Opusc. Zool. Budapest, XVII–XVIII, 1981

Effect of a Prolonged Practice of Crop Rotation and Fertilizer Treatment on the Nematode Fauna

By

M. ABOU-EL-NAGA*

Abstract. The effect of organic and inorganic fertilizer treatment on the species and numbers of nematodes was studied at Bahteem Experimental Station, Egypt. Representative soil samples were collected from each treatment for counting, identifying and chemical analysis, and the following results were obtained.

1. A significant difference was recorded between rotations. The highest percentage of nematode species could be observed at one-year- and two-year rotations (40% and 38% respectively) and the lowest one was recorded at the three-years rotations (22%). **2.** Soils treated with farmyard manure were the ones containing the highest percentage of nematodes (38.10%). On the other hand, the lowest numbers of nematodes were recorded in soils fertilized with N, and NP (11.9% for each treatment), while the numbers observed in soils received NPK and control (19.05% for each treatment) were moderate. **3.** Forty nematode species were observed in the experimental side, twenty of them considered as new for the Egyptian fauna, eleven out of all nematode species illustrated as dominant species, which represent 68.32% of the total number of nematodes.

Introduction

It is well known that fertilization is the prime factor in maintaining soil fertility. As a rule, fertilizers are applied to the soil in the form of inorganic salts and organic manures. The former may be utilized directly and biologically transformed to other forms suitable for plant utilization. Organic manures, however, should be mineralized by soil micro-organisms to be available.

The dynamics of nematode populations in soils under numerous crops and rotations have been extensively studied (NUSBAUM & BARKER, 1971; GOOD & al., 1973), and nematode community structures have been analyzed (JOHNSON & al., 1972). Nematode populations under a particular crop have been correlated with soil and plant properties (NORTON & al., 1971; NYHAN & al., 1972). For example, GRANDISON and WALLACE (1974) analyzed the relationships of populations of *Pratylenchus thornei* SHER & ALLEN under strawberry clover (*Trifolium fragiferum* L.) to soil factors in eight different soils. However, there is little information at disposal on the long-term effects of different management practices under a constant vegetation.

**Dr. Mohamed Abou-El-Naga*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

In the present work nematode populations have been determined in soils under different fertilization treatments. The relationship of these populations to the type of fertilizers and rotations have been determined.

The permanent fertilization experiment at Bahteem was found to be suitable for such investigations. In that experiment, soil received organic manure and different inorganic fertilizers under different conditions of rotation for nearly 56 years.

Nematode identification was accomplished after consulting the taxonomic works of ANDRÁSSY (1959, 1977), GOODEY (1963), HEYNS (1962), MEYL (1961), TARJAN (1973) and various other papers. The nematode species were ranked among the nomenclature and identified according to ANDRÁSSY's 1976 system.

Material and methods

Field selected

The permanent fertilization experiment at Bahteem was found to be suitable for the present investigation. The experiment had been established by the Egyptian Agricultural Society in 1919, for determining the effect of continuous application of fertilizers on the yields of crops. The fertilizer treatments and the total quantities of applied fertilizers per feddan from 1919 till 1975 were as follows:

O: received no fertilizers (control);
N: received sodium nitrate (10 000 kg);
NP: received sodium nitrate (10 000 kg), superphosphate (7200 kg);
NPK: received sodium nitrate (10 000 kg), superphosphate (7200 kg) and putassium sulphate (5700 kg);
FYM: received farmyard manure (1 290 000 kg).

Rotation

See the rotation system in Table 1.

Table 1. Rotation system at Bahteem Experimental Station

Years Rotations	1	2	3	4	5	6
1-year	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton
2-years	Cotton	Maize after wheat	Cotton	Maize after wheat	Cotton	Maize after wheat
3-years	Cotton	Maize after clover	Maize after wheat	Cotton	Maize after clover	Maize after wheat

Table 2. The chemical analysis of soils dressed with organic and inorganic fertilizers under different conditions of rotation

Treatment	Rotation	N	NP	NPK	FYM	Cont. (0)
Ca	1-year	0.26	0.30	0.45	1.05	0.45
	2-years	0.50	0.40	0.55	0.75	0.60
	3-years	0.65	0.50	0.55	0.90	0.87
Mg	1-year	0.66	0.60	0.42	0.77	0.65
	2-years	0.30	0.25	0.30	0.70	0.67
	3-years	0.60	0.55	0.40	0.63	0.40
K	1-year	0.05	0.04	0.06	0.40	0.08
	2-years	0.03	0.03	0.04	0.59	0.06
	3-years	0.03	0.03	0.03	0.18	0.03
Na	1-year	2.17	2.22	2.75	1.60	1.95
	2-years	2.30	2.25	2.75	1.70	1.50
	3-years	1.80	1.75	1.75	1.70	1.45
CO_3	1-year	0.30	0.30	0.20	0.30	0.25
	2-years	0.40	0.40	0.25	0.15	0.20
	3-years	0.25	0.20	0.15	0.10	0.15
HCO_3	1-year	1.75	1.50	1.55	1.85	1.55
	2-years	1.90	1.60	1.70	2.00	1.35
	3-years	1.45	1.00	1.70	1.80	1.55
Cl	1-year	0.85	0.80	1.47	1.45	1.00
	2-years	0.80	0.72	1.30	1.58	1.00
	3-years	0.87	1.00	0.67	1.40	0.80
SO_4	1-year	0.23	0.60	0.47	0.17	0.25
	2-years	0.16	0.16	0.50	1.08	0.35
	3-years	0.68	0.66	0.21	0.13	0.20

(0)	Received no fertilizers;
N	Received sodium nitrate;
NP	Received sodium nitrate and superphosphate;
NPK	Received sodium nitrate, superphosphate & potassium sulphate;
FYM	Received farmyard manure.

Field sampling

In the present investigation representative samples were collected. A sampling tube (2 inches in diameter and 12 inches long) was used. Soil samples of each plot (of all the 15 plots) were thoroughly mixed and then heeped into a conical pile. This pile was vertically divided by a blade into two equal parts. Each half was subsequently divided into four equal parts each of which representated one eighth of the original pile. A one eighth portion was made into another conical pile, and subdivided into two equal parts. The latter fractional part, which represented one sixteenth of the original pile, was divided into two parts (each of them 100 g), the first one of these for nematode investigations, the second for chemical analyses (Table 2).

Chemical analyses

Representative soil samples from each plot were taken for chemical analysis to be done at the Department of Chemistry, Faculty of Science, Al-Azhar University, Cairo.

Nematode extraction

A modification of the methode of COBB (1918), as well as of CHRISTIE and PERRY (1951) for extracting nematodes from soils was used by ANDRÁSSY as follows:

About 300 – 400 ml of water was added to the representative soil sample in a plastic pan and the mixture was agitated with the fingers. After a few seconds the suspension was poured onto a 50 mesh sieve, while the passing suspension was received on a 400 mesh sieve where it was thoroughly washed in a gentle stream of water. The organic matter including nematodes settled on the sieve was quantitatively transferred into a 500 ml beaker. Similarly after a few seconds, 2/3 of the suspension was poured again on the sieve and washed in a gentle stream of water; the remainder of the suspension was ten transferred to a Petri dish and thereafter to a test tube.

Fixation

Nematodes were killed and fixed in FAA (40% formalin 6 parts, glacial acetic acid 1 part, 70% alcohol 20 parts, and distilled water 40 ml).

Clearing and mounting

For clearing, nematodes are transferred from fixative to a small watch-glass containing about 0.5 ml of the following mixture: 70% alcohol 8 parts, glycerin 1 parts, distilled water 1 part. The watch-glass with the nematodes is left resting for at least 48 hours before mounting.

For mounting, glycerin gives the best results as a medium. In any medium it is important to mount small piece of allomenium paper of about the same diameter as the nematodes or somewhat thicker along with the specimens, and these supports are arranged radially towards the edge of the drop. Finally, the drop is covered with a thin cover-slip, the edges of which are sealed with white synthetic lac.

Results and discussion

The effect of the prolonged use of fertilizers and rotation on the species and percentage of nematodes is shown in Table 3.

Table 3. Effect of rotation and fertilizer treatments on the species and numbers of nematodes

Treatment	X'%	X'%	Rotation	X'%
N	0.10	0.12	1-year	0.20
NP	0.10			
NPK	0.16		2-years	0.19
FYM	0.32	0.32	3-years	0.11
(0)	0.16	0.16		

Series	Nematode species	X'%	Series	Nematode species	X'%
1	*Cephalobus persegnis*	0,96	21	*Acrobeloides emarginatus*	0.10
2	*Tylenchorhynchus goffarti*	0.54	22	*Longidorus* sp.	0.08
3	*Thornenema viriosum*	0.52	23	*Discolaimoides filiformis*	0.08
4	*Cervidellus soosi*	0.40	24	*Mylonchulus sigmaturus*	0.08
5	*Dorylaimellus projectus*	0.37	25	*Plectus paracommunis*	0.07
6	*Helicotylenchus digonicus*	0.35	26	*Eudorylaimus projectus*	0.06
7	*Discolaimoides bulbiferus*	0.33	27	*Oionchus obtusus*	0.06
8	*Pratylenchus vulnus*	0.28	28	*Tripyla* sp.	0.05
9	*Filenchus filiformis*	0.28	29	*Rotylenchus reniformis*	0.04
10	*Eudorylaimus nothus*	0.27	30	*Belondira cylindrica*	0.03
11	*Hoplolaimus aegypti*	0.25	31	*Deladenus saccatus*	0.03
12	*Acrobeles complexus*	0.18	32	*Hemicriconemoides affinis*	0.03
13	*Thornenema laevicapitatum*	0.17	33	*Merlinius brevidens*	0.03
14	*Panagrolaimus* sp.	0.16	34	*Heterocephalobus buchneri*	0.03
15	*Eucephalobus oxyuroides*	0.13	35	*Tylenchorhynchus cylindricus*	0.02
16	*Nygolaimus* sp.	0.13	36	*Aphelenchus avenae*	0.02
17	*Tobrilia imberbis*	0.12	37	*Paramphidelus uniformis*	0.02
18	*Dorylaimus* sp. *(stagnalis)*	0.12	38	*Ecumenicus monohystera*	0.02
19	*Ditylenchus intermedius*	0.11	39	*Alaimus* sp.	0.02
20	*Psilenchus hilarulus*	0.10	40	*Aporcelaimellus* sp.	0.02

L.S.D. for treatments	0.09
L.S.D. for rotations	0.07
L.S.D. for species	0.25
L.S.D. for inorganic organic	0.07
L.S.D. for inorganic control (0)	0.07
L.S.D. for organic control (0)	0.09

The effect of the rotation system

The rotation system brought significant results in the present investigation. In case of one-year- and two-years rotation a higher number of nematodes (40% and 38%, respectively) were found. On the other hand, in case of a three-years rotation the number of nematodes was lower (22%). This may be attributed to a one or two years absence of host plants to nematodes in the two- and three-years rotations.

Brodie & al. (1970) suggest a selection and variation of crop plants with diverse abilities of supporting different species of plant parasitic nematodes so that the rise to damaging levels in newly cleared agricultural lands of tropical and subtropical regions may be delayed.

The effect of fertilizer treatments

Fertilization used in this investigation included inorganic fertilizers and organic manure, in addition to the control.

The percentage of nematodes significantly increased in the treatment with FYM, higher than in the other treatments. On the other hand, the lowest per-

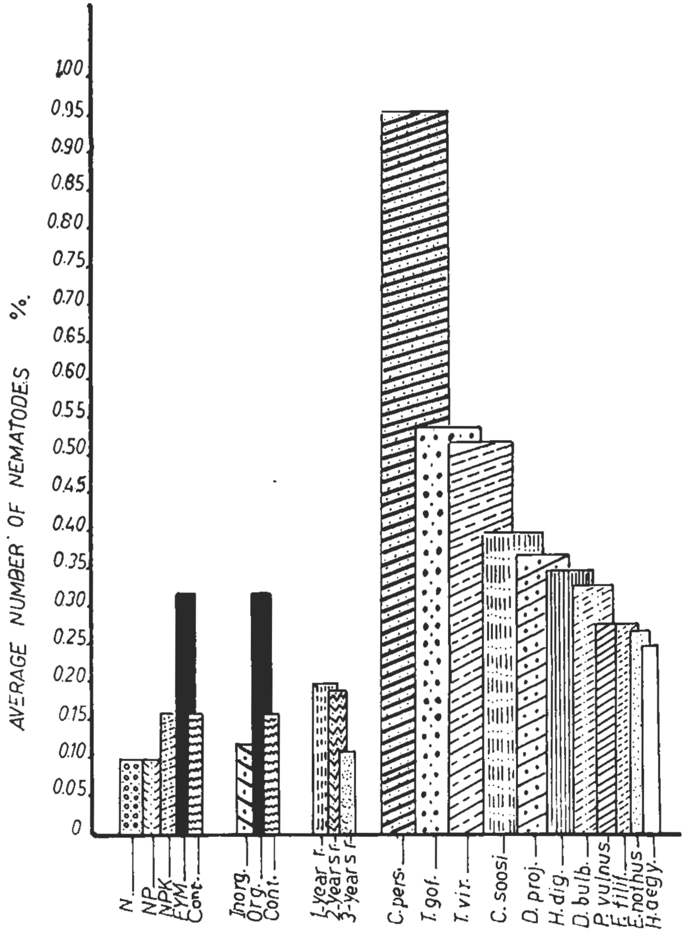


Fig. 1. Effect of rotation and fertilizer treatments on the percentage number of nematode species

centage was recorded in treatments with N and NP, while a moderate number of nematodes was observed in treatment with NPK and in the control.

In general, the application of FYM significantly increased the total number of nematode species. This may be attributed to the increase of the potassium and decrease of the sodium content (Table 2). The application of inorganic fertilizers, namely sodium nitrate, superphosphate and potassium sulphate, relatively decreased the percentage of nematodes. However, it should be stated that the treatment with NPK slightly increased the percentage of nematodes, and this may be attributed to a direct supply of nitrogen, phosphorus and potassium considered to be essential in the nutrition of soil organisms, and indirectly to increasing crop yields and, consequently, plant residues and soil nematodes, too.

The effect of fertilization and rotation on the nematode species

In this study highly significant differences have been found among the species. Forty species were recorded during the investigation, twenty of them can be considered as new for the Egyptian fauna (Table 4). Eleven species (Table 3. represent the most dominant, dominant and subdominant species (30.33%, 21.77% and 16.22% of the total nematode number, respectively). Other species (from 12 to 40 in Table 3) were observed in few number.

Table 4. New records of nematodes from Egypt

Family	Series	Nematode species	Author
Plectidae	1	*Plectus paracommunis*	Hoeppli, 1926
Cephalobidae	2	*Acrobeles complexus*	Thorne, 1925
	3	*Acrobeloides emarginatus*	(de Man, 1980) Thorne, 1937
	4	*Cervidellus soosi*	(Andrássy, 1953) Goodey, 1963
	5	*Eucephalobus oxyuroides*	(de Man, 1876) Steiner, 1936
Tylenchidae	6	*Filenchus filiformis*	(Bütschli, 1813) Meyl, 1961
Anguinidae	7	*Ditylenchus intermedius*	(de Man, 1880) Filipjev, 1936
Neotylenchidae	8	*Deladenus saccatus*	Andrássy, 1954
Criconematidae	9	*Hemicriconemoides affinis*	Luc, 1970
Alaimidae	10	*Paramphidelus uniformis*	(Thorne, 1939) Andrássy, 1977
Tripylidae	11	*Tobrilia imberbis*	(Andrássy, 1953) Andrássy, 1957
Mononchulidae	12	*Oionchus obtusus*	Cobb, 1913
Thornenematidae	13	*Thornenema laevicapitatum*	(Thorne & Swanger, 1936) Andrássy, 1959
	14	*Thornenema viriosum*	Williams, 1964
Qudsianematidae	15	*Discolaimoides filiformis*	Das, Khan & Loof, 1969
	16	*Ecumenicus monohystera*	(de Man, 1880) Thorne, 1974
	17	*Eudorylaimus nothus*	Thorne & Swanger, 1936) Andrássy, 1959
	18	*Eudorylaimus projectus*	Thorne, 1939
Belondiridae	19	*Belondira cylindrica*	Thorne, 1964
Dorylaimellidae	20	*Dorylaimellus projectus*	Heyns, 1962

The most dominant species were *Cephalobus persegnis, Tylenchorhynchus goffarti* and *Thornenema viriosum.* The species *Cervidellus soosi, Dorylaimellus projectus, Helicotylenchus digonicus* and *Discolaimoides bulbiferus* represented the dominant species in the investigation samples. The subdominant nematodes were *Pratylenchus vulnus*, *Filenchus filiformis*, *Eudorylaimus nothus* and *Hoplolaimus aegypti*.

All the above eleven species make out 68.32% of the total number of nematodes. Other species from 12 – 40 represent 31.68% of the total number of nematodes.

Some of the dominant species, e. g. *Cephalobus persegnis* and *Cervidellus soosi* prefer dry or sandy soils, but here they were dominant species, which may be attributed to the effect of prolonged fertilization.

Table 4 shows 20 records of nematodes new for the Egyptian fauna, belonging to 13 families and 18 genera of free-living and plant-parasitic nematodes.

In 1978 I listed 120 species and two subspecies of nematodes recorded from Egypt till that year. Now the total number of the Egyptian soil nematodes will be 140 species and two subspecies.

Acknowledgements

I wish to express my sincere gratitude to Prof. I. Andrássy for his encouragement, supervision and guidance during this work. I am also indebted to Dr. A. Abdel-Hafez, Associate Professor at the Cairo University for his kind assistance and for reviewing the statistical part.

REFERENCES

1. Abou-El-Naga, M. (1978): *List of free living and plant parasitic nematodes recognized from Egypt hitherto.* – Opusc. Zool. Budapest, 16: 3 – 10.

2. Andrássy, I. (1959): *Taxonomiche Übersicht der Dorylaimen (Nematoda).* – Acta Zool. Hung., 5: 191 – 240.

3. Andrássy, I. (1976): *Evolution as a basis for the systematization of nematodes.* – Budapest: 1 – 286.

4. Andrássy, I. (1977): *Die Gattungen Amphidelus Thorne, 1939, Paramphidelus n. gen. und Etamphidelus n. gen. (Nematoda: Alaimidae).* – Opusc. Zool. Budapest, 14: 1 – 22.

5. Christie, J. R. & Perry, G. V. (1951): *Removing nematodes from soil.* – Proc. Helm. Soc. Wash., 18: 160 – 68.

6. Good, J. M., Murphy, W. S. & Brodie, B. B. (1973): *Population dynamics of plant nematodes in cultivated soil, length or rotation in newly cleared and old agricultural land.* – Journ. Nematol., 5: 117 – 22.

7. Goodey, J. B. (1963): *Soil and fresh water nematodes.* – London: 1 – 544.

8. Grandison, G. S. & Wallace, H. R. (1974): *The distribution and abundance of Pratylenchus thornei in fields of strawberry clover (Trifolium fragiferum).* – Nematologica, 20: 283 – 290.

9. Heyns, J. (1962): *A report on South African nematodes of the families Longidoridae, Belondiridae and Alaimidae (Nemata: Dorylaimoidea), with description of three new species.* – Nematologica, 8: 15 – 20.

10. Johnson, S. R., Ferris, V. R. & Ferris, J. M. (1972): *Nematode community structure in forest wood-lots. 1. Relationships based on similarity coefficients of nematode species.* – Journ. Nematol., 4: 175 – 83.

11. Norton, D. C., Frederick, L. R., Ponchillia, P. E. & Nyhan, I. W. (1971): *Correlations of nematodes and soil properties in soybean fields.* – Journ. Nematol., 3: 154 – 63.

12. Nusbanm, C. J. & Barker, K. R. (1971): *Population dynamics in „Plant Parasitic Nematodes"* – London.

13. Nyhan, I. W., Frederick, L. R. & Norton, D. C. (1972): *Ecology of nematodes in Clarion-Webster toosequences associated with Glycine max (L.) Merrill.* – Soil Sci. Soc. Amer. Proc., 36: 74–87.

14. Snedecor, G. W. (1956): *Statistical methods.* – The Iowa State College Press. Amer. Iowa 1–534.

15. Tarjan, C. A. (1973): *A synopsis of the genera and species in the Tylenchorhynchinae (Tylenchoidea, Nematoda).* – Proc. Helm. Soc. Wash.,, 40: 123–44.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Revision of the order Monhysterida (Nematoda) Inhabiting Soil and Inland Waters

By

I. ANDRÁSSY*

Abstract. In this study a new system of the non-marine – freshwater, inland saline water and soil inhabiting – members of the nematode order Monhysterida is presented. The old genera are redefined, whilst three genera are newly established. *Eumonhystera* n. gen. is characterized by the position of the amphids and vulva, and by comparatively short spicules; its type is *E. vulgaris* (DE MAN, 1880) n. comb. *Anguimonhystera* n. gen. is unique because of its long and extremely slender body; its type is *A. stadleri* (GOFFART, 1950) n. comb. *Geomonhystera* n. gen. includes terrestrial species and is characterized by the vulva lying far back and by the structure of the rectum; its type is *G. villosa* (BÜTSCHLI, 1873) n. comb.

Altogether 64 non-marine species of the order Monhysterida are regarded as valid, and their list and synonyms are enumerated. Besides, keys to the genera and species, as well as the geographical data of the continental members of the Monhysterida are given. Finally, three species are described as new to science, viz. *Eumonhystera altherri, E. barbata* and *E. hungarica* n. spp, and a number of new combinations are proposed.

CONTENTS

---

* *Dr. István Andrássy*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

While several papers on marine genera and species of the nematode order Monhysterida have been published hitherto, publications dealing with continental (non-marine) members of the same group are rather poor in number. After the classic descriptions of **Bastian** (1865), **Bütschli** (1873, 1874), **de Man** (1876, 1880, 1881, 1884), **Cobb** (1893, 1906), and **Daday** (1899, 1903, 1905), so to say the only researchers to publish considerable new data to the morphology and taxonomy of the freshwater and soil inhabiting Monhysteridae were **Meyl** (1953, 1954, 1955, 1957), **Juget** (1969) and **Andrássy** (1962, 1968, 1977).

The first classifaction of the continental species was proposed by **Micoletzky** (1922) who listed in his book 32 non-marine species and varieties in the genus *Monhystera.* Afterwards, he was the first to compile a key to determining the species of that genus. Besides him, solely **Schneider** (1939) compiled another key to *Monhystera* species, however, his paper contained only the species occurring in Germany (Central Europe). **Meyl** (1961) enumerated the European species of the family Monhysteridae (31 species), whilst **Goodey** (1963) gave a list of 62 species or varieties in the genus *Monhystera,* 2 species in *Monhystrella* and 2 species in *Hofmaenneria* known over the world to that time. Finally **Andrássy** published a list of each species in the genera *Monhystrella* (1968; 10 species and subspecies) and in *Theristus* (1977; 5 species).

Besides the work quoted above, two further publications are worthwile to mention. One is the paper of **Wieser** (1956) in which an enumeration of the marine and non-marine species of *Monhystera* (31 species in all) can be found, as well as a key to the species group of the genus. The other paper is the check list of **Gerlach** and **Riemann** (1973). Summing up the distribution data of all aquatic Nematoda, the latter authors listed every marine and inland species of the family Monhysteridae as follows: 297 species and subspecies in *Theristus,* 297 species and subspecies in *Monhystera,* 12 species and subspecies in *Monhystrella* and 3 species in *Hofmaenneria.*

Last but not least it should be mentioned that in some recent papers (1977, 1978) **Lorenzen** revised the system of the superfamily Monhysteroidea, namely from a phylogenetical point of view. Among others, he pointed out that the genera *Theristus* and *Monhystera* were not so close one another as to validity as supposed previously. On the contrary, they do have some primary morphological differences (in the structure of the cuticle and in the position of the genital organs) that give good reason for distinguishing them even on family level (Xyalidae and Monhysteridae, respectively).

In this paper, I propose a new systematization of the limnic, inland saline and terrestrial – in short, non-marine – species of the order Monhysterida. I give redefinitions of the genera, descriptions of new genera, lists and synonyms of the species, keys to contribute to the determination of these nematodes, as well as the geographical distribution data of the continental members of the order Monhysterida. In my appraisal, the number of non-marine species of the genera is as follows:

Theristus	6 species
Daptonema	2 species
Monhystera	7 species
Eumonhystera	24 species
Anguimonhystera	3 species

Geomonhystera	5 species
Monhystrella	13 species
Sinanema	1 species
Hofmaenneria	3 species
Altogether	64 species

Order: **MONHYSTERIDA** DE CONINCK & SCHUURMANS STEKHOVEN, 1933

Torquentia. Cuticle smooth or transversely annulated, without punctation. Cephalic setae 4, 4+6 or more. Amphids circular or subspiral, only exceptionally spiral. Mouth cavity generally quite small, funnel-shaped, occasionally wider, mostly without distinct sclerotization. Denticles, if present, generally very small. Oesophagus cylindrical, only rarely swollen proximally, without a true bulb. Cardial glands present. Female gonad outstreched; almost in every case single, prodelphic. Testes one or two; male genital papillae simple, or completely absent.

Predominantly aquatic species, marine or limnic, only a few per cent of them inhabit soil biotopes. The non-marine forms belong to two superfamilies of the suborder Monhysterina DE CONINCK & SCHUURMANS STEKHOVEN, 1933.

Key to the superfamilies

1 Mouth cavity comparatively wide with sclerotized walls, vestibule longitudinally striated . . . . b) **Sphaerolaimoidea** (p. 37)

– Mouth cavity small and narrow, not or only hardly sclerotized, vestibule not striated. . . . . a) **Monhysteroidea** (p. 15)

a) Superfamily: MONHYSTEROIDEA DE MAN, 1876

Monhysterida. Cuticle smooth or annulated. Mostly 10 (6+4) cephalic setae. Stoma simple, funnel-shaped, small, generally not slerotized at all. Denticles, if present, minucious, hardly recognizable. Vestibule smooth.

The continental species belong to two families.

Key to the families

1 Cuticle smooth, without any annulation; testis single; both female and male gonads lying on the right of the intestine . . . . 2. **Monhysteridae** (p. 19)

– Cuticle with fine but distinct annulation; testes mostly two; anterior testis and ovary lying on the left of the intestine. . . . . 1. **Xyalidae** (p. 15)

1. Family: **Xyalidae** CHITWOOD, 1951

Monhysteroidea. Generally small animals. Cuticle finely but conspicuously annulated, with thin setae. Basic number of cephalic setae 4, but further supplementary setae may also occur. Amphids circular, rarely – especially in marine species – spiral. Eye spots (ocelli) may be present. Stoma narrow, funnel-shaped, without sclerotized teeth, at best with some very small denticles. Oesophagus almost cylindrical. Ovary one, testes mostly two; the anterior testis and ovary lying on the left, the posterior testis on the right of the intestine. Postvulval sac of uterus only rarely present. Spicules frequently surrounded by the slipper-shaped gubernaculum. No preanal supplements or papillae. Tails similar in both sexes, elongate-conical or filiform, with glands (generally 3 in number) and terminal spinneret. Females and males equally common in general.

Primarily marine nematodes but two genera of the subfamily Xyalinae CHITWOOD, 1951 contain also freshwater species.

Key to the genera

1 Tail with a pair of terminal setae; vulva at 3/4 of body length. .... 2. **Daptonema** (p. 18)

– Tail without terminal setae; vulva at 2/3 of body length. .... 1. **Theristus** (p. 16)

1. Genus: *Theristus* BASTIAN, 1865

Syn. *Monhystera* (*Theristus* BASTIAN, 1865) MICOLETZKY, 1922; *Tachyhodites* BASTIAN, 1865; *Penzancia* DE MAN, 1889; *Theristus* (*Penzancia* DE MAN, 1889) WIESER, 1956; *Metadesmolaimus* SCHUURMANS STEKHOVEN, 1935.

Xyalidae. Body of freshwater species 0.6 to 1.7 mm long. Cuticle finely but distinctly annulated, with thin submedial setae. Head not or only slightly offset, with 10 or 12 setae. Ocelli occasionally present. Mouth cavity small and narrow, without conspicuous denticles. Vulva at 2/3 of body length. Testes one or two. Spicules usually arched, sometimes very long, often as long as anal diameter of body. Gubernaculum slipper-shaped, with or without a caudal extension. Terminal setae on tail not present.

Numerous species belong to this genus, they are, however, marine for the most part. A few species occur in brackish or fresh water, especially in interstitial habitats.

Type species: *Theristus acer* BASTIAN, 1865 – a marine species.

The following six freshwater species belong to the genus:

Th. agilis (DE MAN, 1880) FILIPJEV, 1918
Syn. *Monhystera agilis* DE MAN, 1880
Theristus (Penzancia) agilis (DE MAN, 1880) FILIPJEV, 1918
Monhystera labiata DADAY, 1903
Monhystera macrocephala RAHM, 1924
Theristus heteroscanicus WIESER in BRINCK, DAHL & WIESER, 1955
Theristus scanicus apud GERLACH, 1953, 1965; RIEMANN, 1966

Th. athesinus ANDRÁSSY, 1962
Syn. *Theristus (Penzancia) athesinus* ANDRÁSSY, 1962 (RIEMANN, 1966)

Th. kaszabi ANDRÁSSY, 1977

Th. ruffoi ANDRÁSSY, 1959
Syn. *Theristus (Penzancia) ruffoi* ANDRÁSSY, 1959 (RIEMANN, 1966)

Th. vesentiniae ANDRÁSSY, 1962
Syn. *Theristus (Penzancia) vesentiniae* ANDRÁSSY, 1962 (RIEMANN, 1966)

Th. wegelinae ANDRÁSSY, 1962
Syn. *Theristus (Penzancia) wegelinae* ANDRÁSSY, 1962 (RIEMANN, 1966)

The further species similarly belong to the genus *Theristus*, they are, however, poorly defined, hence must be regarded as species inquirendae:

Th. helveticus (STEINER, 1914) n. comb.
Syn. *Monhystera helvetica* STEINER, 1914

Th. lingi (HOEPPLI & CHU, 1932) ANDRÁSSY, 1960
Syn. *Microlaimoides lingi* HOEPPLI & CHU, 1932

Th. parasiticus (PENSO, 1938) n. comb.
Syn. *Monhystera parasitica* PENSO, 1938

Key to the limnic species

1 Tail very long, 14–15 times as long as anal body diameter; body to 0.7 mm long. – ♀: L = 0.66–0.70 mm; a = 35–36; b = 4.6–4.8; c = 3.9–4.0; V = 65–66%. ♂ unknown. (Mongolia; in wet moss.) . . . **kaszabi** ANDRÁSSY

– Tail shorter, 6–9 times as long as anal body diameter; body longer than 0.8 mm (generally longer than 1 mm). 2

2 Gubernaculum very long as compared to spicules, spicules surrounded by the gubernaculum to 2/3 of their length; body shorter than 1 mm. – ♀: L = 0.8–0.9 mm; a = 41–45; b = 4.5–4.8; c = 7.0–7.7; V = 61–64%. ♂: L = 0.8–0.9 mm; a = 47–55; b = 4.5–4.9; c = 6.4–7.8. (Italy and Switzerland; in groundwater biotopes and in Lake Léman.) **vesentiniae** ANDRÁSSY

– Gubernaculum shorter, spicules surrounded by the gubernaculum less than to 1/2 of their length; body longer than 1 mm 3

3 Spicules distinctly longer than two anal body diameters; amphids 1.6–1.9 head diameters behind anterior end. – ♀: L = 1.0–1.2 mm; a = 37–46; b = 4.4–5.1; c = 7.5–10; V = 60–63%. ♂: L = 1.1–1.2 mm; a = 43–50; b = 5.0–5.2; c = 7.4–8.0. (Italy; in groundwater.). . **ruffoi** ANDRÁSSY

– Spicules at most twice as long as anal body diameter, but generally shorter; amphids 1.1–1.5 head diameters behind anterior end. 4

4 Cephalic setae about 10 µm long. – ♀: L = 1.2–1.6 mm; a = 31–45; b = 5–7; c = 7–9; V = 60–64%. ♂: L = 1.0–1.5 mm; a = 40–50; b = 5–7; c = 7–10. (Holland, Germany, Denmark, Austria, Switzerland, Czechoslovakia, Poland, Rumania, Italy, Norway, Sweden, Soviet Union; Zaire; Japan, Hainan; USA, Chile; in freshwater and brackish biotopes, and in wet soil.) . . . . **agilis** (DE MAN)

– Cephalic setae about 20 µm long. 5

5 Gubernaculum proximally with short, hook-like apophysis; male tail rapidly narrowing just behind cloacal opening. – ♀: L = 1.5–1.7 mm; a = 34–42;

b = 5.0 – 5.3; c = 8.4 – 10; V = 65 – 66%. ♂: L = 1.7 – 1.8 mm; a = 47 – 60; b = 5.2 – 5.6; c = 8.8 – 9.2. (Germany; in groundwater.) .... **wegelinae** ANDRÁSSY

– Gubernaculum proximally without apophysis; male tail not narrowing rapidly behind cloacal opening. – ♀: L = 1.2 – 1.5 mm; a = 37 – 42; b = 4.8 – – 5.0; c = 7.8 – 8.2; V = 60 – 64%. ♂: L = 1.4 – 1.5 mm; a = 48 – 56; b = = 4.8 – 5.1; c = 6.9 – 7.2. (Italy and Germany; in groundwater.) .... **athesinus** ANDRÁSSY

2. Genus: *Daptonema* COBB, 1920

Syn. *Theristus* (*Daptonema*, COBB, 1920) WIESER, 1956; *Allomonhystera* MICOLETZKY, 1923; *Tubolaimus* ALLGÉN, 1929; *Theristus* (*Mesotheristus* WIESER, 1956); *Mesotheristus* (WIESER, 1956) CHITWOOD & MURPHY, 1964.

Xyalidae. Relatively big animals (1.2 – 2 mm) with massive body. Cuticle finely annulated and supplied with several thin setae. Head region slightly offset, number of cephalic setae 12. Amphids circular. Ocelli not present. Stoma insignificant, narrow, walls not sclerotized. Oesophagus practically cylindrical. Vulva far back, at 3/4 of body length. Spicules comparatively short, almost rectangular. Gubernaculum caudally extended. Tail terminus with a pair of setae.

Marine nematodes, only two species inhabit freshwater biotopes.

Type species: *Daptonema fissidens* Cobb, 1920 – a marine species.

Freshwater species:

D. dubium (BÜTSCHLI, 1873) LORENZEN, 1977
Syn. *Monhystera dubia* BÜTSCHLI, 1873
Monhystera (Theristus) dubia BÜTSCHLI, 1873 (MICOLETZKY, 1922)
Theristus dubius (BÜTSCHLI, 1873) MICOLETZKY, 1925
Mesotheristus dubius (BÜTSCHLI, 1873) HOPPER, 1969
Monhystera setosa BÜTSCHLI, 1874
Monhystera (Theristus) setosa BÜTSCHLI, 1874 (DE MAN, 1907)
Theristus setosus (BÜTSCHLI, 1874) MICOLETZKY, 1925
Theristus (Mesotheristus) setosus (BÜTSCHLI, 1874) MICOLETZKY, 1925 (Wieser, 1956)
Mesotheristus setosus (BÜTSCHLI, 1874) DE CONINCK, 1965
Daptonema setosum (BÜTSCHLI, 1874) LORENZEN, 1977
Theristus setosus izhoricus FILIPJEV, 1930
Theristus setosus gerlachi MEYL, 1955
Monhystera gracillima COBB, 1893
Theristus gracillimus (COBB, 1893) WIESER, 1956
Monhystera crassissima DITLEVSEN, 1911
Monhystera crassoides MICOLETZKY, 1913
Monhystera sentiens COBB, 1914
Monhystera pseudosetosa STEINER, 1919
Allomonhystera tripapillata MICOLETZKY, 1923
Theristus hirtus GERLACH, 1951

D. subsetosum (SCHNEIDER, 1943) n. comb.
Syn. *Theristus subsetosus* SCHNEIDER, 1943

Key to the limnic species

1 Amphids small, only 1/6 as wide as corresponding body diameter, as far from anterior end as 1/2 head diameter; cephalic setae shorter than 50% of head width. – ♀: L = 1.6 – 2.0 mm; a = 13 – 16; b = 2.9 – 3.7; c = 6.3 – 8.0; V = 70 – 75%. ♂ unknown. (Yugoslavia: Ohrid Lake, in a depth of 35 – 100 m.) .... **subsetosum** (SCHNEIDER)

– Amphids 1/4 as wide as corresponding body diameter, about as far from anterior end as one head diameter; cephalic setae longer than those of the preceding species, 60 – 70% of head width. – ♀: L = 1.2 – 2.0 mm; a = 20 – 25; b = 4 – 6; c = 6 – 8; V = 68 – 75%. ♂: L = 1.1 – 1.5 mm; a = 20 – 30; b = 4 – 6; c = 6 – 8. (Germany, Austria, Switzerland, Hungary, Denmark, Yugoslavia, Spain, France, Iceland, Norway, Sweden, Finland, Soviet Union; Canada, USA, Nicaragua; Australia; in standing and running water, brackish biotopes and on coasts of lower salt content.) .... **dubium** (BÜTSCHLI)

2. Family: **Monhysteridae** DE MAN, 1876

Monhysteroidea. Mostly small animals. Cuticle smooth, without any striation, usually with thin submedial setae. Cephalic setae 6, 10 or, rarely, 12, only exceptionally absent. Amphids circular, at different distance from anterior body end. Ocelli occasionally present. Mouth cavity quite narrow, rarely somewhat expanded, not sclerotized. Denticles absent or extremely fine, hardly recognizable. Oesophagus musculous, almost cylindrical. Female and male gonads always unpaired and outstreched (reflexed in a single genus only), both of them lying on the right of intestine. Posterior uterine sac rarely present. Gubernaculum often with caudal extension. Preanal supplements or papillae absent. Tails of both sexes long, with spinneret. Males much less common than females.

Although a great part of the Monhysteridae live in the sea, numerous species may occur also in limnic and terrestrial habitats. The continental species can be ordered in six genera of the subfamily Monhysterinae DE MAN, 1876.

Key to the continental genera

1 Female gonad reflexed; anterior part of stoma with small denticles........
6. **Sinanema** (p. 37)

– Female gonad outstreched; denticles, if present, lying in posterior part of stoma 2

2 Vulva in mid-body, gonad very short; oesophagus with bulb-like proximal swelling; cuticle without setae; tail spinneret usually very long ....
5. **Monhystrella** (p. 34)

– Vulva posterior, gonad long; oesophagus not bulb-like proximally; cuticle with setae; tail spinneret short.. 3

3 Body long, 1.5 – 2.4 mm, extremely slender (a to 100). ....
3. **Anguimonhystera** (p. 29)

– Body shorter and never so slender 4

4 Vulva far back, at 80% of body length, near to the anus; rectum heavily musculous and 2–3 times as long as anal body diameter .... 4. **Geomonhystera** (p. 30)

– Vulva not so far back, generally at about 2/3 of body length, far from the anus; rectum thin, not musculous, usually as long as anal body diameter. .. 5

5 Spicules extremely long, mostly 3–4 times as long as anal body diameter; amphids quite near the anterior end of body (their distance from that is shorter than one head diameter).................... 1. **Monhystera** (p. 20)

– Spicules always shorter than two anal body diameters; amphids at least one head diameter from anterior end of body, but in most of cases further back... 2. **Eumonhystera** (p. 23)

1. Genus: *Monhystera* Bastian, 1865

Monhysteridae. Cuticle smooth, with submedial setae. Body of the continental species 0.5 to 1.5 mm long. Body cavity packed with fine bio-crystals. Head wide, not offset. Cephalic setae relatively short, not longer than 50% of head diameter. Amphids circular, fairly large, near the anterior body end, i. e. their distance from anterior end is not longer than one head diameter. Ocelli mostly (always ?) present. Denticles, if present, minute. Position of vulva varying between 54 to 75% of body length. Spicules extremely long and slender, at least twice, usually 3–4 times, maximally 7 times as long as anal body diameter. Gubernaculum short, with or without caudal apophysis. Tail always shorter than the distance between vulva and anus, terminal spinneret short.

Exclusively aquatic species.
Type species: *Monhystera stagnalis* BASTIAN, 1865.
The genus contains seven continental species:

M. africana ANDRÁSSY, 1964
Syn. *Monhystera pseudomacrura* KHERA, 1971

M. lemani JUGET, 1969

M. paludicola DE MAN, 1881
Syn. *Monhystera rivularis* BASTIAN, 1865
Monhystera annulifera DADAY, 1905

M. paramacramphis Meyl, 1954
Syn. *Monhystera stagnalis salina* PAETZOLD, 1958
Monhystera stagnalis parasalina GERLACH & RIEMANN, 1973

M. stagnalis BASTIAN, 1865
Syn. *Monhystera ocellata* LINSTOW, 1876
Monhystera oculata LINSTOW, 1878
Monhystera psammophila JUGET, 1969

M. uncispiculata GAGARIN, 1979

M. wangi WU & HOEPPELI, 1929
Syn. *Monhystera macramphis* FILIPJEV, 1930
Monhystera izhorica FILIPJEV, 1930
Monhystera somereni ALLGÉN, 1952

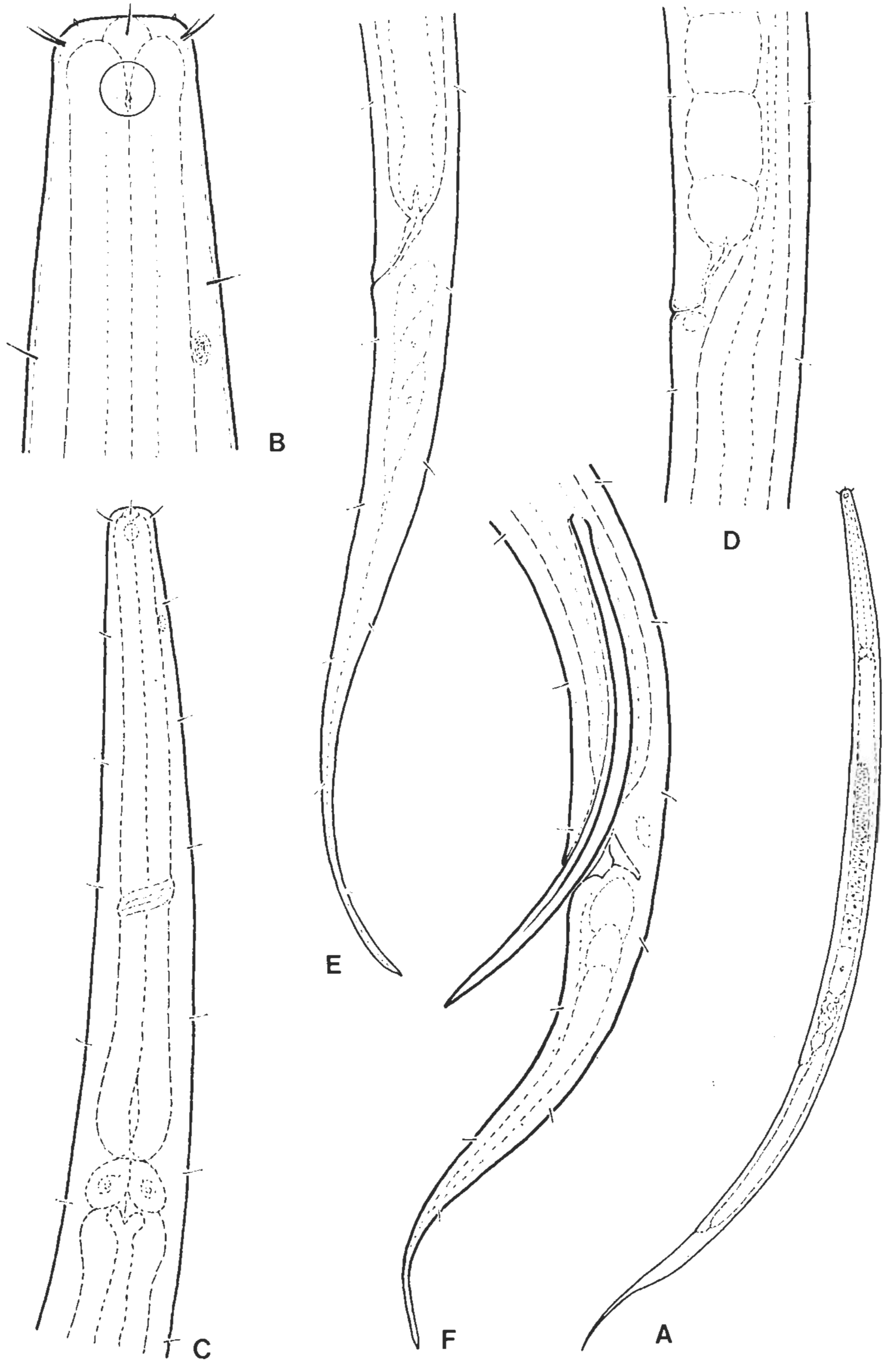


Fig. 1. *Monhystera paludicola* DE MAN, 1881 from Dinnyés, Lake Velence, Hungary — a representative of the genus *Monhystera*. *A:* entire feminale (× 130); *B:* anterior end (× 1600); *C:* oesophageal region (× 550); *D:* vulvar region (× 550); *E:* tail of female (× 550); *F:* tail of male (× 550)

Key to the continental species

1 Spicules longer than 70 µm (to 160 µm) 2
– Spicules 50 µm long or shorter 6

2 Viviparous animals. – ♀: L = 0.9 – 1.4 mm; a = 16 – 26; b = 6.2 – 8.1; c = 5.9 – 6.4; V = 67 – 75%. ♂: 0.8 – 1.1 mm; a = 25 – 35; b = 5.1 – 6.6; c = 6 – 8. (Holland, Germany, Austria, Switzerland, Hungary, Czechoslovakia, Rumania, Bulgaria, France, Portugal, Italy, Poland, Denmark, Great Britain, Spitsbergen, Soviet Union; Columbia; always in fresh-water biotopes.) **stagnalis** BASTIAN
– Oviparous animals **3**

3 Spicules 100 – 160 µm long, almost as long as tail 4
– Spicules 70 – 90 µm long, conspicuously shorter than tail. 5

4 Spicules hook-like distally; body relatively stout (a = 24 – 26). – ♀: L = = 0.94 – 1.0 mm; a = 25 – 26; b = 5.4 – 5.6; c = 6.2 – 6.4; V = 64 – 65%. ♂: L = 0.89 – 0.90 mm; a = 24 – 26; b = 5.8 – 6.0; c = 6.0 – 6.2. (Soviet Union; in aquatic habitats.) .... **uncispiculata** GAGARIN
– Spicules simple, not hook-like distally; body more slender (a = 27 – 35). – ♀: L = 0.9 – 1.2 mm; a = 27 – 35; b = 5.5 – 6.5; c = 5.5 – 7.0; V = 60 – 66%. ♂: L = 0.8 – 1.1 mm; a = 27 – 35; b = 5.4 – 6.2; c = 6 – 7. (Holland, Belgium, Germany, Austria, Switzerland, Hungary, Czechoslovakia, Rumania, Bulgaria, Spain, France, Yugoslavia, Italy, Poland, Denmark, Sweden, Finland, Soviet Union; India, Japan; Kenya, Mauretania, South-West Africa; Surinam, Columbia, Paraguay, Mexico; in different freshwater habitats and wet soil, besides in bays of low salt contant. (Fig. 1 *A – F*) .... **paludicola** DE MAN

5 Tail comparatively short and stout, 5 – 6 times as long as anal body diameter; vulva at 2/3 of body length. – ♀: L = 0.9 – 1.5 mm; a = 20 – 30; b = = 4.4 – 6.1; c = 6.0 – 8.3; V = 66 – 70%. ♂: L = 0.8 – 1.3 mm; a = 22 – 35; b = 4.8 – 5.8; c = 6.8 – 8.8. (Switzerland, in the Lake Léman.) **lemani** JUGET
– Tail slender, 10 – 14 times as long as anal body diameter; vulva before 2/3 of body length. – ♀: L = 1.0 – 1.2 mm; a = 25 – 38; b = 5.9 – 7.2; c = 4.5 – 6.5; V = 58 – 63%. ♂: L = 0.9 – 1.2 mm; a = 30 – 40; b = 6.0 – 6.2; c = 6.2 – 6.3. (Soviet Union, India, East Africa; limnic.) **africana** ANDRÁSSY

6 Body 0.5 – 0.7 mm long; spicules about 30 µm long. – ♀: L = 0.5 – 0.7 mm; a = 27 – 32; b = 5 – 6; c = 6.3 – 6.6; V = 61 – 63%. ♂: L = 0.5 – 0.6 mm; a = 27 – 36; b = 4.0 – 5.2; c = 6.3 – 8.2. (Germany and South Africa; in salt biotopes.) .... **paramacramphis** MEYL
– Body 0.9 – 1.5 mm long; spicules 40 – 50 µm long. – ♀: L = 0.9 – 1.5 mm; a = 23 – 38; b = 5 – 7; c = 5.0 – 6.6; V = 54 – 62%. ♂: L = 0.9 – 1.5 mm; a = 26 – 35; b = 5 – 6; c = 5 – 7. (Germany, Austria, Switzerland, Hungary, Czechoslovakia, France, Italy, Poland, Soviet Union; China; Egypt, Ivory Coast, Kenya, Mauretania; Paraguay; both in small pools and big lakes, furthermore in bays and continental salt lakes.) .... **wangi** WU & HOEPPLI

2. Genus: *Eumonhystera* n. gen.

Monhysteridae. Body small, 0.35 to 1.0 mm, moderately slender. Head wide, mostly not offset, cephalic setae 10, various in length. Amphids circular, at least one head diameter behind anterior body contour. Ocelli often present in aquatic species. Rectum weak, non-muscular. Vulva generally at 2/3 of body length. Spicules comparatively short, i.e. always shorter than double width of anal body region. Gubernaculum with or without extension. Tail as long as or longer than the distance between vulva and anus (shorter only exceptionally), straight or ventrally curved. Spinneret moderately long.

A rich genus with several marine, limicolous and terricolous species. Lively animals, feeding on algae or detritus.

Type species: *Monhystera vulgaris* DE MAN, 1880 = *Eumonhystera vulgaris* (DE MAN, 1880) n. comb.

The following 24 species have been observed in continental habitats:

E. alpina (Filipjev, 1918) n. comb.
Syn. *Monhystera alpina* FILIPJEV, 1918
Monhystera demani HOFMÄNNER & MENZEL, 1914, nec REUVILLE, 1903

E. altherri n. sp.
Syn. *Monhystera* sp. apud ALTHERR, 1976

E. andrassyi (BÍRÓ, 1969) n. comb.
Syn. *Monhystera andrassyi* BÍRÓ, 1969

E. barbata n. sp.

E. dispar (BASTIAN, 1865) n. comb.
Syn. *Monhystera dispar* BASTIAN, 1865
Monhystera crassa BÜTSCHLI, 1873

E. filiformis (BASTIAN, 1865) n. comb.
Syn. *Monhystera filiformis* BASTIAN, 1865

E. gracilior (JOHNSTON, 1938) n. comb.
Syn. *Monhystera gracilior* JOHNSTON, 1938
Monhystera gracillima DE MAN, 1921, nec COBB, 1893
Monhystera paragracillima GOODEY, 1963

E. hungarica n. sp.

E. islandica (DE CONINCK, 1943) n. comb.
Syn. *Monhystera islandica* DE CONINCK, 1943

E. longicaudatula (GERLACH & RIEMANN, 1973) n. comb.
Syn. *Monhystera longicaudatula* GERLACH & RIEMANN, 1973
Monhystera filiformis longicaudata STEFANSKI, 1924, nec BASTIAN, 1865
Monhystera vulgaris lemani JUGET, 1969
Monhystera vulgaris paralemani GERLACH & RIEMANN, 1973
Monhystera stefanskii ANDRÁSSY, 1977

E. multisetosa (MEYL, 1955) n. comb.
Syn. *Monhystera multisetosa* MEYL, 1955

E. mwerazii (MEYL, 1957) n. comb.
Syn. *Monhystera mwerazii* MEYL, 1957

E. papuana (DADAY, 1899) n. comb.
Syn. *Monhystera papuana* DADAY, 1899

E. parasimilis (ALLGÉN, 1926) n. comb.
Syn. *Monhystera parasimilis* ALLGÉN, 1926

E. parasimplex (DE CONINCK, 1943) n. comb.
Syn. *Monhystera parasimplex* DE CONINCK, 1943

E. pratensis (COBB, 1893) n. comb.
Syn. *Monhystera pratensis* COBB, 1893

E. pseudobulbosa (DADAY, 1896) n. comb.
Syn. *Monhystera pseudobulbosa* DADAY, 1896
Monhystera multisetosa hallensis PAETZOLD, 1958
Monhystera hallensis PAETZOLD, 1958

E. rustica (BÜTSCHLI, 1873) n. comb.
Syn. *Monhystera rustica* BÜTSCHLI, 1873
Monhystera subrustica COBB, 1906

E. similis (BÜTSCHLI, 1873) n. comb.
Syn. *Monhystera similis* BÜTSCHLI, 1873
Monhystera similis arenicola JUGET, 1969
Monhystera filiformis pseudobulbosa WU & HOEPPLI, 1929
Monhystera filiformis pseudoparbulbosa GERLACH & RIEMANN, 1973
Monhystera anomala SCHNEIDER, 1937

E. simplex (DE MAN, 1880) n. comb.
Syn. *Monhystera simplex* DE MAN, 1880

E. subfiliformis (COBB, 1918) n. comb.
Syn. *Monhystera subfiliformis* COBB, 1918

E. suecica (ALLGÉN, 1926) n. comb.
Syn. *Monhystera suecica* ALLGÉN, 1926

E. tatrica (DADAY, 1896) n. comb.
Syn. *Monhystera tatrica* DADAY, 1896

E. vulgaris (DE MAN, 1880) n. comb.
Syn. *Monhystera vulgaris* DE MAN, 1880
Monhystera parvella FILIPJEV, 1931
Monhystera filiformis intermedia JUGET, 1969, nec BÜTSCHLI, 1873
Monhystera filiformis intermediella GERLACH & RIEMANN, 1973

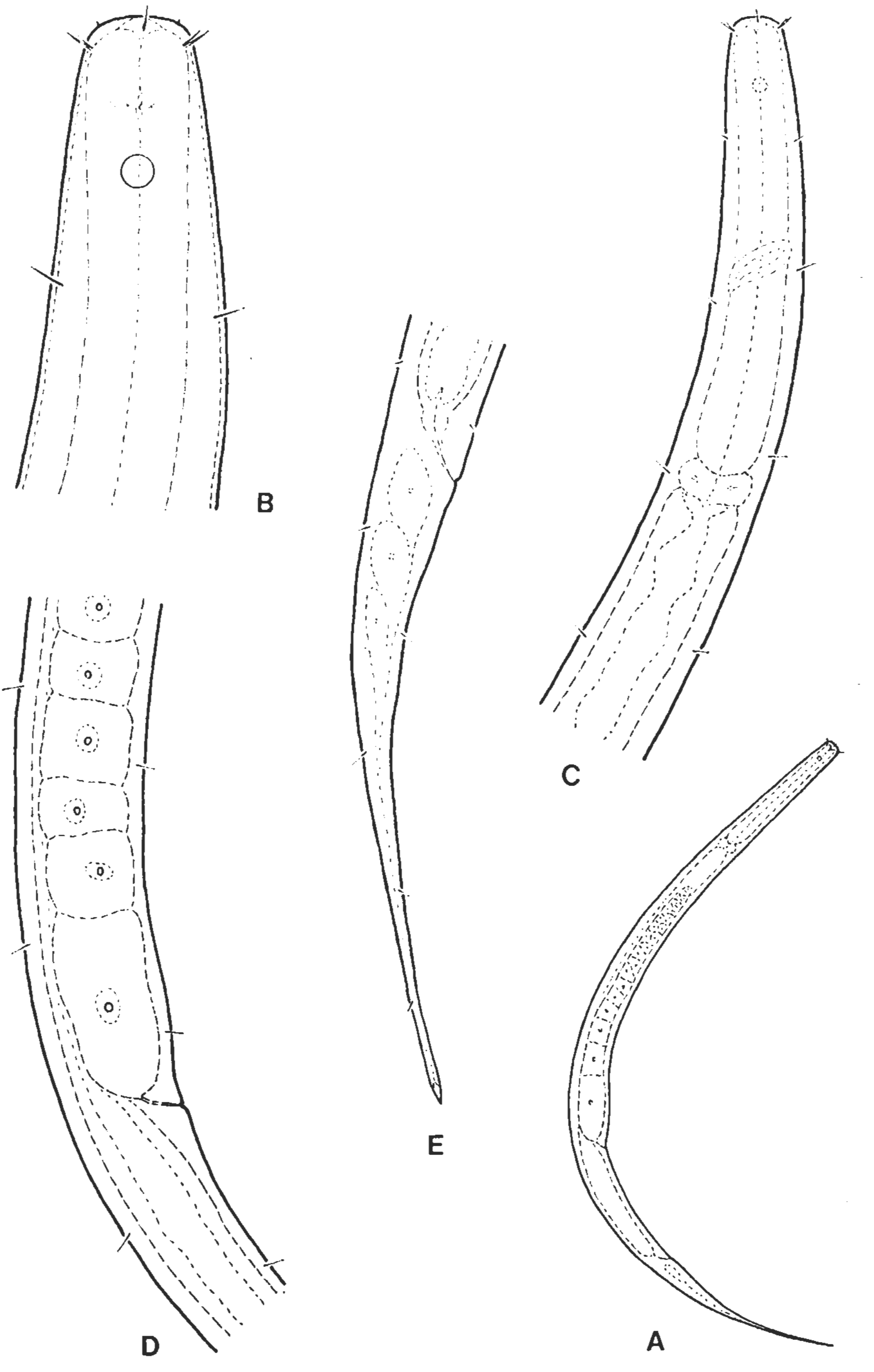


Fig. 2. *Eumonhystera vulgaris* (DE MAN, 1880) n. comb. from Miskolctapolca, Hungary — a representative of the genus *Eumonhystera*. *A:* entire female (× 250); *B:* anterior end (× 1600); *C:* oesophageal region (× 800); *D:* vulvar region (× 800); *E:* tail of female (× 800)

The following limnic species probably belong to the genus *Eumonhystera;* their descriptions are, however, very meagre (species inquirendae):

Monhystera dadayi Goodey, 1963
Syn. *Prismatolaimus macrurus* Daday, 1899

Monhystera frequens de Cillis, 1917

Monhystera fuelleborni Daday, 1908

Monhystera longicaudata Bastian, 1865

Monhystera propinqua Daday, 1905

Key to the non-marine species

1 Amphids two head diameters behind anterior body end or further back (to 4 head diameters) 2
– Amphids distinctly closer to anterior body end (closer than two head diameters) 9

2 Distance between vulva and anus conspicuously longer than tail 3
– Distance between vulva and anus shorter than tail 4

3 Cephalic setae very short, only 1/5 head diameter long; tail stout and short, 6 times as long as anal body diameter. – ♀: L = 0.36 mm; a = 24–26; b = 5.2–6.3; c = 6.0–6.2; V = 57–59%. ♂: L = 0.38 mm; a = 29; b = 5.2; c = 7.7. (Iceland; in brackish soil.) . . . . **islandica** (De Coninck)
– Cephalic setae nearly as long as 1/2 of head diameter; tail more slender, 8–9 times as long as anal body diameter. – ♀: L = 0.46 mm; a = 24; b = 4.6; c = 5.3; V = 57%. ♂ unknown. (Iceland and North Sea; in brackish biotopes.) . . . . **parasimplex** (De Conick)

4 Cephalic setae almost as long as head diameter; amphids far back, 3–3.5 head diameters behind anterior body end, 1/3 as wide as neck. – ♀: L = 0.35–0.50 mm; a = 35–45; b = 4–5; c = 3.5–4.0; V = 54–57%. ♂ unknown. (Holland, Germany, Switzerland, Austria, Hungary, France, Bulgaria, Poland, Great Britain, Soviet Union; in soil, rarely in water.) **simplex** (de Man)
– Cephalic setae shorter: in general not longer than 1/2 of head diameter; amphids only rarely as far back as in the previous species 5

5 Tail twice as long as the distance between vulva and anus 6
– Tail at least one and a half times as long as the distance between vulva and anus 7

6 Body to 3/4 mm long. – ♀: L = 0.62–0.75 mm; a = 35–41; b = 4.0–5.2; c = 4.0–4.3; V = 61–63%. ♂ unknown. (New Guinea and Java; in swamps) **papuana** (Daday)

– Body shorter: to 0.4 mm. – ♀: L = 0.33 – 0.38 mm; a = 40 – 43; b = 4.7 – – 5.3; c = 3.7 – 3.8; V = 61 – 62%. ♂ unknown. (Hungary; in wet moss.) (Fig. 5*A – F*) .... **hungarica** n. sp.

7 Cephalic setae very short, only 1/5 – 1/6 of head diameter or shorter, hardly discernible; amphids small, 1/5 – 1/6 as wide as corresponding body width, 2 – 2.5 (type form) or 3 – 3.5 (subsp. *arenicola*) head diameters from anterior body end, respectively. – ♀: L = 0.4 – 0.6 mm; a = 20 – 30; b = 4.0 – 5.5; c = 3.8 – 5.0; V = 57 – 65%. ♂: L = 0.4 – 0.6 mm; a = 24 – 32; b = 4.5 – – 5.7; c = 4.5 – 5.5. (Hollad, Germany, Switzerland, Austria, Hungary, Czechoslovakia, France, Italy, Bulgaria, Poland, Denmark, Finland, Soviet Union; Nepal, Mongolia; Tanganyika, South Africa; in various water habitats and in the soil, too.) .... **similis** (Bütschli)

– Cephalic setae well visible, 1/3 of head diameter; amphids 1/3 as wide as corresponding body width. 8

8 Body shorter than 0.5 mm; head somewhat widened; amphids more than two head diameters from anterior margin of body. – ♀: L = 0.38 – 0.45 mm; a = 30 – 34; b = 4.0 – 4.7; c = 3.8 – 4.5; V = 55 – 62%. ♂ unknown. (Germany, Austria, Hungary; in freshwater and salt biotopes.) .... **pseudobulbosa** (Daday)

– Body longer than 0.5 mm; head not widened at all; amphids hardly two head diameters from anterior margin of body. – ♀: L = 0.6 – 0.8 mm; a = 25 – – 33; b = 4.8 – 6.4; c = 4.0 – 5.5; V = 58 – 66%. ♂: L = 0.6 – 0.7 mm; a = 26 – 30; b = 5.5 – 6.5; c = 5 – 6. (Holland, Belgium, Germany, Austria, Switzerland, Hungary, Czechoslovakia, Rumania, Bulgaria, Yugoslavia, Spain, France, Italy, Poland, Denmark, Sweden, Finland, Iceland, Spitsbergen, Great Britain, Soviet Union; Mongolia, China, Hainan, Japan, Sumatra, Java; Madeira, Canary Islands, Kenya, Zaire, Annobon; USA, Cuba; Australia, Fiji Islands, Macquarie Islands; mostly aquatic, in very different water habitats, but also in the soil.) .... **filiformis** (Bastian)*

9 Tail as long as or longer than the distance between vulva and anus 10

– Tail distinctly shorter than distance between vulva and anus 20

10 Tail twice as long as vulva-anus distance or longer. (Species difficult to distinguish.) 11

– Tail shorter than the double length of vulva-anus distance 15

11 Tail longer than 1/4 of body length; body slender (a = 30 – 55) 12

– Tail 1/4 of body length or shorter; body not so slender (a = 25 – 30) 13

12 Amphids one head diameter from anterior body margin; vulva in the midbody; cephalic setae short, 1/4 – 1/5 of head width. – ♀: L = 0.9 mm; a = = 55; b = 5; c = 3; V = 50%. ♂ unknown. (Holland; in dune soil. Rather incomletely described.) .... **gracilior** (Johnston)

– Amphids 1.5 – 1.7 head diameters from anterior body margin; vulva behind the middle of body; cephalic setae almost 1/3 of head width. – ♀: L = 0.4 – 0.7 mm; a = 30 – 46; b = 4.2 – 5.0; c = 2.9 – 3.8; V = 55 – 64%. ♂ un-

---

*See also under 16.

known. (Poland, Switzerland, Austria and Mongolia; aquatic.) .... **longicaudatula** (GERLACH & RIEMANN)

13 Larger species, about 3/4 mm. – ♀: L – 0.7 mm; a = 30; b = 4.9; c = 4; V = 63%. ♂ unknown. (USA; aquatic.) .... **subfiliformis** (COBB)
– Smaller species, under 1/2 mm 14

14 Amphids larger than 1/3 of corresponding body width; vulva in 2/3 of body length.– ♀: L = 0.37 mm; a = ?; b = 4; c = 4.4; V = 65%. ♂ unknown. (Czechoslovakia, in lakes.) .... **tatrica** (DADAY)
– Amphids only 1/5–1/6 of corresponding body width; vulva near to the middle of body. – ♀: L = 0.4 mm; a = 23; b = 5; c = 4; V = 55%. ♂ unknown. (Germany, Switzerland, Australia, Fiji Islands; aquatic.) **rustica** (BÜTSCHLI)

15 Amphids 1.6–1.8 (rarely 2) head diameters from anterior body margin ... 16
– Amphids 1–1.5 head diameters from anterior body margin. 17

16 Spicules unusually thick, their widest part occupying more than 1/3 of anal body diameter; somatic setae almost 1/2 of body width. – ♀: L = 0.4–0.5 mm; a = 21–25; b = 4.7–6.2; c = 4.4–4.8; V = 63–67%. ♂: L = 0.5–0.6 mm; a = 25–27; b = 5.7–5.9; c = 5.3–5.4. (Hungary, in Lake Balaton.) .... **andrassyi** (BÍRÓ)
– Spicules more slender, their widest part occupying at most 1/4 of anal body diameter; somatic setae short, 1/4–1/5 of body width. – Measurements and distribution see under item 8. .... **filiformis** (BASTIAN)

17 Cephalic setae relatively long, more than 1/3 of head diameter 18
– Cephalic setae short, 1/4 of head diameter. – ♀: L = 0.4–0.7 mm; a = 20–30; b = 5.5–6.3; c = 4.0–5.5; V = 58–65%. ♂ unknown. (Holland, Belgium, Germany, Switzerland, Austria, Hungary, Czechoslovakia, Rumania, Yugoslavia, Spain, France, Italy, San Marino, Poland, Bulgaria, Denmark, Great Britain, Sweden, Spitsbergen, Jan Mayen, Soviet Union; Vietnam, Java, Sumatra; Ethiopia, Morocco, Tunisia, Mauretania, South Africa; USA, Canada, Venezuela, Peru; Australia, Macquarie Islands; Antarctica; both in aquatic and terrestrial habitats.) (Fig. 2 *A–E)* **vulgaris** (DE MAN)

18 Tail 10–12 times as long as anal body diameter and 1.7–2 times as long as vulva-anus distance, respectively; amphids one head diameter from anterior body end. – ♀: L = 0.57–0.62 mm; a = 28–35; b = 4.0–4.4; c = 4.0–4.4; V = 62–65%. ♂ unknown. (Hungary and Paraguay; in wet soil.) (Fig. 6 *A–G)* .... **barbata** n. sp.
– Tail 7–8 times as long as anal body diameter and 1–1.4 times as long as vulva-anus distance, respectively; amphids more than one head diameter from anterior body end 19

19 Vulva before 2/3 of body length; amphids 40% of corresponding body width. – ♀: L = 0.4–0.5 mm; a = 23–33; b = 4.8–5.5; c = 4.3–4.8; V = 58%. ♂: L = 0.4 mm; a = 23–31; b = 5.3–5.7; c = 4.3–4.8. (Germany and Soviet Union; in salt biotopes.) .... **multisetosa** (MEYL)
– Vulva in or behind 2/3 of body length; amphids 30% of corresponding body width. – ♀: L = 0.5–0.6 mm; a = 24–31; b = 4.0–4.3; c = 5.0–5.3;

V = 67 – 68%. ♂ unknown. (Rumania and Tanzania; aquatic and terrestrial.) .... **mwerazii** (MEYL)

20 Ocelli present, 3 head diameters from anterior body end, red in colour. – ♀: L = 0.7 – 1.0 mm; a = 33 – 42; b = 4.5 – 5.7; c = 5.0 – 5.5; V = 60%. ♂: L = 0.7 – 0.9 mm; a = 30 – 35; b = 4.5 – 5.3; c = 4.7 – 5.8. (Switzerland; aquatic.) .... **alpina** (FILIPJEV)

21 Body much smaller than 1 mm (to 3/4 mm) 22
– Body 1 mm long or longer 23

22 Amphids as wide as 1/3 of corresponding body width, 0.7 – 1 head diameter from anterior body margin. – ♀: L = 0.4 – 0.6 mm; a = 20 – 26; b = 4.7 – 5.9; c = 4.5 – 5.8; V = 54 – 60%. ♂: L = 0.4 – 0.5 mm; a = 23 – 27; b = 5.4 – 6.2; c = 5.3 – 5.8. (Italy and Hungary; in hot springs.) .... **gerlachi** (MEYL)
– Amphids as wide as 1/6 – 1/7 of corresponding body width, 1 – 1.6 head diameters from anterior body end. – ♀: L = 0.5 – 0.8 mm; a = 20 – 24; b = 4.8 – 5.8; c = 5.5 – 7.0; V = 60 – 67%. ♂ unknown. (Holland, Germany, Switzerland, Austria, Hungary, Czechoslovakia, Rumania, Bulgaria, Yugoslavia, Spain, France, Italy, Poland, Great Britain, Denmark, Soviet Union; Sumatra, Java; Tunisia; Canada, USA; both in aquatic and terrestrial habitats.) .... **dispar** (BASTIAN)

23 Distance between vulva and anus twice as long as tail. 24
– Distance between vulva and anus one and a half times as long as tail 25

24 Cephalic setae half as long as head diameter. – ♀: L = 1.0 mm; a = 26; b = 4.5; c = 8.3; V = 60%. ♂ unknown. (Australia; in soil.) **pratensis** (COBB)
– Cephalic setae 1/4 as long as head diameter. – ♀: L = 1.3 mm; a = 21; b = 4.1; c = 9.1; V = 68%. ♂ unknown. (Austria; aquatic.) **altherri** n. sp.*

25 Tail terminus swollen; amphids one head diameter from anterior end of body. – ♀: L = 1.0 mm; a = 33; b = 5; c = 7.4; V = 65%. ♂ unknown. (Sweden, in Lake Wetter.) .... **suecica** (ALLGÉN)
– Tail terminus pointed; amphids 1.5 head diameters from anterior end of body. – ♀ (juv.): L = 0.9 mm; 30; b = 4; c = 7.5; V = 67%. ♂ unknown. (Sweden, in Lake Wetter.) .... **parasimilis** (ALLGÉN)

3. Genus: *Anguimonhystera* n. gen.

Monhysteridae. Long (1.4 – 2.4) and extremely slender animals. Head wide, rounded, not offset; cephalic setae comparatively long. Amphids circular, at least one head diameter behind anterior body end. Ocelli not present. Mouth cavity narrow, funnel-shaped, without any denticles. Vulva far behind middle of body; ovary straight. Spicules short, gubernaculum slipper-shaped. Tail long, without terminal setae.

---

*Syn. *Monhystera* sp. apud ALTHERR, 1976.

This new genus is proposed for three species described by GOFFART from wells. It is close to genus *Eumonhystera*, its species are, however, much longer and slender, and have longer cephalic setae.

Type species: *Monhystera stadleri* GOFFART, 1950 = *Anguimonhystera stadleri* (GOFFART, 1950) n. comb.

Three species:

A. ampliceps (GOFFART, 1950) n. comb.
Syn. *Monhystera ampliceps* GOFFART, 1950

A. stadleri (GOFFART, 1950) n. comb.
Syn. *Monhystera stadleri* GOFFART, 1950

A. tenuissima (GOFFART, 1950) n. comb.
Syn. *Monhystera tenuissima* GOFFART, 1950

Key to the species

1 Body relatively not too slender, a about 50. – ♀: L = 1.4 – 1.8 mm; a = 43 – 50; b = 4.8 – 5.0; c = 6.1 – 6.5; V = 60 – 63%. ♂: L = 1.4 – 1.8 mm; a = 43 – 50; b = 4.8 – 5.0; c = 7.8 – 8.0. (Germany; in groundwater.) **stadleri** (GOFFART)

– Body very slender, a = 70 – 100 2

2 Amphids large, 1/2 corresponding diameter wide or wider, 1.5 head diameters behind anterior body end. – ♀ unknown. ♂: L = 2.4 mm; a = 75; b = 6; c = 8. (Germany; in groundwater.) . . . . **ampliceps** (GOFFART)

– Amphids much smaller, 1/4 – 1/5 corresponding diameter wide, 2 head diameters behind anterior body end. – ♀: L = 1.5 – 1.8 mm; a = 90 – 100; b = 6.0 – 6.3; c = 4.7 – 5.2; V = 80% (62% in one specimen). ♂ unknown. (Germany; in groundwater. Listed also from the Soviet Union, namely from Uzbekistan, but this datum has yet to be confirmed.) . . **tenuissima** (GOFFART)

4. Genus: *Geomonhystera* n. gen.

Monhysteridae. Body length between 0.6 und 1.2 mm. Cuticle smooth but in the inner level often finely striated. Somatic setae numerous. Labial papillae setiform, cephalic setae articulate, fairly strong, 10 in number. Ocelli not present. Mouth cavity similar to that of other monhysterids, sometimes with some very small thickenings (denticles). Rectum strikingly thick, heavily muscular, longer than in other members of the family. Vulva far back, at 80% of the body length, quite near to the anal opening. Spicules slightly curved, gubernaculum short, simple. Tail relatively short and stout, hardly tapering posteriorly, manyfold as long as the vulva-anus distance. Tail spinneret short.

Contrasted with the other genera of the family, the species of *Geomonhystera* are definitely terrestrial nematodes. They occur especially often in moss and under bark. Under unfavourable circumstances they drop off to anabiotic sleep.

Type species: *Monhystera villosa* BÜTSCHLI, 1873 = *Geomonhystera villosa* (BÜTSCHLI, 1873) n. comb.

Five species:

G. aenariensis (MEYL, 1953) n. comb.
Syn. *Monhystera aenariensis* MEYL, 1953

G. australis (COBB, 1893) n. comb.
Syn. *Monhystera australis* COBB, 1893
Monhystera villosa steineri MICOLETZKY, 1922
Monhystera villosa apud TIMM, 1971

G. pervaga (ARGO & HEYNS, 1973) n. comb.
Syn. *Monhystera pervaga* ARGO & HEYNS, 1973

G. tripyloides (ANDRÁSSY, 1968) n. comb.
Syn. *Monhystera tripyloides* ANDRÁSSY, 1968

G. villosa (BÜTSCHLI, 1873) n. comb.
Syn. *Monhystera villosa* BÜTSCHLI, 1873
Monhystera insignis COBB, 1893
Monhystera impetuosa COBB, 1904
Monhystera mali FUCHS, 1938
Monhystera paravillosa MEYL, 1954

Key to the species

1 Vulva-anus distance 2 to 3 times longer than anal body diameter 2
– Vulva-anus distance not or only slightly longer than anal body diameter ... 4

2 Cuticle finely annulated; amphids maximum one head diameter from anterior end. – ♀: L = 0.65–0.86 mm; a = 24–45; b = 4.5–5.5; c = 6.4–7.4; V = 79–84%. ♂ unknown. (South- and South-East Africa; terrestrial.) **pervaga** (ARGO & HEYNS)
– Cuticle smooth, only subcuticle occasionally striated; amphids more than one head diameter from anterior end. 3

3 Amphids slightly but perceptibly oval, 1.5–2 head diameters from anterior end, 1/3 of corresponding diameter in width; body strongly curved ventrally; cuticle, especially in the female, with several somatic setae. – ♀ L = 0.6–1.0 mm; a = 30–42; b = 4.6–5.6; c = 6–8; V = 76–82%. ♂: L = 0.7–1.0 mm; a = 4.8–6.0; c = 7–8. (Holland, Belgium, Germany, Switzerland, Austria, Hungary, Czechoslovakia, Rumania, Bulgaria, Yugoslavia, France, Italy, Poland, Denmark, Spitsbergen, Soviet Union; Vietnam; Zaire; Canada, USA, Mexico, Brazil, Chile; Australia; Antarctic; very frequent in moss, but also in other terrestrial habitats.) (Figs. 3 *A–D* and 4 *A–B*) .... **villosa** (BÜTSCHLI)
– Amphids regularly circular, 1.2–1.5 head diameters from anterior end, 1/4 of corresponding diameter in width; body hardly curved ventrally; somatic setae scattered. – ♀: L = 0.6–1.2 mm; a = 34–46; b = 4.3–5.4; c = 6–11; V = 78–85%. ♂: L = 1.0–1.4 mm; a = 43–71; b = 4.5–5.7; c = 7.4–9.8. (Hungary, Australia and Antarctic; distributed probably similarly world-wide as its sister species, *G. villosa*; terrestrial.) .... **australis** (COBB)

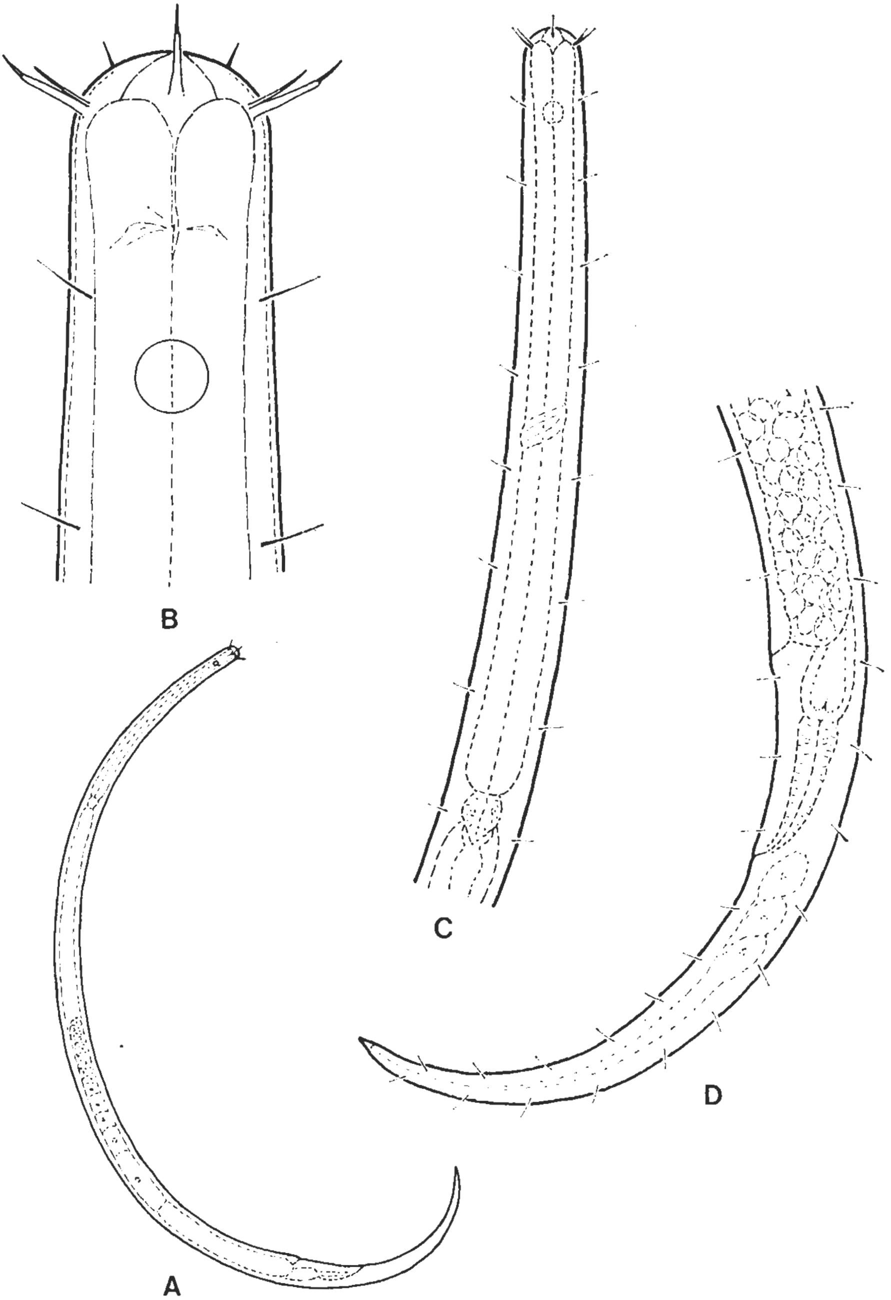


Fig. 3. *Geomonhystera villosa* (BÜTSCHLI, 1873) n. comb. from Mt. Vértes, Hungary — a representative of the genus *Geomonhystera*. *A:* entire female (x 160); *B:* anterior end; *C:* oesophageal region (× 570); *D:* vulvo-anal region (× 570)

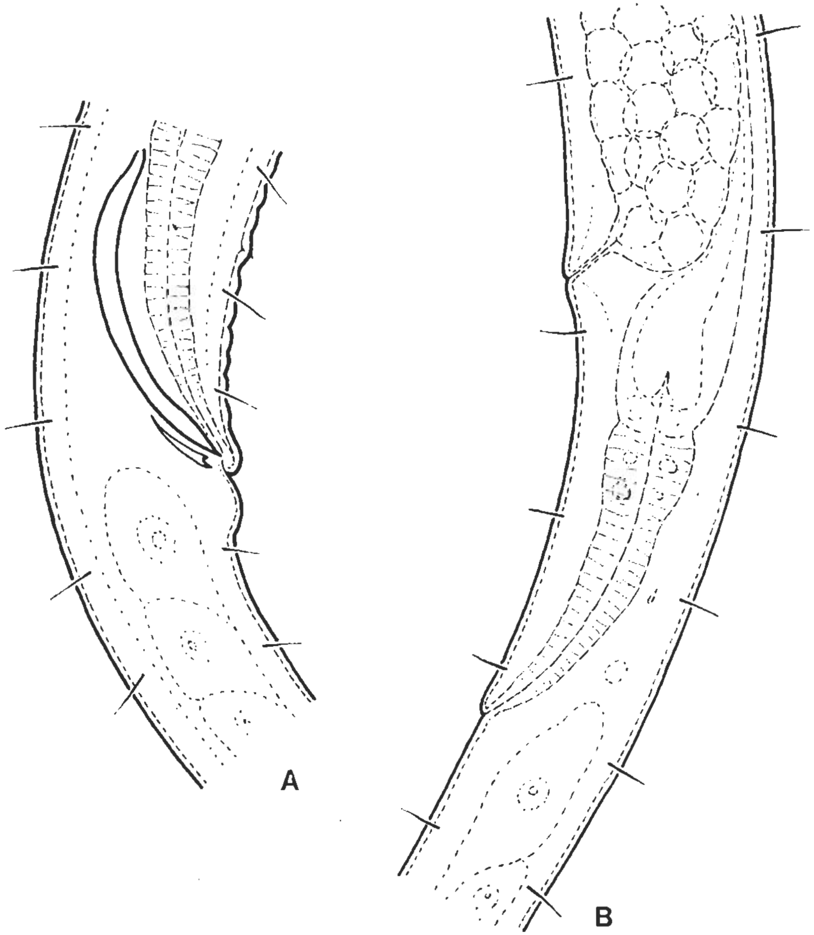


Fig. 4. *Geomonhystera villosa* (BÜTSCHLI, 1873) n. comb. from Mt. Vértes, Hungary. *A:* cloacal region of male (× 1200); *B:* vulvo-anal region of female (× 1200; note the long and muscular rectum)

4 Vagina consisting of a narrow and a broad, anchor-shaped portion; amphids circular, 1.5 – 1.7 head diameters from anterior body end. – ♀: L = 0.9 – 1.0 mm; a = 32 – 38; b = 5.4 – 5.6; c = 8.2 – 8.5; V = 84 – 85%. ♂ unknown. (Italy and Paraguay; in moss and detritus.) .... **tripyloides** (Andrássy)

– Vagina short and simple; amphids oval, 1 – 1.2 head diameters from anterior body end. – ♀: L = 0.6 – 0.8 mm; a = 23 – 40; b = 4.0 – 4.6; c = 6.6 – 8.7; V = 80 – 84%. ♂ unknown. (Italy and Soviet Union; terrestrial but also in hot springs.) .... **aenariensis** (Meyl)

5. Genus: *Monhystrella* Cobb, 1918

Syn. *Monhystera* (*Monhystrella* Cobb, 1918) Steiner, 1920; *Terschellingia* (*Monhystrella* Cobb, 1918) Micoletzky, 1922.

Monhysteridae. Small nematodes, exceptionally longer than 0.5 mm (to 0.7 mm). Cuticle smooth, without somatic setae. Cephalic setae short, labial papillae minute. Amphids at least two head diameters behind anterior body end, but usually further far back. Mouth cavity narrow but conspicuous, tube or funnel-shaped, with a very small tooth on its ground. Ocelli not present. Proximal portion of esophagus generally bulb-like swollen, beginning of intestine globe-like. Vulva on the mid-body. Female gonads short, ovaries consisting of only a few cells. Males rare. Spicules comparatively short. Tail of both sexes long, filiform; terminal spinneret unusually long and slender.

In fresh- and inland saline waters, rarely in wet soil; one species occurring in the sea.

Type species: *Monhystrella plectoides* Cobb, 1918.

Fourteen valid species can be ordered in the genus *Monhystrella:*

M. gracilis Khera, 1966

M. hastata Andrássy, 1968
Syn. *Monhystrella altherri* Juget, 1969

M. iranica Schiemer, 1965
Syn. *Monhystrella marina iranica* Schiemer, 1965

M. lepidura (Andrássy, 1963) Andrássy, 1968
Syn. *Monhystera lepidura* Andrássy, 1963

M. longistoma (Khera, 1970) n. comb.
Syn. *Monhystera longistoma* Khera, 1970

M. macrura (de Man, 1880) n. comb.
Syn. *Monhystera macrura* de Man, 1880
Monhystera vulgaris macrura de Man, 1880

M. mysoriensis Moorthy, 1938

M. paramacrura (Meyl, 1953) Andrássy, 1968
Syn. *Monhystera paramacrura* Meyl, 1953

M. parelegantula (De Coninck, 1943) n. comb.
Syn. *Monhystera parelegantula* De Coninck, 1943

M. plectoides Cobb, 1918
Syn. *Monhystera (Monhystrella) plectoides* (Cobb, 1918) Steiner, 1920
Terschellingia (Monhystrella) plectoides (Cobb, 1918) Micoletzky, 1922
Monhystera filiformis fukiensis Hoeppli & Chu, 1932

M. salina (Meyl, 1954) n. comb.
Syn. *Monhystera filiformis salina* Meyl, 1954
Monhystera salina Meyl, 1954

M. stewarti (Khera, 1970) n. comb.
Syn. *Monhystera stewarti* Khera, 1970

M. thermophila (Meyl, 1953) n. comb.
Syn. *Monhystera thermophila* Meyl, 1953

Besides the continental species listed above there also exist a marine species:

M. marina Timm, 1964

The systematic position of the following species is uncertain:

Monhystrella bulbifera (de Man, 1880) Schneider, 1939 – Syn. *Monhystera bulbifera* de Man, 1880; *Monhystera (Monhystrella) bulbifera* de Man, 1880 (Steiner, 1920); *Terschellingia (Monhystrella) bulbifera* (de Man, 1880) Micoletzky, 1922. – Holland, Germany, Switzerland, Ireland, Soviet Union.

Monhystrella godeti (Steiner, 1920) Timm, 1964 – Syn. *Monhystera (Monhystrella) godeti* Steiner, 1920; *Terschellingia (Monhystrella) godeti* (Steiner, 1920) Micoletzky, 1922. – Peru.

Monhystera spiralis Wu & Hoeppli, 1929. – China. Maybe this species is dentical with *Monhystrella salina*.

Key to the continental species

1 Amphids far back, 4 – 5 head diameters from anterior body end. 2
– Amphids not so far back, 2 – 3 head diameters from anterior body end. 3

2 Amphids relatively large, almost 1/3 of corresponding diameter in width; head narrow, not set off, cephalic setae only 1/5 head diameter long. – ♀: L = 0.36 mm; a = 29; b = 5.6; c = 2.9; V = 47%. ♂ unknown. (Iceland; in brackish water.) . . . . **parelegantula** (De Coninck)
– Amphids very small, only 1/6 – 1/7 of corresponding diameter in width; head hat-like swollen, wider than neck, cephalic setae almost 1/2 head diameter long. – ♀: L = 0.35 – 0.42 mm; a = 31 – 34; b = 6.3 – 6.5; c = 2.5 – 2.9; V = 42 – 44%. ♂ unknown. (India; in standing water.) . . . . **stewarti** (Khera)

3 Cephalic setae nearly half as long as head diameter. 4
– Cephalic setae as long as 1/4 head diameter 6

4 Amphids 1/3 corresponding diameter wide; tail more than twice as long as the vulva-anus distance. – ♀: L = 0.37 – 0.47 mm; a = 27 – 37; b = 5.3 – 6.4; c = 2.2 – 2.6; V = 40 – 44%. ♂ unknown. (Italy, Czechoslovakia; in hot springs.) . . . . **thermophila** (Meyl)

– Amphids 1/5–1/6 corresponding diameter wide; tail one and a half times as long as the vulva-anus distance or shorter 5

5 Tail one and a half times as long as the vulva-anus distance; body slender (a about 40). – ♀: L = 0.38–0.44 mm; a = 37–42; b = 5.4–5.7; c = 3.5–4.0; V = 52–54%. ♂ unknown. (India; aquatic.) .... **gracilis** KHERA

– Tail and vulva-anus distance about equal in length; body not so slender (a to 30). – ♀: L = 0.4–0.5 mm; a = 24–30; b = 5.3–5.6; c = 4.0–4.3; V = 47–50%. ♂ unknown. (India; in standing water.) .... **longistoma** (KHERA)

6 Head cap-like set off; amphids almost 1/3 corresponding diameter wide 7

– Head not or unconspicuously set off; amphids 1/4 corresponding diameter wide or smaller 8

7 A larger species (0.6–0.7 mm) with very long tail; egg about 40 µm long, more than three times longer than the corresponding body diameter; body rapidly narrowing anteriorly. – ♀: L = 0.56–0.70 mm; a = 30–45; b = 5–6; c = 2.5–3.3; V = 46–49%. ♂: L = 0.7 mm; a = 45; b = 5–6; c = 2.5–3.0. (Holland, Belgium, Germany, Switzerland, Hungary, Czechoslovakia, France, Soviet Union; Tunisia; Canada; terrestrial and aquatic.) .... **macrura** (DE MAN)

– A smaller species (0.3–0.5 mm) with comparatively shorter tail; egg 20–35 µm long, 2.5–3 times longer than the corresponding body diameter; body slightly narrowing anteriorly. – ♀: L = 0.30–0.47 mm; a = 25–35; b = 5.0–5.6; c = 3.0–3.9; V = 47–52%. ♂: L = 0.45–0.50 mm; a = 28–35; b = 4.8–5.3; c = 5.3–6.3. (Hungary, Italy; Mongolia; Mauritania, West Sahara; aquatic, also in hot springs.) .... **paramacrura** (MEYL)

8 Amphids 1.5–2 head diameters behind anterior body end. 9

– Amphids distinctly more than 2 head diameters behind anterior body end .. 11

9 Tail 16–20 times as long as anal body diameter. – ♀: L = 0.43 mm; a = 32; b = 5.9; c = 2.8; V = 44%. ♂ unknown. (France, USA, Venezuela; aquatic.) .... **plectoides** COBB

– Tail 9–10 times as long as anal body diameter* 10

10 Head slightly set off; tail spinneret 7–10 µm long. – ♀: L = 0.43–0.57 mm; a = 23–33; b = 6.0–6.2; c = 3.3–4.0; V = 48–52%. ♂ unknown. (Iran; in inland saline water.) .... **iranica** SCHIEMER

– Head not set off; tail spinneret 5–6 µm long. – ♀: L = 0.53–0.58 mm; a = 24–27; b = 5.3–6.0; c = 3.6–4.2; V = 50–53%. ♂ unknown. (Argentina and Ghana; aquatic.) .... **lepidura** (ANDRÁSSY)

11 Tail spinneret unusually long, 10–13 µm, sharply pointed. – ♀: L = 0.35–0.44 mm; a = 26–36; b = 5.0–5.5; c = 2.5–4.0; V = 42–50%. ♂ unknown. (Switzerland and Paraguay; aquatic.) .... **hastata** ANDRÁSSY

– Tail spinneret shorter and terminally rounded. – ♀: L = 0.36–0.46 mm; a = 37–38; b = 5.5–5.7; c = 3.2–3.7; V = 48–51%. ♂: L = 0.47 mm; a = 37; b = 5.4; c = 3.2. (Germany; in saline waters.) .... **salina** (MEYL)

***Monhystrella mysoriensis* MOORTHY, 1938 (India; from the stomach of a fresh-water fish) belongs to this group but the length of its tail spinneret is unfortunately unknown.

6. Genus: *Sinanema* ANDRÁSSY, 1960

Monhysteridae. Small animals, about 0.5 mm. Cuticle smooth. Cephalic setae 10 in number. Amphids small, circular. Mouth cavity funnel-shaped, with small denticles in the anterior part. Oesophagus bulb-like swollen proximally and connected by three cardial glands. Female gonad comparatively long, ovary reflexed. Tail long, slightly swollen on the tip. Spinneret short. Male not known.

The taxonomic position of this genus is rather uncertain. As to general organization it seems to belong to the family Monhysteridae, by the reflexed ovary, however, it distinguishes from all other representatives of this group.

Type and single species: *Monhystrella ginlingensis* HOEPPLI & CHU, 1932 = *Sinanema ginlingense* (HOEPPLI & CHU, 1932) ANDRÁSSY, 1960.

– Cephalic setae 1/3 head diameter long; amphids at the posterior end of mouth cavity; tail 10–12 times as long as anal body diameter and twice as long as vulva-anus distance, respectively. – ♀: L = 0.4–0.6 mm; a = 25–38; b = 5.3–6.6; c = 2.2–4.2; vulva somewhat behind the mid-body. ♂ unknown. (China and Taivan; in hot springs.) .. **ginlingense** (HOEPPLI & CHU)

b) Superfamily: SPHAEROLAIMOIDEA FILIPJEV, 1918

Monhysterida. Cuticle transversely annulated. Mostly 10 (6+4) cephalic setae. Mouth cavity short but wide, barrel-shaped, in vestibule longitudinally striated.

Predominantly marine forms; the freshwater species belong to the following family.

1. Family: **Sphaerolaimidae** FILIPJEV, 1918

Sphaerolaimoidea, with characteristics of the superfamily. One subfamily, Sphaerolaiminae FILIPJEV, 1918, with five genera, of which four contain marine species only.

1. Genus: *Hofmaenneria* SCHNEIDER, 1940

Sphaerolaimidae. Body length between 0.4 and 1.2 mm. Cuticle finely annulated. Head not set off, fairly wide, with 10 setae. Amphids showing genital dimorphism: that of male essentially larger than that of female, far behind the mouth cavity, circular in form. Mouth cavity maximum as long as head diameter, wide, barrel-shaped with cuticularized walls. Behind the stoma some very small denticles can be found in the lumen of oesophagus. Oesophagus cylindrical or uniformly tapering posteriorly. Cardial glands globular. Female gonad one, outstreched. Spicules slender, gubernaculum small. Preanal copulatory organs not present. Tail long, with a small terminal pore.

Limnic or brackish species.

Type species: *Cylindrolaimus brachystoma* HOFMÄNNER in HOFMÄNNER & MENZEL, 1914 = *Hofmaenneria brachystoma* (HOFMÄNNER in HOFMÄNNER & MENZEL, 1914) SCHNEIDER, 1940.

Three freshwater species belong to the genus:

H. brachystoma (HOFMÄNNER in HOFMÄNNER & MENZEL, 1914) SCHNEIDER, 1940
Syn. *Cylindrolaimus brachystoma* HOFMÄNNER in HOFMÄNNER & MENZEL, 1914
Desmolaimus brachystoma (HOFMÄNNER in HOFMÄNNER & MENZEL, 1914) MICOLETZKY, 1925
Desmolaimus thienemanni MICOLETZKY, 1922

H. hazanensis MULVEY, 1969

H. niddensis (SKWARRA, 1921) SCHNEIDER, 1940
Syn. *Cylindrolaimus niddensis* SKWARRA, 1921

Key to the species

1 Tail 15 times as long as anal body diameter, conoid on its terminus. – ♀: L = 0.37 – 0.46 mm; a = 46 – 55; b = 4.2 – 4.4; c = 4.0 – 4.6; V = 59 – 60%. ♂ unknown. (Canada, Arctic region; terrestric.) . . . **hazanensis** MULVEY

– Tail 7 – 10 times as long as anal body diameter, rounded on its terminus . . . 2

2 Mouth cavity 11 – 12 μm long, nearly as long as head diameter, distinctly longer than wide; cephalic setae of female 1/3 head diameter long. – ♀: L = 0.45 – 0.90 mm; a = 30 – 40; b = 4.3 – 7.8; c = 5.8 – 7.5; V = 60 – – 67%. ♂: L = 0.5 – 0.7 mm; a = 37 – 41; b = 5; c = 5 – 6. (Switzerland, Germany, Austria, Yugoslavia, Denmark, Sweden, Soviet Union; especially in lakes.) . . . . **brachystoma** (HOFMÄNNER & MENZEL)

– Mouth cavity 6 – 8 μm long, shorter than head diameter, and distinctly wider than long; cephalic setae of female nearly as long as head diameter. – ♀: L = 1.0 – 1.2 mm; a = 35 – 41; b = 5.3 – 6.0; c = 4.8 – 6.1; V = 61 – 64%. ♂: L = 1.1 – 1.2 mm; a = 44 – 51; b = 5.2 – 5.5; c = 5.8 – 6.3. (Germany, Yugoslavia, Soviet Union; in ground- and brackish water.) . . . . **niddensis** (SKWARRA)

Eumonhystera hungarica n. sp.

(Fig. 5 *A – F*)

Type population, ♀: L = 0.36 – 0.38 mm; a = 40 – 43; b = 4.7 – 5.2; c = = 3.7 – 3.8; V = 61 – 62%.

Cuticle exceedingly thin, with very fine setae measuring 1/4 – 1/5 body diameter. Head continuous with neck contour, 5 – 5.5 μm wide; body at proximal end of oesophagus 2.2 – 2.4 times as wide as head. Cephalic setae 10 in number, very short, often hardly visible, about 1/4 – 1/5 as long as corresponding head diameter. Amphids circular, 1/4 corresponding diameter wide or a little wider, 2 to 2.2 head diameters behind anterior body end. Stoma not cuticularized, funnel-shaped, with a minucious denticle in its basal part.

Oesophagus about 1/5 of entire body length, cylindrical in the most part, slightly swollen proximally. Cardial glands plum-shaped. Rectum shorter than anal body diameter.

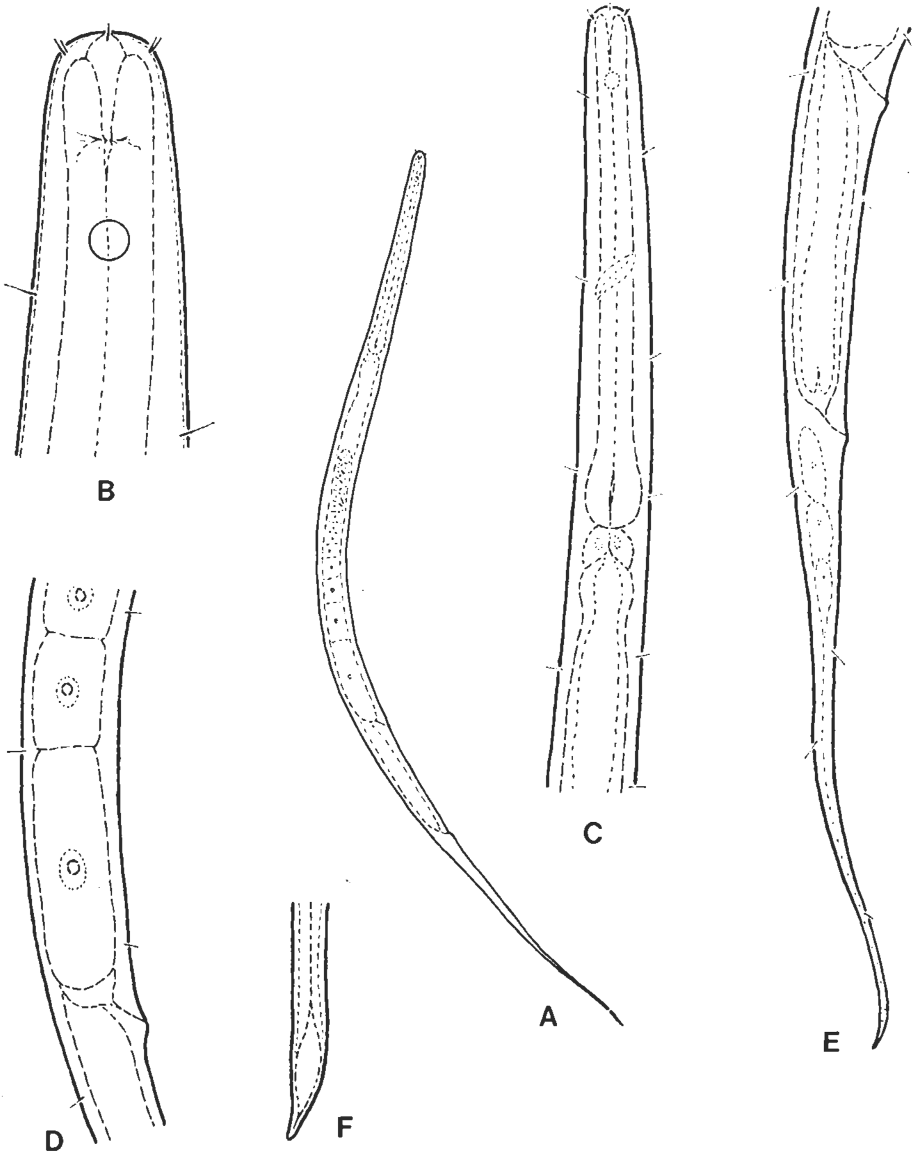


Fig. 5. *Eumonhystera hungarica* n. sp. from the type locality. *A:* entire female (×350); *B:* anterio end (×2500); *C:* oesophageal region (×800); *D:* vulvar region (×800); *E:* posterior end of femal (× 800); *F:* tip of tail

Vagina oblique, somewhat shorter than half diameter of body. Gonad 30% of body length.

Tail uniformly tapering, 1.9 – 2.2 times as long as vulva – anus distance, and 11 – 13 times longer than anal body diameter. Spinneret beak-like, short, slightly bent dorsally.

Male unknown.

A small and slender species of the genus *Eumonhystera*, with short cephalic setae, circular amphids located two head widths behind anterior end, short vagina, comparatively short gonad and long, filiform tail. In the small body, short setae, long tail and location of amphids, it resembles the species *Eumonhystera anomala* (SCHNEIDER, 1937) n. comb., its body is, however, slender (a = = 20 – 28 in *anomala)* and the tail longer (7 – 9 times as long as anal body diameter and only 1.5 times as long as vulva – anus distance, respectively, in *anomala)*.

Holotype (♀) on the slide Nr. H – 0036; paratypes (3 ♀) on the same slide preserved in the collection of the author.

Type locality and habitat: Veresegyház in Hungary, wet moss from a stone wall, March 1951.

Eumonhystera barbata n. sp.

(Fig. 6 *A – G*)

Type population, ♀: L = 0.57 – 0.62 mm; a = 30 – 35; b = 4.1 – 4.4; c = = 4.0 – 4.4; V = 62 – 65%.

Paraguayan population, ♀: L = 0.52 – 0.58 mm; a = 28 – 30; b = 4.2 – 4.3; c = 4.3 – 4.4; V = 62 – 64%.

Cuticle very thin, with short scattered setae. Head continuous with neck contour; 9 – 10 μm wide; body at proximal end of oesophagus 1.6 – 1.8 times as wide as head. Cephalic setae 10 in number, relatively well developed; the longer of them are nearly 1/2 corresponding diameter long. Amphids circular, somewhat wider than 1/4 body diameter at the same level, located 8 – 9 μm – about one head diameter – behind anterior end. Stoma funnel-shaped but narrow, not cuticularized, showing an exceedingly small denticle in its basal part.

Oesophagus slightly swollen proximally, 1/4 of entire body length or a little shorter. Cardial glands conspicuous. Rectum somewhat shorter than anal body diameter. Intestine often green, packed with algae.

Vagina oblique, shorter than corresponding body diameter. Gonad comparatively short, 20% of total body length.

Tail uniformly tapering in its anterior half, and almost cylindrical in the distal portion; in almost every case sharply curved dorsally. It is 1.7 – 1.8 times as long as the distance between vulva and anus, and 10 – 12 times as long as anal body diameter, respectively. Spinneret short, beak-like.

Male unknown.

A relatively slender species of middle length, with broad head, long cephalic setae, circular amphids located one head diameter behind anterior end, cylindrical oesophagus, short gonad, and long tail bent strongly dorsally. In its general appearance and the long cephalic setae, *Eumonhystera barbata* n. sp. is closest to *E. filiformis* (BASTIAN, 1865) n. comb., but the amphids are nearer the anterior

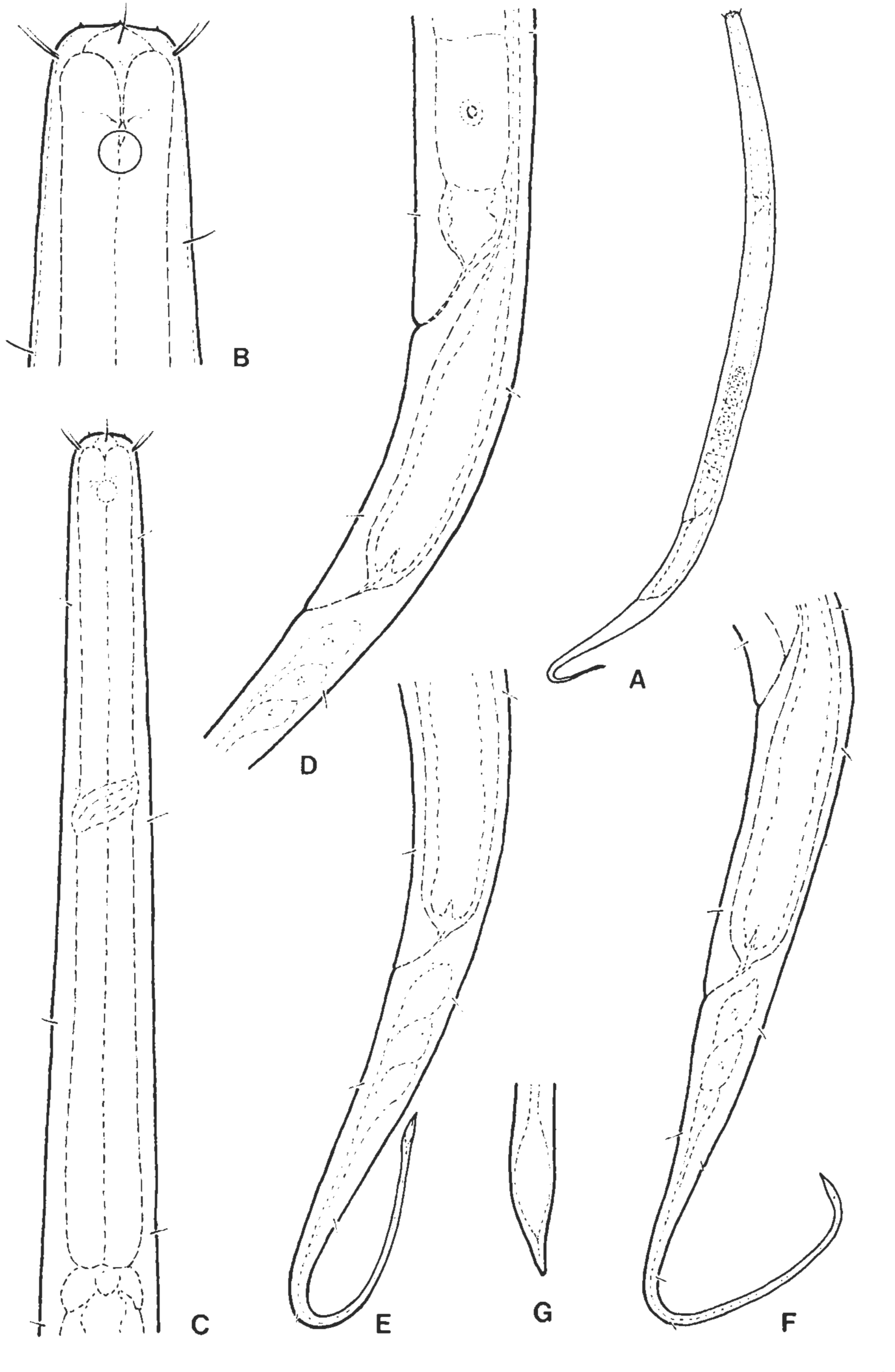


Fig. 6. *Eumonhystera barbata* n. sp. from the type locality. *A:* entire female (×250); *B:* anterior end (×1600); *C:* oesophageal region (×800); *D:* vulvo-anal region (×800); *E–F:* tails of females (×800); *G:* tip of tail

body end, the gonad is shorter, the tail curved characteristically, and the postvaginal cell, which is so characteristic for *E. filiformis*, is completely absent here.

Holotype (♀) on the slide Nr. H – 0514; paratypes on the slides Nr. H – 0514 (3 ♀) and H – 0515 (2 ♀, 1 juv.).

Type locality and habitat: Baradla Cave in Hungary, water filtrated from a small pool on stalagmites, December 1959.

Further locality: Bank of Acaray River in Paraguay, grass roots, January 1967.

REFERENCES

1. Allgén, C. (1926): *Über einige freilebende Nematoden aus dem Wettersee.* – Arch. Hydrobiol. 17: 714 – 729.

2. Allgén, C. (1952): *Über einige freilebende Süsswasser-Nematoden von Mt. Kenya (Brit. Ostafrika). Ein kleiner Beitrag zur Kenntnis tropischer Nematoden.* – Ark. Zool., 3: 139 – 157.

3. Altherr, E. (1976): *Nématodes des eaux stygorhitrales des Alpes autrichiennes.* – Rev. Suisse Zool., 83: 779 – 847.

4. Andrássy, I. (1959): *Nematoden aus dem Psammon des Adige-Flusses,* I. – Mem. Mus. Civ. Storia Nat. Verona, 7: 163 – 181.

5. Andrássy, I. (1960): *Beiträge zur Kenntnis der freilebenden Nematoden Chinas.* – Ann. Hist.-nat. Mus. Nat. Hung., 52: 201 – 216.

6. Andrássy, I. (1962): *Nematologische Notizen, 11.* – Opusc. Zool. Budapest, 4: 9 – 19.

7. Andrássy, I. (1962): *Nematoden aus dem Psammon des Adige-Flusses, II.* – Mem. Mus. Civ. Storia Nat. Verona, 10: 1 – 35.

8. Andrássy, I. (1963): *Nematoda. Neue und einige seltene Nematoden-Arten aus Argentinien.* – In: The zoological results of Gy. Topál's collectings in South Argentina, 2. Ann. Hist.-nat. Mus. Nat. Hung., 55: 243 – 273.

9. Andrássy, I. (1968): *Fauna Paraguayensis. 2. Nematoden aus den Galeriewäldern des Acaray Flusses.* – Opusc. Zool. Budapest, 8: 167 – 315.

10. Andrássy, I. (1977): *Süsswasser- und Bodennematoden aus den Jahren 1967 und 1968.* – In: Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei, 356. Opusc. Zool. Budapest, 13: 3 – 24.

11. Argo, A. – D. & Heyns, J. (1973): *New and little known species of the nematode families Monhysteridae and Tripylidae from South Africa.* – Phytophylactica, 5: 149 – 154.

12. Bastian, Ch. (1865): *Monograph on the Anguillulidae, or free nematoids, marine, land and freshwater: with descriptions of 100 new species.* – Trans. Linn. Soc. London, 25: 73 – 184.

13. Biró, K. (1969): *Eine neue Monhystera-Art (Nematoda) aus dem Balaton, Ungarn.* – Opusc. Zool. Budapest, 9: 255 – 257.

14. Bütschli, O. (1873): *Beiträge zur Kenntnis der freilebenden Nematoden.* – Nova Acta Ksl. Leop.-Carol. Deutsch. Akad. Naturf., 36: 1 – 144.

15. Bütschli, O. (1874): *Zur Kenntnis der freilebenden Nematoden, insbesondere der des Kieler Hafens.* – Abhandl. Senckenb. Nat. Ges., 9: 1 – 56.

16. de Cillis, O. M. (1917): *Nouvi generi e nuove specie di nematodi liberi d'acqua dolce.* – Monit Zool. Ital., 28: 57 – 62.

17. Cobb, N. A. (1893): *Nematode worms found attacking sugar-cane.* – Agric. Gaz. New South Wales 4: 808 – 833.

18. Cobb, N. A. (1904): *Free-living fresh-water New Zealand nematodes.* – Proc. Cambridge Phil Soc., 12: 363 – 374.

19. Cobb, N. A. (1906): *Free living nematodes inhabiting the soil about the roots of cane, and their relation to root diseases.* – Bull. Haw. Sugar Plant. Ass. Exper. Sta. Div. Path. Physiol., 5: 163 – 195.

20. Cobb, N. A. (1914): *North American free-living fresh-water nematodes. (Contributions to a science of nematology, II.)* – Trans. Amer. Microsc. Soc., 33: 69 – 134.

21. Cobb, N. A. (1918): *Filter-bed nemas: Nematodes of the slow sand filter-beds of American cities. (Contributions to a science of nematology, VII.)* – Baltimore: 189 – 212.

22. Cobb, N. A. (1920): *One hundred new nemas. Type species of 100 new genera. (Contributions to a science of nematology, IX.)* – Baltimore: 217 – 343.

23. de Coninck, L. A. P. (1943): *Sur quelques espèces nuovelles de Nématodes libres des eaux et des terres saumâtres de l'Islande.* – Biol. Jaarb., 10: 193 – 219.

24. Daday, J. (1896): *A magyar fauna édesvizi fonálférgei.* – Math. Term.-tud. Ért., 14: 402 – 415.

25. Daday, J. (1899): *Uj-Guineai szabadon élő nematodok.* – Math. Term.-tud. Ért., 17: 557 – 572.

26. Daday, J. (1903): *Turkesztáni édesvizi mikroskpi állatok.* – Math. Term.-tud. Ért., 21: 322 – 357

27. Daday, J. (1905): *Paraguay mikrofaunájának alaprajza.* – Math. Term.-tud. Ért., 23: 312 – 355

28. Daday, J. (1905): *Untersuchungen über die Süsswasser-Mikrofauna Paraguays.* – Zoologica 44: 1 – 349.

29. Daday, J. (1908): *Adatok Német-Kelet-Afrika édesvizi mikrofaunájának ismeretéhez.* – Math Term.-tud. Ért., 26: 1 – 42.

30. Ditlevsen, H. (1911): *Danish freeliving nematodes.* – Vid. Medd. Dansk. Naturh. For. Kobenhavn, 63: 213 – 256.

31. Filipjev, I. N. (1918): *Free-living marine nematodes of the Sevastopol area.* (In Russian.) – Trudy Osob. Zool. Lab. Sebastop. Biol. Sta. 4: 1 – 350.

32. Filipjev, I. N. (1930): *Les Nématodes libres de la baie de la Néva et de l'extrémité orientale du Golfe de Finlande. Deuxième partie.* – Arch. Hydrobiol., 21: 1 – 64.

33. Filipjev, I. N. (1931): *Report on freshwater Nematoda: Mr. Omer-Cooper's investigation of the Abyssinian freshwaters (Hugh Scott Expedition).* – Proc. Zool. Soc. London, 2: 429 – 443.

34. Fuchs, A. G. (1938): *Neue Parasiten und Halbparasiten bei Borkenkäfern und einige andere Nematoden.* – Zool. Jahrb. Syst., 71: 123 – 190.

35. Gagarin, V. G. (1979): *Two new species of free-living fresh-water nematodes.* (In Russian.) – Zool. Zhurn., 58: 596 – 598.

36. Gerlach, S. A. (1951): *Freilebende Nematoden aus der Verwandtschaft der Gattung Theristus.* – Zool. Jahrb, Syst., 80: 379 – 406.

37. Gerlach, S. A. & Riemann, F. (1971): *Über Zahnbildungen in der Mundhöhle von Nematoda Monhysteridae: Monhystrella und Hofmaenneria.* – Nematologica, 17: 285 – 294.

38. Gerlach, S. A. & Riemann, F. (1973): *The Bremerhaven Checklist of aquatic nematodes. A catalogue of Nematoda Adenophorea excluding the Dorylaimida. I.* – Veröff. Inst. Meeresforsch. Bremerhaven, Suppl. 4: 1 – 404.

39. Goffart, H. (1950): *Nematoden aus unterirdischen Gewässern.* – Deutsche Zool. Zeitschr., 1: 73 – 78.

40. Goodey, J. B. (Goodey, T.) (1963): *Soil and freshwater nematodes.* – London – New York 1–544.

41. Goodey, T. (1951): *Soil and freshwater nematodes – a monograph.* – London: 1–390.

42. Hoeppli, R. & Chu, H. J. (1932): *Free-living nematodes from hot springs in China and Formosa.* – The Hong Kong Nat. Suppl. 1: 15–28.

43. Hofmänner, B. & Menzel, R. (1914): *Neue Arten freilebender Nematoden aus der Schweiz.* – Zool. Anz., 44: 80–91.

44. Johnston, T. H. (1938): *A census of the free-living and plant- parasitic nematodes recorded as occurring in Australia.* – Trans. Roy. Soc. S. A., 62: 149–167.

45. Juget, J. (1969): *Description de quelques formes rares ou nouvelles de Nématodes libres du bassin du Léman.* – Bull. Soc. Vaud. Sci. Nat., 70: 141–173.

46. Khera, S. (1966): *Nematodes from the banks of still and running waters. III. Rogerus rajasthanensis n. sp., subfamily Cylindrolaiminae and Monhystrella gracilis n. sp., subfamily Monhysterinae from India.* – Nematologica, 12: 403–408.

47. Khera, S. (1971): *Nematodes from the banks of still and running waters. VII. Family Monhysteridae.* – Nematologica, 16: 492–502.

48. Linstow, O. (1876): *Helminthologische Beobachtungen.* – Arch. Naturgesch., 42: 1–18.

49. Linstow, O. (1878): *Compendium der Helminthologie.* – Hannover: 1–382.

50. Lorenzen, S. (1977): *Revision der Xyalidae (freilebende Nematoden) auf der Grundlage einer kritischen Analyse von 56 Arten aus Nord- und Ostsee.* – Veröff. Inst. Meeresforsch. Bremerhaven, 16: 197–261.

51. Lorenzen, S. (1978): *The system of the Monhysteroidea (nematodes) – a new approach.* – Zool. Jahrb. Syst., 105: 515–536.

52. de Man, J. G. (1880): *Die einheimischen, frei in der reinen Erde und im süssen Wasser lebenden Nematoden, monographisch bearbeitet.* – Tijdschr. Nederl. Dierk. Ver., 5: 1–104.

53. de Man, J. G. (1881): *Über einige neue oder noch unvollständig bekannte Arten von frei in der reinen Erde lebenden Nematoden. (1. Supplement zu den Aufsatz auf S. 1 dieses Bandes.)* – Tijdschr. Nederl. Dierk. Ver., 5: 138–143.

54. de Man, J. G. (1921): *Nouvelles recherches sur les Nématodes libres terricoles de la Hollande.* – Capita Zool., 1: 1–62.

55. Meyl, A. H. (1953): *Beiträge zur Kenntnis der Nematodenfauna vulkanisch erhitzter Biotope. I. Die terrikolen Nematoden im Bereich von Fumarolen auf der Insel Ischia.* – Zeitschr. Morph. Ökol. Tiere, 42: 67–116.

56. Meyl, A. H. (1953): *Beiträge zur Kenntnis der Nematodenfauna vulkanisch erhitzter Biotope. II. Die in Thermalgewässern der Insel Ischia vorkommenden Nematoden.* – Zeitschr. Morph. Ökol. Tiere, 42: 169–208.

57. Meyl, A. H. (1954): *Die bisher in Italien gefundenen freilebenden Erd- und Süsswasser-Nematoden.* – Arch. Zool. Ital., 39: 161–264.

58. Meyl, A. H. (1954): *Die Fadenwürmer (Nematoda) einiger Salzstellen südöstlich von Braunschweig.* – Abhandl. Braunschw. Wiss. Ges., 6: 84–106.

59. Meyl, A. H. (1955): *Freilebende Nematoden aus binnenländischen Salzbiotopen zwischen Braunschweig und Magdeburg.* – Arch. Hydrobiol., 50: 568–614.

60. Meyl, A. H. (1957): *Freeliving nematodes.* – In: Explor. Hydrobiol. Lac Tanganika (1946–1947), III, 7, Bruxelles: 27–51.

61. MEYL, A. H. (1961): *Die freilebenden Erd- und Süsswassernematoden (Fadenwürmer).* – In: Die Tierw. Mitteleur., I, 5a: 1–164.

62. MICOLETZKY, H. (1913): *Die freilebenden Süsswassernematoden der Ostalpen. I. Teil der vorläufigen Mitteilung: Die freilebenden Süsswassernematoden des Lunzer Seengebietes.* – Sitzungsber. Akad. Wiss. Wien, 122: 111–122.

63. MICOLETZKY, H. (1922): *Die freilebenden Erdnematoden.* – Arch. Naturgesch., 87 A: 1–650.

64. MICOLETZKY, H. (1923): *Freilebende Nematoden der Wolga mit besonderer Berücksichtigung der Umgebung von Saratow.* – Rab. Volzh. Biol. Sta., 7: 1–29.

65. MOORTHY, V. N. (1938): *Fresh-water nematodes from the intestine of fish.* – Proc. Helminthol. Soc. Washington, 5: 24–25.

66. MULVEY, R. H. (1969): *Soil-inhabiting nematodes of the orders Araeolaimida, Chromadorida, Enoplida, and Monhysterida from the Canadian high Arctic.* – Canad. Journ. Zool., 47: 365–382.

67. PAETZOLD, D. (1958): *Beiträge zur Nematodenfauna mitteldeutscher Salzstellen im Raum von Halle.* – Wiss. Zeitschr. Martin-Luther-Univ. Halle-Wittenberg, 8: 17–48.

68. PENSO, G. (1938): *Su alcune Anguillulinae parasite degli ortaggi in Libia e sul modo di combatterle.* – Archo Ital. Sci. Med. Colon., 19: 706–722.

69. RAHM, G. (1924): *Beitrag zur Moostierwelt der preussischen Rheinlande.* – Arch. Naturgesch., 90: 153–214.

70. RIEMANN, F. (1966): *Die interstitielle Fauna im Elbe-Aestuar: Verbreitung und Systematik.* – Arch. Hydrobiol. Suppl., 31: 1–279.

71. RIEMANN, F. (1979): *Nematoden aus dem Brackwasser des Weser-Aestuars und Beschreibung von drei Monhysteroidea.* – Veröff. Inst. Meeresforsch. Bremerhaven, 17: 213–223.

72. SCHIEMER, F. (1965): *Über einige Funde der Gattung Monhystrella (Nematoda, Monhysterinae) in binnenländischen athalassohalinen Salzgewässern.* – Wiss. Arb. Bgld., 34: 59–66.

73. SCHNEIDER, W. (1937): *Freilebende Nematoden der Deutschen Limnologischen Sundaexpedition nach Sumatra, Java und Bali.* – Arch. Hydrobiol. Suppl. Trop. Binnengew., 15: 30–108.

74. SCHNEIDER, W. (1939): *Würmer oder Vermes. II. Fadenwürmer oder Nematoden. 1. Freilebende und pflanzenparasitische Nematoden.* – In: Die Tierw. Deutschl., 36: 1–260.

75. SCHNEIDER, W. (1943): *Freilebende Nematoden aus dem Ohridsee.* – Ohrid. Zborn. Srpska Akad. Nauka, 136: 161–184.

76. SKWARRA, E. (1921): *Diagnosen neuer freilebender Nematoden Ostpreussens.* – Zool. Anz., 53. 66–74.

77. STEFANSKI, W. (1924): *Nouvelle contribution à la connaissance de la faune des Nématodes libres des environs de Zakopane (Massif du Tatra polonais).* – Bull. Int. Acad. Pol. Sci. Lett., 2: 539––553.

78. STEINER, G. (1914): *Freilebende Nematoden aus der Schweiz. 2. Teil einer vorläufigen Mitteilung.* – Arch. Hydrobiol., 9: 420–438.

79. STEINER, G. (1919): *Die von A. Monard gesammelten Nematoden der Tiefenfauna des Neuenburger Sees.* – Bull. Soc. Neuchâtel. Sci. Nat., 43: 142–240.

80. STEINER, G. (1920): *Freilebende Süsswassernematoden aus peruanischen Hochgebirgsseen (Huaron 5140 m ü. M. und Naticocha 5140 m ü. M.).* – Rev. Suisse Zool., 28: 11–44.

81. TARJAN, A. C. & HOPPER, B. E. (1974): *Nomenclatorial compilation of plant and soil nematodes.* – DeLeon Springs: 1–419.

82. WIESER, W. (1956): *Free-living marine nematodes. III. Axonolaimoidea and Monhysteroidea.* –– In: Reports Lund Univ. Chile Exp. 1948–49, 26. Lunds Univ. Arsskr., 52: 3–115.

83. WU, H. W. & HOEPPLI, R. (1929): *Free-living nematodes from Fookien and Chekiang.* – Arch: Schiffs- u. Tropenhyg., 33: 35–44.

INDEX

Opusc. Zool. Budapest, XVII–XVIII, 1981

Further Data to the Daily Migration of the Larvae of Aquatic Insects

By

S. ANDRIKOVICS*

Abstract. The author conducted examinations aimed at measuring the activity in 24-hour cycle of the insect larvae of the pondweed habitats *(Utricularia vulgaris* and *Potamogeton pectinatus)* of Lakes Fertő and Velence. He measured the circadian vertical motion of the frequently occurring insects and larvae (Ephemeroptera, Odonata, Chironomidae, Heteroptera), as well s of *Asellus aquaticus*. He did the examinations with the aquatic funnel-trap developed by PIECZYŇSKI (1961) (1).

The young larvae of the mayfly species found in the weedy habitats of Lake Velence do not perform a „pulsating" vertical locomotion as described in the literature. The maximum of their motion intensity can rather be put to a shorter period. The author observed considerable vertical motion in the Agrionidae larvae during the night and at dawn. The data obtained for the Chironomidae and Heteroptera larvae showed a fair agreement with those found in the literature. An interesting new result is the description of the circadian locomotion of *Asellus aquaticus:* by means of plastic traps it could be demonstrated that the nocturnal motion activity of that animal was nearly the threefold of the mean value obtained during the day.

Antecedents

Similarly to the members of the terrestrial fauna, also the aquatic organisms perform mostly well-definable motions. Part of these are incidental, e. g. the movements of feeding, flight or migration. All these and also the other less known motions show a definite seasonal and daily periodicity. The 24-hour activity of terrestrial insects is mostly well-known. ČERNYŠEV (1963) in: PIECZYŇSKI (1964) distinguishes e. g. 12 insect groups by motion activity during the various parts of the day. Generally, the primitive insects are moving all over the day, while the more developed ones suspend activity for a definite time (3).

Of the diurnal rhythm one can say in general that it is connected with the daily changes of physical factors like light intensity, relative humidity and evaporation. It is generally known for example, that the vertical motion of the plankton crustaceans is directly or indirectly connected with the daily periodicity of light.

**Dr. Sándor Andrikovics*, ELTE Állatrendszertani és Ökológiai Tanszék) Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

The description of the motion activity of the invertabrate meso- and macro organisms during the various parts of the day can be found in the first place in PIECZYŇSKI's works (1, 2, 3, 4, 5, 6).

The most important findings of that author can be summed up as follows: the motion activity of the water mites and ostracods is higher during the day, and of the mayflies is significantly higher at night.

During the day the motion activity of the Ostracoda is more or less unchanged, on the other hand, the locomotion maximum of the Hydracarina falls on the hours before noon. PIECZYŇSKI broke down his 24 hours' indexes of activity given for the orders also to species with the Hydracarina.

According to his investigations, *Piona coccinea, Branchypoda versicolor* and *Hydrobates longipalpis* are much more active in the daily-, while *Hydrodroma despiciens* and *Unionicola crassipes* are somewhat more active in the nightly hours. Out of the Hungarian hydrobiological literature the author of the present paper could mention the paper dealing with the migration of the plankton algae and of the zooplankton in the twenty four-hour cycles (7).

After these antecedents of the literature on the subject, the author has set himself the task of describing the locomotion in the twenty four-hour cycles of some frequent insect larva and of *Asellus aquaticus* (Isopoda) living in the pondweed fields of the Lakes Fertő and Velence, as well as of comparing it with the results obtained in Lake Mikolajskie.

Place, date and method of the investigations

The examinations were carried out in two steps, in two different lakes. The model field of the preliminary investigations consisted of a stand of *Potamogeton pectinatus* not in touch with the reed screen, of about 6 m^2 extent, as well as one of *Utricularia vulgaris* contiguous with the reed screen and approx. identical in extent with the former, in the Fertőrákos recreation area (Lake Fertő, Hungarian area, Western part). The dates of the exploratory investigations were 6 – 7 August and 15 – 16 August, 1977.

For following the activity of the aquatic insects to be found in the two habitats, we adopted the aquatic funnel trap method developed by E. PIECZYŇSKI (1961) (1).

This simple appliance consists of a funnel of which the stem has been cut off and of a corresponding vessel, which we joined with a rubber band and a simple metallic clamp.

Using 3 hours each of diurnal and 12 hours of nocturnal exposition times for the examinations, we placed 2 traps each in various depths from the water surface (water depth of 15 to 75 cm). Parallelly with the traps made of synthetic material, we occasionally also applied glass traps. As at present the night stay out is not possible on Lake Fertő, we repeated the investigations at another site – in Lake Velence – chossing and ensuring similar circumstances. The detailed trapping experiments in Lake Velence were carried out in a dense *Utricularia vulgaris* field in the canal in front of the nature conservation watch-house. The depth of the water was about 1 m here. At the site of the examination, on the occasion of a preliminary netting, among the elements of the macrofauna we found very much young larvae of *Cloeon dipterum, Caenis* sp., Agrionidae, Heteroptera

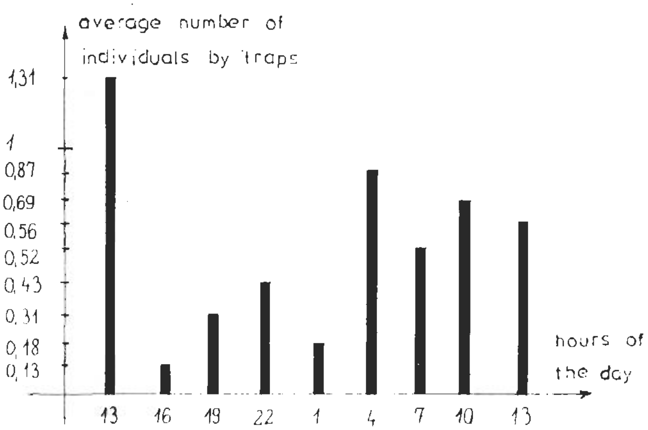


Fig. 1. The change by the single parts of the day in the motion activity of the larvae of *Cloeon dipterum*

and Chironomidae, as well as the *Asellus aquaticus*. On the other hand, we could not collect caddis-fly larvae.

The investigations were begun on 3rd September, 1977, at 10 o'clock in the morning; applying 3 hours' exposition times we continued them through 27 hours. For each sampling we used 16 traps.

We placed the traps about 30 cm above the mud among the dense vegetation. Founded on the results of the preliminary examination (see in more detail later) the traps were made of transparent plastic funnels and glasses. At the time of the examination the temperature of the water fluctuated between 19.9 and 26.5° C.

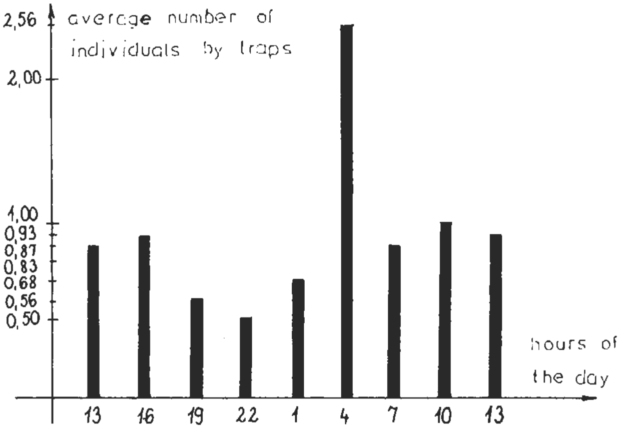


Fig. 2. The change by the single parts of the day in the motion activity of the larvae of the *Caenis* sp.

Examination results and their valuation

From the preliminary examinations conducted in Lake Fertő it appeared that the aquatic funnel-trap, similarly to the Polish results (PIECZYŇSKI 1964) clearly reflects the abundance conditions. By its means the mosaickedness also characteristic of the zoocenoses of the various pondweed fields can be demonstrated. Similarly to the results of the nettings done at the same time, from the *Utricularia vulgaris* stand of Lake Fertő mainly larvae of Chironomida and *Caenis* sp., as well as the *Asellus aquaticus* turned up in significant numbers of individuals. On the other hand, in the spot of *Potamogeton* pectinatus the various species of the water-bug (*Sigara striata, Cymatia coleoptrata,* Corixidae larvae) occurred in great quantities.

Founded upon our investigations results we could also demonstrate a close connection between the phytofauna and the sediment. It was at all times the traps at 15 – 30 cm depth from the mud surface that caught the greatest number

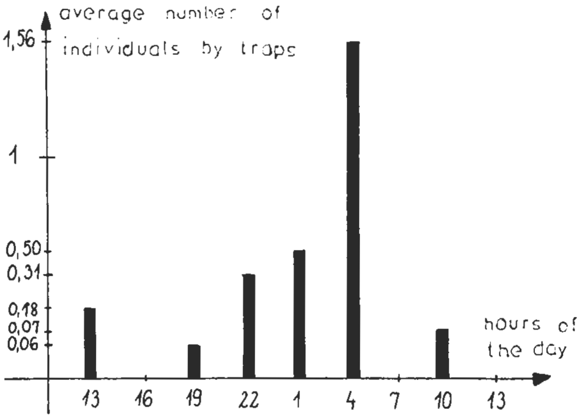


Fig. 3. The change by the single parts of the day in the motion activity of the Agrionidae larvae

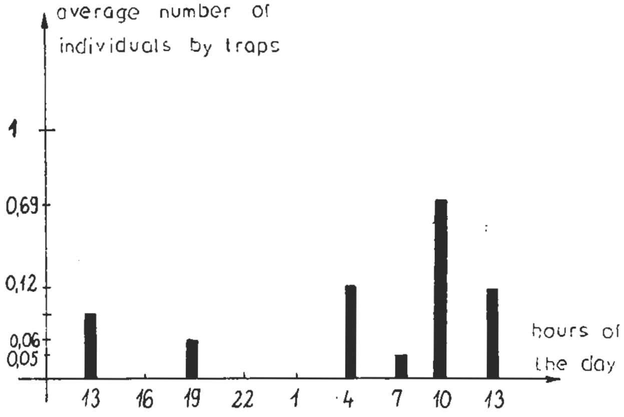


Fig. 4. The change by the single parts of the day in the motion activity of the Corixidae larvae

of animals. Again, the traps set at the same habitat in various parts of the day indicated a difference in motion activity. The relatively small number of traps and the lack of observation during the nocturnal hours did, however, not permit to draw conclusions that could be referred to an exact periodical daily activity. At the end of the presentation of our preliminary investigations, may we come to discuss the connection between the material of the trap and the numerical results of the catches.

Even Pieczyňski (1961) makes mention of the fact that the glass material of the traps exerts a repellent effect on *Asellus aquaticus* and has, on the other hand, probably an attractive one on the snails.

Confirming Pieczyňski's results, our preliminary examinations proved that, as compared to the control traps made of glass, the traps of synthetic material caught more water mites and less snails. In the other groups we did not observe demonstrable changes. The exact explanation of the phenomenon is not yet known.

We present the results of our detailed examinations performed at the various periods of the day and referring to the frequent macro-organisms in the following figures (Fig. 1 – 6).

From the data of the figures it appears, that in the motion activity of the young *Cloeon dipterum* larvae we could not demonstrate any definite daily and nightly periodicity. From the data we could observe a somewhat more intensive movement directed towards the lower layers of water between 10 – 13, as well as 01 – 04 o'clock. Similarly during the day, the young (2nd larval stage) larvae of the *Caenis* sp. perform a fairly even motion towards the mud. Their motion activity has increased significantly only between 01 – 04 o'clock.

If we try to compare our results with the Polish data, we can draw the conclusion that the motion activity during the various parts of the day of the various may-fly larvae also varies by species and larval stages, and that in the young individuals of *Cloeon dipterum* also direct locomotion is quite considerable. Highly interesting are the results of the examination of the motion activity of the young Agrionidae larvae. The motion of the dragonfly larvae directed towards the lower

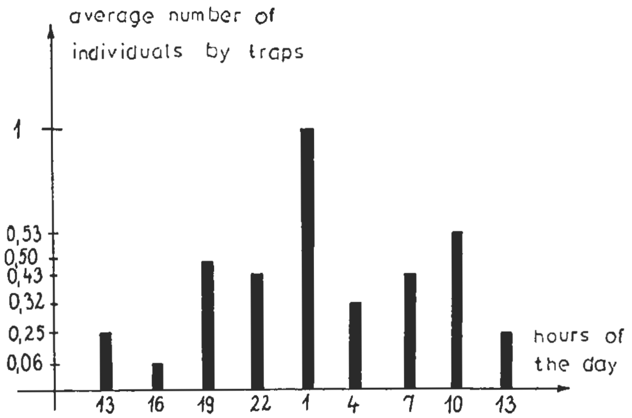


Fig. 5. The course of the locomotion by the single parts of the day of the Chironomidae larvae

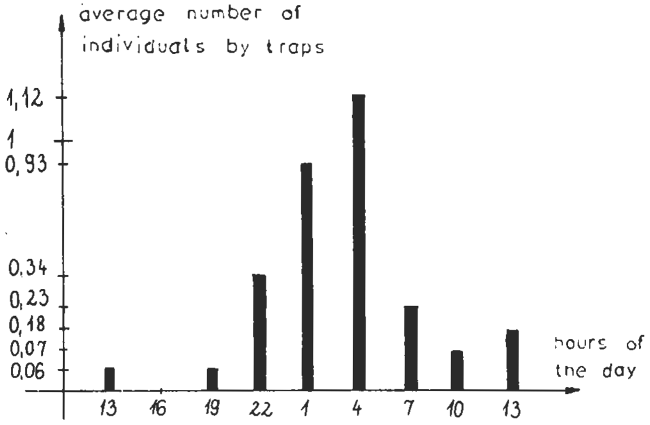


Fig. 6. The change by the single parts of the day in the motion activity of *Asellus aquaticus*

layers of the water is generally slight during the day, then in the night it revives, and reaches a maximum between 01 – 04 o'clock.

During the day, the Chironomidae larvae move with slight activity and more or less evenly. The maximum of their motion towards the lower water layers fell on 22 – 01 o'clock at night. For an exact valuation of the results an identification up to species would be especially important in this group, since as shown by our observations, the generally predatory Tanypodiinae and the mostly herbivorous species of the suborder Orthocladiinae sharply separate also in motion activity.

As shown by our collections, the Corixidae larvae can generally be found in the upper aquatic layer. Their motion towards the lower water layers becomes lively only between 7 and 10 o'clock (Fig. 4).

Ultimately, although taxonomically it belongs the crustaceans, we still discuss the circadian dynamism of *Asellus aquaticus*. Into our traps made of glass came a much smaller number of specimens than accounted for by the actual conditions of abundance and motion activity. On the other hand, we did not observe this phenomenon when using traps made of synthetic material.

It was clearly revealed that the nocturnal motion activity of the *Asellus aquaticus* was nearly the threefold of the value measured in the day. This high activity extends over the whole night and is more or less rising till dawn. A maximum it reaches between 01 – 04 o'clock.

If compared with the findings of the international literature on water trapping, our results modifying these statements and/or being new to science may be summed up as follows.

The young larvae of the mayfly species found in Lake Velence do not perform vertical locomotion of expressly diurnal-nocturnal dynamism. The maxima of their motion activity can rather be fixed on a shorter period (Fig. 1, 2).

Contrary to our expectations, the nocturnal motion of the Agrionidae larvae was also considerable.

Interestingly, the motion maximum of these predatory larvae is nearly identical with those of several groups of significant abundance value (01 – 04 o'clock).

If one compares the small numbers of individuals of the Chironomidae observed in the traps with their high abundance value, then the low motion activity of the species living here appears unambiguously. Again, the situation is reversed with the Corixidae larvae, with which the preliminary examinations in Lake Fertő confirmed PIECZYŃSKI's (1964) results that namely a group of high motility is in question here. However, their abundance value in the stand of *Utricularia vulgaris* is rather low, therefore naturally also the number of individuals caught by one trap is low.

A new finding is the description of the motion dynamism of *Asellus aquaticus*, which is missing from the Polish literature on account of the negative selective effect of the glass traps.

REFERENCES

1. PIECZYŃSKI, E. (1961): *The trap method of capturing water mites (Hydracarina).* – Ecol. Pol. Ser. B: 111–115.

2. PIECZYŃSKI, E. (1962): *Notes on the use of light traps for water mites (Hydracarina).* – Bull. Acad. Polon. Sci., 10: 421–424.

3. PIECZYŃSKI, E. (1964): *Analysis of numbers, activity and distribution of water mites (Hidracarina) and some other aquatic invertebrates in the littoral and sublittoral.* – Ecol. Polska, Ser. A, 12: 691–735.

4. PIECZYŃSKI, E. (1965): *Effect of the size of traps, their exposure time on the catches of aquatic invertebrates, chiefly water mites (Hydracarina).* – Bull. Acad. Polon. Sci., 13: 577–581.

5. PIECZYŃSKI, E. (1967a): *The trap method for ecological studies on water mites (Hydracarina) in Lakes.* – Proc. 2nd Intern. Congr. Acarology: 103–106.

6. PIECZYNSKI, E. (1967b): *The occurrence of water mites (Hydracarina) and some other invertebrates in the littoral and central part of Lake Sniardwy.* – Ecol. Polska, A, 15: 543–551.

7. PONYI, J. & TAMÁS, G. (1964): *Napszakos változások vizsgálata a tihanyi Belső-tó fito- és zooplanktonján. (Examination of daily changes in the phyto- and zooplankton of the Belső-tó of Tihany.)* – Állatt. Közlem., 2: 105–124.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Leg Spination of Some Coccorchestes Species (Araneae: Attidae)

By

P. BALOGH*

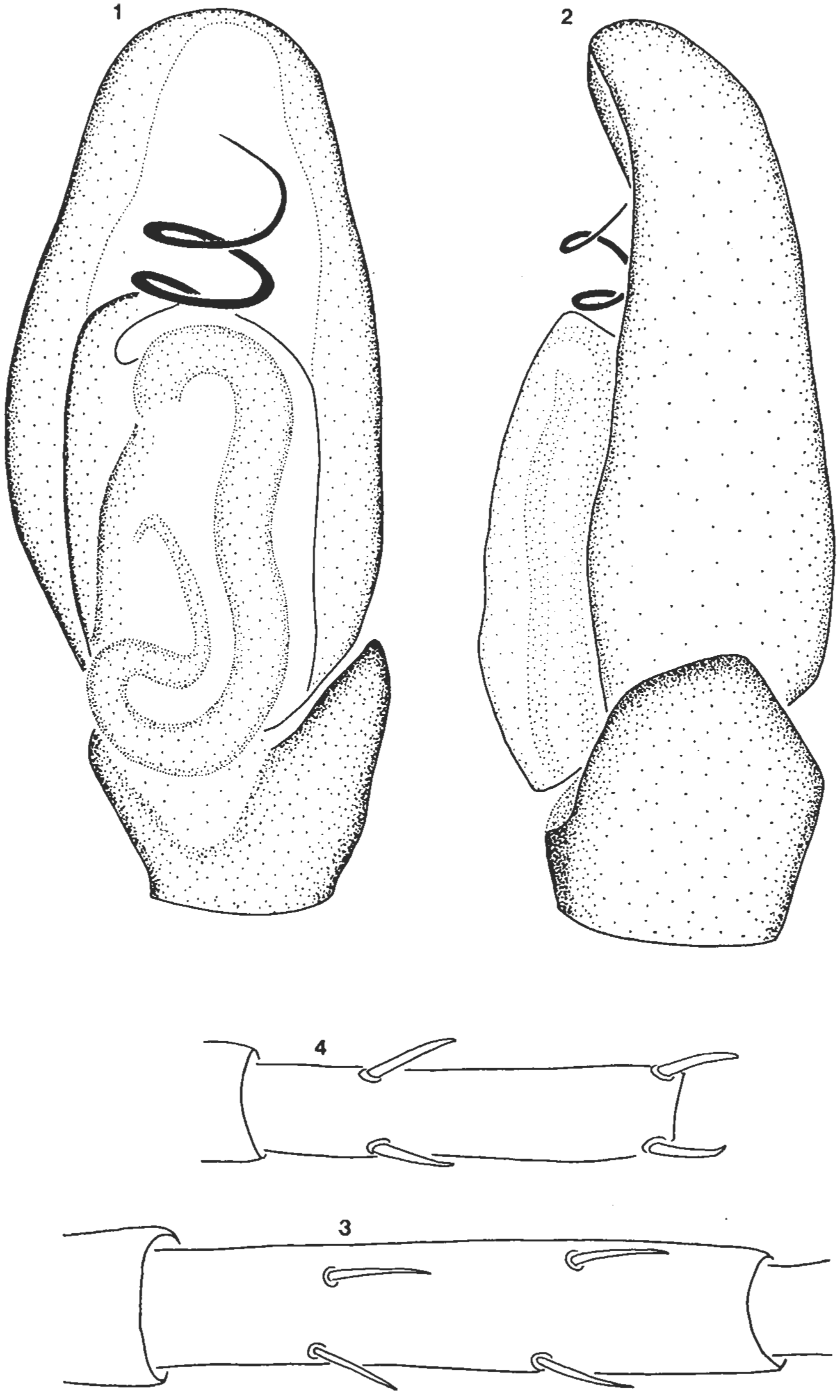
Abstract. A description of leg spination of five *Coccorchestes* species is given. A key and a number of figures accomplished for distinguishing the species.

Founding himself on the study of the type-material, J. PRÓSZYNSKI (1971) has revised the species of the genus *Coccorchestes* and described further three new taxa. These came from a material which was sent to KULCZYNSKI for identification to Kraków, probably during the first decade of this century. It seems that a part of that material remained with KULZYNSKI and was deposited in the collection of the Instytut Zoologiczny PAN after his death. All the above facts are evident from PRÓSZYNSKI's remarks made at the time when the new species were described. All the localities and data well agree with those which the Hungarian LAJOS BIRÓ collected during his stay in New Guinea. PRÓSZYNSKI also made very useful remarks when giving the details of the original labels placed in the vials by KULCZYNSKI. From these it became known that KULCZYNSKI's ,,*Coccorchestes* 1" species was described as *C. buszkoae* PRÓSZ., ,,*Coccorchestes* 2" as *C. staregai* PRÓSZ. and ,,*Coccorchestes* 3" as *C. jahilnickii* PRÓSZ., respectively. I have found *Coccorchestes* species with similar labels in the collection of the Hungarian Natural History Museum, collected by LAJOS BIRÓ. Since also the localities are identical, it is certain that here the same species are in question as the ones described by PRÓSZYNSKI. Evidently, a part of the *Coccorchestes* specimens collected by BIRÓ were kept back for description by KULCZYNSKI, when the others were returned to Budapest.

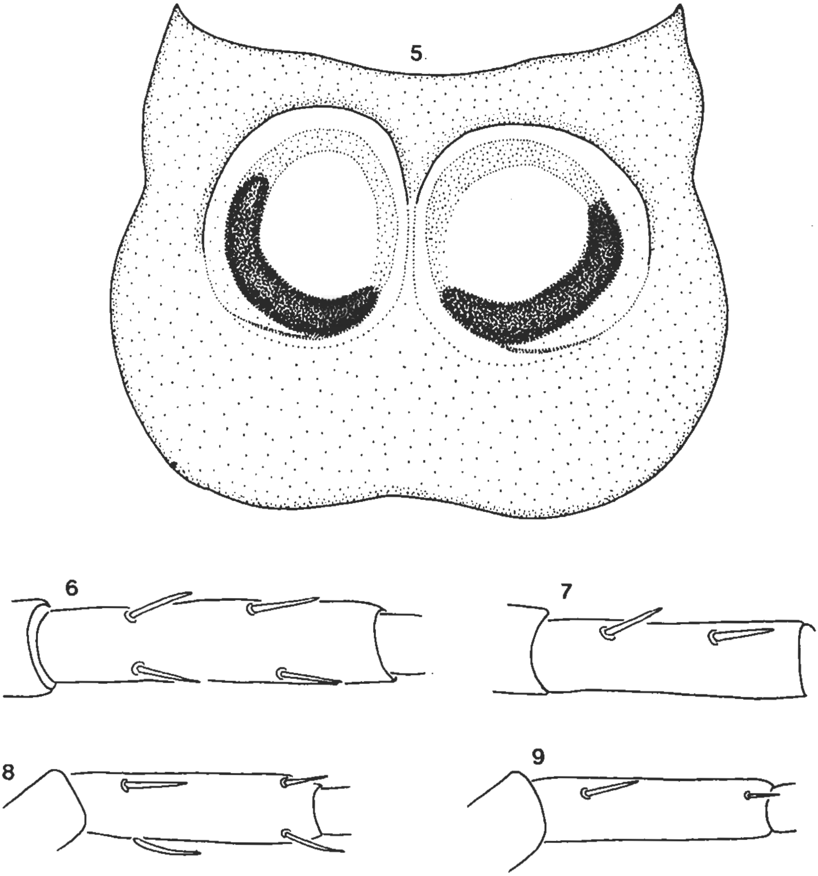
While in lack of type-material, I could still investigate specimens which were identical with PRÓSZYNSKI's species with full certainity. These investigations were made necessary by the new realization that the various *Coccorchestes* materials contained more unknown taxa besides the five already known ones. After a study of all the available specimens it became evident that the leg spination is a useful distinguishing character for species groups or sometimes even for

---

**Dr. Péter Balogh*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.



Figs. 1 – 4. *Coccorchestes rufipes* Thorell, 1881, male. *1:* left palpus, ventral; *2:* left palpus, lateral; *3:* tibia I, ventral *4:* metatarsus I, ventral;



Figs. 5 – 9. *Coccorchestes rufipes* Thorell, 1881, female. *5:* epigynum; *6:* tibia I, ventral; *7:* tibia II, ventral; *8:* metatarsus I, ventral; *9:* metatarsus II, ventral

species. The leg spination was mentioned by Thorell (1881) in his original descriptions, unfortunately however, it was fully mitted by Prószynski. The present work intends to fill up the gap. Regrettably, the species *Coccorchestes blendae* Thorell, 1881 was not available for present study. Its spination is given here after Thorell (1881, p. 676).

Coccorchestes rufipes Thorell, 1881

(Figs. 1 – 9)

The few specimens studied show no variation. As in all species, there is a great deviation between males and females.

Males:

Legs I. Tibiae: with 2.2 ventral, metatarsi with 2.3 spines of which spine 3 situated distally and pushed dorsally.

Legs II. Tibiae: 1.2 ventral; metatarsi: 2.3, their position as in legs I.
Legs III. Tibiae: with no ventral spination; metatarsi: 2.3.
Legs IV. Tibiae: without ventral spines; metatarsi 2.3.

Females:

Legs I. Tibiae: 2.2 ventral; metatarsi 2.2;
Legs II. Tibiae: 1.1 ventral; metatarsi: 1.1;
Legs III.: without spines;
Legs IV.: without spines.

Coccorchestes buszkoae PRÓSZYNSKI, 1971

(Figs. 10 – 17)

Both in males and females studied, tibiae I with changeable numbers of spines.

Males:

Legs I. Tibiae: 2.2 or 1.2 ventral; metatarsi: 2.2;
Legs II. Tibiae: without spines; metatarsi: 2.2 ventral;
Legs III. Tibiae without ventral spines; metatarsi: 0.3 ventral;
Legs IV. Tibiae without ventral spines; metatarsi: 0.3 ventral.

Females:

Legs I. Tibiae: 2.2 or 2.1 ventral; metatarsi: 1.2;
Legs II. Tibiae: 1.0 ventral; metatarsi without spines;
Legs III. without spines;
Legs IV. without spines.

Coccorchestes jahilnickii PRÓSZYNSKI, 1971

(Figs. 18 – 27)

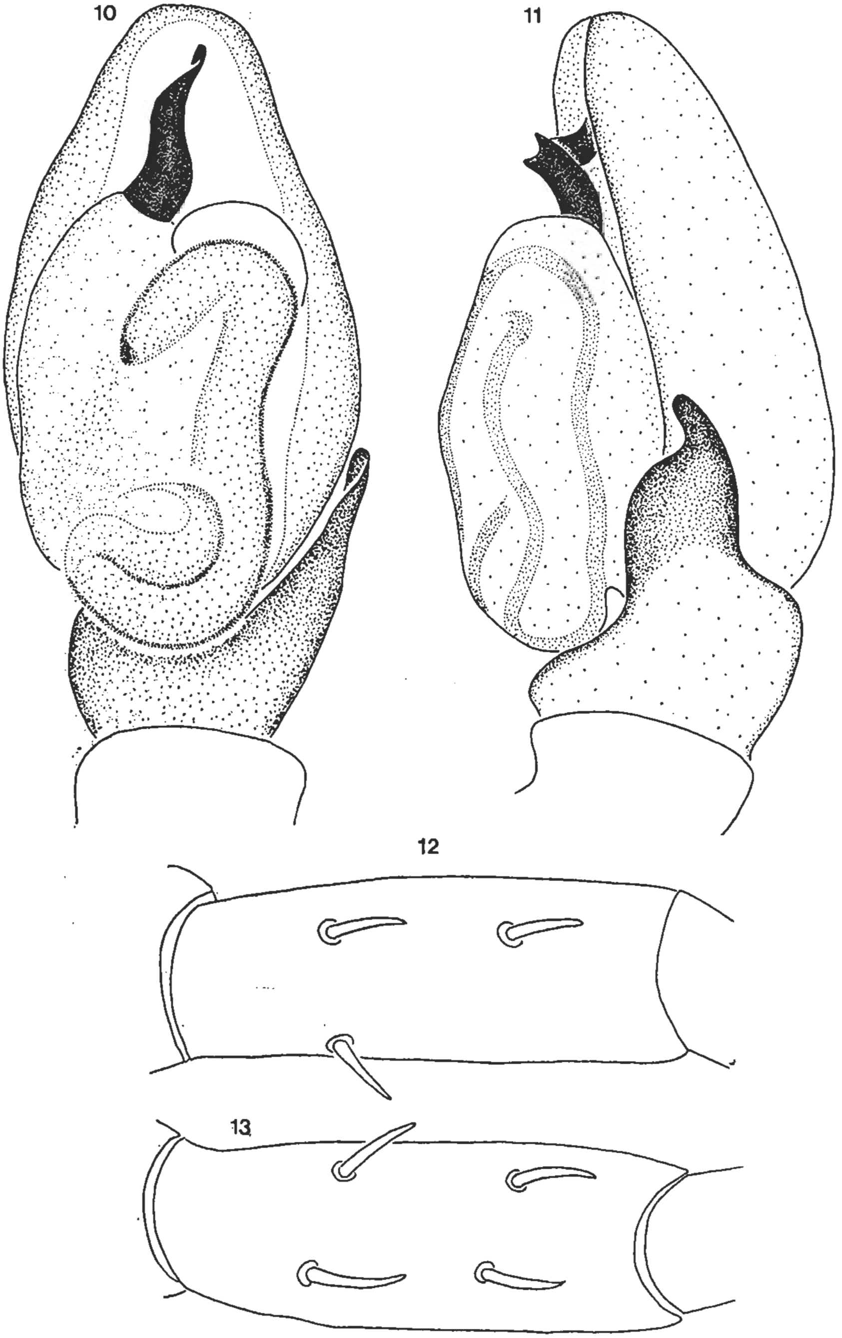
The males studied on tibiae I, the females on metatarsi I, with variable numbers of spines.

Males:

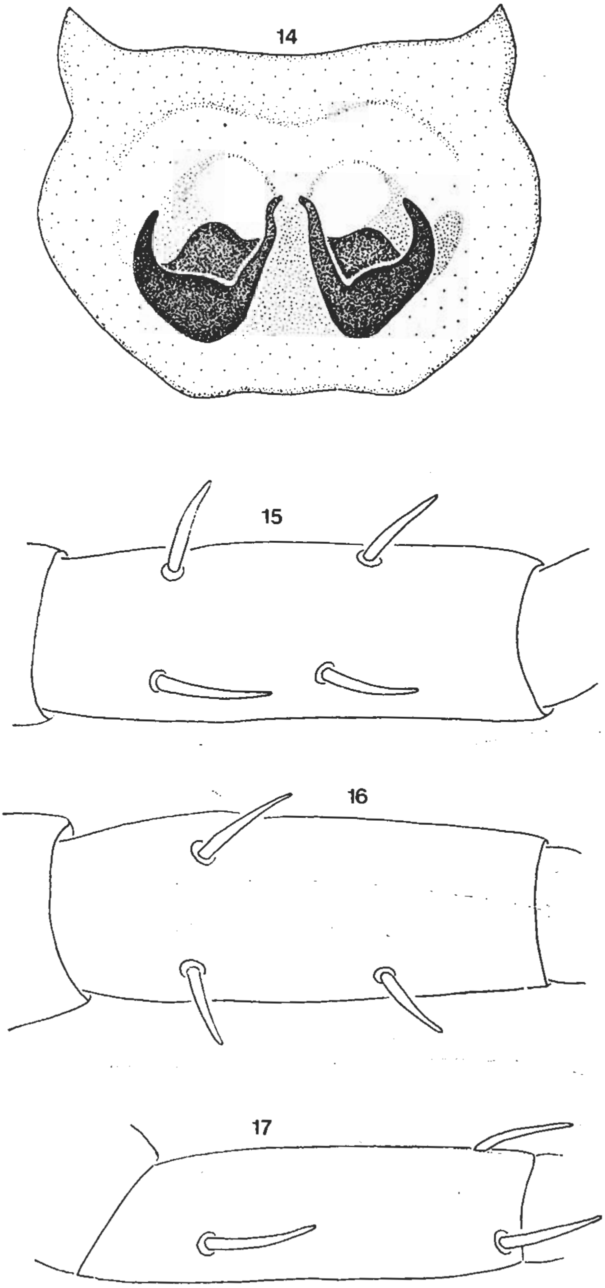
Legs I. Tibiae: 2.2 or 2.1 ventral; metatarsi: 2.0;
Legs II. Tibiae: 1.0 ventral; metatarsi: 2.0;
Legs III. Tibiae with no ventral spines; metatarsi: 1.2;
Legs IV. Tibiae with no ventral spines; metatarsi: 2.2.

Females:

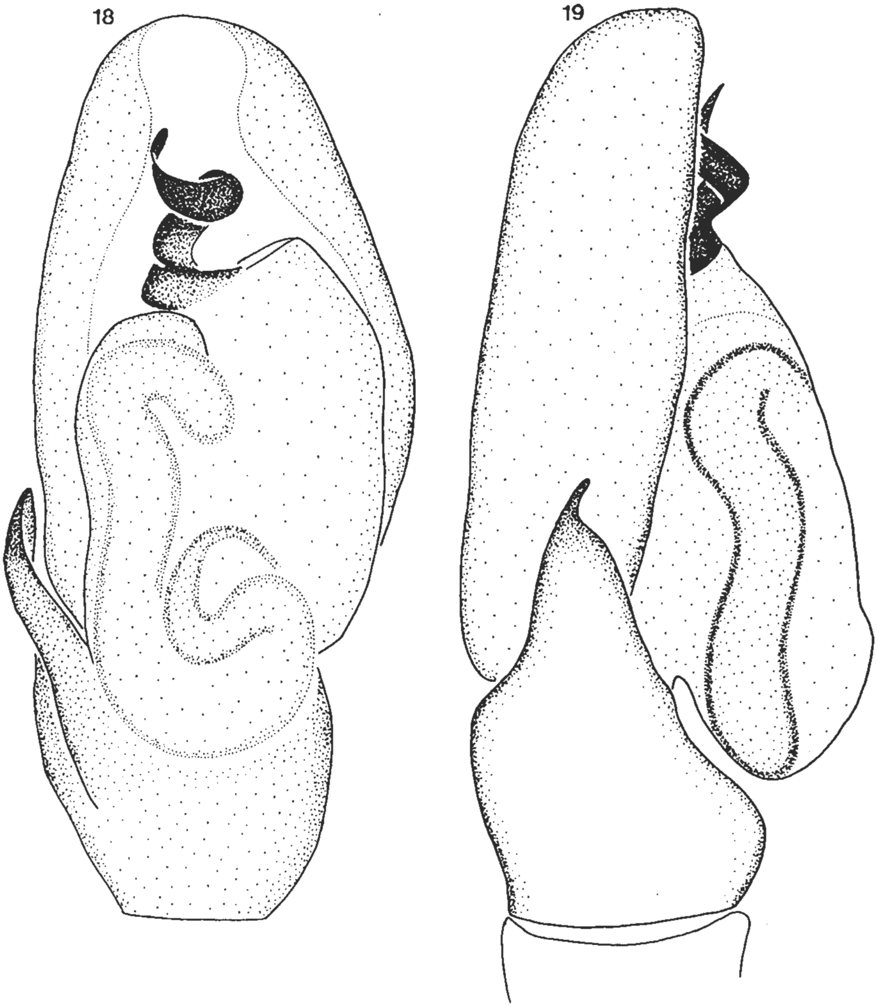
Legs I. Tibiae: 2.2 ventral; metatarsi: 2.0 or 1.0;
Legs II. Tibiae: 1.0 ventral; metatarsi with no spines;
Legs III. without spines;
Legs. IV. without spines.



Figs. 10 – 13. *Coccorchestes buszkoae* PRÓSZYNSKI, 1971, male. *10:* left palpus, ventral*; 11:* left palpus, lateral*; 12:* left tibia I, ventral*; 13:* right tibia I, ventral



Figs. 14 – 17. *Coccorchestes buszkoae* PRÓSZYNSKI, 1971, female. *14:* epigynum, *15:* left tibia I, ventral; *16:* right tibia I, ventral; *17:* left metatarsus I, latero-ventral



Figs. 18 – 19. *Coccorchestes jahilnickii* PRÓSZYNSKI, 1971, male. *18:* right palpus, ventral; *19:* right palpus, lateral

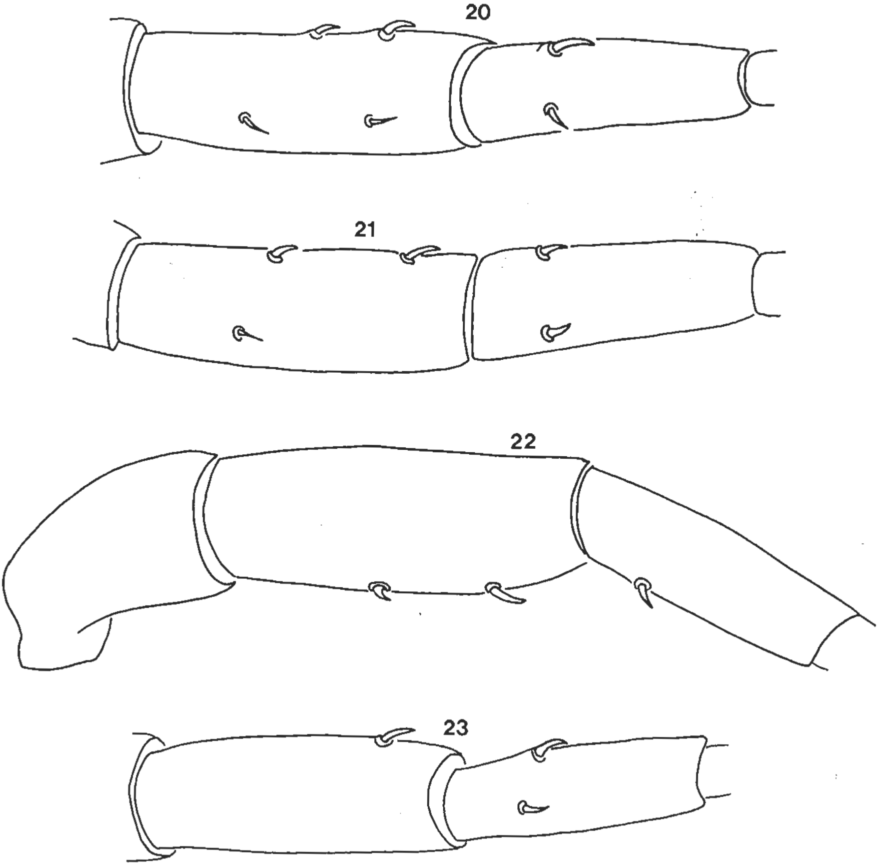
Coccorchestes staregai PRÓSZYNSKI, 1971

(Figs. 28 – 30)

Male: unknown

Females:

Legs I. Tibiae: 2.2 ventral; metatarsi: 2.2;
Legs II. without spines;
Legs III. without spines;
Legs IV. without spines.



Figs. 20 – 23. *Coccorchestes jahilnickii* PRÓSZYNSKI, 1971, male. *20 – 21:* tibia + metatarsus I, ventral; *22:* tibia + metatarsus I, lateral; *23:* tibia + metatarsus II, ventral

Coccorchestes blendae THORELL, 1881

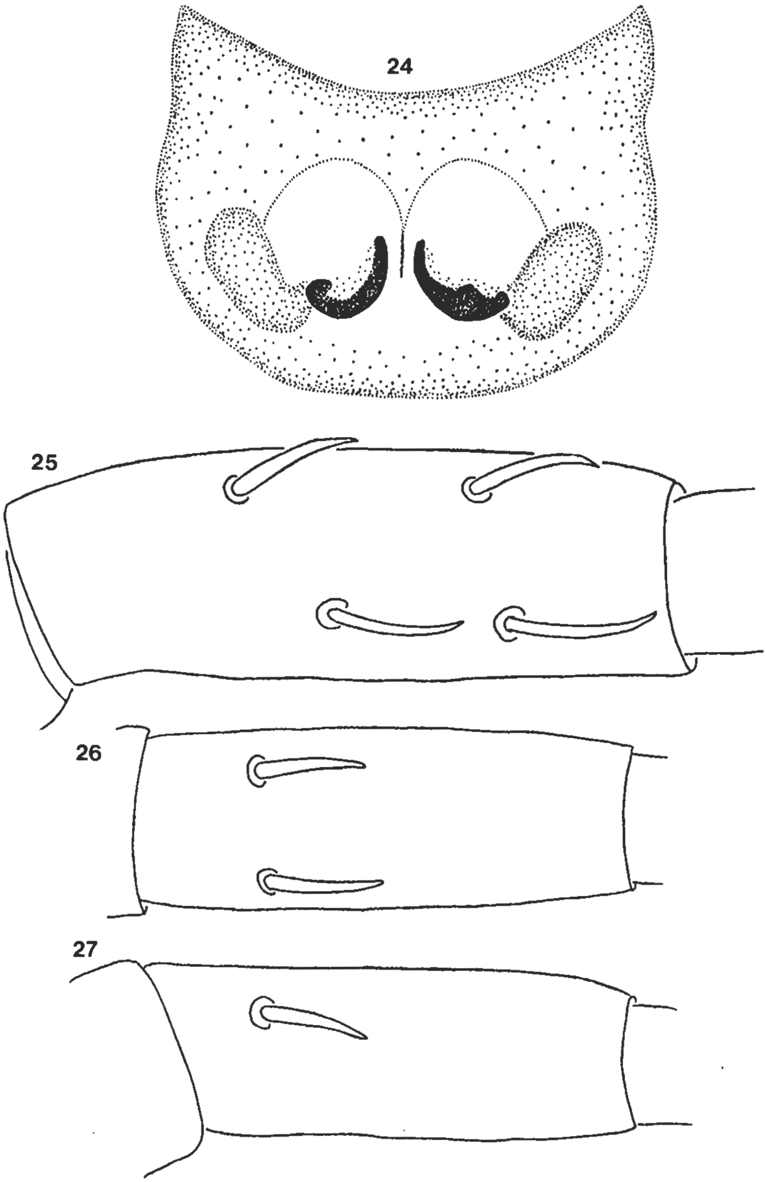
Sexually mature male: unknown; young male: undescribed.

Females:

Legs I. Tibiae: 2.2 ventral; metatarsi: 2.2;
Legs II. Tibiae: 1.1 ventral; metatarsi: 2.2;
Legs III. without spines;
Legs IV. without spines.

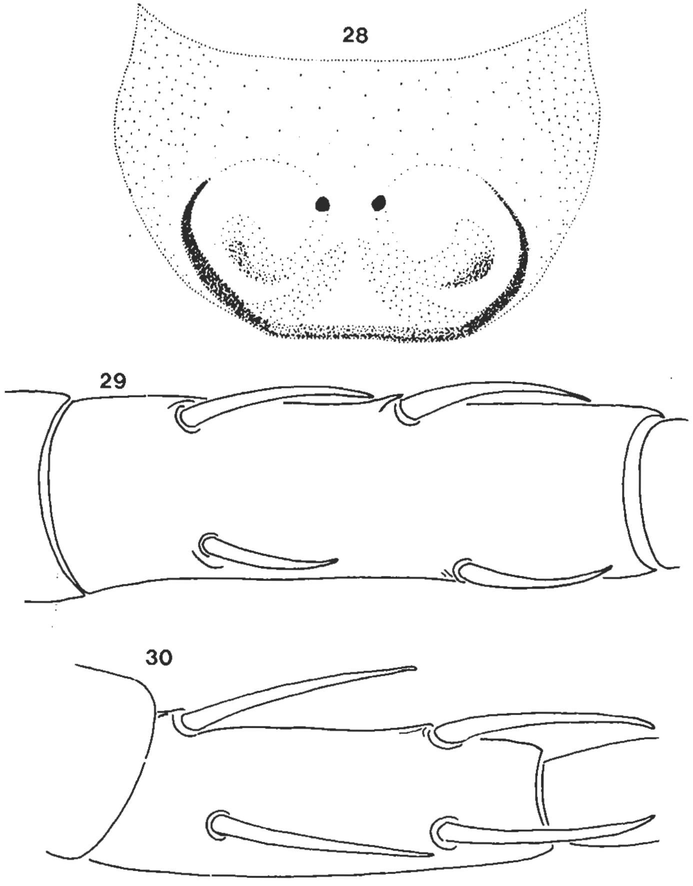
The specimen was not seen, data on this species are from THORELL.

No doubt, the few specimens of the species studied do not permit to draw a unequivocal inference. A special caution is needed, as in other – yet undescribed – species under investigation one could observe a diversity of numbers of spines to an even greater extent. Still, regarding the above five species the following seems to be generally true:



Figs. 24 – 27. *Coccorchestes jahilnickii* PRÓSZYNSKI, 1971, female. *24:* epigynum; *25:* right tibia I, ventral; *26 – 27:* right metatarsus I, ventral

1) Tibiae III and IV are always without spines, both in males and females. *2)* Metatarsi III and IV are always with spines in males, however, always without spines in females. More generally, it could be stated that *3)* All the 4 pairs of legs are with spines, and the legs III and IV of the females are always without spines.



Figs. 28 – 30. *Coccorchestes staregai* Prószynski, 1971, female. *28:* epigynum; *29:* tibia I, ventral; *30:* metatarsus I, ventral

This seems to be a rather important fact as that character, i. e. the presence or absence of spines in legs III and IV is one frequently used in keys for Attidae in Simon's book.

From the characters presented above the following key can be composed to the five species of *Coccorchestes* considered here. The key might also be regarded as a part of differential diagnosis.

1 (8) Metatarsi III and IV with spines (males).
2 (3) Tibiae II without spines .... **C. buszkoae** Prósz.
3 (2) Tibiae II with spines.
4 (5) Tibiae II with 1 single, proximal spine .... **C. jahilnickii** Prósz.
5 (4) Tibiae II with 2 or 3 spines.
6 (7) Tibiae II with 2 (1.1) spines .... **C. blendae** Thor.
7 (6) Tibiae II with 3 (1.2) spines .... **C. rufipes** Thor.
8 (1) Metatarsi III and IV without spines (females).
9 (10) Tibiae II without spines .... **C. staregai** Prósz.

10 (9) Tibiae II with 1 or 2 spines.
11 (14) Tabiae II with 2 (1.1) spines
12 (13) Metatarsi II with 4 (2.2) spines .... **C. blendae Thor.**
13 (12) Metararsi II with 2 (1.1) spines .... **C. rufipes Thor.**
14 (11) Tibiae II with 1 (1.0) spine.
15 (16) Metatarsi I and II with 4 (2.2) spines; metatarsi III and IV with distal spines .... **C. buszkoae Prósz.**
16 (15) Metatarsi I and II with 2 (2.0) spines; metatarsi III and IV besides distal spines with 1 or 2 proximal ones .... **C. jahilnickii Prósz.**

A study of a greater of specimens might show a more pronounced spinal diversity. In that case the above key should be altered.

REFERENCES

1. Prószynski, J. (1971): *Redescriptions of type-species of genera of Salticidae (Aranei), VIII–X. Revision of the subfamily Coccorchestinae.* – Ann. Zool. Warszawa, 27: 153–182.

2. Thorell, T. (1881): *Studi sui ragni Malesi a Papuani.* – Ann. Mus. Civ. Stor. Nat. Genova, 17: 1–720.

Opusc. Zool. Budapest, XVII – XVIII, 1981

New Coccorchestes Species from Papua New Guinea (Araneae: Attidae)

By

P. Balogh*

Abstract. Descriptions and illustrations of three new species of *Coccorchestes* – *C. szentivanyi*, *C. verticillatus*, *C. quinquespinosus* spp. n. – from Papua New Guinea are given.

In the course of studying the *Coccorchestes* material from New Guinea further and yet undescribed species were discovered. The dorsal spination of the femoral segment in some of these was striking. Two species, as *C. szentivanyi* and *C. quinquespinosus* n. spp. have femora with spines. The latter species, where the dorsal surface of femore III bear 3.5 spines, is especially interesting. The descriptions of the new species can be given as follows.

Coccorchestes szentivanyi sp. n.

(Figs. 1 – 3)

Cephalothorax: length 2.4 mm, greatest width 1.75 mm; abdomen: length 1.75 mm, width 1.5 mm. Abdomen covered with a chitinous shield. Cephalothorax: upper portion eyes light yellowish-brown, slightly darker on sides. Abdomen light brown; with large X-shaped, ill-defined blackish marking in the middle-line. Legs light yellow, with no rings.

Palp: comparatively large and thick tibia with wide, triangular and pointed process on its outer margin and with V-shaped incision in ventral view, where basal portion of bulb streches intoit. Tibial apophysis short, pointed and triangular in dorsal view (Fig.). Stylus thin and with S-shaped twists.

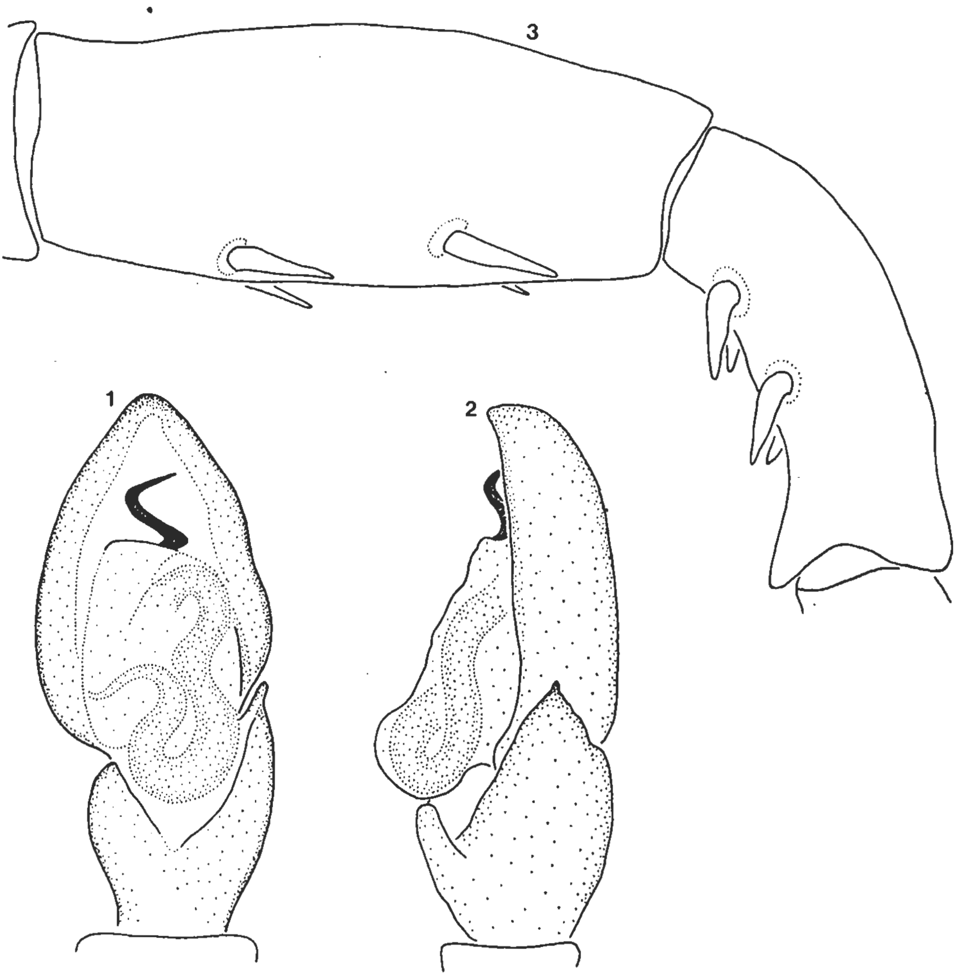
Chaetotaxy of legs: femora I much thicker than the others, with 1 short, curved spine dorsally, at half length. Femora II thinner, similarly with 1 spine at half length. Femora III with 2 short dorsal spines, of which one is at half length, the other situated near tip. Femora IV with 2 spines, one near the base,

---

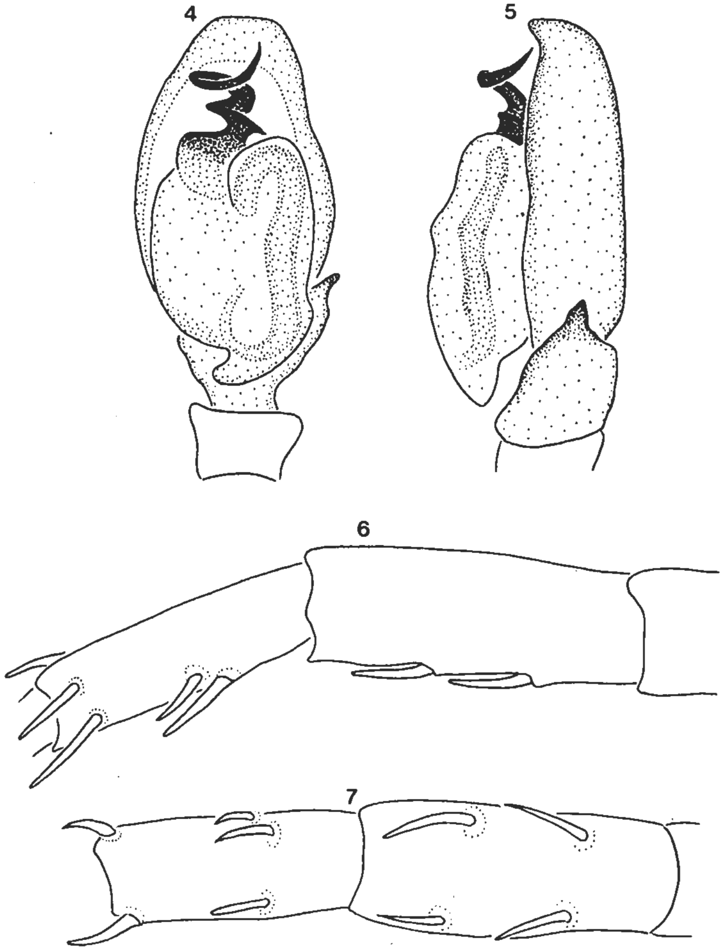
**Dr. Péter Balogh*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

the other at tip (on one side the dorsal femoral spine of leg IV only at base). Tibiae I with 2.2 ventral spines, metatarsus I with 2.2. spines ventrally; all spines thick, thorn-shaped and curved with tip pointed forward. Segments of legs I are much thicker than those of the other legs. Tibiae and metatarsi II with 2.2 spines ventrally, these less thick than in legs I. There are no spines at all on legs III and IV.

The distinguishing characters of the new species are: *1)* Stylus moderately long and spring-like. *2)* Tibial apophysis wide, triangular and pointed (this character separates the present species from all other ones known hitherto). *3)* Legs I with thicker and larger segments than those of the other legs. *4)* Tibiae I and metatarsi I with bulky, thorn-shaped hypertrophized spines *5)* Femora with 1 or 2 spines dorsally



Figs. 1 – 3. *Coccorchestes szentivanyi* sp. n. *1:* male left palpus, ventral side, *2:* lateral side, *3:* leg tibia + metatarsus, lateral side



Figs. 4 – 7. *Coccorchestes verticillatus* sp. n. 4: male, left palpus, ventral side, 5: lateral side, 6: leg 1, tibia + metatarsus, lateral side, 7: ventral side

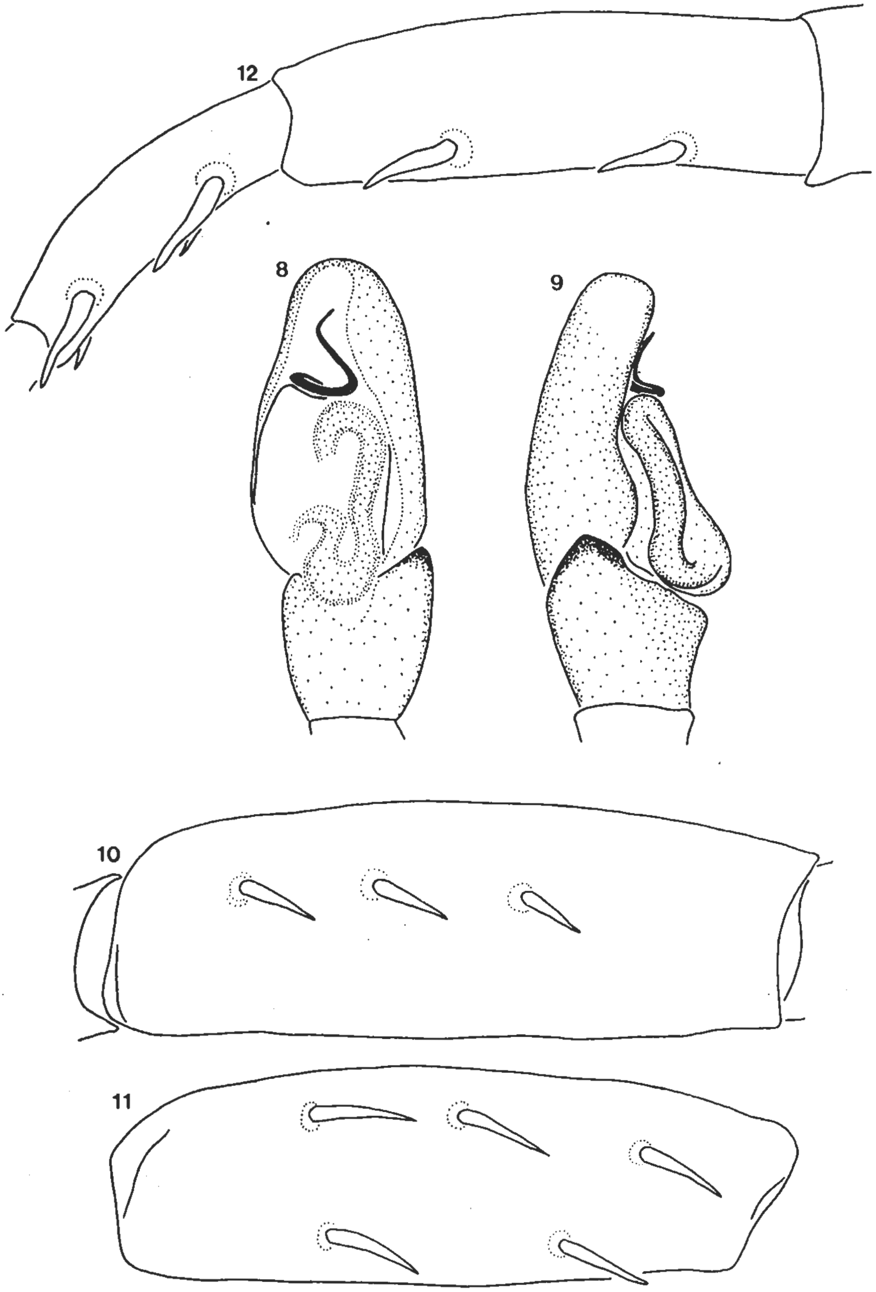
Holotype, male: New Guinea, Wau, at 1200 – 1400 m, 19. X. 1965. Leg.: J. Sedlacek. 1 ♂ ad. Holotype in the Arachnological Collection of the Bernice P. Bishop Museum, Honolulu.

Dedicated to Dr. J. J. H. Szent-Ivány, renowned entomologist and collector of the fauna of Papua New Guinea.

Coccorchestes verticillatus sp. n.

(Figs. 4 – 7)

Cephalothorax: length 1.75 mm, greatest width 1.4 mm; abdomen: length 1.5 mm, width 1.25 mm. Abdomen covered with a chitinous shield. Coloration of body brown, legs brownish-yellow without rings or drak spots.



Figs. 8–12. *Coccorchestes quinquespinosus* sp. n. 8: male, right palpus, ventral side, 9: lateral side, 10: left femur 1, dorsal side, 11: left femur 2, dorsal side, 12: tibia + metatarsus, lateral side

Palp: tibia short, with short and triangular, acutely pointed process on its outer edge and with basal bulb ventrally streching out and coverning part of it. Stylus with extremely wide, coiled basal portion and spring-like, twisted, narrow tip.

Chaetotaxy of legs: all femora without dorsal spines. Tibiae I with 2.2 ventral and 1 posterio-lateral spines; metatarsi I with 2.2 ventral spines, with 1 spine posterio-laterally at midway and 1 spine each, anterio-laterally and posterio-laterally, respectively, near its distal end. Tibiae and metatarsi II with the same spination as on legs I. Tibiae III without spines; metatarsi III with 2 spines ventrally and 1 spine posterio-laterally. Tibiae IV without spines; metatarsi IV with 1 proximo-ventral and 3 distal-ventral spines.

The distinguishind characters of the new species, are: *1)* Stylus with extremely wide and coil-shaped base and spring-like, narrow tip. *2)* Palp with short, triangular and acutely pointed tibial apophysis. *3)* Legs I not or slightly stronger than the others. *4)* Metatarsi I and II with 4 spines in a distal verticil (by this feature it differs from all other species known hitherto). *5)* Metatarsi III with 2.3, metatarsi IV with 1.2 spines. *6)* Femora without dorsal spines.

Holotype, male: New Guinea, Daulo Pass, at 2500 m, Asaro-Chimbu District, 6. XII. 1955. Holotype in the Arachnological Collection of the Bernice P. Bishop Museum, Honolulu.

Coccorchestes quinquespinosus sp. n.

(Figs. 8 – 12)

Cephalothorax: length 1.8 mm, greatest width 1.6 mm; abdomen: length 1.5 mm, width 1.4 mm. Abdomen covered with a chitinous shield. Body dark reddish-brown on top. Tarsi and metatarsi of legs II and III yellow, metatarsi with dark ring on distal half; metatarsi I with dark distal end, tarsi I dark.

Palp: tibia rather large, almost as long as half length of tarsus, thick in lateral view. With short, wide and bluntly pointed process slightly emerging from its outer edge. Stylus slender, twisted and spring-like.

Chaetotaxy of legs: all femora with dorsal spines. Femora I with 3 (in formula 1.1.1), femora II with 5 (2.2.1), femora III with 5 (2.1.2), femora IV with 4 (1.1.2) spines. Even the femur of palp with 1 dorsal spine. Tibiae I with 2.2 ventral spines, here the posterior spines are much more slender than the anterior ones; metatarsi I with 2.2 spines; tibiae II with 2.2 ventral and 1 anterio-distal spines; metatarsi II with 2.2 ventral and 1 anterio-distal spines. Tibiae and metatarsi III and IV without spines.

The distinguishind characters of the new species are: *1)* Stylus slender and spring-like. *2)* Tibial process slightly emerging and bluntly pointed. *3)* Legs I slightly stronger than the others, tibiae I with thicker anterio-ventral spines than the posterio-ventral ones. *4)* Tibiae and metatarsi III and IV without spines. *5)* Femora I – II – III – IV with 3 – 5 – 5 – 4 dorsal spines, respectively. In this diagnostic character it differs from all species known hitherto.

Holotype, male: New Guinea, W. Oriomo, 27. X. 1960. Leg.: L. GRESSITT. Holotype in the Arachnological Collection of the Bernice P. Bishop Museum, Honolulu.

Opusc. Zool. Budapest, XVII–XVIII, 1981

The Metabolism of the Tree Sparrow as the Type of Granivorous Passerines

By

G. GERE*

Abstract. The daily consumption of tree sparrows fed with millet seeds at 22 – 24 °C in cage was 3.42 g dry matter, which is 17.82% of their live weight. The birds assimilated 85.68% of the quantity of food. The caloric value of the food was 4.869, that of the feces 4.036 kcal. g(abs. dry weight)$^{-1}$. The daily energy requirement for the existence of one bird was 14. 453 kcal. The energy requirement, expressed in bird/g live weight was 0.768 kcal.

Under identical experimental conditions, the measure of food consumption (especially referred to body surface) and the food assimilation coefficient of seven bird species belonging with the family of Estrildidae *(Lonchura striata, Taeniopygia guttata, Erythrura p. prasina, E. trichroa cyanofrons, E. trichroa sigillifera, E. psittacea* and *Chloebia gouldiae)* were rather similar to that shown by the tree sparrows This allows the conclusion that on the basis of their similar metabolism the various granivorous passerine birds may be grouped into one type. The existence of such types could be demonstrated in other groups of animals, too. These types make the material and energetic changes taking place in the ecosystem easier to survey.

The daily food assimilation of an ill sparrow calculated for weight units was only 55.6% of the quantity assimilated by healthy specimens. Thus it seems that in case of certain illnesses the bird is capable of moderateing its metabolism in a significant degree.

Introduction

The study of the metabolism of various animals belongs to the important biological tasks of our days. The principal aim is to obtain knowledge about animal production and its role in the ecosystem as far as the exchange of matter and energy is concerned. Passerine birds have been extensively studied in this respect; among these studies numerous contributions have been published on the species of *Passer*. Nevertheless, it seemed desirable to carry out the subsequent investigation of the tree sparrow *(Passer m. montanus)* partly for the reason that we accumulate as much information as possible on its symbiological role, and in particular, to elucidate the mode of its metabolism and to compare it with that of other passerine species. Such comparisons, as carried out among others by KENDEIGH (1970 *a)*, are indispensable in ecology. (I shall come back to this question later.) On the other hand, the huge mass of data available in the literature is

---

**Dr. Géza Gere*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

almost unsuitable for purposes of comparison, since the individual authors applied special methods when carrying out the investigations under different environmental conditions. Bearing this in mind, my research on the tree sparrow was conducted under exactly the same conditions as on other species of the genus.

One specimen of the experimental animals fell ill. This circumstance gave an opportunity also to study the metabolism of the animal in a bad state of health.

Examination methods

The experimental tree sparrows were from the environs of Budapest. All of them were adults, past the moulting and incubation periods. The birds were placed singly, in cages of a 45×24 cm surface. In order to prevent the scattering of food, glass plates were put around the cages.

During the three days prior to the examination and during the investigation proper the birds were fed with millet-seeds only. Feedign took place in the forenoon every day. The millet-seeds were air-dry when fed to the birds, but their water-content, in order to establish dry matter consumption, was determined at 104 °C drying to weight-balance. Next day the surplus food was collected and directly weighed in absolute dry state. The excreta were weighed each day, similarly in absolute dry state. Drinking water was supplied to the birds in unlimited quantity.

The temperature during the investigation was about 22–24 °C, and the light period was daily 12 hours. The measurement of energy-content was performed in a Berthelot-Mahler bomb calorimeter.

Results and conclusions

Food (energy) requirements and the efficiency of utilization in the tree sparrow

The food requirement and utilization of nine tree sparrows are tabulated below (Table 1). Sparrows No. 1–5 were males, the rest were females. The data give the extreme values and averages of a series of measurements lasting for ten days. It is readily conceivable from the table that the average weight of the tree sparrows at the beginning of the experiment was 19.20 g. (According to Seel [1970] it was somewhat higher: 21.96 g in Romford between April and August; while Bauer [1975] found, for the nestleaving nestlings, a value fluctuating between 19.8 and 21.4 g in different years.)

The average quantity of the daily consumption was 3.42 g, corresponding to 17.82% of the live-weight. The daily excreta (feces and urine) came up to 0.49 g as an average value, thus the assimilation coefficient of the food materials was 85.68%.

If we compare these data with the ones found in the literature we see at once that the experimental birds consumed only a rather small amount of food. That is why, for example, according to Kendeigh (1970 *a)* the house sparrow consumed daily 6.2 g comprising various seeds in the month of August. The weight of tree sparrows is about 78% of that of house sparrows. In establishing the weight of the latter I used the data in the papers of Barnett (1970), Weiner (1970),

Table 1. The food requirements and utilization of tree sparrows

Number	Live weight (g)	Weight decrease during the experiment (g)	Daily consumption; dry weight (g)	Daily excrement; dry wieght (g)	$\frac{C\times 100}{G}$	$\frac{FU\times 100}{C}$
1	16.15	0.46	(2.18 – 2.85) 2.65	(0.37 – 0.43) 0.40	(13.48 – 17.62) 16.43	(14.21 – 16.92) 15.21
2	19.46	0.30	(3.36 – 3.79) 3.55	(0.46 – 053.) 0.51	(17.29 – 19.48) 18.25	(13.40 – 15.15) 14.24
3	20.28	0.55	(3.47 – 4.25) 3.79	(0.51 – 0.55) 0.54	(17.11 – 20.96) 18.69	(14.02 – 14.89) 14.37
4	19.69	0.11	(2.86 – 3.55) 3.40	(0.42 – 0.50) 0.47	(14·52 – 18.03) 17.28	(12.55 – 14.73) 13.68
5	21.99	0.46	(3.36 – 4.14) 3.85	(0.50 – 0.54) 0.53	(15.27 – 18.82) 17.50	(13.28 – 14.75) 13.78
6	19.08	0.88	(3.02 – 3.75) 3.43	(0.42 – 0.52) 0.48	(15.85 – 19.64) 17.96	(13.60 – 15.11) 14.00
7	20.65	0.25	(3.44 – 3.78) 3.75	(0.52 – 0.56) 0.55	(16.67 – 18.72) 18.19	(14.30 – 14.91) 14.77
8	16.40	0.09	(2.59 – 3.14) 3.01	(0.40 – 0.47) 0.45	(15.79 – 19.13) 18.35	(14.17 – 15.69) 14.95
9	19.18	0.39	(2.87 – 3.59) 3.40	(0.46 – 0.52) 0.47	(14.98 – 18.70) 17.72	(12.88 – 14.47) 13.94
Mean value	19.20	0.39	3.42	0.49	17.82	14.32

C = daily consumption in dry weight (g); FU = feces + urine, daily quantity in dry weight (g); G = initial live weight of the bird (g); Live weight = the live weight of the bird at the beginning of the experiment.

PINOWSKA (1976), as well as PINOWSKA and MYRCHA (1977). At the same time the daily consumption of the tree sparrows reached only 50.6% of that of the house sparrows in summer. It is just the decrease in body-weight that refers to the fact that the birds could not cover the entire energy demand necessary for their metabolism under the given conditions. However, the weight decrease was not really significant, which can be explained by the good assimilation efficiency of the millet-seeds. The millet-seed has namely, a high content of utilizable carbohydrates, and it seems that the granivorous passerines are able to utilize in their metabolism these carbohydrates with high efficiency as compared to fats and, especially, to proteins. This is clearly proved by our examinations carried out in *Lonchura striata* (Estrildidae; unpublished results). Of course, this fact does by no means decrease the significance of protins in bird metabolism.

The caloric value of the food was 4.869 ± 0.042 kcal. g (absolute dry weight)$^{-1}$ and the average caloric value of the excreta was 4.036 ± 0.028 kcal. g (absolute dry weight)$^{-1}$. The derived data of measurement gave me the opportunity to establish the energy balance of the sparrows. For the sake of preciseness I also considered the drop in body-weight having taken place during the examination. When calculating the energy loss due to decrease in body-weight, the caloric value of the body of the sparrows was only estimated, and taken to be 2.025 kcal. g (live weight)$^{-1}$, relying on the data of Pinowski and Myrcha (1977).

The result of energy balance was as follows:

In food one bird consumed daily:	16.652 kcal (gross energy)
Loss in feces and urine:	1.978 kcal (excretory energy)
Daily assimilation:	14.674 kcal (metabolized energy)
One bird used daily	14.674 kcal of the food
One bird used daily	0.079 kcal of its own body (loss in body-weight)
Daily total energy utilization	14.753 kcal

This value means the subsistence energy of the bird (at a given temperature) at moderate locomotor activity. The energy utilization, expressed in bird/g of live weight is thus 0.768 kcal.

Similarly, the caloric values prove a good utilization of the food. The assimilation coefficient of food energy: $\frac{\text{gross energy} - \text{excretory energy}}{\text{gross energy}} \cdot 100 = 88.1\%$

Taeniopygia guttata (Estrildidae) similarly consuming millet-seeds showed a value of 87.6% (Gere, 1972). An approximately high value (82%) was calculated by Kendeigh (1970 *a)* who fed house sparrows with various seeds. On the other hand, the birds fed with chick starter mash or with egg-laying mash, both very rich in proteins, could utilize the food with less efficiency. Consequently, the assimilation coefficient varied; for example, according to El-Wailly (1966) in *Taeniopygia guttata* it was 73.6, according to Kontogiannis (1968) in *Zonotrichia albicollis* it was 66.8, while according to Weiner (1970) in *Passer domesticus* it was only 65.0%. From the investigations of Myrcha et al. (1970) we know that the utilization coefficient of food in nestlings is dependent on age.

It is common knowledge that the energy requirements of birds are governed by numerous exterior and internal factors. From among these factors we especially mention temperature (Kendeigh 1970b). The energy quantity used at the given temperature of our experiments by the tree sparrow is not far from, though relatively slightly more than, the values found by El-Wailly (1966), Blackmore (1969), Weiner (1970) and Dolnik (1974) for other passerine birds in approximately similar circumstances. Therefore, we may conclude that the tree sparrow covers its energy requirements by a comparatively smaller amount of food along with a better utilization, which is possible through its physiological capacity and, of course, the quality of the food.

The type food (energy) requirements and utilization efficiency in granivorous passerines

A comparison of the literary data on the metabolism of various birds enabled Kendeigh (1970b) to give a general equation for the value of the metabolism of passerine and non-passerine birds, and for the temperature-dependent changes of that value, respectively. The possibility of generalization clearly proves in itself that there is or may be a similarity among the various species as to the character of the metabolism, i. e. the birds can be ranged according to types of food (energy) requirement and utilization.

Results of the numerous investigations indicate that sometimes even very different animals are similar to one another either in one or in several significant characteristics, especially as regards biological production (Gere, 1956, 1965, 1978). Within ontogenesis this similarity may appear, for example, in the rate of increase of body-weight or length measurements, in the composition of substances in the body, in the consumed quantity of food, in digestion, in the qualitative features of the metabolism and in the most diverse characteristics of physiology. It may also happen that two animal species behave in some respect as identical types only under certain definite conditions, however, in case these conditions change, the said species will represent different types. Of course, it is easy to understand that identical types occur more frequently in related species; on the other hand, in numerous instances quite distantly related species may fall in the same type.

It should be stressed that as far as types are concerned, we should rather adopt the term similarity than identity. It seems, namely, quite probable that the characteristics of species are, on the whole, specific, however in the case of an identical type the differences in the feature in question are slight. I am of the opinion that in order to step forward towards a precise evaluation of the similarities and differences further research is needed. With this in mind, as I have mentioned above, I studied the material exchange of passerine species belonging in the family of Estrildidae under identical conditions, as I did in the case of tree sparrows. Table 2 gives the data of my results concerning food utilization. Under numbers 1 and 3 published data (Gere 1974, 1973) are given, while the data under 2 and 4 are unpublished ones. The last data refer to four *Erythrura* species and forms, respectively, *(Erythrura prasina prasina, E. trichroa cyanofrons, E. trichroa sigillifera, E. psittacea)*, as well as to a related species, *Chloebia gouldiae*, representing the extreme values of their material-exchange conditions. As regards comparison, the species of *Erythrura* are especially interesting, since most of them are restricted to small distribution areas, in which environment they have strictly adopted themselves to the prevailing nutritional conditions. When studying the digestive organs, Ziswiler et al. (1972) also demonstrated morphological differences corresponding with adaptation.

Table 2. The food requirements and utilization of various granivorous passerines (Estrildidae)

Number	Species	Live weight (g)	$\frac{C \times 100}{G}$	$\frac{C}{\sqrt[3]{G_{dry}^2}}$ *	$\frac{FU \times 100}{C}$
1	*Lonchura striata*	14.4	21.68	10.82	14.06
2	*Lonchura striata*	15.2	19.77	11.87	15.75
3	*Taeniopygia guttata*	12.5	20.81	10.87	14.85
4	*Erythrura* spp. and *Chloebia gouldiae*	12.53 – 16.75	17.62 – 22.73	10.67 – 11.92	12.94 – 15.42

G_{dry} = dry weight of bird; * = mg; other symbols as in Table 1.

It is well-known that birds of different sizes, otherwise under the same conditions, rather consume food in proportion to the change of the surface of their body than according to that of body-weight (Kendeigh 1970*b)*. Changes in surface area may best be expressed as the 2/3 power value of body-weight (in this case: of dry body weight). Consequently, the quotient of daily consumption and of the latter value expresses the intensity of food consumption as compared to body surface area. (This formula was first used by Bornebusch [1930] in soil zoology.) This quotient is also to be found in Table 2.

From the table it appears that the quantity of the consumed food of the birds in question as compared to their live body-weight, as it follows from the above, is somewhat divergent in relation to the body-size. The fluctuation of consumption as compared to body surface is, however, comparatively small. In the case of the tree sparrow, the respective value is 10.74, which thus fits in well with the rest of the values in the table. A repeated series of experiments with *Lonchura striata* (numbers 1 and 2) shows that, in the quantity of the consumed food the differences may be greater within one species than the ones existing in certain instances between two species, indicating great individual variability. As to be seen, also the differences in the ratio of assimilated food and of wasted matter are rather small. Even in this respect the tree sparrow may readilybe placed among the other birds.

The great similarity of the metabolic symbols definitely supports our assumption that the examined bird species, and most likely several other granivorous passerines, too, belong into a clearly delimitable type. Their basic character is not fundamentally changed even by their adaptation to various types of food. The type is well represented by the tree sparrow. The existence of such types is most important especially in respect of the ecological investigations of extensive character, since they permit to characterize with fair alexactness the materi and energetic changes taking place in the ecosystem, and closely related to the metabolism of the living organism, not broken down to the activity of species-populations, but grouping them by types. This makes the extremely complicated processes of biological production fairly clear.

The food requirement and utilization of an ill tree sparrow

The data of the food requirement and -utilization of an ill tree sparrow are given in Table 3. The symptoms of the illness (ruffled plumage, somnolence) culminated on the third day, yet the bird did not entirely recover even in 10 days. As the illness became graver also the quantity of the consumed food decreased, simultaneously with the measure of used food, as it is easy to determine from the changes in the proporion of wasted materials. The quantity of the assimilated food per day was 1.66 g on an average during the 10 days period. Since the initial weight of the sparrow was 19.46 g, the daily assimilation calculated for g of live weight was 0.085 g. This value is merely 55.6% of the quantity assimilated by healthy sparrows in one day. On the other hand, in the period of 10 days the bird lost only 0.77 g of its body-weight. The decrease of food consumption is much greater than the one in the energy requirements owing to a decrease locomotory activity would account for. Thus, we may conclude that in case of certain diseases the bird is capable of moderating the rate of its netire metabolism in a significant degree.

Table 3. Daily pattern of the food requirement and utilization of an ill tree sparrow. (Symbols as in Table 1)

Daily consumption; dry weight (g)	Daily excrement; dry weight (g)	$\frac{C\times 100}{G}$	$\frac{FU\times 100}{C}$
2.11	0.42	10.84	19.91
2.11	0.40	10.84	18.96
1.29	0.40	6.63	31.01
1.92	0.42	9.87	21.86
1.76	0.38	9.04	21.52
2.28	0.43	11.72	18.86
2.21	0.39	11.36	17.65
2.17	0.41	11.15	18.89
2.59	0.49	13.31	18.92
2.40	0.47	12.33	19.58
Mean value: 2.08	0.42	10.69	20.19

REFERENCES

1. Barnett, B. L. (1970): *Sesonal changes in temperature acclimatization of the house sparrow Passer domesticus.* – Comp. Biochem. Physiol., 33: 559 – 578.

2. Bauer, Z. (1975): *The biomass production of the tree sparrow, Passer m. montanus (L). population in the conditions of the flood forest.* – Intern. Stud. Sparrows, 8: 124 – 239.

3. Blackmore, F. H. (1969): *The effect of temperature, photoperiod and molt on the energy requirements of the house sparrow, Passer domesticus.* – Comp. Biochem. Physiol., 30: 433 – 444.

4. Bornebusch, C. (1930): *The fauna of forest soil.* – Forstl. Forsogsvaesen Denmark, 11: 1 – 158.

5. Dolnik, V. R. (1974): *The energy requirements for existence and for migration, molt and breeding in chaffinches, Fringilla coelebs L.* – Intern. Stud. Sparrows, 7: 11 – 20.

6. El-Wailly, A. J. (1966): *Energy requirements for egglaying and incubation in the zebra finch, Taeniopygia castanotis.* – The Condor, 68: 582 – 594.

7. Gere, G. (1956): *The examination of the feeding biology and the humificative function of Diplopoda and Isopoda.* – Acta Biol. Acad. Sci. Hung., 6: 257 – 271.

8. Gere, G. (1965): *Fütterungsversuche mit bodenbewohnenden Diplopoden und Isopoden in der Baradla-Höhle bei Aggtelek (Ungarn).* – Opusc. Zool. Budapest, 5: 193 – 196.

9. Gere, G. (1972): *Water economy of the zebra finch (Taeniopygia guttata Vieill.) under conditions of watering and thirst.* – Acta Biol. Acad. Sci. Hung., 23: 201 – 206.

10. Gere, G. (1973): *Die quantitativen Verhältnisse des Wasserhaushaltes und des Gesamtstoffumsatzes des Zebrafinken (Taeniopygia guttata Vieil.).* – Opusc. Zool. Budapest, 12: 63 – 72.

11. GERE, G. (1974): *Die quantitativen Verhältnisse des Wasserhaushaltes und des Gesamtstoffwechsels beim Japanischen Mövchen (Domestizierte Form von Lonchura striata [L].* – Ann. Univ. Sci. Budapest. R. Eötvös. Nom. Sect. Biol., 16: 163–176.

12. GERE, G. (1979): *Ökologisch-produktionsbiologische Typen in der Tierwelt.* – Opusc. Zool. Budapest, 16: 77–85.

13. KENDEIGH, S. C. (1970*a): Monthly variations in the energy budget of the hous sparrow throughout the year.* – Intern. Stud. Sparrows, 4: 34–36.

14. KENDEIGH, S. C. (1970 *b): Energy requirements for existence in relation to size of bird.* – The Condor, 72: 60–65.

15. KONTOGIANNIS, J. E. (1968): *Effect of temperature and exercise on energy intake and body weight of the white-throated sparrow Zonotrichia albicollis.* – Physiol. Zoöl. 41: 54–64.

16. MYRCHA, A., PINOWSKI, J. & TOMEK, T. (1970): *Energy budgets of tree sparrow (Passer m. montanus) nestlings.* – Intern. Stud. Sparrows, 4: 36–38.

17. PINOWSKA, B. (1976): *The effect of body composition of female house sparrows, Passer domesticus (L.), on the clutch size and the number of broods.* – Intern. Stud. Sparrows, 9: 55–71.

18. PINOWSKI, J. & MYRCHA, A. (1977): *Biomass and production rates.* – In: Pinowski, J. & Kendeigh, S. C.: Granivorous birds in ecosystems, Cambridge Univ. Press, 107–126.

19. SEEL, D. C. (1970): *Nestling survival and nestling weights in the house in the house sparrow and tree sparrow Passer spp. at Oxford.* – Ibis, 112: 1–14.

20. WEINER, J. (1970): *Energy requirements of house sparrow in southern Poland.* – Intern. Stud. Sparrows, 4: 39–41.

21. ZISWILER, V., GÜTTINGER, H. R. & BREGULLA, H. (1972): *Monographie der Gattung Erythrura Swainson, 1837 (Aves, Passeres, Estrildidae).* – Bonner Zool. Monogr. 2, Berlin: 1–158.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Beitrag zur Evolution der österreichischen Seen

Von

H. LÖFFLER*

Einleitung

Seen sind kurzlebige Ökosysteme, jedenfalls kurzlebiger als die meisten größeren Fließgewässer oder gar Meere und Ozeane. Nur wenige reichen bis ins Tertiär zurück, aber auch hier wahrscheinlich nicht weiter als bis ins Oligozän (Baikalsee). Die überwiegende Mehrzahl der Gewässer, die ihre Existenz pleistozäner oder holozäner Gletschertätigkeit verdankt, hat dementsprechend ein Alter, das von jüngsten Bildungen (Seen der Hochanden, vielfach 20. Jahrhundert) bis etwa 18 000 B. P reicht, also mit dem Rückgang der letzten pleistozänen Vergletscherung zusammenhängt. Da dieser Rückgang von der geographischen Breite abhing, ergibt sich eine entsprechende Altersstaffelung.

Von den ca. 9000 stehenden Gewässern Österreichs (ausgewiesen auf dem Kartenmaterial 1 : 50 000) ist ebenfalls der überwiegende Anteil (neben künstlichen Stau- und Badeseen, Augewässern, durch Erdrutsch und stark erodierende Seitenflüsse gestaute Gewässer, tektonische und Grundwasserseen) pleistozäner Herkunft und somit ca. 12 – 18 000 Jahre alt. Es besteht allerdings kein Zweifel, daß viele der großen Seen des Voralpengebietes auch während der vorangegangenen Zwischeneiszeiten bestanden haben, vielfach, wie jüngste Untersuchungen am Mondsee erkennen lassen (KLAUS, 1975), oft mit größerer Ausdehnung als dies gegenwärtig der Fall ist. Auch sind die pleistozänen Seebildungen vielfach mit tektonischen Beckenbildungen verknüpft oder stehen zumindest mit tektonischen Ereignissen in Zusammenhang. Hier wird die Erfassung des gesamten Sedimentkörpers der verschiedenen Seen noch wichtige Erkenntnisse liefern. Bis jetzt liegen darüber kaum Daten vor.

Die bis zu eigenen Untersuchungen vorliegenden Angaben zur Entwicklung österreichischer Seen beschränkten sich hauptsächlich auf Untersuchungen von GAMS (1927) und BURGER (1964) im Lunzer Raum. Seit 1971 werden vom Limnologischen Institut der Österreichischen Akademie der Wissenschaften und der Limnologischen Lehrkanzel der Universität Wien Seen auf ihre Entwicklungsgeschichte hin untersucht, wobei derzeit noch Pollenanalyse zur groben zeitlichen Einordnung (neben c^{14} Datierungen) und Organismenreste (Diatomeen, Ostrako-

---

Dr. Heinz Löffler, Limnologisches Institut der Österreichischen Akademie der Wissenschaften, 1090 Wien, Berggasse 18, Österreich.

den, Cladoceren und Dipteren, besonders *Chaoborus)* als Kriterien für den jeweiligen Zustand der Seen dienen. In jüngster Zeit werden zusätzlich Pigmentanalysen als Indikation für das Vorkommen von *Oscillatoria rubescens* eingesetzt, fallweise auch mineralogische (röntgenographische) Analysen. Derzeit liegen von rund einem Dutzend holomiktischer und meromiktischer Seen, sowie vom Neusiedlersee Ergebnisse vor, die im folgenden zur Darstellung gelangen sollen.

Alpine und präalpine Seen

Holomiktische Seen

Wohl in den meisten alpinen Seen wird sich, ebenso wie in jenen Nordeuropas (Digerfeld, 1972), in der ersten Phase ihrer Existenz ein Trend zu Eutrophierung nachweisen lassen. Dieser ist eine Begleiterscheinung der zunächst meist stark erhöhten Sedimentationsrate und des damit oft verbundenen Nährstoffeintrages in den damals vegetationslosen Einzugsgebieten. In Österreich läßt der Lunzer Untersee andeutungsweise eine solche Situation erkennen (Löffler, 1975), wo eine relativ hohe Individuendichte von profundalen Ostrakoden und bestimmte Sedimenteigenschaften (Sapropelisierung) Anhaltspunkte dafür sind. (Durch einen Erdrutsch im Jahre 1965 im nördlichen Einzugsgebiet des Sees kam es hier übrigens abermals zu einer leicht eutrophierenden Wirkung, die sich allerdings auf eine Bucht unmittelbar von der Mündung des Mayrgrabens beschränkt. Die hauptsächlich anorganische Trübe dieses Ereignisses stellt eine wichtige Zeitmarke dar, welche die hohe allochthone Sedimentationsrate im Ostteil des Sees – mehrere cm – erkennen läßt.) Spätestens von der jüngeren Dryas an klingen diese Erscheinungen wieder ab, um dann vor allem von stark organisch getönter Sedimentation abgelöst zu werden, die besonders im Subatlantikum beachtlichen Umfang gewinnt (ca. 4 m). Die angeführten Profundalostrakoden (vor allem *Cytherissa lacustris*) sind, freilich mit wechselnder Dichte, das ganze ore-Profil hindurch bis zur Gegenwart vorhanden. Ähnlich dürfte es sich auch bei anderen oligotrophen Seen (Attersee) verhalten.

Ein ganz anderes Bild ergibt sich bei Seen, die starker Kultureutrophierung unterworfen sind (zumeist innerhalb des letzten Jahrhunderts), deren Ausmaß jenes der genannten Eutrophierung mit Beginn der Seenbildung zumeist übertrifft. Lange bevor die Sauerstoffzehrung anaerobe Bedingungen in Sedimentnähe oder im gesamten Hypolimnium verursacht, treten oft Veränderungen am Sediment auf, die zum Ausfall bestimmter Arten führen. So verschwindet *Cytherissa lacustris* aus Profundalzonen, die durch algenbedingte Detritusauflage („ooze") der Sedimentoberfläche gekennzeichnet sind (Löffler, 1969; Powell, 1976). *Cytherissa lacustris* bewegt sich mit ihren Gliedmaßen stelzend fort und hat überdies ein relativ hohes spezifisches Gewicht (Adulttiere über 1,2) was die Art hindert, die Detritusoberfläche zu erreichen. Arten mit Schwimmvermögen wie *Cypria opthalmica* sind dagegen von derartigen Sedimentveränderungen nicht betroffen. Im Bodensee (Zellersee) verschwinden gleichzeitig mit *Cytherissa* eine Reihe von Diatomeen, während andere, wie z. B. *Synedra acus*, von da an auftreten. Auch im Mondsee und Zürcher See fällt *Cytherissa* in den obersten Sedimentschichten aus, doch liegen von diesen Seen zu wenig Befunde vor. Eutrophierung zufolge von Brandodung etwa im Zusammenhang mit den Pfahlbauten der Hallstattzeit, ist von holomiktischen Seen Österreichs nicht bekannt, ist aber zumindest für kleinere bis mittelgroße Seen (Wallersee, Trumer See etc.) zu erwarten.

Meromiktische Seen Kärntens

Innerhalb Österreichs befinden sich auffallend viele meromiktische Seen. Gut ein Dutzend teilzirkulierende Gewässer sind bisher bekannt geworden, wobei den meisten das Fehlen eines größeren Zuflusses gemeinsam ist. Einen Sonderfall stellt der Traunsee, Österreichs tiefster See (191 m) dar, der sich trotz starken Zuflusses meromiktisch verhält: allerdings handelt es sich hier um künstlich ausgelöste Meromixis, bedingt durch die nunmehr seit über 50 Jahren zugeführte Endlauge der Solway Werke. Im Gegensatz zu den holomiktischen Seen ohne wesentliche Eutrophierungsereignisse mit fast gleichartig bleibender Profundalfauna lassen meromiktische Seen durchwegs tiefgreifende Veränderungen erkennen. Ausfall des größten Teiles der Profundalfauna und vielfach Auftreten von *Chaoborus* sind Begleiterscheinungen des Beginns einer meromiktischen Phase. Meromixis ist nicht immer mit völligem Sauerstoffschwund im Monimolimnion verknüpft. Dies gilt in besonderem Maß für den Traunsee, wo der starke Zufluß auch im Monimolimnion eine zur Sauerstoffaufnahme genügend starke Umwälzung verursacht. Sauerstoff ist fallweise auch beim Wörthersee, Längsee und Goggausee bis in die größte Tiefe nachzuweisen. Hier handelt es sich freilich um kurzfristige Ereignisse, die für eine Wiederbesiedlung durch die ursprüngliche Bodenfauna nicht hinreichen.

Längsee

Während bei krenogenen und ektogenen meromiktischen Seen die zeitliche Einstufung allgemein leicht gelingt, bieten die als biogen meromiktisch angesehenen Kärntner (und auch anderere Bundesländer) Seen hier Schwierigkeiten. Dies, weil sich einerseits der Beginn der Teilzirkulation mit hypolimnischem Sauerstoffschwund allein leicht verwechseln läßt, andererseits die Dichteunterschiede, die zur Aufrechterhaltung der Meromixis erforderlich sind, minimal sein können, sodaß auch chemische Analysen des Sedimentes nicht immer aufschlußreich sein müssen. Im Fall des Längsees ließ sich Frey (1955) von einer mächtigen (ca 1,5 m) Sapropelschicht, die den obersten Abschnitt von Bohrproben aus der größten Tiefe (22 m) bildet, dazu verleiten, diese als meromiktische Phase anzusehen. Sie würde damit ca. 2000 Jahre zurückreichen, eben in jene Zeit, da auf Grund der Pollenenanalyse ausgedehnte Waldrodung angenommen werden muß. Frey untersuchte außerdem die Chydoridenfauna, die aber zumeist nur littorale Ereignisse widerspiegelt. Eine eigene spätere Analyse – übrigens zusammen mit Frey – hauptsächlich auf das Profundal besiedelnde Ostrakoden konzentriert, ergab einen völligen Ausfall dieser Tiere, wahrscheinlich schon während des Alleröd. Ihr erstes Auftreten läßt sich dagegen schon vor Bölling festlegen. Somit läßt der Längsee zwei Ereignisse erkennen. Nämlich einmal des Ausfall der Ostrakoden, der übrigens mit dem ersten Auftreten von *Chaoborus* cf. *flavicans* zusammenfällt – einer gewichtigen Indikation für Sauerstoffschwund im Hypolimnium – und der als Beginn der Meromixis anzusehen ist. Zum anderen die Periode der Sapropelisierung, die zur ersten großen Waldrodung durch Siedler zurückreicht und offenbar als Folge einer bis heute anhaltenden Eutrophierungserscheinung aufgefaßt werden muß. Erste Oscillaxanthin-Analysen haben einen positiven Nachweis dieses Pigments für den Sapropelabschnitt (nicht aber für die übrigen) ergeben. Es ist daher nicht auszuschließen, daß die Sapropelisierung mit dem Vorkommen von *Oscillatoria rubescens* zusammenhängt, einer Blaualge, die für die meisten meromiktischen Seen Kärntens charakteristisch ist, deren Auftreten aber mit jüngster Kultureutrophierung in Zusammenhang gebracht wurde. Tatsächlich haben auch die übrigen daraufhin untersuchten meromiktischen Seen Kärntens (Klopeiner See, Wörthersee, Goggausee) nur geringfügige oberflächliche Sapropellagen, wobei das Westbecken des Wörthersees mit 67 cm eine Ausnahme bildet.

Wörthersee, Goggausee

Wie der Längsee und die noch zu beschreibenden Gewässer Klopeiner- und Kleinsee ist auch der Wörthersee vom Draugletscher-System geprägt, obschon im Gegensatz zu den übrigen genannten hier auch tektonische Komponenten für die Beckenformung erhebliche Rolle spielen. Im Wörthersee sind die tieferen Becken im Osten (z_{mat} 73 m) und im Westen (z_{mat} 84, 6 m) meromiktisch, ein dazwischen liegendes drittes Becken mit nur maximal 40 m Tiefe ist dagegen holomiktisch. Diese bemerkenswerte Eigenheit des Sees ist seit den grundlegenden Untersuchungen FINDENEGG's (1932 etc) bekannt, doch erhob sich auch hier die Frage nach dem Alter der beiden monimolimnischen Stockwerke in Ost- und Westbecken. Auch hier erwiesen sich die Ostrakoden, vor allen wieder *Cytherissa lacustris* als wichtige Indikation. In beiden Becken ist ihr Vorkommen auf die Zeit zwischen älterer Dryas und Präboreal beschränkt, während diese Art im mittleren Becken bis vermutlich ins späte Subatlantikum reicht. Ihr Ausfall von diesem Zeitpunkt an (im Gegensatz zum Längsee, wo *Cytherissa* gegenwärtig nicht mehr vorkommt, findet sich die Art auch heute noch im tieferen Litoral des gesamten Sees) hängt vermutlich wieder mit der Veränderung des oberflächlichen Sedimentes durch Eutrophierung zusammen. Ein Vergleich mit dem Längsee läßt erkennen, daß im Wörthersee meromiktische Auswirkungen um wenigstens 1000 Jahre später einsetzen.

Im Gegensatz dazu tritt das meromiktische Stadium im kleinen Goggausee (z_{max} 12 m) noch weitaus früher als im Längsee auf, nämlich im Bölling oder noch davor. Daraus ergibt sich eine Abhängigkeit des Eintrittes ins meromiktische Stadium von der Seegröße, die am Ende dieses Abschnittes noch zu diskutieren sein wird. Der Goggausee bietet aber auch sonst bemerkenswerte paläolimnologische Aspekte, die mit seiner Entstehung zusammen hängen. Als natürlicher Stausee, gebildet durch den Schotterriegel eines stark erodierenden Seitenflusses, läßt er ein erstes, offenbar seichtes Stadium erkennen, das möglicherweise schon sehr bald nach dem Rückzug des Gletschers bestand (möglicherweise in diesem Fall ein Arm des Murgletschersystems). Auf dieses wohl nur kurze Stadium folgte dann ein ebenfalls zeitlich sehr begrenztes holomiktisches, mit wahrscheinlich größerer Tiefe und damit gut entwickeltem Zooplankton, vor allem *Bosmina*. Sehr früh trat dann der See in seinen meromiktischen Zustand ein (Ausfall von *Cytherissa*, erstes Auftreten von *Chaoborus*).

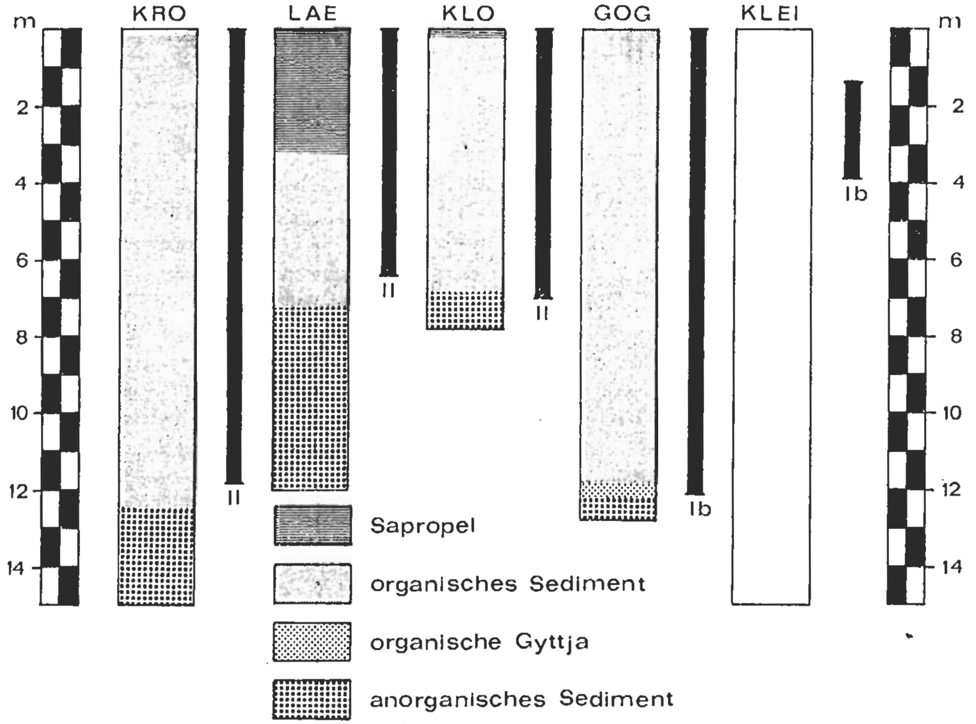


Abb. 1. Bohrkerne von Krottensee (KRO), Längsee (LAE), Klopeiner See (KLO), Goggausee (GOG) und Kleinsee sowie ihre Sedimentzonierung (schematisiert). Daneben der Meromixis dargestellt (II = Alleröd, I b = Bölling); im Kleinsee reicht die Meromixis nur bis in das Subatlantikum

Klopeiner See und Kleinsee

Beide Seen, mit derzeit gemeinsamen Ausfluß in die Drau, gehörten beim Rückzug des würmeiszeitlichen Draugletschers zum Kühnsdorfer See, der mit einem Pegel von 15 – 20 m über jenem der genannten Gewässer beträchtliche Ausmäße hatte und vielleicht 13 000 – 14 000 B. P. noch bestand. Ursprünglich aufgestaut durch die Vellach, war die Lebenszeit dieses Kühnsdorfer Sees einerseits durch den fortschreitenden Rückzug des Draugletschers, andererseits durch die veränderte Fließrichtung der Vellach, begrenzt. Ob Klopeiner See und Kleinsee als Toteislöcher anzusehen sind, ehe sie im Kühnsdorfer See aufgingen, möge weiteren Untersuchungen vorbehalten bleiben. Die Kesselform spricht jedenfalls dafür. Core-Analysen aus dem Litoral beider Seen lassen den plötzlichen Übergang von litoriprofundaler Situation in eine infralitorale als Folge des Ausbruches des Kühnsdorfer Sees klar erkennen. Ansonsten entsprechen die Cores vom Sediment der maximalen Seetiefe des Klopeiner Sees (46 m) was die Ostrakodenfauna angeht, weitestgehend der Verteilung im Längsee, also auch hinsichtlich des Beginns meromiktischen Verhaltens. Hier wie dort erschweren geringe Sedimentationsraten während des ausklingenden Pleistozäns eine zeitliche Einstufung außerordentlich.

Im derzeit holomiktischen Kleinsee (z_{max} 9 m), der hinsichtlich seiner Fläche dem Goggausee entspricht (10 ha), verläuft die Entwicklung völlig abweichend. So setzt das meromiktische Verhalten hier, wie im Goggausee, schon im Bölling oder sogar knapp vorher ein, endet jedoch im Subatlantikum ziemlich unvermittelt, ganz offenkundig eine Folge der Auffüllung des Monimolimnius mit Sediment. Beide Ereignisse lassen sich wieder mit Hilfe der Ostrakoden erkennen: mit spätestens Bölling hört ein Teil der ursprünglichen Ostrakodenfauna des Profundals auf zu existieren (*Cytherissa lacustris, Ilyocypris* cf. *lacustris* u. a.), um für immer aus dem See zu verschwinden. Im Subatlantikum treten dann neben einigen Arten, welche von Anbeginn im See vorhanden sind und das Profundal ganz offensichtlich vom Littoral her aufs neue besiedeln, Formen auf, die in der ersten holomiktischen Phase im Profundal nicht vorkommen (z. B. *Metacypris cordata*). Dieses Phänomen einer „fossilen" Meromixis ist wahrscheinlich auch in dem etwa gleich großen, aber derzeit noch seichteren (z_{max} 6,8 m) Jeserzer See im nordwestlichen Einzugsgebiet des Wörthersees zu vermuten, wo sich zwischen anorganisches Sediment und einem mächtigen organischen Abschnitt (ca. 6 m) ein sapropelisierter Horizont von 108 cm findet. Doch bedarf es hier noch der Analyse, vor allem auch die Ursachen der Sapropelisierung betreffend.

Soweit es sich nunmehr überblicken läßt (auch die Befunde vom Krottensee im Salzkammergut und Piburger See in Tirol passen gut in dieses Bild) haben offenbar viele Seen im alpinen Raum mit schwachem oder überhaupt diffusem Zufluß beim Übergang vom kalt monomiktischen in den dimiktischen Zustand nur kurze oder überhaupt unvollständige Vollzirkulationen aufgewiesen. Zusammen mit einem angehobenen trophischen Niveau, wie es für schlecht durchflossene Becken mit langer Erneuerungszeit zu erwarten ist, war die Bereitschaft zu meromiktischem Verhalten gegeben. Die kleinen Becken reagierten dabei rascher als die großen, die für den Aufbau einer biogenen bedingten Schichtung länger brauchten. Noch fehlen freilich die Analysen zweier großer und wahrscheinlich sehr aufschlußreicher Seen: Millstätter und Weissensee. Erst dann wird sich endgültig zeigen, ob die dargelegten Vorstellungen für den Ostalpenraum zutreffen.

Neusiedlersee

Daß die gegenwärtige Neusiedlersee-Wanne weder Rest des reliktären Pannonsees noch die Bildung eines Donauseitenarmes, sondern eine tektonische Bildung der ausklingenden Würmzeit ist, steht heute außer Zweifel. Nicht geklärt ist dagegen der Beginn der lakustrinen Phase, die nach Auffassung mancher Autoren (GATTINGER, 1974) viel weiter zurück reichen soll. Im Gegensatz zu den bisher behandelten Seen, stellen die Sedimente des Neusiedlersees, selbst auf einem mächtigen pannonen, fast fossilfreien Pannonsediment-Sockel von mehreren hundert Metern Mächtigkeit lagernd, ein Mischsediment mehrerer lakustriner Phasen und des erodierten pannonen Untergrundes dar. Auch muß der Einfluß allochthonen terrestrischen Materials bei jeweiliger Wiederauffüllung der trocken liegenden Wanne bzw. bei Transgression bis zum Doppelten des gegenwärtigen Areals ein erheblicher gewesen sein. Als Beweis für die Mischung verschiedener lakustriner Phasen darf der Fund von *Cytherissa lacustris* in der Seemitte angeführt werden, eine Art, die in diesem Raum bestenfalls mit ausklingendem Pleistozän in Zusammenhang gebracht werden kann. Zusammen mit dieser Art fand sich eine auch gegenwärtig vorkommende Ostrakodenfauna. Als Mischsediment von möglicherweise mehreren hundert lakustrinen Phasen läßt sich bestenfalls die Entwicklung des Sees seit der letzten Austrocknungsphase vor rund 110 Jahren verfolgen, nicht aber früherer Perioden (LÖFFLER, 1969).

Schußbohrungen der ÖMV (1971) und wenige frühere Funde lassen ein Verbreitungsbild von *Lminocythere sanctipatricii* (kalt-stenotherme Art) und *Cytherissa lacustris* (langlebige Art, mind. zwei Jahre) erkennen, das eine frühere Ausdehnung der Neusiedlersee Wanne besonders im südöstlichen Seewinkel und anschließenden ungarischen Hanság nahegelegt. Ein 130 cm langer Bohrkern aus dem Raum von Tadten lieferte ein Pollenprofil von der Wende Alleröd/Jüngere Dryas bis in die ältere Dryas (III/II – I nach FIRBAS). Dieses Profil ist insoferne aufschlußreich, als es eine Abfolge von Ostrakodengesellschaften erkennen läßt, deren früheste für ständig kühle Gewässer (u. a. *Cytherissa lacustris)* charakteristisch ist. Außerdem wäre demnach in diesem Gebiet eine erste lakustrine Phase mit mindestens 13 000 B. P. anzusetzen. Die Basis dieses Bohrkernes (Schotter unbekannter Herkunft) liegt mit 113, 7 m (?) etwas höher als die tiefsten Teile der gegenwärtigen Neusiedlersee Wanne (112,9 m?). Damit würde übereinstimmen, daß die jüngsten Absenkungen im Südteil der gegenwärtigen Seewanne erfolgten und damit die Verlandung des Hanság begann (KÜPPER, 1957). Die Ufergebiete auf ungarischer Seite würden hier zusätzliche Sicherheit für diese Auffassung liefern. Dort dürften nämlich Kaltwasser-Ostrakoden bestenfalls im Osten, nich aber im Südwesten und Westen des Sees in Bohrkernen enthalten sein. Ob der Nordteil des gegenwärtigen Sees mit seinem östlich anschließenden, fallweisen Transgressionsgebiet altersmäßig zwischen Hanság und Südteil des rezenten Sees einzuordnen ist, bleibt noch zu klären, ebenso wie die Frage nach eventuellen lakustrinen Phasen der letzten Zwischeneiszeit.

SCHRIFTTUM

1. BURGER, B. (1964): *Results of a pollenanalytic investigation in the Untersee near Lunz in Austria,* – Geol. Mijnbouw, 43: 94 – 102.

2. DIGERFELDT, G. (1972): *The post-glacial development of Lake Trummen. Regional vegetation history, water level changes and paleolimnology.* – Folia Limnol. Scandinavia, 16: 1 – 104.

3. FINDENEGG, I. (1932): *Die Schichtungsverhältnisse im Wörthersee.* – Arch. Hydrobiol., 24; 253 – – 262.

4. FREY, D. G. (1955): *Längsee:* A history of meromixis. – Mem. Ist. Ital. Indrobiol., 8: 141 – 146.
5. GAMS, H. (1927): *Die Geschichte der Lunzer Seen, Moore und Wälder.* – Int. Rev. Hydrobiol. 18: 305 – 356.

6. GATTINGER, T. (1974): *Das Werden des Seeraumes.* – In: Der Neusiedlersee. Ed. H. Löffler, 11 – 13, Verlag Fritz Molden, Wien – München – Zürich.

7. KLAUS, W. (1975): *Das Mondsee-Interglazial, ein neuer Florenfundpunkt der Ostalpen.* – Jb. Oberösterr. Musealver., 120, I: 315 – 344.

8. KÜPPER, H. (1957): *Erläuterungen zur geologischen Karte von Mattersburg – Deutschkreuz.* – Geol. Bundesanst. Wien.

9. LÖFFLER, H. (1969): *Recent and subfossil distribution of Cytherissa lacustris (Ostracoda) in Lake Constance.* – Mitt. Internat. Verein. Limnol., 17: 240 – 252.

10. Löffler, H. (1971): *Daten zur subfossilen und lebenden Ostrakodenfauna in Wörthersee und Klopeiner See.* – Carinthia II, 31: 79–89.

11. Löffer, H. (1972): *The distribution of subfossil ostracods and diatoms in pre-alpine lakes.* – Verh. Internat. Verein. Limnol., 18: 1039–1050.

12. Löffler, H. (1975): *The onset of meromictic conditions in Alpine Lakes.* – Quaternary Studies, Royal Soc. New Zealand, 211–214.

13. Löffler, H. (1975): *The evolution of ostracode faunas in alpine and prealpine lakes and their value as indicators.* – Bull. Amer. Paleont., 65, 282: 433–443.

14. Löffler, H. (1975): *The onset of meromictic conditions in Goggausee, Carinthia.* – Verh. Internat. Verein. Limnol., 19: 2284–2289.

15. Löffler, H. (1977): *„Fossil" meromixis in Kleinsee (Carinthia) indicated by Ostracods.* – Sixth Intern. Ostracod. Symp. Saalfelden, The Hague, 321–325.

16. Löffler, H., Berger, F., Glatz, A., Jungwirth, M., Kusel-Fetzmann, E., Lew, H., Herzig, A., Powell, S., Hadl, G., Humpesch, U., Schiemer, F., Hacker, R. & Meisriemler, P. (1972): (1972): *Arbeitsbericht der limnologischen Exkursion Klopeiner See 1971.* – Carinthia II: 235–274.

17. Löffler, H., Berger, F. Dokulil, M., Kusel-Fetzmann, E., Lew, H., Herzig, A., Newrkla, P., Strnad, R., Powell, S., Humpesch, U., Schiemer, F., Hacker, R. & Meisriemler, P. (1973): *Arbeitsbericht über die Limnologische Exkursion 1972 zum Längsee.* – Carinthia II,163/83: 331–377.

18. Löffler, H., Berger, F., Gross, F., Hedrich, E., Dokulil, M. & Strnad, R. (1974): *Arbeitsbericht der Limnologischen Exkursion Wörthersee 1973.* – Carinthia II, 164/84: 195–206.

19. Löffler H., Schultze, E., Berger, F., Dokulil, M., Schiemer, F., Dolezal, E., Gnaiger, E., Jantsch, A. & Brenner, T. (1975): *Arbeitsbericht der Limnologischen Exkursion Goggausee 1974.* – Carinthia II, 165/85: 165–196.

20. Löffler, H., Bobek, M., Schultze, E. (1977): *Neue Daten zur Geschichte des Neusiedlersees.* – Wiss. Arb. Bgld.

21. Powell, S. (1977): *Einige Aspekte der Beziehung zwischen Sedimenteigenschaften und der Fortbewegung benthischer Süßwasser-Ostracoden, mit spezieller Berücksichtigung der Cytherissa lacustris (SARS).* – Diss. Univ. Wien.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Die Bodenspinnen zweier Torfmoore im Oberen Theiss-Gebiet Ungarns

Von

I. LOKSA*

Abstract. The soil spider fauna of two *Sphagnum* moors is presented. Five of the 89 species are new to the fauna of Hungary, and one species, *Glyphesis conicus* n. sp., is also new to science.

Auf der im Süden und Westen von der Theiss begrenzten Ebene von Bereg – oder wie dies auf verschiedenen Landkarten auch als Theissrücken bezeichnetem Gebiet – befinden sich viele verlassene, tote Stromabschnitte, die an die lebhaften Oberflächengestaltungen der jüngsten geologischen Vergangenheit erinnern.

Ungefähr 20 km von Vásárosnamény entfernt, in der Nähe der Gemeinde Csaroda entdeckten im August 1952 Dr. T. SIMON und Dr. E. VOZÁRY im verlassenen Flussbett, ca. 1300 m voneinander entfernt zwei Torfmoore. Die beiden Moore werden von ihnen Nyirestó und Bábtava genannt. In der Zwischenzeit wurden eingehende botanische, pollenanalytische und mikroklimatische Untersuchungen durchgeführt (VOZÁRY, 1957; SIMON, 1960), die beiden Moore stehen heute unter strengem Naturschutz.

Die Vegetation der beiden Torfmoore zeigt grosse Ähnlichkeit und ist von borealem Charakter, unterscheidet sich weitgehend von der Vegetation anderer Gebiete der ungarischen Tiefebene. Besonders interessant sind folgende Reliktarten: *Vaccinium oxycoccus, Eriophorum vaginatum, Drosera rotundifolia, Comarum palustre, Salix pentandra, S. aurita, Sphagnum palustre, S. recurvum, S. magellanicum, Drepanocladus exannulatus.*

Die Form beider Torfmoore ist gebogen, kipfelförmig und von nicht grosser Ausdehnung. Bábtava ungefähr 500 × 120 m, Nyirestó 650 × 120 m.

Da von den beiden Mooren bisher keine Nachweise von Spinnenvorkommen vorlagen, wurde die Erkundung dieser Biotope in Gang gesetzt. Die ersten Untersuchungen erfolgten am 30. Mai 1973 und wurden bis zum 19. Juni 1974 in regelmässigen Abständen in verschiedenen Pflanzenassoziationen durchgeführt. Es wurden in grösseren Pflanzenassoziationen des Nyirestó 10 und in denen des

---

**Dr. Imre Loksa*, ELTE Állatrendszertani és Ökológiai Tanszék (Lehrstul für Tiersystematik und Ökologie der Eötvös-Loránd-Universität), 1088 Budapest, VIII. Puskin u. 3.

Bábtava 148 je 5 Äthylenglykol—Barberfallen ausgelegt, die am 19—20. IX. 73., am 16—17. III. 1974 und am 18—19. VI. 1974 geleert wurden. Da die Aushebungen der Fallen in grösseren Zeitabschnitten erfolgte, liessen sich auf die saisonellen Veränderungen nur grobe Schlüsse ziehen, über die in den einzelnen Pflanzenassoziationen lebenden Spinnengemeinschaften konnte hingegen ein verhältnismässig guter Überblick gewonnen werden. Mit dem Leeren der Fallen parallel wurde auch gesiebtes Material ausgelesen, so dass ergänzende Angaben bezüglich der Geschlechtsreife und über den Zeitpunkt der Fortpflanzung einiger interessanter Arten erlangt werden konnten. Es muss jedoch erwähnt werden, dass grösseres Material nur aus den Erlenbeständen entnommen werden konnte, da ansonst die Ausbildung der *Sphagnum*-Pölster gefährdet wurde. Übrigens mussten die zoologischen Aufsammlungen auch deswegen schon sehr vorsichtig durchgeführt werden, da zur Zeit des Sammelns ausserordentliche Trockenheit herrschte, die Sumpfzone der Moore war vollkommen trocken, die *Sphagnum-Pölster* gerade nur etwas feucht. Auch nach der Schneeschmelze im Frühjahr standen nur die tiefsten Stellen der Erlenbeständen und Weidenmooren unter Wasser.

Anfang Juni des Jahres 1974 entzündete sich der nördliche Teil des Bábtava, wobei der Erlenbestand, die Weidenmoor und ein Teil des *Sphagnum*-Moores zugrunde ging. Die zoologischen Untersuchungen, da nur 3 Fallen vernichtet wurden, sind von diesem bedauerlichem Unfall kaum wesentlich betroffen worden.

Für die Aufsammlungen im Terrain spreche ich meinen besten Dank Frau Zs. SZOMBATHELYI, Frl. K. HORÁNSZKY und Frl. M. POBOZSNY auch an dieser Stelle aus.

Cönologischer Teil

In den beiden Torfmooren wurden insgesamt 89 Spinnenarten nachgewiesen. In der zusammenfassenden Tabelle (Tab. 1) wird ein Überblick über die relativquantitativen Verhältnisse der einzelnen Pflanzenassoziationen gegeben. Die Zahlkolumnen der Tabelle beziehen sih auf je 5 Fallen, sie geben die Exemplarzahl der während der Untersuchungsperiode in die Fallen geratenen Tiere an. Wie ersichtlich, sind die meisten Arten in niederer Individuenzahl in den einzelnen Gemeinschaften vertreten, es sind bloss 18 Arten, die in einer Gemeinschaft über 10 Exemplare aufweisen.

Die niedere Individuenzahl verringert die Wahrscheinlichkeit der Art in allen Gemeinschaften ihres Vorkommens nachgewiesen zu werden. Dies beinflusst auch auschlaggebend die Gestaltung der Werte des Jaccard-Indexes.

Wie zu ersehen, sind die Artidentität-Indexe im allgemeinen niedrig, der höchste 47, der niedrigste 12; trotz der niederen Werte kann man auf die Individuen-Beziehungen der Zönosen und auf deren Charakter Schlüsse ziehen.

Durch einen Vergleich der beiden Torfmoore, der auch schon deswegen ermöglicht ist da die Spinnengemeinschaften gleicher Assoziationen untersucht wurde, zeigt, dass eine Übereinstimmung der Arten bloss 58% beträgt, vom Nyirestó wurden 78 vom Bábtava 63 Arten bekannt.

Nachfolgend soll eine kurze Charakterisierung der Spinnengemeinschaften in den einzelnen Assoziationen erfolgen.

Artidentität- (Jaccard-) indexen

Nyírestó										Bábtava									
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	
100	47	38	29	24	29	22	26	33	26	33	28	17	19	16	16	9	13	1	
	100	43	44	27	35	28	30	35	27	35	33	26	31	26	19	19	30	2	Ny
		100	40	40	44	25	33	32	30	27	31	36	31	29	20	21	33	3	i
			100	40	40	39	35	27	25	25	30	24	40	39	29	29	39	4	r
				100	37	29	23	23	21	24	20	22	36	30	22	14	30	5	e
					100	35	36	35	29	36	31	29	47	34	26	21	43	6	s
						100	28	23	12	28	26	14	31	24	23	17	42	7	t
							100	30	26	29	26	24	28	22	20	23	29	8	ó
								100	41	25	31	19	29	22	13	16	33	9	
									100	27	25	29	31	32	15	24	29	10	
										100	28	26	35	35	26	15	26	1	B
											100	27	42	30	24	26	38	2	á
												100	31	24	24	27	33	3	b
													100	45	25	33	40	4	t
														100	25	34	29	5	a
															100	22	36	6	v
																100	23	7	a
																	100	8	

1. Eriophoro vaginati-Sphagnetum

Die Untersuchungen erfolgten in beiden Torfmooren an je zwei Stellen. Kennzeichnend war die hohe Individuenzahl von *Hygrolycosa rubrofasciata*, *Pirata uliginosus* und *Pirata hygrophilus*. Unterschiedlich war in den Assoziationen der beiden Moore das Vorkommen von *Glyphesis servulus* und *G. conicus*, beim Nyirestó konnten hohe Individuenzahlen, beim Bábtava niedere nachgewiesen werden. Aus der Tabelle geht das Vorkommen der Art *G. conicus* im Hochmoor des Bábtava nicht hervor, dass sie nur im Gesiebe angetroffen wurde, in den Fallen hingegen nicht. Obwohl *Taranucnus setosus* und *Allomengea warburtoni* nur niedere Individuenwerte aufwiesen, können sie ebenfalls als Charakterarten betrachtet werden. Interessant hingegen ist die Tatsache, dass *Zodarium germanicum* in den Beständen des Nyirestó massenhaft vorkam, in den Beständen vom Bábtava sozusagen fehlte, übrigens konnte dies auch bei den Arten *Pardosa lugubris* und *Trochosa spinipalpis* nachgewiesen werden.

2. Carici lasicarpae-Sphagnetum

In beiden Mooren wurden in je einem Bestand untersuchungen durchgeführt. Die Spinnengemeinschaften unterscheiden sich kaum von dem vorher angeführten Bestand. Interessant ist das verhältnismässig reiche Vorkommen von *Alopecosa pulverulenta* und *Abacoproeces saltuum* im Bestand vom Nyirestó.

3. *Dryopteridi-Alnetum thelypteridetosum populosum tremulae*

Von den Erlen-Assoziationen des Nyirestó wurden 2 Bestände, einer im Erlen-Pappelbestand, vom Bábtava 3 Bestände untersucht. Zwischen den beiden konnten bezüglich der Spinnengemeinschaften nur unwesentliche Unterschiede vermerkt werden. Gekennzeichnet ist die Zönose durch die Arten *Pirata hygrophilus*, *Pardosa lugubris* und *Trochosa spinipalpis*, die in grösserer Individuenzahl vertreten waren. Ebenfalls höhere Individuenzahlen wiesen die Arten *Stylophora concolor* und *Wideria antica* auf. In den Erlen-Pappelbeständen fällt die Individuenzahl von *Trochosa spinipalpis* zurück, dies konnte in beiden Mooren beobachtet werden. In den Beständen des Nyirestó sind die Individuenzahlen von *Glyphesis servulus* und *G. conicus* ebanfalls verhältnismässig hoch, letztere Art fehlt im Erlen-Pappelbestand. Im Erlen-Pappelbestand des Bábtava ist auch *G. servulus* nur sehr selten, *G. conicus* fehlt vollkommen. Im Erlen-Pappelbestand des Nyirestó kommt auch *Hygrolycosa rubrofasciata* und *Pirata uliginosus* mit niederer Individuendichte vor.

4. *Calamagrosti-Salicetum cinereae*

Im Bereich des Nyirestó wurden 3, beim Bábtava 1 Bestand untersucht. Es sei erwähnt, dass die drei Bestände des Nyirestó – obwohl sie phytocönologisch sich gleichen – stark voneinander abwichen. Im ersten Bestand standen im Frühling grössere Gebiete unter Wasser, der zweite Bestand verfügte über eine dichte Moosshicht (nicht *Sphagnum)*, der dritte Bestand besass auch *Sphagnum-Pölster (Sphagnum recurvum)*. Es schien als ob die Assoziationen sehr vielfältig wären, natürlich hing dies von der Wasserdecke ab, doch beeinflusste die Vegetation im Untersuchungsjahr auch der Kahlfrass von *Lymantria dispar* im II. und III. Bestand.

Die Zusammensetzung der Spinnengemeinschaften zeigen einerseits in Richtung der Sphagnummoor-Assoziationen, anderseits der Erlen-Pappelbestände gewisse Ähnlichkeit. Der III. Bestand zeichnete sich durch seinen Artenreichtum aus, hier konnten insgesamt 41 Arten nachgewisen werden, während im I. und II. Bestand zusammen bloss 29 Arten angetroffen werden konnten. Charakteristisch für den III. Bestand waren die hohen Individuenzahlen von *Zodarium germanicum, Pardosa pullata, Trochosa spinipalpis, Pirata hygrophilus, P. latitans* und *Aulonia albimana*. Zweifelsohne ist *Anacolyte stativa* ein interessantes Element dieser Gemeinschaft, sie ist zwar eine sehr seltene Art, soll nach Angaben der Literatur hohe Feuchtigkeitsansprüche besitzen, ein Vorkommen in Torfmoorgebieten ist ebenfalls schon bekannt.

5. *Scirpo – Phragmitetum urticetosum kioviensis.*

In **beiden** Mooren wurde ein Bestand untersucht, so dass weitläufige Folgerungen aus den Ergebnissen nicht gezogen werden können. Im Bestand vom Nyirestó wurden 29 Arten, im Bestand vom Bábtava 20 Arten nachgewiesen Aus den Ergebnissen geht hervor, dass die Spinnengemeinschaften einen Übergang zwischen den offeneren und geschlossenen Assoziationen bilden.

Faunistisch-taxonomischer Teil

Wie bereits aus dem zoocönologischen Teil der Arbeit hervorgeht, wurden insgesamt 89 Spinnen-Arten angetroffen. 5 Arten sind neu für die Fauna Ungarns, eine auch neu für die Wissenschaft. Im nachstehenden werden nur diese näher besprochen, d. h. die Beschreibung der für die Wissenschaft neuen Art gegeben. Bezüglich der übrigen Arten sind die Angaben in Tabelle I. ausreichend.

Tabelle 1.

Arten	Nyírestó										Bábtava							
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alnetum I.	Dryopteridi – Alnetum II.	Dryopteridi – Alnetum populosum	Calamagrosti – Salicetum cinereae I.	Calamagrosti – Salicetum cinereae II.	Calamagrosti – Salicetum cinereae III.	Scirpo – Phragmitetum urtic. kioviensis	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alnetum populosum I.	Dryopteridi – Alnetum populosum II.	Dryopteridi – Alnetum populosum III.	Calamagrosti – Salicetum cinereae	Scirpo – Phragmitetum urtic. kioviensis
Zodariidae																		
Zodarium germanicum C. L. Koch	35	12	76	2	–	7	–	1	51	43	–	9	–	–	–	–	–	–
Agelenidae																		
Cicurina cicur (Fabr.)	–	–	–	2	1	–	–	–	1	5	–	–	–	–	1	–	–	–
Hahnia montana (Blackw.)	1	1	–	–	4	–	–	–	–	–	1	–	–	–	–	–	–	–
Lycosidae																		
Hygrolycosa rubrofasciata (Ohlert)	41	25	31	–	–	5	–	2	2	2	8	15	2	–	–	–	–	–
Pardosa lugubris (Walck.)	11	12	27	10	6	24	8	–	12	–	–	9	5	26	43	14	7	6
Pardosa paludicola (Cl.)	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	1	–
Pardosa pullata (Cl.)	–	1	3	–	–	–	–	–	18	–	–	1	–	–	–	–	–	5
Alopecosa pulverulenta (Cl.)	–	–	8	–	–	1	–	–	–	6	1	–	1	1	–	–	4	–
Trochosa spinipalpis (Camb.)	14	2	14	13	13	5	–	–	30	–	2	–	2	4	1	–	–	–
Trochosa terricola Thor.	–	–	–	–	1	2	–	1	–	–	–	–	–	3	–	–	–	–
Trochosa ruricola (De Geer)	5	8	3	3	–	–	–	3	3	4	–	1	1	1	–	–	2	–
Pirata uliginosus (Thor.)	30	45	26	–	–	1	1	4	–	–	8	13	4	–	–	–	–	–
Pirata hygrophilus (Thor.)	16	48	10	66	47	45	48	31	54	16	17	6	5	31	51	20	4	4
Pirata latitans (Blackw.)	1	–	–	–	–	–	–	1	14	2	1	–	–	–	–	–	–	–
Aulonia albimana (Walck.)	–	–	–	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–
Pisauridae																		
Pisaura mirabilis (Cl.)	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	–	1	–

Tabelle 1 (Fortsetzung)

Arten	Nyírestó										Bábtava							
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alnetum I.	Dryopteridi – Alnetum II.	Dryopteridi – Alnetum populosum	Calamagrosti – Saileetum cinereae I.	Calamagrosti – Salicetum cinereae II.	Calamagrosti – Salicetum cinereae III.	Scirpo – Phragmitetum urtic. kioviensis	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alnetum populosum I.	Dryopteridi – Alnetum populosum II.	Dryopteridi – Alnetum populosum III.	Calamagrosti – Salicetum cinereae	Scirpo – Phragmitetum urtic. kioviensis
Tetragnathidae																		
Pachygnatha listeri Sund.	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
Argiopidae																		
Theridiosoma gemmosum L. Koch	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–
Linyphiidae																		
Centromerus sylvaticus (Blackw.)	–	–	–	–	–	1	3	2	12	–	4	–	–	3	–	–	–	6
Centromerus expertus (Cambr.)	–	1	–	–	–	–	–	–	1	2	–	3	1	1	–	–	1	2
Meioneta rurestris (C. L. Koch)	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–
Microneta viaria (Blackw.)	–	–	–	–	–	–	–	–	–	–	–	1	–	4	1	–	2	–
Maro minutus (Cambr.)	–	–	–	–	–	–	–	–	–	1	2	–	–	–	1	–	–	–
Drapetisca socialis (Sund.)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Leptyphantes mengei Kulcz.	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
Leptyphantes flavipes (Blackw.)	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Leptyphantes pallidus (Cambr.)	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Stylophora concolor (Wider)	–	14	–	5	3	15	12	5	16	5	11	2	–	16	29	1	4	3
Batyphantes nigrinus (Westr.)	–	1	–	3	–	1	–	1	–	–	2	–	–	2	6	–	1	–
Taranucnus setosus (Cambr.)	3	1	2	–	–	–	–	–	–	–	7	3	–	–	–	–	–	–
Allomengea warburtoni (Cambr.)	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Linyphia clathrata Sund.	–	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	–	–
Micryphantidae																		
Maso sundevalli (Westr.)	–	–	–	1	–	–	–	–	–	–	3	2	–	3	2	–	3	–

Tabelle 1 (Fortsetzung)

Arten	Nyírestó 1 Eriophoro vaginati – Sphagnetum I.	Nyírestó 2 Eriophoro vaginati – Sphagnetum II.	Nyírestó 3 Carici lasiocarpae – Sphagnetum	Nyírestó 4 Dryopteridi – Alnetum I.	Nyírestó 5 Dryopteridi – Alnetum II.	Nyírestó 6 Dryopteridi – Alnetum populosum	Nyírestó 7 Calamagrosti – Salicetum cinereae I.	Nyírestó 8 Calamagrosti – Salicetum cinereae II.	Nyírestó 9 Calamagrosti – Salicetum cinereae III.	Nyírestó 10 Scirpo – Phragmitetum urtic. kioviensis	Bábtava 1 Eriophoro vaginati – Sphagnetum I.	Bábtava 2 Eriophoro vaginati – Sphagnetum II.	Bábtava 3 Carici lasiocarpae – Sphagnetum	Bábtava 4 Dryopteridi – Alnetum populosum I.	Bábtava 5 Dryopteridi – Alnetum populosum II.	Bábtava 6 Dryopteridi – Alnetum populosum III.	Bábtava 7 Calamagrosti – Salicetum cinereae	Bábtava 8 Scirpo – Phragmitetum urtic. kioviensis
Pelecopsis radicicola (L. Koch.)	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Ceratinella brevis (Wider)	1	—	—	—	—	—	—	—	1	—	—	2	—	—	—	—	—	—
Abacoproeces saltuum (L. Koch)	—	—	28	3	5	7	3	—	3	—	—	—	—	1	—	—	—	1
Wideria antica (Wider)	—	8	1	6	5	10	3	5	1	—	2	2	—	7	8	6	—	2
Wideria cucullata (C. L. Koch)	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Wideria melanocephala (Cambr.)	3	6	—	1	—	—	2	1	1	—	1	—	—	—	1	—	—	—
Wideria fugax (Cambr.)	—	—	2	—	—	1	—	—	—	—	—	—	—	—	1	—	—	—
Wideria nodosa (Cambr.)	1	—	4	1	1	1	—	—	—	1	—	—	—	—	—	—	—	—
Trachynella obtusa (Blackw.)	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Trachynella nudipalpis (Westr.)	1	3	—	1	—	5	—	—	1	1	5	1	1	4	1	2	—	1
Panamomops mengei Sim.	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Metopobactrus prominulus (Cambr.)	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—
Anacotlyle stativa (Sim.)	—	—	—	—	—	—	—	—	3	2	—	—	—	—	—	—	—	—
Micrargus herbigradus (Blackw.)	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Silometopus elegans (Cambr.)	—	—	—	1	1	2	2	—	—	—	—	3	—	—	—	—	—	4
Gonatium rubellum (Blackw.)	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	1	—	—
Entelecara flavipes (Blackw.)	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—
Pocadicnemis pumila (Blackw.)	1	3	1	—	1	2	1	—	2	—	1	—	—	—	—	—	—	—
Nematogmus sanguinolentus (Walck.)	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Gongilidium rufipes (Sund.)	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Gongylidiellum murcidum Sim.	6	—	—	—	1	—	1	—	—	—	5	1	—	3	—	—	—	—
Glyphesis servulus (Sim.)	8	10	21	6	4	9	—	3	2	16	2	6	—	1	—	1	—	1
Glyphesis conicus sp. nov.	12	3	11	15	4	—	—	—	—	—	—	—	—	—	—	—	—	—

Tabelle 1 (Fortsetzung)

Arten	Nyírestó										Bábtava							
	1	2	3	4	5	6	7	8	9	10	1	2	5	4	5	6	7	8
	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alhetum I.	Dryopteridi – Alnetum II.	Dryopteridi – Alnetum populosum	Calamagrosti – Salieetum cinereae I.	Calamagrosti – Salicetum cinereae II.	Calamagrosti – Salicetum cinereae III.	Scirpo – Phragmitetum urtic. kioviensis	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alnetum populosum I.	Dryopteridi – Alnetum populosum II.	Dryopteridi – Alnetum populosum III.	Calamagrosti – Salicetum cinereae	Scirpo – Phragmitetum urtic. kioviensis
Symphytognathidae																		
Mysmena leucoplagiata (Sim.)	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Theridiidae																		
Episinus angulatus (Blackw.)	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–
Robertus arundineti (Cambr.)	1	1	5	2	–	–	–	3	–	–	–	–	–	–	–	–	–	–
Mimetidae																		
Ero furcata (Villers)	–	1	–	1	–	–	1	–	–	–	–	1	–	1	–	–	–	1
Drassidae																		
Haplodrassus silvestris (Blackw.)	3	5	3	2	1	10	2	2	2	3	–	–	–	1	1	–	1	–
Drassodes pubescens (Thorell)	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Zelotes pusillus (C. L. Koch)	3	–	1	–	1	–	–	–	5	3	–	1	–	1	4	–	–	–
Zelotes pedestris (C. L. Koch)	–	–	–	–	–	2	–	–	2	–	–	–	–	1	–	–	–	–
Zelotes lutetianus (L. Koch)	2	2	–	–	–	–	–	–	3	3	–	–	–	–	–	–	–	–
Zelotes apricurum (L. Koch)	2	1	2	–	–	–	–	–	4	1	–	–	–	–	–	–	–	–
Zelotes latreillei (Sim.)	4	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Clubionidae																		
Anyphaena accentuata (Walck.)	–	–	1	1	1	–	–	–	–	–	–	–	1	–	–	–	–	–
Clubiona lutescens Westr.	–	–	1	2	2	1	–	1	–	–	–	1	1	1	4	2	1	1
Clubiona subtilis L. Koch	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Micaria pulicaria (Sund.)	3	–	–	–	–	1	–	–	6	–	–	–	–	–	–	–	–	–
Agroecina striata (Kulcz.)	–	15	2	2	–	1	5	–	1	1	9	10	–	24	22	–	–	7

Tabelle 1 (Fortsetzung)

Arten	Nyírestó										Bábtava							
	1	2	3	4	5	6	7	8	9	10	1	2	5	4	5	6	7	8
	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alnetum I.	Dryopteridi – Alnetum II.	Dryopteridi – Alnetum populosum	Calamagrosti – Salieetum cinereae I.	Calamagrosti – Salicetum cinereae II.	Calamagrosti – Salicetum cinereae III.	Scirpo – Phragmitetum urtic. kioviensis	Eriophoro vaginati – Sphagnetum I.	Eriophoro vaginati – Sphagnetum II.	Carici lasiocarpae – Sphagnetum	Dryopteridi – Alnetum populosum I.	Dryopteridi – Alnetum populosum II.	Dryopteridi – Alnetum populosum III.	Calamagrosti – Salicetum cinereae	Scirpo – Phragmitetum urtic. kioviensis
Agroeca brunnea (Blackw.)	–	–	5	–	3	11	–	1	6	1	2	1	1	4	1	–	–	4
Agroeca pullata Thor.	–	–	–	–	–	1	–	–	2	2	–	–	–	–	–	–	–	1
Agroeca proxima (Cambr.)	2	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
Phrurolithus festivus (C. L. Koch)	2	1	6	2	–	2	1	1	5	–	–	–	–	–	–	–	–	2
Phrurolithus szilyi Herm.	–	1	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–
Ctenidae																		
Zora spinimana (Sund.)	5	6	8	1	–	4	1	–	–	2	8	16	1	1	4	1	1	3
Zora pardalis (Sim.)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thomisidae																		
Oxyptila trux (Blackw.)	–	1	1	–	1	1	–	–	–	1	6	–	1	8	6	–	–	1
Oxyptila brevipes (Hahn)	–	–	1	–	–	–	–	1	2	1	–	–	1	–	–	–	1	1
Oxyptila praticola (C. L. Koch)	–	–	2	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxyptila simplex (Camb.)	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
Xysticus cambridgei (Blackw.)	–	–	–	–	–	1	–	–	–	–	–	–	–	4	–	–	–	–
Xysticus sp.	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thanatus vulgaris Sim.	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Salticidae																		
Neon reticulatus (Blackw.)	1	–	–	–	–	–	–	–	1	–	1	1	–	–	–	–	–	–
Neon pictus Kulcz.	2	–	–	–	–	1	–	–	–	–	1	–	–	–	–	2	–	–
Hyctia novoyi (Lucas)	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	1	–

Lycosidae

Hygrolycosa rubrofasciata (Ohlert, 1865)

Aus vielen Teilen Europas bekannt, in ausgesprochen südlichen Teilen Europas kommt sie nicht vor, an den meisten Fundorten wurden nur wenige Exemplare erbeutet. Braun (1976) fasste unlängst die Kenntnisse über die Art zusammen, aus diesen geht hervor, dass sie feuchtigkeitsliebend ist und oft in *Sphagnum*-Moor-Biotopen angetroffen wurde. Über die Phänologie des Tieres gehen die Meinungen auseinander.

Bezüglich der morphologischen Kennzeichen kann sie mit keiner Art verwechselt werden, trotzdem sind sämtliche Angaben eines bisherigen Vorkommens in Ungarn als irrtümlich zu betrachten. Eben deswegen wird sie im XVIII. Band des 3. Heftes auf Seite 8 der Fauna Hungariae in Klammer angeführt. Einzig allein der jetzige Fundort kann als autentisch betrachtet werden. Embolus des Männchens wird auf Abb. 1–2 veranschaulicht. Interessant ist die Vulva

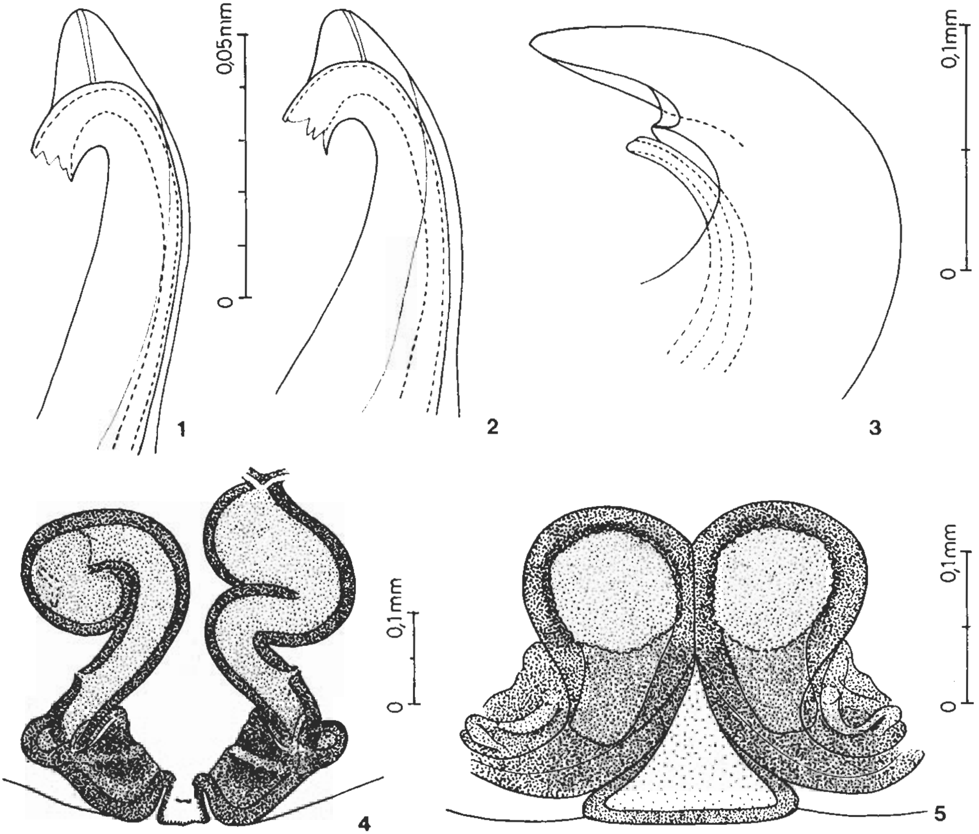


Abb. 1–2 und 4. *Hygrolycosa rubrofasciata* (Ohl.). *1–2:* Embolus des Männchens; *4:* Vulva des Weibchens. – Abb. 3 und 5. *Pirata uliginosus* (Thor.). *3:* Conductor und Embolus des Männchens; *5:* Vulva des Weibchens

der 10 untersuchten Weibchen, da bei allen die Receptaculum zueinander gebogen sind, also asimmetrisch sind (Abb. 4.).

In den Fallen wurden das ganze Jahr hauptsächlich adulte Tiere gefangen. Es scheint als ob die juvenilen Tiere die Fallen meiden würden. Massenhaft traten sie vom Juni bis September auf. In den Fallen vom September bis März konnten nur einige Exemplare nachgewiesen werden, während in denen von März bis Juni wieder mehrere Exemplare erschienen. Meine Funde scheinen die Beobachtungen von WIEBES in Holland zu unterstützen, der folgendes erwähnt ,,Adults in IV. V. and IX., interrupted by winter". In der *Sphagnum*-Vegetation beider Fundorte ist sie eine sehr kennzeichnende, massenhaft vorkommende Art, während sie in anderen Assoziationen nur selten anzutreffen war.

Pirata uliginosus (THORELL, 1865)

Bisher bekannte Verbreitung: Schweden, Dänemark, Deutschland, Tschechoslowakei, Polen, und an einigen Stellen am Balkan. Neu für die Fauna Ungarns.

Die morphologischen Kennzeichen betreffend weicht sie von den Beschreibungen nicht ab. Embolus und Conduktor des Männchens werden auf Abb. 3, die Vulva des Weibchens auf Abb. 5 veranschaulicht.

In der *Sphagnum*-Moorvegetation des untersuchten Gebietes kommt sie massenhaft vor, im Weidenmoor in niederer Individuenzahl, im Erlen, Erlen-Pappel bestand konnte sie auch nachgewiesen werden. Juvenile Tiere wurden in den Fallen nur selten gefangen. Adulte Tiere liessen sich so in den Fallen wie im Gesiebe nur im Sommer erbeuten, vom September bis März waren sie sozusagen verschwunden, d. h. es konnten nur juvenile Tiere gefangen werden. Ebenfalls nach Angaben von BRAUN (1976) wird aufgrund der einschlägigen Literatur *P. uliginosus* als eine stenochrone Art des Sommers betrachtet.

Erigonidae (Micryphantidae)

Anacotyle stativa (E. SIMON, 1881)

Aus mehreren Teilen Europas bekannt, doch überall sehr selten. Neu für die Fauna Ungarns.

Sie wurde in Weidenmoor und Röhricht gesammelt, insgesamt 5 Exemplare in der Sommerperiode.

Glyphesis servulus (E. SIMON, 1884)

Bisher ist diese Art aus Frankreich, aus Holland und aus den Ostalpen gemeldet worden. Sie ist neu für die ungarische Fauna. Obwohl keine Identifikationsschwierigkeiten der angetroffenen Exemplare besteht, werden die wichtigsten morphologischen Merkmale auf Abb. 6–9 und 14–16 veranschaulicht, auch schon deswegen, damit sie mit der neuen *Glyphesis*-Art und deren Abbildungen verglichen werden kann.

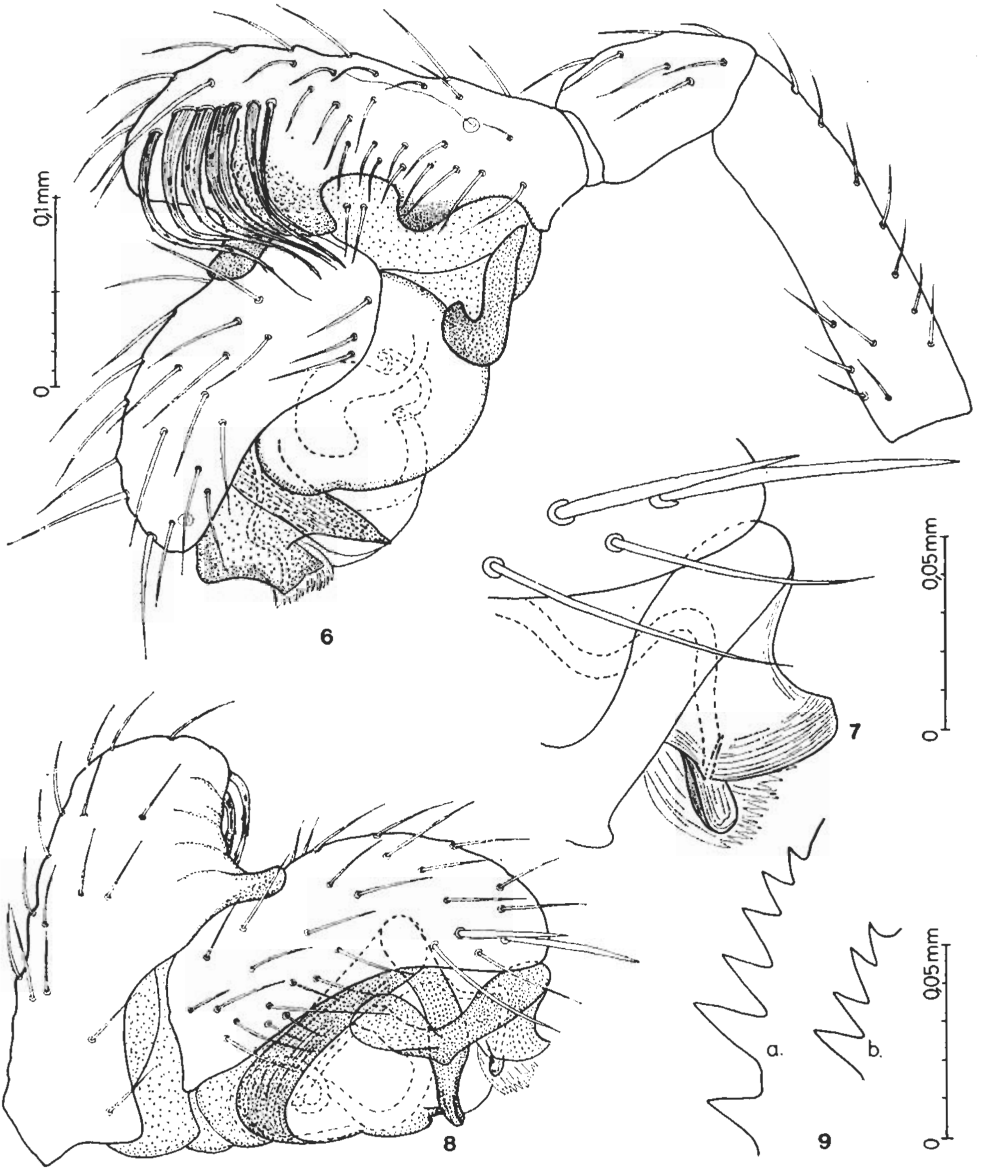


Abb. 6–9. *Glyphesis servulus* (SIM.), Männchen. *6:* Aussenseite des Tasters; *7:* Endabschnitt des Bulbus; *8:* Innenseite des Tasters; *9:* Bezahnung der Cheliceren, *a* = vorderer, *b* = hinterer Klauenfurchenrand

Sie wurde in sämtlichen Assoziationen der Moore angetroffen, aufgrund der Individuenzahlen scheint sie die *Sphagnum*-Vegetationen und das Röhricht zu bevorziehen. Adulte Männchen wurden in den Fallen stets angetroffen, während Weibchen nur in der Zwischenzeit vom März bis Juni. Im Gesiebe wurden adulte Tiere im März, Juni und September erbeutet.

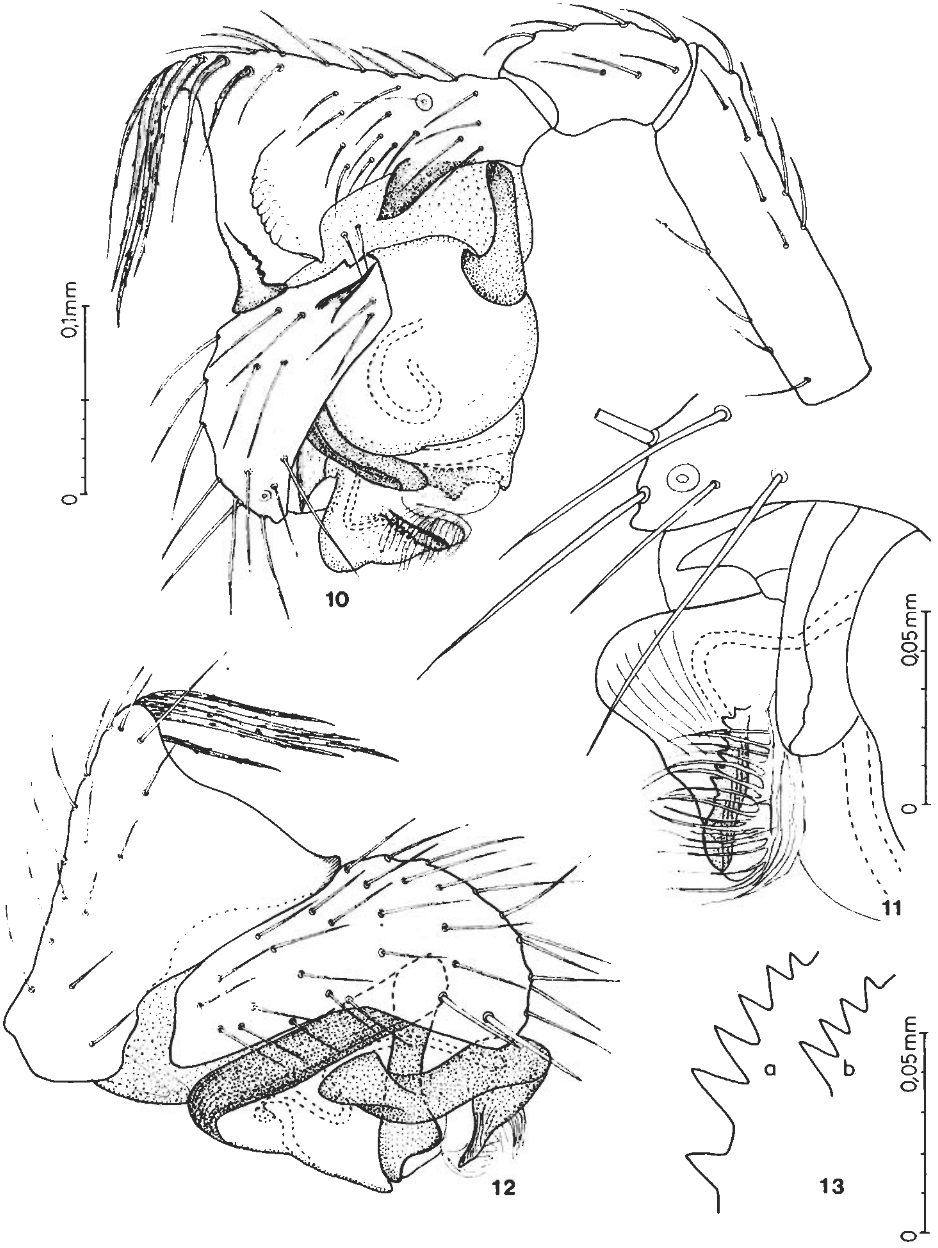
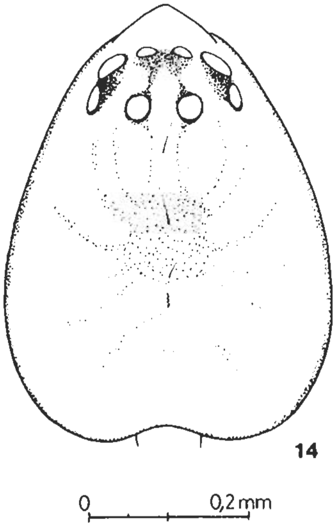
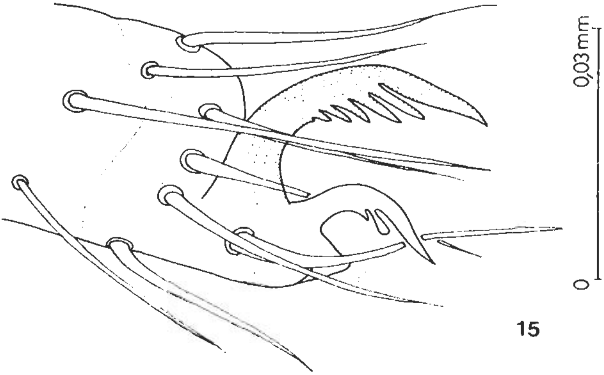


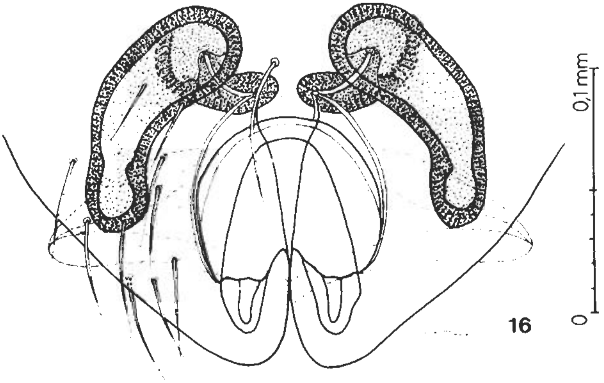
Abb. 10 – 13. *Glyphesis conicus* sp. nov. Männchen. *10:* Aussenseite des Tasters; *11:* Endabschnitt des Bulbus; *12:* Innenseite des Tasters; *13:* Bezahnung der Cheliceren, *a* = vorderer, *b* = hinterer Klauenfurchenrand



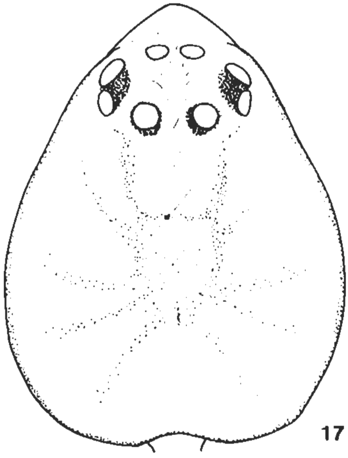
14



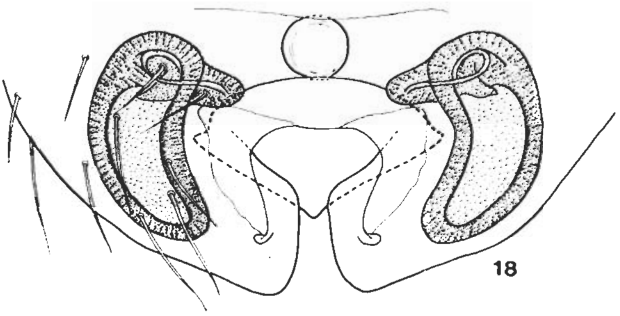
15



16



17



18

Abb. 14 – 16. *Glyphesis servulus* (SIM.). *14:* Cephalothorax des Männchens von oben; *15:* Tarsuskrallen III des Männchens; 16: Vulva des Weibchens. – Abb. 17 – 18. *Glyphesis conicus* sp. nov. *17:* Cephalothorax des Männchens von oben; *18:* Vulva des Weibchens

Glyphesis conicus sp. nov.

Gesamtlänge ♀: 1,1 – 1,2 mm, ♂: 1,0 – 1,1 mm. ♀ Cephalothorax stark gewölbt, graubraun, Rand und Mittelmuster schwarz. Umgebung der Augen schwarz (Abb. 17). Clypeus etwas kürzer als Augenzone. Augenstellung: Hintere Augenreihe stark nach vorne gebogen. Hintere Mittelaugen stehen etwas weiter entfernt voneinander als Augendurchmesser. Entfernung der Seitenaugen von

Mittelaugen entspricht 0,8 Augendurchmesser. Vordere Augenreihe schwach nach hinten gebogen. Vordere Mittelaugen am kleinsten, vordere Seitenaugen am grössten. Entfernung der vorderen Mittelaugen entspricht 0,4 – 0,6 Augendurchmesser.

Sternum so lang wie breit, hinten breit abgeschnitten. IV. Coxa stehen weiter voneinander entfernt als ihre Breite. Sternum braungrau, Rand dunkler. Unterlippe etwas heller als Sternum. Gnathocoxa gelblich. Cheliceren dunkler gelb. Vorderer Klauenfurchenrand mit 6 spitzen Zähnen, der zweite am längsten, hinterer Rand mit 4 Zähnen (Abb. 13).

Beine: 4123, kurz aber kräftig, braun. Femur und Tibia etwas dunkler. Tibia I und II mit zwei kurzen Borsten, nahe dem proximalen und distalen Rand stehend (Borste I: 0,08 – 0,09; Borste II : 0,86 – 0,88); Tibia III und IV mit einer längeren Borste, Stellung auf III : 0,13 – 0,15, auf IV: 0,14 – 0,15. Metatarsus: Becherhaar auf I : 0,37; II: 0,40; III: 0,42. Tarsus: wenig kürzer als Metatarsus; Tarsalorgan auf I : 0,73; II : 0,66, III : 0,45, IV: 0,41.

Abdomen kurz, oval, grauschwarz, Ventralseite etwas heller.

Kontur der Epigyne sowie Vulva wird auf Abb. 18 veranschaulicht.

♂. Taster (Abb. 10 – 12): Patella 1,6 – 1,7 mal so breit wie lang. Tibia 1,8 mal so lang wie Patella. Tibia mit zwei Apophysen, proximale nach vorne gerichtet und spitz, die in der Mitte schwach nach hinten gebogen. Äussert kennzeichnend ist die konusförmige Gestalt der Tibia, auf dem spitz zulaufendem Teil befinden sich 6 gebogene, dicke gefiederte Haare. Cymbium etwas kürzer als Tibia, mit kennzeichnender, nach hinten sich verschmälernder Vertiefung der äusseren Seite. Paracymbium kräftig. Bulbus: Embolus kurz, stumpf, an der Seite mit keinen Zähnen versehen. (Abb. 11). Endteil des Konduktor dreieckförmiges Blatt.

Die neue Art steht eindeutig *G. servulus* (E. SIM) am nächsten, und zwar im allgemeinen Habitus, in der Ausbildung der Vulva und in der Form des Tasters vom Männchen. Auf den ersten Blick unterscheidet sie sich jedoch durch die spitze Form der Tibia, durch den gezähnten Teil des Embolus sowie durch die kürzere und andersartige Epigyne des Weibchens von *G. servulus*.

Sie wurde in den *Sphagnum*-Moor und Erlenbeständen des Nyirestó häufiger angetroffen als im Bábtava. Stadium der Geschlechtsreife stimmt im grossen und ganzen mit der von *G. servulus* überein.

Holotypus (♂) in der Sammlung des Instituts für Tiersystematik der Eötvös-Loránd-Universität, Budapest.

Linyphiidae

Taranucnus setosus (CAMBR.)

Neu für die Fauna Ungarns. Vorkommen in Europa ebenfalls in Torfmoor-Gebieten, an sehr feuchten Orten. In beiden Mooren wurde sie in *Sphagnum*-Moor-Assoziationen angeroffen.

Allomengea warburtoni (CAMBR.)

Neu für die ungarische Fauna. Vorkommen in Europa ähnelt der vorher angeführten Art. Im *Sphagnum*-Moor von Bábtava wurde ein einziges männliches Exemplar erbeutet.

SCHRIFTTUM

1. BONNET, P. (1955–1959): *Bibliographia Araneorum.* – Toulouse, 2:1–5058,

2. BRAUN, M. (1976): *Zur Autökologie und Phänologie einiger für das Rhein-Main-Gebiet und die Rheinpfalz neuer Spinnerarten (Arachnida: Araneida).* – Jb. Nass. Ver. Naturk., 103: 24–68.

3. COOKE, J. A. L. (1962): *The spiders of Colne Point, Essex, with descriptions of two species new to Britain.* – Entomol. Month. Mag., 92 (1961); 21–22.

4. LOKSA, I. (1972) : *Pókok II – Araneae II.* – Magyarország Állatvilága, Fauna Hungariae,18, 3 : 1–112.

5. MILLER, F. (1958): *Prispévek k Poznáni Ceskoslovenskych druhu pavouku rodu Centromerus Dahl.* – Cas. Cesk. Spol. Entom., 55, 1 : 71–91.

6. SIMON, T. (1960): *Die Vegetation der Moore in den Naturschutzgebieten des Nördlichen Alföld.* – Acta Bot. Ac. Sci. Hung., 6 : 107–137.

7. TRETZEL, E. (1954): *Reife- und Fortpflanzungzeit der Spinnen.* – Z. Morph. Ökol. Tiere, 42 : 634–691.

8. WIEBES, J. T. (1959): *The Lycosidae and Pisauridae (Araneae) of the Netherlands.* – Zool. Verhandel. Leiden, 42 : 1–78.

9. WIEBES, J. T. (1962): *Spinachtigen – Arachnoidea. II. Nederlandse Wolfspinnen-Lycosidae en Pisauridae.* – Wetensch. Mededel. Kom. Nederl. Naturhist. Ver., 41 : 1–12.

10. WIEBES, J. T. (1964): *Nieuwe gegevens over Nederlandse wolfspinnen (Araneae, Lycosidae).* – Entomol. Ber., 24 : 97–99.

11. WIEHLE, H. (1956): *Spinnentiere oder Arachnoidea (Araneae), 28. Familie: Linyphiidae-Baldachinspinnen.* – In: Dahl, F.: Die Tierwelt Deutschlands, 44 : 1–337.

12. WIEHLE, H. (1960) : *Spinnentiere oder Arachnoidea (Araneae), XI. Micryphantidae-Zwergspinnen.* – In: Dahl, F.: Die Tierwelt Deutschlands, 47 : 1–620.

Opusc. Zool. Budapest, XVII – XVIII, 1981

A Systematic, Ecological, Zoogeographical and Biometrical Study of the Scorpions of the Peloponnesus

By

K. MICHAILS and M. KATTOULAS*

Abstract. In this paper Peloponnesus scorpions are studied from a systematical, ecological zoogeographical and biometrical point of view. The species established to exist in the area under investigation are *Mesobuthus gibbosus, Euscorpius carpathicus, Euscorpius (Euscorpius) mesotrichus* and *Euscorpius italicus.*

Measurements made on 35 individuals of the *Mesobuthus gibbosus* species, collected at random, have shown their average length in mm of *a)* the cephalothorax to be; 22,34 ± I. 32, *b)* the cauda without telson; 26,50 ± I,69, *c)* the vesicle and the aculeus; 6,60 ± 0,40, and *d)* the body as a whole: 55,60 ± 3,32. All of which amount to a probability of 95%.

An application of criterion t in the number of the teeth, in combs of the species in question, in the case of specimen size $n_1 = 42$ and $n_2 = 28$ has shown that the difference at a probability of 95% is statistically significant.

In both female and male individuals of *Euscorpius (Euscorpius) mesotrichus* from two different localities the number of trichobothria on the padipalp tibia is 10 to 12. An application of criterion t on specimen size of $n_1 = 32$ and $n_2 = 18$ has shown that at a probability of 95% the difference is statistically insignificant.

Introduction

The Peloponnesus is the largest peninsula of Greece. It is situated at the southernmost end of both this country and the European Continent. It has an area 21,439 sq. kilometres and consits of a primarily mountainous country with few exceptions. The Peloponnesian scorpion fauna cannot be said to consist of a wealth of species. In spite of the fact that we took care to collect our specimens at different times of the year and from many different stations, when systematically processed, the material collected was found to belong to two families only; to Buthidae and the Chactidae.

The scorpions of various parts of Greece have at times been studied by researschers as A. BIRULA (1903), F. WERNER (1928), J. GRUBER (1963), R. KINZELBACH (1975) and D. VOULALAS & K. MICHALIS (1977).

---

* *Dr. K. B. Michalis* and Professor *Dr. M. E. Kattoulas*, Laboratory of Zoology, University of Thessaloniki, Greece.

Material and methods

Our material was collected during the months of March, May, June, July and November of the years 1974 to 1976, the specimens being placed at all times within receptacles containing a 70% proof solution of methyl alcohol.

The systematic and statistic processing of the said specimens tooke place in the Laboratory with the help of a Baus and Lob stereoscope.

The main characteristics taken into consideration in the classification of the material collected were; Form of the sternum, number of keels on the caudal segments, arrangement of keels on the cephalothorax, number and arrangement of granules on the movable finger of the pedipalp, proximal tooth, leg spines, number of lateral eyes and shape of the median lemallae on the combs.

Family: Buthidae SIMSON, 1879

Mesobuthus gibbosus (BRULLÉ, 1832)

Synonyms: *Buthus gibbosus* BRULLÉ: Werner, S. B. Ak., Wiss., Wien, 137, 1928; 294 – *Buthus gibbosus* BRULLÉ, 1832; Gruber, Ann., Nat., Mus., Wien, 66, 1963; 307. – KINZELBACH (1975) mentions, among others, the following synonyms: *Androctonus peloponnensis* C. L. KOCH 1836; Arachn., 3 : 34. – *Androctonus stenelus* C. L. KOCH 1841; Arachn., 8: 23.

It is a nocturnal and siccophile animal. During the day it is unsually found under rocks, dry leaves, bales of various kinds of dry grass or straw, etc. in costal regions with low vegetation. The species may also be encountered among the ruins of old houses, storehouses, stables, ect.

It has been recorded in Yugoslavia, Albania, European Turkey, Asia Minor, Bulgaria and elsewhere. In Greece it is widely distributed over both the mainland and the islands of the country.

Distribution in the Peloponnesus; Nafplion (N_1), 15 June 1975: 4♀ and 3♂. Aghios Eleftherios Nafplion (N_2), 20 June 1975: 4♀ and 3♂. Zidaeika, Nafplion (N_3), 5 May 1975: 4♀ and 6♂. Zidaeika Nafplion (N_4), 6 May 1975: 4♀ and 7♂. Areopolis, Lakonia (A_1), 11 October 1976; 2♀ and 3♂.

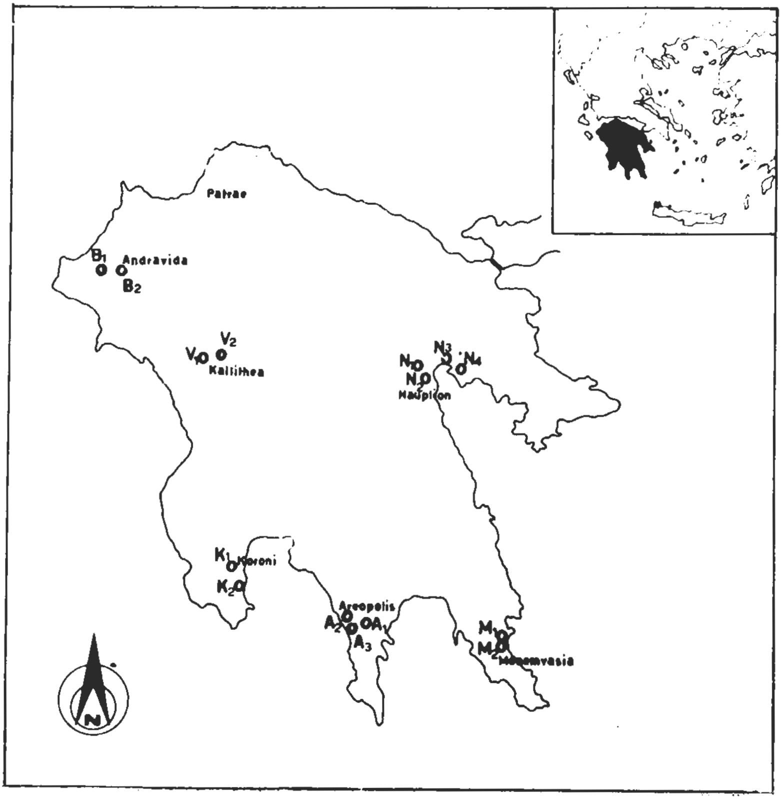
Measurements made on 35 individuals of the species have whown the average length in mm of *a)* the caphalothorax to be 22,34 ± 1,32, *b)* the cauda without the aculeus: 26,50 ± 1,69, *c)* the vesicle with the aculeus; 6,60 ± 0,44 and *d)* the body as a whole; 55,60 ± 3,32. All of the above average lengths are analogous to a probability of 95%.

We have noticed that the range fluctuation number of the teeth on the combs was not constant in the various specimens at our disposal but varied from 21 to 23 in the females and from 27 to 30 in the males. An application of criterion t to specimen size $n_1 = 42$ and $n_2 = 28$ to the number of teeth shows that the difference at a probability of 95% is statistically significant.

Family: Chactidae POCOCK, 1839

Euscorpius carpathicus (LINNAEUS, 1767)

Synonyms: *Scorpio carpathicus* R. CALINESCU & Her. CALINESCU 1930; Bull., de la Scien, XII, 59 – 70. – KINZELBACH (1975) also mentions the following synonyms: *Scorpio carpathicus* LINNAEUS, 1767; System., Nat., 12 ed Holmiae, I, (2); 1038. – *Euscorpius ciliciensis* BIRULA 1828; Horae, Soc.,



Ent., Ross., 33, 136. – *Euscorpius koscheuwnikowi* Birula 1900: Jzw., Obsel., Gest., Mosk., 28, 8 – 20. – *Euscorpius candiota* Birula 1903; Ann., Mus., Zool., St., Peters., 1903; 298.

Similarly to *Mesobuthus gibbosus* it is nocturnal but not so siccophile. Individuals of the species have also been found in humid environments. Specimens have been collected in dark underground parts of houses and storehouses as well as under houses, etc.

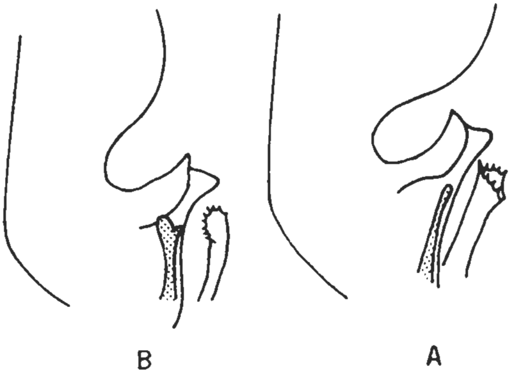
Its distribution begins in N. Africa, crosses over into Spain and proceeds through S. France, Sardinia, Corsica, Italy, the Eastern Alps, the S. Carpathian Mountains, the Balcan Peninsula and Asia Minor to terminate in the Caucasus (Kaestner, 1957).

In Greece it has been mentioned by various writers such as Werner (1928) Birula (1903) in Crete, and Curcic (1972) in Corfu, Zante and Antiparos.

Distribution in the Peloponnesus: Corone, Messinia (K_1), 20 March 1976: 9♀ and 2♂. Areopolis, Lakonia (A_2), 19 November 1975: 3♂.

Euscorpius (Euscorpius) mesotrichus (Hatji, 1929)

Synonyms: *Euscorpius italicus mesotrichus* Curcic: Zool., Rav., Prizot., Mat., Fac., Beograd, 35, 1971: 92 – 102. – Among other synonymous to the species Kinzelbach (1975) mentions: *Euscorpius tergestinus* C. L. Koch 1836; Arachn., 3, 106, 247 – 248. – *Euscorpius carpathicus polytrichus* Hadji, 1929; Loc., Cit., 37.



HADJI (1929, 1931), based on the number of trichobothria especially on the pedipalp tibia ventral surface, considers *Euscorpius (Euscorpius) mesotrichus* as subspecies of *Euscorpius carpathicus*. KINZELBACH (1975) disagrees, and considers it a species in itself.

We also are of the opinion that this is indeed a case of a separate species. The facts that have led us to the formation of this opinion are: *a)* morphological, as the size of the specimens under investigation is greater than that of *Euscorpius carpathicus*, the colour ranges from yellow to brown, the dorsal part of the body is darker than the ventral one, the tergal keel is sharp and often horny, the number of their trichobothria is greater (10 to 12) and they differ anatomically in their organs of reproduction (Fig. 2; *b)* ecological, since *Euscorpius (Euscorpius) mesotrichus* has not been found together with *Euscorpius carpathicus*. The former is usually found in shady woods of any kind of trees (except pine trees). This is not true of *Euscorpius carpathicus* which is encountered at elevations of 30 to 1500 m. above sea level.

It has been found on the Balearic Islands, Corsica, Elba, Sardinia, parts of S. E. Italy, Dalmatia and the Balkan Peninsula, the southernmost end of its zone of occurrence being Peloponnesus and the easternmost one Turkey.

Distribution in the Peloponnesus: Areopolis, Lakonia (A_3), 19 November 1976: 4♀ and 4♂. Areopolis Lakonia (A_4), 21 November 1976: 4♀ and 4♂. Monemvasia area (M_1), 16 August 1976: 5♀ and 4♂.

The range of fluctuation of the number of trichobothria on the pedipalp tibia of female and male individuals from two different areas, namely Areopolis and Monemvasia, is 10 to 12. The application of criterion t to a specimen size of $n_1 = 32$ and $n_2 = 18$ has shown that the difference in respect of this characteristic between the individuals of the two areas mentioned above, at a probability of 95% is statistically insignificant.

Euscorpius italicus (HERBST, 1800)

Synonyms: *Euscorpius (Polytrichus) italicus* A. BYALYNITSKII-BIRULA; Scorpions 1917, 65. – *Euscorpius (Polytrichus) italicus* VACHON, Toxicon 1966 (4); 214. – *Euscorpius italicus* (HERBST) D. M. CURCIC: Rapp., Comm., Int., Mep., Med., 1972, 21, 3, 83. – *Euscorpius italicus* VACHON,Études sur les Scorpions. Inst., Past., D'Alger, 1952; 418. – Among other synonyms KINZELBACH (1975) mentions: *Scorpio naupliensis* C. L. KOCH, 1836; Arachn., 3: 93. *Euscorpius italicus zakinthii* DI CAPORIACCO: Atti, R., Acad., Naz., Cinc., Mem., Cl., Biol., 2, (8), (3–4): 172.

It is species rarely to be encountered among the Greek fauna. It has been found in various places of Peloponnesus by HADJI (1929) and DI CAPORIACCO (1950) but has not been reported as existing in any other part of Greece by anybody.

It is the largest scorpion of the Chactidae family. HADJI (1929), based on the number of trichobothria on the pedipalp tibia, considers *Euscorpius italicus* as subspecies. He divides the species into the following three subspecies: *Euscorpius (Mesotrichus) italicus*, *Euscorpius (Polytrichus) italicus* and *Euscorpius (Oligotrichus) italicus*. DI CAPORIACCO (1950) disagrees. He divided the genus into three groups instead of subspecies. KINZELBACH (1975) disagrees with the views of both of the said researchers. He finds that the type of *Polytrichus* found in Peloponnesus is undoubtedly a deviation.

In our opinion, the number of trichobothria on the pedipalp tibia surface alone is not a sufficiently important criterion to serve as the base of a division of the species into subspecies, and anyway, in both of the areas where the species in question was collected and which are considerably distant from each other, we notice that the number of trichobothria ranges 10 to 12.

Its habitat is primarily mountainous regions with high humidity. Contrary to the *Mesobuthus gibbosus* which is a siccophile animal, *Euscorpius italicus* prefers humidity. It is encountered mostly along coasts of low altitude. In other words, the species lives in a humid and warm climate.

Regarding the geographical distribution of this species, BIRULA (1917) reports that it occupies a narrow zone beginning in S. Transcaucasia, proceeds along the North coast of Asia Minor and more extensively in zones of the Balkan and Italian peninsulas. Specifically, the existence of this species is reported on the coast of Asia Minor, the Black Sea, S. Hungary, North Italy (Tyrol), S. Italy (Calabria) and Peloponnesus.

Distribution in the Peloponnesus: Callithea, Eleias (V$_2$), 20 July 1974: 5♀ and 3♂. Callithea, Eleias (V$_1$), 21 July 1974: 5♀ and 2♂. Andravida, Eleias (B$_1$), 22 July 1974: 3♀ and 2♂. Andravida,

REFERENCES

1. BLACKWELDER, R. (1967): *Taxonomy.* – New York – London – Sidney.

2. VOULALAS, D. & MICHALIS, K. (1977): *The scorpions of Lesvos.* – Sci. Ann. Fac. Phys. Mathem. Univ. Thessaloniki, 17: 131 – 139.

3. BYALYNITSKII-BIRULYA, A. A. (1917): *Scorpions.* – An. Cauc. Mus. Ser., 3: 1 – 170.

4. BOTT, R. (1951): *Beobachtungen am südosteuropäischen Skorpion (Euscorpius italicus).* – Nat. Mus. Fors. Inst. Sen. Frank am Main: 290 – 293.

5. CALINESCU, R. & CALINESCU, Her. (1930): *Systematisch-zoogeographische Beiträge zur Kenntnis der Skorpione Rumäniens.* – A. R. Bull. Sect. Sci., 12: 59 – 70.

6. CURCIC, B. (1971): *The new finding places of scorpions in Yugoslavia.* – Zool. Rav. Prir-mat. Fac. Beograd, 35: 92 – 102.

7. CURCIC, B. (1972): *Consideration upon the geographic distribution and origin of some populations in the genus Euscorpius Thorell (Chactidae, Scorpiones).* – Rapp. Comm. Int. Mer. Medit., 21: 83 – 88.

8. GOFAS, A. (1973): *Applied mathematical statistics.* – Thessaloniki.

9. GRUBER, J. (1963): *Ergebnisse der von Dr. O. Paget und Dr. E. Kritcher auf Rhodos durchgeführten zoologischen Exkursionen.* – Ann. Nat. Mus. Wien, 66: 307 – 316.

10. KAESTNER, A. (1957): *Lehrbuch der speziellen Zoologie.* Teil I. Wirbellose, 3. Lieferung.

11. KAESTNER, A. (1965): *Die Tierwelt Mitteleuropas.* Band 3, Lieferung 1.

12. KINZELBACH, R. (1975): *Die Skorpione der Aegäis, Beiträge zur Systematik, Phylogenie und Biogeographie.* – Zool. Jahrb. Syst., 102: 12 – 59.

13. KRAEPELIN, K. (1905): *Die geographische Verbreitung der Skorpione.* – Zool. Jahrh. Syst., 22: 321 – 364.

14. MARCUZZI, G., FACCHIN FABRIS, F. & RIGATTI-LUCHINI, M. (1956): *Osservazioni sulla variabilita delle populazioni pugliesi dell' Euscorpius carpathicus L.* – Ist. Zool. Univ. Padova, 6: 81 – 89.

15. SIMPSON, G., ROE, A. & LEWONTIN, R. (1960): *Quantitative zoology.* – New York – Chicago – San Francisco.

16. SOKAL, R. & ROHLKF, J. (1969): *Biometry.* – San Francisco.

17. STAHNKE, H. (1970): *Scorpion nomenclature and mensuration.* – Ent. News, 81: 297 – 316.

18. STAHNKE, H. (1972): *A key to the genera of Buthidae (Scorpionidae).* – Ent. News, 83: 121 – 133.

19. TOLUNAY, A. (1959): *Zur Verbreitung der Skorpione in der Türkei.* – Zool. Inst. Univ. Ankara: 366 – 370.

20. VACHON, M. (1940): *Sur la systématique des scorpions.* – Mem. Mus. Nat. Hist. Nat., 13: 241 – 260.

21. VACHON, M. (1952): *Étude sur les scorpions.* – Inst. Past. Algerie: 1 – 482.

22. WERNER, F. (1928): *Scorpiones.* In: Beiträge zur Kenntnis der Fauna Griechenlands, namentlich Aegäischen Inseln. – S. B. Akad. Wiss. Wien, 137: 294 – 295.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Veränderungen chemischer Komponente der Laubstreu bei Regenwurmtätigkeit

Von

M. Pobozsny[*]

Abstract. In this study the author discusses the chemical changes in the hornbeam litter caused by the activity of five earthworm species *(Lumbricus polyphemus, Dendrobaena platyura platyura, Dendrobaena platyura depressa, Dendrobaena platyura montana, Lumbricus terrestris)* under laboratory conditions (cave laboratory, temperature: 10 °C, relative air humidity: 100%). In the litter leaves drawn into the earthworm burrows, the mineralisation- and humification processes are more intensive than in the control experiments. This fact can be established from the changes of the total organic matter- and nitrogen content, of the stability coefficient characteristic of humification and of the composition of organic matter in the leaves (fat- and tannin-agent-, sugar- and starch-, hemicellulose- and pectin-, cellulose-, lignin- and protein content). The changes can be attributed not only to a more intensive microbial activity in the earthworm cast and in its environment, but to the earthworm secretion, too. The most rapid transformations were registered at the activity of the cosmopolitan species *Lumbricus terrestris.*

Die Bedeutung der Bodentiere an Zersetzungsprozessen der Laubstreu wurde eingehend und vielseitig untersucht. Die Ergebnisse weisen einerseits auf die Bedeutung des zoogenen Faktors bei der mechanischen Zerkleinerung pflanzlicher Substanzen, bzw. Laubstreu, anderseits auf die Vermischung dieser mit den Mineralteilen des Bodens hin, wobei komplexe organo-mineralische Verbindungen entstehen.

Die hinsichtlich der Streuzersetzung in zwei Hainbuchen-Eichenwäldern Ungarns durchgeführten Untersuchungen (Zicsi, 1978) erwiesen, dass in Gegenwart von grosskörprigen Regenwurmarten *(Lumbricus polyphemus* Fitz., 1833, *Dendrobaena platyura platyura* (Fitz., 1833) und *D. p. depressa* (Rosa, 1893) die Zersetzungsprozesse eindeutig von diesen Arten gesteuert wird.

Die Regenwürmer beteiligen sich verschiedenartig an diesen Prozessen. Während der Darmpassage beschleunigen sie in erster Linie durch ihre Enzyme die Zersetzung gewisser organischer Komponente der Streu. So wurden z. B. eiweisszersetzende – stärke- und zuckerfermentierende – fettzersetzende Enzyme, Zellulase und Chitinase nachgewiesen (Parle, 1963 a, b; Nielsen, 1963; Stephenson, 1930; Tracey, 1951). Anderseits beschleunigen die mit den Regenwürmern in Symbiose lebenden Mikroorganismen ebenfalls die Zersetzungs-

---

[*] *Mária Pobozsny*, ELTE Állatrendszertani és Ökológiai Tanszék (Lehrstuhl für Tiersystematik und Ökologie der Eötvös-Loránd-Universität), 1088 Budapest, VIII. Puskin u. 3.

prozesse ausschlaggebend, da diese im Darm günstige Lebensbedingungen finden, die auch in den Exkrementen noch weiter bestehen bleiben (KOZLOVSKAJA, 1967). An den Mündungen der Regenwurmgänge, die mit Losungen dieser Tiere ausgestattet sind, wird die herangezogene Streu mit Regenwurmschleim überzogen wobei sich kleine „Mikrohabitate" (ZICSI, POBOZSNY & SZLÁVECZ, 1978) bilden, die nicht nur den Mikroorganismen, sondern auch anderen Elementen der Meso- und Makrofauna günstige Lebensbedingungen bieten (KOZLOVSKAJA, 1976; DÓZSA-FARKAS, 1978; LOKSA, 1978; BAYOUMI, 1978).

Die Zielsetzung der Untersuchungen, die unter Laborverhältnissen durchgeführt wurden, war festzustellen, ob sich intensivere chemische Zersetzungsprozesse der Laubstreu in Gegenwart der grosskörprigen Regenwurmarten vollziehen, welchen Ausmass diese Veränderungen aufweisen und welche artspezifische Unterschiede bestehen.

Untersuchungsmethoden

Zu den Untersuchungen wurde das Material der Fütterungsversuche mit Hainbuchenlaub *(Carpinus betulus)* verwandt (ZICSI & POBOZSNY, 1977). Die Fütterungsversuche wurden im Höhlenbiologischen Laboratorium der Baradla-Höhle in Aggtelek mit 5 Lumbriciden-Arten *(Dendrobaena platyura platyura, D. p. depressa, D. p. montana, Lumbricus polyphemus, L. terrestris)* durchgeführt, wobei im November, Januar, März, und Mai gesammeltes Laub zum Konsum den Tieren angeboten wurde.

Zu den chemischen Analysen wurden folgende Proben genommen: Laub vor den Fütterungsversuchen; Laub aus den Fütterungsversuchen nach einem, bzw. zwei Monaten; Laub aus den Kontroll-Gefässen nach einem, bzw. zwei Monaten.

Die chemischen Analysen erstreckten sich auf die Bestimmung der Gesamtorganischensubstanz, auf den Gesamtstickstoff und auf die Berechnung des Stabilitätskoeffizientes nach HARGITAI (1955). Mit Hilfe der „Streustoffgruppenanalyse" (SCHLICHTING & BLUME, 1966) wurde versucht, die quantitativen Veränderungen der organischen Komponente zu bestimmen, um dadurch den Verlauf der Zersetzung in der Streu zu verfolgen.

Chemisch wurde nur das Fallaub der Monate November und Januar analysiert, da die Zersetzungsprozesse eben in dieser Zeitspanne, also von November bis Januar am intensivesten sind (WITKAMP & VAN DER DRIFT, 1961). Dies geht auch unseren Versuchen eindeutig hervor. In Tabelle 1 wird der Gewichtsverlust der Kontroll-Laubproben verschiedener Monate zusammengefasst.

Wie aus Tabelle 1 ersichtlich, zeigt der Gewichtsverlust der Monate März und Mai nahezu gleiche Werte, beide sind kleiner als die des Monats Januar.

Tabelle 1. Gewichtsverlust der Kontroll-Laubproben nach einmonatiger Versuchszeit

Monat	Gewichtsverlust in % des Ausgangsgewichtes der Laubstreu
November	9,2
Januar	16,3
März	15,8
Mai	15,5

Untersuchungsergebnisse

Die Ergebnisse der chemischen Analysen der Hainbuchenstreu des Monats November werden z. T in Tabelle 2, die des Monats Januar in Tabelle 3 zusammengefasst.

Tabelle 2. Chemische Veränderungen des Hainbuchenlaubes in den Versuchen des Monats November

Versuche	Gesamtorg. Substanz %	Gesamtstickstoff %	K · 10^3
Kontroll			
Vor den Versuchen	92 72	1,92	3,18
nach 1 Monat	88,43	2,49	3,28
nach 2 Monaten	85,63	4,02	2,53
Lumbricidae			
D.p. platyura			
nach 2 Monaten	77,07	4,92	5,17
D.p. depressa			
nach 2 Monaten	77,80	4,75	6,66
D.p. montana			
nach 2 Monaten	71,09	4,80	9,81
L. polyphemus			
nach 2 Monaten	62,98	4,16	10,03
L. terrestris			
nach 1 Monat	66,44	4,21	15,19

Tabelle 3. Chemische Veränderungen des Hainbuchenlaubes in den Versuchen des Monats Januar

Versuche	Gesamtorg. Substanz %	Gesamtstickstoff %	K · 10^3
Kontroll			
Vor den Versuchen	90,56	2,42	3,36
nach 1 Monat	87,18	2,88	4,30
nach 2 Monaten	86,73	2,80	4,53
Lumbricidae			
D.p. platyura			
nach 1 Monat	74,30	4,87	7,31
nach 2 Monaten	61,91	1,65	9,15
D.p. depressa			
nach 1 Monat	73,65	2,07	4,98
D.p. montana			
nach 1 Monat	76,17	1,80	5,83
nach 2 Monaten	67,24	1,69	6,13
L. polyphemus			
nach 1 Monat	74,28	1,78	5,78
L. terrestris			
nach 1 Monat	73,40	4,09	9,99
nach 2 Monaten	64,99	1,56	11,14

Wie aus den Angaben der Tabelle hervorgeht, sind die Zersetzungsvorgänge des organischen Materials in den Versuchen mit Regenwürmern bedeutend intensiver als in der Kontrollversuchen (Verminderung der Gesamtorganischensubstanz). Besonders augenfällig ist die Tätigkeit von *L. terrestris,* hier weisen die Blätter aus dem November nach einem Monat einen Zersetzungszustand auf wie bei den übrigen Lumbriciden-Arten erst nach zwei Monaten. Wahrscheinlich hängt dies – wie dies in den Versuchen beobachtet werden konnte – mit der intensiveren Schleimabsonderung dieser Art zusammen. Der Schleim enthält offensichtlich solche chemische Eigenschaften, die sich fördernd auf die Zersetzung der Laubstreu ausüben. Bei den Versuchen mit Fallaub aus dem Monat Januar waren die Unterschiede bereits nicht so ausgeprägt.

Mit der Mineralisation der Laubstreu parallel verlaufen auch gewisse Humifikationsprozesse, die sich gewissermassen in den veränderten Werten der Stabilitätskoeffiziente widerspiegeln. Der K-Wert ist in allen Fällen höher, und zwar bedeutend höher in den Versuchen mit Regenwürmern (1,5 – 4,8-mal so hoch wie der Anfangswert), in den Kontrollversuchen ungefähr 1,3 mal so hoch wie am Anfang des Versuches. Die verschiedenen organischen Komponente und deren Verhältnis in der Laubstreu kann mit Hilfe der Streustoffanalyse verfolgt werden (Tabelle 4. und 5). Bei allen Regenwurmarten ist die Menge des Fettes und der Gerbstoffe gesunken, insbesondere bei den beiden *Lumbricus*-Arten ist dies augenfällig, wo die Werte um 44 – 46% gegenüber dem Ausgangsmaterial gefallen sind. Bei den *Dendrobaena*-Arten konnte nur bei *D. p. depressa* ein niederer Wert errechnet werden und dieser auch nur im Monat Januar. Während die Menge des Zuckers, der Stärke und des Eiwesses in den Versuchen des Novembers gestiegen ist, ist sie in den Versuchen der Laubstreu vom Januar stark gesunken.

Tabelle 4. Veränderungen im Verhältnis der chemischen Komponente des Hainbuchenlaubes vom November in den Kontrollversuchen bzw. in den Blättern der Regenwurmröhren bei den verschiedenen Arten

Versuche	Fette u. Gerbstoffe	Zucker u. Stärke	Hemi-zellulose u. Pektin	Zellulose	Lignin	Eiweiss
	in % der gesamtorganischen Substanz					
Kontroll						
vor den Versuchen	8,8	0,4	13,2	12,2	57,0	7,8
nach 1 Monat	9,3	2,5	12,4	10,5	50,6	10,9
nach 2 Monaten	6,8	1,4	12,7	12,7	40,6	24,6
Lumbricidae						
D. p. platyura						
nach 2 Monaten	6,5	1,1	13,0	6,8	43,3	29,3
D. p. depressa						
nach 2 Monaten	7,3	1,3	9,4	9,3	46,7	26,0
D. p. montana						
nach 2 Monaten	8,0	0,6	6,4	9,7	54,6	20,6
L. polyphemus						
nach 2 Monaten	5,8	1,2	11,2	10,6	52,1	19,0
L. terrestris						
nach 1 Monat	5,8	1,1	13,2	9,1	50,5	20,0

Tabelle 5. Veränderungen im Verhältnis der chemischen Komponente des Hainbuchenlaubes vom Januar in den Kontrollversuchen bzw. in den Blättern der Regenwurmröhren bei den verschiedenen Arten

Versuche	Fette u. Gerbstoffe	Zucker u. Stärke	Hemizellulose u. Pektin	Zellulose	Lignin	Eiweiss
	in % der gesamtorganischen Substanz					
Kontroll						
vor den Versuchen	7,4	1,6	5,2	5,4	68,2	11,0
nach 1 Monat	6,7	2,4	9,3	8,9	63,3	9,1
nach 2 Monaten	6,0	2,0	6,6	13,9	61,2	8,7
Lumbricidae						
D. p. platyura						
nach 1 Monat	6,7	0,6	12,3	5,4	51,7	21,3
nach 2 Monaten	4,8	0,5	11,8	11,9	64,7	6,0
D. p. depressa						
nach 1 Monat	1,7	0,4	9,5	12,9	70,2	3,1
D. p. montana						
nach 1 Monat	6,8	0,8	10,1	12,2	65,7	2,7
nach 2 Monaten	7,0	0,6	12,0	21,2	55,9	3,1
L. polyphemus						
nach 1 Monat	5,9	0,7	11,3	14,3	61,9	5,0
L. terrestris						
nach 1 Monat	4,0	4,7	11,1	5,7	57,3	15,0
nach 2 Monaten	4,7	4,0	7,4	6,7	66,2	5,5

Entgegengesetzt gestaltete sich das Mengenverhältnis der Zellulose und Hemizellulose in den beiden Monaten: im November ist die Menge dieser Komponente gefallen, im Januar gestiegen. Zugleich ist der Ligningehalt in allen Versuchen bedeutend gesunken, obwohl dies der sich am schwersten zersetzliche Komponent ist.

Wertung der Ergebnisse

Bei der Wertung der Ergebnisse muss berücksichtigt werden, dass die Verhältnisse im höhlenbiologischen Laboratorium (Temperaturen ständig 10 ± 1 °C, relative Luftfeuchtigkeit 99%) optimal ebenso für die Regenwurmtätigkeit, wie für die mikrobiellen Abbauprozesse waren. Die günstigen Voraussetzungen der Umgebungsfaktoren können auch durch die Ergebnisse unserer Freilandsuntersuchungen unterstützt werden (ZICSI, POBOZSNY & SZLÁVECZ, 1978). Ein Vergleich der chemischen Zusammensetzung der in den Jahren 1975/76 gesammelten Laubstreu (Tabelle 6) mit denen der Werte des Kontrollversuches aus Tabelle 2–5 zeigt darauf hin, dass die chemische Zusammensetzung der in den Jahren 1975/76 gesammelten Laubstreu – in der gleichen Zeitspanne, wo im Freien minimale Niederschlagswerte und verhältnismässig viele Frosttage ohne Schnee vorherrschten – zwischen November und Mai keine wesentlichen Veränderunge aufweist. In den Kontroll-Versuchen zeigen sich hingegen nach einem Monat bzw. zwei Monaten schon bedeutende Unterschiede in der chemischen Zusammensetzung der Laubstreu.

Tabelle 6. Veränderungen der chemischen Komponente in der Laubstreu und in den Blättern der Regenwurmröhren vom November 1975 bis Mai 1976 (Zicsi – Pobozsny – Szlávecz, 1978)

	Gesamtorganische Substanz in %		Gesamtstickstoff in %	
	Laub aus der Streuschicht	Laub aus Regenwurmröhren	Laub aus der Streuschicht	Laub aus Regenwurmröhren
1975				
November	92,17	71,98	1,38	1,31
Dezember	92,01	72,04	1,39	1,49
1976				
Februar	91,70	81,38	1,49	1,56
März	90,17	71,28	1,53	1,59
April	89,59	–	1,51	–
Mai	89,06	74,74	1,78	1,81

Im Freien weisen die aus Regenwurmröhren entfernten Blätter in ihrer chemischen Zusammensetzung – gegenüber den aus der Streuschicht gesammelten Blättern – gewisse Unterschiede auf, doch sind diese weitaus nicht so gross, wie die aus den Laborversuchen mit Regenwürmern- und Kontrollversuchen stammenden. Dies zeugt gleichzeitig auch davon, dass nicht nur die günstigen mikroklimatischen Verhältnisse der herangezogenen Blattsubstanz (vor allem die günstigeren Feuchtigkeitsverhältnisse) die Abbauprozesse beschleunigen, sondern auch die direkte Regenwurmtätigkeit, in Form von Schleimabsonderung.

Ob artspezifische Unterschiede die Zersetzungsprozesse der Laubstreu beeinflussen, kann eindeutig nicht beantwortet werden. Es kann eventuell der beschleunigende Einfluss beim Abbau von Fetten und Gerbstoffen bei den 2 *Lumbricus*-Arten hervorgehoben werden. Ebenfalls bei diesen zwei Arten liess sich im frisch gefallenen Laub vom November eine wesentliche Veränderungen der Gesamtorganischensubstanz nachweisen. Offensichtlich stehen auch die hohen Konsumwerte vom Hainbuchenlaub im November bei diesen beiden Arten damit im Zusammenhang (Zicsi & Pobozsny, 1977). Unbedingt muss ferner noch berücksichtigt werden, dass diese Regenwurmarten vorwieglich die Weichteile der Blätter verzehren, die Blattadern und Stiele, die in ihrer chemischen Zusammensetzung abweichen, die Ergebnisse der chemischen Analysen ungünstig beeinflussen.

Zusammenfassend kann ausgesagt werden, dass die grosskörprigen, laubzersetzenden Lumbricidenarten die Abbauprozesse der Laubstreu wesentlich beeinflussen, und zwar beschleunigen sie die Zersetzungsprozesse in den Streuanhäufunge oberhalb ihres Gangsystems einerseits indirekt durch Förderung günstigerer Lebensverhältnisse für andere Bodenorganismen, anderseits durch die direkte Schleimabsonderung, deren Wirkstoffe ebenfalls günstige Zersetzungsprozesse fördern.

SCHRIFTTUM

1. BAYOUMI, M. B. (1978): *Significance of the microhabitat on the distribution of Oribatid mites in a hornbeam-oak mixed forest.* — Opusc. Zool. Budapest, 15: 51—59.

2. DÓZSA-FARKAS, K. (1978): *Die systemökologische Bedeutung des Mikrohabitates für das Vorkommen einiger Enchytraeiden-Arten.* — Pedobiologia, 18: 366—372.

3. HARGITAI, L. (1955): *Összehasonlító szervesanyag-vizsgálatok különböző talajtípusokon optikai módszerekkel.* — Agrártud. Egyet. Közl. Agron. Kar Kiadv., Gödöllő—Budapest, 2: 1—27.

4. KOZLOVSKAYA, L. S. (1967): *Rol ekskrementov bespozvonocnych zivotnych v aktivizacii mikroflori torfjano-bolotnych pocv.* — Vzaimootnosenija lesa i bolota, AN SSSR, Sibirskoe otdelenie, 105—127.

5. KOZLOVSKAYA, L. S. (1976): *Rol bespozvonocnyh v transformacii organiceskogo vescestra bolotnych pocv.* — AN SSSR, Izd. Nauka, Leningrad, 1—212.

6. LOKSA, I. (1978): *Mikrohabitate und ihre Bedeutung für die Verteilung der Collembolengemeinschaften in einem Hainbuchen-Eichenbestand.* — Opusc. Zool. Budapest, 15: 93—117.

7. NIELSEN, C. O. (1962): *Carbohydrases in soil litter invertebrates.* — Oikos, 13: 200—215.

8. PARLE, J. N. (1963 *a*): *Microorganisms in the intestines of earthworms.* — J. Gen. Microbiol., 31: 1—13.

9. PARLE, J. N. (1963 *b*): *A microbial study of earthworm casts.* — J. Gen. Microbiol., 31: 13—23.

10. SCHLICHTING, E. & BLUME, H. P. (1966): *Bodenkundliches Praktikum.* — Berlin—Hamburg, pp 209.

11. STEPHENSON, J. (1930): *The Oligochaeta.* — Oxford, pp. 978.

12. TRACEY, M. V. (1951): *Cellulase and chitinase of earthworms.* — Nature, 167: 776.

13. WITKAMP, M. & VAN DER DRIFT, J. (1961): *Breakdown of forest litter in relation to environmental factors.* — Plant and Soil, 15: 295—311.

14. ZICSI, A. (1978): *Nahrungsaussprüche einheimischer Lumbriciden-Arten und ihre Bedeutung für die Ökosystemforschung in Ungarn.* — Pedobiologia, 18: 341—349.

15. ZICSI, A. & POBOZSNY, M. (1977): *Einfluss des Zersetzungsverlaufes der Laubstreu auf die Konsumintensität einiger Lumbriciden-Arten.* — Soil Organisms as Components of Ecosystems. Ecol. Bull. Stockholm, 25: 229—239.

16. ZICSI, A., POBOZSNY, M. & SZLÁVECZ, K. (1978): *Die Bedeutung der Mikrohabitate bei Streuzersetzungsprozessen in einem Hainbuchen-Eichenwald Ungarns.* — Opusc. Zool. Budapest, 15: 153—163.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Bird Communities in the Parks and Squares of Budapest

By

L. SASVÁRI

Abstract. Bird census was conducted in 10 parks of various size through 3 years, and the number of species, number of individuals, diversity and equitability were estimated. The census was based on the individual bird feeding in the area in breeding and winter season.

70 species were feeding in the parks during the 3 years' survey (1975–1977), 59 species in breeding season, 42 species in winter and 31 species as permanent ones, both in winter and breeding period. The species best adapted to the urban conditions are as follows: *Streptopelia decaocto, Corvus frugilegus* (in winter) *Turdus merula, Sturnus vulgaris, Phoenicurus ochruros, Passer montanus, Passer domesticus, Columba livia domestica,* at times and in places *Coloeus monedula, Parus major.* Significant positive correlation between the park size and the number of species as well as the number of individuals, and significant negative correlation between the park size and the number of individuals per hectare was found. Relying on the census the expected number of the bird species and individuals of the parks to be established in the future as a function of park size could be stated.

Introduction

Just as the cities and industrial settlements are gaining larger and larger areas at the loss of the natural environment, can the rapid adaptation of some bird species be observed. The recent ornithological literature clearly reflects the wide interest aroused by this process, whereas the first written comments were published as early as in the last century. Besides the great number of short papers even comprehensive studies and books have been published on the settlement of the birds in cities and towns.

A brief historical survey could be begun with MARSCHALL and PELZEN's (1882) work on the bird fauna of Vienna, however the city together with its wide natural environment was examined. PATRIZI–MONTORO (1909) already studied the birds of Rome in the narrower area of the city, and RITCHIE (1920), in his work written on the effect of man exerted on the fauna, similarly dealt with the effects of the cities and towns. SCHNURRE (1921) discussed this phenomenon as well. MACPHERSON (1929) concentrated his ornithological investigations in Lon-

---

Dr. Lajos Sasvári, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

don on the downtown district of the city. Advancing in time, the following works may be mentioned: LEGENDRE (1930) published a book on the birds of Paris, FRIELING (1942) on the ones of the German towns and cities, FITTER (1949) once more on the ones of London and ENGSTRÖM (1956) on the ones of Stockholm. LUNIAK, KALBERCZYK and PAWLOWSKI (1946) wrote an extensive study on the birds of Warsaw, and shorter papers were published on the bird fauna of Budapest (KEVE, 1976), Helsinki (KAJOSTE, 1961) and Berlin (GRIMM, THEISS, 1972). Out of the works dealing with the birds of the larger extra-European cities the following ones should be mentioned, indicating the cities in question: Chicago (Park, Burgess, MCKENZIE, 1925), Bangkok (HERMS, 1950), Singapore (WARD, 1968) and Tucson (EMLEN, 1974).

As the number of observations was increasing, theories were constructed concerning the adaptation processes of the birds to the urban environment. (LUNIAK, 1964; ERZ, 1966; SCHNURRE, 1921; GLADKOW, 1958; STRAWINSKI, 1968, etc.). The complexity of the phenomenon is truly reflected by numerous discussions of the present time and thus render the survey of the literature more and more difficult.

Studying the settlement of the birds in cities, the most important aim is to acquire knowledge on the conditions, by which the scanty remains of nature can be preserved even in the great metropolises. It seems that the historical tendency that humanity should dwell in a chain of megalopolises bordering on one another cannot be escaped; consequently, the circumstances which keep the birds even in the big cities must be ensured artificially. Again, this can be attained only by establishing squares and parks, only in this way can a suitable vegetation be formed which ensures permanent possibilities of settling even for less adaptive birds. Therefore, the purpose of the present study was to compare the bird density and species diversity on the parks and squares of different sizes, so that through this some proposal could be suggested regarding a healthy forming of the future cityscapes.

Method

The study areas

Ten study areas were chosen from the periphery towards the central district, so that all characteristic squares and parks of Budapest should be included. The parks were surrounded by closely built, several stories high houses and building estate as well as by industrial plants without vegetation, excepting the Cemetary Park situated in the periphery and being the largest one. Its outskirts were bordered by a young acacia forest and arable fields.

The tree and shrub species in the parks and squares of Budapest are listed as follows:

Vörösmarty Square

Tree species: *Platanus acerifolia, Tilia argentea.*

Schrub species: *Euonymus europaeus, Ligustrum vulgare, Staphylea pinnata.*

Vigadó Square

Tree species: *Abies alba, Betula pendula, Picea pungens, Robinia pseudoacacia.*

Shrub species: *Euonymus europaeus, Ligustrum vulgare, Philadelphus coronarius.*

József Nádor Square

Tree species: *Acer negundo, Celtis occidentalis, Tilia argentea.*

Shrub species: *Ligustrum vulgare, Philadelphus coronarius, Picea pungens.*

Engels Square

Tree species: *Acer campestre, Acer platanoides, Aesculus hyppocastanum, Ailanthus glandulosa, Betula pendula, Catalpa bignonioides, Celtis occidentalis, Fraxinus excelsior, Platanus acerifolia, Robinia pseudoacacia, Salix alba, Salix japonica.*

Shrub species: *Berberis vulgaris, Cercis siliquastrum, Cornus alba, Cornus sanguinea, Eleagnus agnustifolia, Ligustrum vulgare, Syringa vulgaris.*

Museum Park

Tree species: *Acer platanoides, Aesculus hyppocastanum, Catalpa bignonioides, Celtis occidentalis, Fraxinus excelsior, Platanus acerifolia, Robinia pseudoacacia, Sophora japonica, Tilia cordata.*

Shrub species: *Cornus alba, Cornus sanguinea, Cotoneaster dammeri, Eleagnus agnustifolia, Ligustrum vulgare, Taxus baccata.*

Friendship Park

Tree species: *Acer campestre, Acer platanoides, Aesculus hyppocastanum, Betula pendula, Celtis occidentalis, Pinus nigra, Populus alba, Populus euramericana, Populus italica, Robinia pseudoacacia, Salix alba, Sophora japonica.*

Shrub species: *Berberis vulgaris, Cercis siliquastrum, Colutea arborescens, Cornus alba, Cornus sanguinea, Cotoneaster horizontalis, Crataegus crus-galli, Crataegus monogyna, Eleagnus agnustifolia, Gleditsia triacanthos, Ligustrum vulgare, Lonicera caprifolium, Lonicera tatarica, Malus pumila, Morus alba, Padus avium, Rhus typhina, Ribes aureum, Robinia pseudoacacia, Rosa gallica, Rosa tomentosa, Quercus robur, Salix alba, Salix caprea, Salix purpurea, Sambucus nigra, Sorbus aucuparia, Sorbus domestica, Spiraea japonica, Spiraea pumila, Staphylea pinnata, Symphoricarpus orbicularis, Symphoricarpus racemosus, Syringa vulgaris, Syringa persica, Tamarix gallica, Taxus baccata, Thuja occidentalis, Thuja orientalis, Viburnum lantana, Viburnum opulus, Vinca minor, Wistaria chinensis, Yucca filamentosa.*

Margaret Island

Tree species: *Abies alba, Acer campestre, Acer negundo, Acer palmatum, Acer platanoides, Acer rubrum, Acer sacharum, Acer tataricum, Aesculus hyppocastanum, Aesculus pariflora, Ailanthus glandulosa, Alnus glutinosa, Amorpha fruticosa,* *Amygdalus nana, Amygdalus triloba, Betula alba, Carpinus betulus, Catalpa bignonioides, Cedrus atlantica, Celtis occidentalis, Chamaecyparis Lawsoniana, Corylus avellana, Corylus colurna, Cydonia oblonga, Fagus silvatica, Fraxinus americana, Fraxinus excelsior, Fraxinus ornus, Juglans nigra, Juniperus communis, Koelreuteria paniculata, Malus baccata, Malus floribunda, Malus pumila, Morus alba, Padus avium, Picea excelsa, Pinus montana, Pinus mungo, Pinus nigra, Pinus silvestris, Pinus strobus, Platanus acerifolia, Populus alba, Populus canadensis, Populus italica, Populus tremula, Prunus avium, Prunus fruticosa, Prunus mahaleb, Quercus cerris, Quercus robur, Robinia pseudoacacia, Salix alba, Salix caprea, Salix purpurea, Sophora japonica, Tilia argentea, Tilia cordata, Tilia platyphyllos, Ulmus laevis, Ulmus minor, Ulmus montana.*

Shrub species: *Azalea japonica, Berberis thunbergii, Berberis vulgaris, Betula alba, Buddleia Davidii, Buddleia variabilis, Campsis radicans, Cercis siliquastrum, Chaenomeles japonica, Clematis montana, Colutea arborescens, Cornus mas, Cornus sanguinea, Cornus staloriphora, Cotinus coggygria, Cotoneaster dammeri, Cotoneaster horizontalis, Cotoneaster microphylla, Cotoneaster tomentosa, Crataegus crus-galli, Crataegus monogyna, Cytisus albus, Cytisus austriacus, Eleagnus agnustifolia, Gleditsia triacanthos, Hibiscus syriacus, Ilex aquifolium, Kerria japonica, Ligustrum vulgare, Ligustrum ovalifolium, Liliodendron tulipifera, Lonicera japonica, Lonicera litida, Lonicera pileata, Lonicera tatarica, Lycium halimifolium, Magnolia obovata, Magnolia soulangians, Mahonia aquifolium, Rhus typhina, Robinia pseudoacacia, Rosa gallica, Rosa multiflora, Rosa polyantha, Rosa tomentosa, Salix caprea, Salix purpurea, Sambucus nigra, Sorbus aria, Sorbus aucuparia, Sorbus domestica, Sorbus torminalis, Spiraea media, Spiraea japonica, Spiraea pumila, Staphylea pinnata, Syringa persica, Syringa vulgaris, Tamarix gallica, Tamarix tetrandra, Taxodium distichum, Taxus baccata, Thuja ocidentalis, Thuja orientalis, Viburnum lantana, Viburnum opulus, Vinca minor, Vitis silvestris, Wistaria chinensis, Yucca filamentosa.*

City Park

Tree species: *Acer campestre, Acer palmatum, Acer platanoides, Acer sacharum, Aesculus hyppocastanum, Betula pendula, Celtis occidentalis, Fagus silvatica, Fraxinus excelsior, Fraxinus ornus, Juglans nigra, Malus floribunda, Malus pumila, Malus silvestris, Morus alba, Padus avium, Picea abies, Pinus nigra, Pinus silvestris, Pinus strobus, Platanus acerifolia, Populus alba, Populus italica, Quercus robur, Robinia pseudoacacia, Salix alba, Salix caprea, Sophora japonica, Tilia cordata, Tilia platyphyllos.*

Shrub species: *Berberis vulgaris, Cercis siliquastrum, Colutea arborescens, Cornus alba, Cornus sanguinea, Cotoneaster dammeri, Cotoneaster horizontalis, Crataegus crus-galli, Crataegus monogyna, Cytisus nigricans, Eleagnus angustifolia Gleditsia triacanthos, Hibiscus syriacus, Laburnum anagyroides, Ligustrum vulgare, Lonicera caprifolium, Lonicera tatarica, Rhus typhina, Ribes aureum, Robinia pseudoacacia, Rosa gallica, Salix caprea, Sambucus nigra, Sorbus aucuparia, Sorbus aria, Spiraea pumila, Staphylea pinnata, Symphoricarpus orbicularis, Symphoricarpus racemosus, Syringa vulgaris, Syringa persica, Tamarix gallica, Taxus baccata, Thuja occidentalis, Thuja orientalis, Viburnum lantana, Viburnum opulus, Vinca minor.*

People's Park

Tree species: *Acer campestre, Acer platanoides, Acer sacharum, Aesculus hyppocastanum, Amorpha fruticosa, Catalpa bignonioides, Celtis occidentalis, Corylus avellana, Corylus colurna, Fagus silvatica, Fraxinus excelsior, Fraxinus ornus, Ginkgo biloba, Gymnocladus doioica, Juglans nigra, Morus alba, Morus piramidalis, Padus avium, Pinus nigra, Pinus mungo, Pinus silvestris, Platanus acerifolia, Populus alba, Populus italica, Populus tremula, Prunus avium, Quercus cerris, Quercus robur, Robinia pseudoacacia, Robinia monophylla, Robinia hispida, Salix alba, Salix capra, Salix matsuda, Sophora japonica, Tilia cordata, Tilia platyphyllos, Ulmus laevis.*

Shrub species: *Amorpha fruticosa, Cercis siliquastrum, Colutea arborescens, Cornus mas, Cornus sanguinea, Cotoneaster dammeri, Cotoneaster tomentosa, Crataegus monogyna, Euonymus europaeus, Gleditsia triacanthos, Hybiscus syriacus, Ligustrum vulgare, Lonicera, japonica, Rhus typhina, Ribes aureum, Robinia pseudoacacia, Rosa gallica, Sambucus nigra, Sorbus aucuparia, Syringa vulgaris, Tamarix gallica, Taxus baccata, Thuja orientalis.*

Cemetery

Tree species: *Acer campestre, Acer platanoides, Aesculus hyppocastanum, Amorpha fruticosa, Celtis occidentalis, Fagus silvatica, Fraxinus excelsior, Fraxinus ornus, Pinus nigra, Platanus acerifolia, Populus alba, Populus italica, Quercus robur, Robinia pseudoacacia, Salix alba, Tilia argentes, Ulmus laevis.*

Shrub species: *Berberis vulgaris, Betula pendula, Colutea arborescens, Cornus mas, Cornus sanguinea, Cornus staloriphora, Cotinus coggygria, Cotoneaster tomentosa, Crataegus monogyna, Eleagnus agnustifolia, Ligustrum vulgare, Mahonia aquifolium, Rhus typhina, Robinia pseudoacacia, Rosa gallica, Salix alba, Salix caprea, Sambucus nigra, Spiraea media, Syringa vulgaris, Tamarix tetrandra, Taxus baccata, Thuja occidentalis, Viburnum lantana, Vitis silvestris.*

Bird census in breeding season

The census was based on the individuals of the birds feeding in the parks. It would have led to a faulty evaluation of the parks if the number of species and individuals of the birds breeding really in the parks had been recorded exclusively. If so, the birds nesting in the immediate vicinity of the parks would not have been included into the survey, although their breeding there was ensured by the open feeding area of the parks. Their presence and numbers were thus determined by the parks, although they built their nests in the neighbouring houses and factories or in the yards of these. This relationship existed especially in small downtown squares. Besides, numerous individuals of territorial species did not nest and did not hold territories either, notwithstanding that at breeding time they stayed in the parks permanently.

In all parks the transect method, that is the traversing registration was adopted for the census. Decreasing the errors caused by the moving of the birds to a minimum, in the parks of larger extent the shortest possible time had to be expended on the survey. Where there was no extensive continuous foliage, the minimum area of registration was a 100 m range of sight in the traversing, thus 200 m could be covered on the two sides. Where the tree foliage or shrubbery was continuous, the width of the area covered to the right and left was 25 m each, i. e. 50 m. In the practice this meant that proceeding at the border of the clump of trees in the parks, the marginal area of the grove as well as the neighbouring clearing or meadow could be looked over, and in the same grove also an inside way had to be covered which led through the middle under the continuous foliage. The observed species and numbers of individuals were directly registered in the sketch map of the park. The collaborators helped to acquire authentic data even from extensive study areas. From the middle of April to the middle of June the census took place between 6.00 and 11.00 on 8 – 10 occasions in each park in a way that the survey of ona large park took 2 – 3 hours (excepting the Cemetery). The number of species and individuals was calculated by the mean values of the surveys.

Bird census in winter

The method of registration agreed with the transect method applied in breeding season, still with the difference that within the clump of trees the limit of sight was 50 metres on each side. Census took place in each parks on 8 – 10 occasions during one winter in January and February. Also the census was based on the individuals bird feeding in the area.

Bird diversity was calculated relying on Shannon – Weaver's formula – $H' = -\sum p_i \ln p_i$ where p_i is the proportion of the individuals of i species to the total number of the individuals. Equitability was calculated by the $J = \frac{H'}{H_{max}}$ formula, where $H_{max} = \ln S$ (S = the number of species).

Results

70 species were feeding in the 10 study parks, 59 of them in breeding season, 42 in winter and 31 species were permanent ones feeding there both in breeding season and in winter during the 3 years' census. In the small squares of the centre of Budapest, where also the vegetation was poor, only the commonest species, the domestic pigeon, the house sparrow, collared turtledove, and the blackbird were constant in winter and in breeding season. The tree sparrow stayed permanently only in the larger parks of more extensive vegetation. (Friendship Park of 22 hectares was the smallest one where they were.) The number of nesting species was raised by the house martin, the starling and the great tit, further in one year by the jackdaw in the larger squares (Engels Square, Museum Park). With the increase of the vegetation and with the enlargement of the park area the number of species increased conspicuously (Fig. 1). The increasing was somewhat moderated in winter, if only for the reason that the winter guest birds slightly increased the number of species in the small downtown squares; and the number of species in the large parks significantly decreased on account of the absence of the nesting migratory birds (Fig. 2). The detailed data are included in Table 1 and 2, the mean values, diversity and eqitability is presented in Table 3.

Figure 1.

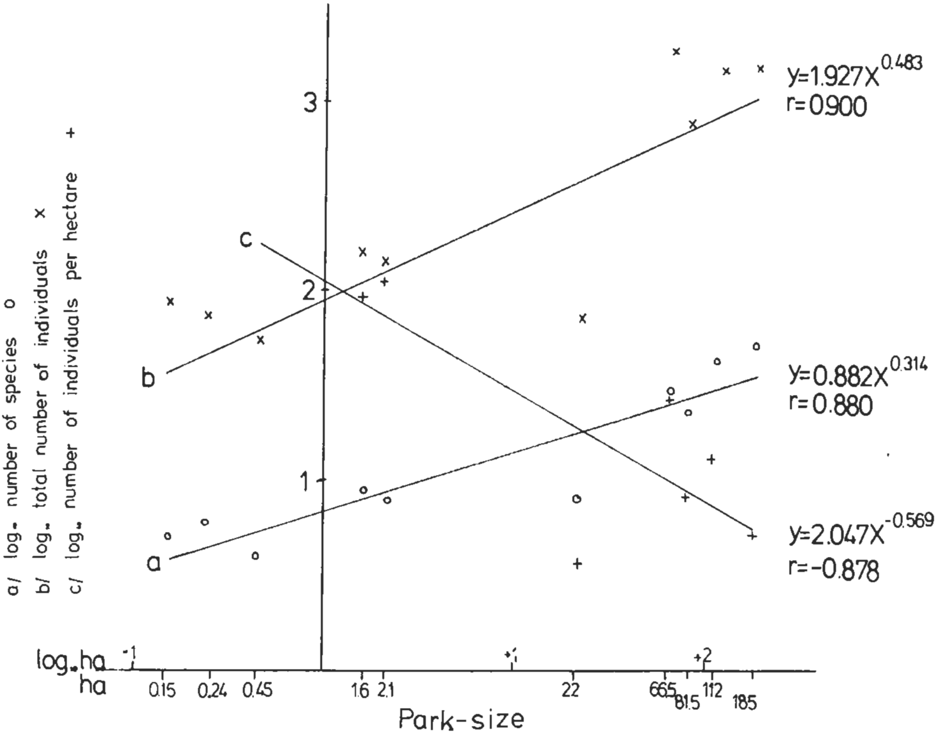


Fig. 1. Logarithmic relationship between the park size and the number of species *(a)*, the total number of individuals *(b)* and the number of individuals per hectare *(c)* in breeding season

The number of individuals of the birds rose parallel with the increase of the parksize (Fig. 1). In winter the higher number of individuals can be ascribed both in the downtown squares and in the large parks to the presence of the rooks and fieldfares (Fig. 2). Apart from these the house sparrow and the blackbird were concentrating both on the smaller squares and on the large parks from the neighbouring areas in higher proportion than in breeding season. This concentration was more moderate in the larger parks, and fluctuated in the succession of years.

Gradually proceeding from the small squares to the large parks, the number of individuals per hectare decreased (Fig. 1, 2). The negative correlation between the number of individuals per hectare and the park size can be attributed mainly the house sparrow and domestic pigeon in compliance with the phenomenon mentioned above that concentration is rising in the areas of the small downtown squares and decreasing in the larger parks. In winter, although the number of individuals increases in all squares and parks, the rooks feed mainly in the large parks, and increasing the number of individuals per hectare, they moderate the negative correlation.

In general, a higher number of species was concomitant with a higher diversity in breeding season and in winter alike. The highest numbers of species, the

Figure 2.

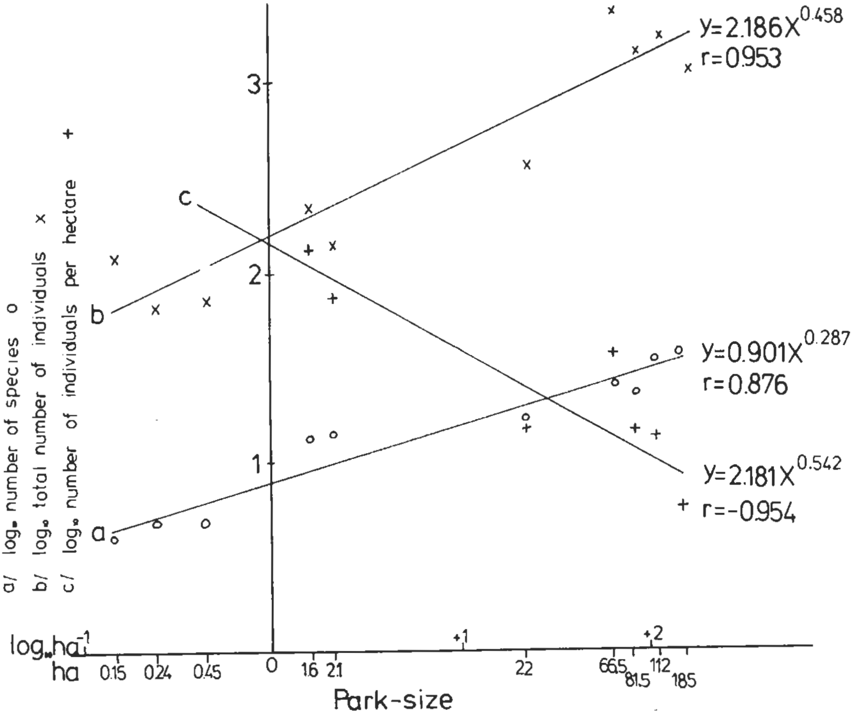


Fig. 2. Logarithmic relationship between the park size and the number of species *(a)*, the total number of individuals *(b)* and the number of individuals per hectare *(c)* in winter season

highest values of diversity and equitability present the most extensive parks (Cemetery and People's Park) as favourable for the settlement of the birds. However, the number of individuals per hectare is too low in the Cemetery, and also the total number is lower than in People's Park of smaller extent and in Margaret Island which is much smaller.

Besides the domestic pigeon and the house sparrow, the species best adapting to urban conditions are the blackbird and the collared turtledove (Table 4). They built their nests in the smallest squares of the city and in the immediate vicinity of these. Also the great tit adapts well: it was observed to have its nests in the two larger downtown squares over *1* hectare in extent. There was only one pair each that nested, but as it is a territorial species, it would not have tolerated another breeding pair in a square of so small area anyhow. Similarly in small numbers of individuals did starling, house martin red-rumped swallow and jackdaw enter the squares of the inner town.

The species which demanded more foliage and were less adapted to the pressure of houses and other buildings occured only in more spacious parks. (Table 4). The species appearing in the Margaret Island and the City Park demonstrate that artificially formed vegetation has to some degree regenerated nature even within the urban environment, since even birds nesting in forest can be found

Table 1. *Bird species and abundance in the large parks of Budapest*

			Cemetery			People's Park			Margaret Island			City Park		
			1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Accipiter gentilis	B	x̄												
		SD												
	W	x̄	.5		.5									
		SD	1		.7									
Accipiter nisus	W	x̄		.5		1								
		SD		1		0								
Buteo buteo	B	x̄		.5										
		SD		.7										
	W	x̄		.5	.5									
		SD		.7	.7									
Falco columbarius	W	x̄	.5	1.3	.5		1		1					.5
		SD	.7	.3	.7		0		0					.5
Falco tinnunculus	B	x̄	2		2	.5	2	2						.5
		SD	0		0	.7	0	0						.7
	W	x̄	1	1.5	1.5									
		SD	1.7	1.2	1.7									
Perdix perdix	B	x̄	2	2.5	6.6									
		SD	0	2.1	.7									
	W	x̄	3.5	7	10									
		SD	.7	2.8	4.2									
Phasianus colchicus	B	x̄	3	10	5.5									
		SD	.7	1.4	2.8									
	W	x̄	8	6	6.3									
		SD	1.4	0	.7									
Streptopelia turtur	B	x̄	3	10.3	5.5	1		3						
		SD	1.4	2.8	2.1	1.4		1.7						

(Table 1.)

			Cemetery			People's Park			Margaret Island			City Park		
			1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Streptopelia decaocto	B	$\bar{x}$	35	13	36	104	59	57.5	72	59	115.5	22.5	27	37
		SD	15.5	4.2	14.1	20.6	4.2	6.3	8.4	9.9	13.4	14.8	9.9	9.9
	W	$\bar{x}$	21.5	9.7	29	99	107.	58	88.5	52	72.5	32	13	20
		SD	7.7	2.1	14.1	57.9	5.6	16.9	9.1	8.4	9.6	19.8	1.4	1.7
Cuculus canorus	B	$\bar{x}$	3	4	4									
		SD	1.4	2.8	1.7									
Athene noctua	B	$\bar{x}$	2.6	2.2	2.5	2		2						
		SD	.5	1.5	.7	0		0						
Strix aluco	B	$\bar{x}$	2											
		SD	0											
Upupa epops	B	$\bar{x}$	2	1	4	2	1	3						
		SD	0	1.4	0	0	.7	1.4						
Jynx torquilla	B	$\bar{x}$	5	4	3	2	1	2			2			
		SD	1.4	0	1.4	0	.7	0			0			
Picus viridis	B	$\bar{x}$	3	5	2	3	2	5	2	2	2	2.5	2	4
		SD	1.4	1.4	0	1.4	0	3.6	0	1.4	0	.7	0	0
	W	$\bar{x}$	2.5	4	3.5	4	3.5	4	3	4	2	2.5	3	3.5
		SD	.7	0	.7	0	.7	0	.7	0	0	2.1	0	2.1
Dendrocopos major	B	$\bar{x}$	3	7	4.5	4.5	2	4.5	4	5.5	5	3	1.5	2
		SD	1.7	1.4	7.	2.1	0	2.8	0	.7	1.4	1.4	.7	0
	W	$\bar{x}$	7	6	4	5	3	5.5	6	6.5	6	2.5	3	4
		SD	1.4	2.8	0	2.8	2.8	3.5	0	2.1	2.8	.7	0	2.8
Dendrocopos syriacus	B	$\bar{x}$	2	1	2		.5	1.5	2	1.5	2			
		SD	0	1.4	0		.7	.7	0	1.2	0			
	W	$\bar{x}$	3.5	1.5	3	1.5	1	2	3.5	2.5	3			
		SD	.7	1.3	1.4	1.2	0	0	.7	2.1	1.4			

(*Table 1.*)

			Cemetery			People's Park			Margaret Island			City Park		
			1976	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Dendrocopos medius	B	x̄		2	2									
		SD		0	0									
	W	x̄	1.5	2	1.5									
		SD	.7	0	.7									
Dendrocopos minor	B	x̄			2	2		2						
		SD			0	0		0						
		x̄			2	2		2						
		SD			0	1.4		1.4						
Galerida cristata	B	x̄	4	4.5	3	2	3.5	4	2	3.5	2	6	4	4.5
		SD	0	2.8	1.4	0	.7	0	0	.7	0	0	0	.7
	W	x̄	9	7.5	6.5	5	9.5	8.5	3	4	4	8.5	3.5	9
		SD	3.6	2.1	3.5	2.8	2.1	4.9	1.4	2.8	0	.7	2.1	2.8
Hirundo rustica	B	x̄	4	6.5	3.5	5.5	5	7.5	6	5.5	6	9	8	6
		SD	2.3	2.8	1.4	2.1	0	2.1	2.8	2.1	4.2	8.4	5.6	4.2
Delichon urbica	B	x̄	23.3	18	14	3.5	17	15	18.5	14	17.5	12.5	10	16
		SD	11.7	2.8	5.6	3.4	2.8	11.3	2.1	7	3.5	6.3	1.4	5.6
Oriolus oriolus	B	x̄	7	8	7	3	5	3	2	2.5	2.5			
		SD	1.4	3.5	4.2	.7	1.4	1.2	1.4	.7	2.1			
Corvus corone	B	x̄	8.3	6	5.5	3	2	3	7	6	6	3	4	4
		SD	3.5	2.8	2.1	.7	0	.7	4.2	5.6	5.6	1.4	0	2.8
	W	x̄	5	4	4	3.5	2	5	12,5	6.5	6.5	2	3	4.5
		SD	4.2	2.8	1.5	2.1	1.4	4.2	2.1	4.2	3.5	0	1.4	2.1
Corvus frugilegus	W	x̄	63.5	40.3	42.7	132.7	118.5	89	105	55.5	144.7	45.7	110.7	50.5
		SD	16.2	33.2	20.5	117.8	36.4	29.7	102.2	48.7	93.3	40.8	56.5	43.1
Coloeus monedula	B	x̄	5	3	3.7	6	4	5.3	9.7	24	19.7	11.5	13.3	8
		SD	3.2	1.7	1.4	2.8		4.2	7.3	16.9	2.4	6.3	3.5	.7
	W	x̄	1.7	4.3	2	7.5	8	10.3	10	11.8	27.7	7	4.3	5.7
		SD	.3	2.8	0	3.6	1.4	5.6	2.8	8.7	8.2	4.2	2.8	2.1

(Table 1.)

			Cemetery			People's Park			Margaret Island			City Park		
			1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Pica pica	B	x	11.3	7.7	9.5	11.7	17.3	19.5	19	15.7	14.7	2.7	2.3	2
		SD	1.7	4.6	7.3	.7	2.8	4.6	.7	.7	3.2	.5	1.2	0
	W	$\bar{x}$	13	12.5	7.7	13	14.7	14	1	2	3.7		5	3.3
		SD	11.3	9.6	4.3	8.4	4.2	8.7	.4	1.7	.7		.5	2.8
Garrulus glandarius	B	$\bar{x}$	3.3	3.7	2	1.5	1	2.3						
		SD	1.2	2.8	0	.7	.3	2.2						
	W	$\bar{x}$	5	3	4.7	4.5	2.5	2.3	2	2.3				
		SD	4.2	1.6	2.8	4.2	1.7	1.2	1.7	1.2				
Parus major	B	$\bar{x}$	47.5	66	38.5	21.7	28	34	67	59	65.3	18	10.3	16.5
		SD	33.2	14.1	26.1	1.7	8.4	8.6	32.5	21.2	33.1	2.8	6.2	12
	W	$\bar{x}$	38.5	44.7	25	43	24.5	38.3	59.7	60.3	83.5	43	27.7	15.5
		SD	9.1	16.9	8.4	18.3	19	32.5	19.9	19	16.2	29.7	26.8	4.9
Parus caeruleus	B	$\bar{x}$	20	18.7	14	18.2	32.5	11	15.5	11.5	20.7	20.5	10.7	9.5
		SD	11.3	8.4	12.3	7	5.6	7.7	13.4	9.1	12.5	8.7	9.9	4.9
	W	$\bar{x}$	18.7	8.3	12.5	11.5	9	7.5	20.7	12.5	23	11.5	7	12
		SD	8·4	5.4	9.1	10.6	8.4	4.9	6.3	6.7	9.3	4.9	4.2	8.7
Parus palustris	B	$\bar{x}$	2	4	2.3		2	2						
		SD	0	0	1.2		0	0						
	W	$\bar{x}$	2	4.5	2.5	1.5	2	2	1	3	2			
		SD	0	.7	1.2	.5	0	1.4	.7	.7	1.4			
Sitta europaea	B	$\bar{x}$	9	9.7	5	9	6.7	9.3	16.3	10.3	17.5	4	2.3	3
		SD	4.2	4.1	3.2	1.7	5.6	7.7	5.6	2.8	4.2	0	1.4	1.7
	W	$\bar{x}$	7	10.5	11	11.7	7.3	11.3	14.7	10.5	6.5	4.7	5.3	4.5
		SD	1.4	4.9	1.7	.7	4.2	4.7	11.3	5.6	1.7	1.4	3.6	1.7
Certhia brachydactyla	B	$\bar{x}$	4	5.7	5	2	3.7	4.5	4	3	3.7	2	3.7	2
		SD	3.2	3.6	2.3	0	1.3	3.7	3.6	1.7	.7	0	1.4	0
	W	$\bar{x}$	5	6.5	4	4.5	2	4	5.5	4.3	4.5	3.5	1.5	3
		SD	4·2	3.5	3.2	2·7	0	0	4.7	3.6	1.3	.7	.5	1.5

(*Table 1.*)

			Cemetery			People's Park			Margaret Island			City Park		
			1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Turdus viscivorus	W	$\bar{x}$	5	5	4	22.5	15.7	12	4	110	10.7	5.7	7.5	6.5
		SD	4.4	3.7	3.6	14.8	8.4	7.6	2.8	1.4	1.7	4.3	6.2	4.6
	W	$\bar{x}$												
Turdus pilaris		SD	40.5	15	46.7	78.7	56	94.5	24	25.8	10.6	9.5	11.7	30.5
			9.1	8.4	22.6	55.7	38.2	77.4	5.6	9.9	7.4	8.6	10.6	16.2
Turdus merula	B	$\bar{x}$	63.4	52.5	53.8	38.3	74	131.3	210.6	195.2	213.7	66.3	41.6	65.6
		SD	35.3	38.8	33.6	10.2	16.9	49	28.4	54.3	69.6	27.	30.2	53.7
	W	$\bar{x}$	61.3	43.6	54.8	172	116.1	147.8	195.6	243.7	255	88	63	69.6
		SD	19.4	16.5	21.1	17.4	73.7	54.1	16.2	20.6	41.8	13.7	28.6	18.1
Turdus philomelos	B	$\bar{x}$	6	4.7	4.3			2						
		SD	2	1.7	1.7									
Oenanthe oenanthe	B	$\bar{x}$	2		3			2						
		SD	0		1.5			0						
Phoenicurus ochruros	B	$\bar{x}$				2			2	1.7	2	2	2	1.5
		SD				0			0	1.5	0	0	0	.5
Luscinia megarhynchos	B	$\bar{x}$	21.5	13	17.7	3	4	4.5	3	2	4	1.5		2.5
		SD	10.6	4.2	10.2	1.4	0	3.2	1.2	0	0	.7		1.5
Erithacus rubecula	B	$\bar{x}$	10.3	6.6	7.3	6	5.3	5	4	6.2	4.3	1.5	2	
		SD	9	4.2	5.2	2	3.5	1.4	1.4	1.7	3.6	1.2	0	
	W	$\bar{x}$	6.3	5.7	5.6	5.6	2.6	8	4.5	7.3	6.6	1.5	2.4	2
		SD	1.5	3.6	3.2	3.5	2	5	1.4	4.6	4	.7	2.2	1.2
Hippolais icterina	B	$\bar{x}$	2	3	4.2	2		3.5						
		SD	0	.5	3.6	0		2.2						
Sylvia atricapilla	B	$\bar{x}$	19	19.3	14.6	0.6	16.3	9	14.3	23.6	13.6	3.6	8.6	5.4
		SD	2.8	12.2	5.6	5.5	2	5.4	7	3.5	6	3.2	3	4.2
Sylvia nisoria	B	$\bar{x}$	2	2	3.5	1		1.7						
		SD	0	1	.5	.7		1.2						

(Table 1.)

			Cemetery			People's Park			Margaret Island			City Park		
			1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Sylvia borin	B	x̄	3.7	4.5	1			2	1	2	.5			
		SD	1.2	1.2	.5			0	.5	0	.5			
Sylvia communis	B	x̄	4	4.6	5.4	4.5	3	4	3.5	2.5	3	2	3	1.5
		SD	1.5	3.2	1	1.5	1.5	1.7	2.5	2.1	2.8	0	1.5	.7
Sylvia curruca	B	x̄	4.6	5	6.6	3	4.2	4.2	2.3	4	3	2	3.3	1.5
		SD	1.7	3.2	3.7	1.2	2.8	3.2	1.5	0	1.2	.5	1.7	.7
Philloscopus trochilus	B	x̄	5	4.5	6.3	1	4.3	4	1	3	1.5	3	2.3	1
		SD	3.6	3.2	3.2	.2	3.2	2	1	1	.7	1	.7	.7
Philloscopus collybita	B	x̄	26.6	31.5	15.3	11.3	7.6	14.6	3	1	4	2	3	1
		SD	11.5	17.7	2.5	7.5	.3	5.6	1.1	.7	2	1.5	2	.5
Philloscopus sibilatrix	B	x̄	5.6	3.6	6.3	7.3	5.2	7.6	3	2	1.5	4.3	2.5	2.3
		SD	1.5	.7	2.8	3.4	4.6	4.2	1.5	.7	1	2.8	1.2	1.2
Regulus regulus	W	x̄	2.3	2.3		3.6								
		SD	2.2	1.5		.5								
Muscicapa striata	B	x̄				5.6	2	4.3	2		3.2		1.2	
		SD												
Muscicapa albicollis	B	x̄	3.3		1	5.6	2	4.3	2		3.2		1.2	
		SD	1.1		.7	.5	1	1.2	1.5		1.7		.7	
Motacilla alba	B	x̄	2	1.5	2.2	1	2.5	2.8						
		SD	0	.7	1.7	.5	1.2	1.3						
Bombycilla garrulus	W	x̄	8.6	14.4		16.6	7.4		22	10.3		31	14.5	
		SD	4.2	8.5		10.6	6.3		11.1	8		9.5	5.5	
Lanius excubitor	W	x̄	1	5		.5								
		SD	0	.2		.2								

(*Table 1.*)

			Cemetery			People's Park			Margaret Island			City Park		
			1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Lanius collurio	B	$\bar{x}$	1.5	2.6	2.6	2.3	1.6	1.5	1		.5			
		SD	.7	2.3	1.1	1.1	1.2	.5	.5		.2			
Sturnus vulgaris	B	$\bar{x}$	34.6	25.3	43.2	57.5	43.7	60	35	18.7	35.5	14.5	29.1	24.5
		SD	26.1	111.8	28.1	24.7	30.9	28.2	25.3	5.6	14.6	4.9	13.5	21.9
Passer domestic	B	$\bar{x}$	60.5	48.2	61.5	46.7	75	160.5	464	245.5	434	262.7	209.4	232.8
		SD	28.9	14.1	32.4	93.5	63.6	127.2	387.4	82.7	359.2	159.1	106.3	130.2
	W	$\bar{x}$	37	56.5	55.4	76	190,5	96,5	641.8	270.3	517.3	418.7	179.2	335.1
		SD	31.1	20.5	21.9	92.7	74	76	460.2	125.8	433.7	397.2	121.3	243.1
Posser montanus	B	$\bar{x}$	192.5	85.8	163.6	16.5	115.7	129.7	242.4	220.5	311	69.7	61.5	47.5
		SD	115.6	63.6	121.9	71.3	134.2	118.1	211	187.3	141.5	26.4	42.8	32.8
	W	$\bar{x}$	265.4	80.8	291.5	91.2	359.4	425.1	250	415.7	172.5	22.4	36.7	24.7
		SD	147.5	74.8	158.2	41.3	252	314.2	168.3	121.3	89.4	16.3	28.2	7
Coccothraustes coccothraustes	B	$\bar{x}$	9	6	9.4	16	15.7	11.5	5.5	9.2	6.8	3	2	3.4
		SD	4.2	5.6	3.7	8.2	7.3	6.5	2.8	3.7	4.2	2	1	1.7
	W	$\bar{x}$	17.5	25	17.8	40	17.6	28.7	26.5	11.4	22.9	18.7	22.2	24.8
		SD	3.5	3.8	2.1	17.2	3.6	13.7	14.8	4.7	18.6	13.7	18.8	16.6
Chloris chloris	B	$\bar{x}$	29.7	34	32	26.7	14.8	21	12	20.4	23.8	14	14.6	15.2
		SD	14	11.3	6.5	12.2	8.3	19.2	8.6	9.2	14.6	11.3	8.3	11.8
	W	$\bar{x}$	17	36.5	18.5	32	17.4	31.5	23.5	14	17.5	8	22.5	10.5
		SD	9.3	14.8	12	28.6	13.2	22.7	8.9	11.2	13.6	5.6	9.1	6.4
Carduelis spinus	W	$\bar{x}$	5	2	5.3	15	11.5	6	3.5	4	5	6.5	3.2	2.5
		SD	1.4	1	.7	2.8	5.6	3.5	1.5	2	2.5	4.8	1.7	1.5
Carduelis carduelis	B	$\bar{x}$	8.2	9.3	5.3	3.5	7	9.3	3	4.7	5	5	8.4	6
		SD	5.4	4.2	4.8	2.1	4.2	7.4	1.4	3.6	4.2	4.5	6.4	5.2
	W	$\bar{x}$	20.5	27	19.7	14.5	12.3	11.6	2	4.5	6	8.7	7.3	4.2
		SD	7.7	4.2	2.8	9.1	8.7	5.5	.7	3.2	5.7	5.6	6.6	2.8

(Table 1.)

			Cemetery			People's Park			Margaret Island			City Park		
			1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Acanthis cannabina	B	$\bar{x}$	11	25.7	2	2.5		1			2			
		SD	4.5	21.3	1.7	2.2		.5			0			
	W	$\bar{x}$	3.7	4	9.3	4	2.5	3		1	3	1		2
		SD	2.8	2.8	7.7	2.5	1.7	1.5		.7	2.5	.5		0
Serinus serinus	B	$\bar{x}$	6.4	3.7	4	2	5	4.6	2	1.5			2	
		SD	2.8	1.4	3.2	0	3.6	2.8	1.5	.5			0	
Pyrrhula pyrrhula	W	$\bar{x}$	11.5	6.8	14.9	6.3	6.5	5.8	1.5	4	4	3.5	4	3.6
		SD	8.7	4.2	11.8	5.6	1.4	1.4	1.2	2	2.5	2.2	.7	.8
Fringilla coelebs	B	$\bar{x}$	17	19.3	23.5	7.5	11	11.8	6	12.3	13.2	3	1.5	4.5
		SD	1.8	2.8	10.6	3.6	1.7	7.6	2.4	7.1	8.4	0	1.2	2.1
	W	$\bar{x}$	10.5	14	13.7	28	17.7	32.5	11.5	17	22	14.5	9.7	11.5
		SD	8.1	9.2	11	18.3	13.5	26.7	4.2	13.5	11.3	7.8	5.6	10.2
Emberiza citrinella	B	$\bar{x}$	2.5	1	2	2		1.5						
		SD	1.5	.5	0	0		1.2						
	W	$\bar{x}$	2	2.5	5.3		2.5	4				1		1.7
		SD	1.4	1.5	4.6		2.2	2.5				.7		1.4
Columba livia domestica	B	$\bar{x}$	10.5	28.7	15.5	65.5	30	64.2	88.5	55.1	124.7	91.5	65.3	69.8
		SD	4.5	13.8	10.7	15.5	20.2	59.7	74.5	25.8	27	61.5	45.7	49.5
	W	$\bar{x}$	17.5	11	25.8	41	27.5	42.8	92	50.7	107,4	72.2	50.7	82.5
		SD	13.5	9.2	12.5	9.6	22.5	12.5	58.7	40.5	67.7	41	40.2	62.3

Notes: B = Breedeng season
W = Winter season

Table 2. Bird species and abundance in

			Friendship Park			Museum Park			F
			1975	1976	1977	1975	1976	1977	1975
Falco tinnunculus	W	$\bar{x}$							
		SD							
Streptopelia decaocto	B	$\bar{x}$	6.5	4.2	5	12	8	13.7	6.5
		SD	.7	.7	2.8	6.7	4.2	5.6	3.8
	W	$\bar{x}$	5	2	2.3	10	21.7	13	8
		SD	1.4	0	2.1	4.6	12.2	5.6	2.8
Galerida cristata	B	$\bar{x}$	2	1.5	2				
		SD	0	.5	0				
	W	$\bar{x}$	6	3.5	5.7	2	2	1	2
		SD	4.2	2.8	3.7	0	0	.5	1
Hirundo rustica	B	$\bar{x}$	2	1	3	2		1	2
		SD	0	.7	1.7	1		0	1.4
Delichon urbica	B	$\bar{x}$	5.5	8	5	2.5	2	4	2
		SD	1.4	.5	2.7	.7	0	1.4	0
Corvus corone	W	$\bar{x}$	.5	1.5	2	.5		.5	1
		SD	.5	.7	1	.2		.2	0
Corvus frugilegus	W	$\bar{x}$	48	14.5	47	6	3	3.7	4
		SD	30.5	8.6	16.8	2.8	2.8	1.4	2.8
Corvus monedula	B	$\bar{x}$				2		.5	4
		SD				0		.5	0
	W	$\bar{x}$				1		3.5	2
		SD				.7		2.7	0
Pica pica	W	$\bar{x}$	1		1.5				
		SD	.7		1.2				
Parus major	B	$\bar{x}$		1	1.5	2		2	1.3
		SD		.7	.7	0		0	.7
	W	$\bar{x}$	1	1.5	3.5	4.5	2	2.5	.5
		SD	.7	.7	2.5	1.7	1.7	1.2	.5
Parus caeruleus	W	$\bar{x}$	1	1		3	2	2.5	.5
		SD	.7	.5		1.7	1.5	1.7	.3
Sitta europea	W	$\bar{x}$	.5	1	1				
		SD	.2	.7	.7				
Turdus pilaris	W	$\bar{x}$	16	22.3	27.4	6	8	5.5	3
		SD	12.5	7.7	16.6	3.7	4.2	4.9	1.7
Turdus merula	B	$\bar{x}$	3.6	3	4.3	8.3	10.3	9	10.6
		SD	3.2	1	2.6	3.2	1.5	3	4.5

ngels Square		József Nádor Square			Vigadó Square			Vörösmarty Square		
1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
	.2				1	1				
	.5				.7	.7				
4.7	6.3	1	.5	1	2	2	3	3	3.7	1
1.2	5.1	.7	.5	.8	1	1.5	2.8	1.2	2.2	.7
11.7	8.5	4	3	2	2.5	2.5	2	2	2.8	2.2
9.2	.7	2.8	1.4	0	2.2	2.2	0	0	1.7	1.2
1										
.7										
	1									
	1									
4.5	4		2	.5	2.5	1	1.5	1.7	.7	.5
3.6	2		0	.2	1.5	1	.8	.3	.2	5.
.5										
.2										
2	5									
1.7	3.6									
3	3									
1.4	1.4									
4.5	2.5									
2.8	.7									
2	1									
0	.5									
3.5	1.5	1		.5	1		.7	1	.4	
1.7	1	.5		.2	.7		.3	1	.2	
3.2	1.7									
2.6	1.2									
5.5	7.6									
3.2	4.7									
7.6	11	1.5	2.5	2	1	1.2	1.5	2	1.5	1.5
5.2	3.6	.7	.2	0	0	.7	.2	0	.5	.7
21.5	17.5	2.5	3	2	.7	.5	.5	1	.5	1.5
3.7	6.1	1.2	1.8	0	.2	.3	.3	1	.5	.7

Corvus frugilegus	W	$\bar{x}$	48	14.5	47	6	3	3.7	4	2
		SD	30.5	8.6	16.8	2.8	2.8	1.4	2.8	1.7
Corvus monedula	B	$\bar{x}$				2		.5	4	3
		SD				0		.5	0	1.4
	W	$\bar{x}$				1		3.5	2	4.5
		SD				.7		2.7	0	2.8
Pica pica	W	$\bar{x}$	1		1.5					
		SD	.7		1.2					
Parus major	B	$\bar{x}$		1	1.5	2		2	1.3	2
		SD		.7	.7	0		0	.7	0
	W	$\bar{x}$	1	1.5	3.5	4.5	2	2.5	.5	3.5
		SD	.7	.7	2.5	1.7	1.7	1.2	.5	1.7
Parus caeruleus	W	$\bar{x}$	1	1		3	2	2.5	.5	3.2
		SD	.7	.5		1.7	1.5	1.7	.3	2.6
Sitta europea	W	$\bar{x}$	.5	1	1					
		SD	.2	.7	.7					
Turdus pilaris	W	$\bar{x}$	16	22.3	27.4	6	8	5.5	3	5.5
		SD	12.5	7.7	16.6	3.7	4.2	4.9	1.7	3.2
Turdus merula	B	$\bar{x}$	3.6	3	4.3	8.3	10.3	9	10.6	7.6
		SD	3.2	1	2.6	3.2	1.5	3	4.5	5.2
	W	$\bar{x}$	8.6	6.3	4.3	8	17.6	11	16	21.5
		SD	1.7	5.2	2.7	6.5	8.2	7.9	2.8	3.7
Erithecus rubocula	W	$\bar{x}$	1.5	1	1.5					
		SD	.7	0	1					
Bombycilla garrulus	W	$\bar{x}$	.5	1	.5	12.5	7	15.3	9.5	12
		SD	.5	.3		7.7	5.2		2.1	9.6
Sturnus vulgaris	B	$\bar{x}$	4	5.5	6.3	3	1.5	4.8	5	3.3
		SD	2.8	1.4	1.8	1.4	1	2.3	4.2	1.7
Passer domesticus	B	$\bar{x}$	27.5	35	24.5	54.5	40.7	39	86.5	112.7
		SD	10.6	21.2	18	34.6	28.2	12.7	37.8	63
	W	$\bar{x}$	70	30.7	62.5	34.5	32.5	39	110.6	122.5
		SD	14.1	21.5	60.1	21	26.8	18.5	84	63.6
Passer montanus	B	$\bar{x}$	11.5	6	11					
		SD	9.9	5.6	8.4					
	W	$\bar{x}$	61.5	42.5	48.7					
		SD	49.9	33	39.4					
Coccothraustes coccothraustes	W	$\bar{x}$	3	1	5	.5	7.5	4	4	5.2
		SD	1.4	1	3.2	.5	3.7	2	2.7	3.7
Chloris chloris	W	$\bar{x}$	5.5	1.2	4.5	1	2	1.5	.5	
		SD	2.1	.7	.5	1	.5	.5	.3	
Carduelis carduelis	W	$\bar{x}$	2		2.5					
		SD	0		.5					
Carduelis spinus	W	$\bar{x}$	.5		.5					
		SD	.5		.3					
Emberiza citrinella	W	$\bar{x}$	.5	2	1					
		SD	.3	0	0					
Columba livia domestica	B	$\bar{x}$	15.7	30	16.7	16	19.5	23	59.5	47.3
		SD	4.5	14	6.9	12.8	12	4.2	47.2	35
	W	$\bar{x}$	23	10	23.8	36.5	27	15.6	34	60
		SD	17.4	7.7	16.9	19	24.7	8.4	26.8	56

Notes: B = Breeding season

W = Winter season

	2.7	0	2.3	.7									
	2	1.3	2	1									
	0	.7	0	.5									
2	2.5	.5	3.5	1.5	1		.5	1		.7	1	.4	
1.7	1.2	.5	1.7	1	.5		.2	.7		.3	1	.2	
2	2.5	.5	3.2	1.7									
1.5	1.7	.3	2.6	1.2									
8	5.5	3	5.5	7.6									
4.2	4.9	1.7	3.2	4.7									
10.3	9	10.6	7.6	11	1.5	2.5	2	1	1.2	1.5	2	1.5	1.5
1.5	3	4.5	5.2	3.6	.7	.2	0	0	.7	.2	0	.5	.7
17.6	11	16	21.5	17.5	2.5	3	2	.7	.5	.5	1	.5	1.5
8.2	7.9	2.8	3.7	6.1	1.2	1.8	0	.2	.3	.3	1	.5	.7
7	15.3	9.5	12										
5.2		2.1	9.6										
1.5	4.8	5	3.3	5.7				2	1	2.2			
1	2.3	4.2	1.7	4.6				0	.7	.7			
40.7	39	86.5	112.7	176	22.5	25	19.3	23	26.3	19.7	21.5	19	31.7
28.2	12.7	37.8	63	56.6	10.6	7.8	14.3	18.3	17	17.6	6.5	8.5	19.3
32.5	39	110.6	122.5	130	28	19	37.5	29.7	32	36.5	23.8	27.5	22
26.8	18.5	84	63.6	35.5	18.7	11.3	6.3	14.4	22.5	13.4	16.1	18.8	9.9
7.5	4	4	5.2	1									
3.7	2	2.7	3.7	.5									
2	1.5	.5		1									
.5	.5	.3		.3									
19.5	23	59.5	47.3	56.5	14.4	17	16.5	12.5	15	22.5	54	408.	28
12	4.2	47.2	35	32.6	12.7	10.6	8.6	7	10.6	7.7	8.4	32.4	18.3
27	15.6	34	60	47.8	25.5	12.6	14	19	17.5	24	38	20.7	49
24.7	8.4	26.8	56	31.1	19	8.7	12.7	17.8	3.5	12.8	26.6	14.1	15.6

among them. In the parks over 100 hectares, with the high volumes of foliage there even appeared species which had adhered most to their original natural environment People's Park, Cemetery).

It should be mentioned as a peculiar phenomenon that, contrary to expectations, two species: the wren and the long-tailed tit did not occur at breeding time in the area under the census. The wren and the long-tailed tit occurred in the study parks only during the summer-autumn season.

Conclusions

The cities and towns offer an extremely heterogeneous environment for the birds wanting, or – because they have not found a more suitable habitat – compelled to settle. Attempts had been made at classifying this environment (Bozsko, 1968; Strawinski, 1966; Erz, 1962), so that in this way also the birds adapted to the cities and towns could be grouped in ecological respect. Obviously, all ecological approaches emphasised the primary importance of vegetation in the settlement of the birds and in the favourable formation of the proportions of their species and individuals. That was also the reason why the present researches was restricted exclusively to squares and parks, that is: to study the bird fauna of the artificial vegetation concentrated on larger and smaller areas.

For an ornithological valuation of the parks of Budapest a comparison can be made with other investigation on the parks of Central and Northern Europe. These surveys inform on the park size, so they afford a possibility of comparing the number of bird species. Using Bozsko and Järvinen's comprehensive study and completing it with the present results, one can state once more that with the increase of the parks also the number of breeding species is increasing, although, according to the Budapest surveys the increase is much more moderate than could be expected relying upon the data of the literature (Table 5). The number of breeding species in the parks of Budapest has been lower than the one of the breeding species in the parks of approximately identical size of other European cities. (As to the number of individuals, no conclusions whatsoever can be drawn founded on the literature).

The census conducted through 3 years afford a possibility to give a prognosis on the avifauna of the parks to be established in the future. This prognosis can be valid mainly in the geographic area of Budapest and Central Europe, respectively although it may also help in drawing certain conclusions on citiens situated farther off. As to be observed, the smaller or greater changes followed in the sequence of years did not disturb the differences appearing either in the individual or species composition among the parks, so that any year could have been taken as the sample of the prognosis. For determining the expectable number of species, total number of individuals and number of individuals per hectare taken as a function of park size, linear regression analysis carried out on the census in 1977 was used. The results of the calculation are summarized in Table 6.

Undoubtedly, our healthy environment can be maintained only if we insert as many and as extensive green spots as possible into the concrete jungles of the towns and cities. In this way nature can be retrieved to the bleakest technical world. Although this endeavour will at all times encounter numerous difficulties,

Table 3. Bird density and species diversity
(B = breeding season,

		Cemetery			People's Park		
Park size in hectare:		185			112		
Years of census:		1975	1976	1977	1975	1976	1977
No. of species	B:	54	52	55	48	42	52
	W:	39	40	38	33	31	30
No. of individuals	B:	780.7	1065.4	708.7	1046.4	657.8	894
	W:	754.5	543.2	773.2	1185.4	1155	1200.5
No. of individuals per hectare	B:	4.2	5.7	3.8	9.3	5.8	7.9
	W:	4	2.9	4.2	10 6	10.3	10.7
H_{max}	B:	3 989	3.951	4.007	3.871	3.738	3.951
	W:	3.664	3.689	3.638	3.497	3.434	3.401
Diversity H'	B:	3.102	2.375	2.932	2.577	2.963	2.900
	W:	2.602	3.082	2.557	2.664	2.339	2.370
Equitability J^1	B:	.778	6.01	.732	.666	.793	.732
	W:	.724	.835	.703	.762	.681	.697

		Museum Park			Engels Square		
Park size in hectare:		2.1			1.6		
Years of census:		1975	1976	1977	1975	1976	1977
No. of species	B:	8	6	8	9	8	9
	W:	14	12	13	14	13	12
No. of individuals	B:	100.3	82	96	173.4	185.1	264.5
	W:	126	132.3	103.3	195.6	253.1	224.3
No. of individuals per hectare	B:	47.7	39	45.7	108.3	115.6	165.3
	W:	60	63	49.1	122.2	158.1	140.1
H_{max}	B:	2.079	1.792	2.079	2.197	2.079	2.197
	W:	2.639	2.485	2.565	2.639	2.565	2.485
Diversity H'	B:	1.521	1.338	1.646	1.338	1.615	1.065
	W:	2.007	2.078	1.986	1.501	2.008	1.605
Equitability J'	B:	.732	.747	.799	.609	.777	.485
	W:	.761	.836	.774	.569	.783	.646

in the parks and squares of Budapest
W = winter season)

Margaret Island			City Park			Friendship Park		
66.5			81.5			22		
1975	1976	1977	1975	1976	1977	1975	1976	1977
35	38	39	33	31	34	11	10	10
29	28	27	26	24	27	20	17	18
1322.6	1046.1	1503.6	1002.2	565.4	626.3	78.3	95.2	79.3
1638.5	1325.4	1448	842.8	602.1	744.4	255.6	272	244.7
19.8	15.7	22.6	12.3	6.9	7.7	3.6	4.3	3.6
24.6	19.9	21.7	10.3	7.4	9.1	11.6	12.3	11.1
3 638	3.555	3.664	3.497	3.464	3.526	2.398	2.303	2.303
3.367	3.332	3.296	3.258	3.178	3.296	2.996	2.833	2.890
2.201	2.438	2.181	1.852	2.459	2.237	1.849	1.698	1 768
2.047	2.423	2.234	1.983	2.324	2.133	2.017	1.424	2.049
.605	.686	.595	.530	.716	.634	.771	.737	.768
.608	.727	678	.609	.731	.647	.673	.503	.709

József Nádor Square			Vigadó Square			Vörösmarty Square		
0.45			0.24			0.12		
1975	1976	1977	1975	1976	1977	1975	1976	1977
5	5	6	7	6	7	6	6	5
4	4	4	5	5	4	4	4	4
40.4	47	39.8	44	46.5	51.1	83.2	66.1	62.7
60	37.6	55.5	52.9	52.5	63	64.5	51.5	74.7
89.7	104.4	88.4	183.3	193.7	212.9	693.3	550.8	522.5
133.3	83.9	123.3	220.4	222.9	262.5	537.5	429.1	622.5
1.609	1.609	1.792	1.946	1.792	1.946	1.792	1.792	1.609
1.386	1.386	1.386	1.609	1.609	1.386	1.386	1.386	1.386
.875	.910	1.072	1.552	1.085	1.295	.972	.985	.887
1.034	1.115	.852	.966	.935	.833	.854	.904	.818
.545	.566	.599	.798	.605	.665	.542	.550	.551
.746	.805	.615	.602	.581	.601	.616	.652	.590

Table 4. The settlement of the bird species in breeding season as a function of park size

The species settled in the smaller downtown parks (under 3 ha), well adapted to the urban conditions.	The species settled in the more extensive parks (up to a 100 hectares), adapting to urban environment only if there was a considerable vegetation cover	Species settling in parks over 100 hectares, ones which adhered most to their original natural environment
Streptopelia decaocto	*Falco tinnunculus*	*Buteo buteo*
Hirundo rustica	*Jynx torquilla*	*Perdix perdix*
Delichon urbica	*Picus viridis*	*Phasianus colchicus*
Coloeus monedula	*Dendrocopos major*	*Streptopelia turtur*
Parus major	*Dendrocopos syriacus*	*Cuculus canorus*
Turdus merula	*Galerida cristata*	*Athene noctua*
Sturnus vulgaris	*Oriolus oriolus*	*Strix aluco*
Passer domesticus	*Corvus corone*	*Upupa epops*
Columba livia domestica	*Pica pica*	*Dendrocopos medius*
	Parus caeruleus	*Dendrocopos minor*
	Sitta europaea	*Garrulus glandarius*
	Certhia brachydactyla	*Parus palustris*
	Phoenicurus ochruros	*Turdus philomelos*
	Luscinia megarhynchos	*Oenanthe oenanthe*
	Erithacus rubecula	*Hippolais icterina*
	Sylvia atricapilla	*Sylvia nisoria*
	Sylvia borin	*Motacilla alba*
	Sylvia communis	*Acanthus cannabina*
	Sylvia curruca	*Emberiza citrinella*
	Philloscopus trochilus	
	Philloscopus collybita	
	Philloscopus sibilatrix	
	Muscicapa albicollis	
	Lanius collurio	
	Passer montanus	
	Coccothraustes coccothraustes	
	Chloris chloris	
	Carduelis carduelis	
	Serinus serinus	
	Fringilla coelebs	

people will maybe give heed to ornithologists speaking up for the parks to be set up and also telling the size, compared to which only larger green areas may ba established.

Table 5. The number of species and the number of individuals per hectare of the birds nesting in the parks in some European towns and in Budapest. (Data in Budapest were registered in 1977)

Name of the park	Town	Park size in hectare	No. of species	No. of individuals per hectare	Author
Vörösmarty Square	Budapest (Hungary)	0.12	5		
Vigadó Square	Budapest (Hungary)	0.24	7		
József Nádor Square	Budapest (Hungary)	0.48	6		
Engels Square	Budapest (Hungary)	1.6	9	165	
Museum Park	Budapest (Hungary)	2.1	8	46	
Zoo	Poznan (Poland)	5.25	18	50 – 60	Mroczkiewicz, 1962
Zoo	Frankfurt/M (GFR)	7.6	21	30 – 40	Steinbacher, 1942
Summer Garden	Leningrad (USSR)	11.7	14	1.4 (without sparrows)	Bozsko, 1957
Zelenec Park	Torun (Poland)	11	26		Strawinski, 1963
Solack Park	Poznan (Poland)	12	27	24	Graczyk, 1952
Cemetery	Rostock (GDR)	17	28	18	Grempe, 1973
Friendship Park	Budapest (Hungary)	22	10	4	
Tavritsheski Garden	Leningrad (USSR)	22	10	1 (without sparrows)	Bozsko, 1967
Botanic Garden	Leningrad (USSR)	23.8	29	6 (without sparrows)	Bozsko, 1967
Suburban Park	Lancut (Poland)	31	50	19	Kalczycki, 1966
Academic Park	Leningrad (USSR)	46	43	14	Maltshevski, 1950
Margaret Island	Budapest (Hungary)	66.5	39	23	
City Park	Budapest (Hungary)	81.5	34	8	
Park of Biological Institut	Leningrad (USSR)	102	52	20 – 30	Bozsko, 1957
People's Park	Budapest (Hungary)	112	52	8	
Oranienbaum Park	Leningrad (USSR)	162	67		Bozsko, 1957
Cemetery	Budapest (Hungary)	185	55	4	
Botanic Garden	Debrecen (Hungary)	13.7	36		Bozsko, 1968

Number of species and number of individuals without information on park size

Name of the park	Town	No. of species	No. of individuals per hectare	Author
City Parks (!)	Helsinki (Finland)	24		Kajoste, 1961
Scytnicki Park	Wroclaw (Poland)		52	Syrcz, 1963
Ostankino Park	Moskwa (USSR)		1	Krotov, 1941
City Parks (!)	Kiel (GFR)		12	Erz, 1964
Zoo	Köln (GFR)		26	Erz, 1964
City Park	Dortmund (GFR)		26	Erz, 1964

Table 6. The prospective bird density in the parks to be established, represented as a function of park size in the breeding season

Park size in hectare	Number of species	Number of individuals	Individuals per hectare
1	7	89	89
5	12	195	38.1
10	14	276	27.6
20	18	358	17.9
30	21	460	15.3
40	22	520	13
50	24	565	11.3
70	28	660	9.4
100	31	870	8.7

Acknowledgement

I thank the Park Maintenance Department of the Budapest Gardening Enterprise for support of the present work.

REFERENCES

1. Bozsko, Sz. (1957): *Ornitofauna parkor Leningrada i ego orkestnostej.* – Vestn. LGU, 15., Ser. Biol., V, 3: 38 – 52.

2. Bozsko, Sz. (1968): *A városi parkok, mint ökológiai egységek és ornithofaunisztikai jellemzésük.* – Aquila, 75: 131 – 149.

3. Engström, K. (1956): *Stockholmd fagellir.* – Stockholm, 148.

4. Erz, W. (1964): *Bemerkungen über Charakteristika in der Verständterung westfälischer Vögel.* – Natur u. Heimat, Münster, Westf., 24: 107 – 117.

5. Erz, W. (1966): *Ecological principles in the urbanization of birds.* – Ostrich, Suppl., 6: 357 – 363.

6. Fitter, R. (1949): *London's birds.* – London. 121.

7. Frieling, H. (1942): *Großstadtvögel.* – Stuttgart.

8. Gladkov, N. A. (1958): *Über die Vogelfauna der Kulturlandschaft.* – Proc. XII. Int. Orn. Congr. Helsinki, 234 – 239.

9. Graczyk, R. (1952): *Ptaki w Solackim w Poznanin.* – Chronmy Pr. Ojcz., 8, 4.

10. Grimm, H.: *Die Vogelwelt der Großstadt und der Industrielandschaft.* – Falke, 19: 150 – 156.

11. Herms, E. (1950): *Das Vogelleben Bangkoks.* – Columba, 2: 75 – 76.

12. Kajoste, E. (1961): *Über die Nistvogelfauna der Innenstadt von Helsinki.* – Orn. Fenn., 38: 45 – 61.

13. Keve, A. (1976): *Gondolatok a madarak urbanizációs kérdéséhez.* – Állattani Közlemények, 63: 83 – 94.

14. Legendre, M. (1930): *Oiseaux de Paris.* – L'oiseau, 11: 378.

15. Luniak, M., Kalbarczyk, W. & Pawlowski, W. (1964): *Birds of Warsaw,* – Acta Orn. PAN, 8: 175 – 285.

16. MACPHERSON, A. H. (1929): *A list of the birds of inner London.* – British Birds, 22: 222 – 244.

17. MALCHEVSKIJ, A. C. (1950): *O gnezdovanii ptic v gorodskih uslovijah.* – Tr. Leningr. Estestvoisp., 70, 4: 140 – 154.

18. MARSCHALL, A. F. & PELZEN, A. (1882): *Ornis Vindobonensis.* – Wien: 192.

19. MROCZKIEWICZ, D. (1962): *Oecology of free-living birds on the grounds of the Poznan Zoological Garden.*

20. PARK, R. E., BURGESS, E. W. & MCKENZIE, R. D. (1925): *The City.* – Chicago.

21. PATRIZI – MONTORO, F. (1909): *Materiali per un avifauna delle provincia di Roma.* – Bull. Soc. Zool. Ital.: 1 – 103.

22. RITCHIE, J. (1920): *The influence of man on animal life in Scotland.* – Edinburgh.

23. SCHNURRE, O. (1921): *Die Vögel der deutschen Kulturlandschaft.* – Marburg a. L.: 136.

24. STEINBACHER, G. (1942): *Siedlungsdichte in der Parklandschaft.* – Journal für Ornithologie, 90: 34 – 43.

25. STRAWINSKI, S. (1963): *The birds of Torun.* – Acta Ornithologica PAN, 7: 115 – 156.

26. STRAWINSKI, S. (1966): *Die Vögelverstädterung vom ökologischer Stadtpunkt.* – Ornithologische Mitteilungen, 18: 44 – 55.

27. WARD, P. (1968): *Origin of the Avifauna of Urban and Suburban Singapore.* – Ibis, 110: 239 – – 255.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Food Composition of Nestling Blackbirds in an Oak Forest Bordering on an Orchard

By

J. Török*

Abstract. The author studied the food composition of nestling blackbirds in an oak forest neighbouring upon an orchard with the neck-collar method. The values of the dry weight and calory content of the food taken in, as well as the proportion of these quantities to the unit weight of the nestlings (1 g) showed a positive correlation with the growth of the latter. The four major groups of food were Lepidoptera larvae, Coleoptera adults, Diptera and earthworms. The nestlings consumed food of high and low caloric value in small, that of medium value in large rate.

Introduction

The blackbird is a common breeding species in various habitats, and therefore its ecological valuation is of special importance when revealing the internal connections of the natural and agro-ecosystems. Numerous studies have been published on this species in the ornithological literature so far, among them the works of Morris (1954), Hartley (1954), Snow (1956, 1958, 1966), Eble (1963), Korodi Gál (1967), Dyrcz (1969), Vauk and Witting (1971), Smith (1973), Berthold (1976), as well as Havlin (1977) are prominent. Snow (1956, 1958, 1966) dealt with the species in many respects, and devoted attention to its territorial behaviour and population dynamics. Hartley (1954), Morris (1954), Berthold (1976), as well as Vauk and Witting (1974) examined, among others, the food composition of the blackbird. Korodi Gál (1967) studied the growth of nestling blackbirds in relation to their food and analysed their diet at different ages. Havlin's (1977) comparative study rested on an analysis of the stomach contents of several hundred starlings and blackbirds. Using the same method Eble (1963) investigated the food of blackbird in several habitats. Dyrcz's (1969) comprehensive paper discussed distribution, habitat selection food composition and breeding ecology of the species. Smith (1973) analysed the food-searching behaviour of blackbirds.

The present study is aimed at setting forth the investigations on the nutrition of nestling blackbirds. Since the purpose of the research has been the ecolo-

---

**Ján*os Török*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

gical examination on the common species breeding in the urban environment and in agricultural areas, I chose the study area in a suburban forest of Budapest bordering on an orchard. The study comprises some preliminary results of a manifold research work planned, in view of the above considerations, to last for several years.

Methods

The dominant tree species of the forest chosen as a study area was *Quercus cerris*, in smaller quantities also *Quercus petrea, Carpinus betulus, Acer campestris* and *Cerasus avium* were growing in it. The edge of the oak forest was covered with dense shrubbery *(Crataegus* spp., *Ligustrum vulgare, Rosa* spp., *Sambucus nigra)*. The orchard neighbouring the forest consisted of apple- (Jonathan, Starking, Golden Delicious), apricot-, peach-, cherry-, sour cherry-, pear- and plum-trees.

From April to July of the years 1978 and 1979 the food samples were collected through 26 days from 47 nestlings of 12 nests. If one considers the food taken in by 1 nestling in 1 hour as a unit, i. e. a sample, then 292 samples were analysed in the course of the investigation. There was a compressing band (a cotton thread 3 mm in diameter) round the neck of the nestlings to hinder the swallowing of food placed, loosely enough so as not to strangle them. The method was applied first by KLUJVER (1933), after him among others also ORIANS (1966), KORODI GÁL (1967), DYRCZ (1969) and WALSH (1978) used it in collecting food from various bird species. The food composition of the nestlings from hatching to the time of leaving the nests (11 – 12 days) was followed with this method. The collars were on the nestlings for an hour, then the food accumulated in the meantime was removed by means of tweezers while gently massaging the throat of the nestling. Subsequently to this the neck-collar was taken off and the nestling was fed with boiled eggs of an approximately identical quantity with that taken away. The collar was put up to that time. After one hour's free swallowing the collar was put round the nestling's neck again. Thus, in hourly turns, the food samples could been continuously obtained between 06.00 and 18.00.

After removal, part of the food samples were rinsed by water and placed into a preserving solution composed of: 53% ethyl alcohol (95% alcoholic strength) 33% distilled water, 7% glycerin, 7% glacial acetic acid (concentrated acetic acid). In this solution animals keep their softness and colour even after a longer time.

The other part of the food samples was separated by taxonomic groups, dried at 104 °C to constant weight, then weighed and its caloric value was determined. When calculating the latter, the caloric data published in the literature were also taken into consideration (Table 1). Where there were more than one such data regarding one animal group at my disposal, I averaged the values and used the obtained means in the course of the further calculations.

Results

The weight of the nestlings taken as a function of time increased according to the logistic equation $wt = 54.5/1 + e^{-0.647\,(t-3.896)}$. Since, however, this value concerned the nestlings at times deprived of their food, it may be presumed

*Table 1. Caloric values of the invertebrate animals occurring in the food (cal/g dry weight; * = mean of several measurements)*

Taxon	cal/g dry wt.	Mean
Lumbricidae	4125,6 Blem (1969) 5012,0 Cummis (1971) 5326,3 East (1976) 4671,3 French (1957)	4783,3
Isopoda	3671,5* Reichle (1967) 3942,5* Saito (1969)	3794,5
Diplopoda	3520,0 Reichle (1967) 3377,0* Török	3424,7
Chilopoda	4985,1 Reichle (1967)	4985,1
Phalangida	5362,0 Reichle (1967)	5362,0
Araneidea	5581,9 Moulder (1970) 6399,0* Török	5990,5
Orthoptera	5501,9 Moulder (1970) 5578,1 Edwards (1970) 5418,5* Cummis (1971)	5420,0
Coleoptera	5561,0* Török	5586,2
Elateridae	5439,9* Cummis (1971)	5439,9
Carabidae	5496,1 Edwards (1970) 5043,9* Lővei (unpub. data)	5270,0
Tenebrionidae	5851,8* Englemann (1961)	5851,8
Melolonthidae	5808,5* Török	5808,5
Diptera	5768,0 Cummis (1971)	5768,0
Hymenoptera	6076,8 Edwards (1970) 4548,8 Cummis (1971) 4867,7 Cummis (1971)	5090,3
Formicidae	6076,8 Edwards (1970) 4548,8* Cummis (1971)	5312,8
Apidae	4867,7 Cummis (1971)	4867,7
Hemiptera	5638,0 Wiegert (1965) 7178,0 Mukerji (1969)	6408,0
Cercopidae	5638,0 Wiegert (1965)	5638,0
Blattidae	5397,0* Woodland (1968)	5397,0
Lepidoptera ad.	6532,3* Török	5056,8
Geometridae ad.	4602,0 Bergeron (1970)	4602,0
Noctuidae ad.	6007,0 Bergeron (1970)	6007,0
Tortricidae ad.	3086,0 Bergeron (1970)	3086,0
Lepidoptera larv.	5297,6* Gere (1957) 6517,0 Mukerji (1969) 4271,4* Török	5362,8
Lepidoptera pupa	6635,0* Gere (1957)	6635,0

that it differs from the values of growth of nestlings reared in undisturbed conditions. Value K = 0.647 shows rapid increase. The weight of the nestlings abruptly rose between the ages of two to eight days, before and after this the rate of growth was slower.

The quantity expressed in dry weight of the food taken in in a day (Fig. 1), as well as its caloric value rose in direct proportion with the growth of the nestlings. By means of linear regression analysis, the equations

$$Y_1 = -0.6977 + 0.0527X \qquad (P < 0.001)$$
$$Y_2 = -3715.37 + 294.95X \qquad (P < 0.001)$$

express this relationship, with values $r_1 = 0.794$ and $r_2 = 0.775$. (Y_1 = the food taken in: g per day, in dry weight, Y_2 = the quantity of calories taken in: cal per day, X = the weight of the nestlings: g.)

In the food samples collected from the nestlings 80 species could be determined; on account of difficulties of determination part of the animals were separated only into genera, families and orders. I found no plant items at all in some cases however grains of sand, pebbles and snail fragments were found.

33.1% of the total nestling diet consisted of caterpillars (Table 2), besides this, the share of the lepidopterous adults was 2.2%, that of the pupae 0.4 %.

The most important species were those of the genus *Agrochola* and *Orthosia cruda*. In a quantity nearly identical with that of the caterpillars were present the Coleoptera adults (32.7%), out of which *Calosoma inquisitor*, *Melolontha*,

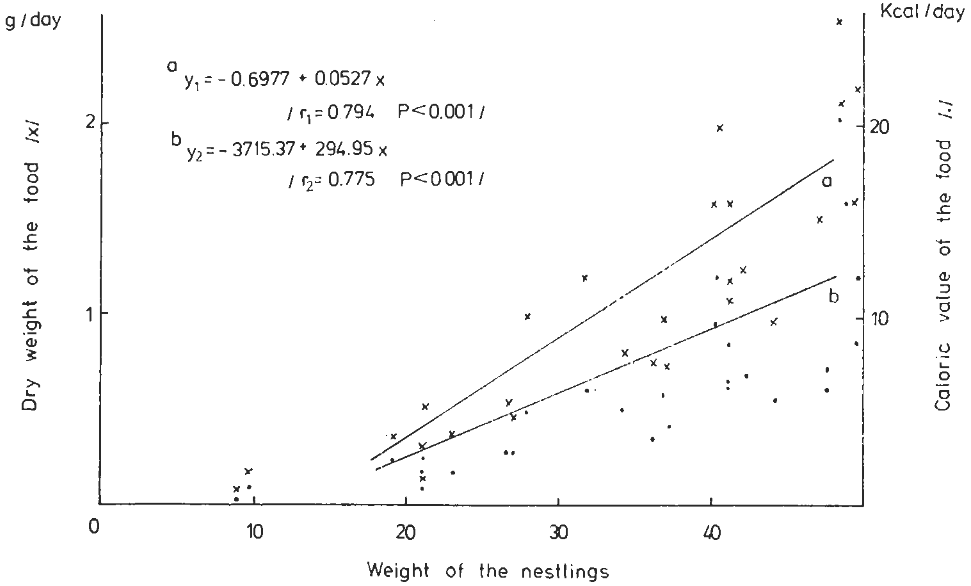


Fig. 1. Relation between the dry weight *(a)*, caloric value *(b)* of the food and the weight of the nestlings

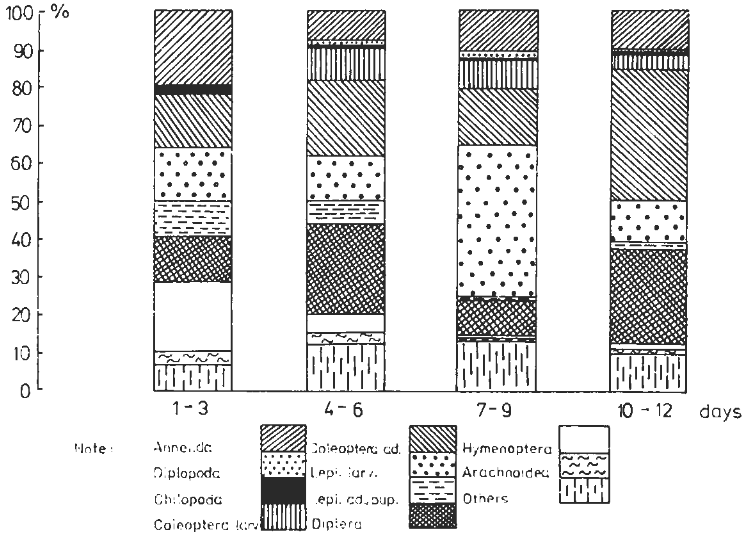


Fig. 2. Percentual distribution of the major groups of food at four stages of the nestlings

Table 2. *Food composition of nestling blackbirds in an oak forest*
(a — total weight in the 292 samples; b — percentual distribution as compared with the total weight of the 292 samples [29.3329 g]; c — number of the samples in which the prey species could be found; [1 sample = quantity of food consumed by 1 nestling in 1 hour])

Taxon	*a* g dry wt.	*b* %	*c* Number of samples
Annelida			
Lumbricidae			
Dendrobaena octaedra	0.0142	8.05	2
Dendrobaena sp.	0.0675		4
Allolobophora caliginosa	0.1636		2
Allolobohora rosea	0.2514		16
Allolobophora sp.	0.1510		2
Lumbricus sp.	0.0656		4
Lumbricidae indet.	1.6447		91
Mollusca			
Limacidae	0.0050	0.02	1
Arthropoda			
Isopoda			
Protracheoniscus amoenus	0.0351	0.21	10
Armadillidium sp.	0.0070		3
Isopoda indet.	0.0203		5
Diplopoda			
Glomeris hexasticha	0.0708	0.70	5
Chromatoiulus projectus	0.1346		20
Chilopoda			
Monotarsobius austriacus	0.0015	0.18	1
Lithobius muticus	0.0361		10
Lithobius forficatus	0.0045		2
Henia illyrica	0.0046		1
Cryptops sp.	0.0036		2
Blattidea indet.	0.0711	0.24	2
Orthoptera			
Pholidoptera griseoaptera	0.0399	0.14	2
Dermatoptera			
Forficula auricularia	0.0951	0.33	11
Heteroptera			
Pentatomidae			
Palomena prasina	0.0227	0.13	2
Miridae indet.	0.0012		1
Heteroptera indet.	0.0120		6
Neuroptera			
Raphidia flavipes	0.0010	0.01	1
Coleoptera			
Carabidae			
Calosoma inquisitor	4.0406	15.65	21
Pterostichus cupreus	0.0433		2
Pterostichus vulgaris	0.0223		1
Pterostichus sp.	0.0200		3
Harpalus rufipes	0.0873		6
Harpalus smaragdinus	0.0061		2
Harpalus sp.	0.0320		2
Carabidae ad. indet.	0.1278		11
Carabidae larv. indet.	0.2152		18

Taxon	*a* g dry wt.	*b* %	*c* Number of samples
Staphilinidae			
Ocypus olens	0.0700	0.38	4
Xantholinus sp.	0.0026		1
Staphilinidae indet.	0.0355		4
Silphidae			
Xylodrepa quadripunctata	0.6149	2.44	26
Silphidae larv. indet.	0.1004		3
Cerambycidae			
Cortodera humeralis	0.0100	0.04	1
Tenebrionidae			
Cylindronotus aeneus	0.2143	0.73	7
Scarabaeidae			
Onthophagus coenobita	0.1681	0.98	3
Onthophagus verticicornis	0.0800		2
Onthophagus spp.	0.0400		2
Melolonthidae			
Melolontha melolontha	1.5594	7.77	17
Rhizotrogus aequinoctialis	0.4215		10
Amphimallon solstitialis	0.1382		2
Melolonthidae indet.	0.1610		4
Cantharidae			
Cantharis fusca	0.0704	0.39	6
Cantharis obscura	0.0312		2
Metacantharis haemorrhoidalis	0.0048		1
Malachius sp.	0.0072		2
Elateridae			
Athous rufus	0.7148	5.30	28
Prosternon tesselatum	0.1382		11
Adelocera murina	0.0567		4
Melanotus sp.	0.0229		2
Elateridae larv. indet.	0.1313		9
Elateridae ad. indet.	0.4936		21
Curculionidae			
Balaninus glandium	0.0237	0.10	4
Phillobius sp.	0.0060		2
Coleoptera ad. indet.	0.1232	3.00	28
Coleoptera larv. indet.	0.7600		21
Lepidoptera adults			
Tortricidae indet.	0.0722	0.24	2
Notodontidae			
Lophopteryx camelina	0.0996	0.34	4
Noctuidae			
Conistra vaccinii	0.1023	1.26	5
Conistra erythrocephala	0.0284		3
Orthosia stabilis	0.0649		9
Orthosia incerta	0.0381		2
Orthosia spp.	0.0538		6
Apatele rumicis	0.0290		3
Ephesia nymphagoga	0.0500		1
Lepidoptera larvae			
Tortricidae			
Tortrix viridana	0.1000	0.65	3
Tortricidae indet.	0.0905		12

Taxon	*a* g dry wt.	*b* %	*c* Number of samples
Notodontidae			
Drymonia chaonia	0.0900	0.31	2
Geometridae			
Colotois pennaria	0.3771	9.37	4
Lycia hirtaria	0.5193		16
Operopthera brumata	0.0179		2
Erannis spp.	0.3108		19
Boarmia spp.	0.3998		7
Geometridae indet.	1.1285		43
Noctuidae			
Dicycla oo	0.0372	20.28	4
Allophyes oxyacanthae	0.1036		4
Tholera decimalis	0.3959		7
Mamestra brassicae	0.0800		3
Conistra erythrocephala	0.2720		3
Conistra spp.	0.2127		12
Orthosia cruda	1.4502		42
Orthosia spp.	0.1100		2
Scotia segetum	0.3521		2
Scotia sp.	0.0911		3
Agrochola spp.	1.6727		52
Noctuidae indet.	1.1783		39
Nymphalidae			
Nymphalis polychloros	0.0967	0.33	2
Lepidoptera ad. indet.	0.0951	0.33	3
Lepidoptera larv. indet.	0.6103	2.09	59
Lepidoptera pup. indet.	0.1149	0.39	21
Diptera			
Tipulidae			
Tipula livida larv.	0.0416	10.65	3
Tipulidae ad. indet.	3.0113		78
Tipulidae pup. indet.	0.0739		3
Limoniidae			
Limonia pannonica	0.0035	1.12	6
Limonia nigripunctata	0.0520		4
Limoniidae indet.	0.2774		28
Bibionidae indet.	0.0776	0.27	21
Asilidae			
Dialtria flavipennis	0.0150	0.07	2
Asilidae indet.	0.0050		2
Syrphidae			
Epistrophe balteata	0.2234	0.78	1
Syrphidae indet.	0.0052		1
Tachinidae indet.	0.0089	0.03	2
Diptera ad. indet.	0.0734	0.25	22
Diptera larv. indet.	0.4088	1.39	10
Hymenoptera			
Tenthredinidae			
Dolerus gonager	0.0051	0.21	2
Allanthus masculatus	0.0230		2
Tenthredinidae indet.	0.0332		5
Ichneumonidae indet.	0.0017	0.01	1

Taxon	*a* g dry wt.	*b* %	*c* Number of samples
Formicidae			
Camponotus ligniperda	0.1052	0.63	4
Camponotus sp.	0.0693		7
Formicidae indet.	0.0085		3
Vespidae			
Vespa cabro	0.0589	0.20	2
Apidae indet.	0.0290	0.10	4
Hymenoptera ad. indet.	0.0236	0.08	7
Hymenoptera pup. indet.	0.0076	0.03	2
Phalangiidea			
Lophopilio palpinalis	0.0023	0.18	1
Zacheus crista	0.0244		4
Platybunus sp.	0.0197		5
Phalangiidea indet.	0.0051		2
Araneidea			
Atypidae			
Atypus affinis	0.0084	0.03	1
Amaurobiidae			
Titanoeca schineri	0.0009	0.01	1
Dysderidae			
Harpactes rubicundus	0.0492	0.17	15
Dysdera erythrina	0.0019		2
Agelenidae			
Tegeneria torpida	0.0066	0.02	2
Pisauridae			
Pisaura mirabilis	0.0062	0.02	2
Lycosidae			
Alopecosa trabalis	0.0318	0.47	11
Alopecosa schulzeri	0.0851		8
Trochosa terricola	0.0214		2
Linyphidae			
Linyphia hortensis	0.0006	0.01	1
Linyphia clathrata	0.0014		1
Drassidae			
Drassodes silvestris	0.0091	0.03	2
Thomisidae			
Xysticus kochi	0.0109	0.59	2
Xysticus lanio	0.0450		9
Xysticus cambridgei	0.0923		4
Xysticus sp.	0.0050		2
Heriaeus hirtus	0.0150		1
Oxyptila atomaria	0.0030		1
Philodromus aureolus	0.0038		2
Total	*292.3329*	*99.73*	*292*

melolontha, *Xylodrepa quadripunctata* and Elateridae were the dominant ones. The proportion of the Coleoptera larvae was 4.1%. Also Diptera meant a relatively significant group of food with 14.6%, within which Tipulidae and Limoniidae families were conspicuous. Earthworms, one of the characteristic animal food of the blackbird, was present only in 8.1% in the collected material. Hymenoptera, spiders and other taxa were of no significance in the food the nestlings.

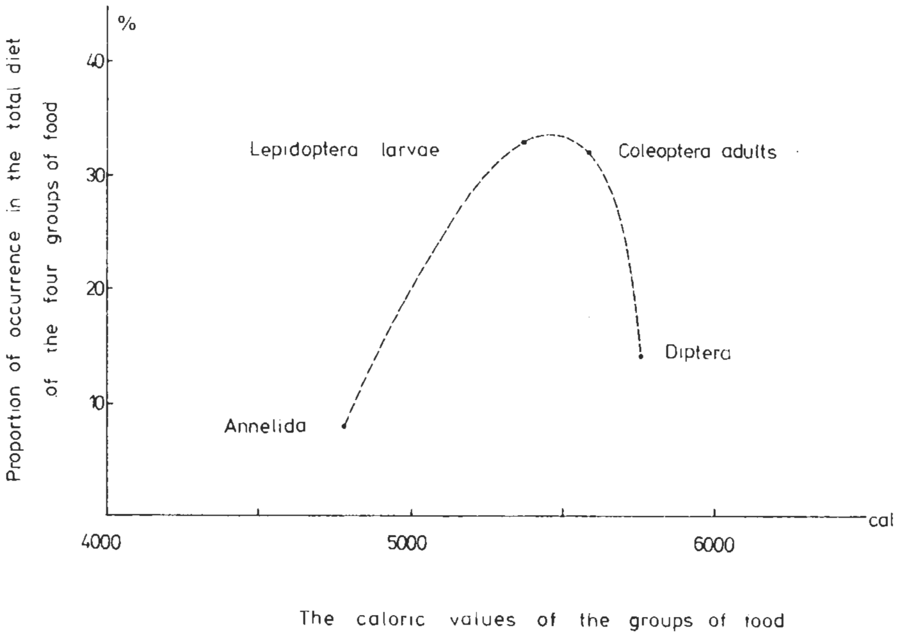


Fig. 3. Frequency distribution of caloric values of major food items in nestling blackbird's diet

With the growth of the nestling blackbirds also the composition of their food was changing (Fig. 2). The 1 – 3 days old nestlings eat mainly softer invertebrates: earthworms, Hymenoptera, spiders. The proportion of Coleoptera was relatively low, but that value increased with the older nestlings. Diplopoda were absolutely lacking from the food at this age of the birds. At a more developed stage of the nestlings the proportion of the adults and pupae of Lepidoptera, Hymenoptera, earthworms and spiders decreased. The occurrence of Diptera and caterpillars did not show an unambiguous tendency.

Relationship can be presented between the caloric value of the prey groups and their rate in nestling diet (Fig. 3). Blackbirds consumed more Coleoptera adults and caterpillars of medium caloric value than earthworms of relatively low and Diptera of high caloric values.

Discussion

Comparing the present results with VAUK and WITTING's (1971) investigations on nutrition conducted in the migration period of birds, one evidently finds significant differences. Thus, in the stomach contents analysed by them during the migration period there was 40% of plant food and the caterpillars were missing. Since the diet of the bird species is determined by the food supply of the various areas well as by the seasons, there are differences also within the insect food, if comparing VAUK and WITTING's data with the ones presented here. In the material collected by them, the food of the migration blackbirds contained many snails *(Oxychilus* sp., *Littorina)*, weevils *(Otiorrhynchus ovatus)* and ants *(Formica* sp.) which do not occur at all or in insignificant quantities in the samples collected by us.

According to EBLE's (1963) study the rate of plant and animal components in the food of blackbird is 48.7% and 51.3% respectively. (HAVLIN's (1977) data: 10% plant food, 90% animal food) In oak forest neither DYRCZ (1969) nor me found plant components in the food of nestlings. The possible reasons of this difference are: *a)* EBLE studied adult specimens and we worked on nestlings, *b)* the study area chosen by EBLE was not an oak forest.

The fact that the food composition has changed in some measure during the growth of the nestlings, can be ascribed in part to the specific character of the preys. At the age of 1 – 3 days a significant part of the food consist of earthworms and easily digestible insects poor in chitin (Diptera, Hymenoptera, Lepidoptera larvae, pupae and adults). The proportion of Coleoptera rose notably during the latter stages of growth. At that time Diplopoda did appear in the food, but their number remained low. Comparing the above results with data of KORODI GÁL (1967) the increase of the rate of Coleoptera and decrease of that of the spiders can also be stated in both investigations.

With the exception of 1 slug, the food did not contain snails. This can, however, be ascribed in the first place to the lack of snails in the environment, and/or to the circumstance that the dry weather did not help the propagation of the snails. Possibly also the relatively small rate of earthworms in the food finds its explanation in this.

In EBLE's (1963) results Coleoptera was dominant, but the proportion of Gastropoda, Diptera, Lepidoptera was also relatively high. In my examination the same taxa proved to be the main animal groups except Gastropoda. DYRCZ's (1969) data are similar, too, but the proportion of Lepidoptera adults was considerably higher.

The food taken in and its caloric value rose in direct proportion to the weight of the nestlings. Also the dry weight and caloric value of the food falling to the unit weight of the nestlings (1 g) rose with the growth of the latter, although the increase was slight. This change is expressed by the equations

$$Y_1 = 0.004 + 0.001X \qquad r_1 = 0.707 \qquad (P < 0.001)$$
$$Y_2 = 11.01 + 4.302X \qquad r_2 = 0.671 \qquad (P < 0.001)$$

(Y_1 = food, g per day falling to unit nestling wight [1 g], Y_2 = calory intake, cal per day falling to unit nestling weight [1 g], X = weight of the nestling, grams.)

Studying the caloric values of the four main groups of food one finds that the blackbirds have consumed more food items of medium caloric value than of the ones of relatively low and high caloric values. In forming this proportion, several factors may have a share. Thus e. g. the proportions could be influenced by the frequency of the prey in the areas where the food was acquired, and by the amount of energy expended to finding them. They could be affected, further, by the assimilation value of the food, e. g. by the rate of indigestible chitin in it. In the present investigation I did not separate the latter from the easily digestible food materials, and used uniform values of dry weight and calories in the calculations.

Acknowledgements

The present study was supported by the Hungarien Academy of Sciences, by the Department of Systematic Zoology and Ecology of the Eötvös Loránd University of Budapest, as well as by the Research Institute of Plant Protection. I owe thanks to Dr. LAJOS SASVÁRI and Dr. GÉZA GERE for their valuable professional advices. Further, I thank for the determination of the animals to Dr. IMRE LOKSA (Araneida, Phalangida), to Dr. ANDRÁS ZICSI (Annelida), to LÁSZLÓ ÁDÁM, OTTO MERKL, Dr. GÁBOR LŐVEI (Coleoptera), to LÁSZLÓ RONKAY, Dr. ZOLTÁN MÉSZÁROS (Lepidoptera), to Dr. TAMÁS VÁSÁRHELYI (Heteroptera, Homoptera), to LÁSZLÓ NAGY (Orthoptera, Dermatoptera).

Summary

The food composition of nestling blackbirds was studied with the neck-collar method in a suburban oak forest of Budapest bordering on an orchard.

The dry weight ($Y_1 = -0.6977 + 0.0527X$) and caloric value ($Y_2 = -3715.37 + 294.95X$) of the food taken in showed a positive correlation with the growth of the nestlings.

The distribution of the ten major food groups was as follows: caterpillars 33.1%, Coleoptera adults 32.7%, Diptera 14.6%, earthworms 8.1%, Coleoptera larvae 4.1%, Lepidoptera adults and pupae 2.5%, Araneida and Phalangida 1.5%, Hymenoptera 1.3%, Diplopoda 0.7%, Chilopoda 0.2%, others 1.1%.

With the development of the nestlings the proportion of the earthworms and Hymenoptera decreased and that of Coleoptera rose in the food.

As regards the caloric values of the various animal groups, as well as the proportion of their occurence in the food, the nestlings consumed beetles and caterpillars of medium caloric value in greatest rates, smaller amounts were ingested of the groups of low and high caloric value.

REFERENCES

1. BERGERON, J. M. & BUCKNER, C. H. (1970): *Caloric values of some bog lepidoptera.* – Manitoba Entomol., 4: 88–93.

2. BERTHOLD, P. (1976): *The control and significance of animal and vegetable nutrition in omnivorous songbirds.* – Ardea, 64: 140–154.

3. CUMMIS, K. W. & WUYCHECK, J. C. (1971): *Caloric equivalents for investigations in ecological energetics.* – Intern. Verein. Theor. Angew. Limnol., 18: 1–159.

4. DYRCZ, A. (1969): *The ecology of the song-thrush (Turdus philomelos Br.) and blackbird (Turdus merula L.) during the breeding season in an area of their joint occurrence.* – Ekol. Pol., 39: 735–793.

5. EAST, R. & POTTINGER, R. P. (1975): *Starling (Sturnus vulgaris L.) predation on grassgrub (Costelytra zealandica/White), Melolonthinae) populations in Conterburry.* – New Zealand Journ. Agric. Res., 18: 417–452.

6. EBLE, H. (1963): *Ernährungsbiologische Untersuchungen an Turdus philomelos Brehm, Turdus merula L. und Sturnus vulgaris* L. – Wiss. Z. Martin-Luther-Univ. Halle-Wittenberg, 12: 211–234.

7. EDWARDS, C. A., REICHLE, D. E. & CROSSLEY, D. A. (1970): *The role of soil invertebrates in turnover of organic matter and nutrients.* – Eoll. Stud. Anal. Synth., 1: 147–172.

8. ENGLEMANN, M. D. (1961): *The role of soil arthropods in the energetics of an old field community.* – – Ecol. Monogr., 31: 221 – 238.

9. FRENCH, C. E., LISCINSKY, S. A. & MILLER, D. R. (1957): *Nutrient composition of earthworms.* – J. Wild. Manage., 21: 348.

10. GERE, G. (1957): *Untersuchung über den Energieumsatz der Raupen der Hyphantria cunea Drury.* – – Acta Zool. Hung., 3: 89 – 105.

11. HARTLEY, P. J. T. (1954): *Wild fruits in diet of British thrushes. A study in the ecology of allied species.* – Brit. Birds, 47: 97 – 107.

12. HAVLIN, J. (1977): *Ein Vergleich der Nahrung des Stars und der Amsel.* – Folia Zool., 26: 45 – 56.

13. KLUJVER, H. N. (1933): *Bijdrage tot de biologie en de ecologie van den spreeuw (Sturnus vulgaris vulg. L.) gedurende zijn voortplantingstijd.* – Versl. Med. Plant. Dients Wageningen, 69: 1 – 145.

14. KORODI GÁL, J. (1967): *Beiträge zur Kenntnis der Brutbiologie der Amsel (Turdus merula L.) und zur Ernährungsdynamik ihrer Jungen.* – Zool. Abh. Mus. Dresden, 29: 25 – 53.

15. MORRIS, D. (1954): The snail-eating behaviour of thrushes and blackbirds. – Brit. Birds, 47: 33 – 49.

16. MOULDER, B. C., REICHLE, D. E. & AUERBACH, S. I. (1970): *The significance os spider predation in the energy dynamics of forest floor arthropod communities.* – Oak Ridge Nati. Lab. USA, ORNL 4452.

17. MUKERJI, M. K. & LE ROUX, E. J. (1969): *A study on energetics of Podosus maculiventris (Hemiptera: Pentatomidae).* – Can. Ent., 101: 449 – 460.

18. ORIANS, G. A. (1966): *Food of nestling yellow-headed blackbirds in Caribou Parklands.* – Condor, 69: 321 – 337.

19. REICHLE, D. E. (1967): *Radioisotope turnover and energy flow in terrestrial isopod populations.* – – Ecology, 48: 351 – 366.

20. SAITO, S. (1969): *Energetics of isopod populations in a forest of central Japan.* – Res. Popul. Ecol., 11: 229 – 258.

21. SMITH, J. N. M. (1973): *The food searching behaviour of two european thrushes. II. The adaptivennes of the search patterns.* – Behaviour, 49: 1 – 61.

22. SNOW, D. W. (1955): *The breeding of the blackbird, song-thrush and mistle thrush in Great Britain.* Bird Study, 2: 72 – 84.

23. SNOW, D. W. (1956): *Territory in the blackbird, Turdus merula.* – Ibis, 98: 438 – 447.

24. SNOW, D. W. (1958): *A study of blackbirds.* – London, 192 pp.

25. SNOW, D. W. (1966): *Population dynamics of the blackbird.* – Nature, 211: 1231 – 1233.

26. VAUK, G. & WITTING, E. (1971): *Nahrungsökologische Untersuchungen an Frühjahrsdurchzüglern der Amsel (Turdus merula) auf der Insel Helgoland.* – Vogelwarte, 26: 238 – 245.

27. WALSH, H. (1978): *Food of nestling purple martins.* – Wils. Bull., 90: 248 – 261.

28. WIEGERT, R. G. (1965): *Intraspecific variation in calories/g of meadow spittlebungs (Philaenus spumarius L.).* – Bioscience, 15: 543 – 545.

29. WOODLAND, D. J., HALL, B. K. & CALDER, J. (1968): *Gross bioenergetics of Blattella germanica.* – Physiol. Zool., 41: 424 – 431.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Weitere Angaben zur Lumbricidenfauna Italiens (Oligochaeta: Lumbricidae)

Von

A. ZICSI*

Abstract. In the course of a revision of the family Lumbricidae the identification of an earthworm material originating from various regions of Italy was carried out. The elaboration comprised about 3000 specimens belonging to 44 species. Four species and a subspecies were described as new for science, viz. *Octodrilus transpadanoides* sp. n., *Octodrilus omodeoi* sp. n. *Octodrilus ruffoi* sp. n., *Allolobophora osellai* sp. n. and *Allolobophora corsicana simplex* ssp. n. In the genus *Octodrilus* OMODEO, 1956 several species were revised and identification charts were drawn up for certain groups of species.

Im Rahmen meiner, die Familie Lumbricidae betreffenden Revisionsarbeiten, die in jüngster Zeit besonders der Gattung *Octodrilus* OMODEO, 1956 gewidmet waren (ZICSI, 1970 *a*, 1971 *a*, 1979), erwies es sich unerlässlich, auch eingehende Untersuchungen in Italien durchzuführen. In vorliegender Arbeit sollen die Ergebnisse der faunistischen Sammlungen bekanntgegeben werden, die sich nahezu auf ganz Italien erstrecken.

Ein Teil des Materials wurd mir von Herrn Prof. Dr. S. RUFFO und Dr. P. OSELLA, Naturhistorisches Museum, Verona zur Bestimmung überlassen, der andere Teil des Materials wurde von mir in den Jahren 1969 und 1971 gesammelt. Für die Ermöglichung und Unterstützung der Aufsammlungen in Italien spreche ich Herrn Prof. Dr. S. RUFFO und Dr. P. OSELLA, sowie Herrn Dr. V. MAHNERT, Naturhistorisches Museum, Genf, auch an dieser Stelle meinen besten Dank aus.

Bei der Anführung des Materials werden zwei verschiedene Inventarnummern angegeben. Die mit dem Buchstaben *V* versehenen Nummern beziehen sich auf die Sammlung des Naturhistorischen Museums von Verona, die mit *Z* versehenen, auf die des Zoosystematischen und Ökologischen Instituts der Eötvös-Loránd-Universität, Budapest.

Gattung *Octodrilus* OMODEO, 1956

Wie aus vorausgehenden Arbeiten ersichtlich (COGNETTI, 1901, 1905; OMODEO, 1962; ZICSI, 1971*a*, 1979), lassen sich zur Begrenzung der *Octodrilus*-Arten weitere morphologische Merkmale heranziehen, die ein sicheres Ausei-

---

**Dr. András Zicsi*, ELTE Állatrendszertani és Ökológiai Tanszék (Lehrstuhl für Tiersystematik und Ökologie der Eötvös-Loránd-Universität), 1088 Budapest, VIII. Puskin u. 3.

nanderhalten dieser Taxa ermöglichen (Gestaltung der Testikelblasen, Lage der männlichen Poren, Meroandrie, Reduktion der Samensäcke). Da diese Merkmale von den Autoren früher nicht berücksichtigt, d. h. zur Begrenzung – eben wegen Fehlen von ausreichendem Material – nicht herangezogen wurden, war es unerlässlich, aus dem bisher bekannten Verbreitungsgebiet der *Octodrilus*-Arten Material einzusammeln. Ausserdem zeigte es sich erforderlich, die bisherigen Bestimmungen – soweit dafür Möglichkeit bestand – zu überprüfen.

Im Rahmen dieser Arbeit stütze ich mich, ausser den stichhaltigen Angaben der Literatur, noch auf die Überprüfung einiger Typen aus dem Museo ed Istituto di Zoologia Sistematica dell' Università, Torino, aus dem Zoologischen Institut und Museum, Hamburg und auf das Material meiner sowie anderer von mir überprüfter Sammlungen (ČERNOSVITOV, Prag; BRETSCHER, Zürich; RIBAUCOURT, Genf).

Im vorliegenden Material konnten 15 *Octodrilus*-Arten bestimmt werden, von diesen sind drei neu für die Wissenschaft.

Octodrilus complanatus (ANT. DUG., 1828)

Wie bereits in einer vorausgehenden Arbeit (ZICSI, 1971 *a)* erwähnt, wurden dieser Art (Typusart der Gattung) sämtliche Arten dieser Gattung von ČERNOSVITOV (1935) eingereiht. Da sich Autoren dieser Ansicht angeschlossen haben, lassen sich heute die Angaben der Literatur nur nach Überprüfung des betreffenden Materials werten.

Ohne das Typenmaterial, bzw. den Typus dieser Art gesehen zu haben, schliesse ich mich – aufgrund der Überprüfung zahlreicher Exemplare verschiedener Sammlungen und eigener Exemplare aus verschiedenen Ländern (Tenerife, Z/5868, Z/6460, ZICSI, 1962; Portugal: Z/6966, Z/6967, GRAFF, 1957, 1961; Türkei: Z/7503 – 7505, ZICSI, 1973 *b*, Griechenland: Z/7525, Z/7529, ZICSI, 1973 *a)*, der Auffassung von OMODEO, (1956, 1962), an. Ich betrachte diejenigen Formen, die in sämtlichen Bestimmungsmerkmalen mit der Originalbeschreibung übereinstimmen und ösophageale und nicht periösophageale Testikelblasen im 10. und 11. Segment besitzen als *O. complanatus.*

Im vorliegenden Material konnten die von verschiedenen Fundorten stammenden Exemplare mit Sicherheit als *O. complatnaus* identifiziert werden. Bei den bestimmten Tieren liegt der Gürtel konstant am 1/2 28, 29 – 37. Segment, die Pubertätswällen erstrecken sich vom 29 – 39. Segment. Diese konstante Ausbildung der Gürtelorgane liess sich auch bei den weiter oben angeführten, in verschiedenen Ländern gesammelten Exemplaren verfolgen.

Ein Variieren der sonst konstanten Merkmale liess sich in der Lage der männlichen Poren beobachten. Von 13 Exemplaren des Fundortes Castiglione Montovano lagen bei einem Exemplar die männlichen Poren am 16. Segment, am Fundort Castion del Garda lagen bei 4 Exemplaren von den 7 angetroffenen die männlichen Poren ebenfalls am 16. Segment, d. h. bei einem Exemplar rechts am 17., links am 16. Segment. Bei Tieren aus Rivoltella konnten bei einem der 3 untersuchten Exemplare die männlichen Poren einerseits auf dem 15. Segment, anderseits auf dem 16. Segment beobachtet werden.

Obwohl die Lage der männlichen Poren bei Arten der Gattung *Dendrobaena* als Gattungsmerkmal betrachtet wurde und zur Aufstellung der neuen Gattung *Fitzingeria* berechtigte (ZICSI, 1978), kann ich mich, wie bereits in einer vorausgehenden Arbeit (ZICSI, 1979) erwähnt, bei der Gattung *Octodrilus* nicht zu diesem Schritt entschliessen. Wie dies auch im Falle von *O. complanatus* ersichtlich, kommen Verschiebungen um ein oder zwei Segmente vor, die aber bei anderen Arten dieser Gattung bis vor die Gürtel-Segmente variieren können. Bei Arten, bei denen die männlichen Poren unmittelbar vor dem Gürtel liegen, bin ich der Meinung, dass die Kopulation funktionell anders verlaufen muss (ZICSI, 1978, 1979), als bei solchen, bei denen die männlichen Poren am 15. oder eins-zwei Segmente weiter nach hinten verlagert sind. Deswegen betrachte ich in dieser Gattung dies als Artenmerkmal und sondere die Formen bei denen die männlichen Poren vor dem Gürtelsegment liegen ab und führte sie als selbständige Arten an. Bei Tieren, die in allen wesentlichen Bestimmungsmerkmalen übereinstimmen und die nur die männlichen Poren um ein oder zwei Segmente verlagert haben, wie dies bei den jetzt untersuchten Exemplaren von *O. complanatus* der Fall ist, lasse ich diese Abweichung unberücksichtigt.

Fundorte: V/164. 4 Ex., Z/8603. 3 Ex., Castion del Garda, 8. V. 1971, leg. OSELLA & ZICSI. – V/180. 1 juv. Ex., Pazzon, 10. V. 1971, leg. MONTOLLI & ZICSI. – V/199. 1 Ex., Dossobuona, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/203. 7 Ex., Z/8604. 6 Ex., Castiglione Montovano, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/208. 4 Ex., Z/8605. 3 Ex., Bancole de Montovano, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/216. 2 Ex., Guidizzolo, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/219. 1 Ex., Rivoltella, 11. V. 1971, leg. MONTOLLI & ZICSI. – Toscana: V/469. 1 Ex., Vallombrosa (Toscana), VI. 1968, leg. RUFFO. – Lazio: V/362. 1 Ex., Terminillo 1900–2000 m (Appenino centrale), 11. VI. 1963, leg. RUFFO. – V/367. 4 Ex., Sella di Leonessa Mt. Termonillo, 19. VI. 1963, leg. RUFFO. – V/377. 1 Ex., Terminillo 1900–2000 m (Appenino centrale), 11. VI. 1963, leg. RUFFO. – Campania: V/392. 1 Ex., Matese Abruzzo Roccamandolfi 820 m, 27. VI. 1967, leg. RIGGIO & OSELLA. – V/400. 4 Ex., Matese Abruzzo Piano di Campitello 1500 m, 29. VI. 1967, leg. RIGGIO & OSELLA. – V/406. 1 Ex., Matese Abruzzo Mt. Miletto 2000 m, 24. VI. 1967, leg. RIGGIO & OSELLA. – V/411. 1 Ex., Mte. Mutria (Matese) 1700 m, 25. IX. 1967, leg. GIUSTI & MINELLI. – V/413. 1 Ex., Pendici del Monte Miletto (Matese) 1700–1900 m, 23. IX. 1967, leg. GIUSTI & MINELLI. – V/421. 1 EX., Bojano (Matese) (paese) 18. IX. 1967, leg. GIUSTI & MINELLI. – V/423. 1 Ex., Mte. Gallinola (Matese), 25. IV. 1967, leg. OSELLA. – V/428. 1 Ex., Bojano (Matese) (paese), 18. IX. 1967, leg. GIUSTI & MINELLI. – V/431. 5 Ex., Matese Abruzzo Mte. Mutria 1400–1800 m, 27. VI. 1967, leg. RIGGIO & OSELLA. – V/438. 2 Ex., Passo S. Crocetta Matese, 10. VI. 1962, leg. RUFFO. – V/445. 1 Ex., Campitello (Matese), 16. VI. 1962, leg. RUFFO. – Calabria: V/386. 1 + 1 juv. Ex., Lorica (La Sila), 22. VI. 1960, leg. RUFFO. – Sicilia: V/461. 1 + 1 juv. Ex., Rive def Lego Pergusa (Enno–Sicilia), 15. VI. 1959, leg. POSO. – V/493. 1 Ex., Rive Lago di Pergusa (Enno–Sicilia), 15. VI. 1959, leg. POSO.

Octodrilus pseudocomplanatus (OMODEO, 1962) comb. n.

Als *O. pseudocomplanatus* wurden diejenigen Tiere bestimmt, bei denen sich der Gürtel vom 29, 30–37. Segment, die Pubertätsstreifen vom 29, 30–39, 40. Segment erstrecken und die 2 Paar periösophageale Testikelblasen im 10. und 11. Segment besitzen. Übereinstimmend mit OMODEO (1962) konnte ebenfalls festgestellt werden, dass bei einigen Exemplaren die männlichen Poren auf dem 16. Segment liegen. Dies konnte bei allen Exemplaren des Fundortes S. Giovanni – – Ilarione und S. Bortolo–Setto vermerkt werden, während bei den übrigen Exemplaren der verschiedenen Fundorte die männlichen Poren in normaler Stellung auf dem 15. Segment lagen. Im weiteren stimmen die übrigen Merkmale der von mir untersuchten Tiere mit der Beschreibung von OMODEO überein.

Fundorte: V/85–86. 1–3. Ex., Grezzana, 6. V. 1971, leg. OSELLA & ZICSI. – V/95. 8 Ex., Z/8609. 7 Ex., St. Anna d' Alfredo, 6. V. 1971, leg. OSELLA & ZICSI. – V/119. 2 Ex., Z/8611. 2 Ex., S. Giovanni – Ilarione, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/130. 4 Ex., Z/8608. 3 Ex., S. Bortolo – Setto, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/165. 20 Ex., Z/8610. 20 Ex., Castion del Garda, 8. V. 1971, leg. OSELLA & ZICSI. – V/246. 2 Ex., Z/8606. 1 Ex., Collio, 13. V. 1971, leg. OSELLA & ZICSI. – V/283. 1 Ex., Z/8607. 1 Ex., Pranzo, 14. V. 1971, leg. OSELLA & ZICSI. – V/294. 6 Ex., Z/8612. 5 Ex., Ballino, 14. V. 1971, leg. OSELLA & ZICSI. – Z/8614. 1 Ex., Gazzanigia, 12. V. 1971, leg. OSELLA & ZICSI. – Veneto: V/319. 1+1 juv. Ex., Buso „di Roncá" Verona, 19. XI 1967, leg. MINGIONE. – V/324. 1 Ex., Bolca Mt. Lessini, 27. V. 1967, leg. MINGIONE. – V/330. 1+2 juv. Ex., Valdritta (Mt. Baldo), VI. 1968, leg. OSELLA. – V/342. 1 Ex., Sotto Bocca di Naole Mt. Baldo 1650–1700 m, 22. VI. 1968, leg. LAZZERONI. – V/541. 2+1 juv. Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA. – V/546. 1+1 juv. Ex., Mte. Baldo, Bocca di Navene, 1600–1700 m, 5. VII. 1970. leg. OSELLA. – V/534. 1 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA.

Octodrilus eubenhami (ZICSI, 1971)

Eine Überprüfung des Typenmaterials erbrachte den Nachweis, dass die männlichen Poren bei dieser Art nicht auf dem 15. Segment liegen. Nachstehend fasse ich die richtige Lage der männlichen Poren, anhand einer Überprüfung des Typen-Materials in Tabelle 1 zusammen.

Tabelle 1. Lage der männlichen Poren bei O. eubenhami aufgrund der Revision des Typenmaterials

Inv. Nr.	Ort	Männliche Poren (Segment) linke Seite	Männliche Poren (Segment) rechte Seite
Holotypus 0.24	S. Floriano	16	16
Paratypen Z/6849	S. Floriano	17	17
Paratypen Z/6849	S. Floriano	16	17
Paratypen Z/6849	S. Floriano	16	16
Paratypen Z/6849	S. Floriano	18	17
Paratypen Z/6849	S. Floriano	16	17
Paratypen Z/6849	S. Floriano	16	16
Paratypen Z/6849	S. Floriano	16	16
Paratypen Z/6849	S. Floriano	16	16
Paratypen Z/6839	Corno di Rosazzo	17	17
Paratypen Z/6832	Peternel	16	16
Paratypen Z/6833	Peternel	16	16
Paratypen Z/6807	Musi	21	21
Paratypen Z/6842	Cormons	18	15
Paratypen Z/6842	Cormons	18	16

Bei der Durchsicht der jetzigen Ausbeute konnten von verschiedenen Fundorten mehrere Exemplare dieser mit *O. eubenhami* in allen wesentlichen Bestimmungsmerkmalen übereinstimmende Tiere angetroffen werden. Sie weichen bloss in der Lage der männlichen Poren ab, da diese konstant auf dem 15. Segment liegen. Der Gürtel erstreckt sich vom 29–36., die Pubertätswällen vom 29–39, 40. Segment.

Obwohl Unterschie de in der Lage der männlichen Poren bestehen und auch die Pubertätswällen um ein oder zwei Segmente weiter nach hinten reichen, reihe ich die jetzigen Tiere der von mir aufgestellten *O. eubenhami* ein.

Fundorte: V/228. 8 Ex., Z/8613. 7 Ex., Gazzanigia, 12. V. 1971, leg. OSELLA & ZICSI. – V/273. 3 Ex., Z/8615. 4 Ex., Vale di Tremalzo 600 m, 13. V. 1971, leg. OSELLA & ZICSI. – Campania: V/497. 1 Ex., Salermo, 14. IV. 1968, leg. MINGIONE.

Octodrilus transpadanus (ROSA, 1884)

Die von verschiedenen Fundorten stammenden Exemplare stimmen mit der Originalbeschreibung und von mir in vorausgehenden Arbeiten als *O. transpadanus* identizifierten Tieren vollkommen überein.

Fundorte: Z/6859. 1 Ex., Visco, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6876. 1+1 juv. Ex., Erto bei Longarone, 20. IX. 1969, leg. ZICSI & MAHNERT. – Z/6880. 2+1 juv. Ex., Sedico, 20. IX. 1969, leg. ZICSI & MAHNERT. – Z/6891. 6 Ex., Sciovie, Passo d' Aune 800 m, 20. IX. 1969, leg. ZICSI & MAHNERT. – V/150. 3 Ex., Z/8600. 5 Ex., Bardolino, 8. V. 1971, leg. OSELLA & ZICSI. – V/155. 3 Ex., Z/8601. 3 Ex., Bardolino, Strada di Salesiane, 8. V. 1971, leg. OSELLA & ZICSI. – V/209. 1 Ex., Villa Fontana, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/239. 1 Ex., Z/8602. 5 Ex., Casto, 12. V. 1971, leg. OSELLA & ZICSI. – Veneto: V/336. 1 Ex., S. Zeno di Montagna (Verona), 4. VI. 1966, leg. LAZZERONI. – Campania: V/427. 1 Ex., Lago del Matese, 2. VII. 1967, leg. RIGGIO & OSELLA.

Da die Reduktion der Samensäcke aus dem 11. Segment bei der Familie Lumbricidae bisher unbekannt war und vom mir angenommen wurde, dass dieser Prozess zur Ausbildung der bereits bekannten meroandrischen Formen (ZICSI, 1971 *a)* mit 2 Paar Samensäcken führt, wurden die Zwischenstadien – Formen mit 3 Paar Samensäcken – als gute Arten angeshen.

Im vorliegenden Material sind wieder Exemplare angetroffen worden, die 3 Paar Samensäcke besitzen, aber in anderen morphologischen Merkmalen abweichen. Es sind dies *O. pseudokovacevici* (ZICSI, 1971) und *O. transpadanoides* sp. n.

Octodrilus pseudokovacevici (ZICSI, 1971)

Diese bisher nur in der Schweiz angetroffene Art (ZICSI, 1971 *a)*, 1979) konnte jetzt auch in Italien nachgewiesen werden. Wie bereits richtiggestellt (ZICSI, 1979), liegen die männlichen Poren bei dieser Art nicht am 15. Segment, sondern unmittelbar vor dem Gürtelsegment, bei den jetzt vorliegenden Exemplaren ebenfalls auf dem 28. Segment. Ein gänzliches Verschwinden der Samensäcke im 11. Segment liess sich ebenfalls erkennen. Der Gürtel erstreckt sich vom 29–35. Segment, die Pubertätsstreifen vom 29–38. Segment.

Fundort: V/528. 1 Ex., Z/8663. 1 Ex., Mte. Grigna, 2. VII. 1970, leg. OSELLA.

Octodrilus transpadanoides sp. n.

Länge: 5,5 cm, Durchmesser: 0,4 cm. Segmentzahl 83. Bei den übrigen Tieren, Länge: 4,5–8,0 cm, Durchmesser: 0,4–0,6 cm, Segmentzahl: 83–134.

Farbe: rotviolett.

Kopf epilobisch 1/2 offen. Erster Rückenporus 11/12. Borsten ungepaart. Borsten aa etwas grösser als ab, ab = bc = cd; dd = 2aa. Weibliche Poren auf dem 14. Segment, unmittelbar oberhalb der Borstenlinie b. Männliche Poren auf dem 15. Segment, in der Mitte zwischen Borstenlinie b und c, winzigkleine Öffnungen. Borsten aa des 9. und 13. Segmentes von Borstenpapillen umgeben. Gürtel vom 30–37. Segment, Pubertätsstreifen vom 30–37. Segment.

Dissepimente praktisch nicht verdickt, die des 12/13–14/15 etwas kräftiger entwicklet. Herzen im 6–11. Segment. Kalkdrüsen im 10–12. Segment mit kleinen Ausbuchtungen im 10. Segment. 1 Paar periösophageale Testikelblasen im

10. Segment, ein Paar ösophageale Testikelblasen im 11. Segment. 3 Paar Samensäcke im 9., 10. und 12. Segment, die des 9. und 12. Segmentes mächtig gross, die des 10. Segmentes klein in Testikelblasen eingeschlossen. 5 Paar Samentaschen im 6 – 10. Segment, mit Ausmündungen in die Intersegmentalfurchen 6/7 – 10/11 unterhalb der Borstenlinie c. Kropf im 15 – 16. Segment, Muskelmagen im 17 – 19. Segment.

Die neu Art steht *O. transpadanus* (ROSA, 1884) am nächsten, unterscheidet sich jedoch von ihr durch die Zahl der Samensäcke, durch die Lage des ersten Rückenporus, und durch die Farbe. Von den anderen Arten mit drei Paar Samensäcken unterscheidet sie sich in mehreren Merkmalen, die in Tabelle 2 nachstehend zusammengefasst werden.

Tabelle 2. Bestimmungsmerkmale der Octodrilus-Arten mit drei Paar Samensäcken

Art	♂	Rükkenporus	Borstenpapillen	Gürtel	Pubertätsstreifen	Testikelblasen	Samentaschen
benhami BRETSCHER 1901	28	12/13	–	29 – 36	29 – 39	1. ösophag. 1. periösoph.	6/7 – 13/14 (8)
pseudokovacevici ZICSI, 1971	27,28	9/10	–	29 – 35	29 – 38	1. ösophag. 1. periösoph.	6/7 – 13/14 (8)
lissaensioides ZICSI, 1971	15	9/10	–	29 – 36	29 – 37	1. ösophag 1. periösoph.	5/6 – 10/11 (6)
transpadanoides sp. n.	15	11/12	9., 13.	30 – 37	30 – 37	1. ösophag. 1. periösoph.	6/7 – 10/11 (5)

Fundorte: Holotypus Z/8689 S. Bortolo Setto, 7. V. 1971, leg. MONTOLLI u. ZICSI. – Paratypen V/131. 1 Ex., Z/8616. 1 Ex. Fundort wie beim Holotypus; Z/6811 1 Ex. Uccea, 18. IX. 1969, leg. V. MAHNERT u. A. ZICSI; – Z/6823. 7 Ex. Nimis, 18. IX. 1969, leg. V. MAHNERT u. A. ZICSI. – V/118. 1 Ex. S. Giovanni Ilarione, leg. MONTOLLI u. ZICSI. 7. V. 1971. – V/84. 1 Ex. Grezzana, 6. V. 1971, leg. OSELLA u. ZICSI. – Z/8617. 2 Ex. St. Anna d'Alfredo, 6. V. 1971, leg. OSELLA u. ZICSI.

Octodrilus damianii (COGNETTI, 1905)

Im vorliegenden Material bin ich von verschiedenen Fundorten mehreren Exemplaren begegnet, die ich der von COGNETTI beschriebenen *O. damianii* einreihe. Aus der Sammlung des Museo ed Istituto di Zoologia Sistematica dell' Università Torino liegen mir zur Durchsicht mehrere Exemplare vor, so auch der Typus dieser Art. Da das Typenexemplar sich in äusserst schlechtem Zustand befindet, muss ich mich, bei der Identifizierung meiner Tiere auch auf die Exemplare stützen, die von COGNETTI im späteren bestimmt und zu *O. damianii* gestellt wurden.

Wie erwähnt (ZICSI, 1971 *a*), schliesse ich mich der von ČERNOSVITOV (1941) empfohlenen und von OMEDEO (1956) angenommenen Einziehung dieser Art zu *O. hemiandrus* nicht an, auch schon deswegen nicht, da bei sämtlichen *O. damianii*-Exemplaren, die COGNETTI in der Literatur anführt, die männlichen

Poren stark nach hinten gelagert sind (COGNETTI, 1905 *b*). Ausserdem besitzt *O. damianii* konstant 5 Paar Samentaschen (6/7 – 10/11), während *O. hemiandrus* 7 Paar (6/7 – 12/13).

Beim Holotypus (OL. 718, A Marciana, Is. d' Elba) von *O. damianii* befinden sich die männlichen Poren auf dem 27. Segment, bei den übrigen Exemplaren der Sammlung von Torino (Colline tra Spezia e Portovenere) liegen sie bei 2 Exemplaren auf dem 27., bei einem auf dem 26. Segment und wiederum bei einem auf dem 25. Segment. Der Gürtel erstreckt sich vom 29 – 36. Segment, die Pubertätsstreifen verlaufen vom 29 – 38. Segment.

Bei der Durchsicht meines Materials wurden sämtliche meroandrischen Formen (ein Paar Hoden und Samentrichter im 11. Segment), die eine periösophageale Testikelblase im 11. Segment besitzen, 2 Paar Samensäcke im 10. und 12. Segment aufweisen und bei denen sich der Gürtel vom 29 – 36. Segment, die Pubertätsstreifen vom 29 – 37, 38. Segment erstrecken und 5 Paar Samentaschen im 6 – 10. Segment, mit Ausmündungen in den Intersegmentalfurchen 6/7 – 10/11 besitzen, zu *O. damianii* COGNETTI, 1905 gestellt. Ausschlaggebend für die Begrenzung dieser Art sind noch die nach hinten verlagerten Ausmündungen der männlichen Poren. Im jetzt untersuchten Material wurden Exemplare Inv. V/475 mit männlichen Poren auf dem 26. Segment, einerseits 26., anderseits 25., oder einerseits 24., anderseits 25. Segment; Inv. V/293 auf dem 28. Segment; Inv. V/389. auf dem 24. Segment; Inv. V/368 auf dem 27. Segment, 25. Segment, 28. und 29. Segment; Inv. V/36. auf dem 27. Segment angetroffen.

Fundorte: Emilia: V/474. 1 Ex., Abetone App. Tosco Emiliano, 8. VII. 1964, leg. RUFFO. – Lazio: V/360. 1 Ex., Terminillo 1900 – 2000 m (Appenino centrale), 12. VI. 1963, leg. RUFFO. – V/368. 5 Ex., Z/8680. 4 Ex., Sella di Leonessa Mt. Terminillo, 19. VI. 1963, leg. RUFFO. – V/373. 1 Ex., Terminillo 1900 – 2000 m (Appenino centrale), 12. VI. 1963, leg. RUFFO. – V/475. 3 Ex., Z/8679. 1 Ex., Terminillo sud 1800 – 1900 m (Appenino centrale), 17. VI. 1963, leg. RUFFO. – Calabria: V/389. 2 Ex., Mt. Botte Donato (La Sila), 25. VI. 1960, leg. RUFFO.

Octodrilus hemiandrus (COGNETTI, 1901)

Die Beschreibung dieser Art erfolgte aufgrund von Exemplaren verschiedener Fundorte (COGNETTI, 1901*a*). Ich hatte die Gelegenheit das Typenmaterial aus Colline a NE die Spezia, Isola Tino und Isola Tinetto zu überprüfen. Da COGNETTI keine Holotype bezeichnete, dessigniere ich vom Fundort Isola Tino unter Inv. Nr. OL 502/A ein Exemplar als Lectotypus und bezeichne die übrigen Exemplare der Fundorte Is. Tino Inv. Nr. OL 502, Isola Tinetto Inv. Nr. OL 504 als Paralectotypen. Die beiden Exemplare des Fundortes Colline a NE die Spezia, die ebenfalls zum Typenmaterial gehören, sind gänzlich ausgetrocknet und unbestimmbar.

Wie aus der Originalbeschreibung hervorgeht, erstreckt sich der Gürtel bei dieser Art vom 28, – 36, 37. Segment, die Pubertätsstreifen verlaufen vom 28 – 38, 39. Segment. Die männlichen Poren liegen konstant auf dem 15. Segment. Die Art besitzt 7 Paar Samentaschen im 6 – 12. mit Ausmündungen in den Intersegmentalfurchen 6/7 – 12/13. Segment. Diese meroandrische Art unterscheidet sich ferner noch dadurch von *O. damianii*, dass sie nicht periösophageale sondern ösophageale Testikelblasen im 11. Segment besitzt.

Im vorliegenden Material konnten von verschiedenen Fundorten mehrere Exemplare einwandfrei als *O. hemiandrus* identifiziert werden. Bei diesen Tieren, die in allen wesentlichen Merkmalen mit der Originalbeschreibung übereinstimmen, erstreckt sich der Gürtel vom 29 – 37. Segment, die Pubertätsstreifen vom 29 – 38, 39. Die männlichen Poren liegen konstant auf dem 15. Segment. Sämtliche Exemplare verfügen über eine ösophageale Testikelblase im 11. Segment und über 7 Paar Samentaschen im 6 – 12. Segment. Wie auch am Typenmaterial festgestellt werden konnte, sind die Borsten ab des 12. Segmentes von Drüsenpapillen umgeben.

Fundorte: Piemonte: V/530. 1 Ex., A. Apuane – Fornovolasco 700 m, 16. VI. 1970, leg. Osella. – Emilia: V/465. 1 Ex., Z/8677. 5 Ex., Mte. Cimone 1900 m, App. T. Emiliano, 2. VII. 1964, leg. Ruffo. – V/514. 2 Ex., Lago Santo Modenese App. T. Emiliano, 9. VII. 1964, leg. Ruffo. – V/516. 1 Ex., Boscolungo – Abetone App. T. Emiliano, 13. VII. 1964, leg. Ruffo, – Toscana: V/399. 2 Ex., Mte. Morello, 20. VII. 1967, leg. Ruffo. – V/466. 1 Ex., Alpe di Poti (Arezzo), 15. VI. 1967, leg. Ruffo. – V/486. 1 Ex., Z/8678. 2 Ex., Vallombrosa (Toscano), VI. 1968, leg. Ruffo. – V/507. 1 Ex., La Verna (Arezzo), 17. VI. 1967, leg. Ruffo. – V/547. 3 Ex., Z/8676. 3 Ex., Alpi Apuane Mt. Pisanino, Foce di Cardeto 1400 – 1700 m, 24. VII. 1970, leg. Osella.

Octodrilus omodeoi sp. n.

Von 2 Fundorten liegen vier Exemplare vor die in gewissen Merkmalen von den bisher bekanntgewordenen meroandrischen Arten dieser Gattung abweichen.

Länge: 6,0 cm, Durchmesser: 0,5 cm, Segmentzahl: 139. Bei den übrigen Tieren, Länge: 5,5 cm, Durchmesser: 0,5 – 0,6 cm, Segmentzahl: 130 – 142.

Farbe: grau.

Kopf proepilobisch-epilobisch 1/3 offen. Erster Rückenporus 12/13. Borsten ungepaart. Borsten aa doppelt so groß wie ab; ab = bc etwas größer als cd; dd = 3 aa. Weibliche Poren auf dem 14. Segment, oberhalb der Borstenlinie b. Männliche Poren auf dem 27. Segment, in der Mitte zwischen Borstenlinie b

Tabelle 3. Bestimmungstabelle der meroandrischen Arten der Gattung Octodrilus

Art	♂	Rükkenporus	Borstenpapillen	Gürtel	Pubertätsstreifen	Testikelblasen	Samentaschen
phaenohemiandrus Zicsi, 1971	24 21 – 25	17/18	–	28, 29 – 35	29 – 38	ösophag.	6/7 – 12/13 (7)
pseudotranspadanus Zicsi, 1971	15	11/12	–	29 – 36, 37	29 – 37	ösophag.	5/6 – 9/10 (5)
damianii Cognetti, 1905	27 24 – 26	19/20	ab 10	29 – 36, 37	29 – 37, 38	periösoph.	6/7 – 10/11 (5)
hemiandrus Cognetti, 1901	15	11/12	ab 12	28, 29 – 37	28, 38 – 39	ösophag.	6/7 – 12/13 (7)
omodeoi sp. n.	27	12/13	ab 11	30 – 36	30 – 39	periösoph.	6/7 – 12/13 (7)

Fundorte: Holotypus V/481: Lasecchieta, (Vallombrosa) Toscana, VI. 1968, leg. S. Ruffo, Paratypen Z/8683 1 Ex. Fundort wie beim Holotypus; Paratypen: V/470 1 Ex, Z/8682, 1 Ex. Vallombrosa, Toscana, VI. 1968, leg. S. Ruffo. –

und c, winzig kleine Öffnungen. Gürtel sattelförmig vom 30–36. Segment, Pubertätsstreifen vom 30–39. Segment.

Dissepimente 6/7–8/9 und 12/13–14/15 sehr schwach verdickt. Herzen im 6–11. Segment. Kalkdrüsen im 10–12. Segment, mit kleinen Ausbuchtungen im 10. Segment. Ein Paar Hoden und Samentrichter im 11. Segment. Ein Paar periösophageale Testikelblasen im 11. Segment, die die Hoden und Samentrichter sowie die Herzen des 11. Segmentes einschliessen. 2 Paar Samensäcke im 10. und 12. Segment. 7 Paar Samentaschen im 6–12. Segment, die sich in Intersementalfurchen 6/7–12/13 unterhalb der Borstenlinie c öffnen. Kropf im 15–16. Segment, Muskelmagen im 17–19. Segment.

Die Abweichungen und Unterschiede von den übrigen meroandrischen Arten werden in Tabelle 3 zusammengefasst.

Die neue Art benenne ich zu Ehren des bekannten Oligochaeten-Spezialisten, nach Herrn Prof. Dr. P. OMODEO.

Octodrilus argoviensis (BRETSCHER, 1899)

Die in Italien gesammelten Exemplare stimmen vollkommen mit den aus der Schweiz und in Österreich angetroffenen Tieren überein. Diese Art wurde jetzt zuerst in Italien nachgewiesen.

Fundorte: V/271. 2 Ex., Storo, 13. V. 1971, leg. OSELLA & ZICSI. – Veneto: V/316. 3+3 juv. Ex., Cima Posta (Lessini), 10. VII. 1968, leg. GIOCO & LAZZERONI. – V/331. 4 Ex., Valdritta (Mt. Baldo), VI. 1968, leg. OSELLA. – V/332. 4+7 juv. Ex., Z/8661. 5+2 juv. Ex., Cima Posta (Lessini), 10. VII. 1968, leg. GIOCO & LAZZERONI. – V/340. 3 Ex., Tra Giazza e Revolto (Verona), 10. VII. 1968, leg. MONTOLLI & GIOCO. – V/523. 7 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA. – V/533. 9 Ex., Z/8662. 5 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA. – V/540. 15 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA.

Octodrilus bretscheri? (ZICSI, 1969)

Von dieser für die Fauna Italiens neuen Art konnte bloss ein Exemplar erbeutet werden.

Fundort: V/270. 1 Ex., Storo, 13. V. 1971, leg. OSELLA u. ZICSI.

Octodrilus boninoi (OMODEO, 1962)

Wie bereits bei der Bearbeitung des Regenwurmmaterials aus dem Tessin (ZICSI, 1979) erwähnt wurde, beschrieb OMODEO (1962) aufgrund von 8 Exemplaren aus drei verschiedenen Lokalitäten der Provinz Bergamo *O. boninoi*, die aber in verschiedenen Merkmalen Abweichungen untereinander aufweisen. Aus dem Tessin wurden von mir ebenfalls 2 Arten beschrieben *(O. aelleni* und *O. besucheti)*, die sich untereinander und von den Formen aus der Provinz Bergamo gut begrenzen lassen. Jetzt wurden in Lodrino zwei Exemplare angetroffen, die von den Arten aus dem Tessin sowie auch von *O. boninoi* in gewissen Merkmalen abweichen. Ich erwähnte bereits, dass weitere Aufsammlungen in Italien entscheiden werden, ob die von OMODEO als *O. bonioni* beschriebene Art in der Zukunft als eine oder als zwei Arten betrachtet werden müssen (ZICSI, 1979).

Meine jetzt vorliegenden Exemplare weichen – wie erwähnt – ebenfalls von der Beschreibung OMODEOS ab, doch da nur zwei adulte Tiere an dem wiederholt aufgesuchtem Fundort erbeutet werden konnten, stelle ich sie mit Bekanntgabe der abweichenden Merkmale, einstweilen zu *O. boninoi.*

Bei meinen grosskörprigen Exemplaren erstreckt sich der Gürtel vom 29–36. Segment, die Pubertätsstreifen vom 29–44. Segment. Die männlichen Poren liegen auf dem 27. Segment. Borsten ab des 9. Segmentes von Drüsenpapillen umgeben.

2 Paar Hoden und Samentrichter im 10. und 11. Segment. 2 Paar periösophageale Testikelblasen im 10. u. 11. Segment, die die Hoden und Samentrichter und die Samensäcke dieser Segmente einschliessen. Ovarien mit langem Stiel und pilzförmigem Hut. Samensäcke des 11. Segmentes nicht zu erkennen. Samentaschen 9 Paar im 6–14. Segment, münden in die Intersegmentalfurchen 6/7–14/15.

Fundorte: Z/8684. 1+1 juv. Ex., V/241. 2 juv. Ex. Lodrino, 12. V. 1971, leg. OSELLA u. ZICSI. – Z/8685. 1. Ex. Lodrino, 13. V. 1971, leg. OSELLA u. ZICSI.

Octodrilus mima (ROSA, 1889)

Von verschiedenen Fundorten liegen mir 31 geschlechtsreife Individuen vor, die vollkommen mit dem von OMODEO (1962) revidiertem Typus, bzw. mit der von ihm gegebenen Beschreibung übereinstimmen. Da von dieser Art und von den in der Literatur bekanntgegebenen Formen, Varietäten und Unterarten stets nur wenige Exemplare erbeutet werden konnten, gehen die Meinungen bezüglich der Begrenzungsmerkmale der Taxa stark auseinander (KARAMAN, 1972). Das mir vorliegende Serienmaterial zeigt eindeutig, dass *O. mima,* wenn es sich um vollkommen geschlechtsreife Tiere handelt, einwandfrei begrenzen lässt, bei den übrigen Formen muss anhand von Serienmaterial entschieden werden, ob sie als Arten oder als Unterarten betrachtet werden. Auf diese Frage werde ich in einer späteren, die *Octodrilus*-Arten Jugoslawiens behandelnden Arbeit näher eingehen.

Fundorte: Z/6825. 2+2 juv. Ex., St. Leonardo bei Cividale, 18. IX. 1969, leg. ZICSI & MAHNERT. – Z/6827. 2+1 juv. Ex., St. Leonardo bei Cividale, 18. IX. 1969, leg. ZICSI, & MAHNERT. – Z/6830. 8+4 juv. Ex., Trusgne, 18. IX. 1969, leg. ZICSI & MAHNERT. – Z/6834. 6 Ex., Corno di Rosazzo, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6840. 12+5 juv. Ex., Corno di Rosazzo, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6847. 1 Ex., St. Floriano del ALTE, 19. IX. . 1969, leg. ZICSI & MAHNERT.

Octodrilus rucneri (PLISKO & ZICSI, 1970)

Mit der Originalbeschreibung vollkommen übereinstimmend konnten mehrere Exemplare dieser äusserst großen Art erbeutet werden. Bei den adulten Tieren erstreckt sich der Gürtel vom 28–43. Segment, die Pubertätsstreifen verlaufen vom 28–43. Segment. Männliche Poren liegen auf dem 15. Segment. Bei allen Tieren konnten 8 Paar Samentaschen nachgewiesen werden.

Fundort: Z/6851. 5+2 juv. Ex., Versa, 19. IX. 1969, leg. ZICSI u. MAHNERT.

Octodrilus ruffoi sp. n.

Vom Mt. Terminillo liegen mir 12 adulte und 4 praeadulte Exemplare dieser neuen *Octodrilus*-Art vor.

Länge: 7 cm, Durchmesser: 0,6 cm. Segmentzahl: 154. Bei den übrigen Exemplaren, Länge: 5 – 8 cm, Durchmesser: 0,5 – 0,7 cm, Segmentzahl: 146 – 181.

Farbe: lebend wahrscheinlich rötlichbraun, konserviert grau.

Kopf prolobisch-epilobisch offen. Erster Rückenporus 12/13. Borsten ungepaart. Borsten aa doppelt so groß wie ab; ab = bc; bc kleiner als cd; dd = 2aa. Borsten ab des 9. Segmentes auf Drüsenpapillen angeordnet. Nephridialporen auf dem 7. Segment beginnend. Weibliche Poren auf dem 14. Segment, etwas oberhalb der Borstenlinie b. Männliche Poren auf dem 15. Segment, winzig kleine Öffnungen zwischen der Borstenlinie b und c. Gürtel sattelförmig vom 30 – 1/2 41. Segment, Pubertätsstreifen vom 30 – 42. Segment (bei den übrigen Exemplaren Gürtel auch vom 30 – 40. Segment, Pubertätsstreifen vom 30 – 41. Segment).

Dissepimente 12/13 – 14/15 etwas verdickt. Herzen im 6 – 11. Segment. Kalkdrüsen im 10 – 12. Segment, mit kleinen Ausbuchtungen im 10. Segment. 2 Paar Hoden und Samentrichter im 10. und 11. Segment. 2 Paar ösophageale Testikelblasen im 10. und 11. Segment, die die Hoden und Samentrichter einschliessen. 4 Paar Samensäcke im 9 – 12. Segment. Ovarien im 13. Segment, pilzförmig mit kleinem Stiel. 7 Paar Samentaschen im 6 – 12. Segment, die in die Intersegmentalfurchen 6/7 – 12/13 in der Höhe der Borstenlinie c ausmünden. Kropf im 15 – 16. Segment. Muskelmagen im 17 – 19. Segment.

Die neue Art unterscheidet sich von *O. complanatus*, die ebenfalls zwei Paar ösophageale Testikelblasen besitzt, durch die Lage des Gürtels und der Pubertätsstreifen, von allen übrigen *Octodrilus*-Arten dadurch, dass sie zwei Paar ösophageale Testikelblasen besitzt.

Ich benenne die neue Art zu Ehren des Sammlers, nach Herrn Prof. Dr. S. RUFFO, Verona.

Fundorte: Holotypus: V/356. Terminillo, 1900 – 2000 m, 11. VI. 1963, leg. S. RUFFO. 2 Ex. Paratypen Z/8688. Fundort wie beim Holotypus. Paratypen: V/361. 1. Ex; Z/8686. 1. Ex. Terminillo, 11. VI. 1963, leg. S. RUFFO. – V/381. 2 juv. Ex. Pian di Rosce, Mt. Terminillo, 12. VI. 1963, leg. S. RUFFO. – V/374. 4 + 1 juv. Ex. Terminillo, 1900 – 2000 m, 12. VI. 1963, leg. S. RUFFO. – V/378. 1 + 1 juv. Ex; Z/8687. 2Ex. Terminillo, 11. VI. 1963, leg. S. RUFFO. –

Octolasium lacteum (ÖRLEY, 1881)

Fundorte: Z/6760. 2 Ex., Val de Egan Carezza, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6767. 2 Ex., Nova Levante 1200 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6772. 1 Ex., Pardoi Pass 1900 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6776. 1 Ex. Pardoi Pass 2160 m. 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6778. 2 Ex., Passo di tre Croci 1600 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6782. 2 Ex., Sappado 1100 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6786. 2 Ex., Forni 800 m., 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6788. 2 Ex., Prato di Resia 400 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6796. 8 Ex., Prato di Resia Wiese, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6818. 4 Ex., Nimis Wald, 18. IX. 1969, leg. ZICSI & MAHNERT. – Z/6856. 6 Ex., Visco, 19. IX. 1969, leg, ZICSI & MAHNERT. – Z/6873. 1 Ex., Erto bei Longarone, 20. IX. 1969. leg, ZICSI & MAHNERT. – Z/6881. 1 Ex., Sedico, 20. IX. 1969, leg. ZICSI & MAHNERT. – Z/6885. 4 Ex., Sciovie, Passo d' Aune 800 m, 20. IX, 1969, leg. ZICSI & MAHNERT. – V/81. 2 Ex,, Grezzana, 6. V. 1971, leg. OSELLA & ZICSI. – V/87. 2 Ex., St. Anna d' Alfredo, 6. V. 1971, leg. OSELLA & ZICSI. – V/98. 1 Ex., Ponte di Veja, 6. V. 1971, leg. OSELLA & ZICSI. – V/106. 2 Ex,, Montecchio, 7. V. 1971, leg. MONTOLLI & ZICSI. V/113. 4 Ex., S. Giovanni – Ilarione, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/122. 1 Ex., S. Bortolo, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/128. 1 Ex., S. Bortolo – Setto, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/135. 2 Ex., Giazza, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/138. 3 Ex., Selva di Progno, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/142. 10 Ex., Affi, 8. V.1971, leg. OSELLA & ZICSI. – V/147. 10 Ex., Bardolino, 8. V. 1971, leg. OSELLA & ZICSI. – V/163. 18Ex. Z/7447. 8 Ex., Castion del Garda, 8. V. 1971, leg. OSELLA & ZICSI. – V/170. 1 Ex., S. Felice

(Verona), 8. V. 1971, leg. Montolli. – V/177. 11 Ex., Z/7456. 10 Ex., Pazzon, 10. V. 1971, leg. Montolli & Zicsi. – V/186. 2 Ex., Sangaro Ferrara d. M. Baldo, 10. V. 1971, leg. Montolli & Zicsi. V/194. 3 Ex., Spiazzi Mt. Baldo, 10. V. 1971, leg. Montolli & Zicsi. – V/202. 2 Ex., Villafranca di Verona, 11. V. 1971, leg. Montolli & Zicsi. – V/205. 11 Ex., Bancole de Montovano, 11. V. 1971, leg. Montolli & Zicsi. – V/211. 13 Ex., Villa Fontana, 11. V. 1971, leg. Montolli & Zicsi. – V/223. 9 Ex., Z/7471. 10 Ex., Gazzanigia, 12. V. 1971, leg. Osella & Zicsi. – V/232. 7 Ex., Barghe, 12. V. 1971, leg. Osella & Zicsi. – V/237. 3 Ex., Casto, 12. V. 1971, leg. Osella & Zicsi. – V/242. 7 Ex., Lodrino, 12. V. 1971, leg. Osella & Zicsi. – V/247. 6 Ex., Collio, 13. V. 1971, leg. Osella & Zicsi. – V/254. 1 Ex., S. Colombano, 13. V. 1971, leg. Osella & Zicsi. – V/259. 5 Ex., Bóvegno, 13. V. 1971. leg. Osella & Zicsi. – V/267. 2 Ex., Storo., 13. V. 1971, leg. Osella & Zicsi. – V/274. 3 Ex., Vale di Tremalzo, 13. V. 1971, leg. Osella & Zicsi. – V/278. 8 Ex., Vale di Tremalzo, 13. V. 1971, leg. Osella & Zicsi. – V/281. 5 Ex., Pranzo, 14. V. 1971, leg. Osella & Zicsi. – V/284. 5 Ex., Lago di Tenno, 14. V. 1971, leg. Osella & Zicsi. – V/292. 11 Ex., Ballino, 14. V. 1971, leg. Osella & Zicsi. – V/299. 5 Ex., Piere di Bono, 14. V. 1971, leg. Osella & Zicsi. – V/303. 3 Ex., Condino, 14. V. 1971, leg. Osella & Zicsi. – V/306. 1 Ex., Storo, 14. V. 1971, leg. Osella & Zicsi. – Veneto: V/315. 3 Ex., Malga Campo Rotando di Sotta, Mt. Tomba (Verona), 19. VI. 1968, leg. Lazzeroni. – V/335. 1 Ex., S. Zeno di Montagna (Verona), 4. VI. 1966, leg. Lazzeroni. – V/341. 1 Ex., Mt. Baldo, 13. VIII. 1967, leg. Cermelini. – V/345. 1 Ex., Mt. Corno: Davanti alla Grotta del Ciabattino (Verona) 29. V. 1968, leg. Gioco, Montolli & Lazzeroni. – V/348. 2 Ex., Rifugo Rivolto (M. Lessini), 9. VII. 1968, leg. Gioco, Montolli & Lazzeroni. – V/349. 1 Ex., Monte Castelberto (Verona), 20. VI. 1968, leg. Montolli. – V/520. 2 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. Osella. – V/525. 6 Ex., Mte. Grigna, 2. VII. 1970, leg. Osella – V/531. 5 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. Osella. – V/538. 8 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. Osella. – V/544. 4 Ex., Mte. Baldo, Bocca di Navene 1600– –1700 m, 5. VII. 1970, leg. Osella. – V/572. 1 Ex., Vaio del Paradiso (Grezzana), 6. V. 1971, leg. Osella. – Lombardia: V/479. 1 Ex., Prealpi Lombarde Val Brembana Oltrel Colle 1000 m, 10. V. 1969, leg. Osella. – Piemonte: V/471. 2 Ex., Alpi Graie-Val Locana Colle del Nivolet 2600 m, 28. VII. 1968, leg. Osella. – V/508. 1 Ex., Alpi Cozie-Valle Susa Colle dell' Assietta 2420 m, 15. VII. 1968, leg. Osella. – V/558. 1 Ex., Gran Paradiso Valnontey (Cogne) 1700–2400 m, 3. VII. 1970, leg. Osella. – Emilia: V/464. 1 Ex., Mt. Cimone 1900 m, App. T. Emiliano, 2. VII. 1964, leg. Ruffo. – V/473. 1 Ex., Abetone App. Tosco Emiliano, 8. VII. 1964, leg. Ruffo. – V/510. 1 Ex., Mt. Falco (Foresta di Campigna-Emilia), IV. 1968, leg. Ruffo. – Toscana: V/468. 1 Ex., Vallombrosa (Toscana), VI. 1968, leg. Ruffo. – V/485. 2 Ex., Vallombrosa (Toscana), VI. 1968, leg. Ruffo. – Abruzzo : V/454. 2 Ex., M. ti della Laga Mt. Gorzano 1800–2300 m, IX. 1968, leg. Osella. – Lazio: V/357. 1 Ex., Terminillo 1900–2000 m (Appennino centrale), 12. VI. 1963, leg. Ruffo. – V/359. 1 Ex., Terminillo 1900–2000 m (Appennino centrale), 11. VI. 1963, leg. Ruffo – V/363. 1 Ex., Busa da neva de la Galbana, Mt. Lessini, VIII. 1956, leg. Ruffo. – V/371. 3 Ex., Terminillo 1900–2000 m (Appennino centrale), 12. VI. 1963, leg. Ruffo. – Campania: V/422. 1 Ex., Bojano (Matese) (paese), 18. IX. 1967, leg. Giusti & Minelli. – Calabria: V/385. 1 Ex., Volpintesta (La Sila), 20. VI. 1960, leg. Ruffo.

Octolasium cyaneum (Savigny, 1826)

Fundort: Piemonte: V/477. 1 Ex., Mte. Musiné (Tó) Caselette 300 m, 4. XI. 1967, leg. Osella.

Lumbricus rubellus Hoffmeister, 1843

Fundorte: Z/6759. 2 Ex., Botzen, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6761. 4, Ex., Val de Egan Carezza, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6765. 18 Ex., Nova Levante 1200 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6769. 7 Ex., Pardoi Pass 1900 m., 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6774. 4 Ex., Pardoi Pass 2160 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6783. 1 Ex., Sappado 1100 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6785. 1 Ex., Forni 800 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6790. 2 Ex., Prato di Resia 400 m, 17. IX. 1969, leg. Zicsi & Mahnert. – Z/6794. 4 Ex., Prato di Resia Wiese, 16. IX. 1969, leg. Zicsi & Mahnert, – Z/6879. 5 Ex., Sedico, 20. IX. 1969, leg. Zicsi & Mahnert. – Z/6889. 4 Ex., Sciovie, Passo d' Aune 800 m, 20. IX. 1969, leg. Zicsi & Mahnert. – Z/6897. 2 Ex., Scovie, Passo d' Aune 1064 m, 20. IX. 1969, leg. Zicsi & Mahnert. – V/82. 2 Ex., Grezzana, 6. V. 1971, leg. Osella & Zicsi. – – V/89. 2 Ex., St. Anna d' Alfredo, 6. V. 1971, leg. Osella & Zicsi. – V/104. 3 Ex., Ponte di Veja, 6. V. 1971, leg. Osella & Zicsi. – V/140. 1 Ex., Affi, 8. V. 1971, leg. Osella & Zicsi. –

V/145. 4 Ex., Bardolino, 8. V. 1971, leg. OSELLA & ZICSI. – V/214. 21 Ex., Villa Fontana, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/222. 4 Ex., Gazzanigia, 12. V. 1971, leg. OSELLA & ZICSI. – V/256. 1 Ex., Mt. Maniva 1000 m, 13. V. 1971, leg. OSELLA & ZICSI. – V/258. 2 Ex., Bovegno, 13. V. 1971, leg. OSELLA & ZICSI. – V/277. 1 Ex., Vale di Tremalzo, 13. V. 1971, leg. OSELLA & ZICSI. – V/280. 3 Ex., Pranzo, 14. V. 1971, leg. OSELLA & ZICSI. – V/290. 9 Ex., Ballino, 14. V. 1971, leg. OSELLA & ZICSI. – V/301. 7 Ex., Pieve de Bono, 14. V. 1971, leg. OSELLA & ZICSI. – V/305. 5 Ex., Condino, 14. V. 1971, leg. OSELLA & ZICSI. – Veneto: V/309. 1 Ex., Bocca di Navene, Mt. Baldo, 4. VI. 1971, leg. OSELLA. – V/311. 6 Ex., Cologna Veneta (Verona), 5. III. 1967, leg. GIOCO. – V/313. 2+3 juv. Ex., Passo delle Fittanze (Verona), 7. VII. 1968, leg. GIOCO. – V/317. 1 Ex., Cima Posta (M. Lessini), 10. VII. 1968, leg. GIOCO & LAZZERONI. – V/320. 1 Ex., Cologna Veneta (Verona), 31. III. 1968, leg. GIOCO. – V/323. 1 Ex., Tra Breonio e. S. Anna di Alfredo (Verona), 24. V. 1969, leg. LAZZERONI & GIOCO. – V/325. 2 Ex., Sega di Ala (Lessini), 20. VI. 1968, leg. LAZZERONI. – V/326. 2 Ex., Tra S. Vigilio e Torri (Verona), 4. VI. 1968, leg. LAZZERONI & GIOCO. – V/328. 1 Ex., Torricelle (Verona), 19. V. 1967, leg. RIGGIO. – V/329. 1 Ex., Valdritta (Mt. Baldo), VI. 1968, leg. OSELLA. – V/333. 1 Ex., Custoza (Verona), 29. IV. 1968, leg. OSELLA & GIOCO & MONTOLLI. – V/334. 2 Ex., Cologna Veneta (Verona), 19. III. 1967, leg. GIOCO. – V/337. 8 Ex., Cologna Veneta (Verona), 7. IV. 1970, leg. GIOCO. – V/339. 1 Ex., Vaio del Paradiso (Grezzana), 19. III. 1968, leg. MINGIONE. – V/347. 1 Ex., Cologna Veneta (Verona), 2. VI. 1968, leg. GIOCO. – V/521. 1 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA. – V/526. 1 Ex., Mte. Grigna, 2.VII. 1970, leg. OSELLA. – V/532. 2 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA. – V/537. 6 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. OSELLA. – V/543. 6 Ex., Mte. Baldo, Bocca di Navene 1600–1700 m., 5. VII. 1970, leg. OSELLA. – V/561. 1 Ex., Cologna Veneta (Verona), 19. IV. 1971, leg. GIOCO. – Trentino: V/524. 2 Ex., S. Giacomo di Brentonico (Trento) 1050 m, 17. V. 1970, leg. OSELLA. – Emilia: V/515. 1 Ex., Boscolungo-Abetone App. T. Emiliano, 13. VII. 1964, leg. RUFFO. – Toscana: V/484. 1 Ex., Vallombrosa (Toscana), VI. 1968, leg. RUFFO. – Marche: V/460. 10 Ex., Mt. dei Fiori (Ascoli Piceno) 1000 m, 12. VI. 1967, leg. RUFFO. – Abruzzo: V/453. 3 Ex., M. ti. della Laga Mt. Gorzano 1800–2300 m, IX. 1968, leg. OSELLA. – V/455. 3 Ex., M. ti della Laga Amatrice-Capricchia 1150–1300 m, IX. 1968, leg. OSELLA. – Lazio: V/365. 1 Ex., Busa da neva de la Galbana, Mt. Lessini, VIII. 1956, leg. RUFFO. – V/494. 1 Ex., Vallonina Terminillo Nord 1300 m, 14. VI. 1963, leg. RUFFO. – Campania: V/426. 3 Ex., Lago del Matese, 2. VII. 1967, leg. RIGGIO & OSELLA.

Lumbricus castaneus (SAVIGNY, 1826)

Fundorte: V/161. 2 Ex., Castion del Garda, 8. V. 1971. leg. OSELLA & ZICSI. – V/302. 13 Ex., Condino, 14. V. 1971, leg. OSELLA & ZICSI. – Piemonte. – V/505. 3 Ex., Leini (Torino), 29. III. 1970, leg. OSELLA. – V/552. 7 Ex., Leini (Torino), 9. IV. 1971, leg. OSELLA. – V/574. 2 Ex., Leini (Torino), 19. III. 1971, leg. OSELLA. – Abruzzo: V/472. 2 Ex., Parco Naz. d'Abruzzo Pescasseroli, 23. VI. 1953, leg. RICCI.

Lumbricus terrestris LINNAEUS, 1758

Fundorte: Z/6835. 1 Ex., Corno di Rosazzo, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6854. 3 Ex., Versa, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6861. 7 Ex., Visco, 19. IX. 1969, leg. ZICSI & MAHNERT. – V/143. 10 Ex., Z/7443. 8 Ex., Affi, 8. V. 1971, leg. OSELLA & ZICSI. – V/172. 1 Ex., S. Felice (Verona), 8. V. 1971, leg. MONTOLLI. – V/198. 19 Ex., Z/7466. 5 Ex., Dossobuona, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/200. 1 Ex., Villafranca di Verona, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/250. 3 Ex., Collio, 13. V. 1971, leg. OSELLA & ZICSI. – V 261. 1 Ex., Bovegno, 13. V. 1971, leg. OSELLA & ZICSI. – Piemonte: V/557. 1 Ex., Gran Paradiso Valnontey (Cogne) 1700–2400 m, 3. VII. 1970, leg. OSELLA.

Dendrobaena rubida (SAVIGNY, 1826)

Fundorte: Z/6764. 7 Ex., Nova Levante 1200 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6771. 2 Ex., Pardoi Pass 1900 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6779. 2 Ex., Passo di Tre Croci 1600 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6798. 8 Ex., Prato di Resia Wiese, 16.

IX. 1969, leg. Zicsi & Mahnert. – Z/6877. 13 Ex., Sedico, 20. IX. 1969, leg. Zicsi & Mahnert. – Z/6896. 6 Ex., Sciovie, Passo d' Aune, 20. IX. 1969, leg. Zicsi & Mahnert. – V/100. 37 Ex., V/101. 23 Ex., Z/7435. 20 Ex., Ponte di Veja, 6. V. 1971, leg. Osella & Zicsi. – V/111. 1 Ex., Giovanni–Ilarione, 7. V. 1971, leg. Montolli & Zicsi. – V./158. 1 Ex., Castion del Garda, 8. V. 1971, leg. Osella & Zicsi. – V/174. 16 Ex., Z/7454. 18. Ex., S. Felice (Verona) 8. V. 1971, leg. Montolli. – V/193. 1 Ex., Spiazzi Mt. Baldo, 10. V. 1971, leg. Montolli. & Zicsi. – V/213. 1 Ex., Villa Fontana, 11. V. 1971, leg. Montolli & Zicsi. – V/227. 1 Ex., Gazzanigia, 12. V. 1971, leg. Osella & Zicsi. – V/251. 2 Ex., S. Colombano, 13. V. 1971, leg. Osella & Zicsi. – V/255. 6 Ex., Mt. Maniva 1000 m, 13. V. 1971, leg. Osella & Zicsi. – Lombardia: V/576. 2 Ex., Ponti sul Minco (Mantora) Palude, 7. II. 1971, leg. Zanetti. – V/577. 2 Ex., Pozzolongo (Brescia), 13. III. 1971, leg. Osella. – Piemonte: V/506. 1 Ex., Leini (Torino), 29. III. 1970, leg. Osella. – V/553. 3 Ex., Leini (Torino), 9. IV. 1971, leg. Osella. – V/559. 2 Ex., Gran Paradiso Valnontey (cogne) 1700 – – 2400 m, 3. VII. 1970, leg. Osella. – V/573. 2 Ex., Leini (Torino, 19. III. 1971, leg. Osella. – – Emilia: V/463. 1 Ex., Mt. Cimone 1900 m, App. T. Emiliano, 2. VII. 1964, leg. Ruffo. – Toscana: V/548. 1 Ex., Alpi Apuane Mt. Pisanino, Foce di Cardeto 1400 – 1700 m, 24. VII. 1970, leg. Osella. – V/578. 1 Ex., Alpi Apuane Gramolozo 1400 m, 26. VII. 1970, leg. Osella. – Marche: V/491. 1 Ex., Grotta del Veruino, 19. VII. 1965, leg. Baroni. – Lazio: V/372. 5 Ex., Terminillo 1900 – 2000 m. (Appennino centrale), 12. VI. 1963, leg. Ruffo. – V/376. 2 Ex., Terminillo 1900 – – 2000 m. (Appennino centrale), 11. VI. 1963, leg. Ruffo. – V/498. 3 Ex., Cima M. di Combio 2080 m (Monti Reatini), 4. VIII. 1969, leg. Carreroni. – V/518. 1 Ex., Cima M. Bove (M. Reatini), leg. Lazzeroni. – Campania: V/393. 1 Ex., Matese Abruzzo Roccamandolfi 820 m, 27. VI. 1967, leg. Riggio & Osella. – V/395. 3 Ex., Faggeta a N. E. del Ri. Campitello (Matese) 1500 m, 22. IX. 1967, leg. Giusti & Minelli. – V/407. 1 Ex., Matese Abruzzo Mt. Miletto 2000 m, 24. VI. 1967, leg. Riggio & Osella. – V/410. 3 Ex., Piani di Campitello Matese 1450 m, 27. IX. 1967, leg. Giusti & Minelli. – V/412. 1 Ex., Mt. Mutria (Matese) 1700 m, 25. IX. 1967, leg. Giusti & Minelli. – V/415. 1 Ex., Pendici Mt. Miletto (Matese) 1700 – 1900 m, 29. IX. 1967, leg. Giusti & Minelli. – V/419. 5 Ex., Rif. Campitello (Matese) 1250 m, 22. IX. 1967, leg. Giusti & Minelli. – V/435. 1 Ex., Mt. Gallinola – Vetta (Matese) 1920 – 1923 m, 27. IX. 1967, leg. Giusti & Minelli. – V/440. 1 Ex., Matese (Abruzzo) Serra del Perrone, 1. VII. 1967, leg. Riggio & Osela. – V/442. 1 Ex., Campitello (Matese), 16. VI. 1962, leg. Ruffo. – V/446. 2 Ex., Presso Miralago (Matese) 1080 m, 26. IX. 1967, leg. Giusti & Minelli. – V/452. 1 Ex., Faggeta presso passo tra il lego Matese e Lago Lenno, 28. IX. 1967, leg. Giusti & Minelli. – Puglia: V/503. 1 Ex., Foresta Umbra (Gargano), 25. V. 1950, leg. Ruffo. – V/570. 4 Ex., Grotta di Montenero (Gargano), 29. IX. 1969, leg. Ruffo – V/527. 1 Ex., Mte Grigna, 2. VII. 1970, leg. Osella.

Dendrobaena octaedra (Savigny, 1826)

Fundorte: Z/6766. 3 Ex., Nova Levante 1200 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6770. 1 Ex., Pordoi Pass 1900 m, leg. Zicsi & Mahnert. – Z/6888. 1 Ex., Sciovie, Passo d' Aune 800 m, 20. IX. 1969, leg. Zicsi & Mahnert. – Z/6894. 2 Ex., Sciovie, Passo d' Aune 1064 m, 20. IX. 1969, leg. Zicsi & Mahnert. – V/99. 4 Ex., Ponte di Veja, 6. V. 1971, leg. Osella & Zicsi. – – V/114. 4 Ex., Giovanni-Ilarione, 7. V. 1971, leg. Montolli & Zicsi. – V/121. 1 Ex., S. Bortolo, 7. V. 1971, leg. Montolli & Zicsi. – V/134. 3 Ex., Giazza, 7. V. 1971, leg., Montolli & Zicsi. V/235. 4 Ex., Casto, 12. V. 1971, leg. Osella & Zicsi. – V/252. 7 Ex., S. Colombano, 13. V. 1971, leg. Osella & Zicsi. – V/265. 3 Ex., Collio, 13. V. 1971, leg. Osella & Zicsi. – V/266. 3 Ex., Storo, 13. V. 1971, leg. Osella & Zicsi. – V/286. 1 Ex., Lago di Tenno, 14. V. 1971, leg. Osella & Zicsi. – V/300. 1 Ex., Pieve di Bono, 14. V. 1971, leg. Osella & Zicsi. – Veneto: V/308. 3 Ex., Agordo (Belluno), 4. V. 1967, leg. Riggio & Gioco. – V/344. 1 Ex., Podestaria (Lessini), VII. 1968, leg. Vigna. – V/346. 1 Ex., Giazza (Tregnago Verona), 8. V. 1968, leg. Gioco. – V/522. 2 Ex., Mte. Baldo, 2060 m, 4. VII. 1970, leg. Osella. – V/535. 1 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. Osella. – V/542. 2 Ex., Mte. Baldo 2060 m, 4. VII. 1970, leg. Osella. – V/544. 1 Ex., Mte. Baldo Bocca di Navene, 1600 – 1700 m, 5. VII. 1970, leg. Osella. – Lombardia: V/482. 2 Ex., Prealpi Bergamasche Oltre ill Colle 1000 m, 10. V. 1969, leg. Osella. – Piemonte: V/476. 1 Ex., Alpi Cozie-Val Chisone Rif. Mt. Granero 2350 m, VII. 1968, leg. Osella. – V/478. 1 Ex., Gran Paradiso-Val Saona Campiglia 1500 m, VII. 1968, leg. Osella. – V/563. 1 Ex., Alpi Marittime Limone Piemonte 1600 – 2000 m, 1. VIII. 1970, leg. Osella. – V/565. 1 Ex., Gran Paradiso Valnontey (Agne) Rif. V. Sella 2400 – 2800 m, 5. VIII. 1970, leg. Osella. – V/566. 1 Ex., Valle Aosta Pondel (Cogne) 1000 m, 6. VIII. 1970, leg. Osella. – V/567. 1 Ex., Gran Paradiso Vallone d' Valleille (Cogne) 1800 – 2000 m, 5. VIII. 1970, leg. Osella. – Lazio: V/364. 1 Ex., Busa da neva de la Galbana, Mt. Lessini, VIII. 1956, leg. Ruffo.

Dendrobaena attemsi (MICHAELSEN, 1902)

Es konnten 3 Tiere dieser Art zugestellt werden, die mit der Beschreibung von Michaelsen vollkommen übereinstimmen. Der Gürtel erstreckt sich vom 28 1/2 34. Segment die Pubertätsstreifen vom 30 – 32. Segment. Die Samentaschen liegen auf langen Stielen die in Drüsenfelder eingebettet sind.

Fundorte: Piemonte: V/496. 1 Ex. Z/8690. 1 Ex. Alpi Marittime-Val Pesio Pian delle Gorre, 1110 m, VII. 1968, leg. OSELLA. – V/519. 1 Ex. Alpi Marittime Val Pesio, Laghetti del Marguareis, VII. 1968, leg. OSELLA.

Dendrobaena alpina (ROSA, 1884)

Fundorte: V/272. 1 Ex. Storo, 13. V. 1971, leg. OSELLA u. ZICSI. – V/291. 1 Ex. Ballino, 14. V. 1971, leg. OSELLA u. ZICSI. – Z/8691. 1 Ex. Alpi Marittime Val Gesso, (1800 – 2400 m), Rifugio Soria, 17. VIII. 1966, leg. OSELLA. – Piemonte: V/501. 1Ex. Alpi Pennine Lago del Muerone (Orope), 1900 – 2200 m, 6. VIII. 1969, leg. OSELLA. – V/509. 1 Ex. Alpi Cozie – Valle Susa Colle dell' Assietta, 15. VII. 1968, leg. OSELLA. – V/517. 1 Ex. Alpi Cozie – Val Chisone, Rif. Jervis, 1700 – 1800 m, VII. 1968, leg. OSELLA.

Dendrobaena cognettii (MICHAELSEN, 1903)

Syn. *Enterion pygmaeum* SAVIGNY 1826, spec. inc. sed.; *Allolobophora minima* ROSA, 1884, spec. inc. sed.; *Helodrilus (Helodrilus) ribaucourti* COGNETTI, 1901; *Helodrilus (Helodrilus) cognettii*, MICHAELSEN, 1903 (nom. nov.).

Diese winzige und oft übersehene Art nimmt innerhalb der Gattung *Dendrobaena* hinsichtlich der stark nach hinten gelagerten Gürtelorgane eine gesonderte Stellung ein und wird auch in der Literatur unter verschiedenen Benennungen angeführt. Dies geht auf die unzulängliche Originalbeschreibung von *Enterion pygmaeum* SAVIGNY, 1826 zurück. Aus der Arbeit von TÉTRY (1937), die sich mit der Revision der Typen von SAVIGNY befasst, geht hervor, dass sie den Holotypus dieser Art nicht ausfindig machen konnte und auch später nur ein einziges Exemplar aus Frankreich untersuchte (TÉTRY, 1938), bei dem undeutliche Pubertätsstreifen auf dem 34., 35., 36. Segment festgestellt werden konnten. Bei den inneren Merkmalen, die nicht festgestellt werden konnten, stützt sich die Autorin auf MICHAELSEN (1900), wo 3 Paar Samensäcke und 3 Paar Samentaschen angeführt werden. BOUCHÉ (1972) konnte ebenfalls keine, mit der Beschreibung von SAVIGNY bzw. MICHAELSEN übereinstimmende Exemplare in Frankreich nachweisen.

ROSA (1884) veröffentlicht unter dem Namen *Allolobophora minima* ebenfalls eine winzigkleine Art mit dem Gürtel vom 33 – 37. Segment, aber ohne Angaben der Pubertätsstreifen und Samensäcke. Es wird bloss angeführt, dass sie der Gruppe die „Receptacula seminis in direzione del paio superiore di setole" besitzen, angehört. In einer späteren Arbeit, führt ROSA (1893) sie als Synonym von *pygmaeum* an, aber ohne weiteres Material gesehen zu haben.

Wieder etwas später wird eine sehr ausführliche und exakte Beschreibung einer winzigen Art *Helodrilus (Helodrilus) ribaucourti* von COGNETTI (1901) bekanntgegeben, bei der sich der Gürtel vom 32,33 – 37. Segment erstreckt, die Pubertätsstreifen fehlen und die 2 Paar Samensäcke im 11. und 12. Segment besitzt, der die Samentaschen jedoch fehlen. Da der Name *ribaucourti* vergeben war, wurde von MICHAELSEN (1903) die Benennung *cognettii* eingeführt.

Da mir jetzt zahlreiche Exemplare von verschiedenen Fundorten in Italien, vorausgehend aus der Schweiz (Zicsi, 1979) zur Bestimmung zur Verfügung standen und in meiner Sammlung aus verschiedenen Ländern vorliegende Exemplare überprüft wurden (Ungarn: Z/400: Pécs, 1 Ex; Österreich: Z/6158, Wurzenpass, 14. Ex, Z/6680 Loibelpass, 2 Ex, Z/7820 Stockerau, 1 Ex; Griechenland: Z/7528 Insel Kefallinia, 1 Ex; Spanien: Z/6445 Prov. Gerona, La Junguera, 1 Ex; Chile: Santiago de Chile, Z/5804, 9 Ex.), konnte erwiesen werden, dass sämtliche Tiere mit der Beschreibung von Cognetti übereinstimmen. Da bisher keine Exemplare mit den Bestimmungsmerkmalen die von Savigny oder Rosa beschrieben wurden wiedergefunden werden konnten, kann ich mich der Ansicht von Gates (1975) nicht anschliessen *D. cognettii* als Synonym von *D. pygmaea* zu betrachten. Aus den gleichen Gründen kann ich auch der Auffassung von Omodeo (1952, 1956) – *D. minima* (Rosa, 1884) – als gute Art zu betrachten, nicht beiflichten, da nicht bewiesen wurde, ob *pygmaea* oder *minima* mit den Kriterien mit denen sie beschrieben wurden überhaupt existieren. Ich betrachte deswegen diese beiden Arten als species incertae sedis.

Meine Exemplare aus verschiedenen Ländern und so auch diese aus Italien stimmen vollkommen mit der Beschreibung von Cognetti überein. Da die Originalbeschreibung, ferner die von Bouché, 1972 *(D. pygmaea cognettii)* und die von Gates, 1975 *(D. pygmaea)* äusserst ausführlich ist, verzichte ich hier auf eine Wiederholung. Es sei bloss bemerkt, dass unter den zahlreichen Exemplaren am häufigsten eine Gürtellage vom 33–37. Segment angetroffen werden konnte, vereinzelt kamen aber Tiere auch mit einem Gürtel vom 32–37. Segment oder 33–38. Segment vor. Deutlich ausgebildete Pubertätsstreifen liessen sich nie nachweisen. Samensäcke konnten immer nur 2 Paar im 11. und 12. Segment festgestellt werden, Samentaschen liessen sich in keinem Fall nachweisen. Interessant ist noch die Tatsache, dass auch der Rückenporus nicht erkannt werden konnte.

Fundorte: Z/6797. 5 Ex. Prato di Resia Wiese, 16. IX. 1969, leg. Zicsi u. Mahnert. – Z/6878. 3 Ex. Sedico, 20. IX. 1969, leg. Zicsi u. Mahnert. – Z/6895. 1 Ex. Sciovie, Passo d' Aune 1064 m, 20. IX. 1969, leg. Zicsi u. Mahnert. – V/166. 2 Ex., Z/7448. 1 Ex. Castion del Garda, 8. V. 1971, leg. Osella u. Zicsi. – V/179. 2 Ex., Z/7457. 6 Ex., Pazzon, 10. V. 1971, leg. Montolli u. Zicsi. – V/182. 3 Ex. Pazzon, 10. V. 1971, leg. Montolli u. Zicsi. – V/212. 7. Ex., Z/7468. 10 Ex. Villa Fontana de Montovano, 11. V. 1971, leg. Montolli u. Zicsi. – V/221. 4 Ex., Z/7472. 5 Ex., Gazzanigia, 12. V. 1971, leg. Montolli u. Zicsi. – V/244. 2 Ex., Z/7476. 1 Ex. Lodrino, 12. V. 1971, leg. Osella u. Zicsi. – V/298. 4 Ex., Z/7479. 9 Ex. Pieve di Bono, 14. V. 1971, leg. Osella u. Zicsi. – V/352. 1 Ex. Gazzo Veronese (Verona), 2. V. 1968, leg. Lazzeroni u. Osella. – Veneto: V/350. 1 Ex. Grezzana – Case Vecie (Verona), 19. X. 1969, leg. Zanetti. – V/353. 2 Ex. Malcesine (Verona), 9. V/1967, leg. Riggio. – V/396. 1 Ex. Faggeta a N. E. del Ri. Campitello (Matese), 1500 m, 22. IX. 1967, leg. Giusti u. Minelli. – Campania: V/416. 1 Ex. Sella del Perrone (Matese), 20. VI. 1962, leg. Ruffo.

Dendrobaena veneta veneta (Rosa, 1886)

Fundorte: V/167. 53 Ex., Z/7449., Z/7450., Z/7451., Z/7452. 40 Ex., S. Felice (Verona), 8. V. 1971, leg. Montolli. – Veneto: V/310. 2 Ex., Cologna Veneto (Verona), 5. III. 1967, leg. Gioco. – V/550. 4 Ex., Quinzano (Verona), 2. V. 1971, leg. Osella.

Die vorliegenden Exemplare wurden ähnlich wie die in Ungarn und Österreich nur in der Umgebung von Städten angetroffen und auch hier in Kompost und Mist von Gärten.

Eiseniella tetraedra tetraedra (SAVIGNY, 1826)

Fundorte: Z/6773. 3 Ex., Pardoi Pass 2160 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6865. 1 Ex., Bicinicco, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6890. 3 Ex., Sciovie, Passo d' Aune 800 m, 20. IX. 1969, leg. ZICSI & MANHERT. – V/92. 1 Ex., St. Anna d'Alfredo, 6. V. 1971, leg. OSELLA & ZICSI. – V/102. 25 Ex., Z/7436. 15 Ex., Ponte di Veja, 6. V. 1971, leg. OSELLA & ZICSI. – V/148. 55 Ex., Z/7445. 20 Ex., Bardolino, 8. V. 1971, leg. OSELLA & ZICSI. – V/153. 15 Ex., Bardolino Strada di Salesiane, 8. V. 1971, leg. OSELLA & ZICSI. – V/159. 13 Ex., Castion del Garda, 8. V. 1971, leg. OSELLA & ZICSI. – V/175. 17 Ex., Z/7455. 15 Ex., Pazzon, 10. V. 1971, leg MONTOLLI & ZICSI. – V/195. 5 Ex., Dossobuona, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/201., 6 Ex., Z/7467. 5 Ex., Villa Franca di Verona, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/207. 2 Ex. Bancole de Montovano, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/220. 4 Ex., Gazzanigia, 12. V. 1971, leg. OSELLA & ZICSI. – V/238. 1 Ex., Casto, 12. V. 1971, leg. OSELLA & ZICSI. – V/243. 4 Ex., Lodrino, 12. V. 1971, leg. OSELLA & ZICSI. – V/253. 2 Ex., S. Colombano, 13. V. 1971, leg. OSELLA & ZICSI. – V/287. 1 Ex., Lago di Tenno, 14. V. 1971, leg. OSELLA & ZICSI. – Veneto: V/327. 3 Ex., Vaio del Paradiso (Grazzana), 14. V. 1967, leg. Mingione. – V/343. 1 Ex., Vaio del Paradiso (Verona) 8. XII. 1967. leg. MINGIONE. – V/351. 1 Ex., Vaio di Squaranto (Verona), 6. IX. 1968, leg. MINGIONE. – V/355. 1 Ex., Malcesine (Verona), 9. V. 1967, leg. RIGGIO. – V/490. 1 Ex., Buco del Meo (Verona), 24. II. 1946, leg. RUFFO. – Toscana: V/483. 2 Ex., Vallombrosa (Toscano), VI. 1968, leg. RUFFO. – Marche: V/488. 1 Ex., Grotta di Frassasi Fabriano, 26. XII. 1964, leg. DINALE. – Abruzzo: V/459. 12. Ex., M. ti della Laga Amatrice-Capricchia 1150–1300 m., IX. 1968, leg. OSELLA. – Campania: V/402. 1 Ex., Matese Abruzzo Piano di Campitello 1500 m, 29. VI. 1967, leg. RIGGIO & OSELLA. – V/409. 1 Ex., Mte. Gallinola (Matese), 26. IV. 1967, leg. OSELLA. – V/424. 3 Ex., Mte. Gallinola (Matese), 25. IV. 1967, leg. OSELLA. – V/425. 13 Ex., Lago del Matese, 2. VII. 1967, leg. RIGGIO & OSELLA. – V/437. 4 Ex., Passo S. Crocetta Matese, 10. VI. 1962, leg. RUFFO. – V/443. 2 Ex., Campitello (Matese), 16. VI. 1962, leg. RUFFO. – Puglia: V/502. 8 Ex., Foresta Umbra (Gargano), 25. V. 1950, leg. RUFFO.

Interessant ist die Tatsache, dass in dieser reichen Ausbeute kein einziges Exemplar der Unterart *hercynia* MICH., 1890 erbeutet werden konnte.

Allolobophora caliginosa (SAVIGNY, 1826)

Fundorte: Z/6763. 2 Ex., Nova Levante 1200 m, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6795. 3 Ex., Prato di Resia Wiese, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6836. 2 Ex., Corno di Rosazzo, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6855. 9 Ex., Versa, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6860. 1 Ex., Visco, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6867. – 11 Ex., Barcis, 19. IX. 1969., leg. ZICSI & MAHNERT. – V/90. 1 Ex., St. Anna d' Alfredo, 6. V. 1971, leg. OSELLA & ZICSI. – V/108. 1 Ex., Montécchio, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/110. 3 Ex., Giovanni–Ilarione, 7. V, 1971, leg. MONTOLLI & ZICSI. – V/126. 1 Ex., S. Bortolo, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/160. 1 Ex., Castion, del Garda, 8. V. 1971, leg. OSELLA & ZICSI. – V/173. 8 Ex., S. Felice (Verona), 8. V. 1971, leg. MONTOLLI. – V/183. 50 Ex., Z/7459. 10 Ex., Z/7460. 10 Ex., Sangaro Ferrara d. M. Baldo, 10. V. 1971, leg. MONTOLLI & ZICSI. – V/190. 5 Ex., Ferrara, 10. V. 1971, leg. MONTOLLI & ZICSI. – V/197. 8 Ex., Z/7465. 9 Ex., Dossobuona, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/204. 3 Ex., Castaglione Montovano, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/210. 3 Ex., Villa Fontana, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/215. 4 Ex., Guidizzolo, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/218. 27 Ex., Z/7469. 15 Ex., Z/7470. 10 Ex., Rivoltella, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/225. 7 Ex., Z/7473. 10 Ex., Gazzinigia, 12. V. 1971, leg. OSELLA & ZICSI. – V/236. 1 Ex., Casto, 12. V. 1971, leg. OSELLA & ZICSI. – V/249. 1 Ex., V/262. 12 Ex., Bovegno, 13. V. 1971, leg. OSELLA & ZICSI. – V/293. 5 Ex., Ballino, 14. V. 1971, leg. Osella & ZICSI. – V/295. 1 Ex. Pieve di Bono, 14. V. 1971, leg. OSELLA & ZICSI. – V/304. 11 Ex., Condino, 14. V. 1971, leg. OSELLA & ZICSI. – Piemonte: V/551. 3 Ex., Leini (Torino), 9. IV. 1971, leg. OSELLA. – V/564. 1 Ex., Alpi Marittime Limone Piemonte 1600–2000 m, 1. VIII. 1970,leg. OSELLA. – Abruzzo: V/450. 1 Ex., Parco Naz. d' Abruzzo Pescasseroli, 23. VI. 1953, leg. RICCI. – V/493. 3 Ex., Parco Naz. d' Abruzzo Pescasseroli, 7. V. 1953, leg. CONSIGLIO. – Campania: V/408. 2 Ex., Mte. Gallinola (Matese), 26. IV. 1967, leg. OSELLA. – V/417. 4 Ex., Rif. Compitello (Matese) 1250 m, 22. IX. 1967, leg. GIUSTI & MINELLI. – V/429. 4 Ex., Bojano (Matese) (paese), 18. IX. 1967, leg. GIUSTI & MINELLI. – V/434. 3 Ex., Mte. Gallinola – Vetta (Matese) 1920–1923 m, 27. IX. 1967, leg. GIUSTI. & MINELLI. – V/451. 2 Ex., Faggeta presso passo tra il lego Matese Lago Lenno, 28. IX.

1967, leg. GIUSTI & MINELLI. – Calabria: V/384. 3 Ex., Volpintesta (La Sila), 20. VI. 1960, leg. RUFFO. – Sicilia: V/579. 2 Ex., Marettimo (Is. Egadi), 26. III. 1969, leg. OSELLA. – V/581. 2 Ex., Favignana (Is. Egadi), 18. III. 1969, leg. OSELLA. – V/582. 1 Ex., Marettimo (Is. Egadi), 21. X. 1967, leg. OSELLA.

Allolobophora chlorotica (SAVIGNY, 1826)

Fundorte: Z/6792. 1 Ex., Prato di Resia Wiese, 16. IX. 1969, leg. ZICSI & MAHNERT. – Z/6838. 2 Ex., Corno di Rosazzo, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6845. 1 Ex., St. Floriano del ALTE, 19. IX. 1969, leg. ZICSI & MAHNERT. – Z/6847. 1 Ex., Visco, 19. IX. 1969, leg. ZICSI & MAHNERT. – V/91. 2 Ex., St. Anna d' Alfredo, 6. V. 1971, leg. OSELLA & ZICSI. – V/103. 7 Ex., Ponte di Veja, 6. V. 1971, leg. OSELLA & ZICSI. V/107. 1 Ex., Montécchio, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/116. 1 Ex., Giovanni – Ilarione, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/125. 2 Ex.,S. Bortolo, 7 V. 1971, leg. MONTOLLI & ZICSI. – V/133. 4 Ex., Z/7442. 5 Ex., Giazza, 7. V. 1971, leg. MONTOLLI & ZICSI. – V/146. 4 Ex., Bardolino, 8. V. 1971, leg. OSELLA & ZICSI. V/157. 10 Ex., Castion del Garda, 8. V. 1971, leg. OSELLA & ZICSI. – V/169. 3 Ex., S. Felice (Verona) 8. V. 1971, leg. MONTOLLI. – V/176. 5 Ex., Pazzon, 10. V. 1971, leg. MONTOLLI & ZICSI. – V/196. 7 Ex., Z/7464. 5 Ex., Dossobuona, 11. V. 1971, leg. MONTOLLI & ZICSI. – V/217. 6 Ex., Rivoltella, 11. V. 1971, leg. MONTOLLI & ZICSI. – Trentino: V/512. 1 Ex., Brentonico (Trento) 800 m, 19. IV. 1970, leg. OSELLA. – Piemonte: V/555. 1 Ex., Leini (Torino), 9. IV. 1971, leg. OSELLA. – Abruzzo: V/499. 2 Ex., Parco Naz. d'Abruzzo Pescasseroli, 23. VI. 1953, leg. RICCI. – Lazio: V/358. 4 Ex., Terminillo 1900–2000 m (Appenino centrale), 11. VI. 1963, leg. RUFFO. – V/370. 6 Ex., Terminillo 1900–2000 m (Appenino centrale), 12. VI. 1963, leg. RUFFO. – V/375. 5 Ex., Terminillo 1900–2000 m (Appenino centrale), 11. VI. 1963, leg. RUFFO. – V/380. 1 Ex., Pian di Rosce Mt. Terminillo, 12. VII. 1963, leg. RUFFO. – Campania: V/403. 1 Ex., Sassinoro (Matese) Torente Tammaro, 9. VI. 1962, legRUFFO. – V/420. 6 Ex., Bojano (Matese) (paese), 18. IX. 1967, leg. GIUSTI & MINELLI. – V/430. 4 Ex., Bojano (Matese) (paese), 18. IX. 1967, leg. GIUSTI & MINELLI – V/ 449. 1 Ex., Gola del Tor. Quirino (Matese), 20. IX. 1967. – Calabria: V/382. 5 Ex., Volpintesta (La Sila), 20. VI. 1960, leg. RUFFO.

Allolobophora georgii MICHAELSEN, 1890

Insofern mir bekannt, wurde diese von Vorderasien bis Spanien verbreitete Art zuletzt von COGNETTI, 1905*b* aus Italien gemeldet, seither nicht angetroffen.

Fundort: Lazio: V/379. 1 Ex. Pian di Rosce, Mt. Terminillo, 12. VI. 1963, leg. RUFFO.

Allolobophora jassyensis MICHAELSEN, 1891

Ein Vorkommen dieser Art aus Italien ist mir unbekannt. Das einzige Exemplar stimmt vollkommen mit der Originalbeschreibung überein.

Fundort: Lazio: V/366. 1 Ex. Busa da neva de la Galbana, Mt. Lessini, VIII., leg. RUFFO. –

Allolobophora leoni (MICHAELSEN, 1891)

In einer vorausgehenden Arbeit habe ich auf die abweichende Ausbildung der Pubertätsstreifen, bzw. deren hervorspringenden Ausbuchtungen bei den italienischen Exemplaren hingewiesen (ZICSI, 1971*b*). Während bei *A. leoni* aus Ungarn die Samentaschen in Gruppen von 2–4 angeordnet sind, konnten bei den Exemplaren aus Italien nur zwei Paar angetroffen werden. Auf eine enge Verwandtschaft mit *A. nematogena* ROSA, 1903 wurde in der vorher erwähnten Arbeit ebenfalls hingewisen.

Fundorte: Z/6869. 8 Ex. Barcis, 19. IX. 1969, leg. ZICSI u. MAHNERT. – Z/6882. 14 Ex. Sedico, 20. IX. 1969, leg. ZICSI u. MAHNERT. – Z/6893. 7 Ex. Sciovie, Passo d' Aune, 1064 m, 20. IX. 1969, leg. ZICSI u. MAHNERT.

Allolobophora nematogena (Rosa, 1903)

Auf die Synonyme dieser Art (*H.* [*E.*] *meledaensis* Michaelsen, 1908, *H.* [*E.*] *bellicosus* Ude, 1922, *Allolobophora dudichiana* Zicsi, 1966) wurde in einer vorausgehenden Arbeit hingewiesen. (Zicsi, 1971*b*).

Fundorte: Z/6801. 8 Ex. Zwischen Vedronza u. Pradielis, 18. IX. 1969, leg. Zicsi u. Mahnert. Z/6805. 15. Ex. Fundort wie zuvor. – Z/6841. 3 Ex. Cormons, 19. IX. 1969, leg. Zicsi u. Mahnert. – Z/6863. 4 Ex. Fundort wie zuvor. –

Allolobophora gestroi (Cognetti, 1905)

Da ich mich in einer vorausgehenden Arbeit (Zicsi, 1970*b*) mit den Fundorten der Aufsammlungen des Jahres 1969 in Italien befasste und auch die Synonymenfrage dieser Art berührte, werden nachstehend nur die neueren Fundorte bekanntgegeben.

Interessant ist die Tatsache, dass im Monat Mai des Jahres 1971 vollkommen geschlechtsreife Tiere nicht erbeutet werden konnten, während im Herbst des Jahres 1969 häufig geschlechtsreife Tiere gesammelt werden konnten. Es ist anzunehmen, dass diese Tiere den Gürtel zurückbilden und der nur angedeutet erscheint.

Fundorte: V/83. 10 Ex., Z/7432. 7 Ex. Grezzana, 6. V. 1971, leg. Osella u. Zicsi. – V/93. 22 Ex., Z/7433. 8 Ex. St. Anna Alfredo, 6. V. 1971, leg. Osella u. Zicsi. – V/97. 7 Ex., Z/7434. 6 Ex. Ponte di Veja, 6. V. 1971, leg. Osella u. Zicsi. – V/109. 15 Ex. Montécchio, 7. V. 1971, leg. Montolli u. Zicsi. – V/117. 14 Ex., Z/7438. 5 Ex. Giovanni – Ilarione, 7. V. 1971, leg. Montolli u. Zicsi. – V/127. 6 Ex., Z/7439. 8 Ex. S. Bortolo, 7. V. 1971, leg. Montolli u. Zicsi. – V/132. 7 Ex. S. Bortolo – Setto, 7. V. 1971, leg. Montolli u. Zicsi. – V/137. 11 Ex. Selva di Progno, 7. V. 1971, leg.Montolli u. Zicsi. – V/149. 1 Ex. Bardolino, 8. V. 1971, leg Osella u. Zicsi. – V/154. 3 Ex. Bardolino Strada di Salesiane, 8. V. 1971, leg. Osella u. Zicsi. – V/156. 9 Ex. Rocca di Garda, 8. V. 1971, leg. Osella u. Zicsi. – V/162. 3 Ex. Castion del Garda, 8. V. 1971, leg. Osella u. Zicsi. – V/171. 1 Ex. S. Felice (Verona), 8. V. 1971, leg. Montolli. – V/178. 9 Ex. Pazzon, 10. V. 1971, leg. Montolli u. Zicsi. – V/181. 6 Ex., Z/7485. 6 Ex. Pazzon, 10. V. 1971, leg. Montolli u. Zicsi. – V/184. 9 Ex., Z/7461. 14 Ex. Sangaro Ferrara d. M. Baldo, 10. V. 1971, leg. Montolli u. Zicsi. – V/187. 7 Ex., Z/7462. 10 Ex. Refugio Novezina, 10. V. 1971, leg. Montolli u. Zicsi. – V/189. 3 Ex., Ferrara, 10. V. 1971, leg. Montolli u. Zicsi. – V/192. 4 Ex. Spiazzi Mt. Baldo, 10. V. 1971, leg. Montolli u. Zicsi. – V/226. 4 Ex. Gazzanigia, 12. V. 1971, leg. Osella u. Zicsi. – V/231. 4 Ex., Z/7475. 1 Ex. Barghe, 12. V. 1971, leg. Osella u. Zicsi. – V/240. 10 Ex., Z/7474. 15 Ex., Casto, 12. V. 1971, leg. Osella u. Zicsi. – V/245. 1 Ex., Lodrino, 12. V. 1971, leg. Osella u. Zicsi. – V/260. 1 Ex., Bovegno, 13. V. 1971, leg. Osella u. Zicsi. – V/263. 1 Ex., Brozzo, 13. V. 1971, leg. Osella u. Zicsi. – V/275. 4 Ex., Z/7478. 3 Ex., Vale di Tremalzo, 13. V. 1971, leg. Osella u. Zicsi. – V/279. 9 Ex., Z/7477. 8 Ex. Vale di Tremalzo, 13. V. 1971, leg. Osella u. Zicsi. – V/282. 1 Ex. Pranzo, 14. V. 1971, leg. Osella u. Zicsi. – V/307. 1 Ex. Storo, 14. V. 1971, leg. Osella u. Zicsi. – Veneto: V/312. 1 Ex. Verona, 14. III. 1968, leg. Montolli u. Gioco. – V/539. 1 Ex., Mt. Baldo 2060 m, 4. VII. 1970, leg. Osella.

Allolobophora sineporis (Omodeo, 1952)

Die an zwei Fundorten angetroffenen Exemplare stimmen mit denen aus Ungarn und Österreich bestimmten vollkommen überein.

Fundorte: Z/6884. 31 Ex. Sedico, 20. IX. 1969, leg. Zicsi u. Mahnert. – Z/6886. 7 Ex. Sciovie, Passo d' Aune 800 m, 20. IX. 1969, leg. Zicsi u. Mahnert.

Allolobophora rosea (Savigny, 1826)

Fundorte: Z/6762. 5 Ex., Nova Levante 1200 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6768. 1 Ex., Pardoi Pass 1900 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6775. 3 Ex., Pardoi Pass 2160 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6781. 5 Ex., Sappado 1100 m, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6787. 3 Ex., Prato di Resia 400 m, 17. IX. 1969, leg. Zicsi & Mahnert. – Z/6789. 3 Ex., Prato di Resia 400 m, 17. IX. 1969, leg. Zicsi & Mahnert. – Z/6793. 17 Ex., Prato di Resia Wiese, 16. IX. 1969, leg. Zicsi & Mahnert. – Z/6802. 3 Ex., Vedronza, 18. IX. 1969, leg. Zicsi & Mahnert. – Z/6804. 6 Ex., Pradielis 800 m, 18. IX. 1969, leg. Zicsi & Mahnert. – Z/6837. 1 Ex., Corno di Rosazzo, 19. IX. 1969, leg. Zicsi & Mahnert. – Z/6864. 1 Ex., Cormons, 19. IX. 1969, leg. Zicsi & Mahnert. – Z/6846. 3 Ex., St. Floriano del ALTE, 19. IX. 1969, leg. Zicsi & Mahnert. – Z/6853. 1 Ex., Versa, 19. IX. 1969, leg. Zicsi & Mahnert. – Z/6858. 6 Ex., Visco, 19. IX. 1969, leg. Zicsi & Mahnert. – Z/6868. 2 Ex., Barcis, 19. IX. 1969, leg. Zicsi & Mahnert. – Z/6875. 1 Ex., Erto bei Longarone, 20. IX. 1969, leg. Zicsi & Mahnert. – Z/6883.1 Ex., Sedico, 20. IX. 1969, leg. Zicsi & Mahnert. – Z/6887. 1 Ex., Sciovie, Passo d' Aune 800 m, 20. IX. 1969, leg. Zicsi & Mahnert. – Z/6898. 1 Ex., Sciovie, Passo d' Aune 1064 m, 20. IX. 1969, leg. Zicsi & Mahnert. – V/79. 3 Ex., Grezzana, 6. V. 1971, leg. Osella & Zicsi. – V/88. 1 Ex., St. Anna d' Alfredo, 6. V. 1971, leg. Osella & Zicsi. – V/96. 3 Ex., Ponte di Veja, 6. V. 1971, leg. Osella & Zicsi. – V/112. 3 Ex., Giovanni – Ilarione, 7. V. 1971, leg. Montolli & Zicsi. – V/120. 5 Ex., Z/7440. 4 Ex., S. Bortolo, 7. V. 1971, leg. Montolli & Zicsi – V/129. 2 Ex., S. Bortolo – Setto, 7. V. 1971, leg. Montolli & Zicsi. – V/136. 6 Ex., Z/7441. Selva di Progno, 7. V. 1971, leg. Montolli & Zicsi. – V/141. 3 Ex., Affi, 8. V. 1971, leg. Osella & Zicsi. – V/152. 1 Ex., Bardolino Strada di Salesiane, 8. V. 1971, leg. Osella & Zicsi. – V/185. 1 Ex., Savgaro Ferrara d. M. Baldo, 10. V. 1971, leg. Montolli & Zicsi. – V/191. 1 Ex., Ferrara, 10. V. 1971, leg. Montolli & Zicsi. – V/206. 7 Ex., Bancole de Montovano, 11. V. 1971, leg. Montolli & Zicsi. – V/224. 6 Ex., Gazzanigia, 12. V. 1971, leg. Osella & Zicsi. – V/230. 4 Ex., Barghe, 12. V. 1971, leg. Osella & Zicsi. – V/233. 5 Ex., Casto, 12. V. 1971, leg. Osella & Zicsi. – V/248. 1 Ex., Collio, 13. V. 1971, leg. Osella & Zicsi. – V/268. 1 Ex., Storo, 13. V. 1971, leg . Osella & Zicsi. – V/276. 1 Ex., Vale di Tremalzo, 13. V. 1971. leg. Osella & Zicsi. – V/288. 5 Ex., Lago di Tenno, 14. V. 1971, leg. Osella & Zicsi. – V/289. 2 Ex., Ballino, 14. V. 1971, leg. Osella & Zicsi. – V/296. 5 Ex., Pieve di Bono, 14. V. 1971, leg. Osella & Zicsi. – Veneto: V/321. 1 Ex., Vallone di Malera (Lessini), 23. VI. 1966, leg. Ruffo. – Lombardia: V/511. 1 Ex., Prealpi Lombarde Val Brembana, V. 1969, leg. Osella. – Piemonte: V/554. 1 Ex., Leini (Torino) 9. IV, 1971, leg. Osella. – Emilia: V/462. 2 Ex., Mt. Cimone 1900 m App. T. Emiliano, 2. VII. 1964, leg. Ruffo. – – Toscana: V/467. 2 Ex., Camaldoli (Arezzo) 18. VI. 1967, leg. Ruffo. – Abruzzo: V/456. 3 Ex., M. ti della laga Amatrice-Capricchia 1150 – 1300 m, IX. 1968, leg. Osella. – V/458. 1 Ex., M. ti della laga Amatrice-Capricchia 1500 m Loc. Prato alla fonte, IX. 1968, leg. Osella. – Lazio: V/513. 1 Ex., M. Jacci (Realini) Sotto la cima, 4. VIII. 1969, leg. Lazzeroni. – Campania: V/401. 1 Ex., Matese Abruzzo Piano di Campitello 1500 m, 29. V. 1967, leg. Riggio & Osella. – V/441. 2 Ex., Campitello (Matese), 16. VI. 1962, leg. Ruffo. – Calabria: V/383. 3 Ex., Volpintesta (La Sila), 20. VI. 1960, leg. Ruffo. – Sicilia: V/583. 1 Ex., Marettimo (Is. Egadi). 26. 1969. leg. Osella.

Allolobophora minuscula Rosa, 1905

Syn. nov. *Allolobophora (Bimastus) icenorum* Pickford, 1926; *Bimastus muldali* (Omodeo, 1956) = nom. nov. für *Allolobophora minima* Muldal, 1952.

Eine Nachbestimmung des Typenmaterials der beiden Arten aus dem British Museum erbrachte den Nachweis, dass sie mit *A. minuscula* identisch sind.

Fundorte: Z/6800. 3 Ex. Prato di Resia Wiese, 16. IX. 1969, leg. Zicsi u. Mahnert. – Z/6844. 1 Ex. St. Floriano del ALTE, 19. IX. 1969, leg. Zicsi u. Mahnert. – V/80. 2 Ex., Z/7431. 2 Ex. Grezzana, 6. V. 1971, leg. Osella u. Zicsi. – V/115. 1 Ex. Giovanni – Ilarione, 7. V. 1971, leg. Montolli u. Zicsi. – V/123. 1 Ex. S. Bortolo, 7. V. 1971, leg. Montolli u. Zicsi. – Veneto: V/571. 3 Ex. Vaio del Paradiso, (Grezzana), 6. V. 1971, leg. Osella.

Allolobophora oculata (Hoffmeister, 1845)

Da es sich nur um juvenile Tiere handelt, können sie nur mit Vorbehalten dieser Art eingereiht werden.

Fundort: V/151. 5 Ex, Z/7446. 5 Ex. Bordolino di Salesiane, 8. V. 1971, leg. Osella u. Zicsi.

Allolobophora osellai sp. n.

Länge: 10 cm, Durchmesser 0,8 cm, Segmentzahl: 210. Bei den übrigen Tieren, Länge 9 – 12 cm, Durchmesser: 0,7 – 0,9 cm, Segmentzahl 206 – 242.

Farbe: farblos, grau.

Kopf pro-epilobisch. Erster Rückeporus auf Intersegenmtalfurche 9/10. Borsten eng gepaart. Borsten aa doppelt so groß wie bc; ab gleich cd, d = 1/2 u. Borsten ab des 12 – 15. Segmentes auf Drüsenpapillen angeordnet. Weibliche Poren auf dem 14. Segment zwischen der Borstenlinie b und c, sehr kleine Punkte. Männliche Poren auf dem 15. Segment, von kleinen Drüsenhöfen umgeben, die auf die benachbarten Segmente nicht übergehen. Gürtel sattelförmig vom 1/2 23 – 38. Segment, Pubertätsstreifen bandförmig vom 26 – 35. Segment, werden von den Segmenten unterbrochen. (Bei den übrigen Tieren Gürtel auch vom 24 – – 39. Segment, Pubertätsstreifen vom 26 – 36. Segment.).

Dissepimente 5/6 – 9/10 stark verdickt. Herzen im 6 – 11. Segment. Kalkdrüsen im 11. und 12. Segment, Kalkdrüsenstruktur auch im 9. u. 10. Segment. Zwei Paar Hoden und Samentrichter im 10. und 11. Segment, frei ohne Testikelblasen. Ovarien im 13. Segment klein, ohne Stiel. Zwei Paar Samensäcke im 11. und 12. Segment. 5 Paar Samentaschen im 13., 14., 15., 16. und 17. Segment, Samentaschenporen münden in Höhe der Borstelinie c in die Intersegmentalfurchen 13/14 – 17/18. Kropf im 15 – 16. Segment. Muskelmagen im 17 – 20. Segment.

Die neue Art gehört der Artengruppe *januaeargenti* COGNETTI, 1903 an (OMODEO, 1956). Unterscheidet sich von dieser Gruppe angehörenden Arten durch die andersartige Lage des Gürtels und der Pubertätsstreifen, sowie durch die Lage der Samentaschen.

Die neue Art benenne ich zu Ehren des Sammlers, nach Herrn Dr. P. OSELLA, Naturhistorisches Museum, Verona.

Fundorte: Holotypus V/433 Campania: Mt. Gallinola (Matese). 25. IV. 1967, leg. OSELLA. – Paratypen: V/432. 1 Ex. Campania: Mt. Mutria (Matese) 1400 – 1800 m, 27. VI. 1967, leg. RIGGIO u. OSELLA. Z/8692. 1 Ex. Campania: Mt. Miletto, (Matese – Abruzzo) 18. VI. 1962, leg. RUFFO. –

Obwohl OMODEO in einer früheren Arbeit (1948) die Arten *Helodrilus (Eophila) sardus* MICHAELSEN, 1910 und *H. (E) apuliae* BALDASSERONI, 1913 als Synonyme von *januaeargenti* betrachtet, kann ich mich dieser Ansicht nicht anschliessen. Es steht fest, dass von dieser Art – *januaeargenti* miteinbegriffen – stets nur einige Exemplare erbeutet wurden, wodurch die Variationsweite der Gürtelorgane und so auch das Variieren der Samentaschen nicht erfasst werden konnte. Trotzdem erscheinen mir die bedeutenden Unterschiede in der Ausdehnung der Gürtelorgane (bei *apuliae* 22 – 40. Segment) sehr unwahrscheinlich sie artlich mit *januaeargenti* (Gürtel vom 23., 24., 25 – 35., 36. Segment) vereinigen zu müssen.

Allolobophora corsicana simplex ssp. n.

Äussere Merkmale: Länge des Holotypus: 7 cm, Durchmesser: 0,6 cm, Segmentzahl 102. Bei den übrigen Exemplaren Länge: 105 – 112 cm, Durchmesser 0,5 – 0,7 cm, Segmentzahl 99 – 154.

Farbe: weiss

Kopf pro-epilobisch. Erster Rückenporus 11/12. Borsten eng gepaart. Borsten aa = 2 bc, ab = bc, dd = 1/2 u. Borsten ab des 10. und 11. sowie des 36.

und 37. Segmentes von Drüsenpapillen umgeben. Bei den übrigen Tieren Borsten ab 10 – 13. Segment ebenfals von Drüsenpapillen umgeben. Weibliche Poren auf dem 14. Segment, klein oberhalb der Borstenlinie b. Männliche Poren auf dem 15. Segment, mit mächtigen Drüsenhöfen die auf die benachbarten Segmente 14 – 16 übergehen. Gürtel sattelförmig vom 26 – 1/2 36. Segment, Pubertätsstreifen vom 29 – 1/2 33 Segment.

Innere Merkmale: Dissepimente 5/6 – 9/10 stark verdickt. Herzen im 6 – 11. Segment. Kalkdrüsen im 10. Segment, Kalkdrüsenstruktur auch im 11. und 12. Segment. Zwei Paar Hoden und Samentrichter im 10. und 11. Segment. Zwei Paar Testikelblasen im 10. und 11. Segment, die auch die Samensäcke der entsprechenden Segmente einschliessen. Ovarien im 13. Segment, klein ohne Stiel. 4 Paar Samensäcke im 9 – 12. Segment, die des 9. und 10. Segmentes äusserst klein. Ein Par doppelt ausgebildete, zapfenförmige Samentaschen im 13. Segment, mit deutlichen Ausmündungen im 13/14. Segment, in der Borstenlinie c. Korpf im 15 – 16. Segment. Muskelmagen im 17 – 19. Segment.

Die neue Unterart unterscheidet sich von *A. corsicana* und deren Unterarten und Varietäten (Vergl. Tabelle 4) durch die verminderte Zahl der Samentaschen, dh. allein bei dieser Unterart konnten bisher nur ein Paar Samentaschen nachgewiesen werden. Dies Merkmal war bei allen untersuchten Exemplaren konstant.

Fundorte: Holotypus V/405. Campania: Matesse – Abruzzo, Mt. Miletto, 2000 m, 24. VI. 1967, leg. RIGGIO u. OSELLA. – Paratypen: V/391 3 Ex. Z/8698. 2 Ex. Matesse – Abruzzo, Mt-Miletto 2000 m, 30. VI. 1967, leg. RIGGIO u. OSELLA. – V/398. 1 E. Z/8697. 2 Ex., Matesse – Abruzzo, Mt. Miletto, 2000 m, 24. VI. 1967, leg. RIGGIO u. OSELLA. – V/444. 1 Ex. Z/8696. 1 Ex. Camptello (Matese) 16. VI. 1962, leg. RUFFO. –

In Tabelle 4 werden nur die zum Artenkreis *corsicana* angehörenden Formen angeführt, die 4 Paar Samensäcke besitzen. Die Arten mit 2 Samensäcken und einer ähnlichen Lage des Gürtels wurden nicht berücksichtigt.

Tabelle 4. Wichtige Bestimmungsmerkmale der Art Allolobophora corsicana Pop, 1947 und deren Unterarten und Varietäten

Art	Gürtel	Pubertätsstreifen	Papillen	Samentaschen
corsicana POP, 1947	27 – 34, 35, 36	29, 30, 31 – 32, 34, 35	ab 10 – 17	12/13, 13/14 ein-doppelt-dreifach
corsicana POP, 1947 in BOUCHÉ, 1972	1/2 26, 1/2 27 – 1/2 36, 36	1/2 30, 31 – 1/2 34	ab –911 ab 27 – 30 ab 35 – 37	12/13, 13/14 einfach
c. albomaculata BOUCHÉ, 1972	1/2 26, 27 – 37, 38 1/2	30 – 38	–	11/12, 12/13, 12/14 eins-siebenfach
c. v. magna BOUCHÉ, 1972	27., 28 – 37	31 – 34., 35	–	12/13, 13/14 eins-fünffach
c. v. popi	29., 1/2 29 – 1/2 36	1/32, 33 – 35, 36	–	11/12, 12/13, 13/14 einfach
c. simplex ssp. n.	26 – 1/2 36	29 – 1/2 33	ab 10 – 13	13/14 dop-

Eisenia spelaea (Rosa, 1901)

Fundorte: V/105. 2 Ex., Z/7437. 2 Ex. Ponte di Veja, 6. V. 1971, leg. Osella u. Zicsi. – Veneto: V/318. 1 Ex. Z/8693 1 Ex. Vaio del Paradiso, (Grezzana), 19. VI. 1966, leg. Mingione. – V/354. 2 Ex. Z/8694. 1 Ex.Grotta di S. Mauro di Saline (Verona) 24. III. 1968, leg. Osella. – V/560. 1+1 juv. Ex. Grotta Sopra S. Andrea Fraz Badia Calavena (Verona) 900 m, 13. IV. 1970, leg. Ruffo. – V/562. 2 Ex. Grotta Sopra S. Andrea Fraz Badia Calavena (Verona) 900 m, 3. V. 1970, leg. Ruffo. – Piemonte: V/487. 2 Ex. Leini (Piemonte), 19. II. 1967, leg. Osella. – Toscana: V/529. 1. Ex. Z/8695 1 Ex. A. Apuane – Fornovolasco, 700 m., 16. VI. 1970, leg. Osella. – V/569. 2+2 juv. E. A. Apuane – Fornovolesco, 700 m, 16. VI. 1970, leg. Osella.

Eisenia foetida (Savigny, 1826)

Fundorte: V/314. 1 Ex., Nelo Veronese, 8. V. 1968, leg. Lazzeroni & Gioco. – V/549. Quinzano (Verona), 2. V. 1971, leg. Osella. – V/168. 30 Ex., Z/7453. 20. Ex., S. Felice (Verona), 8. V. 1971, leg. Montolli. – V/188. 24 Ex., Z/7463. 15 Ex., Refugio Novezina, 10. V. 1971, leg. Montolli & Zicsi.

Eisenia eiseni (Levinsen, 1884)

Fundorte: V/269. 1 Ex., Storo, 13. V. 1971, leg. Osella & Zicsi. – Piemonte: V/556. 1 Ex., Leini (Torino), 9. IV. 1971, leg. Osella. – V/575. 2 Ex., Leini (Torino), 19. III. 1971, leg. Osella. – Toscana: V/568. 1 Ex., Alpi Apuane Mte. Sumbra 1600 – 1710 m, 24. IX. 1970, leg. Osella. – Lazio: V/369. 1 Ex., Terminillo 1900 – 2000 m (Appenino centrale), 12. VI. 1963, leg. Ruffo. – Campania: V/394. 6 Ex., Faggeta a. N. E. del Ri. Campitello (Matese) 1500 m, 22. IX. 1967, leg. Giusti & Minelli. – V/418. 1 Ex., Rif. Campitello (Matese), 22. IX. 1967, leg. Giusti & Minelli. V/436. 1 Ex., Mte. Mileto 2040 – 2050 m, 23. IX. 1967, leg. Giusti & Minelli. – V/440. 1 Ex., Matese (Abruzzo) Serra del Perone, 1. VII. 1967, leg. Riggio & Osella. – V/448. 1 Ex., Gola del Tor. Quirimo (Matese) 500 – 950 m, 20. IX. 1967. – V/450. Matese, Abruzzo Mte. Mutria 1400 – 1800 m, 27. VI. 1967, leg. Riggio & Osella. – Puglia: V/504. 2 Ex., Foresta Umbra (Gargano), 25. V. 1950, leg. Ruffo. – Calabria: V/388. 1+2 Ex., Gariglione (La Sila), 26. VI. 1960, leg. Ruffo.

Fam. Hormogastridae Michaelsen, 1928

Hormogaster redii (Rosa, 1887)

Fundort: Sizilien: V/585. 1 Ex., Z/8699. 1 Ex. Favignana, Montagna Groβa, 19. III 1969, leg. Osella.

SCHRIFTTUM

1. Bouché, M. B. (1972): *Lombriciens de France.* – Ann. Zool. Ecol. Anim. (Hors-sér.): 1 – 671.

2. Černosvitov, L. (1935): *Monographie der tschechoslowakischen Lumbriciden.* – Arch. Prir. Vyzk. Čech., 19: 1 – 86.

3. Černosvitov, L. (1941): *Oligochaeta from various parts of the world.* – Proc. Zool. Soc. London, 111: 197 – 236.

4. Cognetti De Martiis, L. (1901 *a*): *Octolasium hemiandrum nov. sp. ed altri Lumbridi raccolti dal doot. E. Festa nei dintorni della Spezia.* – Boll. Mus. Zool. Anat. comp. Torino, 16 (383): 1 – 8.

5. Cognetti De Martiis, L. (1901 *b*): *Gli Oligocheti della Sardegna.* – Boll. Muss. Zool. Anat. Comp. Torino, 16 (404): 1 – 26.

6. Cognetti De Martiis, L. (1905 *a*): *Lombrichi liguri del Museo Civico die Genova.* – Ann. Mus. Civ. Genova, 2: 102 – 107.

7. Cognetti De Martiis, L. (1905 *b*): *Oligocheti dell isola d'Elba e di Pianosa.* – Boll. Mus. Zool. Anat. Comp. Torino, 20 (490) : 1 – 6.

8. Gates, G. E. (1975): *Contributions to a revision of the earthworm family Lumbricidae. XVII. Allolobophora minuscula Rosa, 1906 and Enterion pygmaeum Savigny, 1826.* – Megadrilogica, 2 (6) : 7 – 8.

9. Graff, O. (1957): *De Lumbricidis Quibusdam in Lusitania Habitandibus.* – Agr. Lusitana, 19: 299 – 306.

10. Graff, O. (1961): *Lumbicidarum Quarundam Lusitanorum Notificatio.* – Agr. Lusitana, 13 : 81– – 83.

11. Karaman, S. (1972): *Beitrag zur Kenntnis der Oligochaetenfauna Jugoslawiens.* – Biol. Vestnik, Ljubljana, 20: 95 – 105.

12. Michaelsen, W. (1900): *Oligochaeta.* – In: Das Tierreich, 10, Berlin, pp. 575.

13. Michaelsen, W. (1903): *Die geographische Verbreitung der Oligochaeten.* – Berlin, pp. 186.

14. Omodeo, P. (1948): *Oligocheti della Campania I. Sistematica e morfologia del Lumbricide Eophila januae-argenti (Cogn.).* – Ann. Mus. Zool. Univ. Napoli, 8: 1 – 7.

15. Omodeo, P. (1952): *Lumbricidae.* – In: Materiali zoologici raccolti dal Dr. Marcuzzi sulle Alpi Dolomitiche. – Arch. Zool. It., 37: 29 – 59.

16. Omodeo, P. (1956): *Contributo alla revisione dei Lumbricidae.* – Arch. Zool. It., 41: 129 – 212.

17. Omodeo, P. (1962): *Oligochetes des Alpes. I.* – Mem. Mus. Civ. Stor. Nat. Verona, 10: 73 – 85.

18. Pop, V. (1947): *Lombriciens de la Corse.* – Arch. Zool. Exp. Gen., 85: 1 – 18.

19. Rosa, D. (1884): *Lumbricidi del Piemonte.* – Torino, pp. 55.

20. Rosa, D. (1893): *Revisione dei Lumbricidi.* – Mem. Ac. Torino, 43: 399 – 476.

21. Tetry, A. (1937): *Révision des Lombriciens de la collection de Savigny.* – Bull. Mus. Nat. Hist. Nat., 9: 140 – 155.

22. Tetry, A. (1938): *Contribution à l'étude de la fauna de l'Est de la France (Lorraine).* – Nancy, pp. 453.

23. Zicsi, A. (1962): *Beiträge zur Lumbriciden-Fauna Spaniens.* – Ann. Univ. Sci. Budapest, Sect. Biol., 5: 281 – 285.

24. Zicsi, A. (1970 *a): Bemerkungen zum Problem von Octolasium (Octodrilus) croaticum (Rosa, 1895), nebst Beschreibung von zwei neuen Arten der Untergattung Octodrilus (Oligochaeta: Lumbricidae).* – Opusc. Zool. Budapest, 10: 165: – 174.

25. Zicsi, A. (1970 *b): Allolobophora gestroides sp. nov., ein neuer Regenwurm (Oligochaeta: Lumbricidae) aus Ungarn.* – Opusc. Zool. Budapest, 10: 359 – 370.

26. Zicsi, A. (1971 *a): Regenwürmer aus dem Tessin sowie Bemerkungen über die meroandrischen Formen der Untergattung Octodrilus (Oligochaeta: Lumbricidae).* – Acta Zool. Hung., 17: 219 – 231.

27. Zicsi, A. (1971 *b): Bemerkungen über Allolobophora nematogena Rosa, 1903 (Oligochaeta: Lumbricidae) und ihre Synonyme.* – Ann. Univ. Sci. Budapest, Sect. Biol., 13: 339 – 347.

28. Zicsi, A. (1973 *a): Regenwürmer (Oligochaeta: Lumbricidae) aus Griechenland.* – Opusc. Zool. Budapest, 12: 99 – 103.

29. Zicsi, A. (1973 *b): Regenwürmer (Oligochaeta: Lumbricidae) aus der Türkei.* – Acta Zool. Hung. 19: 217 – 232.

30. Zicsi, A. (1978): *Revision der Art Dendrobaena platyura (Fitzinger, 1833) (Oligochaeta: Lumbricidae).* – Acta Zool. Hung., 24: 439 – 449.

31. Zicsi, A. (1979): *Neue Angaben zur Regenwurm-Fauna der Schweiz (Oligochaeta: Lumbricidae).* – Rev. Suisse Zool., 86: 473 – 484.

Communicationes Breves

A Mesodorylaimus Species (Nematoda) with Two Vulvae, Separated Ovaries and Different Tail Shapes

By

M. ABOU-EL-NAGA*

Bivulvate nematodes are very rare. To my knowledge this is the first report of a bivulvate condition in the family Dorylaimidae.

Bivulvate forms have been reported in *Mononchus muscorum* (DUJARDIN) by CASSIDY (1933), in *Anatonchus tridentatus* (DE MAN) by HIRLING (1969) and in *Scutellonema bradys* (STEINER & LEHEW) by CAVENESS (1971). The literature on bivulvate forms in nematodes has also been reviewed by ANDRÁSSY (1960) and GERAERT (1963).

During the examination of specimens of the genus *Mesodorylaimus* in samples collected from the village Szendehely in Hungary (about 40 km north-east of Budapest), one specimen having two vulvae was observed when extracting nematodes from hornbeam-leaves. Also several normal females of the same species (*Mesodorylaimus* sp. aff. *aberrans* SIDDIQI) were found.

The bivulvate specimens resembled the normal females, the vulvae and separated ovaries appeared to be equally developed. Both vulvae were in normal ventral position. The measurements of this peculiar animal were as follows: L = 1.94 mm; a = 40.8; b = 5.7; c = 22; $V_1 = 49\%$ $V_2 = 51.5\%$; $\text{ovary}_1 = 21\%$ of body length; $\text{ovary}_2 = 22\%$ of body length; distance between vulvae = 50 μm.

Some different tails of the same nematode specimens were observed in samples obtained from the above mentioned locality and from the Vértes Mountains (about 50 km west of Budapest).

The specimens are deposited at the Department of Plant Protection, Al-Azhar University, Cairo, Egypt.

Dr. Mohamed Abou-El-Naga, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

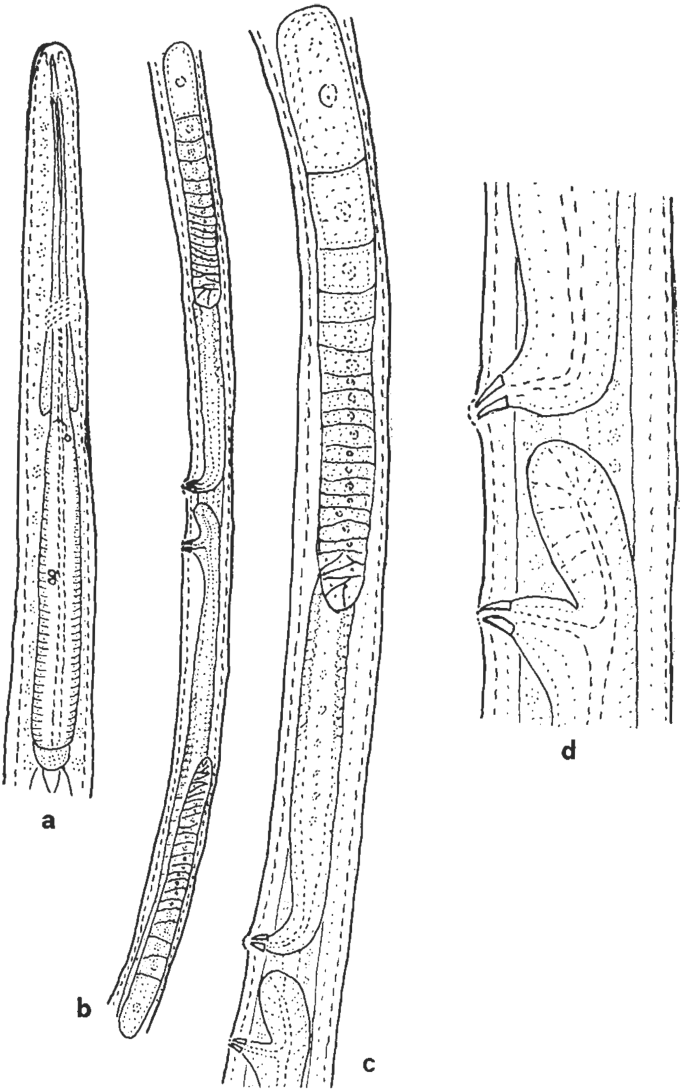


Fig. 1. *Mesodorylaimus* sp. with two vulvae. *a:* anterior end; *b:* vulvar region with two vulvae and separated ovaries; *c:* anterior gonad; *d:* both vulvae

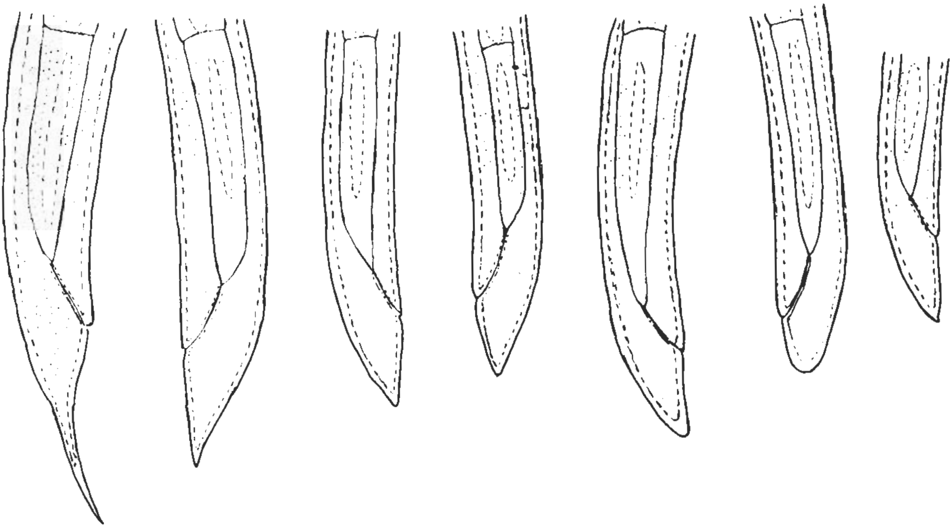


Fig. 2. *Mesodorylaimus* sp. showing different tail shapes

REFERENCES

1. Andrássy, I. (1960): *Ein Nematode (Tobrilus sp.) mit doppelter Vulva.* – Opusc. Zool. Budapest, 3: 111–116.

2. Cassidy, G. H. (1933): *A bivulvar specimen of the nematode Mononchus muscorum (Dujardin) Bastian.* – Journ. Wash. Acad. Sci., 23: 141–144.

3. Caveness, F. E. (1971): *Scutellonema bradys (Steiner & LeHew) with two vulvae and malformed conduct.* – Journ. Nematol., 3: 95.

4. Geraert, E. (1963): *Aporcelaimellus female with two vulvae.* – Nematologica, 9: 302–303.

5. Hirling, W. (1969): *Anatonchus tridentatus (de Man, 1876) De Coninck, 1939 mit zwei Vulvae.* – Nematologica, 15: 161–162.

Opusc. Zool. Budapest, XVII–XVIII, 1981

Nematological Notices

By

I. ANDRÁSSY*

I. Renaming of a homonymous species of the genus Dorylaimus

In a recent paper (ANDRÁSSY, 1978) I described a new *Dorylaimus* species from the Himalayas, viz. *Dorylaimus conurus* ANDRÁSSY, 1978. When proposing the new name, I unfortunately failed to perceive that the specific name „conurus" had already been used by THORNE (1939) for another member of the genus *Dorylaimus*. As a consequence, my „*Dorylaimus conurus*" became a junior homonym of THORNE's „*conurus*".

To resolve this homonymy, the following new name is proposed herewith for the Himalayan species:

Dorylaimus conicus n. nom. – Syn. *Dorylaimus conurus* ANDRÁSSY, 1978, nec THORNE, 1939.

II. Check list of free-living nematode genera and subgenera described after my book published in 1976

In the book on the systematization of the Nematoda (ANDRÁSSY, 1976), I compiled a check list of the genera and subgenera of free-living nematodes that have been described to that time. This enumeration contained 1410 generic taxa.

In the five years passed after finishing the manuscript, a great deal of further genera and subgenera have been established as new to science by different authors. To complete the list of 1976, I shall add here a list of the generic taxa described in the last years, as well as of those somes that had been omitted from the said book. The following list contains 136 genera and 13 subgenera, i. e. 149 generic names published by 84 authors. (The abbreviations of the orders are: AR = Areolaimida, CH = Chromadorida, DE = Desmoscolecida, DO = Dorylaimida, EN = Enoplida, MO = Monhysterida, RH = Rhabditida, TY = = Tylenchida.)

**Dr. István Andrássy*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

Admirandus Belogurov & Belogurova, 1979	EN: Oncholaimidae
Aerotylenchus Fotedar & Handoo, 1979	TY: Tylenchidae
Allotrichodorus Rodriguez, Sher & Siddiqi, 1978	DO: Trichodoridae
Amphidirhabditis Andrássy, 1978	RH: Rhabditidae
Amplimerlinius Siddiqi, 1976	TY: Tylenchorhynchidae
Ammotheristus Lorenzen, 1977	MO: Xyalidae
Anguimonhystera Andrássy, 1981	MO: Monhysteridae
Anivanema Platonova, 1976	EN: Leptosomatidae
Apenodraconema Allen & Noffsinger, 1978	CH: Prochaetosomatidae
Aponema Jensen, 1978	CH: Molgolaimidae
Arctidorylaimus Mulvey & Anderson, 1979	DO: Arctidorylaimidae
Athernema Ahmad & Jairajpuri, 1978	DO: Leptonchidae
Aulosphora Siddiqi, 1980	TY: Hemicycliophoridae
Axonchium (Dactyluraxonchium Coomans & Nair, 1975)	DO: Belondiridae
Axonchium (Discaxonchium Coomans & Nair, 1975)	DO: Belondiridae
Axonchium (Epaxonchium Coomans & Nair, 1975)	DO: Belondiridae
Axonchium (Heynsaxonchium Coomans & Nair, 1975)	DO: Belondiridae
Axonchium (Hypaxonchium Coomans & Nair, 1975)	DO: Belondiridae
Axonchium (Metaxonchium Coomans & Nair, 1975)	DO: Belondiridae
Axonchium (Poraxonchium Coomans & Nair, 1975)	DO: Belondiridae
Axonchium (Syncheilaxonchium Coomans & Nair, 1975)	DO: Belondiridae
Baicalobrilus Thalolikhin, 1976	EN: Tobrilidae
Basirolaimus Shamsi, 1979	TY: Hoplolaimidae
Bathyeurystomina Lambshead & Platt, 1979	EN Enchelidiidae
Berntsenus Massey, 1974	TY: Aphelenchoididae
Bicirronema Andrássy, 1978	RH: Chambersiellidae
Bidera Krall & Krall, 1978	TY: Heteroderidae
Caballeroides Chaturwedi & Khera, 1977	TY: Aphelenchoididae
Cactodera Krall & Krall, 1978	TY: Heteroderidae
Californidorus Robbins & Weiner, 1978	DO: Longidoridae
Calomicrolaimus Lorenzen, 1976	CH: Microlaimidae
Calvatylus Jairajpuri & Siddiqi, 1979	TY: Hoplolaimidae
Campbellenchus Wouts, 1978	TY: Tylenchidae
Cephalanticoma Platonova, 1976	EN: Anticomidae
Chromanema Khera, 1975	CH: Chromadoridae (?)
Colbranium Andrássy, 1979	TY: Criconematidae
Coomansus Jairajpuri & Khan, 1977	DO: Mononchidae
Cornilaimus Truskova & Eroshenko, 1977	RH: Chambersiellidae
Coslenchus Siddiqi, 1978	TY: Tylenchidae
Croserinema Khan, Chawla & Saha, 1976	TY: Criconematidae

Cygnonema Allen & Noffsinger, 1978	CH:	Prochaetosomatidae
Desmogerlachia Freudenhammer, 1975	DE:	Desmoscolecidae
Desmolorenzenia Freudenhammer, 1975	DE:	Desmoscolecidae
Desmotimmia Freudenhammer, 1975	DE:	Desmoscolecidae
Discotylenchus Siddiqi, 1980	TY:	Tylenchidae
Dolichorhynchus Mulk & Jairajpuri, 1974	TY:	Dolichodoridae
Dracogalerus Allen & Noffsinger, 1978	CH:	Draconematidae
Dracognomus Allen & Noffsinger, 1978	CH:	Draconematidae
Dracograllus Allen & Noffsinger, 1978	CH:	Draconematidae
Draconactus Allen & Noffsinger, 1978	CH:	Prochaetosomatidae
Dracotoranema Allen & Noffsinger, 1978	CH:	Draconematidae
Duosulcius Siddiqi, 1979	TY:	Tylenchidae
Eminensia Mahajan, 1979	RH:	Panagrolaimidae
Enchodorus Vinciguerra, 1976	DO:	Nordiidae
Endeolophus Boucher, 1976	CH:	Chromadoridae
Epicharinema Raski, Maggenti, Koshy & Sosamma, 1980	TY:	Ecphyadophoridae
Etamphidelus Andrássy, 1977	EN:	Alaimidae
Ethmodora Khera, 1975	CH:	Ethmolaimidae
Eumonhystera Andrássy, 1981	MO:	Monhysteridae
Fescia Truskova & Eroshenko, 1977	RH:	Chambersiellidae
Gairleanema Warwick & Platt, 1973	AR:	Tripyloididae
Geomonhystera Andrássy, 1981	MO:	Monhysteridae
Gerthus Goseco, Ferris & Ferris, 1975	DO:	Tylencholaimellidae
Gnomoxyala Lorenzen, 1977	MO:	Xyalidae
Gracilancea Siddiqi, 1976	TY:	Tylodoridae
Haptotricoma Lorenzen, 1977	DE:	Desmoscolecidae
Hemicaloosia Ray & Das, 1978	TY:	Hemicycliophoridae
Hylonema Luc, Taylor & Cadet, 1978	TY:	Heteroderidae
Ibipora Monteiro & Lordello, 1977	TY:	Belonolaimidae
Imphalenchus Dhanachand & Jairajpuri, 1980	TY:	Tylenchidae
Indokochinema Darekar & Khan, 1979	DO:	Kochinematidae
Ipsaphelenchus Lieutier & Laumond, 1978	TY:	Aphelenchoididae
Jairajpuria Baqri & Jana, 1980	DO:	Thornenematidae
Kurikania Thalolikhin, 1976	EN:	Tobrilidae
Lambertia Brzeski, 1977	TY:	Nothotylenchidae
Lamuania Thalolikhin, 1976	EN:	Tobrilidae
Laurophragus Nesterov, 1976	DO:	Axonchiidae
Leoberginema Thalolikhin, 1977	AR:	Cylindrolaimidae (?)
Leptolaimus (Alveolaimus Alekseev & Rassadnikova, 1977)	AR:	Leptolaimidae
Leptolaimus (Boveelaimus Alekseev & Rassadnikova, 1977)	AR:	Leptolaimidae
Leptolaimus (Tubulaimus Alekseev & Rassadnikova, 1977)	AR:	Leptolaimidae
Leptolaimus (Tubulaimulus Lorenzen, 1979)	AR:	Leptolaimidae
Lindseyus Ferris & Ferris, 1973	DO:	Roqueidae
Loncharionema Goseco, Ferris & Ferris, 1974	DO:	Leptonchidae

Longidoroides KHAN, CHAWLA & SAHA, 1978	DO: Longidoridae
Loofia SIDDIQI, 1980	TY: Hemicycliophoridae
Luella MASSEY, 1974	TY: Neotylenchidae
Madinema KHAN, CHAWLA & SAHA, 1976	TY: Criconematidae
Marilynnia HOPPER, 1977	CH: Cyatholaimidae
Marispelodera BELOGUROV, 1977	RH: Rhabditidae
Medalinema BAQRI & JANA, 1980	DO: Thornenematidae
Mehdinema BAQRI & JANA, 1980	DO: Thornenematidae
Meiodorus SIDDIQI, 1976	TY: Tylenchorhynchidae
Merocriconema RASKI & PINOCHET, 1976	TY: Criconematidae
Meylis GOSECO, FERRIS & FERRIS, 1974	DO: Leptonchidae
Mikinema CHESUNOV, 1978	MO: Linhomoeidae
Multidens MUKHINA, 1978	EN: Tripylidae
Nannolaimoides OTT, 1972	CH: Cyatholaimidae
Neoleptonchus KHAN, 1974	DO: Leptonchidae
Neomalenchus SIDDIQI, 1979	TY: Tylenchidae
Odontanticoma PLATONOVA, 1976	EN: Anticomidae
Odontophoroides BOUCHER & HELLÉOUET, 1977	AR: Axonolaimidae
Orientylus JAIRAJPURI & SIDDIQI, 1979	TY: Hoplolaimidae
Oxybelondira AHMAD & JAIRAJPURI, 1978	DO: Oxydiridae
Parachromadorita BLOME, 1974	CH: Hypodontolaimidae
Paradraconema ALLEN & NOFFSINGER, 1978	CH: Draconematidae
Paraereptonema EROSHENKO, 1977	AR: Plectidae
Parahadronchus MULVEY, 1978	DO: Mononchidae
Parallelocoilas BOUCHER, 1975	CH: Metachromadoridae
Paramononchus MULVEY, 1978	DO: Mononchidae
Paramonoviola BLINOVA & VOSILITE, 1976	RH: Neodiplogastridae
Paramphidelus ANDRÁSSY, 1977	EN: Alaimidae
Paraoxydirus JAIRAJPURI & AHMAD, 1979	DO: Oxydiridae
Parasitodiplogaster POINAR, 1979	RH: Diplogastridae (?)
Phallaxonchium JAIRAJPURI & DHANACHAND, 1979	DO: Belondiridae
Pilosinema PLATONOVA, 1976	EN: Leptosomatidae
Plesiodorus SIDDIQI, 1976	TY: Dolichodoridae
Polenchus ANDRÁSSY, 1980	TY: Tylenchidae
Proleptonchoides FERRIS, GOSECO & KUMAR, 1979	DO: Leptonchidae
Proplatycoma PLATONOVA, 1976	EN: Leptosomatidae
Pseudocephalobus JOSHI, 1972	RH: Cephalobidae
Pseudodesmodora BOUCHER, 1975	CH: Desmodoridae
Pseudomicrolaimus SERGEEVA, 1976	CH: Mircolaimidae
Punctodera MULVEY & STONE, 1976	TY: Heteroderidae
Quadricomoides DECRAEMER, 1976	DE: Desmoscolecidae
Quasibrilus THALOLIKHIN, 1976	EN: Tobrilidae
Retrotheristus LORENZEN, 1977	MO: Xyalidae
Robleus MASSEY, 1974	TY: Neotylenchidae
Ruidosaphelenchus LAUMOND & CARLE, 1971	TY: Aphelenchoididae
Sadkonavis PLATONOVA, 1979	EN: Leptosomatidae

Safianema Siddiqi, 1980	TY: Anguinidae
Siddiqia Khan, Chawla & Saha, 1978	DO: Longidoridae
Stylotheristus Lorenzen, 1977	MO: Xyalidae
Subsphaerolaimus Lorenzen, 1978	MO: Sphaerolaimidae
Teragramia Massey, 1974	TY: Aphelenchoididae
Thecavermiculatus Robbins, 1978	TY: Heteroderidae
Timminema Khan, 1978	DO: Dorylaimidae
Timmus Goseco, Ferris & Ferris, 1976	DO: Dorylaimoididae
Triceratonema Platonova, 1976	EN: Leptosomatidae
Trochamus Boucher & Bovée, 1972	CH: Chromadoridae
Tubuligula Boucher & Helléouet, 1977	AR: Aegialoalaimidae
Tylenchocriconema Raski & Siddiqi, 1975	TY: Tylenchocriconematidae
Tylorhabdus Sukul, 1971	RH: Rhabditidae (?)
Valvaelaimus Lorenzen, 1977	MO: Xyalidae
Wilsereptus Chawla, Khan & Saha, 1977	AR: Plectidae
Xiphidorus Monteiro, 1976	DO: Longidoridae
Xiphinema (*Filliphinema* Roy & Gupta, 1974)	DO: Longidoridae
Yubeldus Khan, Azmi & Chawla, 1979	DO: Belondiridae
Zanenchus Siddiqi, 1979	TY: Tylenchidae

The total number of genera and subgenera of free-living nematodes described hitherto amounts to 1559.

Opusc. Zool. Budapest, XVII – XVIII, 1981

On the Possibilities of a Scanning Electron Microscopic Examination of Ephemeroptera, Odonata and Trichoptera larvae

By

S. ANDRIKOVICS*

The purpose and antecedents of the investigations

As the aquatic insects impopulate our waters generally in great numbers of species and individuals, and are rather large-sized, their use as indicator organisms in the practice of water quality tests seems by all means expedient. However, the fulfillment of this evident task of theirs is still hindered by several objective difficulties at present.

The majority of the information on aquatic insects most important for us is, namely, connected primarily with the biology of their aquatic larvae. In many instances, however, the determination of the larvae is extremely uncertain, often not even possible. In general, we do not even know the biology of the larvae as our requirements would necessitate it; or, even if there are data pertaining hereto at disposal in the literature, on account of the differences in the ecological conditions, the adoption of these references is often not feasible. For solving these problems at least in part, opportunities for applying several methods are presented. One may simultaneously collect adults and larvae, and raise the latter. Still, besides these expedient yet most time-consuming methods we also have to search incessantly after the new and modern procedures which afford hopes of making the determination of the larvae of aquatic insects easier, and which also further a more thorough knowledge of the ecology of such larvae.

In 1977/78 the author had opportunity to work with the Scanning Electron Microscope type SEOL 50A of the Biological Department Group of the Eötvös Loránd University and to make an attempt at the taxonomic and ecological application of the SEM technique.

On the method

The principle and main field of application of the electron microscope operating with the scanning electron ray are treated of in a great number of handbooks (1, 2), etc. Of the principle of the method the author might only mention that

---

**Dr. Sándor Andrikovics*, ELTE Állatrendszertani és Ökológiai Tanszék (Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

this technique constitutes, in numerous respects a transition between the various methods of light microscopy and the traditional electron microscope. Its great advantage is that by its means stereoscopic pictures can be made, and the highly demanding work of sectioning applied in transmission electron microscopic examination is spared.

The disadvantages of the Scanning Electron Microscope, namely that its resolving power is less than the one of the traditional electron microscope, and that it serves in the first place for examining the surface structures, do not give rise to problems in the taxonomic and ecological investigations, indeed, it is often expressly advantageous.

The significance of SEM is being discovered in a number of fields of biology again and again. One can agree with V. A. HEYWOOD's (1971) statement that the SEM technique will soon become a routine procedure, and that in an even greater measure than transmission electron microscopy (2).

First results and the possibilities of further application

Since it was an experiment unique in Hungarian hydrozoology up to now in question here, the author had to lay the main emphasis upon solving the problems of methodology. Examinations had to be conducted for deciding which of the methods of preparation could be adopted with the animal groups in question.

Even the simplest method proved sufficient with the examined species at all times. With all three taxonomic groups we could adopt the preparation as follows: 1) conveying alcoholic material – through a series of dilutions – into distilled water; 2) ultrasonic shaking (for 5–7 minutes, depending on the quality of the material); 3) drying under cover for 2–3 hours; 4) mounting on to a copper stud and steaming with gold.

After the methodological problems have been solved, our initial results can be surveyed by animal groups.

In the course of the examination of the mayfly larvae it proved true that the certainty of the determination of the larvae could be increased by the SEM technique only if in the single genera a material of a significant number of species and individuals was at disposal, which had been unambiguously determined by the traditional microscope.

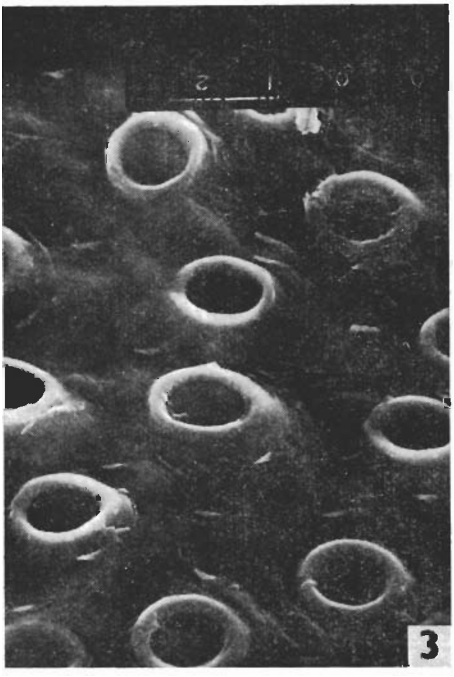
A problem of methodology was presented in the province of enlargements above 1000–1500×, where morphological structures already difficult to observe by the light microscope and even less known as yet appeared to view.

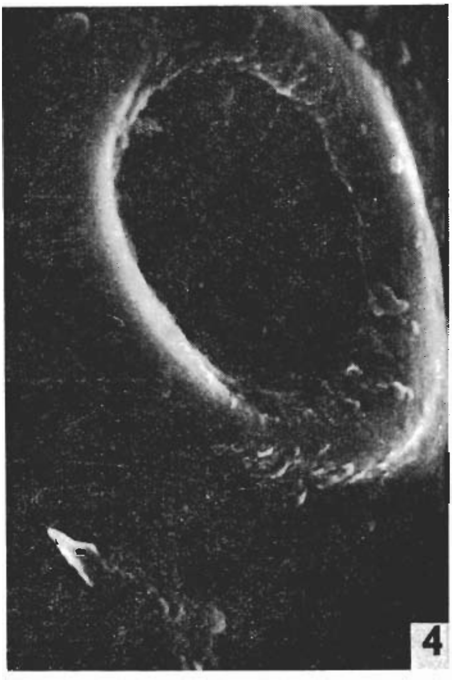
With the larvae of *Cloeon dipterum* living among the vegetation, the chitin shield showed a tiling-like pattern.

In the mud-inhabiting *Caenis robusta* and *Caenis horaria* larvae this chitin structure of the surface was of spinous arrangement (Photograph 1).

In taxonomic respect the SEM examination of the formations of the chitin structure and of the sense organs on the surface did not afford much that could be used; it is only the number and location of the individual types of hairs – in general, mechanical sense organs – that can be employed later on as taxonomic characters (Photograph 2).

On the gills and on the chitin cuticle below same of *Caenis robusta* and *Caenis horaria* „craterlike" sense organs are to be found, which belong with the chemical sense organs (Photographs 3 and 4).





Photographs 1–4. *1:* 4th abdominal segment of *Caenis horaria*, dorsal side (2450 x); *2:* 2nd leg of *Cloeon dipterum*, last segment, ciliary hairs (1480 x); *3:* crater-like sense organs under the gills of *Caenis robusta* (2450 x); *4:* crater-like sense organ under the gill of *Caenis robusta* (8200 x).

Structures similar to these have been discovered also in the larvae of the American mayfly species *Caenis diminuta* as well as in other insect larvae, and an osmoregulative function – connected with chloride ion secretion – is attributed to them (5, 6).

Making use of the experience acquired previously in the examination of the mayfly larvae, we conducted exploratory examinations in the larvae of some Odonata and Trichoptera species.

In the larvae of the dragonfly the chitin framework is smooth, nearly free of any structure, only here and there is its monotony broken by vast spine- and hair formations. In taxonomic respect, the observation of the fine details may bring new results in this field.

In the Trichoptera larvae – both by species and by stages of development – the chitin structure of the surface showed extreme diversity; therefore further comparative material needs to be collected of them.

By way of a summary: it can be stated relying upon our examinations that the SEM technique can be profitably used in the taxonomic and ecological examinations of each of the three animal groups. It can be used for obtaining information on the fine details of the taxonomic characters and also in ecological respect numerous further application possibilities present themselves.

REFERENCES

1. Bernolák, K., Szabó, D. & Szilas, L. (1979): *A mikroszkóp. Zsebkönyv. (The microscop. Hand book).* – Budapest: 1 – 590.

2. Heywood, V. H. (1971): *Scanning Electron Microscopy (Systematic and Evolutionary Applications).* – London and New York: 1 – 331.

3. Wichard, W. & Komnick, H. (1973): *Feinstruktureller und histochemischer Nachweis von Chloridzellen bei Steinfliegenlarven. 1. Die coniformen Chloridzellen.* – Cytobiologie, 7: 297 – 314.

4. Wichard, W. & Komnich, H. (1974): *Feinstruktureller und histochemischer Nachweis von Chloridzellen bei Steinfliegenlarven. 2. Die caviformen und bulbiformen Chloridzellen.* – Cytobiologie, 8: 297 – 311.

5. Wichard, W. & Komnich, H. (1974): *Structure and function of the respiratory epithellium in the tracheal gills of stonefly larvae.* – J. Insect. Physiol., 20: 2397 – 2406.

6. Wichard, W., Tsui Philip T. P. & Dewal, A. M. (1975): *Chloridzellen der Larven von Caenis diminuta Walker (Ephemeroptere, Caenidae) bei unterschiedlicher Salinität.* – Int. Rev. Ges. Hidrobiol., 60: 705 – 709.