatus sp. n.
(Figs 26-30)

Measurements. – Length of body: 375-408 μm, width of body: 255-300 μm. No greater difference among the sexes.

Integument: Waxy layer well developed, granulation and small particles of different kinds apparent also in this thicker part. Cuticle punctate, foveolate and alveolate.

Prodorsum: Lamellar line well developed, its margin well protruding from the outline of the body in dorsal aspect (Fig. 26). Rostrum foveolate, prodorsal surface alveolate. Rostral setae simple, filiform, lamellar ones represented only by their alveoli, interlamellar setae bacilliform, finely and distinctly barbed. Sensillus strong but setiform, with short spines on its laterodorsal surface (Fig. 30).

Notogaster: Its surface mostly alveolate. Dorsosejugal suture absent. Posterior part of notogaster with a rough structure, and with longitudinal hollows and protuberances with well sclerotised margins (Fig. 26). Pteromorphae large, also with a strong sculpture consisting of larger alveoli medially and basally, and foveolae gradually becoming smaller foveolae marginally. Ten pairs of bacilliform notogastral setae present, no essential difference among them, but all longer than the similar interlamellar setae. Sacculi (or pore) – excepting *Sa* – hardly observable, median pore present, clearly visible.

Lateral part of podosoma: Lamellar and sublamellar lines (*L* and *S*) running parallel, the shape of ridges *T* and *E* as shown in Fig. 30. Surface between the sublamellar lines and ridge *T* with same polygonal sculpture.

Ventral regions: Epimeral surface foveolate, ventral plates alveolate (Fig. 29) Epimeral setal formula: 1 – 1 – 2 – 1. Surface of genital plates with small, longitudinal pits, anal plates alveolate. All setae in the anogenital region minute, adanal setae arising far from the anal aperture, setae ad_1 and ad_2 in posteromarginal, ad_3 in adanal position, setae ad_1 conspicuously near to each other (Fig. 29).

Gnathosoma: This region with normal galumnoid characters, mentum is very large.

Legs: All legs are tridactylous. Chaetotaxy of legs is normal galumnoid type, some ventral setae of tarsi I-IV with strong spines. Genu of leg IV with a dorsal spur (Fig. 28), solenidia δ on genu III and IV long, filiform. The position of the solenidial group of leg I as shown in Fig. 27.

Material examined: Holotype (1492-HO-1994): Comoro Islands, Mwali (Moheli) Island. Secondary lowland rainforest near Miringoni village on the SSW slope of the main mountain range, at 230-400 m. 30. 08. 1992. Leg. Dr T. PÓCS. 5 ex.: paratypes from the same sample. Holotype and 4 paratype: HNHM, 1 paratype: MHNG.

Derivatio nominis: After the strong posteromarginal structure of the notogaster.

Remarks: The new species is well characterised by the strong notogastral sculpture on the posterior part of the notogaster and the notogastral setae nearly of equal length. On this basis it stands nearest to *P. denticulatus* MAHUNKA, 1986, but the characteristic prodorsal structure which is present in *denticulatus*, absent in the new species, its notogastral setae mostly shorter, the sensillus thinner, with finer spines, etc. It is distinguished also from the new species by the sculpture of the genital plates, which are rarely foveolate in *denticulatus*.

REFERENCES

BALOGH, J. and P. BALOGH (1992) *The Oribatid Mites Genera of the World, I-II.* Hungarian Natural History Museum, Budapest, 263+375 pp.

ENGELBRECHT, C. M. (1972) Dimidiogalumna villiersensis (Galumnidae: Oribatei), a new South African Galumnid genus and its type species. *Acarologia* **14**: 141-149.

HAMMER, M. (1961) Investigations on the oribatid fauna of the Andes Mountains, II. *Biol. Skr.* **13**: 1-157+43 pl.

LEE, D. C. (1993): Incabates Hammer and Setincabates gen. n. (Acarida: Cryptostigmata: Haplozetidae) from South Australian soils. *Trans. Roy. Soc. S. Aust.* **117**: 7-85.

MAHUNKA, S. (1986) Studies on the Oribatid fauna of Kenya (Acari: Oribatida) II. *Folia ent. hung.* **47**: 77-102.

MAHUNKA, S. (1993) Oribatids from Madagascar I. (Acari: Oribatida). *Revue suisse Zool.* **100**: 289-315.

MAHUNKA, S. (1994*a*) Comorozetes atavisticus gen. et sp. n., a new microzetid mite from the Comoro Islands (Acari: Oribatida). *Intl. J. Acarol.* **20**: 53-56.

MAHUNKA, S. (1994*b*) Baloghia gen. n., a new haplozetid genus from the Comoro Islands (Acari: Oribatida). *Opusc. zool. Budapest*, in print.

MÄRKEL, K. (1964). Die Euphthiracaridae Jacot, 1930 und ihre Gattungen (Acari Oribatei). *Zool. Verh., Leiden,* **67**: 78 pp.

Received June 1, 1994; accepted July 1, 1994

ACTA ZOOLOGICA
ACADEMIAE SCIENTIARUM HUNGARICAE

An international journal of animal taxonomy and ecology

Instruction to authors

Submission of a paper implies that it has not been published previously, that is not under consideration for publication elsewhere, and that if accepted for the Acta Zoologica Hungarica, the authors will transfer copyright to the Hungarian Academy of Sciences/the Hungarian Natural History Museum as is customary. Articles and illustrations become the property of the HAS/HNHM.

Papers must be in English with British spelling, and be original contributions in the field of animal taxonomy, systematics, zoogeography and ecology. All manuscripts must be submitted to one of the editors (editor, assistant editor).

Entire manuscripts must be submitted on IBM compatible floppy disk and in duplicate printed copies and the author should retain a copy. In the case of multiple authors, the corresponding author should be indicated. Series of numbered papers will not be considered.

Manuscripts must be printed with double spacing (including the reference list), and with wide margins (30-35 mm) on the left side of the paper only. Authors are requested to keep their communications as concise as possible. Footnotes should be avoided or minimized, and italics should not be used for emphasis. A running head of not more than 30 letters should be supplied.

The manuscript should contain the following information:

Title. This should be followed by the name and full address of the author(s). Where possible, the fax and/or E-mail number of the corresponding author should be supplied with the manuscript, for use by the publisher.

Abstract. This should be a brief summary of the contents and conclusions of the paper, and should not be longer than 200 words and should not contain references.

Key words. No more than five (exceptionally 6) key word entries should be provided for rapid scanning of the contents of the paper and used for compiling the index.

Introduction. This should contain a brief survey of the revelant literature and the reasons for doing the work.

Materials and Methods. Sufficient information should be given to permit repetition of the experimental or field work. The technical description of methods should be given only when such methods are new.

Results. These should be presented concisely. Only in exceptional cases will it be permissible to present the same set of results in both table and a figure. The results section should not be used for discussion.

Discussion. This should be separate from the results section and should deal with the significance of the results and their relationship to the object of the work (and, this is the place of the identification key in taxonomical revisions).

Acknowledgements. (at most in 10 lines)

References. In principle the Harvard system is to be followed. References should be detailed in the following order: authors' names and initials, date of publication (in parentheses), the title of the article, the name of the journal as abbreviated in the World List of Scientific Periodicals (4th edn 1963), the volume, and the first and last pages of the article, e.g.

Norrbom, A. L. and Kim, K. C. (1985) Taxonomy and phylogenetic relationships of Copromyza Fallén (s.s.) (Diptera: Sphaeroceridae). *Ann. Entomol. Soc. Am.* **78**: 331-347.

For books the author's names, date of publication, title, edition, page reference, publisher's name and the place of publication should be given, e.g.

Hinton, H. E. (1981) *Biology of insect eggs*, vol. 2. Pergamon Press, New York.

or

McAlpine, J. F. (1981) Morphology and terminology, adults, pp. 9-63. *In* McAlpine *et al.* (eds) *Manual of Nearctic Diptera*, vol. 1. Agriculture Canada, Ottawa.

In the text references should be given as Marshall (1992) or (Marshall, 1992). When a citation includes more than two authors, e.g. Grey, Black and White, the paper should be referred to in the text as Grey et al., provided that this not ambiguous. If papers by the same author(s) in the same year are cited, they should be distinguished by the letters, a, b, c, etc., e.g. Marshall (1992a).

References to papers "in press" must mean that the article has been accepted for publication. References to "personal communications" and unpublished work are permitted in the text only: references to papers in preparation or submitted are not permissible.

All necessary **illustrations** should accompany the manuscript, but should not be inserted in the text. All photographs, graphs and diagrams should be numbered consecutively in Arabic numerals in the order in which they are referred to in the text. Glossy photographs or positive prints should be sent unmounted wherever possible and should be kept to a minimum. Figures should be of good quality. Explanation of lettering and symbols should be given in the figure caption and only exceptionally in the figures. Lettering and symbols to appear on the illustration should be of sufficient size to allow for considerable reduction where necessary (usually proper for a 50% reduction in size). Scales must be indicated on micrographs, not by magnifications in the legends. Figure size must not exceed 24×30 cm. On the back of each illustration should be indicated the author's name, the figure number (in Arabic numerals), and the top of the illustration, where this is not clear. Halftones should be included only when they are essential. Details and quotation of publication of colour plates should be made to the editors. The following symbols should be used on line drawing: ● ■ ○ ❑ ▲ ◆ ♦ etc.

Legends to figures should be typed on a separate sheet. They should give sufficient data to make the illustration comprehensible without reference to the text.

Tables and appendices should be constructed so as to be intelligible without reference to the text, numbered in Arabic numerals and typed on separate sheets. Every table should be provided with an explanatory caption and each column should carry an appropriate heading. Units of measure should always be indicated clearly (metric units are preferred). All tables and figures must be referred to in the text.

Only standard **abbreviations** should be used. Arbitrary abbreviations and jargon will not be accepted.

The Latin names should be given for all species used in the investigation, although taxonomic affiliation and authority need not be provided in the title.

Page proofs will be sent to the author (or the first-mentioned author in a paper of multiple authorship) for checking. Corrections to the proofs must be restricted to printers' errors. Any substantial alterations other than these may be charged to the author. Authors are particularly requested to return their corrected proofs as quickly as possible in order to facilitate rapid publication. Please note that authors are urged to check their proofs carefully before return, since late corrections cannot be guaranteed for inclusion in the printed journal.

Fifty reprints free of charge will be sent to the first author; extra copies of the issue (at a specially reduced rate) can be ordered on the form which will accompany the proofs. These should be returned to: The Editorial Office of the Acta Zoologica, Hungarian Natural History Museum, Budapest, Baross u. 13, H-1088, Hungary

The **page charge** required from authors outside Hungary is 15 USD per printed page. Authors of papers exceeding 16 printed pages are asked to pay 40 USD (or HUF equivalent) for each such page i.e. all costs of publication (irrespective of their nationality).

FOR FURTHER INFORMATION PLEASE CONTACT US

The Editorial Office of the Acta Zoologica
H-1088 Budapest, Baross u. 13, Hungary
Fax: (36)-(1)-1138820.
E-mail: h7962per@huella.bitnet.

SUBSCRIPTION INFORMATION

Orders should be addressed to

Editorial Office of the Acta Zoologica
Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13, Hungary

Typeset: Pars Ltd., Budapest.
Printed by Dabas Jegyzet Ltd., Hungary

CONTENTS

HU ISSN 1217–8837

Acta Zoologica Academiae Scientiarum Hungaricae

VOLUME 40 - NUMBER 4 - 1994

HUNGARIAN NATURAL HISTORY MUSEUM, BUDAPEST

ACTA ZOOLOGICA ACADEMIAE SCIENTIARUM HUNGARICAE

AN INTERNATIONAL JOURNAL OF ANIMAL TAXONOMY AND ECOLOGY

Acta Zoologica Academiae Scientiarum Hungaricae is published quarterly from February 1994 (other issues in May, August and November) by the Hungarian Natural History Museum and the Biological Section of the Hungarian Academy of Sciences with the financial support of the Hungarian Academy of Sciences.

Acta Zoologica Academiae Scientiarum Hungaricae 40 (4), pp. 289-327, 1994

FOUNDATIONS FOR DEVELOPING A NATIONAL STRATEGY OF BIODIVERSITY CONSERVATION

A report prepared by the
COMMITTEE ON ECOLOGY, BIOLOGY SECTION, HUNGARIAN ACADEMY OF SCIENCES*

INTRODUCTION

Gábor Fekete

Biodiversity is the variety of nature. It is manifested at several levels of biological organization. It can be studied at the levels of individuals, populations and biocoenoses (plant, animal and microbial communities). In evolutionary terms the ultimate cause of diversity existing at higher levels is genetic variation. Any change at one level can affect other levels, leading either to increased or decreased biodiversity.

Species diversity, an important and operative term, is the biodiversity of populations categorized by a taxonomic unit, the species. In this report we use mostly – but not exclusively – this term.

Nature in Hungary, even in its present state of diversity, has great and indispensable value. It is part of our natural resources. Therefore it must be treated rightly as national treasure.

The need for a worldwide strategy of biodiversity conservation was formulated by the initiative of the IUCN, UNEP and the World Resource Institute in 1991. Recognizing the importance of the topic, a small working group of ecologists was formed in the Institute of Ecology and Botany of the Hungarian Academy of Sciences in late 1991. They recognized the responsibility of Hungarian ecologists in laying down the foundation of a national work plan. A description of present situation in as a complex way as possible was started. After the magnitude of the task had been realized, the list of contributors was extended considerably, and the report was finally released as an official document of the Committee on Ecology of the Hungarian Academy of Sciences (HAS).

* *Sándor Bartha, István Csapody, Béla Dános, Gábor Fekete, László Gallé, László Holly, Ferenc Horváth, Gábor Jenser, Zoltán Kereszty, György Kovács, Ferenc Németh, László Papp, Tibor Simon, Dezső Surányi, Attila T. Szabó, Zoltán Szőcs, Zoltán Varga*
Address for correspondance: Prof. G. Fekete, Institute of Ecology and Botany, Hungarian Academy of Sciences, Vácrátót, Alkotmány u. 2-4, H-2163 Hungary

Besides ecologists, experts of different fields (taxonomy, conservation, plant protection, horticulture, medicinal plants, gene bank, zoological gardens, etc.) were also involved in formulating this material. The first draft had been ready by the opening of the UN Congress on Environment and Development in Rio de Janeiro (i.e. the signing of the International Treaty on Biological Diversity). The material submitted by the Committee on Ecology of the HAS was endorsed by the Biology Section of HAS. Then it was submitted to the Presidium of the HAS. The Agricultural Sciences Section of the HAS presented a critique of the chapter discussing the interpretation of biodiversity in connection with agriculture. The present version of the document contains all the necessary changes. The report of the Committee was first published in Hungarian in 1993 as a separate document. The monthly periodical of the HAS (Magyar Tudomány, 1993(3): 983-1010). For a short English abstract, see: Biology International 1994, 28.

When describing the state of biodiversity in Hungary, there were several works to build upon. We could rely on extensive Floras and Faunas based on the works of many generations. We know what we have to save. Several academic meetings have provided good outlines of certain issues. However, our knowledge is unbalanced. Issues of conservation have a long tradition in Hungary and the establishment of a network of important protected areas has progressed much although the task is not completed yet. These steps, however, are not enough to preserve biodiversity.

The principal aim of this work is to provide a scientific status report on the preservation Hungary's biological assets. We highlight the causes and symptoms of recent diversity erosion in Hungary, judge the efficiency of certain methods of preservation, and also indicate future research tasks.

It is stressed that the novelty of this publication is that – unlike any other previous analysis in Hungary – it provides the basis for actions necessary for preserving biological diversity. The necessary administrative measures to be taken, management and development are also identified.

COMMUNITY DIVERSITY, HABITAT PROTECTION: THE OPTIMIZATION OF NATURE CONSERVATION

Sándor Bartha, István Csapody, Gábor Fekete, László Gallé, Ferenc Horváth, Ferenc Németh, Tibor Simon, Zoltán Varga

Biodiversity of native species can be preserved most expediently within the system of complex natural habitats. In practice it is mostly achieved by preserving continuous vegetation patches, plant communities, or by protecting the landscape. The species richness of the Hungarian flora and fauna originates from the great variation in vegetation types, and from the high community-level diversity. There are several plant communities in the Carpathian Basin that may be considered unique, hence they should be treated as part of the European natural heritage. Along with their role in preserving taxonomic diversity, plant communities also mark the visible borders of nature's functional nutrient-cycling, energy-flow units – the ecosystems. The most widespread, "common" communities happen to have the greatest importance in this respect.

1. Sources of decreasing diversity of the vegetation

Phenomena and impacts that seriously threaten biodiversity have increased significantly over the past few decades. Most of them are related to economic activities. Of these, agriculture is dealt with in a separate chapter at the end of this document. Hungarian water management policy – the quickest possible drainage of excess water – has caused serious damage protection of natural values. Heavy industries seriously polluting the air and water with their outdated technologies, together with the forced development and expansion of mining have spoiled the state of semi-natural habitats. Establishment of new settlements and construction of new roads have also caused fragmentation and/or destruction of habitats. Examples of destruction of vegetation will be discussed in the following.

1.1 Direct destruction of stands

Direct impacts represent the most drastic kind of threats. The extreme example is when vegetation is destroyed together with its habitat.

Extermination of large steppe-woodland and Scots pine stands near Fenyőfő and Bakonyszentlászló (bauxite mining) is one of the most notable examples in recent times. Alder woods along brooks, which preserve several montane species, have also be destroyed because of riverbed dredging. The cool continental steppe-woodland stands (field maple-oak and the even scarcer lime-oak woods) of the Gödöllő Hills, which used to be unique in Central Europe, was destroyed so "successfully", that their regeneration seems to be impossible. The most valuable colline woods near Albertirsa, at the boundary of the Great Plain, have also disappeared almost completely.

1.2 Habitat destruction

This is a more subtle and slier kind of depauperation habitat.

The impacts of sinking watertable are far-reaching and they affect several vegetation types simultaneously. Consequences of dropping karstic watertable in Transdanubia have been studied at several locations. Degradation of fens and hay meadows has been shown to be caused by drying out. Drainage and amelioration serving agricultural purposes (reclaiming new fields) have resulted in considerable decrease of ground watertable in the Great Plain (especially in the Danube-Tisza Mid-Region and in the Nyírség), causing the retreat of oak woods. Amelioration of the Dráva plains has also caused degradation. Semi-natural hardwood gallery forest stands have also been destroyed, losing their character one after another. The deterioration of protected mires that are not surrounded by a buffer zone (Kelemér, Csaroda, Bátorliget) has also started. However, the unfavourable changes of vegetation dynamics caused by drying are reversible.

Increasing pollution of ponds and lakes has caused first impoverishment then the devastation of reeds.

Native oak woods have been cleared from large areas to cultivate new lands in sandy areas. In these areas the practiced landuse techniques (arable field) have changed (diminished) habitat characteristics so intensively that oak woods cannot be reclaimed (or it is not feasible).

One consequence of the nation-wide oak decline which started in the late 1970s is that, because of canopy layer opening up, species composition of the herb layer has changed. Falling dead oak individuals open the place for nitrophilous and ubiquitous plants. In some places oak-hornbeam woods have also changed in species composition. There is little knowledge on the long-term effects of these changes.

1.3. Land use, stand alteration

Spruce stands planted in place of native beech woods have been shown to dry out their habitats because of their higher interception. In black locust (*Robinia*) plantations (planted in place of species-rich native woods like sandy oak woods) native species of the herb layer have disappeared. Pure turkey oak stands in Transdanubia, where they are in place of beech woods, undergo similar transformation. Afforestation of barren hillsides with black pine used to be a politically forced practice in the 1950s. Several pioneer dolomite grasslands have been destroyed in this way. Grazing of sandy grasslands resulted in the disappearance of the pioneer annual grassland facies and the destruction of the mosaic structure of clonal and tall plants rich in edge species. Changes and cessation of traditional management practices (e.g. mode or intensity of grazing) have caused alteration of diverse mountain meadows or oligotrophic grasslands.

1.4. Tolerance characteristics: resistance, fragility

Communities have inherent characteristics like fragility (often at considerably different levels) and the presence or lack of resistance against alien species. Recent ecological researches have shed new light on the questions of perturbation and restoration.

Basically plastic responses are characteristic of soft- and hardwood gallery forests occurring along large rivers: the characteristic reaction to adventive species of trees, shrubs and herbs is incorporation and, not exclusion. As a result, the number of native species usually decreases. One possible source of degradation in Hungarian sub-montane forests is the reduction of valuable subordinate species (large-leafed lime, wild cherry, etc.). The habitats of certain mantle species like hazel, goat willow, aspen have also been reduced. This is also disadvantageous for those important phytophagous species (for example protected butterflies) which use these trees and shrubs as food plant. Increasing weediness together with simultaneous impoverishment of mesophytic oak and hornbeam woods is becoming more and more general. Mixed maple, ash-lime and xerothermic colline oak woods can be regarded as the most stable among the forest communities in Hungary. Different varieties of the same community can be considerably dissimilar because of the loss of species, for example, after trampling. Although the exact reasons are not known, it is a fact that depending on bedrock type, rock-ledge and debris swards have different levels of resistance against loss of species and deterioration. The above-mentioned fens and meadows are the most threatened, since these communities have lost unique plant species the most.

1.5. Isolation and fragmentation

It is well known that isolation is a natural phenomenon of the vegetation. It is an ordinary characteristic in certain communities and complexes (spring fens, raised bogs, scrubs in rocky places etc.). However, even in these cases a negative relationship between diversity and isolation can be shown. Antropogenic fragmentation of once continuous vegetation can lead to secondary isolation.

Fragmentation of species – rich forests has been taking place in front of our eyes in recent years (examples: sandy oak forests of the Nyírség, Balatonfüred park wood, Monor wood, gallery forests along the Danube, oak and beech woods surrounding Budapest etc.). The substantial fragmentation of loess grasslands is well documented. This fragmentation is directly related to the significant decrease in species number and to the drastic decrease in abundance over the past thirty years.

It must be noted that the recent changes in land ownership have had unfavourable effects on preserving the present level of biodiversity.

2. Conditions for preserving the biodiversity of natural vegetation

In the following we present those tasks (planning, operation, management) of the nature conservation authorities that should be based upon ecological (sometimes also conservation biological) expertise.

2.1 Optimization of the network of protected areas to maximize biodiversity

Designation and determination of the size of protected areas had been practised without serious planning (though with expert intuition) worldwide up to the late 1960s. The situation in Hungary is similar. It was an obvious solution to give priorities for designating remote areas less affected by development which were rich in species, rarities and in unusual habitats. Ideas have considerably changed since the late 1960s in two areas. The theory of island biogeography, introduced by MacArthur and his followers, has proved theoretically and empirically that under otherwise identical conditions, the number of maintained species is decisively determined by the size of the area. The recognition of the importance of environmental heterogeneity is closely related to this theory. All these have introduced new approaches to designating protected areas. Examples are: determination of optimum size, attempts to ensure habitat diversity, differentiation of protection measures of core areas and buffer zones. These could be called the intensive planning consideration. It is still a future task to put them into practice effectively.

The second realization – the principle of representativeness – was formulated within the framework of complex ecological research projects, especially by UNESCO-MAB programme. It has become evident that, as the first step of a global conservation strategy, protected areas should be designated from all biocoenoses. This duty is especially urgent in case of threatened biocoenoses or of communities restricted to small areas. The international association of biosphere reserves has emerged from this realization. This planning consideration can be called extensive.

Global conservation strategies and activity plans (UNEP, IUCN, WWF programmes) based on these new theoretical foundations try to strengthen conservation activities from two aspects. First, the results of theoretical ecology should be applied in conservation practice more rapidly. Secondly, recommendations and concrete tasks should be formulated separately for each administrative level (global, regional, national, local).

In the following recommendations are presented for a plan helping optimum designation of protected areas at the national level, with a perspective on global and regional connections and possible local applications.

An ideal protected area is characterized by the ability to maintain high species richness and preferable species composition (many rarities, few disturbance tolerators) on the long run. To achieve this, a spatially continuous habitat complex is required, which contains all seral stages of the given successional network in appropriate dimensions and also the possibility of interchanges among them is given. If any stage of the network is missing, only the spontaneous endurance of climax communities can be expected. Pioneer and mid-successional stages can only be maintained by special conservation measures (intensive planning consideration).

On the other hand, within a wider geographic region (biome, biogeographic unit) a representative network of protected areas is necessary. This network should contain not only characteristic geographic variants but also the whole spectrum of disturbance-tolerating species and coenoses (extensive planning considerations).

The existence of a small database (serving as a starting point) is a prerequisite for scientifically based accomplishment of planning considerations. It should contain the list of species occurring within the area, their locality data and conservation value. For each coenosis the data base should also contain the list of the representative stands, their extension, quality, possibility of preservation and reclamation.

It is plain from the foregoing that a close connection is needed between conservation biological research and the establishment of the network of protected areas. Though scientific concepts have only been applied controversially and inconsistently in establishing our present national network, it represent the nature of Hungary quite well. This is why only the plans for future designations need revision. Formerly gazetted areas need only possible border revisions, and the increase of strictly protected core parts. Furthermore, based on the results of ecological assessments, land appraisal, (re)classification, finer categorization and clarification of zone structure should be done. New management practices must be based the foregoing.

2.2 Survey and classification of habitat types according to threats

To lay the foundation of measures aimed at reducing loss of diversity, it is indispensable to create a database that contains classifications of habitat types, their conservation values and the threatening factors. Biodiversity is affected by both quality and adverse factors: in diverse habitats rich in rarities a relatively slight damage or impact can cause as large (or larger) loss of diversity as the complete destruction of less rich types with only a few specialities. So the general assessment should be based on the status of the species: conservation value of a given species is higher if it occurs exclusively in endangered habitats.

Estimation of vulnerability of habitat types is based upon the following:

2.2.1. Risk factors

Commonness. Approximation by estimating representation in small geographic regions.

Distribution. A simple areal measure.

Dispersion. A measure created by utilizing the number, size and distribution pattern of isolates.

Degradation. Ratio of characteristic occurrences to that of differently degraded stands.

Protection. Ratio of protected stands to unprotected ones.

A task accompanying the latter point is the construction of the Red Data Book of endangered habitats.

2.2.2. Concrete detrimental factors

First of all, the range of detrimental factors must to be determined for each habitat type (e.g. open rocky grasslands: opencast mining, overpopulation of game, mass tourism; drying fens: drainage, flooding, peat-cutting, intensive grassland use, afforestation). Secondly, susceptibility of each habitat type to specific factors and their combinations should be discovered. Finally, the proportion of areas affected by different factors and combinations must be estimated.

In all probability, such a survey will not change conservation assessment of the most rarest and the most common species and habitats. On the other hand, new findings might be expected with regard to species and habitats with moderate or unknown degree of endangerment, for which even short-term predictions might also be provided.

3. Proposal for the establishment of a network of Environmentally Sensitive Areas in Hungary

Several areas with traditional land use have survived in East European countries including Hungary. Examples are: floodplains of large rivers with hay meadows, pastures and orchards; peculiar settlement structure and land use types of western Hungary along the Austrian border; species-rich hay meadows of submontane and colline regions; poor pastures of sandy, karstic and salt-affected areas. These traditional land use types have already been seriously affected by large-scale industrialized agriculture. Nowadays the development of intensive private farming may lead to disadvantageous changes. In the same time, abandonment of vast areas where farming has been uneconomical is predicted. This state of affairs calls for the introduction of a system (already implemented in EEC countries) which brings us closer to an environmentally friendly agriculture by applying management practices that make preservation of natural habitats possible.

The establishment of Environmentally Sensitive Areas (ESA) network is aimed at creating a more harmonious relationship between agriculture and nature conservation. ESA would guarantee the survival of the existing heterogeneity of the artificial landscape and isolated semi-natural habitats that could be otherwise destroyed by the intensification of farming. Moreover, the connection of these existing habitat islands by a network of "green corridors" (hedges- and tree rows, wooded zones, extensively managed grasslands, wetlands) is also aimed at. This would ensure the routes for animal migration and the communication among populations in cultivated landscapes. This could also help in preserving nature and in the maintenance of the essential biodiversity of traditionally managed areas. The position of Hungary in the Carpathian Basin presents a more general reason for introducing this system. Most of the watercourses originate in the surrounding mountains. They usually become loaded with varying levels of pollution before entering the country. From the Alps and the North Carpathians some watercourses with better water quality also enter the country. It is extremely important to protect the state of bordering mountains and hills around the basin. This explains why the Great Hungarian Plain should be surrounded (from west and north) by a buffer zone, in which especially environmental friendly agricultural practices should be implemented. These ESAs could also provide excellent opportunities for ecotourism and recreation by preserving nature, landscape values and traditional farming.

The IUCN – the World Conservation Union gives technical assistance for this project, moreover it supports the study tours of Hungarian experts to Western Europe. Full implementation of this programme needs sufficient funding; the PHARE (Poland–Hungary, Assistance for the Reconstruction of the Economy) of the European Community could be one possible source.

Designation of ESAs must conform to existing protected areas (e.g. ESAs could serve as their buffer zones). The legislative basis of creating ESAs should be codified in the Landuse, Environmental and Conservation Acts.

4. Development of a biomonitoring network

The objective of creating a biomonitoring network is to follow the changes of biodiversity under the influence of human impacts and the decisions and actions initiated by a national program for maintaining biodiversity. It is stressed that the objects of biomonitoring are not necessarily protected populations or stands. Valuable but unprotected isolated objects can be used as sensitive indicators, especially in extreme situations (close to tolerance limits). At presently the most urgent task is research (they will be detailed below). An equally important duty is to organize and create the operational and financial background of biomonitoring techniques.

5. Forestry and biodiversity conservation

Approximately 20% of Hungary is wooded or afforested, and the much of the presently protected 4% of the country's area is also forested. About 45% of the Hungarian flora (and a great proportion of different animal groups) live in forests. Consequently, forests play a fundamental role in maintaining species (genetic) diversity. This function can only be fulfilled on the long term if the whole system of forestry change to a more environmental friendly approach. This would result in a biologically based forestry serving sustainablity much better than profit-oriented wood production.

Maintenance of biodiversity calls for the implementation of the following considerations in forestry:

Forests should to be regenerated naturally by applying gradual regeneration cuts. This priority should be given regardless of financial or convenience motivations and the benefit of any interest group. Natural regeneration causes the least damage to the biota, the survival of native dominant and associate species is ensured. Forest plants are not threatened by temporally occurring weeds and adventives. This is the only way to preserve the genetic material of certain forest communities.

If natural regeneration is not possible for any reasons, the choice of species to plant is decisive. The restoration of native and semi-natural communities should be preferred, because in this way the original flora (and fauna) is not damaged. If habitat factors allow, creation of monocultures (e.g. pine and turkey oak plantations) should be avoided, whereas existing ones (alien black locust and cultivated poplar stands) should be restricted.

Afforestation of areas that still preserve the relics of pristine vegetation (the barren parts of Transdanubian mountains, calcareous sandy grasslands of the Kis-Alföld) should be avoided. Wetlands (fens, marshes), rocky and loess grasslands deserve special attention as important gene preserving biotopes.

- Cost and labour intensive silvicultural activities are often replaced by herbicides. Biodiversity is threatened and declined radically depleted by the residues of pesticides and herbicides. Consequently their use must be minimized and controlled.
- It is important to preserve valuable accessory species (crab apple, wild pear, wild cherry, St. Lucie cherry, rowan, whitebeams, aspen, goat willow, etc.) while doing regular silvicultural selection cuts. Producing and preserving species-rich mixed stands, secondary canopy and shrub layers enhance the maintenance of biodiversity.
- Biodiversity conservation sometimes requires active impediment of natural succession (otherwise mountain hay meadows would turn to birch or Scots pine stands, karstic scrub-woods are replaced by manna ash, etc.).
- Overpopulated big game of the woodlands must be controlled drastically in accordance with the carrying capacity of the particular area. Especially extensive damage is caused by wild boar and introduced species like mouflon.
- The conservation of biodiversity is also one of the urgent reasons for the earliest possible establishment and maintenance of a network of forest reserves.

6. Ecologically based restoration tasks for maintaining and enhancing biodiversity in Hungary

Ecologically based artificial restoration techniques must be elaborated for areas that are seriously damaged and isolated from natural vegetation. These have to harmonize local and regional environmental conditions and they should not impede natural succession. Moreover, they should take vegetation dynamics and stability into consideration. Effects and results of former restoration and recultivation projects need to be assessed.

Experience learnt by now suggests that multispecies assemblages of many native plants capable of development should be preferred. The regular practice of restoration (preference of monocultures incapable of development and resistant to invasion by native species, but sensitive to weeds) must be revised. Current regulations of recultivation must be revised in the long run.

7. Biodiversity and environmental policy. Integration into the European information network of nature conservation

The importance of biodiversity has already been recognized in western countries. One sign of its valuation is the CORINE (Coordination of Information on the Environment) Biotope Programme, which was started in 1985 by the European Community.

Within this project data collection and information exchange about species and biotopes of European importance are possible using standardized principles. In this way a unique standard was established for providing reliable information on fragile ecosystems and species from the whole European Community. This classification serves as the basis for determining priorities in nature conservation and for assessing the effectiveness of conservation policies. The CORINE programme itself has introduced new approaches into regional planning and development, since it builds a "new dimension", environmental aspects, into the existing economic practices by acknowledging the value of natural resources.

Hungary joined the CORINE Biotope Programme in late 1991 (as part of the PHARE programme). This integration is not only the interest of nature conservation, but is also a milestone in the process of an European integration. The question is whether we can succeed in changing our attitudes, whether we can implement these Europe-wide accepted principles and attain wider recognition of biodiversity.

8. Important research tasks

– It is necessary to determine optimum stand-size for each vegetation type and mosaic from the viewpoint of conservation and regeneration.

- Population biological analysis and comparison of primarily isolated (containing populations evolutionary adapted to isolation) and secondarily isolated (by fragmentation) plant communities (stands) need to be carried out.
- Filling up the database of the nature conservation information system needs to be speeded up. It is worth mentioning that the existing systems for assessing biotopes and landscapes (developed by the National Office for Nature Conservation, the Eötvös University and the Kossuth University) are not uniform and only partly comparable.
- A database of regional protection of species and biocoenoses (biotope types) should be created as soon as possible.
- It is urgent to prepare potential and existing biodiversity maps for Hungary.
- Maps showing the level of vulnerability for species and biotopes should also be made.
- Based on the maps listed above, the most appropriate sites, communities and populations should be chosen for biomonitoring and, following up diversity changes. The theoretical and methodical bases of a biomonitoring system must be decided. The combination of applied methods should be determined. Object-oriented monitoring techniques should be chosen. The practice of collecting and evaluating remote sensing data (areal and satellite images) is to be established. Information gained in this way needs ground truthing.
- Assessments based on nature conservation rank values of species should be improved and applied.
- A national coenological data bank should be developed.
- As a final goal, setting up a coherent information system is desirable. This system could process data on biodiversity status effectively and also communicate with other existing databases.
- Standard areas should be designated primarily in national parks (by taking the zone structure into consideration) for developing the basis of environmental monitoring. These should conform to the recommendations of the International Geosphere-Biosphere Programme.
- Basic research in restoration biology should be supported. The following need to be described by a national data collection programme: areal distribution of damaged communities, factors hindering restoration, areal distribution of refugia providing native species, vegetation types to be be tragetted to be restored for each part of the country. Experiments on a long-term vegetation dynamics should be started using permanent quadrats which could lay the foundation for restoration techniques that increase biodiversity.

9. Nature conservation strategies for preserving the biodiversity of animal communities

9.1. Biodiversity of animals

Biodiversity, the variety of species and their assemblages, is the greatest and most characteristic among animals. Millions of extant species, compositional and structural varieties of communities are all characteristics that call for multiple interpretation of diversity, and also for many different strategies of diversity conservation. The most well-known components of this multiplurality are taxonomic and genetic diversities that are manifested in the variety of forms.

The causes of the development of these diversities may be found among coexistence relations at the level of homo- and heterotypic assemblages. Suffice it to refer to the role of niche differentiation in speciation, or to the selection of alternative strategies in character groups and metapopulations, or the importance of mutualistic and competitive interactions in coevolution.

Besides the most frequently mentioned taxonomic and genetic diversities, there are some other aspects of zoodiversity, which are usually neglected and are not taken into consideration. Diversity of life histories is one example. By the extinction of certain species, in addition to the loss of taxonomic diversity, we also have to face the loss of evolutionary strategy patterns. As another example, the variety of interactions within an animal community can be mentioned (e.g. competition, trophic relations, mutualistic interactions). These could all be called "interaction diversity", which essentially determines community connectivity and consequently contributes to community complexity. Moreover, in many communities these interactions play a regulatory role, so their loss can degrade regulatory mechanisms. If we add that zoodiversity plays an important role in maintaining the diversity of vegetation, it becomes even more evident that preserving zoodiversity is important not only from zoological, but also from general biocoenological and theoretical aspects. Since zoodiversity has special characteristics, it is plain that it requires specific methods for its preservation.

9.2 Threats to zoodiversity

9.2.1. Direct intentional killing

Although its importance has decreased as regards vertebrates, it should not be overlooked. Nowadays it mainly affects the invertebrate fauna. The use of pesticides and insecticides has harmful effects from the conservation point of view. It can also have economically disadvantageous effects, e.g. by wiping out predators and parasitoids that otherwise control pests, if the models and rules worked out more than 50 years ago that are capable of forecasting hazards and, are neglected (e.g. Lotka-Volterra and Nicholson-Bailey models, Volterra rule).

9.2.2. Indirect killing

There are three branches of economic activities in Hungary that are especially dangerous since they cause loss of zoodiversity:

- Monocultures, the characteristic type of many forests and plantations, decrease the choice of food plants. As a consequence the development of diverse animal communities is hindered. On the other hand, monocultures enhance the possibility of pest outbreaks, which also results in loss of diversity. Excessive use of artificial fertilizers can have similar effects.
- Unreasonably high densities of certain game species caused by intensive game management has disadvantageous effects. On the one hand, the equitability of the communities decreases. On the other hand, equilibria developed in interactions (e.g. competition) are shifted (a good example is the shift in the abundance ratio of pheasant and partridge populations). Predator controll that accompanies game management, has harmful effects among other thing by impeding the positive effects of predators on diversity.
- Overuse of grasslands and waters (e.g. overgrazing, introduction of phytophagous fish, etc.) causes shortcuts in nutrients cycles, simplification of energy pathways and impoverishment of trophic networks. All these result in decreasing population and interaction diversities.

9.2.3. Habitat changes

Three types of habitat changes can affect zoodiversity.

- Degradation. In most cases degradation means that habitats loose their characters and become homogeneous. Diversity structures of the fauna and animal communities change. Populations of minor conservation importance with opportunistic strategy become more dominant. Certain less intense degradation processes can cause increasing diversity by "diluting" the original community. However, this can only be called pseudo-diversity, since it is the result of the appearance of populations undesirable for conservation.
- Range reduction. The size of seminatural areas has abruptly decreased and some habitats have completely disappeared in Hungary, especially in the Southern Great Plain, as a result of spreading residential and industrial areas. Range reduction of habitats affects mainly the populations with large territorial requirements and their communities. Top predators that are usually threatened otherwise, are among these populations.
- Isolation. Fragmentation of seminatural areas and the isolation of fragments are among the most serious problems of nature conservation. In Hungary, these processes are especially intense and dangerous in the Great Plain, where seminatural areas, including reserves, are scattered in the "matrix" of arable fields and other cultivated areas. Given this situation, any further iso-

lation like the destruction of gallery forests, wooded roadsides and any other ecological corridors, can have serious irreversible consequences.

9.3. Measurement of the status of diversity and its transformation

9.3.1. State assessment

– Different seminatural and degraded communities should be assessed in terms of composition and typical diversity patterns (e.g. species number, evenness, dominance-diversity curves etc.). Populations and regulatory mechanisms, playing a key role in maintaining diversity patterns, should also be determined.

9.3.2. Measurement of state transformations

– A monitoring system capable of surveying changes in community composition and diversity patterns by continuous routine observations and measurements should be worked out.

Since species richness and technical difficulties of sampling and problems of identification in animal communities do not allow complete monitoring, at typical standard sites one should be content with monitoring so-called reference coalitions. These reference coalitions have to represent the most characteristic features of the whole animal community. Such features are characteristics of indication and stability, territorial requirements, the need for habitat homogeneity etc. The practice of "umbrella group" is not acceptable, since it uses only one group (generally birds) to characterize animal communities and to follow their state transformations.

9.3.3. Detailed studies at reference sites

– The routine observations described above do not provide information on several important characteristics of biocoenoses that are substantial for zoodiversity, e.g. richness in interactions, the stability of assemblages. For this reason at some special study sites detailed research on community ecology needs to be carried out to comprehend these features. After these characteristics are understood, it will be possible to judge connectivity and stability of coenoses from their species composition.

9.4. Possibilities for preserving zoodiversity

The measures arranged under this subtitle are roughly equivalent to the tasks of the so-called passive nature conservation.

9.4.1. Direct protection of populations

Direct protection is necessary and adequate with specially endangered populations that play a key role in maintaining diversity (e.g. certain top predators). Since the tasks and methods of protection are dependent on the target population, no general recommendation can be given.

9.4.2. Protection of animal communities

Conservation of diversity and connectivity characteristics of whole animal assemblages is only possible with knowledge of susceptibility and stability of communities, which must be based on the results of researches described in 9.3.3. Tolerable levels of stress and perturbation, and environmentally friendly ways of land use not threatening animal assemblages can only be determined on the basis of the foregoing knowledge.

9.4.3. Habitat protection

Both in Hungary and abroad, habitat preservation is usually associated with the protection of plant communities of the area. This approach is similar to the "umbrella group" approach mentioned and criticized above, and is not likely to provide effective strategies for the protection of animal assemblages. The space requirements of animal communities are different from those of plant communities. They usually perceive and indicate their habitat on a larger scale in a rather fine-grained manner. This is why the minimum area necessary for the development of an autonomous animal community, exceeds that of a plant community.

Heteromorphy of space also plays an important role in maintaining diversity. The reaction to spatial heteromorphy (its indication) is the basis for judging whether the habitat is homogeneous or heterogeneous for the community in question. Neglecting indication of heteromorphy in organizing habitat protection can result in considerable decline and impoverishment of animal assemblages.

9.4.4. Local and regional aspects of conservation

To take local measures to preserve zoodiversity (e.g. at habitat level) it is rarely sufficient. The regional dependence of local communities is obvious. There is a certain probability of extinction of each population in each habitat. Consequently, the lack of propagule supply from the neighbourhood can cause the extinction of the population causing diversity loss for the community. It is also the prerequisite of biotic succession that a sufficient supply of propagules, originating from the populations that are characteristic of the successive seral stage, is available.

It is also important to stress that many populations exist in the form of fragmented subpopulations or by forming metapopulation. Hence, it is also important to organize the protection of metapopulations, so that the abundance of local and subpopulations should not fall below a critical limit that would threaten the persistence of the whole metapopulation.

Strip-like habitats, the so-called ecological corridors are vital for both communities that have been fragmented into isolates and for populations that persist by regular migration. Preservation of valuable zoodiversity can be assisted by sensible maintenance of ecological corridors, and by creating barriers on corridors in which degradation, impoverished assemblages and undesirable populations can spread for nature conservation.

9.5. Essential tasks

The problems outlined above and the recommendation for the principles of diversity preservation imply the most important tasks, so they are only briefly summarized. This activity can be divided into two parts: research and necessary conservation measures. Recently we have seen some good experiments for combining these two but there is still a lot to be done in this field. Scientists must introduce high quality research on conservation biology and adapt them to Hungarian circumstances. Conservation practice should establish monitoring network capable of providing data and information continuously for developing necessary measures. Concrete tasks are the following:

9.5.1. Development of conservation oriented research programmes

Some urgent research tasks, for example:

- It is essential to further develop the methodical basis of diversity measurements. Conventional metrics are not always suitable for solving special synzoological research tasks. Good examples are analysis of interaction richness of assemblages and, measurement of the diversity of strategies.

For the latter, conventional diversity functions and indices may not be appropriate. Pattern analysis of points, representing populations in a population attribute space, or in its transformed factor-space, may be a solution.

- It is important to study indication characteristics and space requirements of animal assemblages. It is necessary to know environmental tolerance characteristics and their manifestation, in order to be able to preserve populations and communities. We still have a lot to do in this respect even at the population level. The knowledge of collective tolerance features is extremely weak. For example, we know very little about the relationships between the indication of spatial heteromorphy and the space requirements of animal assemblages, and about the possibilities of using this knowledge in preserving these assemblages.
- It is also important to study susceptibility and stability of assemblages. Several plant ecological studies of this kind are known from Hungary. However, zoologists are still to investigate the stability and susceptibility of at least the community types that play a key role in maintaining biodiversity. Lacking this knowledge, concrete activity plans would be unfounded.

9.5.2. Operating a monitoring network

Hungarian ecologists have urged the establishment of a monitoring network for decades. Within this network routine observations and measurements should be carried in at characteristic habitats to assess the status of biodiversity, to detect state transformations and to support actual measures. Lacking this network, the current status assessment of Hungarian national parks is being done by different research institutions imposing an extra load on them, since this work is different from their basic activity. Considering that this current assessment must be continued by regular monitoring, the establishment of this network is a pressing need.

9.5.3. Preparing habitat inventories and maps

This activity is closely related to the tasks described in 9.5.2., but it requires more comprehensive and sophisticated scientific studies. Fortunately, as a result of researches carried out in certain important protected areas (e.g. the national park programmes of the Hungarian Natural History Museum), we have a lot of valuable data. These data should be filled in an easy-to-use geographic information system. Working out the zoological part of an alike system would make it possible to combine local results (described in 9.5.1. and 9.5.2.) with landscape and regional scales.

9.5.4. The planning and initiation of regional actions

Although in the 1950s and 1960s a kind of regional approach was adopted in Hungarian field biology, in recent times local programmes have become characteristic again. This is especially true for conservation actions and measures, though there are some important exceptions (e.g. efforts of national parks, Hungarian programs of WWF). Important regional tasks are: continuation of research in the Tisza region; complex Danube research at the landscape scale; development of regional programs as the planned Great Plain Program.

PRESERVATION OF TAXONOMIC DIVERSITY AND THE PROSPECTS OF ITS CONTINUED MAINTENANCE

Béla Dános, Zoltán Kereszty, György Kovács, Ferenc Németh, László Papp, Attila T. Szabó, Zoltán Varga

1. Biogeographic aspects of taxonomic diversity in the Carpathian Basin

The Carpathian Basin has great importance in biodiversity preservation. Due to its transitional geographic position, it is characterized by the overlap of different biogeographic regions and by the joint occurrence of floral and faunal elements with different distribution centres. The great variety of floral and faunal elements is especially characteristic for the transitional outer margins of the basin. Such area is, e.g. extreme western Hungary, where effects from the Eastern Alps (praenoric) Western Mediterranean (illyric) and the Pannonic region meet. Specific effects are brought together in the Gömör-Torna Karst: the distributions of boreal, Carpathian and arid montane (xeromontane) elements overlap here with the northern distributional limit of the characteristic fauna and flora of the Pannonic steppe-woodlands. Similar overlaps occur in the Bükk Mts., whereas because of different types of bedrock, the Zemplén Mts. shows slightly different pattern. The Tokaj Hills have a special character, since Pannonic effects are manifested in the occurrence of more continental unique steppe elements. Another example of unique, border areas of high diversity is the Bereg-Szatmár Plain, where extensive hardwood gallery forests, resembling those of the Dráva Plain, surround the islands of *Sphagnum* bogs occurring in filling former river branches and island volcanoes preserving Transylvanian (Dacian) relics.

Another important biogeographic aspect of taxonomic diversity is history. At places where local factors allowed the development of extra- or azonal vegetation (by impeding zonal effects like the development of postglacial forest phases), relics of varying age and character could survive. Moreover, certain specific or subspecific neoendemisms could evolve.

Dolomitic areas are good examples, since because of the special physical weathering of dolomite, the conditions on this bedrock resemble arid high mountains. Under these circumstances, several species of former historic phases have persisted, and because of isolation, several endemic and subendemic plants and animals have evolved in these sites (*Linum dolomiticum, Seseli leucospermum, Phyllometra culminaria, Gnophos variegatus cavus, Euxoa vitta vitta, Chersotis fimbriola fimbriola*, etc.). Some karstic plateaux have preserved plant and animal rarities of xeromontane origin (e.g. Gömör-Torna Karst). Relics of late glacial and early postglacial cold steppes occur on loess walls (*Eurotia ceratoides, Kochia prostrata, Agropyron pectinatum*), whereas the steppe and steppe woodland relics of strongly continental postglacial climatic phases occur on loess, sandy, dolomitic and karstic areas (*Adonis transsylvanicus, Crambe tataria, Salvia nutans, Dracocephalum austriacum*; several Orthoptera species: *Saga pedo, Stenobothrus eurasius, Isophya costata* etc.; Lepidoptera: *Plebejides sephirus, Cucullia formosa, C. absinthii, C. xeranthemi, C. dracunculi, C. mixta, Euxoa distinguenda, E. hastifera, E. segnilis*). Several southern elements of karstic white oak woods and xerothermic oak woods expanded from Asia Minor and the Balkan during the climatic optimum of early postglacial times. At the other extreme, there are several boreal-continental relics originating from one of the postglacial cool periods. These historic biogeographic effects have contributed significantly to the considerably high level of biodiversity still preserved in Hungary, although there are no high mountains and seashores, more than 70% of the country is cultivated and, only one third of the forests can be called seminatural (not plantation).

2. Development and updating of red data lists. Databases on vulnerability

Taxonomic diversity expresses biological variety including diversity of supraspecific taxa and infraspecific forms (species, varieties, hybrids). However, in most cases determination of taxonomic diversity is based upon species, so preservation and increase of taxonomic diversity should be based on species protection and on optimizing species' conditions. Systematic and effective conservation cannot be practiced without determining what needs to be protected and their relative importance. Traditionally, this information was extracted from the proposals for protection submitted by researchers of botanists and zoologists so it unavoidably contained subjective elements. Later, a more systematic survey were initiated. Habitat and community-focussed proposals have elaborated long-term plans for designating areas for protection. Taxonomic aspects have appeared in red data lists.

It was in the red data lists, where the first reference was made to the principle (not emphasized sufficiently even nowadays) that the aim of conservation is to preserve not only the "collection of rarities", but also "completeness". The practical reason for concentrating the efforts on rarities was the shortage of resources. We have always believed that the more common species can survive without special protection until we have the chance to deal with them.

Nowadays both long-term plans of designating protected areas and red data lists need further development. The increased rate of destruction of the flora and fauna cannot be followed in recent times. This tendency is the most characteristic of a wide range of moderately rare species. Even if the rate of species extinctions does not increase on the short run (at least in temperate regions), there may be long-term risks, because more and more unthreatened or only potentially endangered species, may qualify for a status of varying levels of vulnerability.

The need for more detailed and flexible (easy to update) surveys is in good agreement with the revolution of computer techniques which enables the development and regular use of multidimensional, expandable and modifiable databases. These data bases in most cases verify (rarely disprove) priorities that were determined intuitively. They also point to the existence of huge yet unknown areas. This is true not only for defining the set protected species, but also for organizing the network of protected areas and for determining the strategies of active conservation (management, captive breeding). It is obvious that our limited resources should be concentrated on the protection of the most valuable and endangered species, though objective estimation of conservation value and vulnerability is not an easy task. Developing appropriate assessing methods is a challenging research task that cannot be done lacking multidimensional data bases of species' vulnerability. These data bases could also give the most obvious estimation of the biodiversity of certain areas.

As a first trial, in 1980 the National Office of Nature Conservation and Environmental Protection worked out the structure of a data base. It was filled up with data in the Botanical Department of the Hungarian Natural History Museum in 1991. By keeping it updated, the status of vulnerability of the Hungarian flora and the composition of most the threatened groups can be estimated approximately. However, status assessment of the more numerous moderately rare species requires the refinement of scaling methods and more intensive field surveys.

It can be done parallel with the studies on locality-based aspects of biodiversity. Data capture for the Nature Conservation Information System (KVI, 1987-1988) has been going on for several years, and is the most easily adaptable work of its kind, though up to now only data of protected areas have been entered. A similar, extremely versatile plan (Kossuth University, Debrecen, 1985) also contains valuable components, but its complete implementation is unrealistically labour intensive demanding (an earlier version was much simpler and realistic). In order to integrate into international cooperation, it is necessary to reconsider the used scales from a regional and global perspective.

The variables and scaling considerations used in the Hungarian flora database are the following:

- phylogenetic isolation (monotypic family, genus, subgenus, well-defined specific, or infraspecific (approaching specific level) status);
- global size of range (for Hungarian species on a five-class scale in comparison with the Pannonic floristic region);
- disjunct character of distribution (relation of Hungarian populations to the whole distribution: central position, edge character, locally relic or adventive character);
- extension of Hungarian populations (from local unique species to species common throughout the country);
- estimated size of Hungarian populations (on exponential scale);
- trends of expansion and/or decline determined by comparing the literature and field data;
- resistance to degradation inferred from phytosociological characteristics.

(A similar system has been partly worked out for well-known groups of animals.)

Another system for flora assessment (Simon, 1984, 1988) uses the following categories: unique and rare species (endemisms, relics), strictly protected species, protected species, community dominants (edificators), native associate species, native disturbance tolerators, native pioneers, adventive species, cultivated species, cosmopolitan weeds.

A data base that could combine the advantage of the foregoing system would be a multidimensional red data list. The considerations applied for developing the foregoing could be used for other reference groups of organisms (vertebrates, relatively well-known invertebrate groups like dragonflies: Dévai, 1988).

Revision of lists of protected species and areas could become scientifically sounder and better documented by the use of these databases. They could also be used for determining priorities of active conservation measures (special land use, captive breeding, reintroduction etc.).

If such a database were supplemented by specially planned monitoring-like field observations, it would provide information on the effectiveness of conservation measures.

This data base could be improved by the results of genetic and biochemical screening, which provide information on possible short- and long-term economic applications.

– Research results of the past 30-40 years can be easily wasted if the conditions for establishing databases on the vulnerability of certain reference groups are not ensured, since it will be impossible to keep the results updated.

3. Problems of detecting biodiversity, as exemplified by Hungarian zootaxonomy

Considering animals, the main obstacle to scientific monitoring of the biodiversity crisis is the lack of well-trained taxonomists in Hungary. The present institutional background is not sufficient, and even the existing institutes face financial difficulties and some of them are threatened by closing down. Even under the given circumstances Hungarian zootaxonomist need to revise their research and publishing practices. Progress might be accelerated by introducing some new methods and by getting even rid of illusions. The current number of entomologists has for long been insufficient to cope with the tasks to be carried out (discovering species diversity, producing handbooks, identification keys for helping applied researcher, performing applied studies to help nature conservation etc.) for ages.

Similarly to worldwide patterns of most of the existing species diversity being due to insects, most of the fauna of Hungary is composed of insects. According to a rough estimate half of the 40,000 species occurring in Hungary are dipterans and hymenopterans, there are about ten thousand coleopterans and lepidopterans, whereas all the remaining groups (of which the most numerous is Chelicerata) make up ten thousand. Hungarian vertebrates are 1.4% of the whole fauna with about 550 species, though they are the most often cited group in nature conservation.

Staff for pure and applied vertebrate research has been available though not invariably. However, there are no experts of certain invertebrate groups, especially among insects. Because of the foregoing, deficiency is also uneven. The fact that the taxonomists still active nowadays are not able to identify more than 40% of the hymenopteran and dipteran species, respectively. This fact, together with the existence of several "orphaned" groups means that it is not possible to have every third species of the Hungarian fauna identified.

Zootaxonomy has been at a disadvantage for decades; one consequence of this is that this field is contra-selected. However, zootaxonomy, particularly insect taxonomy, is one of the scientific fields in which Hungary has played a leading role, and we have preserved this relatively good position. This seeming contradiction can be explained by two things. On the one hand, we have managed to preserve and develop our huge animal collections (especially in the Hungarian Natural History Museum, Budapest). On the other hand, as a result of fortuitous circumstances, talented and tenacious researchers have remained or have chosen this field in sufficient number. The collections that had been established with self-sacrificing work and a lot of invested money in the last century, can pay their "interest" only if continued work by hardworking qualified experts is ensured.

There are only two alternatives for the decision-makers responsible for biodiversity research:

1) To make every possible efforts to employ young talented zootaxonomists to fill existing vacancies. (Immediate positive decisions would have apparent results only 6-8 years later, since this is the minimum required time for a talented young taxonomist to be able to do routine identification and revisions.)

2) Simply to forget to refer to the millions of insect species that become extinct while talking about the biodiversity crisis.

In this seemingly hopeless situation of zootaxonomy, it is the moral obligation of scientists to search for solutions that help rapid development. We must not resign ourselves to reaching soon an era in which nobody cares how many species of insects and other animals had been unknown and remain so forever.

Over and above encouraging steady work, we must state that the noisy worry about the unknown and extinct species has become ridiculous and insincere, since it has not been coupled with providing extra resources and by creating new jobs for young talented taxonomists.

We do not know if there is any good method for speeded up identification of unknown animal species and for the quickened recognition of rare species. But we do not believe, that aiming at a sort of record, conscientious taxonomist can let the quality of descriptions fall. Nor can they get rid of other responsibilities for the coming decades just to keep a faster pace. The only way to achieve considerable progress is to train many young experts and involve them in this work.

4. Species protection in original habitats

The most effective way of preserving biodiversity is protection in the habitats themselves: the so-called *in situ* conservation. This method is dealt with in another chapter of this paper. Large continuous reserves (national parks, landscape protection areas) preserve taxonomic diversity by maintaining community diversity, and in most cases they sustain genetic variety properly. In other instances the size of the area (woodlot, patch of grassland, small mire) has decreased so much that it has become insufficient for sustaining the necessary genetic variability. In many cases protection is restricted to preserving a few rare "target" species, and it is done *in situ* by contructing fences and setting up buffer zones (e.g. the only Hungarian population of *Salvia nutans*). In other cases habitat requirements of the rare species are ensured (e.g. *Iris spuria*). It is quite common that the conservation of rare species is thought to be guaranteed by extending protection to the area, though with small population areas need to be closed off within the protected area. However, protection of the species cannot always be guaranteed by complete enclosure and by trying to maintain constant conditions. Continuous or temporary disturbance (mowing, grazing) is necessary for maintaining certain species. In situ preservation of small populations should be complemented with other methods that will be discussed below.

5. Species protection outside the habitat

Nowadays there are more and more cases when *in situ* conservation is either not a sufficient solution in itself, or it cannot be carried out at all. At present there are several artificial means to support the protection of species, populations or genetic resources. They include artificial habitat maintenance, habitat imitation, sample collections of different populations, germ-banks. Whenever the species are removed from their original habitats, we talk about *ex-situ* conservation. Translocation to an artificial environment or to new sites can have different aims and extent, ranging from the type of vegetation best resembling the original habitat to experimental sample collection of populations. Gene banks, seed banks, germ banks and lately gene libraries (genome banks) are suitable for long-term storage and preservation of living or latent plant genetic material under natural, refrigerated or deep-frozen conditions.

The term "gene bank" has several meanings. In fact, all methods of conservation that ensure the preservation of a species or any other taxa, or the (ecologically) complete genetic diversity of a given population, community or biome, can be called gene bank in the wider sense. Hence, there are plantations of living individuals, where several hundred randomly selected then transplanted individuals preserve the genetic material of the whole population, or the similar genetic resources of a population are reserved in the form of seeds.

In a stricter sense, only the conservation of direct genetic organs (germ bank, gene library) can be called a gene bank.

The maintenance of the species driven close to extinction calls for artificial propagation mainly laboratory methods (cell, tissue and organ cultures) widely used in biotechnology. These could be called *in vitro* methods of conservation.

Nowadays effective international cooperation in biodiversity conservation cannot be imagined without the use of all the above methods of conservation biology. Artificial methods can never replace *in situ* maintenance and conservation, but rather supplement them. Consequently, it is also a principal task in Hungary to apply these conservation methods in the framework of a well-coordinated unified programme.

In addition to being gene bank, collections of living plants can be efficiently used in education, and they can also provide material for researches related to biodiversity conservation (e.g. for plant breeders who increase genetic variety by producing new genotypes via interspecific or intergeneric crossings). The relative disadvantages of these collections are the high maintenance costs and the space requirement. Controlled pollination, necessary for plants reproducing by seed and for annuals, and prevention of hybridization create extra costs. Special care is required because of the increased sensitivity to diseases characteristic of monocultures.

The most common *ex situ* method is the storage of seeds, which is possible either in disinfected rooms, or by deep-freezing. The advantages of seed banks include small space and laboratory capacity they requirements and, relative low specific cost. Their disadvantages are the need for reliable continuous power supply and the necessity of periodic renewal of seeds. The safety and effectiveness of the method can only be guaranteed by creating duplicates, in the form of international cooperation if necessary.

Meristem cultures are especially suitable means of long-term preservation of genotypes. Their economic significance lies in that changes in gene frequency, which may be considerable even in living gene banks, are halted, at least temporarily. Optimum conditions for regeneration can be found for all taxa by this method, which also provides the means of preserving the polyploid lines of each taxon in the cleanest possible form. According to current research results, about half of the Hungarian plants are suitable for producing meristem culture. The possibility of storage by deep-freezing (cryo-preservation), a routine practice in case of certain species, should be explored. However, meristem culture does not ensure long-term maintenance of species.

The gene library is the latest achievement of biological sciences. They make the storage of whole genomes possible for a long period in deep-frozen form. No repeated renewal is necessary. These genomes can be transferred to other genotypes, but whole individuals cannot be created by this method.

6. The role of botanical gardens in conserving diversity

Ex situ conservation highlights the importance of related basic and applied genetic, taxonomic and reproduction biological research all over the world. The discovery, appropriate utilization and preservation of plant resources can be carried out optimally in botanical reserves, considering both scientific and economic conditions. The term reserve includes every institution where the diversity of (all or part of) existing plant species is represented accurately and scientifically in a collection: botanical gardens, arboretums, zoological-botanical gardens, greenhouses, aquariums, protected areas, national parks, clone collections, scientifically managed castle gardens and parks, cultural plant collections and exhibitions, field gene banks, agricultural experimental stations, experimental and demonstration collections of research institutes.

Botanical gardens should be emphasized, since the action plan of biodiversity conservation can be best exemplified on their activities. In botanical gardens it is possible to maintain, to study (by making continuous scientific observations) and to reproduce stands of both wild and cultivated plants. They also provide opportunities for parallel and equally important ecological, physiological, taxonomic and reproduction biological researches. Because of the incompleteness of information on ecology and systematics, programmes aiming at biodiversity conservation cannot be accomplished without coordinating optimally these two disciplines.

Originally, botanical gardens were not founded for biodiversity, so now they are forced to change their activities somewhat. In addition to traditional collections with systematic groupings, there has been an increasing need for units representing the interdependence of biological systems: successional series, vegetation samples, etc. These activities are supplemented by the organization and coordination of *ex situ* conservation programmes. Preparation of the strategy for collection improvement, taking into consideration the potentials of the garden is also an important task.

Coordinated conservation of the genetic resources of the Hungarian flora would be served best by the establishment of a network of botanical gardens. The 1500 botanical gardens of the world play three roles: preservation, cultivation and development. By now about 14000 rare, protected and/or otherwise important species have been preserved ex situ, but in a rather uneven distribution. It is obvious that an international network of botanical garden has prominent importance for conservation biology, since it could optimize the exchange of both information and plants. There is a good reason for the developement of national networks. Probably the best admirable example is the network in Mexico. An European network, initiated by the Global Botanical Garden Network, has just launched. The aim of this network is to coordinate internationally not only conservation biological, but also any other activities of botanical gardens. It would be beneficial for Hungary to join this organization, but first network of the national botanical gardens must be set up.

The introduction of conservation biological methods has directed attention to problems of proprietary rights: the content of the term "natural materials" has been widened since 1990. Nowadays it also includes biological material of genetic importance that needs to be preserved. This indicates the legal obligation and responsibility of Mankind to Nature, which can be best represented by botanical gardens as legal entities. They can take advantage of the change in legal terms without reservation and publicize the legal valorization of biological material.

Botanical gardens have the following tasks in conservation of taxonomic diversity: taking part in *ex situ* conservation of rare, protected and threatened species, taxa and populations. This contribution can take the following forms:

- Establishment and maintenance of gene banks – minimum 50 individuals;
- Establishment of population samples of 10-30 individuals, then development to gene banks by continuous breeding;
- Planting of a collection of population sample primarily for experimental taxonomic revision;
- Increase of the abundance of declining natural populations by replantation: for this, prior transplantation of parent plants and their careful cultivation in gardens, or the use of other population samples is inevitable for supplying sufficient yield of seeds. Hybridization should be prevented. This step can be followed by optimal propagation to obtain as many seedlings as possible and then they can be replanted to their original habitat.
- Prevention of the extinction of rare, protected species by developing methods of artificial propagation;
- Protection of local variants, forms and endemisms;
- Establishment of gene banks for cultivated species and breeds in accordance with the possibilities and capacity of the garden;
- Establishment of other gene banks, if possible: seed bank, germ bank, gene library;
- Exhibition of unique species with special attention to the representatives of the Hungarian flora.

Depending on local conditions, botanical gardens can also take part in *in vitro* conservation of rare, protected and threatened species, either by establishing a data bank, or by organizing an appropriate information network.

7. Maintenance of variability of wild fodder plants.
Preservation of wild medicinal plants

Researches aimed at studying the diversity of wild fodder plants, especially dominant grasses and legumes, have gained worldwide interest. The objectives of these researches are to collect the species, to study and to assess experimentally their genecological variability to store, maintain and use the variants in plant breeding programmes. Most of these species, like perennial rye-grass and clover, occur both wild and under cultivation. Therefore important research priorities of genetic resources of these plants include exploration of adaptive ecotypes, discovery of genecological diversity centres, collection and preservation of reserves, and utilization in breeding programmes. Special pasture and hay meadow management types, traditionally used in the Carpathian Basin, have also contributed to the diversity of the flora. Discovery and characterization of diversity centres, and transfer of genetic resources into national and international gene banks are urgent and important tasks of the Hungarian biodiversity action plan. Studies of botanical, genetic and ecological variety of natural populations have shown that diminishing habitats and changing management types have been coupled with the deterioration of population systems. Genetic vulnerability and erosion in this group of plants can also be prevented within the scheme of natural and artificial gene preserving systems (nature reserves, national parks, protected natural grasslands, meadow and pasture ecosystems, gene banks). Research results on grassland dominants in Hungary has shown the indispensable value of the great variety of genetic resources coding adaptive biological characters.

The worldwide use of natural materials as medicine, cosmetics and spices is considerable, and the observed trends project further increase. More than half of the materials already utilized for drug production in Hungary in the past decade originates from wild plants. On the other hand, it is sad that natural stands have been deteriorating and loosing productivity drastically because of environmental pollution and intensified cultivation. These phenomena are well indicated by the fact that the number of protected medicinal plant species has increased. At present 30 species are under strict protection.

- Considering the above, it is obvious that the preservation of the genetic resources of Hungarian medicinal plants, which are of European significance, is the basic national interest of the country for both scientific and economic reasons. *In situ* conservation should play the main role, but at certain suitable sites, but the implementation of other conservation methods may also be considered.

8. Role of zoological gardens in conserving diversity

During their history of more than 200 years, modern zoological gardens have always played an important role by the special exhibition of nature and wild animals, as permitted by the level of knowledge of natural history of the time. No medium has been found up to now that could replace this function of zoological gardens. This educational function was originally aimed at exhibiting wild animals and their behaviour. The scope of educational aspects has been widened during the past decade because of new ecological background knowledge and the increasing pressure of the environmental crisis. Nowadays the aims of exhibiting include not only presentation of species, but also making the public aware of the importance of nature and species conservation, by using exhibits of animals (and plants).

However, zoological gardens contribute conservation not only by education, but also by active participation in different programmes for preserving animal species.

It is generally agreed that the stock animal species kept in captivity, should be self-sustained on the long run to minimize the necessity for bringing in wild-caught stock. This purpose in itself should be considered a conservation activity.

A further aim is to try to keep the "wild character" of captured populations as much as possible for two reasons. Firstly, this guarantes the most faithful representation of the species. Secondly, re-introduction to the original habitat using parts of the captured populations may become a realistic objective in the case of certain threatened species. The prerequisite for successful species conservation in zoological gardens is international coordination. Individuals or smaller groups of individuals of various species can be found in different zoological gardens of the world. However, to achieve the aims of species conservation whole populations must be managed as a unit. Because of being scattered and sharing a common goal, zoological gardens have more cooperative than competitive recently.

The institutional background of coordination is being set up. National associations such as the Hungarian Zoological Garden Association are the building blocks, they are coordinated in regional associations, whereas the International Union of Zoological Gardens (IUDZG) is the summit organization.

Regional, mostly continental programmes have been organized for preserving threatened species in captivity (by now there are about 200) for example in North America, Australia, Japan, India, and Europe.

Though these programmes work independently, there is a centre for super-coordination. The Captive Breeding Specialist Group (CBSG) of the Species Survival Commission of the IUCN, is specialized not in animal and plant species, but in habitats and zoological gardens. It is the CBSG, together with other specialist groups on certain species, who determines which threatened species are in need of captive breeding.

The European Endangered Species Programme (EEP) was established in 1985. At present 25 countries (including Hungary), and more than 200 zoological gardens are involved. As the legal successor of the European Community Association of Zoo and Aquaria (ECAZA), the new European Association of Zoo and Aquaria was founded in 1992, and since that year EEP has worked as a permanent committee of this association.

The efficiency of information exchange among zoological gardens throughout the world is supported by a computer data base, the International Species Information System (ISIS). This data base is in the phase of exponential growth, and it is hoped that it will lead to the development of a standard studbook system used worldwide. Since 1985 members of ISIS have had access to internal softwares (ARKS – for cataloguing animals; MedARKS – veterinary purposes, SPARKS – for population analyses), that provide on-line connection to the centre. In July 1991 IUDZG and CBSG (IUCN) prepared the first draft of The World Zoo Conservation Strategy. The publication of the final version was expected by September 1993. There is a close kinship between this material and other publications (Caring for the Earth, 1991; Global Biodiversity Strategy, 1992) regarding both philosophy and format.

- It is necessity to coordinate *in situ* and *ex situ* programmes of species protection. There are considerable deficiencies of this coordination in Hungary (also in other countries). At the international level, the situation has improved due to the activity of CBSG.
- It is important to build connections between these two fields. However, there are two prerequisites for this. Firstly, *ex situ* conservation practiced by zoological gardens need to be acknowledged by *in situ* conservationists. Secondly, zoological gardens should accept this responsibility.
- Hungarian zoological gardens – with their intellectual and material capabilities – should play a more significant role in species conservation in the future.

9. National duties of conservation of taxonomic diversity

- The government, national and local authorities should declare concordantly, that tasks of nature conservation, including conservation of biodiversity, are of national significance. Financial, legal and moral backgrounds need to be ensured, so that executive bodies can enforce existing laws.

- It is desirable that a national network of biodiversity research be set up in co-operation between the nature conservation authorities and biological research institutes. For this reason the strategy of participation of zoological and botanical institutes and then action plan should be worked out. Institutes should be encouraged in finding a role best suited to their background and geographic location for building collections. Financial support and infrastructure should be ensured for them. All this would make it possible to coordinate the activities, enable fast flow of information and integration into international networks and programmes. Establishment and continuous operation of a national information system and data bank would support this work. As a first step, existing data should be collected and revised according to unified standards. Present state of the data base for justifying the protection of species is disproportionate. No reliable estimate of what is not known can be given, which is proven by the new floristic and faunistic discoveries of the past years. Surveys of incompletely known areas should be started without delay. For the planning of these surveys the criteria and methods, applied for the standardized Western European system of data collection and storage, should be considered (*c.f.* CORINE Biotopes Project).
- Taxa, communities and biocoenoses recommended for *ex situ* conservation should be selected, and priorities of conservation biological research must be identified though *ex situ* conservation must also be initiated. Rare, protected and threatened species and communities should be protected *in situ* as much as possible.
- An inventory of only potentially threatened populations should also be made, since they might be truly endangered in the near future. Red data lists need regular revision, since environmental hazards vary all the time. It is a top priority, as in several countries, to select species and communities in extreme danger or of unique value, and to assess their status and work out the strategy of their conservation. It is desirable that research organizations and conservation agencies work more closely together towards this goal, and that local administrative and educational institutions be involved in conservation activities.
- Basic and applied research on biodiversity and conservation must be strengthened. Without high quality taxonomic and ecological research biodiversity conservation cannot be achieved. For this reason financial support of these fields must be increased.
- Studies of the geographic and ecological variation of wild species of economic significance, chiefly grasses and legumes, should be carried out. It is necessary to collect taxa from as many localities as possible, and to store and preserve them. Ecological genetic investigations are also of great importance. The moist to wet habitats of these species (meadows, marshes, pastures) deserve protection for themselves, since they diminish at a constant rate.

- It is necessary to discover the populations of protected and endangered medicinal plants. They should be collected in gene reserves, the methods of their propagation (both traditional and biotechnological techniques) should be worked out. The importance of observations concerning medicinal plants of natural landscapes, has increased (geographic variation of drug production).

BIODIVERSITY IN AGRICULTURE

László Holly, Gábor Jenser, Dezső Surányi, Zoltán Szőcs

1. Definition

The following section is concerned with agricultural land (in a wider sense) such as cultivated areas (arable fields, gardens, orchards, vineyards), pastures, hay meadows, abandoned fields and ruderal areas. These areas together give most part (71%) of the country.

Plant communities, vegetation, cultivated flora, weed flora

In these areas there are plantations of cultivated plant species for the most part; originally natural associations modified by cultivation in the remaining and the usual weed communities in both. Species composition and spatial pattern of the first group (cultivated flora sensu lato) can be altered year by year. Those of the second group can be influenced, whereas the third group (weed flora) can adapt flexibly to human interference with spontaneous reactions.

Animal communities, domestic animals (sensu lato)

The spontaneously originated fauna of the agricultural fields consists of much more species than the cultivated or weed flora itself. For this reason agricultural animal communities are much less known, though intensive research has been done for decades. Especially plentiful data have been collected concerning insect pests of arable fields and gardens through the work of scientists and experts dealing with plant protection. In cultivated areas the number of harmful and beneficial insects depends on the method of cultivation and on the surrounding (e.g. semi-natural or natural) communities. If the insect fauna of meadows and pastures is added to this, a huge assemblage of insects is gathered both as regards abundance and species number, Pest like various species of rodents, pathogenic worms and other groups of animals are similarly important.

The species diversity of domestic animals has not changed significantly for a long time, but there have been many changes concerning breeds. Domestic animal breeds are also part of biodiversity. Their conservation is governmental responsibility as often is not economical. Landscape protection and tourism should incorporate conservation of these breeds. It is desirable that breeds, best suited to natural grasslands, should be protected in the frame of landscape protection by applying sound grazing regimes.

Different solutions of conservation problems, *in situ* or *ex situ* (deep frozen reproductive material) are equally important.

It is a scientific task to determine the viable population sizes to be kept considering the variability to be preserved and the breeding activity necessary.

Microbes

The diversity and abundance of soil microorganisms is extremely great. Both characteristics are significant in relation to soil fertility. The role and diversity of pathogenic microbes (viruses, bacteria, fungi) – though in a negative way – are also enormous considering both cultivated plants and domestic animals.

Biodiversity in these species groups and communities is defined as follows:

1) diversity of cultivated plants, bred domestic animals at the levels of species, breeds, varieties, etc.,

2) diversity of plants and animals which live in these areas or occur there spontaneously, at the levels of species and subspecies,

3) diversity and distribution of land use types (arable field, garden, pasture, etc.),

4) diversity and distribution of agricultural systems (large-scale farming, small farms, traditional farming, organic or bio-farming).

Hereinafter these will be called: cultivated species diversity, spontaneous species diversity, land use diversity, management diversity, and these four types together will simply be called diversity.

2. Aims

The natural potentials of Hungary provide the opportunity to create a much higher level of diversity than the present one. For a more efficient stewardship of the natural resources, it is essential to increase and optimize diversity. Low diversity – considering a farm or the whole country – may limit productivity and the utilization of resources. It diverts from stability (both ecologically and economically) and it also favours the processes of degradation.

Thus the creation of the greatest possible diversity permitted the natural potentials, taking into consideration existing social and economic circumstances, would be beneficial for the whole country. It is also a prerequisite for the harmonic development of agriculture.

The following is a contribution towards their goal:

An example: Climatic conditions in Hungary have always favoured the production of seed grains. More efficient utilization of this potential is in the vital interest of the country. The Hungarian seeds/grains used to be famous all over the world. Global climatic changes (dessication and warming) probably increase the potential of grain production, however it is impossible to utilize this potential at this level of diversity of cultivated species, land use and management. The revival of Hungarian seed grain production can only be expected if specialized farms are created which are able to grow many kinds of cultivated species at a high standard (cultivated species diversity). It is necessary to have different cultivation techniques (management diversity). Finally, these farms should large be enough (land use diversity) to be able to obtain significant production. (Obviously, apart from these many other economic, commercial etc. conditions are needed for development).

3. Increased diversity and stability

Increased diversity is coupled with increased resistance to disturbing effects in natural communities, too. Similarly, all the four types of diversity increase the safety of crop (as a consequence increase economic stability) both in a single farm and at the national level. They increase the probability of resistance to disturbance. Agriculture has been experiencing ever increasing levels and numbers of disturbing effects: along with usual fluctuations of weather, climate changes may result in extreme droughts, increased temperature and UV radiation. More and more new adventive weeds and hardly known agricultural insect pests appear, the impact of viruses can increase. Despite the use of herbicides and insecticides for many decades, classical diseases, pests and weeds present the same kind of threat as in the past. The spread of these diseases and pests is favoured by monocultures (as diversity minima). On the contrary, crop-rotation, mixed cultures, ruderal field edges, hedgerows, smaller field size and management diversity decrease their chances. They also prevent the development of chemical-resistant races, and strengthen the regulatory role of insect predators. Local breeds represent the most stable cultivation within a given landscape and agricultural district (crop safety, resistance), since they are the results of long-term selection and adaptation. The genetic adaptation developed in them needs to be valued. The combination of broad adaptation abilities meeting current needs with special local characteristics should be ensured by transferring advantageous local traits to new breeds.

4. Sources of decreasing diversity

Intensification of agriculture (mechanization, use of artificial fertilizers and chemicals) has decreased diversity worldwide. The same has happened in Hungary since the Second World War. Several species and breeds have been ousted, local breeds have become extinct. In the meantime large-scale farming has become dominant, land use forms other than arable fields have lost importance, even weed diversity has decreased. An overall degradation occurs in meadows and pastures: the number of species has decreased, aggressive weeds have became dominant.

It is important to stress the decreasing diversity (and also density) of soil microorganisms, which is caused by general soil deterioration (structural changes, decrease in organic matter content, acidification). Soil deterioration also includes secondary soil salinity caused by huge dams and/or inappropriate irrigation and soil compaction caused by heavy machinery. All these together have caused the degradation of agricultural habitats and have decreased their potential diversity. In other words they limit the number of potential crop species.

On the other hand, the damage caused by weeds, insect pests and microorganisms has not decreased: nowadays less species cause on the whole larger damage than experienced before. Part of this loss is indirect, since expenses of pest control cause economic loss.

Interestingly, during this period we have also faced the appearance of new (resistant) pests and weeds. Partly because of chemical weed control, and partly the result of global warming and dessication, several new (some of them adventive) weed species have multiplied in agricultural fields. They have even entered natural communities. Similarly, new insect pests have appeared in orchards: some of them are adventive species, but others are native species that have turned to be pests only recently. However, these phenomena can hardly be regarded as desirable spontaneous increase of diversity.

Long-term raison d'être of industrialized agriculture is questioned by the exhaustion and the relative increase in the price of fossil fuels and by serious damages to the environment. All these phenomena reduce the efficiency of expenditure by indirect losses. It is important to decrease and rationalize industrial inputs, and in the same time to optimize the use of agricultural resources.

– It is desirable that legislation in Hungary (Nature Conservation Bill and Environmental Protection Bill under preparation) should include preservation of biodiversity of agricultural areas as a basic prerequisite for sustainable development. Land owners or tenants should be supported in employing environmentally friendly techniques by a new Land Ownership Act. Economic subsidiary is also necessary to achieve this purpose.

5. Sources of conserving and increasing diversity

Some of the species and local cultivars that have been displaced in production, thanks to the work done by the gene bank network, are still present in these collections. So the opportunity of their propagation is given, though their direct use in recent mass production is recommended only within limits or locally. On the other hand they can serve as basis for increasing genetic diversity, for selecting resistant forms, for creating new breeds etc.

- These values should be appreciated again both among specialists and the general public. It should be realized that they are an important part of the national heritage. Their use and incorporation in production should be supported especially in the case of newly created small farms. Little known values kept in gene banks or botanical gardens should be made available and familiar to the public.

The Hungarian gene bank network maintains and conserves an extremely valuable material. All conditions should be guaranteed to make this work possible in the future as well. However, much of the valuable genetic material occurring in the country also important for agriculture, has not been collected yet. Extremely numerous local cultivars deserving protection can be found among vegetables and fruits. (Because of short-sighted administration several irreplaceable fruit cultivar collections have been discarded recently).

- The gene bank network should be extended and developed in the future. Permanent, long-term financial support should be guaranteed by legislation. It is the best investment to spend money on this project.
- Edible and medicinal plants together with all native forest tree species (all of their genetic variation) should be collected. Later this work should extend to the whole of the Carpathian Basin.

Local and traditional cultivars are most important as raw material for cultivating new breeds. Presently both their cultivation and the supply of appropriate genetic resources are problematic. These activities are uneconomic in agriculture. This is why in developed countries local cultivars are mostly dealt with by local "Seed Saver" organizations, though in France and in Germany state institutions are also involved.

In recent years, because of the high value of potential crop production, selection of new cultivars has been carried out under optimum conditions. As a result genes, that are responsible for tolerance against biotic and abiotic stress factors, have acted as genetic loads (in the lack of environmental stress), so they have disappeared.

- However, these genes can be found in old cultivars and in closely related native species. These forms should be collected to provide the basis for resistance selection.
- The system worked out for collecting and conserving local cultivars (having been run successfully by the Agrobotanical Research Istitute in Tápiószele for years) should be strengthened and extended. Farms and estates working inside the boundaries of national parks should also be involved in conserving both plant and animal species and cultivars.
- Being a part of the national heritage, all traditional Hungarian cultivars should be collected and preserved. They should be preserved and spread within (or as close as possible to) their original areas.

- It is extremely urgent to collect all fruit-tree cultivars (from the whole Carpathian Basin) and to preserve them in national cultivar collections and plantations. They should also be registered in a database.
- On the basis of international models, a quantitative economic assessment of the genetic values preserved in gene banks should be worked out. All selected species, local cultivars and native species with agricultural potentials should be given appropriate nominal value. (A possible approach is to estimate the expected cost of artificial selection from the beginning to the official recognition of the type).
- Similar economic quantification is needed for all cultivated breeds on the basis of the profit obtained by the introduction of bred cultivars. This approach could also assist in the value assessment of native species.
- All plant and animal species and cultivars that are cultivated (or can be potentially cultivated) should be economically assessed. The obtained values should be incorporated into the estimate of national product and other statistics.
- It is desirable that the Nature Conservation Act should declare: the diversity described above is part of the national assets, similarly to the cultural heritage. As a consequence, it is a national interest to collect, conserve (in gene banks and preferably in cultivation), or even enhance this diversity. Accordingly, the costs of conservation and enhancement should be borne by the community, since the benefits are also gained by the whole country. In other words, all these tasks should be treated as public duty (like protection of historic buildings), they should not be relegated to the profit oriented sector.
- It is the task of plant breeding institutions and botanical gardens to collect and preserve those species and varieties that are related to cultivated species.
- Botanical gardens should be treated as anterooms for gene banks, consequently they require special support.
- It is important to coordinate the collecting and preserving activities of botanical gardens at least at the regional level. This would ensure higher efficiency and that all important taxa and geographic regions would be covered. To achieve this goal it is necessary to develop appropriate databases.
- To enhance propagation and replantation of endangered species, botanical gardens need special support for these activities.
- Effective cooperation among gene banks, plant breeding institutes, botanical gardens and nature reserves should be encouraged in fulfilling these duties.
- It is expedient to organize the introduction of new cultivated plants in plant-breeding institutions, botanical gardens, gene banks, or in specialized field stations, paying special attention to all possible threats (weeds).

- As a result of mapping the agroecological potential of the country, districts of successful cultivation have been outlined for the main crop species. Expected yield and possible threats are also known for each crop and district.
- This survey should be continued and extended to other (minor or eclipsed) species, or even to only potential cultivated species.
- Similarly this survey should be done for Hungarian local breeds of the main crops. This is a prerequisite of distributing the best adapted high quality cultivars producing optimum yield in the agricultural districts of Hungary. Hungarian breeders can play an important role in this work in the future as well.
- Agricultural districts of uniform features should be formed in each geographic region by considering the foregoing and existent natural economic potentials. These districts (among other things) are characterized by high species diversity and high quality cultivation of certain assemblages of crops.
- Farming is based on the knowledge and experience of many generations. In the last decades this chain of passing on experience has been cut. This is why in the future a computerized expert system may be a good solution. It should integrate traditional farming experience (for each region and culture), market information, old and recent research results (information on sensitivity of the environment, agroecological potential, limiting ecological factors; intercropping; permaculture; computerized growth models; crop-rotation; melioration).
- This complex system would serve food production and the enhanced utilization and preservation of biodiversity in agriculture much better than "modern" standardized mass production technologies using the "best" cultivars in monocultures.

6. Changing attitudes

To increase diversity in agriculture, in the first place we need changes in attitudes.

- The importance of biological diversity should be stressed in general, and specialized education, and in influencing public opinion. Diversity-friendly farming techniques should be popularized through extension services.
- To increase diversity in agriculture we must change the attitude of the whole society (media, education). Without this, the contradictory and complicated transition towards the desirable diverse agriculture cannot be successful.
- We should increase species diversity: many more cultivated species should be planted. The number of species and breeds of domestic animals can also be increased, though only to a limited extent.
- At the same time it is important to preserve the diversity of native plant and animal species (by preserving their habitats). Though the abundance of

weeds and pests should be controlled, their complete extirpation should be avoided.

- Until recently arable fields have dominated Hungarian agriculture. The proportion of other land use types can be increased (which is also desirable). It is extremely important to harmonize agricultural practices with traditional agricultural districts which need revitalization and development.
- The optimum ratio of small, intermediate and large farms should established. Each of these types plays a special role, all of them are necessary. Equally reasonable mixture of land use forms is also needed. The foregoing four types of diversity are interrelated: they mutually improve each other, they all foster variation.
- Scientific investigation and assessment of different production systems and techniques are necessary. Scientific experiments are needed to define the optimum diversity of farm in a given environment under existent conditions. They are also needed to determine the size, energy consumption of prosperous farm and optimum pattern and dynamics of land use.

As it was mentioned in the introduction, in this work the authors approach the national duties of Hungary from a scientific base and the development based on that. Evidently, a comprehensive fiscal-management system must be elaborated for maintaining biodiversity. This must be a central task, since it is not in the interest of individuals or groups, but rather the public at large: long-term preservation of biological assets. Short-term interests of profit-oriented economy are always opposing. These conflicts can only be solved by applying sound subsidy, legislation and economic regulation.

Acta Zoologica Academiae Scientiarum Hungaricae 40 (4), pp. 329-336, 1994

THE SPERMATHECA AND FEMALE TERMINALIA OF SOME XYLOMYIDAE (DIPTERA)

N. LIU & A. NAGATOMI

Entomological Laboratory, Faculty of Agriculture
Kagoshima University, Kagoshima, 890 Japan

The spermatheca and female terminalia are presented in 5 species of *Xylomya* and 4 species of *Solva* known from Japan. PAPAVERO and ARTIGAS (1991) showed in detail the spermatheca of 3 genera and 4 species from America and stimulated us to prepare the present article.

Key words: Diptera, Xylomyidae, female terminalia, spermatheca

PAPAVERO and ARTIGAS (1991) described and illustrated the spermatheca of the following 3 genera and 4 species: *Xylomya* [=*Macroceromys*] *pallidifemur* (MALLOCH); *Xylomya* [=*Macroceromys*] *simillimus* (STEYSKAL); *Solva* sp.; *Arthropeina fulva* LINDNER.

NAGATOMI and IWATA (1978) dealt with the female terminalia of 2 genera and 3 species: *Xylomya* [=*Macroceromys*] *gallois* (SÉGUY); *Solva japonica* FREY; *Solva procera* FREY, but they did not discuss the spermatheca.

YANG and NAGATOMI (1993) revised the Chinese Xylomyidae (including *Xylomya, Formosolva, Solva*) and mentioned the female terminalia (including genital fork and spermathecal capsule) but did not pay attention to the basal portion of spermathecal duct.

This paper based on Japanese material (2 genera and 9 species) adds several new things to these three works. For external and male genitalic characters of the genera and species studied here, see NAGATOMI and TANAKA (1971).

GENERAL CHARACTERS

1. Spermatheca

Spermatheca consists of the following 3 parts: (1) basal common duct; (2) a pair of lateral long ducts each having capsule; (3) median shorter duct having membranous glandular bag.

According to PAPAVERO and ARTIGAS (1991), the (3) above is entirely absent in *Solva* sp. ("American species") and is "represented only by a short, whip-like remnant of the duct (Figs 8-9)" in *Arthropeina fulva* LINDNER.

The basal common duct of *Xylomya* is longer than that of *Solva* in the species studied here.

In the *Xylomya* species and *Solva procera* studied here, the part just before the capsule is widened and this part may vary in shape with species. In three species of *Solva* (*flavoscutellaris, harmandi* and *japonica*), there is (ii) a membranous tube between (i) terminal capsule and (iii) apical widened part, and (ii) and (iii) above are telescopic into (i). In these 3 species of *Solva,* (iii) above (which may be less sclerotized than the widened part before the capsule in the *Xylomya* species and *Solva procera*) may be a part of the capsule, together with (ii). The (ii) and (iii) are covered with prongs which are absent on (iii) of *harmandi* (Figs 30, 33-34, 41, 47).

The lateral long duct (except the apical widened part before the capsule) may be divided into 3 sections (a, b, c) according to the degree of thickness, pigmentation, etc. (Figs 9, 30, 54).

Xylomya: Section (c) very long, more or less darker, and with a number of piles whose apices are globular; section (b) wider than sections (a) and (c) in many species (*longicornis, matsumurai, moiwana*, and *shikokuana*), longer than (a), but shorter than (c).

Solva (except *procera*): Section (a) wider somewhat in apical portion; section (b) narrower; section (c) wider than (a) and (b).

Solva procera: Section (a) wider than sections (b) and (c); section (b) not wider than (c); section (c) very long and darker.

2. Genital fork

Y-shaped in *Xylomya* and U-shaped in *Solva*, but rather U-shaped in *Xylomya matsumurai* and *X. longicornis*.

NAGATOMI (1993) wrote, "According to YANG and NAGATOMI (1993) on the Chinese Xylomyidae: female furca is Y-shaped in *Solva gracilipes* YANG et NAGATOMI, rather Y-shaped in *Solva tigrina* YANG et NAGATOMI, and U-shaped in *Xylomya chekiangensis* [ÔUCHI]".

The lateral bar of genital fork is apparently connected with tergum 9 in *Xylomya* and entirely fused with it in *Solva.*

The shape of genital fork varies considerably with species in *Xylomya* and *Solva.*

3. Tergum 10

Much smaller than tergum 9; T-shaped in *Xylomya,* and consisting of paired transverse bars in *Solva.*

According to YANG and NAGATOMI (1993), tergum 10 is not T-shaped in *Xylomya alamaculata* YANG et NAGATOMI or its mid-posterior protruded part is very short in *X. decora* YANG et NAGATOMI and *X. gracilicorpus* YANG et NAGATOMI. In some Chinese species of *Solva*, tergum 10 is not divided.

4. Sternum 10

Triangular or sometimes rather pentagonal; there is a median paler or less sclerotized line.

The shape of sternum 10 varies with species, but its accurate recognition may need more study in each species studied here. In *Solva harmandi* and *S. japonica*, sternum 10 is much longer than wide.

5. Tergum 9

Undivided and rather rectangular or divided into 2 sclerites each of which is wider than long in *Xylomya*, but divided into 2 sclerites each of which is longer than wide (from dorsal view) in *Solva*.

The shape of tergum 9 varies considerably with species in *Xylomya* and *Solva*.

Lateral part or anterolateral part is folded ventrally and may be connected with lateral bar of genital fork in *Xylomya*.

6. Sternum 9 (?)

There are a pair of small sclerites opposite the base of the lateral bar of the genital fork in *Solva flavoscutellaris, S. harmandi* and *S. japonica*. It is uncertain to us whether or not this vestigial sclerite represents the true sternum 9.

It is generally accepted that the genital fork is derived from sternum 9 which disappears then (see BONHAG,1951; MCALPINE 1981, 1989). This view is not deniable, but needs more evidence to prove it.

7. Tergum 8

Much larger than tergum 9, rather rectangular or trapezoid, and with anterior margin often more or less concave (or deeply so in *Solva harmandi*). The shape of tergum 8 may vary with species in *Xylomya* and *Solva*, but more study is necessary for an exact understanding of the shape in each species studied here.

8. Sternum 8

Rather quadrate, with a mid-posterior convexity, and with mid-posterior paler part convex anteriorly and variable in extent according to species. The shape of sternum 8 may vary with species but its exact understanding needs more material in each species studied here.

9. Cercus

Segment 1 wider basally; segment 2 narrower and shorter than segment 1. In *Solva*, segment 1 narrower and segment 2 longer than in *Xylomya*.

CHARACTERS OF EACH SPECIES

Xylomya galloisi (SÉGUY)
(Figs 1-6)

Solva galloisi SÉGUY, 1956, Rev. franc. Ent. Paris 23: 174. Type locality: Japan (Mt. Takao, Hachioji).

Spermatheca: Capsule elliptical or nearly circular according to individual or condition; in lateral duct, section (b) not wider than sections (a) and (c), widened part before capsule white and longer than wide but relatively short. Genital fork: Y-shaped. Tergum 10: T-shaped. Tergum 9: undivided. Sternum 8: mid-posterior paler part smaller than in the congeners studied here.

Specimens examined: *Honshu*: 1 ♀, Hyonosen, Tajima, 11. vii. 1952, R. MORIMOTO; *Kyushu*: 1 ♀, Gokanosho, Higo, 22. vii.1966, A. TANAKA.

Xylomya longicornis MATSUMURA
[=*Xylomya takachihoi* (ÔUCHI)]
(Figs 7-11)

Xylomya longicornis MATSUMURA, 1915, Konchu-bunruigaku, part 2, p. 46. Type locality: Japan (Hokkaido: Sapporo).

Spermatheca: Capsule nearly circular; lateral duct relatively short and its widened part before capsule relatively long and gradually tapering towards base of duct. Genital fork: rather U-shaped; mid-anterior part rather trapezoid. Tergum 10: T-shaped. Tergum 9: probably narrowly divided into 2 sclerites.

Specimens examined: *Hokkaido*: 1 ♀, Mt. Soranuma, 3.vii.1964, A. NAGATOMI; 1 ♀, Mt. Soranuma, 17.vi.1967, K. KUSIGEMATI.

Xylomya matsumurai (NAGATOMI et TANAKA)
(Figs 12-17)

Solva (Macroceromys) matsumurai NAGATOMI and TANAKA, 1971, Mushi 45: 113. Type locality: Japan (Kyushu: Mt. Kirishima).

Spermatheca: Capsule nearly circular; lateral duct longer than in the congeners studied here and its widened part before capsule relatively long and gradually tapering towards base of duct;

grandular bag smaller than in the congeners. Genital fork: rather U-shaped (if mid-anterior transparent part is not wholly seen). Tergum 10: T-shaped. Tergum 9: widely divided into 2 sclerites; lateral wide part is folded ventrally and in lateral view triangular.

Specimens examined: *Hokkaido*: 1 ♀ , Maruyama, Sapporo, 17.vi.1964, K. KUSIGEMATI; *Honshu*: 1 ♀ , Hyonosen, Tajima, 12.vii.1952, R. MORIMOTO.

Xylomya moiwana MATSUMURA
(Figs 18-22)

Xylomya moiwana MATSUMURA, 1915, Konchu-bunruigaku Part 2. p. 46. Type locality: Japan (Hokkaido: Sapporo).

Spermatheca: Capsule elliptical or nearly circular; in lateral duct, widened part before capsule relatively short. Genital fork: Y-shaped, with mid-anterior part rather narrow and longer than wide. Tergum 10: T-shaped and apparently fused with cercal segment 1 at base. Tergum 9: undivided; posterolateral part folded ventrally is rather quadrate and connected widely with lateral bar of genital fork.

Specimens examined: Hokkaido: 2 ♀ , Ashoro, 15-17.vii.1964. A. NAGATOMI.

Xylomya shikokuana (MIYATAKE)
(Figs 23-27)

Solva shikokuana MIYATAKE, 1965, Trans. Shikoku Ent. Soc. 8: 111. Type locality: Japan (Shikoku: Mt. Saragamine).

Spermatheca: Capsule elliptical; in lateral duct, widened part before capsule relatively short. Genital fork: Y-shaped; paired lateral bars convergent posteriorly; mid-anterior part narrow and longer than wide. Tergum 10: T-shaped; smaller than in other species examined here. Tergum 9: undivided and colourless, but with a pair of large darker spots. Cercus: segment 1 considerably wider than in the congeners examined here.

Specimens examined: *Honshu*: 1 ♀ , Ôtomura, Kii, 18.v.1962, J. YUKAWA; *Kyushu*: 1 ♀ , Gokanosho, Higo, 11.vii.1966, A. TANAKA.

Solva flavoscutellaris (MATSUMURA)
(Figs 28-34)

Xylomya flavoscutellaris MASTUMURA, 1915, Konchu-bunruigaku, part 2, p. 46. Type locality: Japan (Sahoro).

Spermatheca: Terminal capsule quadrate with apical margin rounded. Genital fork: lateral bar waved; mid-anterior part wider than long and more or less concave near anterolateral corner. Tergum 10: consisting of paired thin transverse bars. Tergum 9: widely divided into 2 parallel sclerites each of which is much longer than wide. Sternum 9 (?): a pair of small sclerites present near base of common spermathecal duct. Sternum 8: mid-posterior paler part large and roughly occupying half of sternum 8.

Specimens examined: *Kyushu*: 1 ♀, Mt. Kirishima, Satsuma, 11.ix.1966, A. TANAKA; *Yakushima*: 1 ♀, Kosugidani, 1.vi.1969, K. KUSIGEMATI.

Solva harmandi SÉGUY
(Figs 35-41)

Solva harmandi SÉGUY, 1956, Rev. franc. Ent. Paris 23: 175. Type locality: Japan (Honshu).

Spermatheca: Terminal capsule rectangular and longer than wide; two-segmented part before terminal capsule distinctly longer than in *flavoscutellaris* and *japonica*; lateral duct relatively short; glandular bag may be smaller than in other species studied here. Genital fork: lateral bar convex outward; mid-anterior part rectangular, wider than long and with anterolateral angle rounded. Tergum 10: consisting of paired thin transverse bars. Sternum 10: much longer than wide. Tergum 9: widely divided into 2 narrow sclerites divergent at anterior half; ventrally folded part of each sclerite (=possibly posterior [=basal] part of lateral bar in genital fork) relatively large. Sternum 9 (?): a pair of narrow longitudinal sclerites present near base of common spermathecal duct. Tergum 8: deeply concave at anterior margin.

Specimens examined: *Hokkaido*: 1 ♀, Shari, 8.vii.1964, A. NAGATOMI; 1 ♀, Mt. Soranuma, 3.vii.1964, A. NAGATOMI.

Solva japonica FREY
(Figs 42-47)

Solva japonica FREY, 1960, Commentationes Biologicae 23: 15. Type locality: Japan (Honshu: Karuizawa).

Spermatheca: Terminal capsule quadrate, with apical portion rounded. Genital fork: lateral bar convex outward; mid-anterior part rectangular, wider than long, and with anterolateral corner angulate. Tergum 10: consisting of paired thin transverse sclerites. Sternum 10: much longer than wide. Tergum 9: widely divided into 2 sclerites; sclerite from dorsal view much longer than wide but wider than in *harmandi*. Sternum 9 (?): a pair of small sclerites present near base of common spermathecal duct. Sternum 8: mid-posterior paler part large and roughly occupying half of sternum 8.

Specimens examined: *Hokkaido*: 1 ♀, Ashoro, 15.vii.1964, A. NAGATOMI; *Honshu*: 1 ♀, Hyonosen, Tajima, 11.vii.1952, A. NAGATOMI.

Solva procera (FREY)
(Figs 48-54)

Xylomya procera FREY, 1960, Commentationes Biologicae 23: 7. Type locality: Japan (Shikoku: Iya).

Spermatheca: Terminal capsule semicircular and wider than long; widened part before capsule relatively long and gradually tapering towards base of duct. Genital fork: lateral bar convex outward; mid-anterior part rectangular, wider than long, and with an anterolateral tooth. Tergum 10: consisting of paired transverse bars. Tergum 9: widely divided into 2 triangular sclerites in dorsal view; sclerite folded ventrally at anterior part which is rather triangular in shape. Sternum 9(?): not seen.

Specimens examined: *Kyushu*: 1 ♀, Naidaijin, Higo, 10.v.1967, A. NAKANISHI; 1 ♀, Mt. Osuzu, Hyuga, 21.v.1966, K. KUSIGEMATI.

CONCLUDING REMARKS

In the spermatheca of *Solva* sp. from America, the glandular bag is entirely absent (after PAPAVERO and ARTIGAS, 1991), but is present in all of the 4 Japanese species of examined *Solva*.

The female tergum 10 was overlooked in *Xylomya galloisi* and *Solva japonica* by NAGATOMI and IWATA (1976) but is present in all of the Japanese and Chinese species examined (for the Chinese species, see YANG and NAGATOMI, 1993).

In the spermatheca, the 2-segmented part before the terminal capsule is telescopic and very often enters into the terminal capsule in many species of *Solva*. Thus, the apical portion of spermatheca varies greatly in shape with the condition within the same individual in these species.

The shape of the spermatheca especially at the apical portion, the genital fork, and tergum 9 each provides a useful specific character.

The tergum 10, sternum 10, tergum 8, and sternum 8 and the extent of mid-posterior paler part of sternum 8 may vary in shape with species but the extent of individual variation should be clarified in each part and more careful study is necessary in the future.

The function of "glandular bag" here so named is not necessarily certain. However, it is probably different from that of spermatheca which stores the spermatozoa. If so, the number of spermathecae is two in the genera and species of Xylomyidae examined here.

There are a pair of small sclerites opposite the base of the lateral bar of the genital fork in the Japanese species of *Solva* (having 3-segmented capsule mentioned above). This sclerite may possibly represent a vestigial sternum 9.

* * *

Acknowledgments. – Sincere thanks are expressed to Drs N. MIYAUCHI, J. YUKAWA and K. KUSIGEMATI (Kagoshima University), Dr N. ISHIBASHI (Saga University) and Dr H. UEMATSU (Miyazaki University) for their help in various ways.

REFERENCES

BONHAG, P. E. (1951) The skeleto-muscular mechanism of the head and abdomen of the adult horsefly (Diptera: Tabanidae). *Trans. Am. ent. Soc.* **77**: 131-202.

MCALPINE, J. F. (1981) Morphology and terminology - adults. *In* J. F. MCALPINE, B. V. PETERSON, G. E. SHEWELL, H. J. TESKEY, J. R. VOCKEROTH, and D. M. WOOD (eds): *Manual of Nearctic Diptera,* **1**: 9-63. Agriculture Canada Monograph No. 27.

MCALPINE, J. F. (1989) Phylogeny and classification of the Muscomorpha. *In* J. F. MCALPINE and D. M. WOOD (eds): *Manual of Nearctic Diptera,* **3**: 1397-1581. Agriculture Canada Monograph No. 32.

NAGATOMI, A. (1993) Taxonomic notes on Xylomyidae (Diptera). *South Pacific Study* **14**: 85-93.

NAGATOMI, A. & IWATA, K. (1976) Female terminalia of lower Brachycera, I. *Beitr. Ent.* **26**: 5-47.

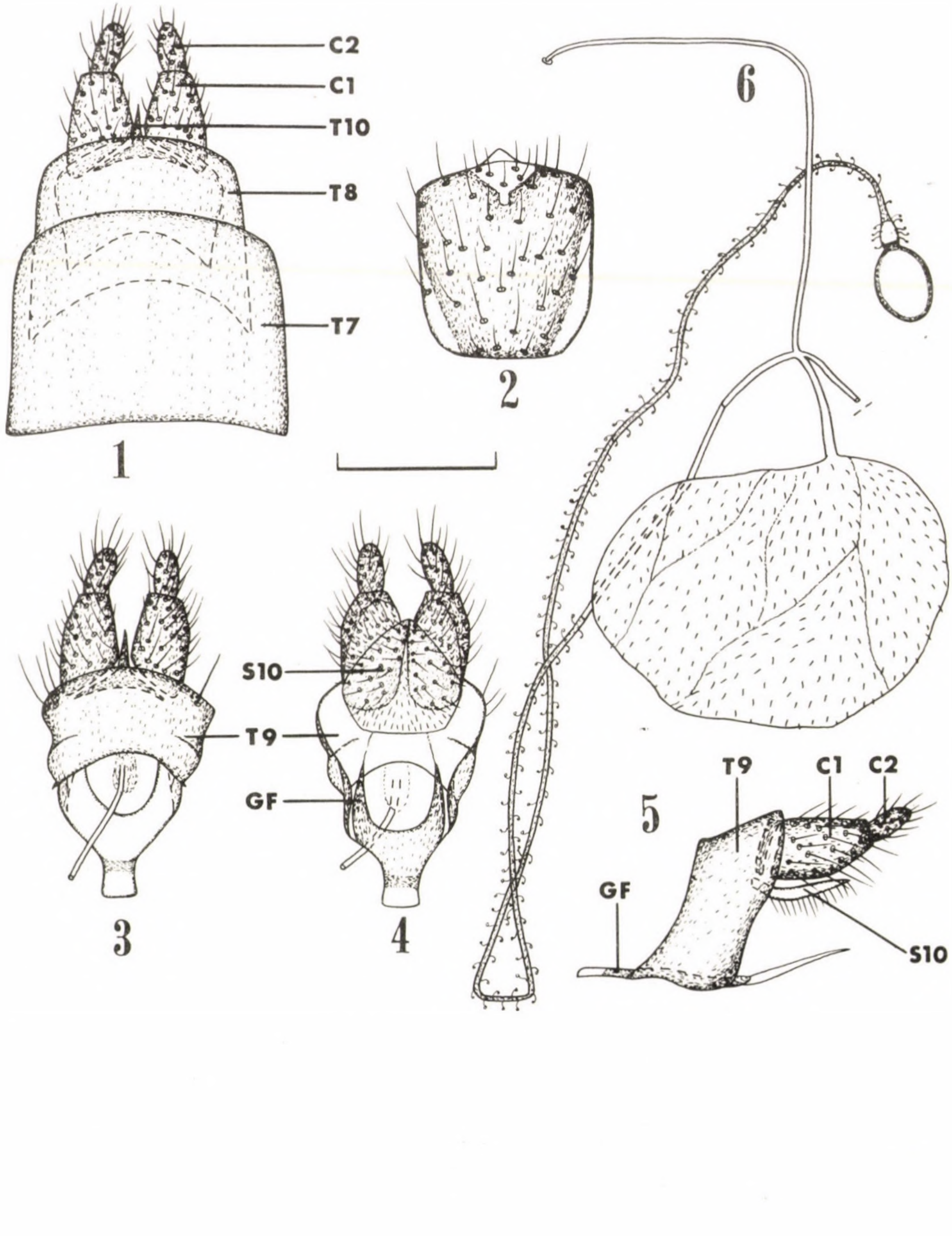
NAGATOMI, A. & TANAKA, A. (1971) The Solvidae of Japan (Diptera). *Mushi* **45**: 101-146.

PAPAVERO, N. & ARTIGAS, J. N. (1991) Phylogeny of the American genera of Solvidae (Xylomyidae) (Diptera), with illustrations of the female spermatheca. *Gayana Zool.* **55**: 101-113.

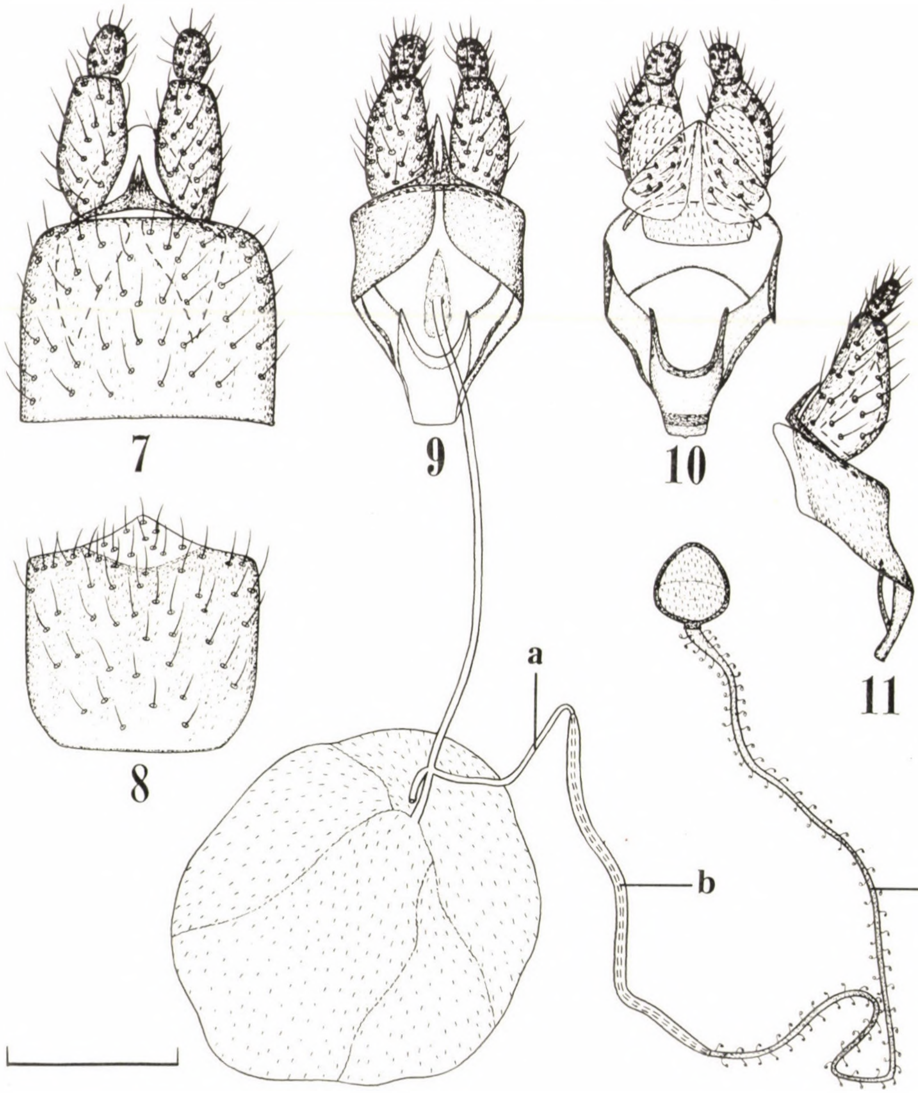
YANG, D. & NAGATOMI, A. (1993) The Xylomyidae of China (Diptera). *South Pacific Study* **14**: 1-84.

Received August 18, 1994; accepted September 5, 1994

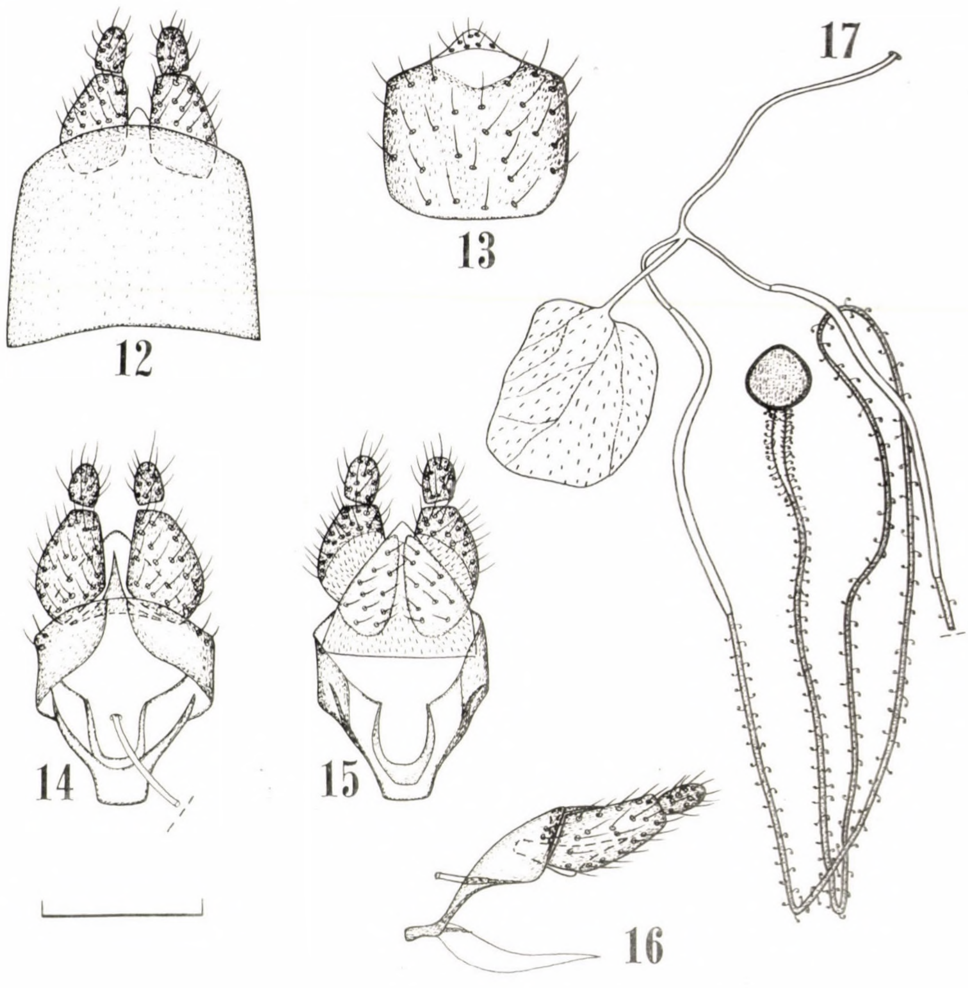
Figs 1-6. *Xylomya galloisi* (SÉGUY): 1 = Terga 7-10 and cerci, dorsal view; 2 = sternum 8, ventral view; 3-5 = terga 9-10, cerci, sternum 10 and genital fork, dorsal, ventral and lateral views; 6 = spermatheca. C1-C2 – Cercal segments 1-2; GF – genital fork; S10 – sternum 10; T7-T10 – terga 7-10. Scale 0.5 mm



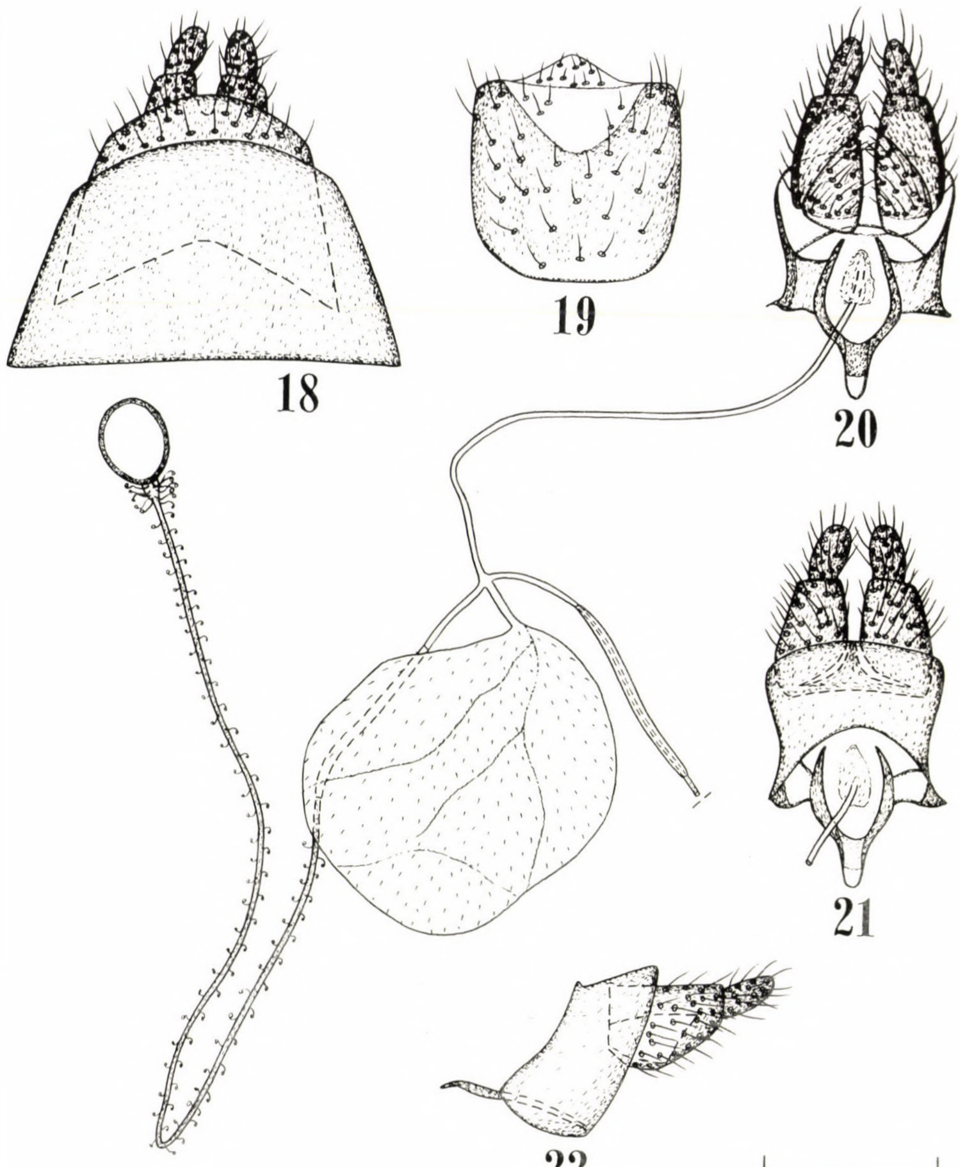
Figs 7-11. *Xylomya longicornis* MATSUMURA: 7 = Terga 8, 10 and cerci, dorsal view; 8 = sternum 8, ventral view; 9 = terga 9-10, cerci, genital fork and spermatheca, dorsal view; 10-11 = terga 9-10, cerci, sternum 10 and genital fork, ventral and lateral views. Scale 0.5 mm



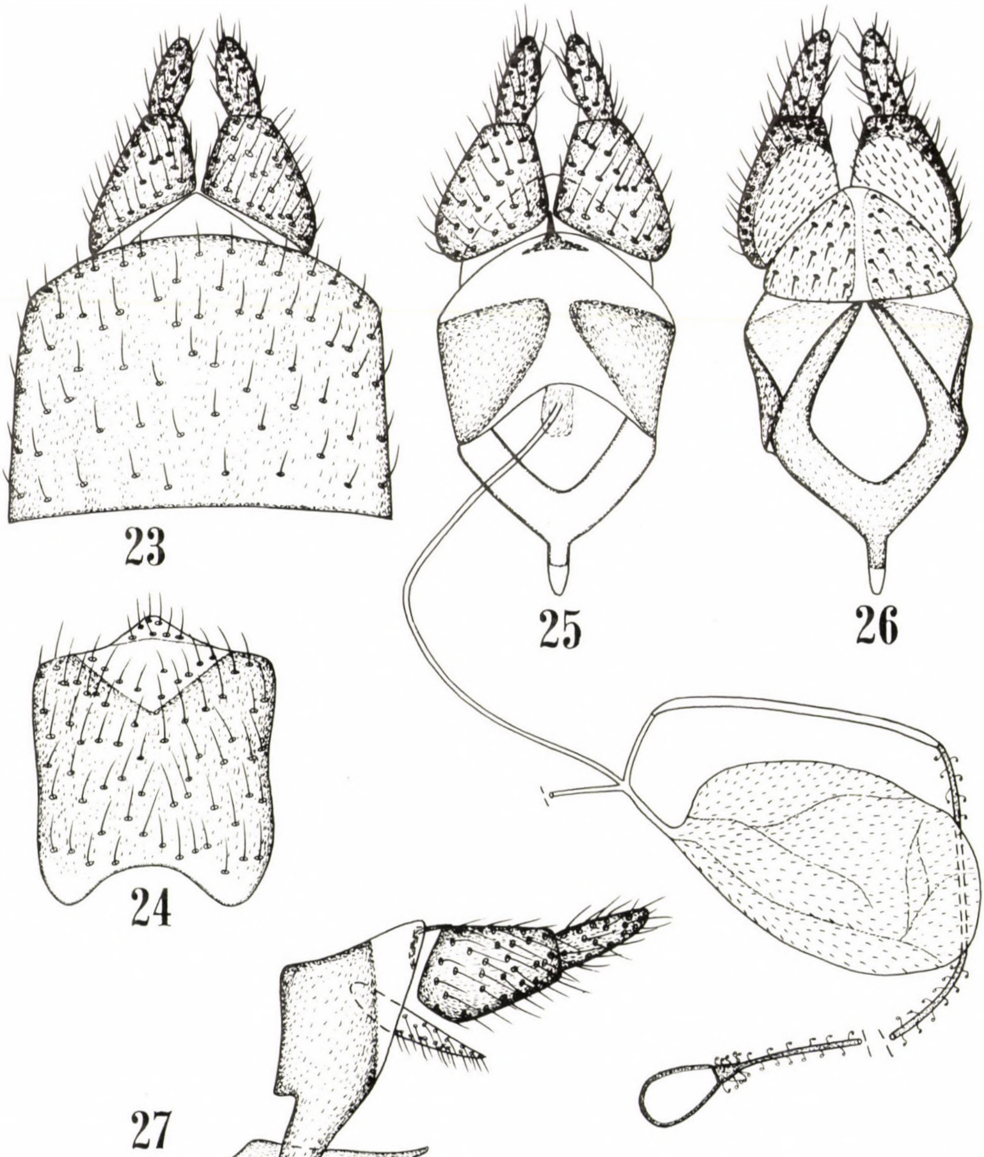
Figs 12-17. *Xylomya matsumurai* (NAGATOMI et TANAKA): 12 = Tergum 8 and cerci, dorsal view; 13 = sternum 8, ventral view; 14-16 = terga 9-10, cerci, sternum 10 and genital fork, dorsal, ventral and lateral views; 17 = spermatheca. Scale 0.5 mm



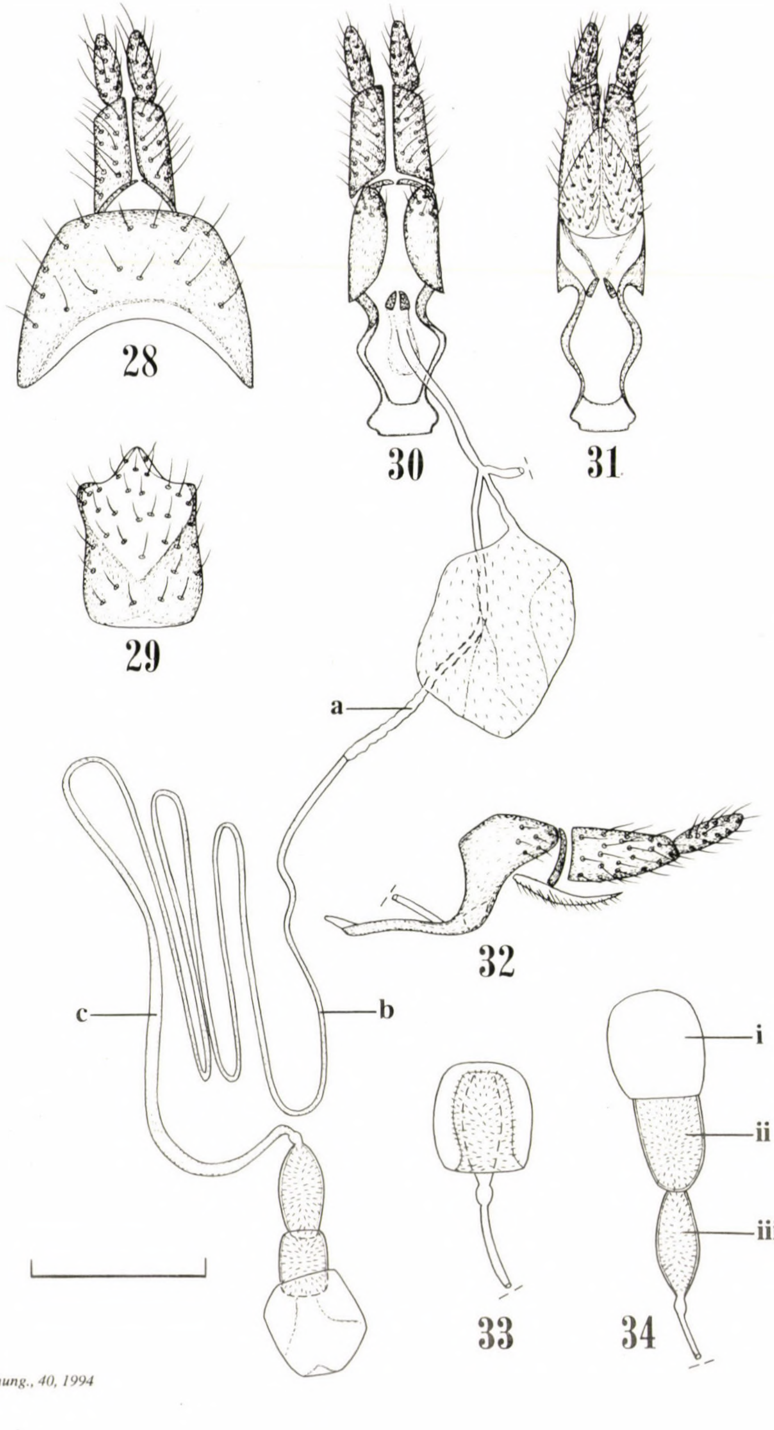
Figs 18-22. *Xylomya moiwana* MATSUMURA: 18 = Terga 7-8 and cerci, dorsal view; 19 = sternum 8, ventral view; 20 = tergum 9, cerci, sternum 10, genital fork and spermatheca, ventral view; 21-22 = terga 9-10, cerci and genital fork, dorsal and lateral views. Scale 0.5 mm



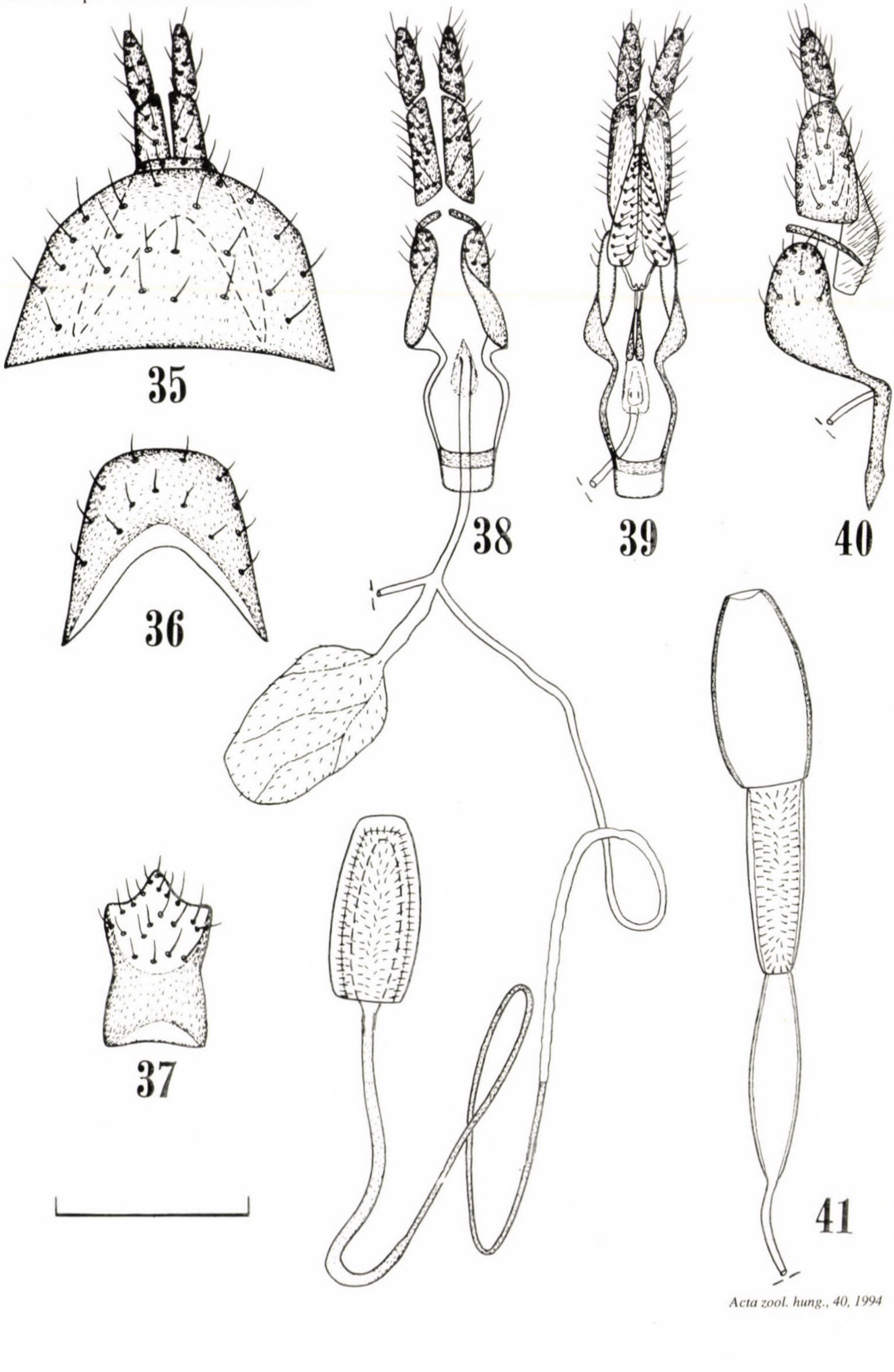
Figs 23-27. *Xylomya shikokuana* (MIYATAKE): 23 = Tergum 8 and cerci, dorsal view; 24 = sternum 8, ventral view; 25 = terga 9-10, cerci, genital fork and spermatheca, dorsal view; 26-27 = terga 9-10, cerci, sternum 10 and genital fork, ventral and lateral views. Scale 0.5 mm



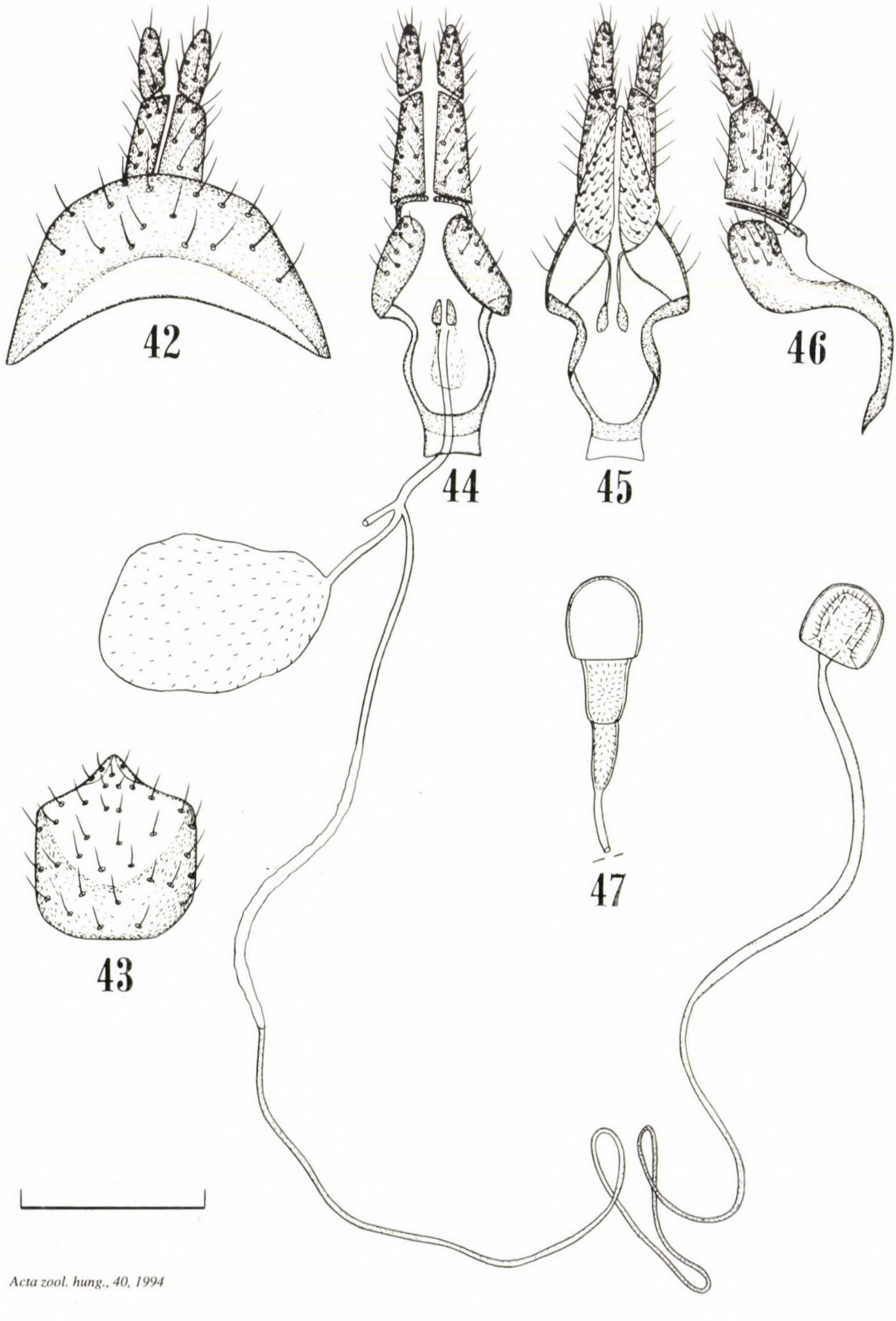
Figs 28-34. *Solva flavoscutellaris* (MATSUMURA): 28 = Terga 8, 10 and cerci, dorsal view; 29 = sternum 8, ventral view; 30 = terga 9-10, sternum 9 (?), cerci, genital fork and spermatheca, dorsal view; 31-32 = terga 9-10, cerci, sterna 9(?)-10 and genital fork, ventral and lateral views; 33-34 = capsule of spermatheca. Scale 0.4 mm



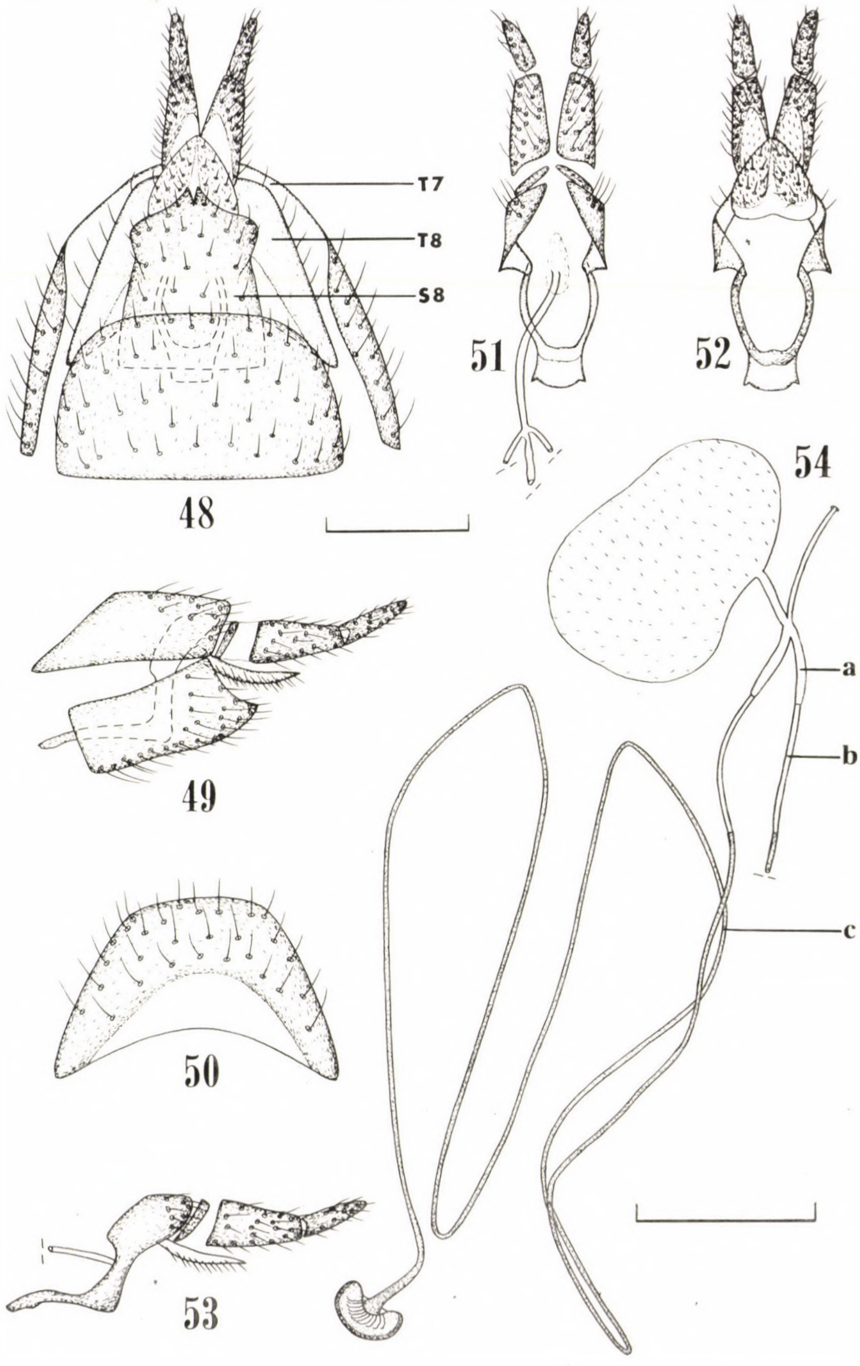
Figs 35-41. *Solva harmandi* SÉGUY: 35 = Terga 7-8 and cerci, dorsal view; 36 = tergum 8, dorsal view; 37 = sternum 8, ventral view; 38 = terga 9-10, cerci, genital fork and spermatheca, dorsal view; 39-40 = terga 9-10, cerci, sterna 9(?)-10 and genital fork, ventral and lateral views; 41 = capsule of spermatheca. Scale 0.4 mm



Figs 42-47. *Solva japonica* FREY: 42 = Tergum 8 and cerci, dorsal view; 43 = sternum 8, ventral view; 44 = terga 9-10, cerci, sternum 9(?), genital fork and spermatheca, dorsal view; 45-46 = terga 9-10, cerci, sterna 9(?)-10 and genital fork, ventral and lateral views; 47 = capsule of spermatheca. Scale 0.4 mm



Figs 48-54. *Solva procera* (FREY): 48 = Terga 7-8, sterna 7-8, 10 and cerci, ventral view; 49 = terga 8 and 10, sterna 8 and 10 and cerci, lateral view; 50 = tergum 8, dorsal view; 51-53 = terga 9-10, cerci, sternum 10 and genital fork, dorsal, ventral and lateral views; 54 = spermatheca. T7-T8 – Terga 7-8; S8 – sternum 8. Scale 1 mm for Fig. 54; 0.5 mm for others



Acta Zoologica Academiae Scientiarum Hungaricae 40 (4), pp. 337-342, 1994

TWO NEW CENTISTES SPECIES FROM KOREA (HYMENOPTERA, BRACONIDAE: EUPHORINAE)*

J. PAPP

Department of Zoology, Hungarian Natural History Museum
H-1431 Budapest, pf. 137, Hungary

Description of two new *Centistes* s. str. HALIDAY species from Korea: *C. sinapis* sp. n. and *C. spinulosus* sp. n., and an interpretation of the subgenera comprising the genus *Centistes* are given. A checklist of the *Centistes* s. str. species of the Palaearctic Region is presented. With 14 original figures.

Key words: Hymenoptera, Braconidae, Euphorinae, *Centistes*, taxonomy, Korea

INTRODUCTION

In his paper VAN ACHTERBERG (1985) interpreted the genus *Centistes* HALIDAY, 1835 in a wide sense placing four subgenera into it: *Anartionyx* VAN ACHTERBERG, 1985, *Ancylocentrus* FOERSTER, 1862, *Centistes* s. str. and *Syrrhizus* FOERSTER, 1862 which taxa, except *Anartionyx*, have been previously considered as valid genera (SHENEFELT, 1969). Recently BELOKOBYLSKIJ (1992) published a revision of *Centistes* s. l. asserting that the taxon *Syrrhizus* represents an independent genus, on the one hand, and *Anartionyx* is monotypic from the Nearctic Region (U.S.A.), on the other. Hence in the Palaearctic Region the genus *Centistes* comprises two subgenera: *Ancylocentrus* and *Centistes* s. str. I accept this classification of *Centistes* with the remark that *Ancylocentrus* seems also to form a valid genus – a presumption which perhaps will be strengthened in the future partly morphologically and partly bionomically. Under this taxonomic conception five species of the genus *Centistes* s. str. are recorded in the Palaearctic Region, furthermore, two species are new to science and their descriptions are presented subsequently; the checklist of the seven species are as follows:

Centistes alekseevi BELOKOBYLSKIJ, 1992 – Russian Far East Maritime Territory
cuspidatus (HALIDAY, 1835) – Palaearctic Region
dilatus PAPP, 1992 – Nepal
fuscipes (NEES, 1834) – Palaearctic Region
scymni FERRIÈRE, 1954 – Switzerland, Germany, European part of Russia
sinapis sp. n. – Korea
spinulosus sp. n. – Korea

* Zoological Collectings by the Hungarian Natural History Museum in Korea, No 129. – Braconidae (Hymenoptera) from Korea, XVI.

Centistes (Centistes) sinapis sp. n.
(Figs 1-6)

Description of the holotype ♂. – Body 2.8 mm long, Head in dorsal view (Fig. 1) less transverse, 1.66 times as broad as long, eye as long as temple, latter rounded. Ocelli small, elliptic, far from each other, OOL somewhat longer than POL. Eye in lateral view small, i. e. less high, only one-third higher than wide, temple somewhat wider than eye (Fig. 2). Malar space long, one-third longer than basal width of mandible. Face clearly twice as wide as high. Distance between tentorial pits somewhat shorter than distance between tentorial pit and lowest point of eye. Occiput and temple behind distinctly carinated. Head polished. – Antenna with 24 antennomeres and about as long as body. First flagellomere almost four times as long as broad apically, penultimate flagellomere distinctly twice as long as broad.

Mesosoma in lateral view 1.48 times as long as high. Notaulix and precoxal furrow indistinct. Propodeum with a transverse and a medio-longitudinal carina and a pair of less distinct, antero-lateral carinae, a pair of antero-median fields uneven to smooth, otherwise propodeum laterally rugo-rugulose and posteriorly uneven with rugulae (Fig. 3). Metapleuron also rugo-rugulose, otherwise mesosoma polished. – Hind femur 3.5 times as long as broad medially. Hind basitarsus as long as tarsomeres 2-3. Claws long and narrow (Fig. 4).

Fore wing about as long as body. Pterostigma (Fig. 5) 3.2 times as long as wide, issuing radial vein from its middle; r1 short, just half as long as width of pterostigma, r2 arched and approaching tip of wing; n. rec. interstitial. Metacarp just longer than pterostigma, length of radial cell along metacarp as long as pterostigma (Fig. 5, see arrows). – Hind wing: first section of n. med. 2.5 times as long as its second section.

Metasoma almost as long as mesosoma. First tergite (Fig. 6) somewhat longer medially than broad behind, evenly broadening from base to hind end, pair of spiracles before its middle, its surface longitudinally striate. Second and third tergites equal in length, combined length of tergites 2-3 equal with basal width of tergite 2. Tergites, except first tergite, polished.

Ground colour of body mustard yellow. Ocellar field brown. Propodeum and tergites brownish, tergites 4-8 with blackish tint. Sternites 1-3 yellowish, rest of sternites brownish. Palpi pale yellow. Antenna brownish yellowish. Tegula straw yellow. Legs light mustard yellow. Wings hyaline, pterostigma yellow, veins opaque yellow.

Deviating features of the male paratypes (2 ♂♂). – Similar to the holotype ♂. Body 2.5-2.6 mm long. Head in dorsal view 1.6–1.62 as broad as long. Temple in lateral view one-fourth wider than eye. Antenna with 23 antennomeres. Hind femur 3.6 times (1 ♂) and 4 times (1 ♂) as long as broad medially. Pterostigma 3.1-3.4 times as long as wide. Length of radial cell along metacarp slightly shorter than pterostigma (1 ♂). Ocellar field brown (1 ♂) to dark brown (1 ♂).

Female and host unknown.

Material examined. – Holotype ♂: Korea, Tesson, 35 km SW from Pyongyan, water-basin, netting in grass, 4 July 1977, leg. Á. DELY-DRASKOVITS, No. 343. – 2 ♂ paratypes: with same data as the holotype.

Holotype and two paratypes are deposited in the Hungarian Natural History Museum, (Department of Zoology), Budapest, Hym. Typ. Nos 1379 (holotype) and 1380, 1381 (paratypes).

Etymology. – The species name "sinapis" refers to the mustard yellow ground colour of the body.

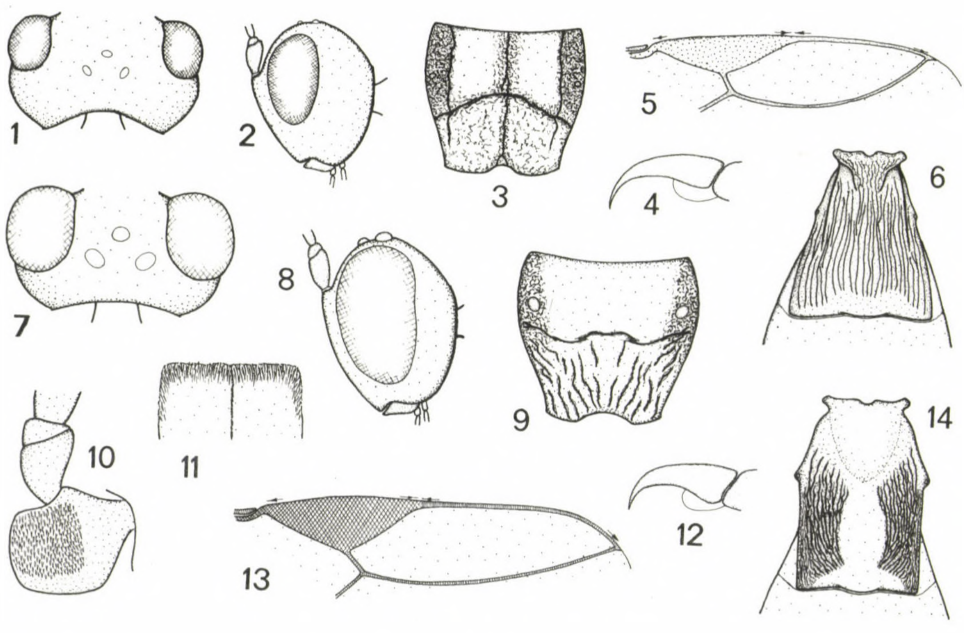
The new species, *Centistes* (*Centistes*) *sinapis* sp. n., is nearest to *C.* (*C.*) *scymni* FERRIÈRE, 1954 (Switzerland, Germany, European part of Russia) regarding their common features as smooth precoxal suture, rounded temple in dorsal view and brownish yellow mesonotum; the two species are distinguished by the features keyed :

1 (2) Eye in lateral view less high, one-third higher than wide; temple somewhat wider than eye; malar space long, one-third longer than basal width of mandible (Fig. 2). Pterostigma issuing radial vein from its middle (Fig. 5). Antenna with 23-24 antennomeres. Body mustard yellow, ocellar field brown to dark brown, tergites 4-8 blackish. ♂ : 2.5-2.8 mm

C. sinapis sp. n.

2 (1) Eye in lateral view high, twice higher than wide; temple as wide as eye; malar space short, shorter than basal width of mandible. Pterostigma issuing radial vein somewhat distally from its middle. Antenna with 22 antennomeres. Body black; head, side of mesosoma and first tergite reddish. ♀ : 2 mm

C. scymni FERRIÈRE, 1954



Figs 1-14. – Figs 1-6. *Centistes (C.) sinapis* sp. n.: 1 = head in dorsal view, 2 = head in lateral view, 3 = propodeum, 4 = claw in lateral view, 5 =distal part of right fore wing, 6 = first tergite. – Figs 7-14. *Centistes (C.) spinulosus* sp. n.: 7 = head in dorsal view, 8 = head in lateral view, 9 = propodeum, 10 = fore coxa and trochanters in latero-ventral view, 11 = fore part of mesosternum, 12 = claw in lateral view, 13 = distal part of right fore wing, 14 = first tergite

The new species is allied to C. (*Ancylocentrus*) *rufithorax* TELENGA, 1950 (European part of Russia, Finland, Germany) and C. (*A.*) *medythiae* MAETÔ et NAGAI, 1985 (Japan) too regarding absence of notaulix on the disc of mesonotum, however, the three species are distinguished by the following features:

1 (2) Mesopleuron without precoxal suture. Mesonotum entirely smooth, i. e. without median dimple before prescutellar furrow and notaulix absent also on declivous fore part of mesonotum (subgeneric features). Antenna with 24-23 antennomeres. Eye in lateral view less high, only one-third higher than wide; malar space long, also one-third longer than basal width of mandible. Body mustard yellow, ocellar field brown to dark brown, tergites 4-8 blackish. ♂: 2.5-2.8 mm

C. (C.) sinapis sp. n.

2 (1) Mesopleuron with at least a short crenulate precoxal suture. Mesonotum with a median dimple before prescutellar furrow and notaulix present on declivous fore part of mesonotum (subgeneric features). Antenna with 21-22 antennomeres. Eye in lateral view high, about twice as high as wide; malar space less long, at most as long as basal width of mandible.

3 (4) Penultimate flagellomere 1.5-2 times as long as broad, antenna with 21-22 antennomeres. First tergite 1.3-1.5 times as long as broad behind; less broadening posteriorly, i.e. 1.4 times at rear than basally (Fig. 10 in MAETÔ & NAGAI 1985: 731). Ovipositor sheath short, about half as long as first tergite. Brownish yellow, head above and hind half of metasoma dark brown, sometimes (♀) or usually (♂) mesonotum + propodeum, metasoma and first tergite brown. ♀ ♂ : 2-2.5 mm

C. (A.) medythiae MAETÔ et NAGAI, 1985

4 (3) Penultimate flagellomere 1.3-1.6 times as long as broad, antenna with 21 antennomeres. First tergite about 1.3 times as long broad behind, more broadening posteriorly, i.e. twice broader at rear than basally. Ground colour of body dark: black(ish) to dark brown, mesosoma except propodeum and metathorax yellowish brown, legs yellow. ♀ ♂ : 2.2-2.5 mm

C. (A.) rufithorax TELENGA, 1950

Centistes (Centistes) spinulosus sp. n.
(Figs 7-14)

Description of the holotype ♂. – Body 5 mm long. Head in dorsal view (Fig. 7) transverse, 1.87 times as broad as long, eye somewhat protruding and 2.6 times as long as temple, latter strongly rounded (or constricted). Ocelli large and elliptic, POL three times as long as OOL. Eye in lateral view 1.76 times as high as wide, twice wider than temple (Fig. 8). Malar space somewhat shorter than basal width of mandible. Face quadratic, slightly wider than high. Tentorial pits far from each other, distance between them three times as long as distance between a pit and eye. Occiput distictly carinated. Face along eye uneven, otherwise head polished. – Antenna somewhat shorter than body and with 30 flagellomeres. First flagellomere 3.6 times and penultimate flagellomere 1.8 times as long as broad.

Mesosoma in lateral view 1.55 times as long as high. Mesonotum entirely smooth and shiny, i. e. dimple before prescutellar furrow as well as notaulix on declivous part of mesonotum absent. Mesosternum along its fore and lateral margin densely haired (Fig. 11). Precoxal furrow also absent. Propodeum with a medio-transverse carina, its surface anteriorly from carina smooth and shiny, laterally (on declivous part) rugulose, posteriorly from carina with longitudinal rugae, interspaces shiny (Fig. 9). Metapleuron uneven to polished, otherwise mesosoma polished. – Fore coxa cubic, its outer surface densely spinulose (Fig. 10). Hind femur five times as long as broad medially. Inner spur of hind tibia as long as half basitarsus. Claws long (Fig. 12). Hind basitarsus as long as tarsomeres 2-3 and half of tarsomere 4.

Fore wing about as long as body. Pterostigma (Fig. 13) 2.85 times as long as wide, issuing radial vein just distally from its middle, r1 half as long as width of pterostigma, r2 straight and approaching tip of wing; n. rec. antefurcal. Metacarp 1.37 times as long as pterostigma; length of radial cell along metacarp one-fifth longer than pterostigma (Fig. 13, see arrows). – Hind wing: first section of n. med. three times as long as its second section.

Metasoma elongate, as long as head and mesosoma together. First tergite 1.56 times as long as broad behind, pair of spiracles before its middle, from base to spiracle broadening, beyond spiracle parallel-sided, laterally longitudinally striated, medially polished. Second tergite one-fourth shorter than third tergite, combined length of tergites 2-3 twice as long as basal breadth of tergite 2. Tergites 2-8 polished. Sternites 6-7 fused to form a common plate and setaceous.

Body tricoloured. Head black, clypeus and mandible brownish yellow. Mesosoma brownish yellow, metanotum and propodeum blackish brown. Metasoma blackish brown, sternites 1-2 yellow, further sternites brown. Scape and pedicel brownish yellow, flagellum greyish brownish. Palpi and tegula pale yellow. Legs yellow. Wings hyaline, pterostigma brown, veins opaque brownish.

Description of the male paratypes (5 ♂♂). – Similar to the holotype ♂. Body 4.5-5.2 mm long (4.5: 1 ♂, 4.8: 1 ♂, 5: 2 ♂♂, 5.2: 1 ♂). Antenna with 29-33 antennomeres (29: 2 ♂♂, 30: 1 ♂, 31: 1 ♂, 33: 1 ♂). Pterostigma 2.85-3 times as long as wide (2.85: 1 ♂, 3: 4 ♂♂). First tergite 1.42-1.66 times as long as broad behind (1.42: 2 ♂♂, 1.5: 1 ♂, 1.56 : 1 ♂, 1.66 : 1 ♂). Mesosoma blackish, prosternum brownish (1 ♂).

Female and host unknown.

Material examined. – Holotype ♂ + 4 ♂ paratypes: Korea, Pyongyang, City, Mt. Ryongak, at light, 30 May 1985, leg. VOJNITS et ZOMBORI, No. 962. – 1 ♂ paratype: Korea, Prov. North Pyongan, Mt. Myohyang, 13 September 1980, leg. FORRÓ et TOPÁL, No. 663.

Holotype and five paratypes are deposited in the Hungarian Natural History Museum (Department of Zoology), Budapest, Hym. Typ. Nos 7651 (holotype) and 7652-7656 (paratypes).

Etymology. – The species name "spinulosus" refers to the spinulose surface of fore coxa.

The new species, *Centistes* (*Centistes*) *spinulosus* sp. n., differs from all known Palaearctic species of *Centistes* s. str. by the following features: 1. temple very short, i.e. eye distinctly twice as long as temple (Fig. 7), 2. fore coxa cubic and its outer surface densely spinulose (Fig. 10), mesosternum along its fore and lateral margin densely haired (Fig. 11), 3. sternites 6-7 fused to form a common plate and setaceous, 4. body long (4.5-5.2 mm).

REFERENCES

ACHTERBERG, C. VAN (1985) VI. The genera and subgenera of Centistini, with the description of two new taxa from the Nearctic region (Hymenoptera: Braconidae: Euphorinae). *Zool. Med.* **59**(27): 348-362.

BELOKOBYLSKIJ, S. A. (1992) Revision of the genus Centistes Haliday (Hymenoptera: Braconidae: Euphorinae) of the USSR Far East and neighbouring territories. *Zool. Med.* **66**(11): 199-237.

MAETÔ, B. K. and NAGAI, K. (1985) Notes on braconid parasitoids of Medythia nigrobilineata (Motschulsky) (Coleoptera, Chrysomelidae), with description of a new species of Centistes Haliday (Hymenoptera, Braconidae). *Kontyû (Tokyo)* **53**(4): 729-733.

PAPP, J. (1992) New braconid wasps (Hymenoptera, Braconidae) in the Hungarian Natural History Museum, 3. *Annls hist.-nat. Mus. natn. hung.* **84**: 125-160.

SHENEFELT, R. D. (1969) Braconidae, part 1. *Hym. Cat.* (n. ed.) 4: 1-176.

TOBIAS, V. I. (1986) Podsem Euphorinae [in: 27th order Hymenoptera, Braconidae part 1.] *Opred. nasekomyh evropeyskoy chasti SSSR, Hymenoptera* **3**(4): 181-250.

Received October 3, 1994; accepted October 10, 1994

Acta Zoologica Academiae Scientiarum Hungaricae 40 (4), pp. 343-349, 1994

NEW EUPITHECIA AND CHLOROCLYSTIS SPECIES FROM SOUTH AMERICA (LEPIDOPTERA, GEOMETRIDAE: LARENTIINAE)

A. M. VOJNITS

Zoological Department, Hungarian Natural History Museum
H-1088 Budapest, Baross utca 13, Hungary

Five Neotropical species of *Eupithecia* CURTIS and two of *Chloroclystis* HÜBNER (sensu PROUT, 1915) are described: *Eupithecia oppidana* sp. n., *E. natalicia* sp. n., *E. percuriosa* sp. n., *E. subnixa* sp. n., *E. ina* sp. n., *Chloroclystis ignava* sp. n., *Ch. parthenia* sp. n.

Key words: *Eupithecia, Chloroclystis*, Neotropical, taxonomy

INTRODUCTION

The elaboration of the South American *Eupithecia* and related genera is still just beginning. The number of species hitherto described represents assumably a small fraction only of the probable richness of species. Beyond this, the older specific diagnoses are in many respects inadequate, but there are among the relatively recent ones also some which disregard the genitalia, although in these groups one cannot, or is hardly able to, rigthly work without a knowledge of the configuration of the genital apparatuses. Literature itself is also scattered enough to allow an easy tracing of the descriptions published here and there. RINDGE's (1987, 1991) communications form a refreshing exception. These masterly works on the *Eupithecia* fauna of Chile represent the best starting points for every subsequent survey dealing with the *Eupithecia* fauna of South America.

I emphasized in an earlier paper (VOJNITS, 1985) that within the tribus Eupitheciini the formation of the antennal structure is of significant importance, and have established on this basis some new genera. RINDGE, however, failed to find, in one of his works mentioned above (RINDGE, 1987), my arguments as convincing enough, but on the basis of the present elaboration I deem my original concept well founded and believe that when the Eupitheciini fauna of South America shall be better known, and when considerably more species will have been described than known at present, the reality of the subdivisions proposed by me will become acceptably manifest.

TAXONOMY

In the diagnoses given below the antennal structure will be given special attention, principally that in some species the ciliation of the males is shorter than that of the females.

Eupithecia oppidana sp. n.
(Figs 1-2, 9, 13, 20, 25)

Derivation of specific name: oppidanus (= suburban).

Diagnosis (Figs 1-2). Stature relatively small, wing elongate. Eye flattened hemisphaerical. Labial palp mottled yellow and brown, porrect, nearly one and a half times longer than diameter of eye. Antenna very densely ciliate, cilia extremely short, not reaching even one-third of diameter of shaft. Cilia of female sparser and longer, and also with cilia as long as diameter of shaft, situated in more or less regular distances. Alar expanse of male fore wings 20-21 mm, of the single female 18 mm. Fore wing an isosceles triangle, apex rounded, tornus obtuse. Hind wing short. Basic colour fuscous, darker in fore than in hind wing. Transverse stripes of fore wings yellowish, discal spot rounded, black, near costa. Underside of wings brownish yellow, pattern brown. Cilia striated yellowish brown and dark brown.

Male genitalia (Figs 9, 13, 20). Uncus actually monoapical, though another apex also appears much more posteriorly, as a minute tooth. Valva short, basally wide, rapidly narrowing apicad. Apex elongate and arcuate. Ampulla elongate, cylindrical, sparsely covered with short setae. Vinculum wide, basally concavely arcuate, bilaterally with auriculate projections. Aedoeagus elongate, cylindrical, with ribbon- and rod-like chitinous formations. Sternite VIII peculiar: bifid to its base, bilaterally with heavily sclerotized and arcuate arms, terminally robustly uncinate.

Female genitalia (Fig. 25). Bursa copulatrix asymmetrical, arched like a quarter moon, with a spinose field and a distinct, elongate, irregularly shaped, heavily sclerotized formation bearing short spines. Anterior and posterior apophyses short, papillae anales flat.

Biology. First states and foodplant unknown. The known species have been collected in September–October.

Distribution. South America, Ecuador. Locus typicus: Guachayacu.

Specific differences. A rather indistinct species, resembling several other species of similarly small stature and fuscous coloration; easily distinguished by the peculiar configuration of sternite VIII and the structure of the bursa copulatrix.

Material examined. Holotype male: "Guachayacu Ecuador Sep-Okt. 1926 9/6 28 Vorbech" "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. 14738 ♂ det. A. Vojnits". Paratypes: 8 males and 1 female with the same data. Holotype deposited in the Zoological Museum, Copenhagen, paratypes in Copenhagen and in the Hungarian Natural History Museum.

Slides: Nos 14734, 14738, 14740, 14741, 14742, 14743, 14744, 14745 (males), 14739 (female), gen. prep. A. VOJNITS.

Eupithecia natalicia sp. n.
(Figs 3, 10, 14, 19)

Derivation of specific name: natalicius (= birthdayly).

Diagnosis (Fig. 3). Stature medium, wings slightly elongate. Eye somewhat oval. Labial palp porrect, thick, broad, slightly longer than diameter of eye; mottled yellowish white and dark brown. Antenna densely ciliate, not or hardly longer than half diameter of shaft. Alar expanse of fore wings 19 mm. Termen of fore wing slightly longer than dorsum; costa, termen and dorsum arcuate. Apex obtuse, tornus widely rounded. Hind wing only slightly elongate, rounded. Basic colour of fore wing fuscous, toward median field rufous; antemedian obsolescent, postmedian broad, brown, submarginal line of terminal field yellowish. Discal spot circular, medium large, brownish black. Hind wing sericeous light brown, minute discal spot approaching costa, transverse stripes defined only in inner marginal field. Cilia short, on fore wings striated brownish yellow-brown, on hind wings fuscous-brownish yellow. Underside of both pairs of wings sericeous yellowish brown, pattern elements brown.

Male genitalia (Figs 10, 14, 19). Uncus elongate, bifid. Valva auriculate, apex obtuse, dorsum slightly arcuate, ventrum nearly evenly arched. Ampulla minute, oval, twice longer than its greatest diameter, and only sparsely setose. Vinculum wide, rounded. Aedoeagus short, cylindrical, with a rather Y-shaped chitinous formation. Sternite VIII rather large, basis long and incised, arms arcuate and terminally inclinate.

Female genitalia unknown.

Biology. Foodplant and first stages unknown. The single known specimen was captured in February.

Distribution. South America. Locus typicus: Ecuador.

Specific differences. Definitely of a "Palaearctic appearance"; to a certain degree resembling *Eupithecia curacautinae* RINDGE, 1987, but the new species is darker, greyish, while the latter is yellowish rufous. The configuration of the male genitalia is wholly different.

Material examined. Holotype male: "Ecuador Vorbech 2/6 29." "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. No. 15376 ♂ det. A. Vojnits". Holotype deposited in the Zoological Museum, Copenhagen.

Slide. No. 15376 (male), gen. prep. A. VOJNITS.

Eupithecia percuriosa sp. n.
(Figs 4, 24)

Derivation of specific name: percuriosus (= rather curious).

Diagnosis (Fig. 4). Wings elongate, external appearance marked. Eye hemisphaerical. Labial palp porrect, mottled brownish and yellowish white, nearly one and a half times longer than diameter of eye. Antenna densely ciliate, cilia shorter than half diameter of shaft. Alar expanse of fore wings 21 mm. Fore wing an isosceles triangle. Costa slightly arcuate preapically, termen hardly arched; apex pointed, tornus obtuse. Hind wings elongate. Basic colour of fore wing dark brown, obsolescent and disjointed transversal bands and submarginal line yellowish, veins covered by dark scales, especially in apical area, in anterior part of median field and in basal field. Discal spot indiscernible. Hind wing light, but along tornal region fuscous; therein transverse stripes well discernible, otherwise pallid. Cilia relatively long, on fore wing striated grey-dark grey, on hind wing grey-white. Underside of fore wing dark fuscous, of hind wing brownish white. Pattern elements, including discal spots, well defined.

Male genitalia unknown.

Female genitalia (Fig. 24). Bursa copulatrix small, narrow, root-shaped with irregularly situated chitinous spines. Anterior and posterior apophyses medium long. Papillae anales broad.

Biology. Foodplant and first stages unknown. The single known specimen was collected in June.

Distribution. South America. Locus typicus: Ecuador.

Specific differences. Resembling *Eupithecia taracarpa* RINDGE, 1987, but wings more elongate, basic colour of fore wing darker. Genitalia configuration of the new species is very peculiar and hardly confusable with those of any other congener; however, only the male is known of *taracarpa*, whereas the female only of the new species.

Material examined. Holotype female: "Ecuador Vorbech 2/6 29." "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. No. 15377 ♀ det. A. Vojnits". Holotype deposited in the Zoological Museum, Copenhagen.

Slide. No. 15377 (female), gen. prep. A. VOJNITS.

Eupithecia subnixa sp. n.
(Figs 5, 11, 15, 18)

Derivation of specific name: subnixus (= insolent).

Diagnosis (Fig. 5). Stature large, pattern conspicuous. Eye nearly sphaerical. Labial palp porrect, rufous, mixed with white, as long as one and a half diameter of eye. Antenna densely ciliate, cilia attaining half length of diameter of shaft. Alar expanse of fore wings 26 mm. Costa of fore wing very finely arcuate, subangulate preapically, termen weakly arched, essentially longer than unusually short dorsum; apex slightly elongate, tornus widely rounded. Hind wing rounded, extending beyond tornus of fore wing, but because fore wing elongate and its dorsum shortened, the hind wing is still short. Basic colour of fore wing yellowish brown, transverse stripes narrow, yellowish, discal spot minute, rounded, black. A greyish irroration and a marbled pattern discernible along costa, and partially in basal and median fields near dorsum. The most conspicuous is the broad, fuscous stripe extending – occasionally angulate – from apex toward middle of dorsum, containing black sagittate spots in apical field and in median field bordering on apical area. Hind wing yellowish grey, transverse stripes obsolescent, grey. Cilia medium long, on fore wing striated grey-whitish grey, on hind wing greyish white. Underside of wings sericeous yellowish brown, darker on fore than on hind wing; pattern elements obsolete.

Male genitalia (Figs 11, 15, 18). Uncus bifid, but ventral apex considerably smaller than dorsal one. Valva short, attenuating, both dorsum and ventrum thickened, apex obtuse. Ampulla small, short and thick, hardly attaining triple length of diameter; emitting long fascicles of spines and thus ampulla appearing longer. Vinculum wide. Aedoeagus long, cylindrical with a slightly arcuate chitinous spine nearly in its entire length. Base of sternite VIII slightly excised, arms very long, terminally pointed and arcuate.

Female genitalia unknown.

Biology. First stages and foodplant unknown. The single known species was collected in May.

Distribution. South America: Colombia. Locus typicus: Mt. Tolima, 4200 m.

Specific differences. As to size and basic colour, it resembles *Eupithecia nublae* RINDGE, 1987, while the conspicuous stripe decurrent from the apical area appears also in *E. vallenarensis* RINDGE, 1987; however, with respect to their other characteristics, they differ widely from the new species. As to the configuration of the male genitalia, the most conspicuous feature of the new species is the robust longitudinal chitinous spine in the aedoeagus.

Material examined. Holotype male: "Monta Tolima 4200 m Colomb. Cent. Cord Coll. Fassl" "Monte Tolima 4200 m Central Cordill. Columbia Fassl Modt. 6/5 1912 A. H. Fassl Coll. C. S. Larsen, Faaborg" "ZOOL. MUSEUM DK COPENHAGEN" "Gen. prep. No. 15363 ♂ det. A. Vojnits". Holotype deposited in the Zoological Museum, Copenhagen.

Slide. No. 15363 (male), gen. prep. A. VOJNITS.

Eupithecia ina sp. n.
(Figs 6, 23)

Derivation of specific name: inus (= lower).

Diagnosis (Fig. 6). Stature large, as a whole a grey and rather patternless species. Eye hemisphaerical. Labial palp porrect, yellowish white, twice longer than diameter of eye. Antenna sparsely ciliate, their length generally not reaching half diameter of shaft; also some longer cilia present here and there. Alar expanse of fore wings 21 mm. Costa subangulate praeapically, termen very slightly undulate, dorsum straight. Termen longer than dorsum. Apex elongate, tornus well developed. Hind wing short, slightly angulate. Basic colour of fore wing fuscous, transverse stripes yellowish white; veins covered with dark scales mainly in basal and costal fields. An elongate, blackish spot – nearly a stripe – present in terminal field. Hind wing light grey, stripes fuscous. Discal spots on both pairs of wings extremely small, punctiform, black. Cilia of fore wing short, on hind wing striated grey-light grey. Underside of wings sericeous fuscous, fore wing lighter than hind wing, pattern elements yellowish white. Discal dots well discernible.

Male genitalia unknown.

Female genitalia (Fig. 23). Bursa copulatrix pyriform, densely padded by chitinous spines. Antrum small. Both anterior and posterior apophyses short. Papillae anales squat.

Biology. First stages and foodplant unknown. The single known species was collected in May.

Distribution. South America: Colombia. Locus typicus: Mt. Tolima, 3200 m.

Specific differences. As to size and wing shape, the new species resembles *Eupithecia corralensis* (BUTLER, 1882) but it differs by its coloration and pattern; however, only the male of *corralensis* is known, whereas the female only of the new species.

Material examined. Holotype male: "Monte Tolima 3200 m Colomb. Cent. Cord. Coll. Fassl" "Monte Tolima 3200 m Central Cordill. Columbia Fassl Modt. 6/5 1912 af A. H. Fassl Coll. C. S. Larsen, Faaborg" "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. No. 15365 ♀ det. A. Vojnits".

There is a further specimen with the same data but from an elevation of 4200 m. Its genitalia are injured, the bursa copulatrix missing, and the insect does not wholly agree in its external morphology with the preceding specimen, hence it is relegated here only provisionally.

Holotype deposited in the Zoological Museum, Copenhagen.

Slides. Nos 15364, 15366 (females), gen. prep. A. VOJNITS.

Chloroclystis ignava sp. n.
(Figs 7, 12, 16-17, 22)

Derivation of specific name: ignavus (= weak).

Diagnosis (Fig. 7). Stature small, wings moderately broad. Eye hemisphaerical. Labial palp porrect, yellowish, not reaching one and a half diameter of eye. Male antenna densely ciliate, cilia hardly reaching half diameter of shaft. Female cilia only one-third as long. Alar expanse of male fore wings 18-19 mm, that of female 18.5 mm. Costa and termen of fore wing arcuately convex, dorsum slightly longer than termen; apex finely pointed, tornus obtuse. Hind wing angulate. Basic colour of fore wing rufous brown, median field and postmedian line yellowish, in terminal and apical areas irrorated greyish. Discal spot minute, round, dark, hardly discernible. Hind wing brownish yellow, transverse bands obsolescent, fuscous. Cilia striated brown-fuscous. Underside brownish yellow, fore wing darker than hind wing; pattern elements brown.

Male genitalia (Figs 12, 16, 17). Uncus elongate, actually monoapical, though ventrally with a minute, dentiform projection. Valva elongate, narrow, dorsum thickened to two-thirds of its length, ventrum to one-half; heavily sclerotized, apex rounded. Ampulla narrow, six times as long as wide, its rounded apex inner side covered with some thin and short setae. Vinculum widely rounded. Aedoeagus elongate, thin, slightly curved, terminally clavate and sclerotized, with two ribbon-like and twisted chitinous formations. Base of sternite VIII heavily sclerotized, ribbon-shaped and divided into two parts, its arms long and arcuate and especially heavily sclerotized.

Female genitalia (Fig. 22). Bursa copulatrix small, strawberry-shaped, padded with densely situated chitinous spines. Antrum sclerotized, infundibuliform. Both anterior and posterior apophyses short. Papillae anales rice-shaped.

Biology. First stages and foodplant unknown. The known specimens have been collected in September-October.

Distribution. South America: Ecuador. Locus typicus: Guachayacu.

Specific differences. Externally, the new species resembles *Eupithecia caburgua* RINDGE, 1987, but its wings are longer, the basic colour darker. The configuration of the genitalia is naturally wholly different.

Material examined. Holotype male: "Guachayacu Ecuador Sep-Oct. 1926 Vorbech 9/6 28" "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. No. 14732 ♂ det. A. Vojnits". Paratypes: two males and one female with the same data. Holotype deposited in the Zoological Museum, Copenhagen, paratypes in the same institute and in the Hungarian Natural History Museum.

Slides. Nos 14732, 14736 (males), 14754 (female), gen. prep. A. VOJNITS.

Chloroclystis parthenia sp. n.
(Figs 8, 21)

Derivation of specific name: parthenius (= virginal).

Diagnosis (Fig. 8). Stature medium, wings relatively broad. Eye hemisphaerical. Labial palp porrect, elongate, yellow, twice longer than diameter of eye. Antennal cilia densely situated, very short, not longer than 1/3 or 1/4 of shaft. Alar expanse of fore wings 19 mm. Costa and termen of fore wings very finely arcuate, dorsum straight. Apex pointed, tornus angulate. Hind wing small and angulate. Basic colour of fore wing yellowish brown, transverse stripes brown, discal spot round, dark brown, medium large with straight sagittate spots. Hind wing fuscous; stripes narrow, brown, with also a very characteristic wide, arcuate, greyish band. Discal spot minute, brownish black, near costa. Cilia medium long, on fore wing striated brownish yellow-brown, on hind wing fuscous-greyish yellow. Underside of wings brownish yellow, pattern elements brown.

Male genitalia unknown.

Female genitalia (Fig. 21). Bursa copulatrix sphaerical, cervical part long, tubiform; antrum heavily sclerotized. Both anterior and posterior apophyses short. Papillae anales broad.

Biology. First stages and foodplant unknown. Flight period of imago unknown.

Distribution. South America: Peru. Locus typicus: Paucartambo.

Specific differences. Externally, the new species resembles *Eupithecia correana* RINDGE, 1987, but *parthenia* can be distinguished by the dark sagittate spots of the fore wing. The configuration of the genitalia is naturally wholly different.

Examined material. Holotype female: "Paucartambo Peru 1953 Sundholm" "ZOOL. MUSEUM DK COPENHAGEN" "gen. prep. No. 15368 ♀ det. A. Vojnits". Holotype deposited in the Zoological Museum, Copenhagen.

* * *

Acknowledgements. – I am indebted to Dr N. P. Kristensen (Copenhagen) for his placing to my disposal the specimens discussed above from the Zoological Museum. I am also thankful to Mr M. Honey (London), for his permission to study the material preserved in The Natural History Museum, London.

The research was supported by the National Scientific Research Fund (OTKA No. 3181).

REFERENCES

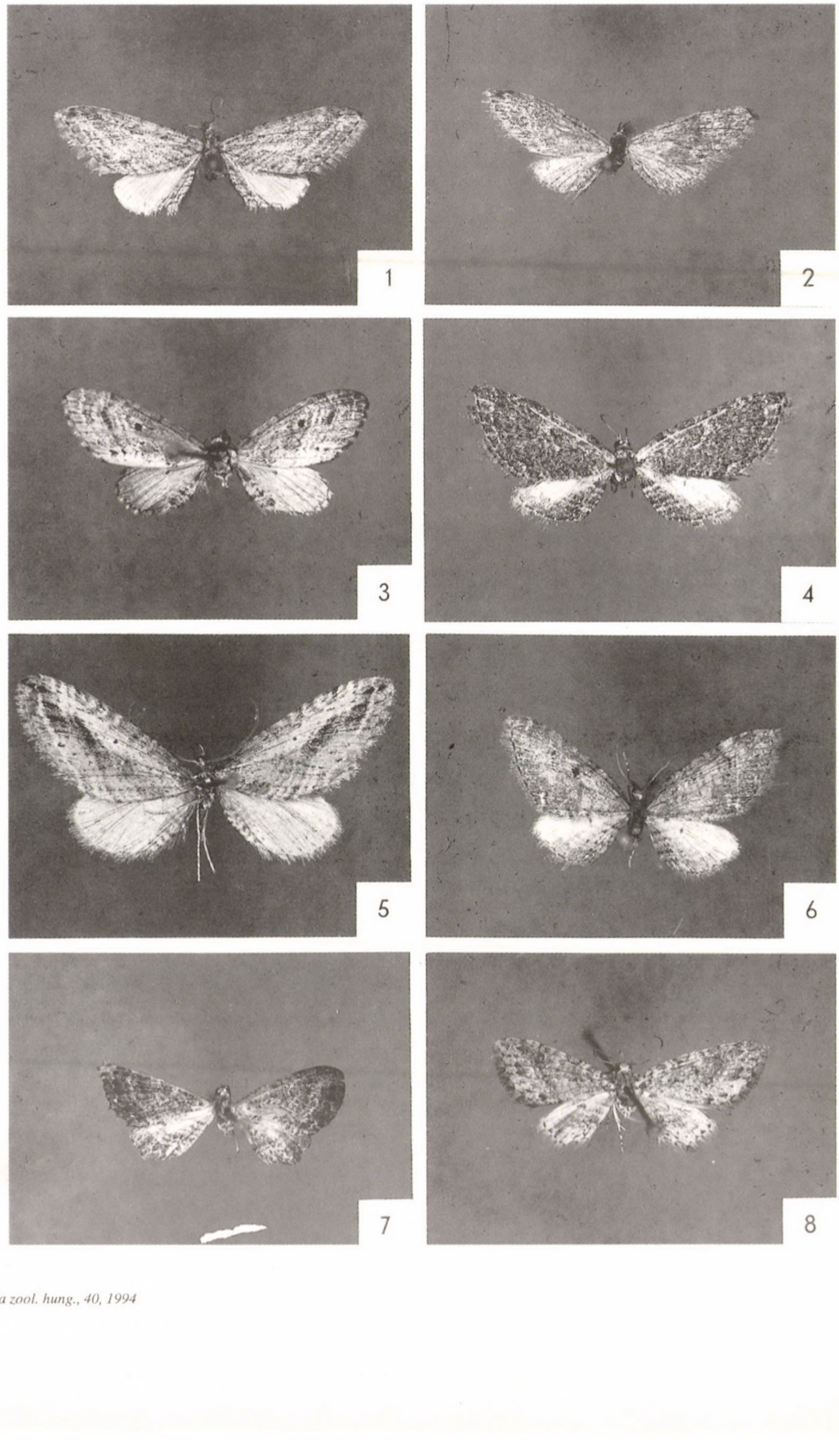
RINDGE, H. F. (1987) The Eupithecia (Lepidoptera, Geometridae) of Chile. *Bulletin of the American Museum of Natural History, New York* **186**: 269-363.

RINDGE, H. F. (1991) The Eupithecia (Lepidoptera, Geometridae) of Chile. II. *American Museum Novitates* **3020**: 1-14.

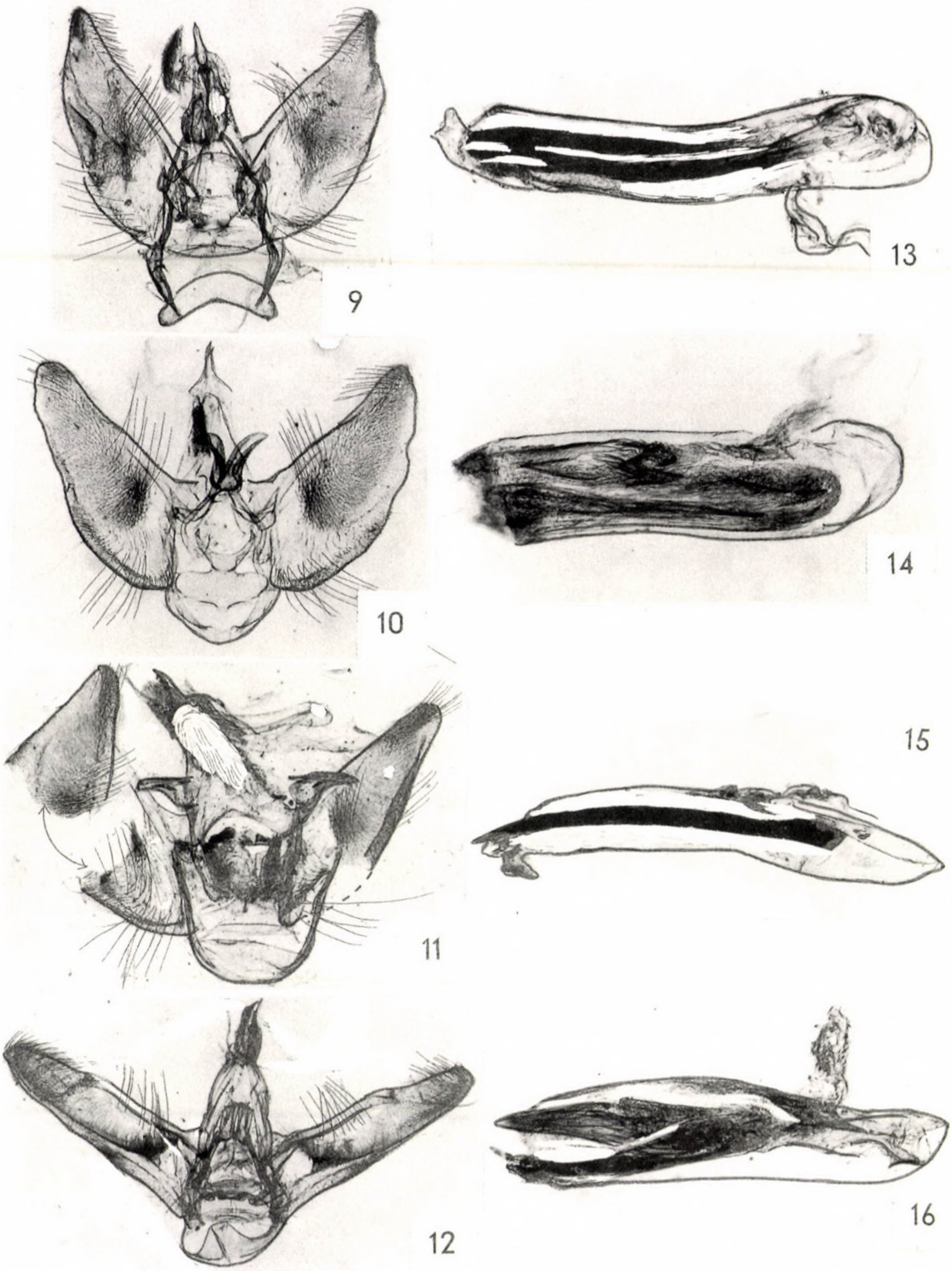
VOJNITS, A. M. (1985) New South American genera and species of Eupitheciini (Lepidoptera: Geometridae). *Acta zool. hung.* **31**: 405-418.

Received September 20, 1994; accepted October 20, 1994

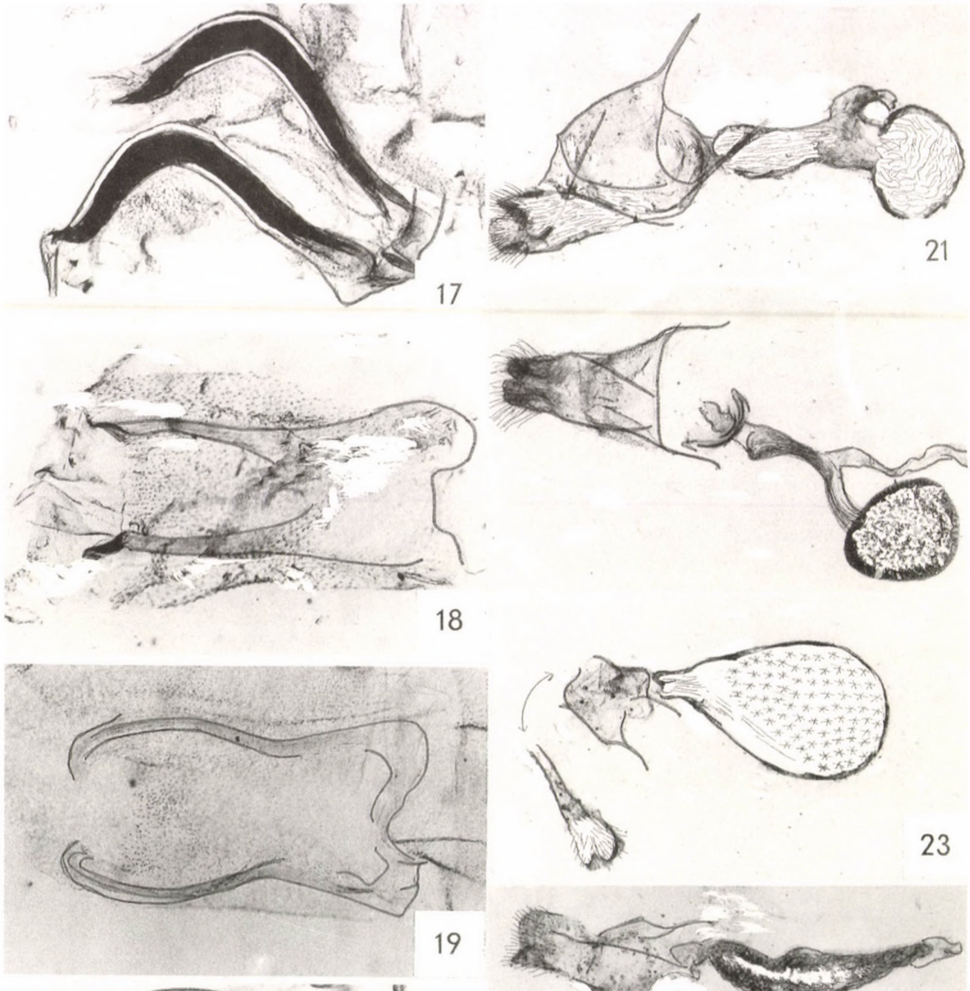
Figs 1-8. 1 = *Eupithecia oppidana* sp. n. paratype male, 2 = paratype female, 3 = *E. natalicia* sp. n. holotype male, 4 = *E. percuriosa* sp. n. holotype female, 5 = *E. subnixa* sp. n. holotype male, 6 = *E. ina* sp. n. holotype female, 7 = *Chloroclystis ignava* sp. n. holotype male, 8 = *Ch. parthenia* sp. n. holotype female.



Figs 9-16. Male genitalia of 9 = *Eupithecia oppidana* sp. n., 10 = *E. natalicia* sp. n., 11 = *E. subnixa* sp. n., 12 = *Chloroclystis ignava* sp. n.; Aedoeagus of 13 = *E. oppidana* sp. n., 14 = *E. natalicia* sp. n., 15 = *E. subnixa* sp. n., 16 = *Ch. ignava* sp. n.



Figs 17-25. Sternite VIII of 17 = *Chloroclystis ignava* sp. n., 18 = *Eupithecia subnixa* sp. n., 19 = *E. natalicia* sp. n., 20 = *E. oppidana* sp. n.; Female genitalia of 21 = *Ch. parthenia* sp. n., 22 = *Ch. ignava* sp. n., 23 = *E. ina* sp. n., 24 = *E. percuriosa* sp. n., 25 = *E. oppidana* sp. n.



Acta Zoologica Academiae Scientiarum Hungaricae 40 (4), pp. 351-357, 1994

TWO NEW GALUMNID SPECIES (ACARI: ORIBATIDA) FROM THAILAND*

S. MAHUNKA

Department of Zoology, Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13, Hungary

Emendation and description of oribatids from Thailand. Description of two galumnid species from the Kaeng Krachan and from the Erewan National Parks. One of them *Bigalumnella csavasorum* gen. et sp. n. is representing also a new genus. With 14 original figures.

Key words: Acari, Oribatida: Galumnidae, taxonomy, new taxa, Thailand

A collecting trip to Thailand was organized in this year by the Hungarian Natural History Museum (MAHUNKA & MAHUNKA-PAPP 1994). The main aim was to collect the soil fauna in this – zoogeographically – very important territory**.

I am planning a series of publications** for the collected mites; and in this first contribution I describe 2 species of the family Galumnidae. One of them belongs to the genus *Pergalumna* GRANDJEAN, 1936, however for the other species it was necessary to establish a new genus (*Bigalumnella* gen. n.).

Bigalumnella gen. n.

Diagnosis: Family Galumnidae, subfamily Galumnellinae. Cerotegument with strong sculpture. Lamellar and sublamellar lines present, nearly equally developed. All setae of prodorsum reduced, or represented only by their alveoli. Dorsosejugal suture complete, a strong median apophysis present, a similar one as in the *Eupelops* genus. Ten pairs of minute notogastral setae, many of them represented again by their alveoli. Neither porose area nor sacculi visible on the notogaster. Mentum suctorial type with a long tube anteriorly. Epimeral setal formula: 1 – 1 – 2 – 2. Anal aperture located far from the posterior margin of the ventral plate. Anogenital setal formula: 3 – 1 – 2 – 3. Lyrifissures *iad* originating far anteriorly from the anal plates. All legs bidactylous and heterodactylous, with normal chaetotaxy.

Type species: *Bigalumnella csavasorum* sp. n.

* Oribatids from Thailand, I.

** Supported by the National Scientific Research Fund (OTKA 3165)

Remarks: On the basis of the peloptoid chelicerae, the characteristic sculpture of the body, the minute notogastral setae, the position of the adanal lyrifissures the new species is well ranging to the relationships of the genus *Galumnella* Berlese, 1916 (Galumnellinae Balogh, 1960). However, the species belonging to this genus, showed monodactylous and tridactylous legs, bidactylous form was heretofore not known. The question is, whether the number of claws (and the other also questionable feature: e.g. the presence of a strong median sejugal apophysis) enough or not for an establishment of a new genus.

Derivatio nominis: After the number of claws.

Bigalumnella csavasorum sp. n.
(Figs 1-7)

Measurements: Length of body: 294-316 μm; width of body: 223-240 μm.

Prodorsum: Rostral apex sharply pointed. Prodorsal surface distinctly punctate, this sculpture much weaker between the lamellar and sublamellar lines than on the other surface. These lines run nearly parallel to each other (Fig. 2). All prodorsal setae reduced. Sensillus large, directed backwards, with strong spines arranged in longitudinal rows. Its ventral part smooth.

Notogaster: Dorsosejugal suture convex. The median notogastral apophysis characteristically incised distally. Pteromorphae and the whole surface of the notogaster punctate, the size and the distance of these formations vary. In the deeper layer a characteristic but weak polygonate sculpture also observable (Fig. 1). Ten pairs of minute setae present, they are well visible only in the posteromarginal position. The number and position of lyrifissures, etc. as usual.

Ventral regions (Fig. 4): Whole surface including the mentum and the genital and anal plates, but excluding the region outside the circumpedal carina, punctate, the polygonal sculpture well observable on the ventral plate. Epimeral setae reduced, represented also by their alveoli. Setae *3b* originating conspicuously posteriorly, beside the genital aperture. Three pairs of genital setae arising along the anterior margin of the genital plates, insertions of adanal setae compose a semicircular formation (Fig. 4).

Legs: All legs bidactylous, with strong heterodactyly. Femora of some legs foveolate and/or rugose. Legs setal formulae:

I: 0 – 4 – 3+1 – 4+1 – 20+2 – 2 (Figs 3 and 7),
II: 0 – 4 – 3+1 – 4+1 – 15+1 – 2,
IV: 1 – 2 – 2 – 3+1 – 12 – 2 (Figs 5-6).

Seta v on femur I very short, solenidium of genu II conspicuously long, setae d near to it very short, spiniform.

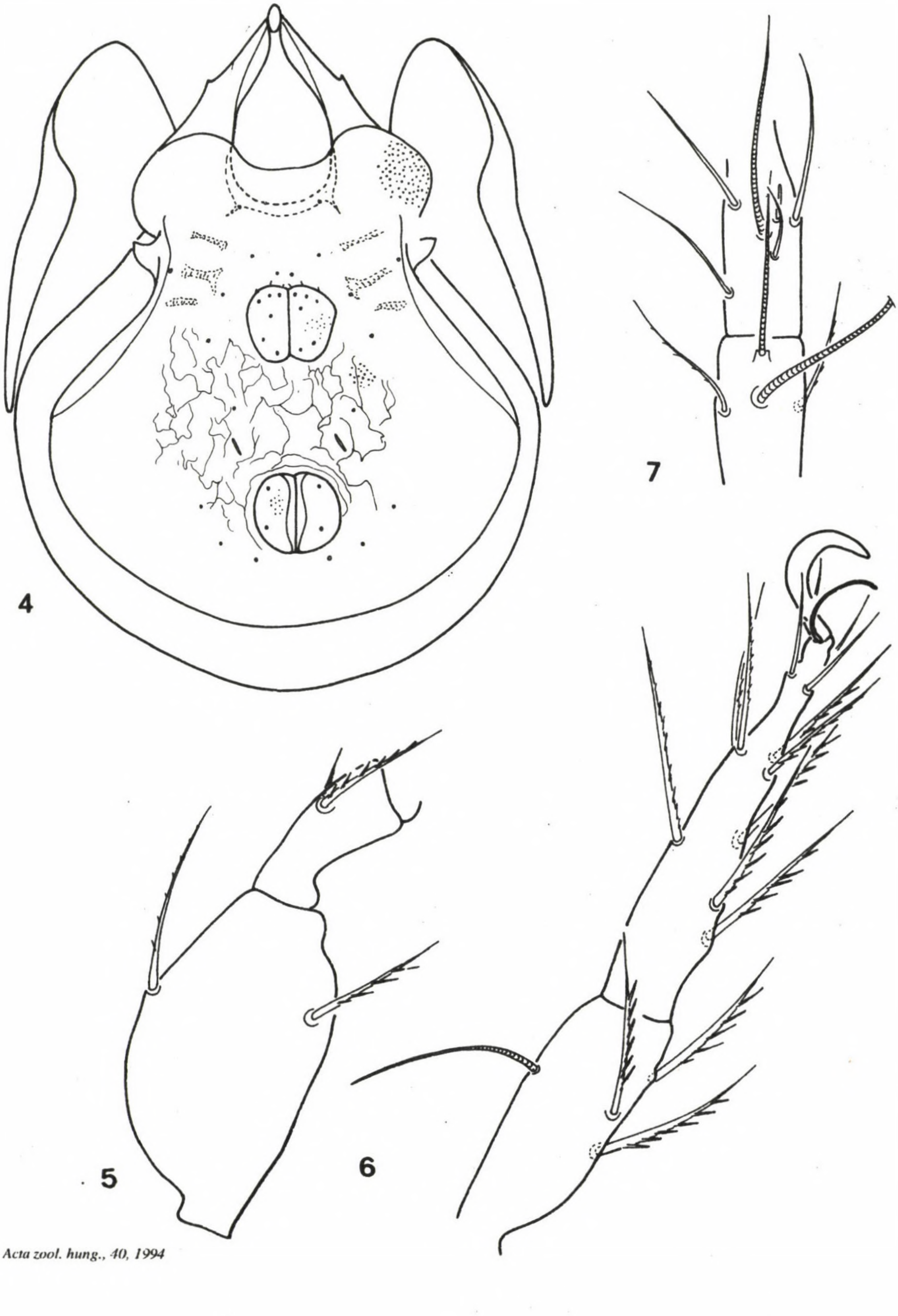
Material examined: Holotype (1493-HO-94): Thailand, Erawan National Park (Kancsanaburi), Erawan waterfall. 14. II. 1994. Berlese sample from litter accumulated at the foot of trees between the 5th and 6th steps of the waterfall. Leg. S. MAHUNKA & L. MAHUNKA-PAPP.

Remarks: Beside the features mentioned in the genital diagnosis, the new species is well distinguished from all congeners by the form of the sensillus and the fine polygonal sculpture.

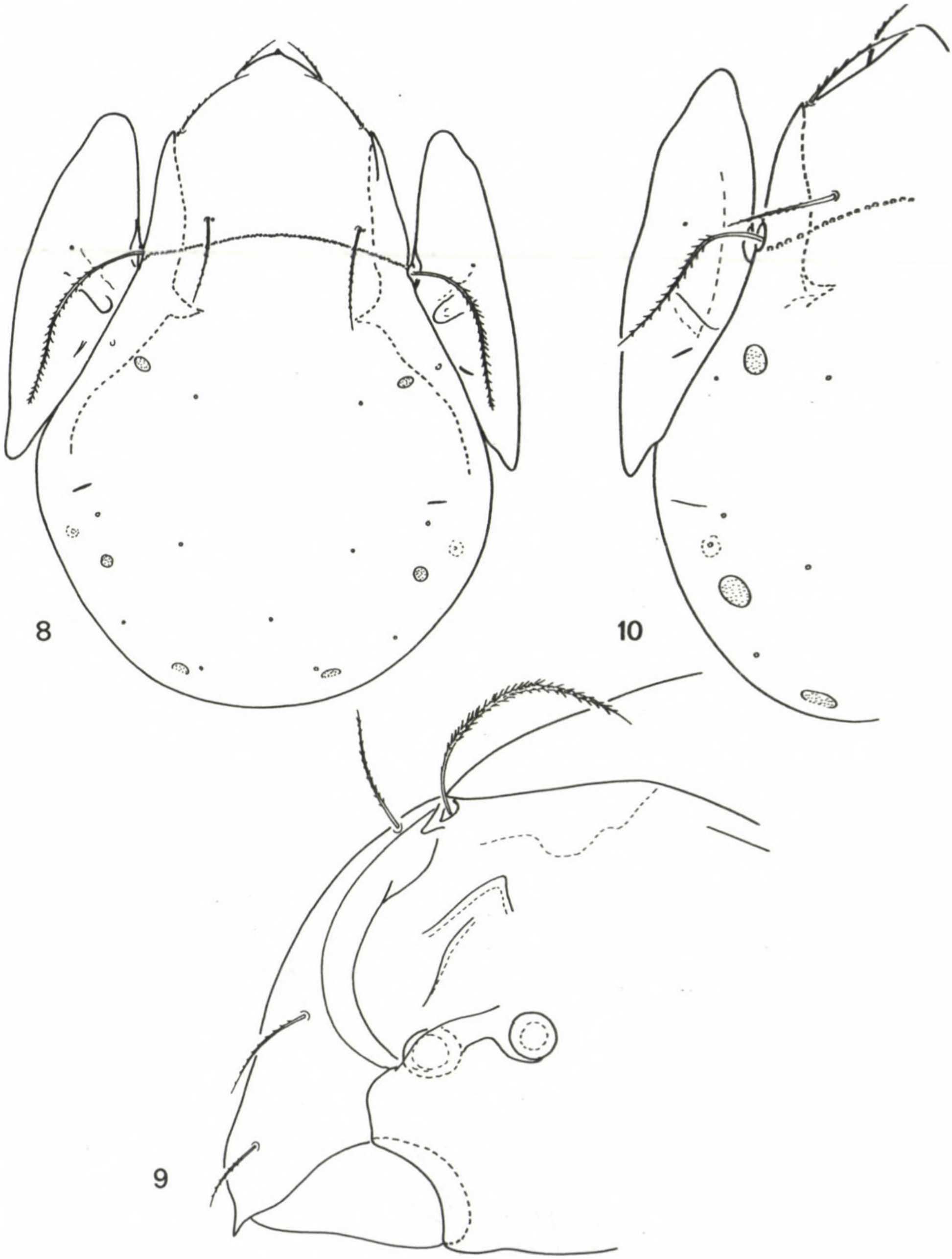
Derivatio nominis: I dedicate this new species to Mr I. CSÁVÁS (the aquacultural research officer of FAO) and Mrs M. CSÁVÁS (Bangkok), for their incessant help in our collecting work in Thailand (see MAHUNKA & MAHUNKA-PAPP 1994).

Figs 1-3. *Bigalumnella csavasorum* gen. et sp. n.: 1 = body in dorsal aspect, 2 = prodorsum in lateral aspect, 3 = tarsus and tibia of leg I

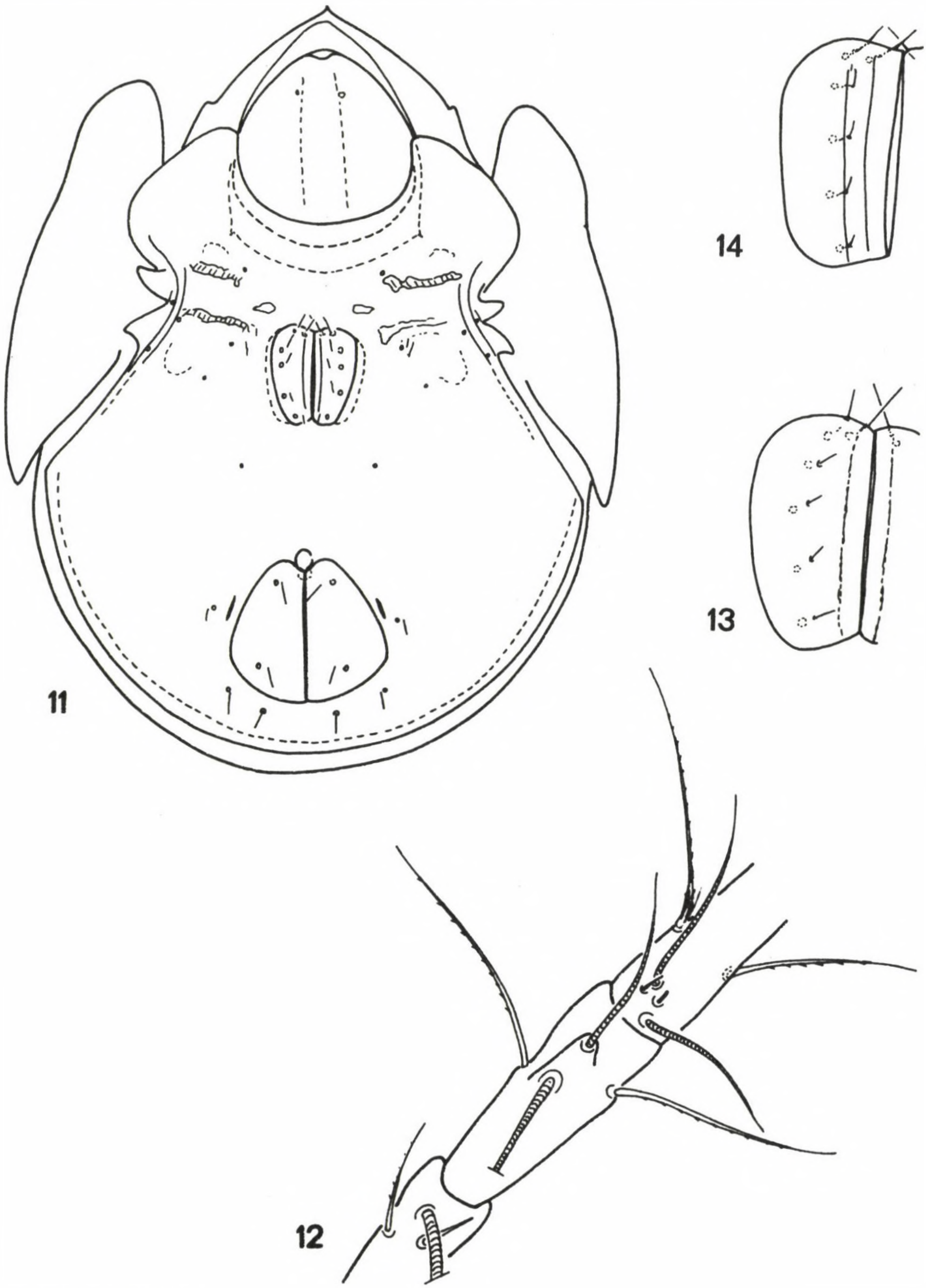
Figs 4-7. *Bigalumnella csavasorum* gen. et sp. n.: 4 = body in ventral aspect, 5 = femur and genu of leg I, 6 = tarsus and tibia of leg IV, 7 = solenidial group of leg I



Figs 8-10. *Pergalumna pseudomargaritata* sp. n.: 8 = body in dorsal aspect, 9 = prodorsum in lateral aspect, 10 = *Pergalumna margaritata* MAHUNKA, 1989 (holotype): body in dorsal aspect



Figs 11-14. *Pergalumna pseudomargaritata* sp. n.: 11 = body in ventral aspect, 12 = solenidial group, 13 = genital plate, 14 = *Pergalumna margaritata* MAHUNKA, 1989 (holotype): genital plate



Pergalumna pseudomargaritata sp. n. (Figs 8-11)

Measurements. Length of body: 402-447 μm, width of body: 281-315 μm.

Prodorsum: Whole surface strongly punctuate. Rostrum with elongated, sharply pointed apex. Prodorsal outline in lateral aspect (Fig. 9) waved anteriorly. Lamellar and sublamellar lines equally strong, running nearly parallel with each other. All three pairs of prodorsal setae long, setae *in* slightly thicker, setae *le* longer than the others. Setae *le* not reaching to the rostrum, all three pairs well pilose. Sensillus very long, directed backwards, with long cilia on both margins. Areae porosae dorsosejugales absent.

Notogaster: A typical dorsosejugal suture absent, but a arched row of very small granules (Fig. 8) present. Three pairs of very small porose areae, ten pairs of large alveoli, 5 pairs of lyrifissures (*im* in lateral position), a small median porus on the notogaster well observable.

Ventral regions: The whole surface well punctate. Epimeral setae visible, setal formula: 1 – 0 – 3 – 2. Circumpedal carina strong (Fig. 11). One pair of weak longitudinal scratch, near to and parallel with the inner margin on the genital plates present. Two pairs of genital setae arising on the anterior margin of and four pairs stand in a longitudinal row on the genital plate (Fig. 13). Among the setae in the anal region setae ad_1 longest of all. Area porosa postanalis absent.

Legs: All tridactylous, the solenidial group of leg I as shown in Fig. 12.

Material examined: Holotype (1494-HO-1994): Thailand, Kaeng Krachang (Phetchaburi), Kaeng Krachang National Park, Camp. 9. II. 1994. Berlese sample from wet litter and soil near the water basin. Leg. S. MAHUNKA & L. MAHUNKA-PAPP. 12 ex.: from the same sample. Holotype and 10 paratypes: HNHM, 2 paratypes: MHNG.

Derivatio nominis: Referring its relationship (very similar to *P. margaritata*).

Remarks: The new species stands so close to *Pergalumna margaritata* MAHUNKA, 1989 described from Vietnam, that at the first moment I identified it with the latter. But after the examination of the type specimen of *P. margaritata* it became clear that it is a new species distinguishable from the other by the much smaller tubercles in the dorsosejugal region, the much smaller porose areas on the notogaster, the longer rostral apex, the weak sculpture on the anterolateral part of coxisternal region and the number of the longitudinal scratches on the genital plates (see partly these features of *P. margaritata* in Figs 10 and 14).

REFERENCES

MAHUNKA, S. (1989) A survey of the Oribatid fauna (Acari) of Vietnam, III. *Folia ent. hung.* **50**: 47-89.

MAHUNKA, S. & L. MAHUNKA-PAPP (1994) A report on the first Hungarian zoological collecting trip to Thailand. *Folia ent. hung.* **55**: 263-270.

Received October 1, 1994; accepted October 17, 1994

Acta Zoologica Academiae Scientiarum Hungaricae 40 (4), pp. 359-367, 1994

ROOSTING SITE FIDELITY OF GREAT TITS (PARUS MAJOR) DURING WINTER

BÁLDI, A.[1] & T. CSÖRGŐ[2]

[1] *Ecological Research Group, Hungarian Natural History Museum*
Budapest, Baross u. 13, H-1088, Hungary
[2] *Department of General Zoology, Eötvös Loránd University*
Budapest, Puskin u. 3, H-1088, Hungary

We studied roosting site fidelity of the Great Tit in winter. The study was conducted in a Central-Hungarian Alder forest from 1986 to 1990. We found strong area fidelity in majority of the roosting Great Tits. Eighty percent of adult males used nestboxes within an area of D = 130 m, and adult females within an area of D = 150 m. Eighty percent of observations were within 180 m for immature males. For immature females the sample size was too low to establish conclusions. The wintering sites overlapped strongly with the breeding territories, eighty percent of roosting Great Tits were observed less than 120 m apart from their breeding holes. This study supports the hypothesis that familiarity with future breeding site may promote territory establishment, although it does not exclude the alternative explanation that residency may confer an advantage during winter alone.

Key words: Great Tit, *Parus major*, winter roosting, site fidelity, age, sex

INTRODUCTION

Although the Great Tit (*Parus major*) is one of the best studied birds (see e.g. PERRINS, 1979, KREBS, 1985), its roosting behaviour is relatively poorly known. Both HINDE (1952) and PERRINS (1979) in their comprehensive books about tits gave only one or two pages for the roosting habits of the Great Tit. However, in the last years more and more papers have been published on the winter roosting of tits. WINKEL & HUDDE (1988) surveyed all nestbox roosting bird species on a regional scale. SCHMIDT *et al.* (1985) evaluated the limits of nocturnal checks for tits, and found this method applicable to estimate the relatively stable population. BÁLDI & CSÖRGŐ (1991) also found that the number of resident Great Tits sharply declined for the feeding birds, but not for the ones roosting during winter. DHONDT & EYCKERMAN (1980), DHONDT *et al.* (1991) and KEMPENAERS & DHONDT (1991) studied the competition between Great and Blue Tit (*P. caeruleus*) for roosting sites in winter. DRENT (1987) studied the importance of holes for territory settlement. BÁLDI & CSÖRGŐ (1993) used the number of recaptures in nestboxes as an indication of resource holding power in Great Tits, and evaluated social dominance applying this new approach.

The aim of this study is to analyse roosting site fidelity of individually marked Great Tits. Our questions were:

(i) How do Great Tits distribute themselves into roosting sites?
(ii) What are the temporal dynamics of roosting pattern?
(iii) Are there differences in roosting site fidelity between the age and sex classes?
(iv) What is the underlying evolutionary reason for wintering area fidelity?

STUDY AREA AND METHODS

The study was conducted in the Ócsa Landscape Conservation Area, about 30 km from Budapest in Central Hungary (47°15'N; 19°15' E). The study area is situated in a small (7 ha) Alder (*Alnus glutinosa*) forest. In spring of 1986 100 nestboxes were spaced out into the forest, in the point of a 30×30 m grid. All boxes were of the same type with an entrance diameter of 32 mm. Boxes in poor condition were replaced.

Diameter of the tree trunks at breast height was about 15-25 cm. The habitat next to the nestbox area is a heterogeneous landscape consisting mainly of marshes, reeds, and various willow bushes (*Salix alba, S. cinerea, S. caprea*). We assume that the number of natural holes was negligible, therefore all possible roosting cavities were checked by us.

The nestboxes were visited at night two weekly between November/December and March from 1986/87 to 1989/90. SCHMIDT *et al.* (1985) suggested that more frequent checkings may disturb the population. The starting date usually depended on the onset of cold weather. All tits in the nestboxes were ringed, and their age and sex were determined.

We investigated the area fidelity in two ways. First, the distances of movements within a winter were evaluated, i. e. how many individuals moved in 2, 4, 6, 8, 10 week intervals over distances of 0, 30, 60, etc. m apart. Second, the overlap between winter home range and breeding territory was evaluated. For this purpose we measured for all the detected breeding individuals the distances between the breeding-hole and all nestboxes used for roosting.

RESULTS

There were 847 observations of roosting Great Tits during the study. In addition, there were 23 observations of roosting Blue Tit, 11 observation of Tree Sparrow (*Passer montanus*) and 3 records of Nuthatch (*Sitta europaea*). We evaluated only the Great Tit data, because the other species were very rare.

The great majority of observations (89%) were recaptures. Of 847 captures, 751 were of ringed birds, and only 96 of unringed immigrant birds. All Great Tits were ringed in the nestbox area, in nestboxes or by mistnets at feeders in winter, or during the breeding season at the nesting holes. The immigrant birds were ringed mainly in November (Fig. 1), at the first checkings, usually when the weather became cold. New immigrant birds were only rarely registered later in the winter. The fluctuations in number of roosting Great Tits were small (Fig. 2), except in the winter of 87/88, when a disease decimated the roosting tits in January.

Table 1. Sizes of areas used by Great Tits for roosting in winter in a Hungarian Alder forest. The area parameters values were based on more than 80% of observations. (N: number of observations; D: diameter (m); A: area (ha))

	N	D	A
Adult male	498	130	1.3
Adult female	205	150	1.8
Immature male	427	180	2.5
Immature female	152	200	3.1

Most wintering tits used nestboxes within a restricted area (Fig. 3). The size of these areas (Table 1) seemed to be stable, as it did not change considerably with the increasing time between two observations (2, 4, 6, ... weeks). The curves of the different checking times changed parallel. It shows, that the individuals moved within a limited area, irrespective of time between the two checkings (Fig. 4). However, there are some differences among the age and sex classes in the size of the area (Table 1). In adult and immature females the curves are less parallel, than those of males, perhaps as a consequence of smaller number of females.

The curves of distances between the nesting and the roosting holes showed similarity to the shape of the curves of wintering area fidelity (Fig. 5). However, the curves of breeding area fidelity showed that distances between the nesting

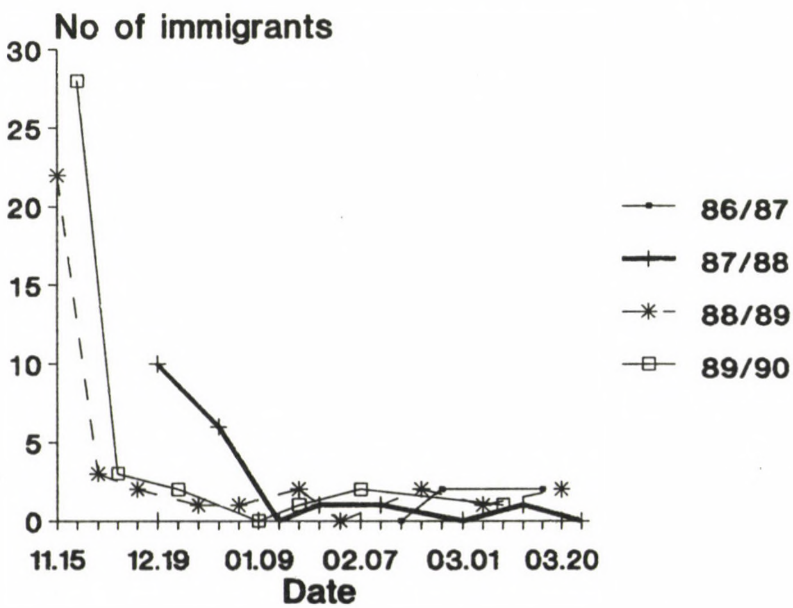


Fig. 1. Number of immigrant Great Tits observed as roosting birds in winter. Total number of individuals was 96

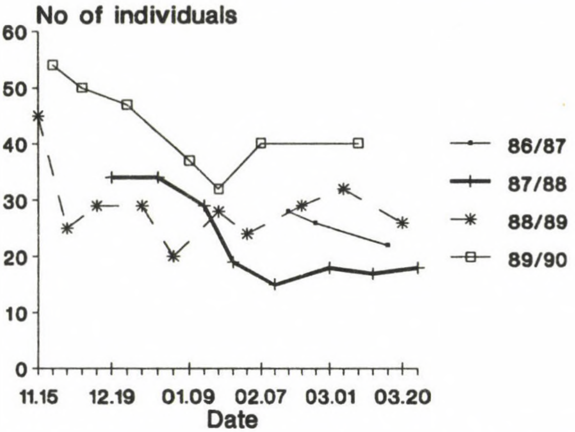


Fig. 2. Number of roosting Great Tits during winter. Total number of observations for the 4 years was 847

hole and the roosting holes of an individual were less than the distances between the roosting holes. The distances remain within 120 m for eighty percent of both males and females. The underlying reason for the smaller distances is that the nesting hole is tend to be in the middle of the winter home range.

DISCUSSION

Roosting site selection probably affects survival. Based on life history strategies different species apply different strategies. One strategy is based on the availability of food. Communal roosting of birds (e.g. Starling *Sturnus vulgaris*; Carrion Crow, *Corvus corone corone*) is explained by the information centre hypothesis, as an adaptation for exploiting patchily and unpredictably distributed food (e. g. RICHNER & MARCLAY, 1991, but see CACCAMISE & MORRISON, 1986).

A second strategy is based on the avoidance of predators and/or winter inclement weather. JENNI (1991) suggests that the roost sites selected by Bramblings (*Fringilla montifringilla*) are protected against both wind and cold air. Tits usually select roosting sites which provide protection against wind, precipitation and predators (DRENT, 1987, WINKEL & HUDDE, 1988). If holes or nestboxes are not available, tits roost in dense vegetation. T. SZÉKELY (pers. comm.) found that tits often use the very dense twigs on trunks caused by fungal disease (*Taphrina* spp.) for roosting.

Tits are all territorial in the breeding season, but show a wide range of territorial behaviour in winter (GIBB, 1956). Recently EKMAN (1989) and MATTHYSEN (1990) reviewed the social organization of titmice in the nonbreeding

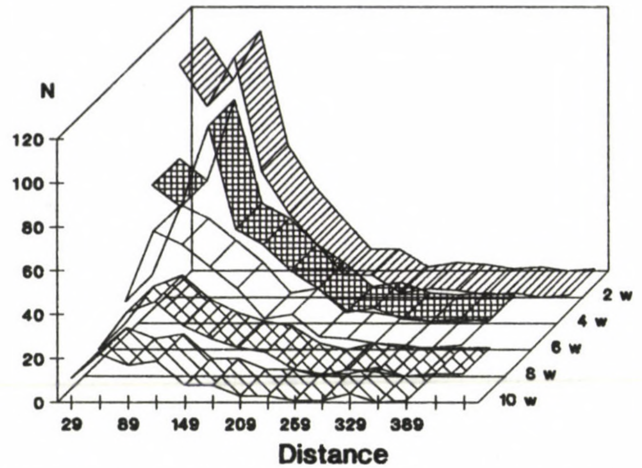


Fig. 3. Frequency distribution of the distance between roosting sites in winter plotted against the time between two checks (weeks). Number of observations (N) were 454, 343, 238, 149 and 98 for the 2, 4, 6, 8 and 10 weeks periods, respectively

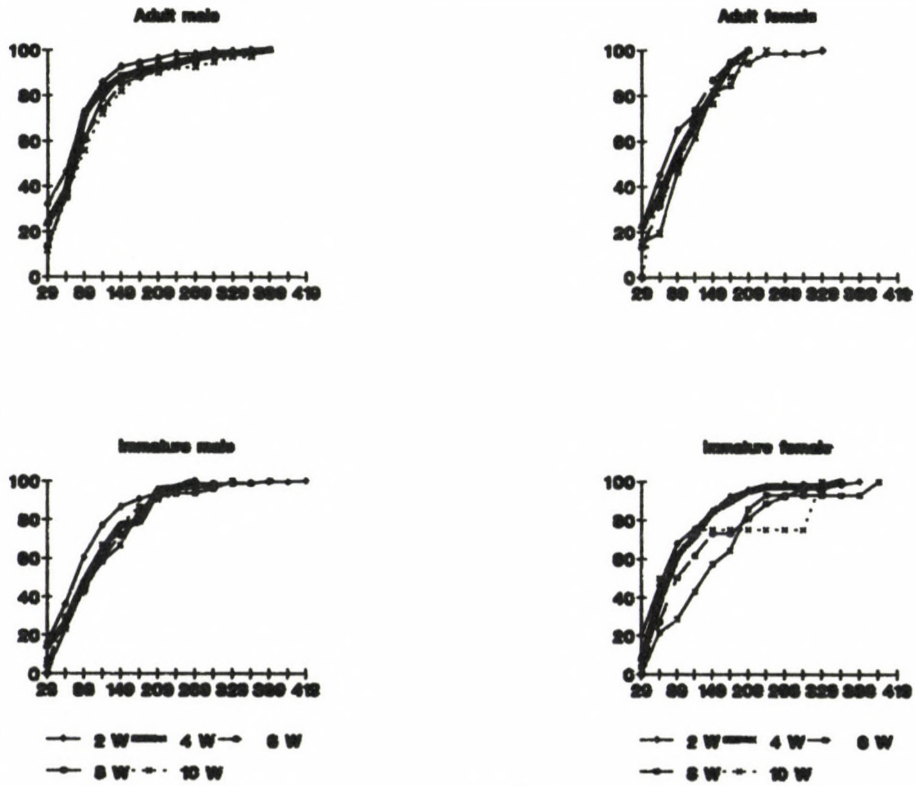


Fig. 4. Cumulative frequencies of roosting Great Tit age and sex classes plotted against dispersion (m) between two checkings. Number of observations were 498, 205, 427 and 152 for adult males, adult females, immature males and immature females, respectively. (W: weeks)

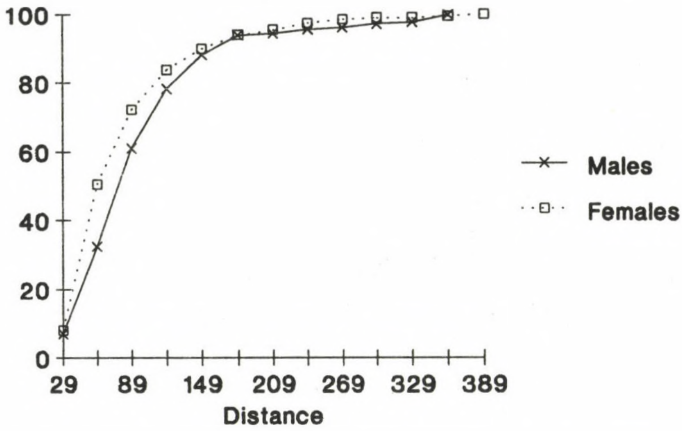


Fig. 5. Cumulative frequencies of male and female Great Tits plotted against the distances between the breeding hole and the roosting holes. Number of observations were 185 for males and 198 for females

period, which include the study of group and individual territories. Group territories are recorded for the Willow Tit (*P. montanus*), Crested Tit (*P. cristatus*), Black-capped Chickadee (*P. atricapillus*), Mountain Chickadee (*P. gambeli*), Tufted Titmouse (*P. bicolor*) and Black Tit (*P. niger*). The Marsh Tit (*P. palustris*) lives in pairs and uses exclusive areas in winter. They defend territory, but tolerate floater birds travelling through the territory. The Great Tits defend their local dominance rights in winter within the former or future breeding territory, but do not defend the area. Winter territoriality in the Blue Tit seems to be similar to that of the Great Tit, although there are uncertainties yet. (See references in EKMAN (1989) and MATTHYSEN (1990).)

Our observations so far are compatible with winter territoriality, although this would be very different from the pair-based winter territories or flock-based territories described for other species. We showed that individuals used nestboxes for roosting within a restricted area, which is overlapped with the breeding territory. There were several roosting holes within one territory, but the number of roosting birds remained stable (Fig. 2), and well below the possible 100. In addition, there were bird feeding stations 0.8 km, and 8 km apart from the nestbox area, where non resident individuals were always present (BÁLDI & CSÖRGŐ, 1991). These observations may therefore indirectly suggest area defense.

There was very high breeding density in the nestbox area (BÁLDI, 1991). It was almost three times higher than one would expected on the basis of number of roosting birds. This may indicate, that tits modified the boundaries of their territories to incorporate a breeding hole (DRENT, 1987). However, the tits did not modify their winter home ranges to involve roosting sites in this study, instead they dispersed. This interesting deviation reflects to the significance of roosting behaviour in winter survival, and to the limits of our knowledge.

The number of female Great Tits declined more rapidly than that of males during winter. The reason may be the higher mortality in females, which was described for the breeding season by BULMER & PERRINS (1973), and for the winter period by BÁLDI & CSÖRGŐ (1993).

BÁLDI & CSÖRGŐ (1991) found that the population fluctuations of tits during winter is mainly due to the dispersers, according to samples from feeders. This study revealed that the number of roosting individuals changed much less after the weather became cold. This may strengthen the applicability of nocturnal checkings to distinguish the stable and dispersing populations (SCHMIDT *et al.*, 1985).

Winter site fidelity is markedly differ from the spring territoriality. In winter during day-time the territorial tits may leave their territories, sometimes they move 800 m apart for feeding (pers. observation). In the breeding season Great Tits leave their territories for feeding to a much smaller distance, usually only to the neighbouring territories (YDENBERG, 1984).

What could be the underlying evolutionary reasons for the wintering area fidelity? There are evidences that the earliest breeding Great Tits produced the most surviving offspring (PERRINS, 1965). In addition, the earlier arrived Coal Tits occupied better territories (PERRINS, 1979), and the earlier arrived Pied Flycatchers (*Ficedula hypoleuca*) and Willow Warblers (*Phylloscopus trochilus*) were in better condition, older and defended better territories (ARVIDSSON & NEERGAARD, 1991, POTTI & MONTALVO, 1991). Earlier arrived Great Reed Warblers (*Acrocephalus arundinaceus*) occupied a territory of higher rank (BENSCH & HASSELQUIST, 1991). Therefore we can conclude that the evolutionary strategy for greater reproduction supports the earlier starting of territorial activity and breeding of temperate-zone passerine birds. The wintering area fidelity of Great Tit could also be an adaptation for maximizing reproduction, since residency may provide the possibility for the earliest starting of breeding (hypothesis 1). However, we can not exclude the alternative hypothesis (hypothesis 2) that residency may confer advantage during winter alone, through the improvement of dominance status and survival (BÁLDI & CSÖRGŐ, 1993).

A way to test between these hypothesis may be as follows: residency is the main component of dominance (see KREBS, 1982, SANDELL & SMITH, 1991, BÁLDI & CSÖRGŐ, 1993, KOIVULA *et al.*, 1993), therefore the starting of breeding should be earlier in dominant tits, if the first hypothesis is true. There would be no difference if the second is true, because this hypothesis had no predictions about the starting of breeding.

We studied the influence of dominance on breeding biology of Great Tits in the same area (BÁLDI & CSÖRGŐ, 1994). We did not find significant differences in first egg laying in either females or males, although the dominants laid earlier

(1=1st of April; dominant females: 12.18±4.60, subdominant females: 14.94± 5.75; dominant males: 12.94±3.93, subdominant males: 16.57±8.58). However, the sample sizes were low (28 females and 25 males altogether). To test the evolutionary role of residency in the Great Tit needs more detailed studies.

* * *

Acknowledgements – C. MOSKÁT, S. M. SMITH and T. SZÉKELY made helpful comments on an earlier draft of the manuscript. I would like to thank J. BÁLDI and G. MIKLAY for field assistance. The study was supported by a grant to A. B. from the 'For the Hungarian Sciences Fund', and the preparation of paper was partly supported by a grant from the National Scientific Research Fund (OTKA F/5249).

REFERENCES

ARVIDSSON, B. L. & NEERGAARD, R. (1991) Mate choice in the Willow Warbler – a field experiment. *Behav. Ecol. Sociobiol.* **28**: 225-229.

BÁLDI, A. (1991) The effect of nestboxes on bird species diversity and on the breeding density of the Great Tit (Parus major L., 1758) in different habitats. *Aquila* **98**: 141-146.

BÁLDI, A. & CSÖRGŐ, T. (1991) Effect of environmental factors on tits wintering in a Hungarian marshland. *Ornis hung.* **1**: 29-36.

BÁLDI, A. & CSÖRGŐ, T. (1993) Social dominance in the resident part of a Great Tit (Parus major) population in winter. *Ornis hung.* **3**: 7-12.

BÁLDI, A. & CSÖRGŐ, T. (1994) Influence of age and dominance status of male and female Great Tits on laying date, clutch size and egg dimensions. *Acta zool. hung.* **40**: 99-107.

BENSCH, S. & HASSELQUIST, D. (1991) Territory infidelity in the poligynous Great Reed Warbler (Acrocephalus arundinaceus): the effect of variation in territory attractiveness. *J. Anim. Ecol.* **60**: 857-871.

BULMER, M. G. & PERRINS, C. M. (1973) Mortality in the Great Tit Parus major. *Ibis* **115**: 277-281.

CACCAMISE, D. F. & MORRISON, B. W. (1986) Avian communal roosting: implications of diurnal activity centers. *Am. Nat.* **128**: 191-198.

DHONDT, A. A. & EYCKERMAN, R. (1980) Competition between the Great Tit and Blue Tit outside the breeding season in field experiments. *Ecology* **61**: 1291-1296.

DHONDT, A. A., KEMPENAERS, B. & DE LAET, J. (1991) Protected winter roosting sites as a limiting resource for Blue Tits. pp. 1436-1443. *In* QUELLET, H. (ed.) *Acta XX Congressus Internationalis Ornithologici*. Ornithological Congress Trust Board, New Zealand.

DRENT, P. J. (1987) The importance of nestboxes for territory settlement, survival and density of the Great Tit. *Ardea* **75**: 59-71.

EKMAN, J. (1989) Ecology of non-breeding social system of Parus. *Wilson Bull.* **101**: 263-288.

GIBB, J. (1956) Territory in the genus Parus. *Ibis* **98**: 420-429.

HINDE, R. A. (1952) The behaviour of the Great Tit (Parus major) and some related species. *Behaviour* (Suppl.) **2**: 1-201.

JENNI, L. (1991) Microclimate of roost sites selected by wintering Bramblings Fringilla montifringilla. *Ornis scand.* **22**: 327-334.

KEMPENAERS, B. & DHONDT, A. A. 1991. Competition between Blue and Great Tit for roosting sites in winter: an aviary experiment. *Ornis scand.* **22**: 73-75.

KOIVULA, K., LAHTI, K., ORELL, M. & RYTKÖNEN, S. (1993) Prior residency as a key determinant of social dominance in the willow tit (Parus montanus). *Behav. Ecol. Sociobiol.* **33**: 283-287.

KREBS, C. J. (1985) *Ecology*. 3rd edition. Harper & Row, New York. 800 pp.

KREBS, J. R. (1982) Territorial defence in the Great Tit (Parus major): do residents always win? *Behav. Ecol. Sociobiol.* **11**: 185-194.

MATTHYSEN, E. (1990) Nonbreeding social organization in Parus. pp. 209-249. *In* POWER, D. M. (ed.): *Current Ornithology*. Vol. 7. Plenum Press, New York.

PERRINS, C. M. (1965) Population fluctuation and clutch-size in the Great Tit, Parus major L. *J. Anim. Ecol.* **34**: 601-647.

PERRINS, C. M. (1979) *British Tits*. Collins, London. 304 pp.

POTTI, J. & MONTALVO, S. (1991) Male arrival and female mate choice in Pied Flycatchers Ficedula hypoleuca in Central-Spain. *Ornis scand.* **22**: 45-54.

RICHNER, H. & MARCLAY, C. (1991) Evolution of avian roosting behaviour: a test of the information centre hypothesis and of a critical assumption. *Anim. Behav.* **41**: 433-438.

SANDELL, M. & SMITH, H. G. (1991) Dominance, prior occupancy, and winter residency in the Great Tit (Parus major). *Behav. Ecol. Sociobiol.* **29**: 147-152.

SCHMIDT, K.-H., BERRESSEM, H., BERRESSEM, K. G. & DEMUTH, M. (1985) Studies on Great Tits (Parus major) in winter – possibilities and limits of nocturnal checks. *J. Orn.* **126**: 63-71. (In German with English summary.)

WINKEL, W. & HUDDE, H. (1988) Nest-box roosting of birds in winter. *Vogelwarte* **34**: 174-188. (In German with English summary.)

YDENBERG, R. C. (1984) The conflict between feeding and territorial defence in the Great Tit. *Behav. Ecol. Sociobiol.* **15**: 103-108.

Received September 25, 1994; accepted October 20, 1994

Acta Zoologica Academiae Scientiarum Hungaricae 40 (4), pp. 369-377, 1994

EFFECT OF HABITAT SELECTION STRATEGY ON SPATIAL CORRELOGRAMS IN A HETEROGENEOUS ENVIRONMENT: A SIMULATION STUDY

Z.-J. HU and C. MOSKÁT*

Ecological Research Group, Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13., Hungary
(Permanent address of Z.-J. Hu: Crop Pests Forecasting Station, Dong Hu East Suburb, Changsha, Hunan Prov. 410127, P. R. China)

Habitat occupancy patterns of a hypothetic habitat specialist or habitat generalist species were simulated in general homogeneous and heterogeneous environments, in contiguous quadrats along a transect. Spatial autocorrelation analysis (measured by Moran's I coefficient) proved to be helpful to reveal spatial aspects of habitat selection. The figure of spatial correlograms showed the periods of systematic changes in spatial characteristics of the habitat both at low and high density of the population. Blocking of raw data may help to detect spatial scales and is advisable if population density is low. Comparison of habitat and species correlograms offers a helpful technique in the study of species-habitat relationships.

Key words: autocorrelation, correlogram, habitat selection, simulation model, spatial pattern

INTRODUCTION

Spatial autocorrelation is an important structural function in ecology (LEGENDRE, 1993). It tests whether the observed value of a variable at one locality is significantly dependent on values of the variable at neighbouring localities (SOKAL & ODEN, 1978*b*). The coefficients of Moran's I (MORAN, 1950) and Geary's c (GEARY, 1954) are most frequently employed to measure the autocorrelation of continuous variables in biology (SOKAL & THOMSON, 1987). Figures plotting the values of spatial autocorrelation coefficients against distance classes are called spatial correlograms (SOKAL & ODEN, 1978*a*). When the spatial problem is reduced to only one direction (e.g. transect data), calculation of the spatial autocorrelation coefficient is similar to the computation of correlograms in time series analysis. In the latter case autocorrelation is computed against time-lags. Spatial correlograms are informative about the spatial process.

In the present study we investigated the effects of habitat selection strategy to the shape of spatial correlograms. We generated habitat selection of a habitat generalist or a habitat specialist species in general homogeneous and heteroge-

* To whom correspondance should be addressed.

neous environments by computer simulation. The effects of scale were also evaluated.

MATERIAL AND METHODS

Computer simulation was carried out to generate one-directional occurrences of a general species in a general environment. Data were stored in vectors having 5000 elements, representing 5000 contiguous quadrats in a transect. An element having a zero value indicated no occurrence in the quadrat, and integers (1, 2, 3 ...) indicated the number of specimens. Occurrences were drawn by random number generators (for details, see below).

Several data sets were generated according to the following rules:

Habitat

(I) Homogeneous habitat: there was no blocking in the transect.

(II) Heterogeneous habitat: there were 2 types of sections of the transect (block of quadrats) alternating with each other, habitat-A and habitat-B. For both types of these habitat patches the number of quadrats (block-length) was equal. For example, if block-length was equal to n = 8, eight elements of the vector belonged to habitat-A, the next eight elements to habitat-B, the next eight elements again to habitat-A, etc. For blocking of quadrats n = 2, 4, 8, 16, and 32 were applied, so this technique produced 2, 4, 8, 16, and 32 quadrats-wide patches along the transect.

(III) Habitat structure is rarely as regular in nature as described above, which was suitable to demonstrate an extreme, well-definable situation. In a more realistic model the habitat variable got a value within the range (0, 100), following the normal approximation. (The normal series was transformed from a simulated data-set generated with the following parameters: N (0, 25).)

Species

(1) Habitat generalist species: it could occupy all types of habitat patches with the same probability. The species is able to occupy the quadrats following the Poisson distribution (λ=0.2 for a low density population (case (1/a)), and λ=1.0 for a high density population (case (1/b)).

(2) Habitat specialist species: when only one habitat was available, and this habitat was favourable for the species, it resulted in the same habitat occupancy pattern as in case (1).

(3) Habitat specialist species was restricted to one habitat: it could occupy only one of the two habitat types (A and B). Technically only the quadrats be-

longing to the habitat type which it preferred could have occurrences. The dispersion of the species follows the Poisson distribution with the parameter $\lambda=1.0$.

(4) Habitat specialist species which utilised both habitat types, but preference for habitat-A and for habitat-B was different. When the density of the species was low ($\lambda=0.2$), it occupied only the primary habitat (case (4/a)), but when it was full at higher densities ($\lambda=1.0$), it could also occupy the secondary habitat in lower densities (case (4/b)). This model of density-dependent habitat selection was described by FRETWELL & LUCAS (1969).

(5) Habitat specialist species: habitat selection differed individually (ROUGHGARDEN, 1972). Some individuals preferred habitat-A, while others showed preference for habitat-B. For the sake of simplicity an individual could prefer only one habitat type. The ratio of the individuals belonging to these groups within the population determined the preference of habitat types at the population level. Practically this type of habitat occupancy resulted in the same spatial pattern like case (4), so the habitat occupancy pattern could not be distinguished between cases (4) and (5).

(6) Effects of spatial scale were studied in the case of heterogeneous habitat (n=32), when the habitat specialist species occupied only the patches of habitat type B (see (3) above). Equal distance classes were formed along the transect, summarising the contents of 2, 4, 8 or 16 neighbouring quadrats.

(7) When the habitat structure was generated as in case (III), the hypothetic habitat specialist species was able to occupy a site following the random expectation ($\lambda=1.0$) only where the habitat variable showed the value greater than 50.

(8) A variant of case (7) was generated by simplifying the abundance values to 1 when the species occupied the quadrat, or 0, when the quadrat remained empty.

Parameters in the spatial simulation models were chosen regarding to the characteristics of a real data-set collected on passerine birds in a marshland area

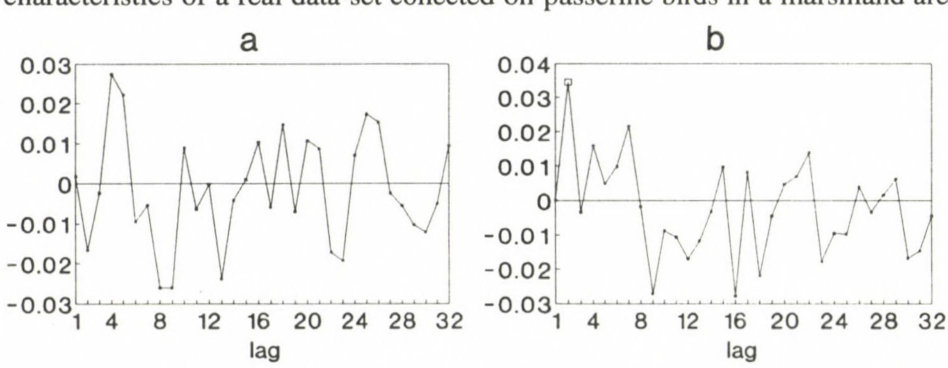


Fig. 1. Spatial correlogram of a hypothetic habitat generalist species over the set of contiguous quadrats. Significant autocorrelation coefficients ($P<0.05$) are indicated by squares. (Habitat type: data set (I); habitat occupancy pattern of the species: (a): data set (1/a), (b): data set (1/b); see MATERIAL AND METHODS)

(MOSKÁT *et al.*, 1992). Habitat occupancy patterns of the hypothetic species were generated following the random probability distribution function with the parameter $\lambda=0.2$ when low density population was simulated, and with the parameter $\lambda=1.0$ when high density population was simulated.

We applied Moran's I (MORAN, 1950) to measure autocorrelation by the computer program TRANSPAT version 2.0 (HU & MOSKÁT, 1994). Normality

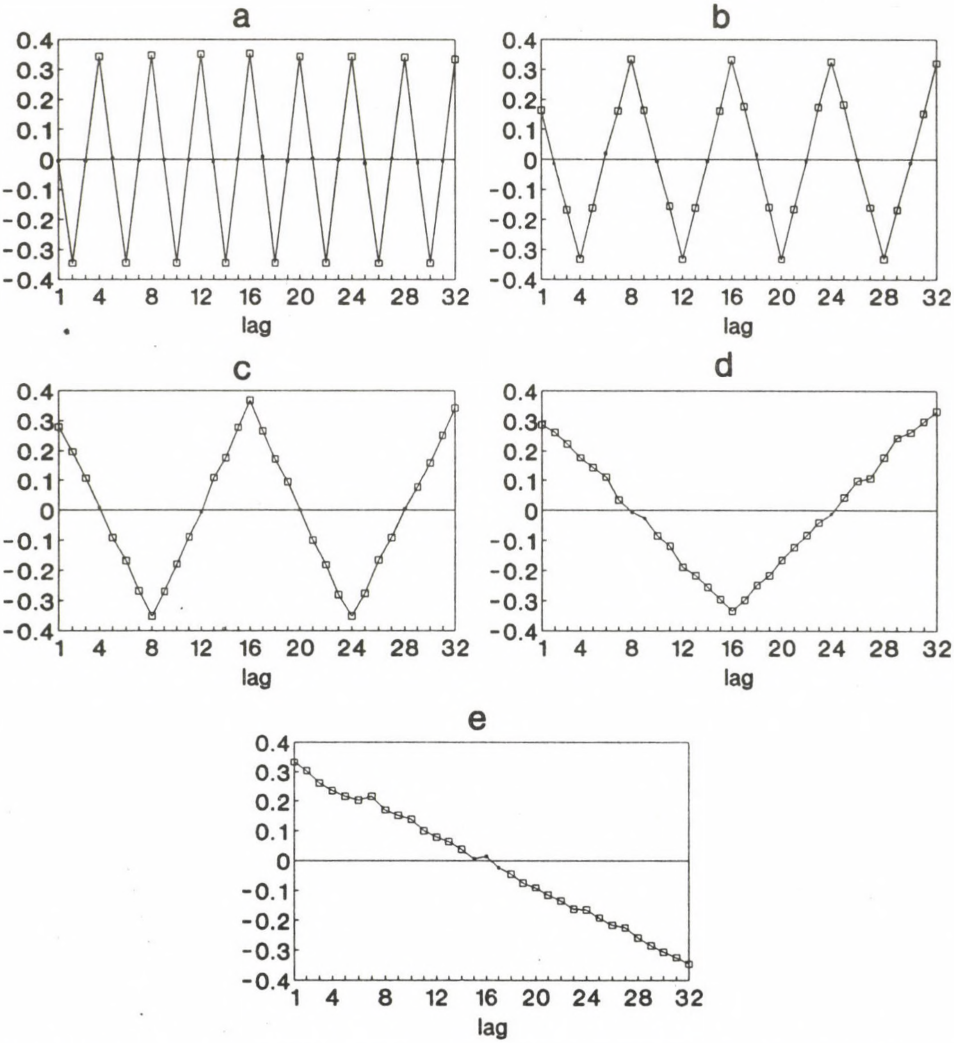


Fig. 2. Spatial correlograms of a hypothetic habitat specialist species in a heterogeneous environment when patch size is increasing from case (a) to (e). Significant autocorrelation coefficients (P<0.05) are indicated by squares. (Habitat structure: data set (II); occupancy pattern: data set (3); see MATERIAL AND METHODS)

and randomisation tests (CLIFF & ORD, 1973) were used for testing the significance of the Moran's I values.

RESULTS

A habitat generalist species with random dispersion over the quadrats displayed a randomly fluctuating correlogram (Fig. 1). In a systematically heterogeneous habitat a habitat specialist species, which totally avoids habitat-A but prefers habitat-B, showed a fluctuating figure (Fig. 2). These harmonic waves occurred at 2n distances, where n was the number of adjacent quadrats belonging to the same habitat type (n = 2, 4, 8, 16, and 32). The periods of harmonic peaks and troughs increased when the length of the homogeneous sections of the transect increased. When low-density sections alternated with high-density sections (the species preferred habitat-B as a primary habitat, but also occurred in habitat-A as a secondary habitat), the shape of the correlogram (Fig. 3) was similar to the former case (Fig. 2). The shape of the correlogram showed more stochasticity in the case when both habitat types were occupied but with different intensity (Fig. 3 vs. Fig. 2).

When neighbouring quadrats were amalgamated to simulate the scale problem (see details in MATERIAL AND METHODS), the pattern remained stable, but the amplitude of the correlograms increased with number of quadrats amalgamated (Fig. 4). In this case when the starting point of the distances remained the same this process only strengthened the peaks and troughs in the correlogram. As a consequence of the amalgamation of quadrats, distances and the number of ele-

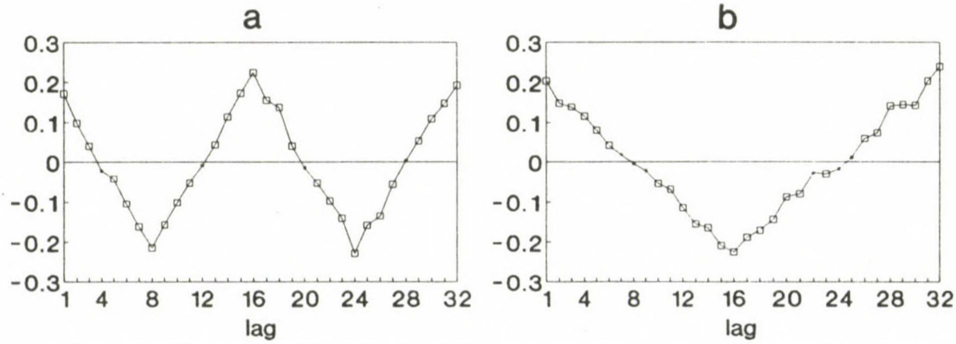


Fig. 3. Spatial correlograms of a hypothetic habitat specialist species in a heterogeneous environment, which contains habitat-A and habitat-B, alternating along the transect. The species occupies the quadrats of habitat-A in low density, but occupies the quadrats of habitat-B in high density. Significant autocorrelation coefficients ($P<0.05$) are indicated by squares. (Habitat type: data set (II); occupancy pattern: data set a: n=8, b: n=16; see MATERIAL AND METHODS)

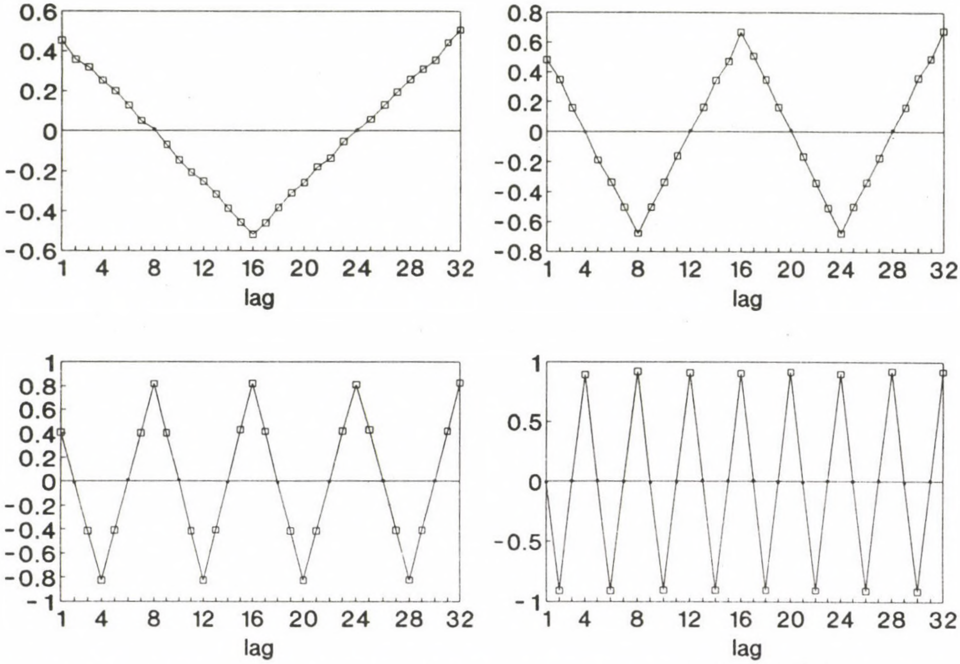


Fig. 4. Effect of amalgamation of neighbouring quadrats on the spatial correlogram of a hypothetic habitat specialist species in a heterogeneous environment. Significant autocorrelation coefficients ($P<0.05$) are indicated by squares. (Habitat structure: data set (II); occupancy pattern: data set (6); see MATERIAL AND METHODS)

ments were reduced. More variations could be expected after this scaling process in correlograms when the starting points of distance classes are different, or distances are unequal (patch size is not constant).

Data-set (III) represented a habitat structure, and data set (7) characterized the habitat occupancy pattern of a species in this habitat. When the habitat was simplified into two types of pattern only (see details in MATERIAL AND METHODS), the habitat specialist species avoided the patches of habitat type-A, but preferred the patches of habitat type-B (data-set (8)). Autocorrelation analysis of the data sets revealed similar correlograms (Fig. 5). Mostly the correlogram of data sets (III) and (7) looks like very similar in the shape of the figure (Figs. 5a and 5b). Some distortion could be realized in the case of the data set (8), where a simplified habitat occupancy pattern was generated (Fig. 5c).

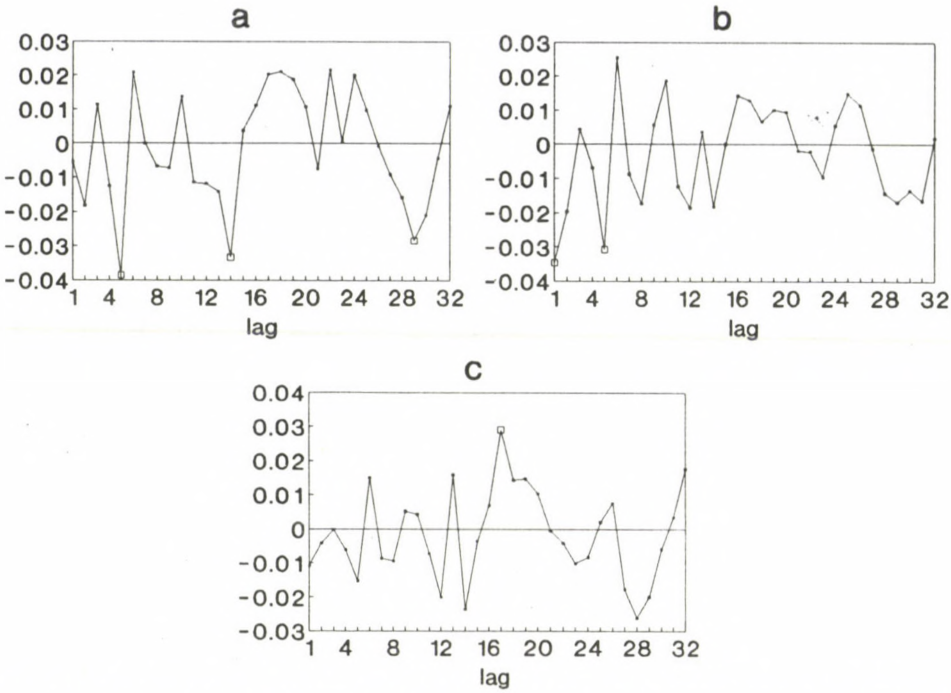


Fig. 5. Spatial correlograms of a habitat variable (a) and a hypothetic habitat specialist species (b, c) in a heterogeneous environment. Significant autocorrelation coefficients ($P<0.05$) are indicated by squares. (Habitat structure and habitat variable (a): data set (III); habitat variable and occupancy pattern: (b): data set (7), (c): data set (8); see MATERIAL AND METHODS)

DISCUSSION

When spatial correlograms are analyzed we are especially interested in the following question: "What information can we gain about spatial relatedness among organisms from the correlograms?"

First of all spatial autocorrelation analysis is the tool for testing spatial relatedness, and the shape of the correlogram could also be informative. The main rule for analyzing correlograms was specified by SOKAL & ODEN (1978*b*) as: "Identical variation patterns lead to identical correlograms, but different patterns may or may not yield different correlograms". In the present study a habitat generalist species, which could occupy all sites with the same probability, and its habitat selection followed the random expectation, produced a randomly fluctuating correlogram. In a systematically patchy environment a habitat specialist species showed a systematically fluctuating correlogram according to patch size. If the primary habitat patches were filled and the habitat specialist species was able to colonise secondary habitat patches in a low density, this process only slightly modified the graph of the autocorrelation function.

The comparison of correlograms both for the habitat and the species proved that this technique seems to be helpful for identifying spatial aspects of species-habitat relationships.

In ecology spatial autocorrelation can be deduced from sign, magnitude and order of autocorrelation (SOKAL, 1979). On the technical side testing of a single value of Moran's I can be carried out by two methods (normality test and randomisation test, see e.g. CLIFF & ORD, 1973, 1981, UPTON & FINGLETON, 1985). In the present paper we also applied these two methods. Generally, the null-hypothesis (H0) states that: there is no spatial autocorrelation, i.e., the values of the variable are spatially independent. Alternatively, H1 states that there is significant spatial autocorrelation: the values of the variable are spatially dependent. Technically, both for the normality and randomisation assumptions the test statistic can be compared with the table of the normal distribution. If H1 does not specify a direction a two-tailed test of significance applies, otherwise when positive or negative autocorrelation is specified one-tailed test of significance is appropriate (CLIFF & ORD, 1973). Comparison of correlograms seems to be more difficult. Although several methods have already been developed (see e.g. LEGENDRE, 1993), they are not without problems. CLIFFORD *et al.* (1989) developed the test of association between two spatially autocorrelation processes. Recently DUTILLEUL (1993) modified this test, which seems to offer the solution for this problem in the future.

Scale seems to be fundamental when ecological communities or populations are studied (WIENS *et al.*, 1986, WIENS, 1989, JUHÁSZ-NAGY 1992). In the analysis of biological populations along transects the differences in the correlograms at different levels of the spatial scales (e.g. territorial, habitat, or geographical scales) can be explained on biological grounds, but scaling also has an importance in the methodological point of view. When the scale is too small, the data set may contain a lot of double zeros, and in this case spatial autocorrelation analysis cannot be performed, because autocorrelation would be overestimated. Proper scaling could help to come through this technical obstacle, like forming equal distance classes or classes with equal frequencies (LEGENDRE & FORTIN, 1989).

What could be the advantages of the application of spatial correlograms in community or population ecology? Besides the basic goal to determine spatial relatedness of ecological measurements, correlograms give more insight into the structural features of communities or populations. The comparison of spatial correlograms, e.g. the correlograms of habitat variables and the correlogram of the abundance of a species may reveal important structural relationships between a habitat variable and the population, or some ecological characteristics of the habitat selection mechanisms (generalist vs. specialist species).

* * *

Acknowledgements. – We thank J. PODANI for helpful comments on the ms. This paper was written during the stay of Z.-J. HU at the Hungarian Natural History Museum within the framework of the Hungarian and Chinese Educational Cooperation Program, sponsored by the Hungarian Ministry for Culture and Education, and State Education Commission of China (No. of program I/1). The study was supported by the grant No. 3188 of the National Scientific Research Fund (OTKA) to one of the authors (C. M.).

REFERENCES

CLIFF, A. D. & ORD, J. K. (1973) *Spatial autocorrelation*. Pion Ltd., London.

CLIFF, A. D. & ORD, J. K. (1981) *Spatial processes. Models & applications*. Pion Ltd., London.

CLIFFORD, P., RICHARDSON, S. & HÉMON, D. (1989) Assessing the significance of the correlation between two spatial processes. *Biometrics* **45**: 123-134.

DUTILLEUL, P. (1993) Modifying the t test for assessing the correlation between two spatial processes. *Biometrics* **49**: 305-314.

FRETWELL, S. D. & LUCAS, H. L. (1969) On territorial behaviour and other factors influencing habitat distribution in birds. I. Theoretical development. *Acta Biotheor.* **19**: 16-36.

GEARY, R. C. (1954) The contiguity ratio and statistical mapping. *Incorporated Statistician* **5**: 115-145.

HU, Z.-J. & MOSKÁT, C. (1994) *Computer program (TRANSPAT) for spatial pattern analysis of transect data in ecology (Version 2.0)*. User's guide. Hungarian Natural History Museum, Budapest.

JUHÁSZ-NAGY, P. (1992) Scaling problems almost everywhere; an introduction. *Abstracta Botanica* **16**: 1-5.

LEGENDRE, P. (1993) Spatial autocorrelation: trouble or new paradigm? *Ecology* **74**: 1659-1673.

LEGENDRE, P. & FORTIN, M.-J. (1989) Spatial pattern and ecological analysis. *Vegetatio* **80**: 107-138.

MORAN, P. A. P. (1950) Notes on continuous stochastic phenomena. *Biometrika* **37**: 17-23.

MOSKÁT, C., WALICZKY, Z. & BÁLDI, A. (1992) Dispersion and association of some marshland-nesting birds: a matter of scale. *Acta zool. hung.* **38**: 47-62.

ROUGHGARDEN, J. (1972) Evolution of niche width. *Am. Nat.* **106**: 683-718.

SOKAL, R. R. (1979) Ecological parameters inferred from spatial correlograms. pp. 167-196. *In* PATIL, G. P. & ROSENZWEIG, M. L. (eds): *Contemporary quantitative ecology and related ecometrics*. Statistical Ecology Series. vol. 12. International Co-operative Publ. House, Fairland, Maryland.

SOKAL, R. R. & ODEN, N. L. (1978*a*) Spatial autocorrelation in biology. 1. Methodology. *Biol. J. of the Linnean Soc.* **10**: 199-228.

SOKAL, R. R. & ODEN, N. L. (1978*b*) Spatial autocorrelation in biology. 2. Some biological implications and four applications of evolutionary and ecological interest. *Biol. J. of the Linnean Soc.* **10**: 229-249.

SOKAL, R. R. & THOMSON, J. D. (1987) Applications of spatial autocorrelation in biology. pp. 431-466. *In* LEGENDRE, P. & LEGENDRE, L. (eds): *Developments in Numerical Ecology*. NATO ASI Series G: Ecological Sciences vol. 14., Springer, Berlin.

UPTON, G. & FINGLETON, B. (1985) *Spatial data analysis by example.* vol. 1. Point patterns and quantitative data. Wiley, New York.

WIENS, J. A. (1989) *The ecology of bird communities.* Cambridge University Press, Cambridge, vols 1-2.

WIENS, J. A., ADDICOTT, J. F., CASE, T. J. & DIAMOND, J. (1986) Overview: the importance of spatial and temporal scale in ecological investigations. pp. 145-153. *In* DIAMOND, J. & CASE, J. T. (eds): *Community ecology.* Harper and Row, New York.

Received July 18, 1994; accepted September 5, 1994

ACTA ZOOLOGICA ACADEMIAE SCIENTIARUM HUNGARICAE

CUMULATIVE INDEX FOR VOLUME 40, 1994

HU ISSN 1217–8837

SUBSCRIPTION INFORMATION

Orders should be addressed to

Editorial Office of the Acta Zoologica
Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13, Hungary

SUBSCRIPTION INFORMATION

Orders should be addressed to

Editorial Office of the Acta Zoologica
Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13, Hungary

Typeset: Pars Ltd., Budapest.
Printed by Dabas Jegyzet Ltd., Hungary

CONTENTS

HU ISSN 1217–8837