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A new local race of the root-knot nematode Meloidogyne thamesi Chitwood in Chitwood, Specht & Havis, 1952 in Hungary

By

A. W. AMIN*

Abstract. Root-knot nematodes, *Meloidogyne* species, are widely distributed both in open fields and in greenhouses in Hungary. *Meloidogyne thamesi* is one of the seven *Meloidogyne* species recorded in Hungary so far. It was detected alone or in combination with *Meloidogyne arenaria* in six localities till now including east, west and middle region. *Meloidogyne thamesi gyulai* is described and illustrated from tomato *(Lycoperscicon esculentum* MILL. cv. Balca) planted in plastic greenhouses in Gyula (South-East Hungary). Females have a characteristic perineal pattern with moderately high dorsal arch and distinctly broken striae near the tail tip in lateral fields above the anus.

The root-knot nematodes, *Meloidogyne* species, are of worldwide distribution. They are the cause of a major problem all over the world as well as in Hungary (1, 2, 3, 5), especially in the areas between the Danube and the Tisza rivers (appr. 25—30,000 ha) and in greenhouses (appr. 4000 ha). *Meloidogyne thamesi* was reported for the first time in Hungary by BUDAI (1980) as a serious pest of tomato in heated plastic greenhouses in the area between the Danube and the Tisza rivers. *Meloidogyne thamesi* was found in four further localities (Balástya, Kistelek, Bordány, Gyula) out of those twenty six locations (appr. 15%) surveyed between 1990 and 1992 (AMIN, 1993). It was observed on cultivated vegetable crops, such as on tomato, pepper, cucumber and weed host, *Glansoga parviflora* (2), furthermore on pepper at Boglárlelle and on carnation in Szeged (5). *Meloidogyne thamesi* has been reported in the hot Palo Verde Valley of Southern California along the coast and cooler areas (29). In Greece it is one of the most common species on cucumber, grape, tomato, hyacinth, tobacco, carrot and cabbage (15). It is frequent in Turkey as well on different cultivated plants and weeds. In Chile *M. thamesi* is one of the five commonest root-knot nematode species on cultivated plants (25).

Meloidogyne thamesi was found in several countries (Table 1) as a major or minor pest associated with very wide range of cultivated crops and host weeds. In the present study a subspecies (or race) causing heavy damage on tomatoes in Gyula is presented and described.

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Materials and methods

Specimens were obtained from plastic greenhouses (tomato, *Lycopersicon esculentum* MILL. cv. Balca) in Gyula (South-East Hungary, in September, 1992). Larvae and males were recovered from infected tomato roots, females were dissected from the roots in 3% formaldehyde solution. 20 female perineal patterns were prepared and used in the identification as proposed by DABAJ (1990).

Measurements of different populations of Meloidogyne thamesi Chitwood in Chitwood, Specht & Havis, 1952

1. After Whitehead (1968)

Females. L=590 µm ±51 (514—703); widht= 409 µm ±53 (331—534); stylet= 17 µm (15—18); stylet knobs=3µm; dorsal oesophageal gland orifice=4 µm (3—5) behind stylet base; length of medial bulb=35 µm (33—42); width of medial bulb=30 µm (26—33); length of medial valve=16 µm (13—18); width of medial bulb valve=10 µm (9—10).

Males. L=1526 µm ±194 (1081—1804); a=47.7 µm ±3.94 (39.1—59.2); head= 8.3 µm ±0.59 (6.5—9.4); stylet=24.9 µm ±1.69 (20.5—28.1); stylet knobs=4.4 µm ±0.48 (3.6—5.4); b_1=16 ±1.64 (12.4—18.2); c=121 ±37.8 (83—219); length of medial bulb=23.4 µm ±2.56 (18.7—29.5); width of medial bulb 9.9 µm ±1.65 (6.5—14.7); length of medial bulb valve=7.1 µm ±1.18 (5.0—8.6); spicules=25.7 µm ±2.42 (21.6—28.1); gubernaculum=9.2 µm ±1.23 (7.9—10.8).

Larvae. L=432 µm ±17 (410—476); a=32.4 ±1.83 (30—37.8); b=2.19 ±0.267 (2.01—2.41); b_1=6.9 ±0.3 (6.5—7.4); length of tail=53 µm ±2 (50—58); d=5.8 ±0.4 (5.3—7.0); c=8.1 ±0.27 (7.6—8.6); length of body to middle of primordium=269 µm ±11 (252—298); stylet=11.1 µm ±0.62 (10.2—12.7); length of medial bulb=12.5 µm ±1.08 (10.8—14.4); width of medial bulb=7.1 µm ±0.64 (6.1—8.3); length of medial bulb valve=5.2 µm ±0.64 (4.3—6.5)

Eggs. 92 µm ±6.0 (78—101)×33 µm ±3.3 (27—40).

2. Populations from Hungary

Females. Stylet length=16.5 µm (15.1—17.7 µm); DGO=5.5 µm (4.2—6.3 µm).

Males. Stylet length=22.4 µm (20.1—23.2 µm); DGO=3.8 µm (3.3—4.0 µm); spicules=31 µm (29.7—22.2 µm).

Larvae. Length=409 µm (372—441 µm); tail length=55.4 µm (45.5—62.3 µm); hyaline part of tail=14.8 µm (12.5—18.6 µm).

3. Meloidogyne thamesi gyulai subsp. n.

Females (17). Length=918—1667 µm (mean 1095 µm, standard deviation, SD=148); width=344—826 µm (633.8 µm, SD=124); a=1.3—2.3 (1.6, SD=0.3); stylet=14.4—15.6 µm (14.7 µm, SD=0.57); width of stylet knobs=2.1—2.4 µm (2.3 µm, SD=0.1); stylet w/h ratio=2—2.3 (2.1, SD=0.15); dorsal oesophageal gland orifice (DGO)=2.4—3.6 µm (2.8 µm, SD=0.5); distance from vulva slit to anus=20.2—26.4 µm (23.9 µm, SD=1.9); excretory pore=24—36 µm (30.9 µm, SD=6) from anterior part; medial bulb center=90—140 µm (99.1 µm, SD=9.4) from anterior part.

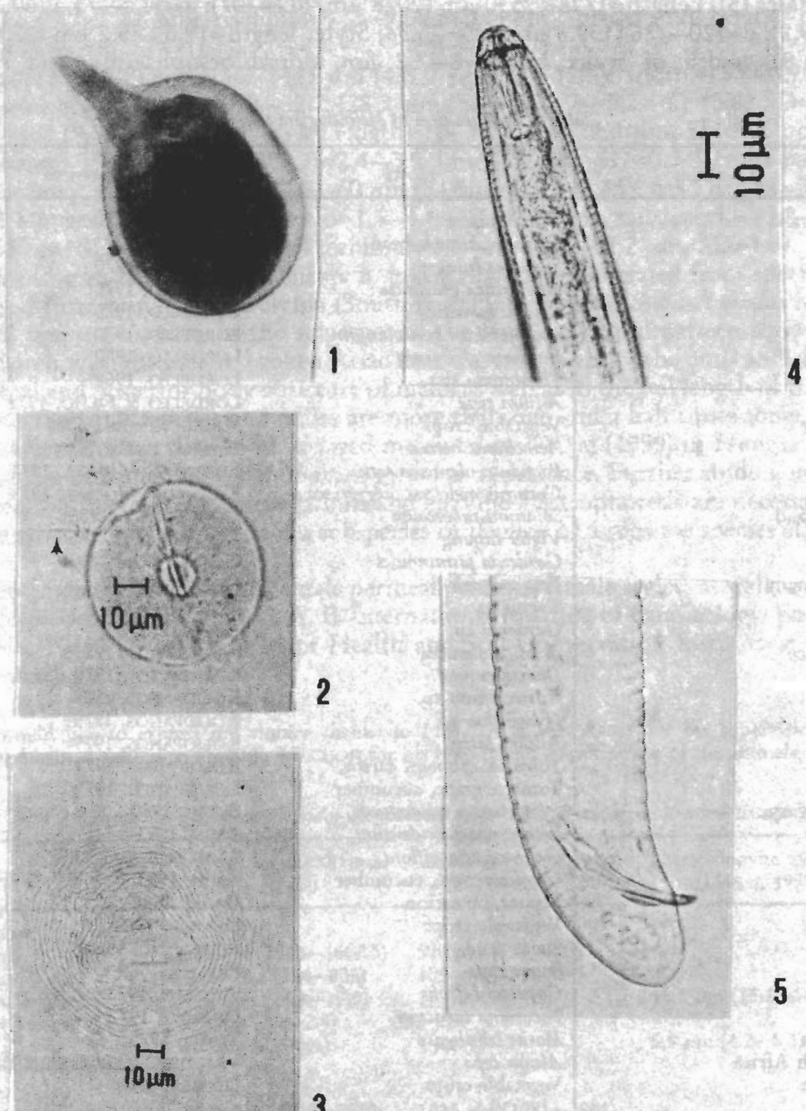

Fig. 1. *Meloidogyne thamesi gyulai* subsp. n. 1: adult female; 2: stylet (arrow) and medial bulb; 3: perineal pattern; 4: male head; 5: posterior end of male

Males (5). Length=1728—2530 µm (2028 µm, SD=307); a=51.5—75.3 (60.2 µm, SD=9.8); c=120—176 (139.8 µm, SD=25.34; Stylet length=19.6—25.2 µm (22.6 µm, SD=1.9); width of stylet knobs=6—7.2 µm, dorsal oesophageal gland orifice

Table 1. Distribution of Meloidogyne thamesi

Localities	Hosts	References
Australia	*Vitis vinifera*	McLeod & Khair, 1974
	Cabbage, french bean	Jensen, 1972
Brazil	*Spondias lutea*	Lordello, 1970
	Momardica charantia	Lordello, 1970
	Rivina humilis	Lordello, 1970
	Lycopeersicon peruvianum	Lordello, 1970
	Leonurus sibericum	Lordello, 1970
	Theobroma sp.	Lordello, 1968
	Allium cepa	Lordello & Filho, 1971
Chile	Vegetable crops	Mauricio et al., 1982
	Artocarpus incisa	Maura, 1967
Egypt	*Portulaca oleraceae sativa*	Elgindi & Moussa, 1971
	Cucumis melo var. *aegyptiaca*	Elgindi & Moussa, 1971
England	*Solanum tuberosum*	Goodey et al., 1956
	Vigna catjang	Goodey et al., 1956
	Gardenia jasminoides	Goodey et al., 1959
Germany	*Beta vulgaris*	Goffart, 1957
	Cactus sp.	Goffart, 1957
	Gardenia sp.	Goffart, 1957
Greece	*Brassica oleracea*	Koliopanos, 1979
	Daucus carota	Koliopanos, 1979
	Antirrhinum sp.	Koliopanos, 1979
	Hyacinthus sp.	Koliopanos, 1979
	Allium sativa	Koliopanos, 1979
	Tobacco, cabbage, carrot,	Koloipanos, 1979
	Tomato, grape, cucumber	Koloipanos, 1979
Hungary	*Lycopersicon esculentum*	Budai, 1980
	Lycopersicon esculentum	Amin, 1993
	Galinsoga parviflora	Amin & Budai, 1992
	Capsicum spp., cucumber	Amin, 1993
	Pepper, carnation	Dabaj, 1990
India	Vegetable crops	Deaker, 1969
Iraq	Sugar cane	Sethi et al., 1964
	Sugar cane	Prasad, 1969
	Cucumis sativus	Stephan, 1973
Italy	*Nicotiana tabacum*	DiMuro, 1972
Japan	*Morus bombysis*	Toida, 1973
South Africa	*Alium cepa*	Van der Linde et al., 1959
Spain	Vegetable crops	Decker, 1969
USA		
(Kansas)	*Clematis paniculate*	Mulvey, 1961
(Florida)	*Boehmaria utilis*	Chitwood et al., 1952
(Florida)	*Petivaeria hexaglochin*	Mulvey, 1961
(Texas)	*Rosa* sp.	Mulvey, 1961
USA	French been, cabbage	Jensen, 1972
	Potato	Winslow & Willis, 1972
	Sugar cane	Williams, 1969
	Oriza sativa	Hollis & Keoboonrueng, 1984
	Beta pateellaris	Golden, 1959
	B. procumbens	Golden, 1959
	Beta webbiana	Golden, 1959
	Albizzia julibrissim	Schndler, 1958
	Vitis Solonis	Linder, 1960
	V. chamini	Linder, 1960

(DGO)=2.4—4.2 μm (2.8 μm, SD=0.9) from base of stylet; spicules=31.2—33.6 μm (32.7 μm, SD=1.2); gubernaculum=7.2—9.6 μm (8.4 μm, SD=1.2); tail length=14.4—16.2 μm (15 μm, SD=1).

Larvae (67). Length=367—443 μm (421.7 μm, SD=12.3); width=13.8—15.6 μm (14.7 μm, SD=0.46); a=22.8—32.2 (28.3 μm, SD=2.7); b=5.2—6.1 (5.8, SD=2.7); c=8.1—8.7 (8.35), SD=0.18); stylet length=12—13.2 μm (12.3 μm, SD=0.5); dorsal oesophageal gland orifice (DGO)=2.4—3.9 μm (2.9 μm, SD=0.54) from base of stylet; center of medial bulb=52.8—60 μm (54.5 μm, SD=0.45); head height=3—3.6 μm (3.3 μm, SD=0.3); hw/hh ratio=1.3—1.6 (1.5, SD=0.1); tail length=49.2—52.8 μm (51 μm, SD=1.4); hyaline tail terminal=9.6—14.4 μm (12.2 μm, SD=1.9).

Meloidogyne thamesi gyulai subsp. n. is described and illustrated from specimens obtained from tomato from Gyula (South-East Hungary). *M. thamesi gyulai* resembles *M. thamesi thamesi,* in the structure of the female perineal pattern showing a round arch with distinctive broken striae near the tail tip above the anus and also in the labial and posterior body structure of males as well as in the tail length of the larvae, but the adult females and males are more than one and a half times longer and their stylets shorter than in *M. thamesi* measured by DABAJ (1990) in Hungary.

For the present, I regard *M. thamesi gyulai* as a local race. Further studies, including electron microscopic investigations and enzyme electrophoresis are necessary to decide whether our nematode is a subspecies of *thamesi* or a separate species close to that.

Specimens on slides: adult female perineal patterns, female stylets as well as males and larvae were deposited in C. A. B. International Institute of Parasitology, England (IIP No. 10/93 [1—14], and Plant Health and Soil Conservation Institute at Hódmezővásárhely, Hungary.

I would like to express my sincere thanks to Prof. Dr. I. ANDRÁSSY for his supervision and unlimited help as well as to Dr. J. E. MACHON for his help in the identification of the animals.

Table 2. Comparison between Meloidogyne thamesi gyulai and Meloidogyne thamesi thamesi

Stage/Characters	Meloidogyne thamesi gyulai	Meloidogyne thamesi (WHITEHEAD, 1968)	Meloidogyne thamesi (DABAJ, 1990)
Females:			
Length	1095 μm (918—1667.5)	590 μm (514—703)	—
Width	633.8 μm (344—826)	409 μm (331—534)	—
Stylet length	14.7 μm (14.4—15.6)	17 μm (15—18)	16.5 μm (15.1—17.7)
Stylet knobs	2.3 μm (2.1—2.4)	3 μm	—
DOG*	2.8 μm (2.4-3.6)	4 μm (3—5)	5.5 μm (4.2—6.3)
Males:			
Length	2028 μm (1728—2530)	1526 μm (1081—1804)	—
Stylet length	22.6 μm (19.6—25.2)	24.9 μm (20.5—28.1)	22.4 μm (20.1—23.3)
DOG	2.8 μm (2.4—4.2)	—	3.8 μm (3.3—4)
Spicules	32.7 μm (31.2—33.6)	25.7 μm (21.6—28.1)	31 μm (29.7—32.2)
Gubernaculum	8.4 μm (7.2—9.6)	9.2 μm (7.9—10.8)	—
Larvae:			
Length	421.7 μm (367.2—443.7)	432 μm (410—476)	409 μm (372.7—441)
Stylet length	12.3 μm (12—13.2)	11.1 μm (10.2—12.7)	—
DOG	2.9 μm (2.4—3.9)	—	—
Tail length	51.0 μm (49.2—52.8)	53 μm (50—58)	—
Hyaline tail terminal	12.2 μm (9.6—14.4)	—	14.8 μm (12.5—18.6)

* Dorsal oesophageal gland orifice.

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A taxonomic survey of the family Anatonchidae (Nematoda)

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Abstract. The third paper of a series summarizing the taxonomy of the nematode superfamily Mononchoidea treats the family Anatonchidae. Twenty genera grouped into three subfamilies are characterized: *Nullonchus*, *Iotonchulus*, *Caputonchus*, *Mulveyellus*, *Jensenonchus*, *Iotonchus*, *Hadronchus*, *Parahadronchus*, *Prionchulellus*, *Prionchuloides*, *Hadronchoides* and *Hadronchulus* (Iotonchinae); *Miconchus*, *Promiconchus*, *Crassibucca*, *Paracrassibucca* and *Doronchus* (Miconchinae); *Truxonchus*, *Anatonchus* and *Tigronchoides* (Anatonchinae). 131 valid species are listed and presented in form of identification keys. Two species new to science, *Parahadronchus egregius* and *Anatonchus sympathicus* spp. n., are described and several new combinations proposed.

In two of my last papers (1992, 1993) I outlined the taxonomic picture of the families Mononchidae CHITWOOD, 1937 and Mylonchulidae JAIRAJPURI, 1969, both belonging to the superfamily of predaceous nematodes, Mononchoidea CHITWOOD, 1937. Within the family Mononchidae I characterized eleven genera and 100 species, within Mylonchulidae seven genera and 67 species. The present study discusses the family Anatonchidae JAIRAJPURI, 1969.

Anatonchidae is the richest among the three families both in genera and species: 131 valid species will be enumerated below and grouped into twenty genera. Although the representatives of the family show a fairly colourful picture in their appearance, especially in the organization of the buccal cavity, all they are common in a peculiar character: they have a structure in the oesophago-intestinal junction which never occurs in the other two families.

Family **ANATONCHIDAE** JAIRAJPURI, 1969

Mononchina, Mononchoidea. Medium-sized or large animals to over 6 mm. Buccal cavity heavily sclerotized, large, often very roomy, flattened at base. Dorsal tooth present (a single exception: *Nullonchus*), not too large, occasionally even rather weak, predominantly projected forward but in some cases backward, retrorse; located either in anterior or posterior part of buccal capsule. Beside this main tooth, subven-

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tral teeth, minute denticles or longitudinal ridges of various type and arrangement can be present. Oesophago-cardial junction tuberculate.

Anatonchidae mainly differs from both Mononchidae and Mylonchulidae by the presence of a special tuberculate structure in the junction between the oesophagus and cardia—intestine. These "tubercles" are formed by the widening of the oesophago-cardial lumen, and show a triradiate symmetry. Whereas the oesophago-intestinal valve in the other two families is always simple, not widened. The role of this phenomenon of Anatonchidae is not known exactly.

Moreover, Anatonchidae can be distinguished from Mylonchulidae by the fact that such a very large claw-like dorsal tooth and those transverse rasp-like denticles being so typical for Mylonchulidae never occur in it. To separate Anatonchidae from Mononchidae is, however, not so simple. The reason for this is that in the appearance of the buccal cavity — the main distinguishing character for genera — a sort of parallel evolution can be often observed. That means that similarly shaped and structured buccal capsules can occur in both families. The stoma of Anatonchidae is, however, in general more roomy and more flattened at base than that of the other family; moreover, the junction between the anterior end of the buccal capsule and the short sclerotized "funnel" just before that is never as sharply pointed as in Mononchidae. It may be mentioned else that the lumen of the oesophagus predominantly begins with a distinct widening in Anatonchidae but it begins simply in Mononchidae (Fig. 1). But the main distinguishing character of the two families is the presence or absence of those tubercles in the oesophago-intestinal junction as mentioned above.

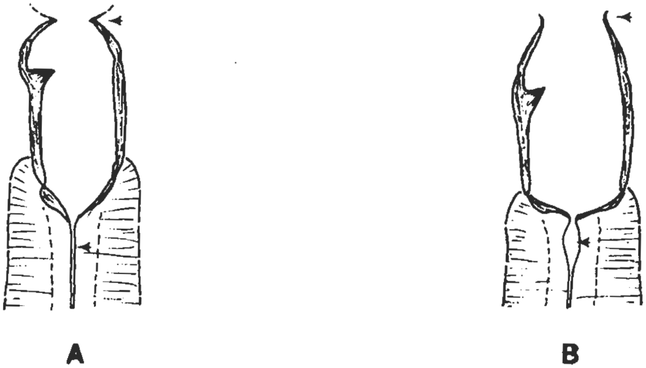

Fig. 1. Some differences in the buccal-oesophageal region between Mononchidae and Anatonchidae. (See in text, page 10)

The present family is not so homogeneous as Mononchidae and far not so as Mylonchulidae. This is supported by the fact, too, that while Mononchidae can be divided into two subfamilies, and Mylonchulidae has only one subfamily, for the 20 genera of Anatonchidae three subfamilies must be distinguished.

Key to subfamilies of Anatonchidae

1 Teeth three, equal in shape and location, and directed backward (retrorse) .... **Anatonchinae**
— Teeth various in shape and arrangement, directed forward, never retrorse 2

2 Subventral walls of buccal cavity unarmed or provided with several small denticles, either scattered or arranged along longitudinal ribs .... **Iotonchinae**
— Subventral walls of buccal cavity without minute denticles but armed with teeth grouped into one or two pairs, similar in shape as, or somewhat smaller than dorsal tooth .... **Miconchinae**

Subfamily IOTONCHINAE JAIRAJPURI, 1969

Anatonchidae. Buccal cavity roomy. Dorsal tooth — lacking in one genus — located in anterior or posterior half of buccal capsule and pointed forward. Subventral walls either completely unarmed or provided with smooth or serrate longitudinal ribs, or scattered denticles. Valid teeth, similar to dorsal tooth, never occurring on subventral walls (Fig. 2).

12 genera (with 79 species), in alphabetic order:

Caputonchus SIDDIQI, 1984
Hadronchoides JAIRAJPURI & RAHMAN, 1984
Hadronchulus RAY & DAS, 1983
Morenchus DHANACHAND, RENUBALA & MOHILAL, 1991 (syn. n.)
Hadronchus MULVEY & JENSEN, 1967
Iotonchulus gen. n.
Iotonchus COBB, 1916
Mononchus (*Iotonchus* COBB, 1916)
Jensenonchus JAIRAJPURI & KHAN, 1982
Mulveyellus SIDDIQI, 1984
Nullonchus SIDDIQI, 1984
Parahadronchus MULVEY, 1978
Prionchulellus MULVEY & JENSEN, 1967
Prionchuloides MEYL, 1963

Key to genera of Iotonchinae

1 Buccal cavity completely unarmed, without any teeth or denticles .... **Nullonchus** SIDDIQI
— Buccal cavity armed at least with a dorsal tooth 2

2 Only one — the dorsal — tooth present 3
— Beside dorsal tooth also serrate ribs or/and small denticles present 7

3 Dorsal tooth located at or near base of buccal cavity .... **Iotonchus** COBB
— Dorsal tooth located in anterior fourth to somewhat posterior to middle of stoma 4

4 Facing the dorsal tooth a thin longitudinal ridge present .... **Jensenonchus** JAIRAJPURI & KHAN
— Facing the dorsal tooth no longitudinal ridge 5

5 Lip region sharply set off by a deep constriction; tail straight .... **Caputonchus** SIDDIQI
— Lip region not set off so sharply; tail more or less arcuate 6

6 Tail filiform, 10—20 anal body widths long; terminal spinneret present .... **Iotonchulus** gen. n.
— Tail conoid, 2—6 anal body widths long; terminal spinneret lacking .... **Mulveyellus** SIDDIQI

7 Dorsal tooth opposed by two, rarely four, longitudinal serrate ridges 8
— Dorsal tooth opposed by fine scattered denticles 11

8 Dorsal tooth located in posterior half of buccal cavity, mostly subbasal, serrate ridges similarly posterior in location; caudal spinneret present .... **Parahadronchus** MULVEY
— Dorsal tooth located in anterior half of buccal cavity, serrate ridges occupying almost the entire length of stomatal walls; caudal spinneret absent 9

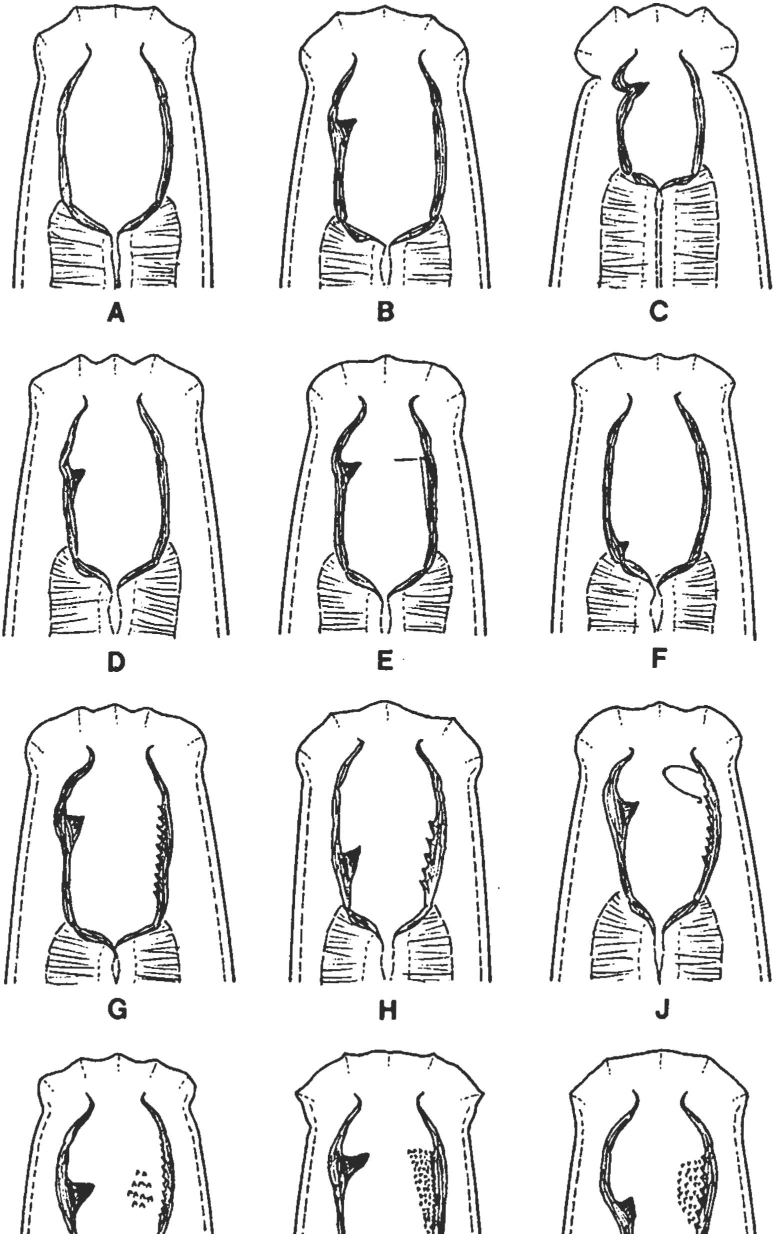

Fig. 2. Buccal cavities in the family Anatonchidae. A—M: Genera of the subfamily Iotonchinae; A: *Nullonchus*, B: *Iotonchulus*, C: *Caputonchus*, D: *Mulveyellus*, E: *Jensenonchus*, F: *Iotonchus*, G: *Hadronchus*, H: *Parahadronchus*, J: *Prionchulellus*, K: *Prionchuloides*, L: *Hadronchoides*, M: *Hadronchulus*

9 Subventral serrate ridges forming a hook-like loop anteriorly ... **Prionchulellus** MULVEY & JENSEN
— Subventral serate ridges simple, not forming loops ... 10

10 Beside ribs, subventral walls with a number of irregularly dispersed minute denticles; female amphidelphic ... **Prionchuloides** MEYL
— Subventral walls only with two ribs; female prodelphic ... **Hadronchus** MULVEY & JENSEN

11 Dorsal tooth in anterior part of buccal cavity, denticles almost along the entire length of subventral walls; female prodelphic ... **Hadronchoides** JAIRAJPURI & RAHMAN
— Dorsal tooth in posterior part of buccal cavity; denticles also restricted to the posterior walls; female amphidelphic ... **Hadronchulus** RAY & DAS

Genus ***Nullonchus*** SIDDIQI, 1984

Anatonchidae, Iotonchinae. Body length between 1 and 2 mm. Cuticle smooth. Lip region slightly set off. Buccal cavity roomy, broadly ovoid, completely devoid of any teeth or denticles or ribs. Proximal end of oesophagus tuberculate, tubercles however smaller than in general in the family. Female mono-prodelphic, with or without posterior uterine sac. Vulva located in 68—76% of body length. Male not known. Tail conoid-arcuate, 2—5 times as long as anal diameter. Caudal glands and spinneret present.

Type species: *Nullonchus levistomus* SIDDIQI, 1984.

A very remarkable genus, the sole within the superfamily Mononchoidea which has nothing armature in the buccal cavity. Whether the toothless stoma should be regarded as a primary or secondary phenomenon, it cannot be decided in lack of known transitional forms toward the tooth-bearing types. SIDDIQI (1984) grants that whichever theory may be right. Owing to the fact that also the larval stages have no tooth in the stoma we may suppose that this type of unarmament is an ancient character.

The species of *Nullonchus* have been described from soils of rain forests in South America.

Three species:

N. levistomus SIDDIQI, 1984
N. rapax SIDDIQI, 1984
N. valens SIDDIQI, 1984

Key to species of Nullonchus

1 Postvulval uterine sac present, 1.5 times as long as corresponding width of body; buccal cavity about 50 μm long. — ♀: L=1.9 mm; a=31; b=4; c=10; V=72%; c'=5. ♂ unknown. (Colombia) ... **valens** SIDDIQI
— Postvulval uterine sac absent; buccal cavity 30—35 μm long ... 2

2 Tail shorter, 2—3 anal diameters; vagina strongly arcuate, directed forward. — ♀: L=1.0—1.5 mm; a=23—28; b=3.3—4.1; c=12—18; V=74—76%; c'=2.3—3.1. ♂ unknown. (Colombia) ... **levistomus** SIDDIQI
— Tail onger, 4—5 anal diameters; vagina slightly oblique. — ♀: L=1.4—1.7 mm; a=28—36; b=4.0—4.1; c=9.8—11.4; V=68—73%; c'=4.3—5.1. ♂ unknown. (Colombia) ... **rapax** SIDDIQI

Genus ***Iotonchulus*** gen. n.

Anatonchidae, Iotonchinae. Body either small, near 1 mm, or very large, close to 4 mm. Cuticle smooth. Buccal cavity barrel-shaped, dorsal tooth rather small, located close to midway in stoma. Subventral armature lacking. Oesophago-intestinal valve tuberculae. Female genital system amphidelphic or prodelphic, in the latter case with a very short postvulval sac. Vulva between 52 and 62%. Spicula with small lateral pieces. Copulatory supplements 11—13. Female tail filiform, 12—19 times as long as anal diameter, male tail comparatively shorter and plumper. Caudal glands and spinneret present.

Type species: *Iotonchus longicaudatus* BAQRI, BAQRI & JAIRAJPURI, 1978 = *Iotonchulus longicaudatus* (BAQRI, BAQRI & JAIRAJPURI, 1978) comb. n.

In the anterior position of the dorsal tooth *Iotonchulus* comes close to *Jensenonchus* JAIRAJPURI & KHAN, 1982, *Mulveyellus* SIDDIQI, 1984 and *Caputonchus* SIDDIQI, 1984 but it can be easily distinguished from them in having a filiform tail and well developed terminal spinneret.

The representatives of this genus are inhabitants of wet soils and occur in Asia (2 species) and Australia-Oceania (1 species).

Three species:

I. bangkokensis (BUANGSUWON & JENSEN, 1966) comb. n.
  Iotonchus bangkokensis BUANGSUWON & JENSEN, 1966
I. longicaudatus (BAQRI, BAQRI & JAIRAJPURI, 1978) comb. n.
  Iotonchus longicaudauts BAQRI, BAQRI & JAIRAJPURI, 1978
  Mulveyellus longicaudatus (BAQRI, BAQRI & JAIRAJPURI, 1978) SIDDIQI, 1984
  Iotonchus heynsi MOHANDAS & PRABHOO, 1979 (syn. n.)
I. ophiocercus (CLARK, 1961) comb. n.
  Iotonchus ophiocercus CLARK, 1961

Remarks

Iotonchus heynsi MOHANDAS & PRABHOO, 1979. — This species seems to be identical with *Iotonchulus longicaudatus* (BAQRI, BAQRI & JAIRAJPURI, 1978). The little "differences" mentioned by MOHANDAS and PRABHOO do not seem to be enough to separate *heynsi* from *longicaudatus.*

Key to species of Iotonchulus

1 Large species, 3.7—4 mm; female amphidelphic. — ♀: L=3.8—4.0 mm; a=41—47; b=4.7—4.9; c=4.7—5.2; V=54—62%; c'=12—14. ♂: L=3.7—3.8 mm; a=38—40; b=4.6—5.2; c=5.8—10; PO: 11—13. (New Zealand) .... **ophiocercus** (CLARK)
— Much smaller species, near 1 mm; female prodelphic 2

2 Tail terminus bulbous; buccal cavity 13—15 μm long, 1.5 times as long as wide. — ♀: L=0.8—0.9 mm; a=33—43; b=4.1—4.7; c=2.9—4.0; V=52—60%; c'=12—15. ♂ unknown. (Thailand) .... **bangkokensis** (BUANGSUWON & JENSEN)
— Tail terminus cylindrical; buccal cavity 21—24 μm long, twice as long as wide. — ♀: L=1.0—1.3 mm; a=32—45; b=3.4—4.6; c=3.4—4.1; V=59—62%; c'=13—19. ♂ unknown. (India, Kazakhstan) .... **longicaudatus** (BAQRI, BAQRI & JAIRAJPURI)

Genus *Caputonchus* SIDDIQI, 1984

Anatonchidae, Iotonchinae. Very small nematodes, 0.5—0.6 mm. Cuticle smooth. Lip region sharply set off by a deep constriction. Buccal cavity spacious but small, shorter than labial width, dorsal tooth located in its anterior fourth, pointing forward. No subventral ridges or denticles. Oesophageal base tuberculate. Vulva somewhat posterior to mid-body; ovaries two. Male not known. Tail straight, conical with minutely rounded tip, 2.5—3 times as long as anal body width. Caudal glands and spinneret lacking.

Type species: *Caputonchus capitatus* SIDDIQI, 1984.

Caputonchus is closely related to *Mulveyellus* SIDDIQI, 1984 in having an anteriorly located tooth, unarmed subventral walls, a short tail and rudimentary caudal glands. It differs from that by the small and stout body, the sharply separated head, the unusually small buccal cavity, the farther forward located tooth and the straight tail.

Terricolous animals, known from the Caribbean Region.

One species:

C. capitatus SIDDIQI, 1984

— ♀: L=0.5—0.6 mm; a=19—21; b=3.4—3.7; c=15—16; V=54—59%; c'=2.4—2.7. ♂ unknown. (St. Lucia) .... **capitatus** SIDDIQI

Genus *Mulveyellus* SIDDIQI, 1984

Anatonchidae, Iotonchinae. Body 0.8 to 3.1 mm long. Cuticle smooth. Buccal cavity barrel-shaped with a single dorsal tooth varying in location from anterior third to somewhat posterior to the middle of buccal capsule. Subventral walls devoid of ribs or denticles. Oesophago-cardial valve tuberculate. Vulva between 52 and 81% of body length. Female reproductive system prodelphic or amphidelphic. Spicula with lateral accessory pieces. Supplements 11—15. Tails of both sexes equal in shape, as long as 2.5—6 anal body widths, conoid-arcuate. Caudal glands reduced, spinneret absent.

Type species: *Mononchus jairi* LORDELLO, 1959 = *Mulveyellus jairi* (LORDELLO, 1959) SIDDIQI, 1984.

Mulveyellus is closest to *Jensenonchus* JAIRAJPURI & KHAN, 1982 but differs from that in the absence of small longitudinal ribs on the subventral walls.

Terrestrial nematodes. They have been observed in four continents: Asia (2 species), Africa (2 species), South America (4 species) and Australia-Oceania (1 species).

Five species:

M. arenicola (ALTHERR, 1963) comb. n.
  Iotonchus arenicola ALTHERR, 1963
M. jairi (LORDELLO, 1959) SIDDIQI, 1984
  Mononchus jairi LORDELLO, 1959
  Iotonchus jairi (LORDELLO, 1959) CLARK, 1961
M. monhystera (COBB, 1917) SIDDIQI, 1984
  Mononchus monhystera COBB, 1917
  Iotonchus monhystera (COBB, 1917) JAIRAJPURI, 1970
M. parazschokkei (ALLGÉN, 1929) comb. n.
  Mononchus parazschokkei ALLGÉN, 1929
  Mononchus (Iotonchus) parazschokkei ALLGÉN, 1929 (GOODEY, 1951)
  Iotonchus parazschokkei (ALLGÉN, 1929) GOODEY, 1951
M. shamimi (PATIL & KHAN, 1982) comb. n.
  Iotonchus shamimi PATIL & KHAN, 1982

Remarks

Mulveyellus jairi (LORDELLO, 1959). — *Iotonchus jairi* apud MALCEVSCHI, 1981 seems to belong more to *M. monhystera* (COBB, 1917) than *M. jairi* by virtue of the anterior position of the dorsal tooth; as a consequence, the first description of the male concerns *monhystera* and not *jairi*.

1 Female genital organ unpaired, prodelphic, without a posterior uterine sac 2
— Female genital organ paired, amphidelphic 3

2 Dorsal tooth in anterior third of buccal cavity. — ♀: L= 1.0—1.3 mm; a=23—30; b=3.6—4.3; c=12—17; V=72—81%; c'=2.6—3.0. ♂: L=1.1—1.2 mm; a=31—35; b=3.6—4.0; c=13—16; PO: 11—12. (Ivory Coast, South Africa, Colombia, Brazil, Argentina) .... **monhystera** (COBB)
— Dorsal tooth midway in the buccal cavity. — ♀: L=0.8—1.6 mm; a=23—30; b=3.4—4.3; c=12—16; V=71—76%; c'=2.5—3. ♂ unknown. (India, Nigeria, St. Lucia, Brazil) .... **jairi** (LORDELLO)

3 Apex of dorsal tooth situated in anterior third of stoma. — ♀: L=1.7 mm; a=24; b=3.6; c=14; V=64%; c'=3. ♂ unknown. (India) .... **shamimi** (PATIL & KHAN)
— Apex of dorsal tooth situated behind the middle of stoma 4

4 Tail longer, 5—6 anal diameters and curled up. — ♀: L=3.1 mm; a=41; b=5.4; c=13; V=52%; c'=5—6. ♂ unknown. (Argentina) .... **arenicola** (ALTHERR)
— Tail shorter, 3.5—4 anal diameters, simply arcuate, not curled up. — ♀: L=1.1—2.8 mm; a=23—27; b=3.4—4.6; C=8—15; V=57—65%; c'=3.5—4. ♂: L=2.9 mm; a=33—36; b=3.7—4.1; c=25—27; PO: 14—15. (Chile, New Zealand, Campbell Islands) .... **parazschokkei** (ALLGÉN)

Genus *Jensenonchus* JAIRAJPURI & KHAN, 1982

Anatonchidae, Iotonchinae. Body length varying between 0.5 and 2.3 mm. Cuticle smooth. Buccal cavity roomy, armed with a dorsal tooth situated in anterior third to mid-section of stoma. Facing the tooth a small longitudinal ridge and/or a fine transverse rib on each subventral wall present. Oesophago-intestinal junction tuberculate. Female amphidelphic or prodelphic, in latter case without postvulval sac. Vulva located between 60 and 80% of body length. Spicula arcuate with bifurcate accessory pieces. Supplements 9—15 in number. Tails similar in both sexes, either very short and rounded or 2—5 anal diameters long and conoid-arcuate. Caudal glands reduced, terminal opening absent.

Type species: *Iotonchus ovatus* JENSEN & MULVEY, 1968 = *Jensenonchus ovatus* (JENSEN & MULVEY, 1968) JAIRAJPURI & KHAN, 1982.

JAIRAJPURI and KHAN (1982) suggested this genus for one — the type — species. I would like to widen it for some further species, too, which can be characterized in having an anteriorly located dorsal tooth and conspicuous subventral ribs opposite that. *Jensenonchus* comes closest to *Mulveyellus* SIDDIQI, 1984, from which it differs by the presence of the ribs mentioned above. This difference between them is quite the same as that between *Clarkus* JAIRAJPURI, 1970 and *Coomansus* JAIRAJPURI & KHAN, 1977 in the family Mononchidae. *Clarkus* and *Coomansus* on the one side, and *Jensenonchus* and *Mulveyellus* on the other side — serve a good precedent for the parallel evolution within two different families.

Terrestrial animals occurring in six continents: Europe (2 species), Asia (1 species), Africa (1 species), North America (5 species) and Oceania (1 species).

Six species:

J. alter sp. n.
Iotonchus amphigonicus apud JENSEN & MULVEY, 1968
J. amphigonicus (THORNE, 1924) comb. n.
Mononchus amphigonicus THORNE, 1924
Iotonchus amphigonicus (THORNE, 1924) ANDRÁSSY, 1958
J. antedontoides (COETZEE, 1967) comb. n.
Iotonchus antedontoides COETZEE, 1967
Mulveyellus antedontoides (COETZEE, 1967) SIDDIQI, 1984

Iotonchus monhystera apud JAIRAJPURI, 1970; KHAN & JAIRAJPURI, 1980; JAIRAJPURI & KHAN, 1982

J. antedontus (MULVEY, 1963) comb. n.
Iotonchus antedontus MULVEY, 1963
Mulveyellus antedontus (MULVEY, 1963) SIDDIQI, 1984

J. ovatus (JENSEN & MULVEY, 1968) JAIRAJPURI & KHAN, 1982
Iotonchus ovatus JENSEN & MULVEY, 1968

J. vorax (COBB, 1917) comb n.
Mononchus vorax COBB, 1917
Mononchus papillatus vorax COBB, 1917 (MICOLETZKY, 1922)
Iotonchus vorax (COBB, 1917) MULVEY, 1963
Mulveyellus vorax (COBB, 1917) SIDDIQI, 1984
Mononchus sphagni BRZESKI, 1960 (syn. n.)
Clarkus sphagni (BRZESKI, 1960) JAIRAJPURI, 1970
Iotonchus sphagni (BRZESKI, 1960) LOOF & WINISZEWSKA-SLIPINSKA, 1993
Iotonchus celer SUSULOVSKIJ, 1988 (syn. n.)

Remarks

Jensenonchus alter sp. n. — JENSEN and MULVEY (1968) described under the name *"Iotonchus amphigonicus"* a species that is scarcely identical with THORNE'S *amphigonicus*. It differs clearly from the latter by some characteristics which are enumerated below in the present key. I regard these differences as of specific value and suggest a separate name, *Jensenonchus alter* sp. n., for the species of JENSEN and MULVEY.

Jensenonchus antedontoides (COETZEE, 1967). — JAIRAJPURI (1970), KHAN and JAIRAJPURI (1980) and JAIRAJPURI and KHAN (1982) described a species each from India, under the name *"Iotonchus monhystera"*. They supposed that *"Iotonchus antedontoides* COETZEE, 1986 was identical with their *"monhystera"*. I am in agreement with them; we may synonymize both species. But there is an other problem: the Indian *"monhystera" (=antedontoides)* can not be equal with the true *monhystera* as described by COBB in 1916. They differ in two main respects: the ventral wall of the stoma facing the dorsal tooth in the Brazil species (COBB's) is smooth, unarmed, in the Indian one, however, it bears two kinds of fine ribs, longitudinal and transverse as well; the tail of the Brazilian nematode is blunt, conspicuously rounded on its tip, while that of the Indian is more slender and pointed on its tip. As a consequence, JAIRAJPURI's species is other than COBB's one but the same as COETZEE's.

Iotonchus sphagni (BRZEKI, 1960). — It is scarcely doubt that both *I. sphagni* (BRZESKI, 1960) and *I. celer* SUSULOVSKIJ, 1988 are identical with *Jensenonchus vorax* (COBB, 1917). They agree in every morphological respect as well as in the measurements. The agreement in shape and length of the tail is especially noteworthy. Neither COBB (1917) nor MULVEY (1963) mentioned or illustrated a ventral ridge opposite the dorsal tooth, LOOF and WINISZEWSKA-SLIPINSKA (1933) however examined specimens of both *vorax* and *sphagni* and constated that ventral ridges do occur in them.

Key to species of Jensenonchus

1 Female prodelphic. — ♀: L=0.7—1.5 mm; a=21—35; b=3.1—4.7; c=10—19; V=72—81%; c'=2—3. ♂: L=1.1—1.2 mm; a=31—35; b= 3.6—4.0; c=13—14; PO: 11. (India, South Africa, New Caledonia) .... **antedontoides** (COETZEE)

— Female amphidelphic 2

2 Tail in both sexes broadly rounded, shorter than anal body width; body very small, under 1 mm. — ♀: L=0.5—0.8 mm; a=19—27; b=3.5—3.7; c=31—58; V=59—63%; c'=0.6—0.7. ♂: L=0.6—0.9 mm; a=20—26; b=3.5—4.7; c=39—46; PO: 9—10. (United States: Oregon) .... **ovatus** (JENSEN & MULVEY)

— Tail in both sexes conoid, ventrally bent, 2—5 times as long as anal body diameter; body larger, to 2.3 mm 3

3 Apex of dorsal tooth situated in anterior third of buccal cavity 4

— Apex of dorsal tooth situated midway in buccal cavity 5

4 Tail longer, 4—5 anal diameters, sharply ventrally arcuate. — ♀: L=1.4—2.0 mm; a=24—38; b=3.4—4.3; c=9—14; V=58—67%; c'=4—5. ♂ unknown. (Great Britain, Poland, Bohemia, Ukraine, Canada, United States [New Jersey, Wisconsin]) .... **vorax** (COBB)

— Tail shorter, 2—3 anal diameters, not so sharply arcuate. — ♀: L=1.2—1.5 mm; a=22—24; b=3.1—4.0; c=13—19; V=65—69%; c'=2—3. ♂: L=1.1—1.4 mm; a=24—30; b=3.1—3.8; c=12—20; PO: 14—15. (India, United States [California]) .... **antedontus** (MULVEY)

5 Transverse ribs on subventral walls levelling with dorsal tooth; tip of tail rounded; body about 2 mm. — ♀: L=2.3 mm; a=29; b=5; c=22; V=68%; c'=2.5. ♂: L=2.3 mm; a=35; b=4.9; c=25; PO: 10—12. (United States [Utah]) .... **amphigonicus** (THORNE)

— Transverse ribs on subventral walls situated more forward than dorsal tooth; tip of tail pointed; body about 1 mm. — ♀: L=1.2—1.3 mm; a=26; b=3.2; c=17—23; V=67—72%; c'=2.5. ♂ unknown. (United States [Oregon]) .... **alter** sp. n.

Genus *Iotonchus* COBB, 1916

Mononchus (*Iotonchus* COBB, 1916).

Anatonchidae, Iotonchinae. Body length varying between very wide limits: 0.8 and 6.4 mm. Cuticle smooth. Bucal cavity predominantly roomy, occassionally oblong, moderately wide (varying in length from 20 to 90 μm). Dorsal tooth always basal or suprabasal, not too strong, often rather small. No other armature in buccal cavity. Oesophago-cardial junction of tuberculate type. Female genital organ paired or unpaired, prodelphic. Vulva located from mid-body to 80% of body length. Spicula more or less arcuate; bifurcate lateral pieces present. Number of copulatory supplements 6 to 22. Tail similar in both sexes, variable in shape and length, predominantly conoid or filiform, rarely very short and bluntly rounded, 0.7 to 50 (!) anal diameters long. Caudal glands and spinneret mostly well developed, in some species rudimentary or lacking; spinneret often subterminal.

Type species: *Mononchus gymnolaimus* COBB, 1893 = *Iotonchus gymnolaimus* (COBB, 1893) COBB, 1916.

As for number of species *Iotonchus* is the richest genus in the family, and after *Mylonchulus* the second richest in the whole superfamily. In the basal position of the dorsal tooth and lack of other armature, *Iotonchus* can be easily distinguished from the other genera of Anatonchidae.

A worldwide distributed genus but the majority of species has been recorded from Asia, Africa and Australia. The species of *Iotonchus* are distributed as follows: in Europe 5, Asia 19, Africa 20, North America 4, South America 7 and Australia-Oceania 11 species. It is remarkable that the European and North American continents are poor in representatives of the genus (*carpathicus, magyar, risoceiae* and *rotundicaudatus,* or *acutus, brachylaimus, gymnolaimus* and *tenuidentatus,* respectively). The most widely occurring species is *I. trichurus* observed in 9 countries or states.

Forty-seven species:

I. acuticaudatus MULVEY & JENSEN, 1967

I. acutus COBB, 1917

Mononchus (Iotonchus) acutus COBB, 1917

Iotonchus laticupulatus RAZZHIVIN, 1971 (syn. n.)

I. anisostomus BUANGSUWON & JENSEN, 1966
I. baqrii JAIRAJPURI, 1969
I. basidontus CLARK, 1961
    Iotonchus prabhooi MOHANDAS, 1979 (syn. n.)
I. brachylaimus COBB, 1917
    Mononchus (Iotonchus) brachylaimus COBB, 1917
I. candelabri YEATES, 1992
I. carpathicus POPOVICI, 1990
I. chantaburensis BUANGSUWON & JENSEN, 1966
    Iotonchus khani MOHANDAS & PRABHOO, 1979 (syn. n.)
I. clarki MULVEY & JENSEN, 1967
I. consimilis COBB, 1917
    Mononchus (Iotonchus) consimilis COBB, 1917
I. geminus HEYNS & LAGERWEY, 1965
I. gymnolaimus (COBB, 1893) COBB, 1916
    Mononchus gymnolaimus COBB, 1893
    Mononchus (Iotonchus) gymnolaimus COBB, 1893 (COBB, 1916)
I. indicus JAIRAJPURI, 1969
I. kherai MOHANDAS & PRABHOO, 1979
I. kirbyi SIDDIQI, 1984
I. kirghistanicus SULTANALIEVA, 1983
I. lacuplanarum YEATES, 1992
I. lamottei MALCEVSCHI, 1981
I. litoralis COETZEE, 1967
I. loteniae DE BRUIN & HEYNS, 1992
I. magyar ANDRÁSSY, 1973
I. maragnus CLARK, 1961
I. microdontus THONG, 1971
I. montanus YEATES, 1992
I. nayari MOHANDAS & PRABHOO, 1979
    Iotonchus shafii KHAN & JAIRAJPURI, 1980 (syn. n.)
I. nigeriensis MULVEY & JENSEN, 1967
I. parabasidontus MULVEY & JENSEN, 1967
I. parageminus JIMÉNEZ-GUIRADO, 1994
I. pauli HEYNS & LAGERWEY, 1965
I. percivali CLARK, 1961
I. pseudodigonicus AHMAD & JAIRAJPURI, 1983
I. rapidulus SIDDIQI, 1984
I. recessus YEATES, 1992
I. rayongensis BUANGSUWON & JENSEN, 1966
I. rinae COETZEE, 1967
I. risoceiae CARVALHO, 1955
    Mononchus (Iotonchus) risoceiae CARVALHO, 1955
    Mononchus (Iotonchus) sp. apud CARVALHO, 1953
    Iotonchus carvalhoi ANDRÁSSY, 1958
I. rotundicaudatus PEÑA-SANTIAGO & JIMÉNEZ-GUIRADO, 1991
I. silvallus AHMAD & JAIRAJPURI, 1983
I. spinicaudatus COETZEE, 1967
I. stockdilli YEATES, 1988
I. tarjani MULVEY & JENSEN, 1967

I. tenuidentatus (KREIS, 1924) GOODEY, 1951
Mononchus tenuidentatus KREIS, 1924
Mononchus (Iotonchus) tenuidentatus KREIS, 1924 (GOODEY, 1951)
I. transkeiensis HEYNS & LAGERWEY, 1965
Iotonchus thailandensis BUANGSUWON & JENSEN, 1966 (syn. n.)
I. trichurus COBB, 1917
Mononchus (Iotonchus) trichurus COBB, 1917
I. vulvapapillatus ANDRÁSSY, 1964
I. zullinii MALCEVSCHI, 1981

Remarks

Iotonchus indicus JAIRAJPURI, 1969 and *Iotonchus tenuidentatus* (KREIS, 1924). — COOMANS and KHAN (1981) called the attention to the close resemblance of these species. I think that the nematode they described from Kenya under the name *"indicus"* was in the validity a *tenuicaudatus*. For *I. indicus* it is very characteristic that the tip of tail is regularly conical and sharply pointed as described by JAIRAJPURI (1969), KHAN and JAIRAJPURI (1980) and JAIRAJPURI and KHAN (1982) whereas that of *I. tenuicaudatus* is rounded as illustrated by KREIS (1924), MULVEY (1963), MULVEY and JENSEN (1967) and COOMANS and KHAN (1981).

Iotonchus khani MOHANDAS & PRABHOO, 1979. — It is hardly doubtful that this species is identical with *I. chantaburensis* BUANGSUWON & JENSEN, 1966. They agree both in morphology and measurements.

Iotonchus lacuplanarum YEATES, 1992. — It is very close to *I. baqrii* JAIRAJPURI, 1970 differing only by shorter spicula and narrower anterior body end from that.

Iotonchus laticupulatus RAZZHIVIN, 1971. — This species cannot be differenciated from *I. acutus* COBB, 1917.

Iotonchus prabhooi MOHANDAS, 1979. — MOHANDAS characterized his species as being very closely related to *I. basidontus* CLARK, 1961 and differring by the smaller body and the shorter tail from that. These values are, however, within the range of *basidontus;* body 1.4—1.7 mm, tail 200—250 µm in *prabhoi* — body 1.5—1.9 mm, tail 210—300 µm in *basidontus.* There is no reason to maintain *prabhooi* as a separate species.

Itonchus shafii KHAN & JAIRAJPURI, 1980. — This species corresponds entirely with *I. nayari* MOHANDAS & PRABHOO, 1979.

Iotonchus stockdilli YEATES, 1988. — Beside the type population YEATES found animals from an other locality as well which were unusually large (♀: 5.9 mm, ♂: 6.4 mm). It is questionable if they belonged to *stockdilli.*

Iotonchus thailandensis BUANGSUWON & JENSEN, 1966. — It agrees so completely with *I. transkeiensis* HEYNS & LAGERWEY, 1965 that it cannot be separated from that.

Iotonchus vulvapapillatus ANDRÁSSY, 1964. — MULVEY and JENSEN (1967) found a nematode in Nigeria they identified as *I. vulvapapillatus.* Those specimens were however much smaller than the true *vulvapapillatus* — only half as long as that — thus the identity of them is rather doubtful.

Key to species of Iotonchus

1 Female genital organ unpaired, prodelphic, or asymmetric, pseudo-prodelphic with rudimentary, non-functional posterior ovary 2
— Female genital organ paired, amphidelphic 18

2 Genital organ prodelphic, at most with a short postuterine sac 3
— Genital organ pseudo-prodelphic, with a posterior rudimentary ovary 16

3 Larger species, about 3 mm; buccal cavity 60 μm long or so 4
— Smaller species, 2 mm or shorter; buccal cavity 50 μm or shorter 5

4 Tail terminus swollen, bulbous. — ♀: L=2.9 mm; a=40; b=4.2; c=7.1; V=67%; c'=9. ♂ unknown. (Fiji Islands, United States [Virginia]) .... **gymnolaimus** (Cobb)
— Tail terminus cylindrical, not swollen. — ♀: L=2.8—3.5 mm; a=34—41; b=4.5—4.9; c=6.6—7.6; V=68—69%; c'=8. ♂ unknown. (India, Brazil, Hawaii) .... **consimilis** Cobb

5 Postvulval uterine sac present, 1—3 times as long as corresponding body width 6
— Postvulval uterine sac practically absent (conspicuously shorter than one body width) 10

6 Postvulval sac 2—3 times longer than body diameter 7
— Postvulval sac about equal with body diameter 8

7 Tail 360 μm, as long as 10—11 anal diameters, cylindrical in its posterior part. — ♀: L=2.1 mm; a=43; b=4.6; c=5.8; V=63%; c'=10—11. ♂ unknown. (New Caledonia) .... **recessus** Yeates
— Tail 200—230 μm, as long as 6 anal diameters, uniformly tapering to its tip. — ♀: L=1.6 mm; a=32—35; b=4.1—4.4; c=7.2—7.9; V=65—66%; c'=7. ♂: L=1.6 mm; a=31; b=4; c=8.3; PO: 9. (Ivory Coast) .... **lamottei** Malcevschi

8 Caudal glands and spinneret lacking; spicula bifurcated distally. — ♀: L=1.6—1.9 mm; a=25—35; b=3.9—4.6; c=10—13; V=68—72%; c'=4. ♂: L=1.4—1.7 mm; a=28—36; b=3.9—4.5; c=12—16; PO: 6—8. (Nigeria) .... **nigeriensis** Mulvey & Jensen
— Caudal glands conspicuous, spinneret present, subdorsal 9

9 Tail 5—6 anal diameters long; gubernaculum quite thin. — ♀: L=1.9—2.1 mm; a=29—34; b=3.8—4.7; c=9—12; V=71—75%, c'=5—6. ♂: L=2.0—2.3 mm; a=27—34; b=4.0—4.4; c=9—12; PO: 6—8. (Nigeria) .... **acuticaudatus** Mulvey & Jensen
— Tail 4 anal diameters long; gubernaculum swollen. — ♀: L=1.3—2.0 mm; a=26—36; b=3.8—4.7; c=9.6—13; V=69—76%; c'=4. ♂: L=1.3—2.0 mm; a=29—37; b=3.9—4.6; c=10—13; PO: 7—10. (Ivory Coast) .... **zullinii** Malcevschi

10 Tail filiform, 15—20 anal diameters long. — ♀: L=1.2—1.8 mm; a=28—46; b=3.5—5.4; c=3—5; V=52—65%; c'=15—20. ♂: L=1.7 mm; a=28; b=4.4; c=3.6; PO: 8—10. (India, Singapore, Mauritius, Nigeria, St. Lucia, Brazil, New Zealand, New Caledonia, Campbell Islands) .... **trichurus** Cobb
— Tail conoid to elongate, 4—10 (exceptionally 12) anal diameters long 11

11 Tip of tail swollen. — ♀: L=1.2—1.3 mm; a=29—31; b=3.7—4.2; c=5.5—6.0; V=61—64%; c'=6. ♂ unknown. (Singapore) .... **microdontus** Thong
— Tip of tail simple, not swollen 12

12 Small species, 0.8—1 mm; tail strongly curved, hook-like. — ♀: L=0.8—1.0 mm; a=24—32; b=3.5—4.5; c=3.8—6.0; V=59—65%; c'=6.0—7.5. ♂ unknown. (Thailand, Singapore) .... **chantaburensis** Buangsuwon & Jensen
— Larger species, 1.4—2 mm; tail simply curved, not hook-like 13

13 Tail short, as long as 4—5 anal body widths, spinneret terminal. — ♀: L=1.7 mm; a=30; b=3.7; c=13; V=68%; c'=4—5. ♂ unknown. (Thailand) .... **anisostomus** Buangsuwon & Jensen
— Tail longer, as long as 7—12 anal body widths, spinneret subventral 14

14 Buccal capsule twice as long as wide, conspicuously longer than labial width; lips high. — ♀: L=1.4—1.8 mm; a=27—36; b=3.9—4.3; c=4.8—5.6; V=62—65%; c'=7—12. ♂ unknown. (India) .... **silvallus** Ahmad & Jairajpuri
— Buccal capsule as long as or slightly longer than wide, about equal in length with labial width; lips low 15

15 Spicula 80—90 μm long; head broad, truncate. — ♀: L=1.5—1.7 mm; a=28—37; b=4.0—4.6; c=5.7—6.0; V=62—70%; c'=8—11. ♂: L=1.4—1.7 mm; a=31—35; b=4.3—4.8; c=5—7; PO: 9—10. (India) .... **baqrii** Jairajpuri
— Spicula 50—60 μm long; head markedly narrowed. — ♀: L=1.9—2.0 mm; a=36—39; b=4.6; c=6.1—6.3; V=63—64%; c'=10. ♂: L=1.8—2.1 mm; a=38—45; b=4.2—4.9; c=6.3—7.2; PO: 9—12. (New Caledonia) .... **lacuplanarum** Yeates

16 Body long, about 3 mm; tail as long as 8—9 anal diameters, with terminal pore; buccal cavity about 60 μm long. — ♀: L=2.9—3.3 mm; a=40—46; b=4.2—4.6; c=6.8—7.8; V=67—72%; c'=8—9. ♂ unknown. (Fiji Islands) .... **kirbyi** Siddiqi

— Body shorter, about 1.5—2 mm; tail as long as 11—18 anal diameters, with slightly subterminal pore; buccal cavity 30—40 μm long 17

17 Tail 330—370 μm, 11—12 anal diameters long; posterior gonad twice the body width. — ♀: L=1.4—1.6 mm; a=31—34; b=4.2—4.7; c=4.1—4.7; V=60—63%; c'=11—12. ♂: L=1.4—1.7 mm; a=33—41; b=4.4—4.7; c=4.6—5.1; PO: 6—8. (India) .... **pseudodigonicus** Ahmad & Jairajpuri

— Tail 430—540 μm, 13—18 anal diameters long; posterior gonad thrice the body width. — ♀: L=1.7—2.3 mm; a=41—51; b=4.2—5.1; c=3.9—4.4; V=55—66%; c'=13—18. ♂ unknown. (Fiji Islands) .... **rapidulus** Siddiqi

18 Tail broadly rounded, hemispheroid, shorter to slightly longer than anal diameter 19

— Tail conoid-arcuate or filiform, generally much longer than anal diameter 20

19 Head sharply set of by a constriction; body 2—3 mm long, very slender. — ♀: L=2.3—3.2 mm; a=45—63; b=5.9—7.7; c=55—108; V=62—69%; c'=0.8—1.4. ♂ unknown. (Spain) .... **rotundicaudatus** Peña-Santiago & Jiménez-Guirado

— Head slightly set off by a depression; body 4 mm long, less slender. — ♀: L=4.2 mm; a=38; b=4.9; c=86; V=69%; c'=0.7. ♂ unknown. (Hungary) .... **magyar** Andrássy

20 Tail unusually long, whip-like, 40—50 times anal diameter, thereupon vulva far ahead; large species, 3.3—4.2 mm. — ♀: L=3.6—4.2 mm; a=59—69; b=6.3—7.1; c=2.3—2.9; V=36—39%; c'=40—50. ♂: L=3.3 mm; a=53; b=6.2; c=27; PO: 12. (New Zealand) .... **maragnus** Clark

— Tail never so long, at most 25 times anal diameter, vulva at or behind mid-body 21

21 Body large, 6 mm, and slender; tail very long, about 25 anal diameters. — ♀: L=5.9 mm; a=71; b=5.0; c=3.8; V=51%; c'=25. ♂: L=6.1 mm; a=74; b=5.1; c=4.1; PO: 18. (New Zealand) .. **percivali** Clark

— Body at most 4.5 mm long but generally shorter, not so slender; tail maximal 15 anal diameters long 22

22 Caudal spinneret present 23

— Caudal spinneret absent 39

23 Tail 90—190 μm, 1.5—4 times as long as anal diameter 24

— Tail 200 μm or longer, 5—15 times as long as anal diameter 29

24 Tail as long as 1.5—2 anal diameters. — ♀: L=1.4—1.8 mm; a=20—23; b=3.2—3.7; c=23—28; V=72—75%; c'=1.5—2. ♂: L=1.6 mm; a=19—22; b=3.3—3.8; c=20—25; PO: 22. (Kirghizia) .... **kirghistanicus** Sultanalieva

— Tail as long as 3—4 anal diameters 25

25 Buccal cavity 50—65 μm long, very roomy, with convex walls; supplements 15—17 26

— Buccal cavity 30—40 μm long, less roomy, with parallel wells; supplements 9—14 27

26 Bigger species, 3.2—3.5 mm; tail uniformly tapering to its tip. — ♀: L=3.2 mm; a=33; b=4.8; c=17; V=65%; c'=3—4. ♂: L=3.5 mm; a=40; b=5.3; c=17; PO: 16. (United States: Virginia) .... **brachylaimus** Cobb

— Smaller species, 2.1—2.8 mm; tail almost cylindrical in its posterior half. — ♀: L=2.1—2.0 mm; a=24; b=4—5; c=10—15; V=61—68%; c'=3.5—4.0. ♂: L=2.6—2.8 mm; a=34—37; b=4—5; c=16—21; PO: 13—17. (South Africa) .... **litoralis** Coetzee

27 Head set off by a strong constriction; spinneret subterminal-subdorsal; vulval papillae absent. — ♀: L=1.8—2.4 mm; a=39—53; b=5.1—6.2; c=17—25; V=63—69%; c'=2.5—4.3. ♂: L=1.7—2.2 mm; a=35—52; b=5.1—6.1; c=24—32; PO: 9—13. (Spain) .... **parageminus** Jiménez-Guirado

— Head set off by a depression; spinneret terminal; vulval papillae present. 28

28 Tail more slender, in its posterior half — especially in male — nearly cylindrical. — ♀: L=1.4—1.9 mm; a=27—38; b=4—5; c=10—17; V=61—72%; c'=3.5—5. ♂: L=1.3—1.9 mm; a=28—40; b=4—5; c=15—19; PO: 9—12. (South Africa) ....**rinae** Coetzee

— Tail less slender, uniformly narrowing. — ♀: L=1.6—2.4 mm; a=25—37; b=3.9—4.7; c=12—17; V=64—68%; c'=(2, 5—) 3—4. ♂: L=1.7—2.0 mm; a=28—44; b=3.9—4.5; c=12—21; PO: 11—14. (South Africa, Argentina) .... **geminus** Heyns & Lagerwey

29 Tail filiform, 14—16 times as long as anal body width; vulval region with papillae. — ♀: L=3.8—4.3 mm; a=50—53; b=5.2—5.7; c=4.8—5.5; V=50—53%; c'=14—16. ♂: L=3.7—3.9 mm; a=48—62; b=4.9—5.1; c=6.1—6.8; PO: 10—11+2—4. (Kenya, Uganda, Nigeria) .... **vulvapapillatus** Andrássy
— Tail shorter, 5—10 times as long as anal body width; papillae predominantly lacking at vulval region 30

30 Spinneret conspicuously subterminal, subventral 31
— Spinneret regularly terminal 36

31 Tip of tail slightly but distinctly swollen. — ♀: L=2.0 mm; a=37; b=4.9; c=9.5; V=57%; c'=7—8. ♂ unknown. (Thailand) .... **rayongensis** Buangsuwon & Jensen
— Tip of tail not swollen (closely related species) 32

32 Tip of tail conical, sharply pointed; body 2 mm or shorter. — ♀: L=1.2—2.2 mm; a=21—39; b=4.0—4.8; c=5—8; V= 56—65%; c'=6—10. ♂ unknown. (India, St. Lucia, El Salvador) .... **indicus** Jairajpuri
— Tip of tail finely rounded; body 2 mm or longer (to 4 mm) 33

33 Buccal cavity (of female) about 70 µm long; male supplements 9—11. — ♀: L=2.5—3.4 mm; a=33—26; b=4.2—4.6; c=6.0—8.3; V=61—62%; c'= 7—8. ♂: L=2.1—2.9 mm; a=32—38; b=4.1—4.9; c=7—9; PO: 9—11. (India) .... **kherai** Mohandas & Prabhoo
— Buccal cavity (of female) about 50 µm long; male supplements 12—17 34

34 Larger species, 3.5—4 mm; tail 550 µm long. — ♀: L=3.5—3.8 mm; a=38—40; b=4.7—4.8; c=6.4—6.9; V=57—60%; c'=9—10. ♂: L=3.7 mm; a=43; b=4.7; c=8.4; PO: 12. (New Caledonia) .... **montanus** Yeates
— Smaller species, 2—3 mm; tail 450 µm or shorter 35

35 Buccal cavity comparatively narrow, nearly twice as long as wide. — ♀: L=1.9—2.7 mm; a=28—46; b=4—5; c=5—9; V=53—61%; c'=6—9. ♂: L=2.1—2.5 mm; a=30—42; b=4.4—5.0; c=8—10; PO: 12—17. (Nigeria, Kenya, United States, Suriname) .... **tenuidentatus** Kreis
— Buccal cavity spacious, hardly 1.5 times as long as wide. — ♀: L=2.3—2.9 mm; a=38—42; b=4.2—4.6; c=6.4—7.5; V=61—63%; c'=7.5—9. ♂: L=2.6—2.8 mm; a=38—43; b=4.3—4.5; c=7.1—8.6; PO: 12—16. (New Caledonia) .... **candelabri** Yeates

36 Body shorter than 2 mm. — ♀: L=1.4—1.9 mm; a=24—36; b=3.6—4.9; c=6.4—9.0; V=48—63%; c'=5—7. ♂: L=1.9 mm; a=30; b=3.8; c=8.6; PO: 14. (India, Thailand, Singapore, Ivory Coast, Colombia, New Zealand) .... **basidontus** Clark
— Body longer than 2 mm (to 4.3 mm) 37

37 Buccal cavity oblong, about twice as long as wide; advulval papillae present. — ♀: L=2.2—2.7 (—3.5) mm; a=27—50; b=4.0—4.9; c=6.0—10.5;V=56—66%; c'=6.5—9. ♂: L=2.0—2.4 (—3.1) mm; a=27—50; b=4.2—4.7; c=9—15; PO: 12—13+2. (India, Nigeria, South Africa) .... **parabasidontus** Mulvey & Jensen
— Buccal cavity very roomy, only 1.2—1.3 times as long as wide; advulval papillae rarely present .. 38

38 Body 3—4 mm long; tail 300—400 µm, as long as 6—8 anal diameters. — ♀: L=2.7—4.3 mm; a=30—37; b=4.2—4.9; c=8—11; V=59—64%; c'=6—8. ♂: L=3.1—3.7 mm; a=36—39; b=4.5—5.1; c=10—11; PO: 14—18. (Hungary, India, Mauritius, South Africa, Brazil, Hawaii) .... **risoceiae** Carvalho
— Body 2—3 mm long; tail 200—300 µm, as long as 4—6 anal diameters. — ♀: L=2.0—2.7 mm; a=27—40; b=4.0—4.6; c=8—14; V=60—70%; c'=4—6. ♂: L=2.0—2.6 mm; a=30—37; b=3.8—4.7; c=8—16; PO: 12—16. (India) .... **nayari** Mohandas & Prabhoo

39 Tail 3—5 anal diameters or 120—170 µm long 40
— Tail 7—15 anal diameters or 200—700 µm long (closely related species, not easy to separate them) 41

40 Vulval lips sclerotized; supplement 9—12. — ♀: L=1.6—2.4 mm; a=22—40; b=4.4—6.0; c=11—16; V=61—66%; c'=3—5. ♂: L=1.4—1.9 mm; a=28—40; b=4.4—5.5; c=13—16; PO: 9—12. (Kazakhstan, South Africa, United States [California, Virginia]) .... **acutus** Cobb
— Vulval lips not sclerotized; supplements 8—9. — ♀: L=1.3—1.5 mm; a=35—42; b=4.8—5.1; c=8.4—9.3; V=59—63%; c'=5. ♂: L=1.3—1.4 mm; a=38—45; b=4.6—5.1; c=10—11; PO: 8—9. (South Africa) .... **pauli** Heyns & Lagerwey

41 Tail length between 420 and 690 μm 42
— Tail length between 210 and 420 μm 44

42 Body 1.7—2.2 mm; buccal cavity oblong, nearly twice as long as wide. — ♀: L=1.7—2.2 mm; a=27—41; b=4.4—5.0; c=3.3—4.0; V=47—51%; c'=15. ♂: L=1.6—1.7 mm; a=34—39; b=4.3—4.4; c=4; PO: 11+1. (Nigeria) .... **tarjani** MULVEY & JENSEN
— Body 2.5 to 4.2 mm; buccal cavity roomy, 1.2—1.5 times as long as wide 43

43 Tip of female tail somewhat swollen then conoid, tail as long as 7—10 anal body widths. — ♀: L=3.2—4.2 mm; a=41—49; b=5.2—5.7; c=7—9; V=58—73%; c'=7—10. ♂: L=3.2—3.7 mm; a=45—54; b=5—6; c=8—9; PO: 11—12. (New Zealand) .... **stockdilli** YEATES
— Tip of female tail not swollen, cylindrical then finely rounded, tail as long as 9—15 anal body widths. — ♀: L=2.5—3.5 mm; a=32—44; b=4.2—5.1; c=4.3—6.6; V=55—60%; c'=9—15. ♂: L=2.1—3.7 mm; a=33—47; b=4.3—5.1; c=4.9—6.7; PO: 11—13. (Romania) .... **carpathicus** POPOVICI

44 Buccal cavity elongate, distinctly longer (about 1.5 times) than labial width; tail cylindroid in posterior half. — ♀: L=1.7—2.0 mm; a=28—34; b=3.9—5.2;c=4.6—5.9; V=52—59%; c'=9—10. ♂ unknown. (Nigeria) .... **clarki** MULVEY & JENSEN
— Buccal cavity barrel-shaped, roomy, as long as labial width; tail uniformly tapering 45

45 Body 2.2—3 mm; tail 10—12 anal diameters long. — ♀: L=2.2—3.0 mm; a=33—42; b=5—6; c=6—10; V=62—66%; c'=10—12. ♂: L=1.3—2.5 mm; a=36—42; b=5—6; c=9—13; PO: 13—14. (South Africa) .... **spinicaudatus** COETZEE
— Body 1.5—2 mm; tail 7—9 anal diameters long 46

46 Posterior ovary much smaller than anterior. — ♀: L=1.9—2.4 mm; a=34—42; b=4.3—5.1; c=7.3—8.6; V=61—68%; c'=7—9.5. ♂ unknown. (South Africa) .... **loteniae** DE BRUIN & HEYNS
— Both ovaries about equal in length. — ♀: L=1.5—1.7 mm; a=28—48; b=3.7—5.7; c=6—8; V=58—66%; c'=7—8. ♂ unknown. (India, Thailand, South Africa) .... **transkeiensis** HEYNS & LAGERWEY

Genus ***Hadronchus*** MULVEY & JENSEN, 1967

Anatonchidae, Iotonchinae. Body 1.5—2.2 mm long. Cuticle smooth. Buccal cavity roomy, broad on its both ends, as long as, or somewhat longer than labial width. Dorsal tooth well developed, in anterior half (in 30—40%) of stoma. Opposed by two denticulate or serrate ridges occupying almost entire length of subventral walls. Posterior end of oesophagus tuberculate. Female genital system prodelphic, with or without posterior uterine branch. Vulva in 61—69% of body length. Spicula arched. Supplements 8—10 in number. Tails in both sexes similar, conoid-arcuate, 4—6 times as long as anal body width. Caudal glands and spinneret reduced.

Type species: *Hadronchus bisexualis* MULVEY & JENSEN, 1967.

The genus is distinctive because of the anterior position of the dorsal tooth, the presence of long subventral serrate ridges, the monodelphic female, the short tail and lacking spinneret.

Terrestrial nematodes known in Africa.

Two species:

H. bisexualis MULVEY & JENSEN, 1967
H. monohystera MULVEY & JENSEN, 1967

Key to species of Hadronchus

1 Posterior uterine sac present; tail as long as 4 anal diameters; subventral denticles small. — ♀: L=1.6—2.2 mm; a=27—35; b=3.7—4.1; c=12—17; V=61—65%; c'=4. ♂: L=1.5—1.9 mm; a=33—40; b=3.7—4.1; c=16—24; PO: 8—10. (Nigeria) .... **bisexualis** MULVEY & JENSEN
— Posterior uterine sac absent; tail as long as 6 anal diameters; subventral denticles comparatively large. — ♀: L=1.6—1.9 mm; a=34—40; b=3.6—3.9; c=9—10; V=64—69%; c'=6. ♂ unknown. (Nigeria) .... **monohystera** MULVEY & JENSEN

Genus *Parahadronchus* MULVEY, 1978

Anatonchidae, Iotonchinae. Body 1.9—3.3 mm long. Cuticle smooth. Buccal cavity large, barrel-shaped, as long as, or longer than labial diameter. Dorsal tooth large, located in posterior half of stoma; opposed by two or four short longitudinal ridges bearing small denticles, 2—8 each, located also in posterior part of stoma. Oesophago-intestinal junction tuberculate. Female reproductive apparatus didelphic or mono-prodelphic. Vulva in 54—75% of body length. Spicula comparatively slender and arcuate. Male with 10—13 supplements. Tails of both sexes similar, elongate to filiform, as long as 6 to 18 anal diameters. Caudal glands and spinneret present or absent.

Type species: *Hadronchus andamanicus* JAIRAJPURI, 1969 = *Parahadronchus andamanicus* (JAIRAJPURI, 1969) MULVEY, 1978.

The genus is closely allied to *Hadronchus* MULVEY & JENSEN, 1967 but differs from that by the posterior location of the dorsal tooth and the subventral ridges, the restricted number of denticles and the longer tail.

Terricolous animals occurring in Asia.

Six species*:

P. andamanicus (JAIRAJPURI, 1969) MULVEY, 1978
  Hadronchus andamanicus JAIRAJPURI, 1969
P. diphuensis (PHUKAN & SANWAL, 1981) comb. n.
  Hadronchus diphuensis PHUKAN & SANWAL, 1981
P. egregius sp. n.
P. shakili (JAIRAJPURI, 1969) MULVEY, 1978
  Hadronchus shakili JAIRAJPURI, 1969
  Hadronchus karangensis PHUKAN & SANWAL, 1981 (syn. n.)
P. subhonicus DHANACHAND, RENUBALA & MOHILAL, 1991
P. yuenae (THONG, 1971) MULVEY, 1978
  Hadronchus yuenae THONG, 1971

Remarks

Hadronchus karangensis PHUKAN & SANWAL, 1981. — According to the original description this species differs from *Parahadronchus shakili* (JAIRAJPURI, 1969) by the somewhat longer tail (and by the slender body and more anterior postion of vulva — being consequence of the longer tail). JAIRAJPURI and KHAN (1982) as well as BAQRI (1991) presented further specimens of *shakili* showing an intermediate position both in tail length and location of vulva. I think it correct if we regard *shakili* and *karangensis* as one and the same species.

Key to species of Parahadronchus

1 Female prodelphic 2
— Female amphidelphic 4

2 Postuterine sac absent; tail 590—660 μm long. — ♀: L=2.3—2.9 mm; a=35—41; b=4.2—4.7; c=3.9—4.7; V=56—62%; c'=12—13. ♂ unknown. (Singapore) .... **yuenae** (THONG)
— Postuterine sac present, 2—3 times the body width; tail 410—500 μm long 3

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* RENUBALA and DHANACHAND recently (1992) described two further species: *P. marami* and *P. siroii* from India, but their paper was not attainable.

3 Buccal cavity 60—80 μm long, roomy; caudal spinneret terminal. — ♀: L=2.2—3.2 mm; a=30—41; b=3.7—4.4; c=5—13; V=64—75%; c'=8—10. ♂: L=2.2—2.8 mm; a=32—42; b=4.0—4.4; c=6—8; PO: 12—13. (India) .... **andamanicus** JAIRAJPURI

— Buccal cavity 50 μm long, less roomy; caudal spinneret subdorsal. — ♀: L=2.8 mm; a=38; b=4.7; c=5.7; V=67%; c'=8—9. ♂: L=2.2—2.5 mm; a=36—39; b=4.2—4.9; c=6.6—7.1; PO: 12—13. (India) .... **subhonicus** DHANACHAND, RENUBALA & MOHILAL

4 Subventral denticles arranged along four ridges; caudal spinneret lacking. — ♀: L=2.5 mm; a=42; B=4.5; c=4.2; V=54%; c'=18. ♂ unknown. (Vietnam) .... **egregius** sp. n.

— Subventral denticles arranged along two ridges; caudal spinneret present 5

5 Apex of dorsal tooth at 60—70% of buccal length; subventral ridges with 2—3 denticles each; spicula 65—70μm long. — ♀: L=1.9—2.2 mm; a=34—38; b=4.2—4.7; c=4.9—5.3; V=56—59%; c'=10—12. ♂: L=1.9—2.2 mm; a=36—40; b=4.4—4.8; c=5—6; PO: 10—11. (India) .... **diphuensis** (PHUKAN & SANWAL)

— Apex of dorsal tooth at 50—60% of buccal length; subventral ridges with 3—6 denticles each; spicula 80—95 μm long. — ♀: L=2.3—3.3 mm; a=32—47; b=4.2—4.9; c=5.5—11; V=56—70%; c'=6—11. ♂: L=2.0—2.8 mm; a=28—44; b=3.4—4.6; c=6.6—13; PO: 11—13. (India) .... **shakili** (JAIRAJPURI)

Genus *Prionchulellus* MULVEY & JENSEN, 1967

Anatonchidae, Iotonchinae. Small nematodes, 0.9—1.4 mm. Cuticle smooth. Buccal cavity barrel-shaped, dorsal tooth in anterior third of it, opposed by two denticulate ribs occupying the anterior two-third of stoma and terminating distal in a hook-like loop. Oesophago-cardial junction tuberculate. Vulva at mid-body, female mono-prodelphic. Male unknown. Tail elongate, as long as 6 anal body diameters, without glands and spinnerets.

Type species: *Prionchulellus cavenessi* MULVEY & JENSEN, 1967.

The genus resembles *Hadronchus* MULVEY & JENSEN, 1967 but the hooked anterior ends of the subventral ribs easily distinguish it from *Hadronchus*.

Soil inhabiting animals occurring in Africa.

One species:

P. cavenessi MULVEY & JENSEN, 1967

— ♀: L=0.9—1.4 mm; a=18—27; b=3.7—4.6; c=6.1—7.7; V=49—56%; c'=6. ♂ unknown. (Nigeria) .... **cavenessi** MULVEY & JENSEN

Genus *Prionchuloides* MULVEY, 1963

Anatonchidae, Iotonchinae. Body close to 2 mm. Cuticle smooth. Buccal cavity very spacious, dorsal tooth midway in it. Each subventral wall bearing a finely denticulated longitudinal rib and a number of minute, irregularly dispersed denticles. Oesophago-intestinal junction most probably tuberculate. Female amphidelphic, vulva posterior to mid-body. Male unknown. Tail conoid-arcuate, without glands and terminal spinneret.

Type species: *Mononchus (Sporonchulus) micoletzkyi* MEYL, 1954 = *Prionchuloides micoletzkyi* (MEYL, 1954) MULVEY, 1963.

Prionchuloides is characterized by the combination of two types of subventral denticles, one arranged along longitudinal ribs, the other irregularly scattered. The original description of MEYL is rather laconic, it says nothing about the nature of the oesophago-intestinal junction. Due to the very roomy buccal capsule we may suppose that *Prionchuloides* belongs rather to the family Anatonchidae than Mononchidae.

Terrestrial, known from Europe.

One species:

P. micoletzkyi (MEYL, 1954) MULVEY, 1963
Mononchus (Sporonchulus) micoletzkyi MEYL, 1954
Judonchulus micoletzkyi (MEYL, 1954) ANDRÁSSY, 1958

— ♀: L=1.7 mm; a=22; b=4; c=14; V=62%; c'=?. ♂ unknown. (Italy) .... **micoletzkyi** (MEYL)

Genus *Hadronchoides* JAIRAJPURI & RAHMAN, 1984

Anatonchidae, Iotonchinae. Small nematodes, hardly longer than 1 mm. Cuticle smooth. Buccal cavity moderately roomy. Dorsal tooth large, sharply pointed, located in anterior in anterior half of buccal cavity. Subventral walls armed with numerous small denticles gradually decreasing in number posteriorly. Oesophageal terminus of tuberculate type. Female prodelphic with long postuterine sac. Vulva post-equatorial. Male unknown. Tail filiform, 15—20 times anal body width. Caudal glands present, spinneret terminal.

Type species: *Hadronchoides microdenticulatus* JAIRAJPURI & RAHMAN, 1984.

The genus is distinctive because of the anteriorly located dorsal tooth and the several minute denticles occupying the majority of stomatal length. It differs from *Hadronchulus* RAY & DAS, 1983, its closest relative, by the position of the dorsal tooth and the denticles, moreover by the monodelphic female genital organ.

Soil inhabitants, distributed in Asia.

One species:

H. microdenticulatus JAIRAJPURI & RAHMAN, 1984

— ♀: L=1.1—1.2 mm; a=39—41; b=4.8—4.9; c=2.8—3.8; V=52—60%; c'=15—21. ♂ unknown. (India) .... **microdenticulatus** JAIRAJPURI & RAHMAN

Genus *Hadronchulus* RAY & DAS, 1983

Morenchus DHANACHAND, RENUBALA & MOHILAL, 1991 (syn. n.)

Anatonchidae, Iotonchinae. Body 1.8—3.2 mm long. Cuticle smooth. Buccal cavity moderately large. Dorsal tooth massive, in posterior part of stoma. Facing to it, subventral walls bearing minute denticles arranged in majority on the posterior walls. Oesophago-cardial junction tuberculate. Female amphidelphic but posterior gonad occasionally less developed than anterior. Vulva located in 50—70% of body length. Spicula arcuate, supplements 10—13 in number. Tails of both sexes similar, elongate-conoid to filiform, as long as 4 to 20 anal diameters. Caudal glands and spinneret present.

Type species: *Hadronchulus shamimi* RAY & DAS, 1983.

Closely related to *Hadronchoides* JAIRAJPURI & RAHMAN, 1984 but the dorsal tooth lies posteriad in the buccal cavity and the small denticles are facing to it; furthermore the female genital organ is didelphic. The recently described genus *Morenchus* DHANACHAND, RENUBALA & MOHILAL, 1991 is so close to *Hadronchulus* that I do not think it is real to separate them from each other. The only difference is that the subventral denticles in *Morenchus* are less in number.

Terrestrial animals known in Asia.

Three species:

H. denticulus (DHANACHAND, RENUBALA & MOHILAL, 1991) comb. n.
Morenchus denticulus DHANACHAND, RENUBALA & MOHILAL, 1991

H. grandis (Patil & Khan, 1982) comb. n.
Sporonchulus grandis Patil & Khan, 1982
H. shamimi Ray & Das, 1983

Remarks

Iotonchus similis (Cobb, 1893). — Cobb described this species without any illustration. It has a dorsal tooth at the base of the buccal cavity and sevaral small denticles like those of a file. Maybe this species belongs to *Hadronchulus* but owing to the meagre description it is better to regard it as a species incertae sedis.

Key to species of Hadronchulus

1 Subventral denticles reduced in number and forming a wavy pattern. — ♀: L=2.7—3.1 mm; a=48—61; b=4.9—5.3; c=3.5—5.0; V=51—53%; c'=15—21. ♂: L=3.0—3.2 mm; a=46, b=4.7—5.0; c=4.4—4.5; PO: 10—13. (India) .... **denticulus** (Dhanachand, Renubala & Mohilal)
— Subventral denticles very numerous, rasp-like 2

2 Tail 4 anal diameters or 110—155 µm long; both ovaries equally developed. — ♀: L=2.0—2.2 mm; a=31—37; b=3.6—4.0; c=14—18; V=67—70%; c'=3.5—4.5. ♂: L=1.85 mm; a=39; b=3.6; c=18; PO: 12. (India) .... **grandis** (Patil & Khan)
— Tail 15—20 anal diameters or 480 µm long; posterior ovary less developed than anterior. — ♀: L=2.6—2.8 mm; a=39—44; b=4.5—4.7; c=5.8—6.3; V=62—68%; c'=14—15. ♂: L=2.4—2.7 mm; a=42—46; b=4.5—4.7; c=6.6—7.6; PO: 10—13. (India) .... **shamimi** Ray & Das

Subfamily MICONCHINAE Andrássy, 1976

Anatonchidae. Buccal cavity roomy. Dorsal tooth located in anterior or posterior part of stoma and pointed forward. Subventral walls also with teeth equal in shape with dorsal tooth or somewhat smaller, arranged in one pair or two pairs and located anteriorly and/or posteriorly in buccal cavity (Fig. 3).

Five genera (with 32 species); in alphabetic order:

Crassibucca Mulvey & Jensen, 1967
Doronchus gen. n.
Miconchus Andrássy, 1958
Miconchoides Jairajpuri & Khan, 1982
Paracrassibucca Baqri & Jairajpuri, 1974
Promiconchus Jairajpuri & Khan, 1982

Key to genera of Miconchinae

1 Buccal cavity with one dorsal tooth and two subventral teeth 2
— Buccal cavity with one dorsal tooth and four subventral teeth 4

2 Dorsal tooth in anterior, subventral teeth in posterior part of buccal cavity .... **Promiconchus** Jairajpuri & Khan
— All teeth in posterior part of buccal cavity, levelling with each other 3

3 Tail showing sexual dimorphism: in female elongate-conoid with sharp tip, in male much shorter and plumper, with bluntly rounded tip .... **Doronchus** gen. n.
— Tail without sexual dimorphism, similar in both sexes .... **Miconchus** Andrássy

4 Dorsal tooth anterior, one pair of subventral teeth levelling with it, the other pair located posterior in buccal cavity; female prodelphic .... **Crassibucca** Mulvey & Jensen
— Dorsal tooth anterior, both pairs of subventral teeth located posterior in buccal cavity; female amphidelphic .... **Paracrassibucca** Baqri & Jairajpuri

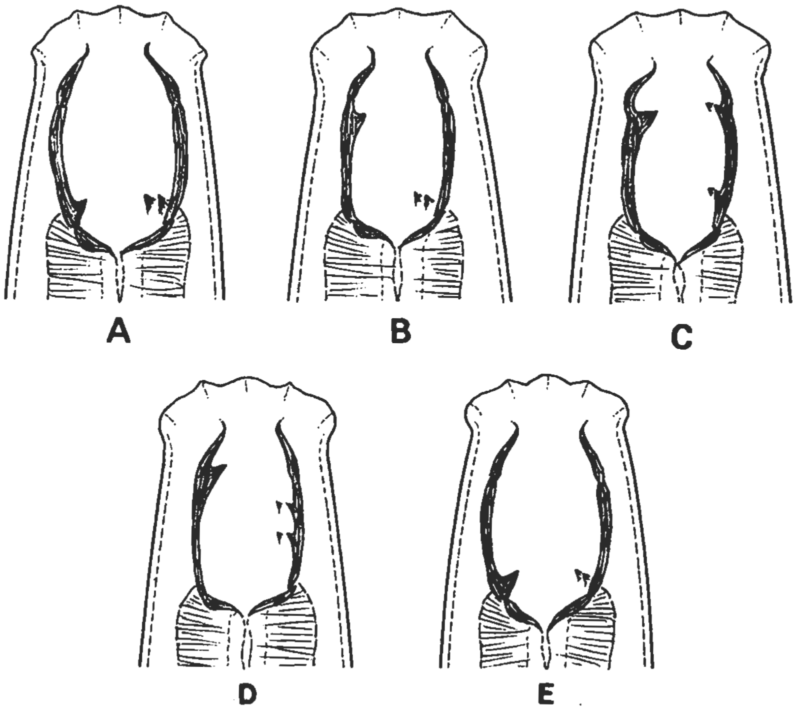

Fig. 3. Buccal cavities in the family Anatonchidae. A—E: Genera of the subfamily Miconchinae; A: *Miconchus*, B: *Promiconchus*, C: *Crassibucca*, D: *Paracrassibucca*, E: *Doronchus*

Genus *Miconchus* ANDRÁSSY, 1958

Miconchoides JAIRAJPURI & KHAN, 1982.

Anatonchidae, Miconchinae. Body length varying between 1 and 7 mm, but generally 2—3 mm long. Cuticle smooth. Buccal cavity roomy, armed with three teeth — one dorsal and two subventral — equal in shape and location, lying in posterior half of stoma. Other denticles or ridges lacking. Oesophago-intestinal valve tuberculate. Female predominantly didelphic, rarely monodelphic: prodelphic or pseudo-prodelphic. Position of vulva varying between 49 and 79%. Males known in two-third of species. Spicula arcuate, with lateral guiding pieces. Copulatory supplements 9 to 24. Tails of both sexes equal in shape, more or less conoid, occasionally filiform, with pointed or rounded tip, 2 to 25 times as long as anal body width. Caudal glands and spinneret either well developed or reduced.

Type species: *Mononchus digiturus* COBB, 1893 = *Miconchus digiturus* (COBB, 1893) ANDRÁSSY, 1958.

The genus is well characterized in having three equal teeth levelling with each other and located in the posterior part of stoma. JAIRAJPURI and KHAN (1982) separated one species — *Miconchus studeri* (STEINER, 1914) — from the other and suggested a new genus, *Miconchoides*, for it. They characterized *Miconchoides* in having a very small teeth behind each "normal" teeth. KHAN and COOMANS (1980) demonstrated, however, that those tiny secondary teeth occur generally in juvenile stages only, it is not judged therefore to separate *studeri* from the other representatives of

Miconchus in generic level. On this account JIMÉNEZ-GUIRADO, PEÑA-SANTIAGO and CASTILLO-CASTILLO (1993) synonymized *Miconchoides* with *Miconchus*.

The species of *Miconchus* prefer terrestrial habitats, and are distributed over the globe. In Europe 7, Asia 9, Africa 6, North America 11, South America 2 and Australia 2 species occur. The most abundant of them is *Miconchus studeri* recorded from 14 countries.

Twenty-three species:

M. aquaticus KHAN, AHMAD & JAIRAJPURI, 1978
M. californicus MULVEY, 1962
M. citri KHAN, AHMAD & JAIRAJPURI, 1978
M. crenicaudatus GAGARIN, 1984
M. dalhousiensis JAIRAJPURI, 1969
M. digiturus (COBB, 1893) ANDRÁSSY, 1958
  Mononchus digiturus COBB, 1893
  Mononchus (Iotonchus) digiturus COBB, 1893 (COBB, 1916)
  Iotonchus digiturus (COBB, 1983) COBB, 1916
M. effilatus (SCHUURMANS STEKHOVEN & TEUNISSEN, 1938) ANDRÁSSY, 1958
  Mononchus effilatus SCHUURMANS STEKHOVEN & TEUNISSEN, 1938
  Mononchus (Iotonchus) effilatus SCHUURMANS STEKHOVEN & TEUNISSEN, 1938 (GOODEY, 1951)
M. elegans LAL & KHAN, 1988
M. eurinus EROSHENKO, 1975
M. exilis (COBB, 1917) ANDRÁSSY, 1958
  Mononchus exilis COBB, 1917
M. fasciatus (COBB, 1917) ANDRÁSSY, 1958
  Mononchus (Iotonchus) fasciatus COBB, 1917
  Iotonchus fasciatus COBB, 1917
M. hopperi MULVEY, 1962
M. kansasensis MULVEY & DICKERSON, 1970
M. longicaudatus JIMÉNEZ-GUIRADO, PEÑA-SANTIAGO & CASTILLO-CASTILLO, 1993
M. oregensis JENSEN & MULVEY, 1958
M. pararapax MULVEY & JENSEN, 1967
M. rapax (COBB, 1917) ANDRÁSSY, 1958
  Mononchus (Iotonchus) rapax COBB, 1917
  Iotonchus rapax COBB, 1917
M. regius (COBB, 1917) ANDRÁSSY, 1958
  Mononchus (Iotonchus) regius COBB, 1917
  Iotonchus regius COBB, 1917
M. rex (COBB, 1904) ANDRÁSSY, 1958
  Mononchus rex COBB, 1904
  Mononchus (Iotonchus) rex COBB, 1904 (COBB, 1917)
  Iotonchus rex (COB, 1904) COBB, 1917
M. schneideri (MEYL, 1955) ANDRÁSSY, 1958
  Iotonchus schneideri MEYL, 1955
M. studeri (STEINER, 1914) ANDRÁSSY, 1958
  Mononchus studeri STEINER, 1914
  Mononchus (Iotonchus) studeri STEINER, 1914 (COBB, 1916)
  Iotonchus studeri (STEINER, 1914) COBB, 1916
  Mononchus (Anatonchus) studeri STEINER, 1914 (COBB, 1916)
  Miconchoides studeri (STEINER, 1914) JAIRAJPURI & KHAN, 1982
M. thornei MULVEY & JENSEN, 1967
M. triodontus BUANGSUWON & JENSEN, 1966

Remarks

Miconchus crenicaudatus GAGARIN, 1985. — Possibly identical with *M. eurinus* EROSHENKO, 1975, differing in the shape of tail tip from that.

Key to species of Miconchus

1 Female monodelphic or pseudo-monodelphic (posterior ovary present but strongly reduced) 2
— Female didelphic 3

2 Female monodelphic, posterior uterine sac about as long as corresponding body width; apex of dorsal tooth in posterior third of buccal cavity. — ♀: L=1.4—1.9 mm; a=22—39; b=3.7—5.2; c=12—19; V=70—79%; c'=3—4. ♂: L=1.5—1.7 mm; a=36—37; b=3.5—4.4; c=13—18; PO: 12—17. (Yugoslavia, India, Fiji Islands, United States [Oregon], St. Lucia, Colombia, Venezuela) .... **digiturus** (COBB)
— Female pseudo-monodelphic, posterior genital branch as long as two corresponding body widths; apex of dorsal tooth midway in buccal cavity. — ♀: L=1.6—1.8 mm; a=27—33; b=3.6—4.3; c=12—15; V=68—74%; c'=3. ♂: L=1.8 mm; a=35; b=4; c=16; PO:15. (Thailand) .... **triodontus** BUANGSUWON & JENSEN
3 Teeth basal in position, originating at the very end of the interlateralia (lateral walls) 4
— Teeth suprabasal in position or farther forward, to midway in buccal cavity, conspicuously originating before the proximal ends of the interlateralia (lateral walls) 10

4 Tail filiform, 15—25 anal diameters long. — ♀: L=2.5—3.3 mm; a=45—62; b=5.2—5.9; c=3.2—4.5; V=49—58%; c'=15—25. ♂: L=2.3—2.9 mm; a=30—49; b=5.0—5.6; c=3.4—4.4; PO: 10—14. (Spain) .... **longicaudatus** JIMÉNEZ-GUIRADO, PEÑA-SANTIAGO & CASTILLO-CASTILLO
— Tail conoid to elongate, not filiform, 2—8 anal diameters long 5

5 Tail 7—8 anal diameters long 6
— Tail 2—5 anal diameters long 7

6 Body very large, near 5 mm, slender. — ♀: L=4.8 mm; a=59; b=4.6; c=8.9; V=68%; c'=8. ♂ unknown. (Lake Tanganyika, Brazil) .... **schneideri** (MEYL)
— Body much smaller, about 1 mm, plump. — ♀ unknown. ♂: L=1.1 mm; a=18; b=3; c=4.8; PO: 10. (Zaire) .... **effilatus** (SCHUURMANS STEKHOVEN & TEUNISSEN)

7 Caudal spinneret present. — ♀: L=1.4—2.2 mm; a=24—38; b=3.6—4.6; c=12—20; V=60—70%; c'=2—4. ♂: L=1.4—2.0 mm; a=25—32; b=3.7—4.2; c=14—21; PO: 11—20. (Holland, Germany, Great Britain, Switzerland, Poland, Austria, Slovakia, Romania, Spain, France, Italy, Mauritius, United States [California], El Salvador) .... **studeri** (STEINER)
— Caudal spinneret absent 8

8 Large species, about 3 mm. — ♀: L=3.2 mm; a=40; b=5; c=40; V=62%; c'=4. ♂: L=2.8 mm; a=43; b=5; c=23; PO: 11. (United States: Oregon) .... **oregensis** JENSEN & MULVEY
— Smaller species, 1.5—2 mm 9

9 Tail plump, 2.5—3 times anal body width; buccal teeth strong. — ♀: L=1.8—2.0 mm; a=21—31; b=3.6—4.0; c=13—18; V=68—73%; c'=2.5—3.5. ♂ unknown. (India) .... **citri** KHAN, AHMAD & JAIRAJPURI
— Tail slenderer, 5—5.5 times anal body width; buccal teeth small. — ♀: L=1.5—1.6 mm; a=21—24; b=3.8—4.2; c=9—10; V=61—64%; c'=5—5.5. ♂ unknown. (India) .... **elegans** LAL & KHAN

10 Apices of teeth midway in buccal cavity; tail always short, 2—3 times anal body width 11
— Apices of teeth in 60—70% of buccal cavity; tail varying in length 14

11 Body large, 3—4 mm; male supplements 21—24 12
— Body smaller, 1.5—2 mm; male supplements 14—15 13

12 Tail sharply pointed on tip. — ♀: L=2.7—2.9 mm; a=23; b=3.6—4.2; c=18—22; V=70—72%; c'=2.2—2.5. ♂: L=2.8—3.1 mm; a=23—25; b=3.6—4.2; c=18—23; PO: 21—23. (Russia) .... **crenicauda** GAGARIN
— Tail rounded on tip. — ♀: L=3.9 mm; a=32; b=4; c=21; V=70%; c'=2. ♂: L=3.4 mm; a=28; b=4.4; c=26; PO: 24. (Russia: Far East) .... **eurinus** EROSHENKO

13 Tail short, c=56. — ♀: L=2.0 mm; a=43; b=3.7; c=56; V=78%; c'=1.8. ♂: L=2.0 mm; a=45; b=4.2; c=50; PO: 14. (Romania, Georgia, Australia) .... **exilis** (Cobb)
— Tail longer, c=15—18. — ♀: L=1.4—1.6 mm; a=25—31; b=3.6—3.9; c=15—18; V=70—72%; c'=3. ♂: L=1.5—1.6 mm; a=29—31; b=3.4—4.0; c=18—20; PO: 14—15. (United States: Kansas) .... **kansasensis** Mulvey &Dickerson

14 Very big species, 6—7 mm 15
— Smaller species, 2—3.5 mm 16

15 Tail 1200—1300 µm, 13 anal diameters long. — ♀: L=6.5—7.0 mm; a=45; b=5; c=5.3; V=58%; c'=13. ♂: L=6.5—7.0 mm; a=43; b=5; c=7.1; PO: 17. (New Zealand) .... **rex** (Cobb)
— Tail 600 µm, 7 anal diameters long. — ♀: L=6.2 mm; a=43; b=5.9; c=10; V=63%; c'=7. ♂ unknown. (United States: Virginia) .... **regius** (Cobb)

16 Tail with spinneret 17
— Tail without spinneret 20

17 Body about 4 mm long. — ♀: L=3.7 mm; a=38; b=4.7; c=10; V=61%; c=6. ♂ unknown. (Poland?, United States [Virginia]) .... **rapax** (Cobb)
— Body 2—3 mm long 18

18 Advulval papillae, especially anterior to vulva, present; tail 2.5—3 anal diameters long. — ♀: L=1.9—2.8 mm; a=24—37; b=3.7—4.6; c=15—21; V=66—73%; c'=2.5—3. ♂: L=1.4—2.5 mm; a=26—40; b=3.9—4.6; c=17—20; PO: 17—21. (Romania, India) .... **aquaticus** Khan, Ahmad & Jairajpuri
— Advulval papillae absent; tail 4—10 anal diameters long 19

19 Tail slender, 300—500 µm, as long as 8—10 anal diameters. — ♀: L=2.2—2.9 mm; a=35—51; b=3.6—5.1; c=5.2—7.9; V=58—65%; c'=8—10. ♂: L=2.7—2.8 mm; a=49—54; b=4.4—4.8; c=6.7—8.4; PO: 12—13. (Ivory Coast, Nigeria, United States [California]) .... **pararapax** Mulvey & Jensen
— Tails stout, 150—250 µm, as long as 4—6 anal diameters. — ♀: L=2.0—2.6 mm; a=25—37; b=3.6—4.0; c=9—19; V=63—68%; c'=4—6. ♂: L=2.0—2.4 mm; a=36—40; b=4.3—4.5; c=22—25; PO: 15. (Egypt, Nigeria, St. Lucia, El Salvador, Cuba) .... **thornei** Mulvey & Jensen

20 Buccal capsule comparatively slender, about twice as long as wide; apices of teeth about in 60% of buccal length 21
— Buccal capsule broad, about 1.5 times as long as wide; apices of teeth about in 70% of buccal length 22

21 Teeth unusually small; tail of 5 anal diameters. — ♀: L=2.1—2.4 mm; a=36—42; b=5.5—6.0; c=7.8—10; V=60—66%; c'=5—5.5. ♂ unknown. (United States: Florida) .... **fasciatus** (Cobb)
— Teeth normally developed; tail of 7—9 anal diameters. — ♀: L=2.2—3.3 mm; a=34—57; b=4.2—6.0; c=6.9—9.7; V=60—66%; c'=7—9. ♂: L=2.3—2.9 mm; a=33—45; b=4.4—5.7; c=8—14; PO: (9—) 14—15. (Romania, United States [Florida]) .... **hopperi** Mulvey

22 Teeth small, less projecting; tail 140—160 µm long. — ♀: L=1.9—2.3 mm; a=28—31; b=3.5—4.0; c=12—14; V=63—68%; c'=3.5—4. ♂ unknown. (India) .... **dalhousiensis** Jairajpuri
— Teeth large, well projecting; tail 190—350 µm long. — ♀: L=2.4—3.2 mm; a=31—51; b=4.5—5.9; c=7.4—14; V=59—70%; c'=4.5—6.0. ♂: L=2.2—3.1 mm; a=43—49; b=5.3—5.9; c=15—21; PO: 15. (Egypt, United States [California, Oregon]) .... **californicus** Mulvey

Genus ***Promiconchus*** Jairajpuri & Khan, 1982

Anatonchidae, Miconchinae. Body of medium length, 1.3—1.9 mm. Cuticle smooth. Buccal cavity barrel-shaped, spacious, armed with three teeth. Dorsal tooth located in anterior third/fourth of stoma, rather weak, less stronger than subventral teeth. These latter located in posterior third/fourth of buccal capsule. Oesophago-cardial valve tuberculate. Female mono-prodelphic, vulva in 63—70% of body length. Spicula arcuate, accessory pieces bifurcate. Supplements unusually few in number: 5—6. Tail elongate, ventrally or first ventrally then dorsally bent, as long as 4—10 anal body widths. Caudal glands and spinneret lacking.

Type species: *Crassibucca microdonta* Mulvey & Jensen, 1967 = *Promiconchus microdontus* (Mulvey & Jensen, 1967) Jairajpuri & Khan, 1982.

Promiconchus, in having the dorsal tooth anterior, subventral teeth posterior in buccal cavity, resembles *Crassibucca* Mulvey & Jensen, 1967 and *Paracrassibucca* Baqri & Jairajpuri, 1974. It can be separated from them by the presence of one pair of subventral teeth only.

The species of *Promiconchus* favour wet biotopes and are distributed in Africa, Central- and South America.

Three species:

P. conicaudatus (Altherr, 1970) comb. n.
    Crassibucca conicaudata Altherr, 1970
P. incultus (Carvalho, 1960) comb. n.
    Mononchus (Cobbonchus) incultus Carvalho, 1960
    Cobbonchus incultus Carvalho, 1960
    Promiconchus siddiqii Ahmad & Jairajpuri, 1993 (syn. n.)
P. microdontus (Mulvey & Jensen, 1967) Jairajpuri & Khan, 1982
    Crassibucca microdonta Mulvey & Jensen, 1967

Remarks

Promiconchus conicaudatus (Altherr, 1970). — Maybe this species is identical with *P. incultus* (Carvalho, 1060). The sole specimen of Altherr was still young, it may not be compared therefore with mature females of Carvalho.

Promiconchus siddiqii Ahmad & Jairajpuri, 1993. — There is no doubt that this recently described species is the same as *P. incultus* (Carvalho, 1960). It corresponds in every respect to Carvalho's species, in the mesurements as well. The single "difference" is that *siddiqii* shows a very short, quite insignificant postuterine part.

Key to species of Promiconchus

1 Tail 300 µm, as long as 10 anal diameters, simply bent ventrad. — ♀ unknown. ♂: L=1.5—1.7 mm; a=34—38; b=4.3—4.6; c=5.3—5.7; PO: 5+1. (Nigeria) .... **microdontus** (Mulvey & Jensen)
— Tail 100—160 µm, as long as 4—6 anal diameters, first ventrally then dorsally bent 2

2 Apex of dorsal tooth located in the anterior third of buccal cavity; body 2 mm or longer. — juv. ♀: L=1.95 mm; a=45; b=3.8; c=20; c'=4. ♂ unknown. (Brazil) .... **conicaudatus** (Altherr)
— Apex of dorsal tooth located in anterior fourth of buccal cavity; body about 1.5 mm long. — ♀: L=1.3—1.7 mm; a=27—41; b=3.8—4.2; c=11—20; V=63—70%; c'=5—6. ♂ unknown. (Dominica, Brazil) .... **incultus** (Carvalho)

Genus ***Crassibucca*** Mulvey & Jensen, 1967

Anatonchidae, Miconchinae. Smaller nematodes, 1—1.5 mm. Cuticle smooth. Buccal cavity oblong, narrower than general in the family, provided with five teeth. Dorsal tooth, largest of them, situated in the anterior third of buccal capsule. Subventral teeth arranged in two pairs: one pair, the smaller, levelling with dorsal tooth, the other pair, the larger, located in posterior third/fourth of stoma. Junction between oesophagus and intestine tuberculate. Female prodelphic, without postuterine sac. Vulva in 60—70% of body length. Male known in one species. Spicula with accessory pieces, supplements 8. Tails of both sexes similar, conoid-arcuate to elongate, 3—14 times anal body with. Caudal glands poorly developed, spinneret present or absent.

Type species: *Crassibucca penicula* Mulvey & Jensen, 1967.

Crassibucca is well characterized by the special armature in the buccal cavity. It differs from *Paracrassibucca* Baqri & Jairajpuri, 1974, a genus which is also characterized by five teeth, by the anterior position of one pair of subventral teeth, as well as by the prodelphic gonad.

Soil inhabitants known from Africa and South America.

Three species:

C. colombica Siddiqi, 1984
C. macrocauda Mulvey & Jensen, 1967
C. penicula Mulvey & Jensen, 1967

Key to species of Crassibucca

1 Tail long, 12—14 anal diameters, very slender. — ♀: L=1.4—1.5 mm; a=38—41; b=3.8; c=5.0—5.4; V=63%; c'=12—14. ♂ unknown. (Nigeria) .... **macrocauda** Mulvey & Jensen
— Tail shorter, 2.5—4.5 anal diameters, fairly plump 2

2 Tail 50—70 µm; posterior subventral teeth nearly as strong as dorsal tooth; spinneret lacking. ♀: L=0.9—1.2 mm; a=27—43; b=3.4—3.9; c=16—18; V=60—70%; c'=2.5—3. ♂: L=1.1—1.2 mm; a=30—37; b=3.8—4.2; c=20—29; PO: 8. (Nigeria, St. Lucia) .... **penicula** Mulvey & Jensen
— Tail 110—120 µm; posterior subventral teeth much smaller than dorsal tooth; spinneret present. — ♀: L=1.3 mm; a=36—38; b=3.6—3.7; c=11—12; V=69—70%; c'=4.5. ♂ unknown. (Colombia) .... **colombica** Siddiqi

Genus ***Paracrassibucca*** Baqri & Jairajpuri, 1974

Anatonchidae, Miconchinae. Small nematodes, 0.7—0.8 mm. Cuticle smooth. Buccal cavity oblong, comparatively narrow, armed with five teeth. Dorsal tooth large, in anterior third or fourth of buccal cavity, subventral teeth — two pairs — much smaller than dorsal tooth and lying in the posterior half of stoma, behind each other. Oesophago-intestinal valve tuberculate. Female amphidelphic, vulva in 60—63% of body length. Male unknown. Tail short, ventrally arcuate, 2—2.5 anal diameters long. Caudal glands and spinneret present.

Type species: *Paracrassibucca jenseni* Baqri & Jairajpuri, 1974 = *Paracrassibucca paucidentata* (Lordello, 1970) Jairajpuri & Khan, 1982.

Paracrassibucca can be compared with *Crassibucca* Mulvey & Jensen, 1967 — which is similarly armed with five teeth — but it differs from that in showing both pairs of subventral teeth in posterior location.

Terrestrial nematodes known in Asia and South America.

One species:

P. paucidentata (Lordello, 1970) Jairajpuri & Khan, 1982
Sporonchulus paucidentatus Lordello, 1970
Paracrassibucca jenseni Baqri & Jairajpuri, 1974 (syn. n.)

— ♀: L=0.7—0.8 mm; a=17—25; b=3.1—3.7; c=17—22; V=60—63%; c'=2—2.5 ♂ unknown. (India, El Salvador, Brazil) .... **paucidentata** (Lordello)

Remarks

Paracrassibucca jenseni Baqri & Jairajpuri, 1974. — This species corresponds so entirely to the characteristics of *P. paucidentata* (Lordello, 1970) that it is advisable to regard it as a junior synonym of the latter.

Genus *Doronchus* gen. n.

Anatonchidae, Miconchinae. Body 1.8 to 3.6 mm long. Cuticle finely annulated. Labial region set off from body. Buccal cavity barrel-shaped, moderately roomy, slightly longer than cephalic diameter, armed with three basal teeth lying at the same level. Dorsal tooth distinctly larger than subventral ones. Oesophageal terminus tuberculate. Female amphidelphic, vulva located in 53—62% of body length. Spicula arcuate, with forked lateral pieces. Copulatory supplements 12—16. Tails of both sexes different: in female almost straight, elongate-conoid with sharp terminus and 5—10 times as long as anal body width, in male ventrally bent, broadly conoid with bluntly rounded terminus, only 1.5—2 times as long as anal body width. Caudal glands and spinneret lacking.

Type species: *Miconchus kirikiri* YEATES, 1967 = *Doronchus kirikiri* (YEATES, 1967) comb. n.

YEATES described in 1967 two *Miconchus* species from New Zealand for which I feel necessary to suggest a new genus. This genus, *Doronchus* gen. n., fits in general characteristics into the subfamily Miconchinae, and shows a close resemblance to the genus *Miconchus* ANDRÁSSY, 1958 in number and location of teeth. By virtue of a phenomenon it is however unique not only in the mentioned subfamily but also in the whole suborder Mononchina: it shows a definite sexual difference in shape and length of the tail. It occurs commonly in the mononchid nematodes that the tail of males is comparatively somewhat shorter than that of females but the general shape of this region of body is always equal in both sexes. MULVEY and DICKERSON (1970) also pointed at this sexual dimorphism in tail shape in the two *Miconchus* species presently transferred into the genus *Doronchus*, and they drew a parallel between these species and the representatives of the family Dorylaimidae showing the same phenomenon in forming the tail.

Terrestrial nematodes inhabiting dune sands in New Zealand.

Two species:

D. kirikiri (YEATES, 1967) comb. n.
  Miconchus kirikiri YEATES, 1967
D. reflexus (YEATES, 1967) comb. n.
  Miconchus reflexus YEATES, 1967

Key to species of Doronchus

1 Body shorter, 1.8—2.8 mm; female tail 5—8 anal diameters long; posterior fork of lateral guiding piece in male distally curved. — ♀: L=1.8—2.8 mm; a=33—53; b=4.6—6.0; c=8—14; V=53—62%; c'=4.5—8.3. ♂: L=2.1—2.3 mm; a=39—52; b=4.9—5.7; c=26—26; PO: 12—13. (New Zealand) .... **reflexus** (YEATES)
— Body longer, 3.2—3.6 mm; female tail 8—10 anal diameters long; both forks of lateal guiding piece in male straight. — ♀: L=3.2—3.6 mm; a=38—41; b=4.8—5.3; c=6.9—7.6; V=55—60%; c'=8—10. ♂: L=2.9—3.2 mm; a=35—37; b=4.5—5.6; c=27—29; PO 14—16. (New Zealand.) ...... **kirikiri** (YEATES)

Subfamily ANATONCHINAE JAIRAJPURI, 1969

Anatonchidae. Buccal cavity more or less roomy. Teeth three, equal in shape and location — in anterior or posterior half of buccal capsule — retrorse, backward pointed, often hinging by conspicuous hafts on walls. Minute denticles lacking (Fig. 4). Oesophago-cardial tubercles especially prominent.

Three genera (with 20 species):

Anatonchus Cobb, 1916
Mononchus (Anatonchus Cobb, 1916)
Tigronchoides Ivanova & Dzhuraeva, 1971
Truxonchus Siddiqi, 1984

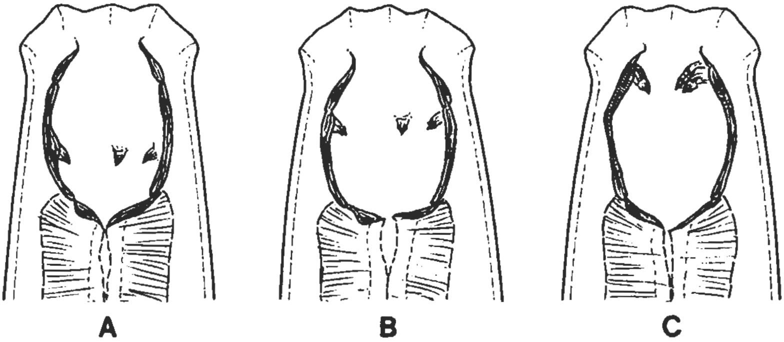

Fig. 4. Buccal cavities in the family Anatonchidae. A—C: Genera of the subfamily Anatonchinae; A: *Truxonchus*, B: *Anatonchus*, C: *Tigronchoides*

Key to genera of Anatonchinae

1 Teeth lying behind the middle of buccal cavity .... **Truxonchus** Siddiqi
— Teeth lying midway or farther forward in buccal cavity 2

2 Teeth, especially in females, located at anterior end of stoma; dorsal wall of buccal cavity becoming thinner and somewhat angular in mid-region .... **Tigronchoides** Ivanova & Dzhuraeva
— Teeth located midway in stoma; dorsal wall of buccal cavity not becoming conspicuously thinner and angular in mid-region .... **Anatonchus** Cobb

Genus *Truxonchus* Siddiqi, 1984

Anatonchidae, Anatonchinae. Body length varying from 2 to 6.5 mm. Cuticle smooth. Buccal cavity either oblong, about half as wide as long, or very broad, nearly as wide as long. One dorsal and two subventral retrorse teeth, equal in shape and position, located behind the middle of stoma (originated on or near the posterior ends of interparietalia). Oesophago-intestinal junction well tuberculate. Female amphidelphic, vulva in 49—68% of body length. Spicula fairly massive, arcuate, with forked lateral pieces. Supplements 12—20 in number. Tail in both sexes similar, arcuate-conoid or, exceptionally, straight, 2 to 14 times as long as anal body width. Caudal glands and spinneret present or absent.

Type species: *Anatonchus subacutus* Mulvey, 1961 = *Truxonchus subacutus* (Mulvey, 1961) Siddiqi, 1984.

This genus differs from *Anatonchus* Cobb, 1916 and *Tigronchoides* Ivanova & Dzhuraeva, 1971 in the location of the teeth lying in the posterior part of buccal cavity. They are close to the posterior ends of the interparietalia (Fig. 5). I agree with Siddiqi (1984) that this situation of teeth can be regarded as more primitive than that occurring in *Anatonchus* and especially in *Tigronchoides*, since the migration of these buccal elements during the ontogenesis clearly show a from-back-to-ahead direction.

Soil animals living in Europe (2 species), Asia (1 species) and North America (5 species).

Six species:

T. alleni (MULVEY, 1961) SIDDIQI, 1984
  Anatonchus alleni MULVEY, 1961
T. dolichurus (DITLEVSEN, 1911) SIDDIQI, 1984
  Mononchus dolichurus DITLEVSEN, 1911
  Mononchus (Anatonchus) dolichurus DITLEVSEN, 1911 (COBB, 1916)
  Anatonchus dolichurus (DITLEVSEN, 1911) COBB, 1916
T. gracilicaudatus (COBB, 1917) comb. n.
  Mononchus (Anatonchus) gracilicaudatus COBB, 1917
  Anatonchus gracilicaudatus COBB, 1917
T. mulveyi (ALTHERR, 1968) SIDDIQI, 1984
  Anatonchus mulveyi ALTHERR, 1968
T. paralleni (JAIRAJPURI & KHAN, 1982) SIDDIQI, 1984
  Anatonchus sp. apud MULVEY, 1961
  Truxonchus confusus SIDDIQI, 1984
T. subacutus (MULVEY, 1961) SIDDIQI, 1984
  Anatonchus subacutus MULVEY, 1961

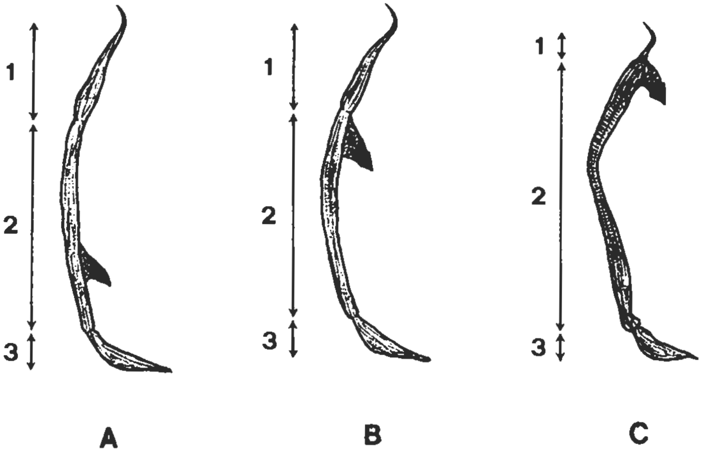

Fig. 5. Dorsal walls of buccal cavities in the subfamily Anatonchinae; A: *Truxonchus*, *B: Anatonchus*, C: *Tigronchoides*. (1: praeparietale, 2: interparietale, 3: postparietale)

Remarks

Truxonchus mulveyi (ALTHERR, 1968). — The shape of the tail in this species is strange for the subfamily Anatonchinae. It is not impossible that the single specimen of ALTHERR had a wounded tail and was not other than a premature female of *T. dolichurus* (DITLEVSEN, 1911). The shape and structure of buccal cavity entirely conform with those of the latter species.

1 Tail cylindroid with bluntly rounded tip, 2—2.5 anal diameters long. — Juv. ♀: L=3.2 mm; a=39; b=3.4; c=27; V=68%; c'=2—2.5. ♂ unknown. (Germany) .... **mulveyi** (ALTHERR)
— Tail elongate-conoid with sharp of finely rounded tip, 7—14 anal diameters long 2

2 Buccal cavity oblong, twice as long as wide. — ♀: L=5.8—6.5 mm; a=36—43; b=4.6—5.0; c=4.3—5.4; V=49—55%; c'=12—14. ♂: L=5.9—6.3 mm; a=40—50; b=4.5—5.0; c=5.5—5.9; PO: 20. (Holland, Denmark, Germany, Great Britain, Poland, Norway, Faeroer Islands, Switzerland, Austria, Bohemia, Slovakia, Spain, United States [New York], Canada) .... **dolichurus** (DITLEVSEN)
— Buccal cavity nearly globular, as long as or hardly longer than wide 3

3 Large nematodes, 4—6 mm; tail 10—12 anal diameters long 4
— Smaller nematodes, 2—3.5 mm; tail 7—8 anal diameters long 5

4 Caudal spinneret subventral; body 4.8—6.1 mm; teeth large. — ♀: L=4.8—6.0 mm; a=50—71; b=4.3—6.5; c=8—12; V=60—67%; c'=11—12. ♂: L=4.8—6.1 mm; a=56—78; b=4.8—5.9; c=6.6—10.8; PO: 17—19. (United States: California, Oregon, Virginia) .... **gracilicaudatus** (COBB)
— Caudal spinneret terminal; body 3.8—4 mm long; teeth comparatively small. — ♀: L: 4.0—4.8 mm; a=42—51; b=4.8—5.2; c=7.3—11; V=53—67%; c'=10. ♂: L=3.8—4.6; a=42—51; b=4.7—5.2; c=8.3—10; PO: 15—16. (United States: California) .... **paralleni** (JAIRAJPURI & KHAN)

5 Tip of tail sharp, subacute, without spinneret. — ♀: L=2.5—3.5 mm; a=36—46; b=4.2—5.6; c=8—13; V=60—66%; c'=7—8. ♂: L=2.1—3.2 mm; a=33—50; b=4.2—5.6; c=8—13; PO: 12—19. (United States: California, Oregon) .... **subacutus** (MULVEY)
— Tip of tail finely rounded, with spinneret. — ♀: L=2.5—3.5 mm; a=33—50; b=4.4—5.5; c=6.7—11; V=60—66%; c'=8; ♂: L=2.7—3.0 mm; a=37—48; b=4.7—5.5; c=8.5—10; PO: 12—17. (Georgia, United States [California]) .... **alleni** (MULVEY)

Genus ***Anatonchus*** COBB, 1916

Mononchus (*Anatonchus* COBB, 1916).

Anatonchidae, Anatonchinae. Body length between 1.5 and 4.1 mm. Cuticle smooth or occasionally finely annulated. Buccal cavity either oblong or spheroid, very roomy in the latter case. Teeth retrorse, in equal shape and level, located at the mid-region of stoma, hinging by haft on the buccal walls and ending in arrow-like tips. Oesophago-cardial tubercles especially well developed. Female didelphic, vulva in 58—71% of body length. Advulval papillae generally present. Spicula with forked accessory pieces. Supplements 10—17 in number. Tail conoid to filiform, 2 to 14 anal diameters long, in both sexes similar. Caudal glands and spinneret predominantly present.

Type species: *Mononchus tridentatus* DE MAN, 1876 = *Anatonchus tridentatus* (DE MAN, 1876) COBB, 1916.

This genus differs from *Truxonchus* SIDDIQI, 1984 by the more anterior position of the teeth, from *Tigronchoides* IVANOVA & DZHURAEVA, 1971 by the shape of dorsal wall (see there) and the more posterior position of the teeth (Fig. 5).

Soil inhabiting animals occurring in four continents as follows: in Europe 5, Asia 3, Africa 1 and North America 1 species. The most common form is *A. tridentatus* recorded from 24 countries.

Seven species:

A. acutus ALTHERR, 1974
A. ferox SIDDIQI, 1984
A. hortensis ANDRÁSSY, 1973
A. kashmirensis JAIRAJPURI & KHAN, 1982
A. mamillatus ALTHERR, 1968
A. sympathicus sp. n.

A. tridentatus (de Man, 1876) Cobb, 1916
Mononchus tridentatus de Man, 1876
Mononchus (Anatonchus) tridentatus de Man, 1876 (Cobb 1916)
Mononchus (Iotonchus) tridentatus de Man, 1876 (Cobb, 1916)

Remarks

Anatonchus kreisi Meyl, 1961. — Meyl proposed this name for *Mononchus (Anatonchus) tridentatus* apud Kreis, 1924. The single specimen observed by Kreis was an aberrant one showing the buccal teeth in different levels (the dorsal tooth in the anterior, the two subventral teeth in the posterior half of the stoma). Such a peculiar arrangement of teeth is strange for *Anatonchus* and related genera.

Anatonchus kashmirensis Jairajpuri & Khan, 1982. — It is closely allied to *A. mamillatus* Altherr, 1968, perhaps identical with that.

Anatonchus tridentatus (de Man, 1876). — See the description below.

Key to species of Anatonchus

1 Tail 10—14 anal diameters long; teeth with unusually long hafts. — ♀: L=3.6—4.1 mm; a=45—53; b=4.6—5.1; c=4.9—7.6; V=58—65%; c'=10—14. ♂: L=3.2 mm; a=50; b=4.7; c=5—8; PO: 14. (Fiji Islands) .... **ferox** Siddiqi
— Tail 2—8 anal diameters long; teeth with short hafts 2

2 Bigger animals, 2.5—3.6 mm; eggs spherical, generally 6—8 in the uterus. — ♀: L=2.8—3.6 mm; a=27—40; b=4.5—5.2; C=8—12; V=60—65%; c'=5—8. ♂: L=2.5—2.7 mm; a=30—40; b=4—5; c=8—12; PO: 15—17. (Holland, Belgium, Germany, United Kingdom, Poland, Switzerland, Austria, Bohemia, Slovakia, Hungary, Romania, Yugoslavia, Spain, France, Italy, Estonia, Russia, Turkey, Georgia, Uzbekistan, Iran, Ghana, United States, Mexico) .... **tridentatus** de Man
— Smaller animals, 1.5—2.3 mm; eggs oblong, 1—2 in the uterus 3

3 Tail very sharp on tip, without spinneret. — ♀ unknown. ♂: L=1.6 mm; a=34; b=4.2; c=9.6; c'=4; PO: 11. (Germany) .... **acutus** Altherr
— Tail finely rounded on tip, with spinneret 4

4 Buccal cavity oblong, much longer than wide 5
— Buccal cavity spherical, about as wide as long 6

5 Female tail as long as 5—6 anal diameters, male tail first conoid then cylindroid;vulva longitudinal. — ♀: L=2.0—2.3 mm; a=28—33; b=4.2—4.5; c=8.7—10; V=62—63%; c'=5.2—5.6. ♂: L=1.9—2.4 mm; a=30—37; b=4.2—4.5; c=10—12; PO: 11—13. (Germany, Hungary) .... **sympathicus** sp. n.
— Female tail as long as 2.5—4 anal diameters, male tail conoid, uniformly tapering; vulva transverse. — ♀: L=1.5—2.0 mm; a=25—37; b=3.8—4.8; c=11—20; V=63—71%; c'=2.5—4. ♂: L=1.5—1.8 mm; a=28—36; b=3.7—4.6; c=12—20; PO: 10—14. (Hungary, Romania, Yugoslavia, France) .... **hortensis** Andrássy

6 Tail 300 µm long, 6—7 anal diameters. — ♀: L=2.1 mm; a=27; b=4.5; c=6.7; V=62%; c'=6—7. ♂: L=2.1 mm; a=35; b=4.6; c=11.5; PO: 14. (Germany) .... **mamillatus** Altherr
— Tail 180 µm long, 4—5 anal diameters. — ♀: L=1.8 mm; a=30; b=3.6; c=11; V=67%; c'=4.5. ♂ unknown. (India) .... **kashmirensis** Jairajpuri & Khan

Genus *Tigronchoides* Ivanova & Dzhuraeva, 1971

Anatonchidae, Anatonchinae. Medium-sized to large animals, 1.7 to 5 mm. Cuticle smooth or, especially on tail, finely annulated. Buccal cavity roomy to very roomy, often nearly globular; dorsal wall (interparietale) transversely striated, becoming thinner in its mid-region and bulged. Teeth retrorse, equal in shape and location, in female lying quite at the anterior end of buccal cavity and hinging by conspicuous hafts on the walls, in male located somewhat more posterior and having shorter hafts. Apices of teeth arrow-like. Oesophago-intestinal valves tuberculate. Female amphidelphic or prodelphic; vulva in 59—77% of body length, often provided with advulval papillae. Spicula with forked accessory pieces. Supplements 9 to 18. Tails of both sexes nearly equal in shape, conoid to filiform, as long as 3 to 20 anal body widths. Caudal glands and spinneret mostly present.

Type species: *Tigronchoides varidentus* IVANOVA & DZHURAEVA = *Tigronchoides ginglymodontus* (MULVEY, 1961) comb. n.

The genus *Tigronchoides* was erected by IVANOVA and DZHURAEVA (1971) as a related genus of *Tigronchus* KIRJANOVA in KIRJANOVA & KRALL, 1969. The Soviet authors suggested also a separate family, Tigronchidae (better: Tigronchoididae — see SIDDIQI, 1984, being Tigronchoides the type genus) for them. Both genera were characterized in having very long, tigre-like teeth in the buccal cavity. *Tigronchoides* was differenciated from *Tigronchus* in having also "normal", *Anatonchus*-like teeth hinging on the anterior end of the buccal capsule. In my book (1976) I supposed that both *Tigronchus* and *Tigronchoides* belonged to the family Anatonchidae and were most probably identical with the genus *Anatonchus* COBB, 1916. The so-called tigre-teeth were nothing else than simple splits between the mural plates (interparietalia) of the buccal capsule at their points of junction. SIDDIQI (1984) shared my opinion, and synonymized both genera mentioned above with *Anatonchus.*

To make a clean sweep in the matter, I tried to obtain the original slides with the type specimens of *Tigronchus* and *Tigronchoides* as well, but in vain. Whereas I have received some soil samples from near the locus typicus of *Tigronchoides varidentus,* namely from around roots of a *Fraxinus* tree in the vicinity of the Zoological Institute in Dushanbe, Tadzhikistan (collected by Z. KOVÁCS). In two of these samples I have found several specimens — both females and males — which I could identified with *Tigronchoides varidentus.* Well, these nematodes completely agreed also with *Anatonchus ginglymodontus* MULVEY, 1961! Indeed, if we compare the descriptions given by MULVEY on the one hand and given by IVANOVA and DZHURAEVA on the other hand, we can see an actual agreement between *ginglymodontus* and *varidentus.**

I propose therefore to retain the name *Trigronchoides* for that genus which has *ginglymodontus* as type species and which shows some differences from both *Truxonchus* and *Anatonchus* (see below).

Although KIRJANOVA's *Tigronchus* also belongs most probably to the subfamily Anatonchinae, the type species, *T. taurinus,* remains a species inquirenda seu incertae sedis.

Tigronchoides is closely related to *Truxonchus* SIDDIQI, 1984 and *Anatonchus* COBB, 1916. It can be distinguished from the first genus by the very anterior position of the buccal teeth, from the second one by the shape and structure of the interparietale, the poorly developed proparietale and the more anterior arrangement of the hinging teeth (Fig. 5).

The representatives of *Tigronchoides* favour terrestrial habitats and are distributed in five continents: in Europe 4, Asia 1, North America 1, South America 1 and Australia 2 species. The most abundant species is *T. ginglymodontus.*

Seven species:

T. amiciae (COOMANS & LIMA, 1965) comb. n.
Anatonchus amiciae COOMANS & LIMA, 1965

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* I think it is unnecessary to give here a description of *T. ginglymodontus* since very good ones can be found in the recent papers of POPOVICI (1990) and BARSI (1991). My animals completely correspond to those.

T. australicus (WINISZEWSKA-SLIPINSKA, 1989) comb. n.
Anatonchus australicus WINISZEWSKA-SLIPINSKA, 1989
T. filicaudatus (ALTHERR, 1971) comb. n.
Anatonchus filicaudatus ALTHERR, 1971
T. ginglymodontus (MULVEY, 1961) comb. n.
Anatonchus ginglymodontus MULVEY, 1961
Anatonchus killickae CLARK, 1963 (syn. n.)
Tigronchoides varidentus IVANOVA & DZHURAEVA, 1971 (syn. n.)
Anatonchus varidentus (IVANOVA & DZHURAEVA, 1971) SIDDIQI, 1984
T. istvani (WINISZEWSKA-SLIPINSKA, 1989) comb. n.
Anatonchus istvani WINISZEWSKA-SLIPINSKA, 1989
T. monohystera (ALTHERR, 1977) comb. n.
Anatonchus monohystera ALTHERR, 1977
T. sukuli (BAQRI, DAS & AHMAD, 1981) comb. n.
Anatonchus sukuli BAQRI, DAS & AHMAD, 1981

Remarks

Anatonchus killickae CLARK, 1963. — I have no doubt whatever this species is equal with *T. ginglymodontus* (MULVEY, 1961). The shape and position of the teeth, the presence of numerous advulval papillae, the shape, length and the fine annulation of the tail as well as the measurements all conform with each other in both species.

Anatonchus valitangiensis KHAN & SAEED, 1987. — I could not obtain the original paper. In the Nematological Abstracts (Abstr. No. 1563 in the Volume 59) it is noted that this species resembles *A. killickae* CLARK, 1963. Is it perhaps similarly equal with *ginglymodontus?*

Key to species of Tigronchoides

1 Female monodelphic with posterior uterine sac 2
— Female amphidelphic 3

2 Buccal cavity wider than long; tail straight; body about 3 mm. — ♀: L=3.1 mm; a=40; b=4; c=22; V=75%; c'=3. ♂ unknown. (Brazil) .... **monohystera** (ALTHERR)
— Buccal cavity longer than wide; tail arcuate; body about 2 mm. — ♀: L=1.7—2.0 mm; a=30—35; b=3.9—4.3; c=12—16; V=73—77%; c'=3—4. ♂: L=1.7—2.0 mm; a=32—38; b=4.1—4.7; c=14—16; PO: 13—17. (Yugoslavia, Italy) .... **amiciae** (COOMANS & LIMA)

3 Large species, 4—5 mm 4
— Smaller species, 2—3 mm 5

4 Tail filiform, as long as 12—20 anal diameters; spicula 80—90 μm long. — ♀: L=3.1—4.8 mm; a=40—50; b=5.0—5.7; c=4—5; V=60—64%; c'=12—20. ♂: L=3.3—4.6 mm; a=42—56; b=4.4—5.6; c=5.0—7.6; PO 13—14. (Romania) .... **filicaudatus** (ALTHERR)
— Tail not so long, 7—8 anal diameters; spicula 140—150 μm long. — ♀: L=4.9 mm; a=47; b=5; c=8; V=64%; c'=7—8. ♂: L=4.4—4.7 mm; a=43—46; b=5.1—5.2; c=12; PO: 14—15. (India) .... **sukuli** (BAQRI, DAS & AHMAD)

5 Advulval papillae and caudal spinneret lacking; tail strongly curved, hook-like. — ♀: L=2.0 mm; a=35; b=5.7; c=7.4; V=61%; c'=7. ♂: L=1.7—1.9 mm; a=36—40; b=4.5—5.4; c=12—13; PO: 9—12. (Australia) .... **australicus** (WINISZEWSKA-SLIPINSKA)
— Advulval papillae and caudal spinneret present; tail not hook-like 6

6 Teeth located in anterior fourth of buccal capsule; this latter conspicuously longer than wide. — ♀: L=2.8 mm; a=33; b=4.7; c=15; V=72%; c'=3.4. ♂: L=2.1—2.6 mm; a=27—33; b=4.5—4.9; c=17—19; PO: 16—18. (Poland) .... **istvani** (WINISZEWSKA-SLIPINSKA)

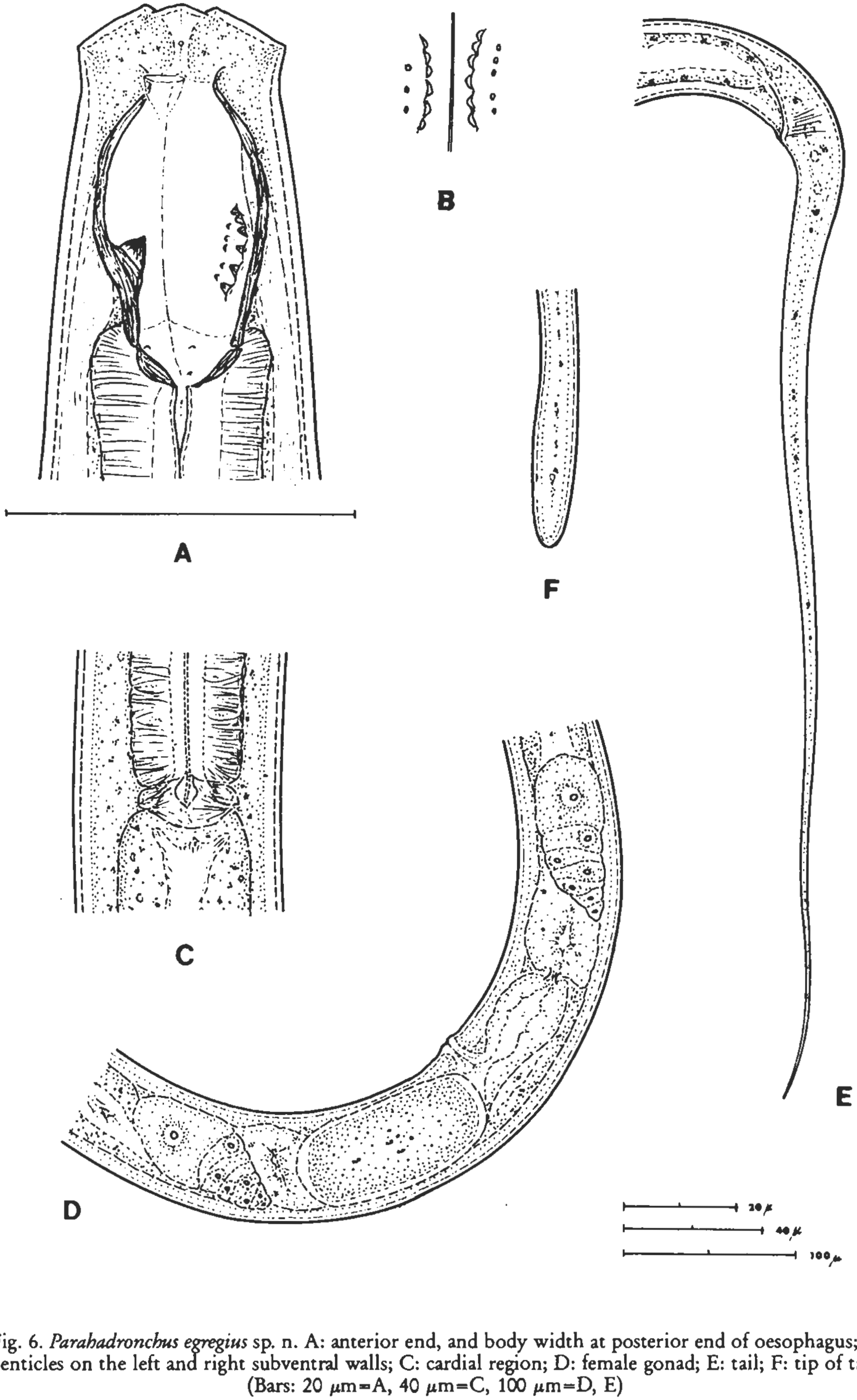

Fig. 6. *Parahadronchus egregius* sp. n. A: anterior end, and body width at posterior end of oesophagus; B: denticles on the left and right subventral walls; C: cardial region; D: female gonad; E: tail; F: tip of tail. (Bars: 20 μm=A, 40 μm=C, 100 μm=D, E)

— Teeth hinging on the anterior end of buccal capsule; this latter as wide as, or wider than long. — ♀: L=1.7—3.2 mm; a=20—42; b=3.7—5.2; c=8—17; V=59—72%; c'=3.5—6. ♂: L=2.5—3.2 mm; a=32—44; b=4.0—5.1; c=11—19; PO: 12—17. (Poland, Romania, Yugoslavia, Spain, Tadzhikistan, United States [California], New Zealand) .... **ginglymodontus** (MULVEY)

Parahadronchus egregius sp. n.

(Fig. 6A—F)

♀: L=2.48 mm; a=42; b=4.5; c=4.2; V=54%; c'=18.

Body slender, 60 µm wide at the middle. Cuticle smooth, only 1.5—2µm thick. Head slightly set off from body, 36 µm wide, lips conoid. Body at posterior end of oesophagus 1.7 times as wide as head. Amphids caliciform, small, 1/6 the body width, located at level with beginning of buccal capsule.

Buccal cavity (the "capsule") 55×32 µm, 1.7 times as long as wide, or 1.5 times as long as labial diameter, about 1/10 the oesophageal length. Buccal walls comparatively thin, dorsal postparietale shorter but thicker than subventral ones. Dorsal tooth large, located in posterior half of buccal cavity with apex lying midway in the latter. Facing the dorsal tooth there are two denticulate ribs on each subventral wall. Denticles contiguous, sitting in common "gums". Subventral ribs slightly but conspicuously arched with 6 denticles each, sublateral ribs straight, shorter than the former and provided with 5 denticles (on the right side) or 3 denticles (on the left side). Denticles located between 40 and 70% of buccal length.

Oesophagus 550 µm long. Distance between oesophagus and vulva 1.4 times as long as oesophagus. Oesophago-intestinal junction clearly tuberculate. Nerve ring at 28% of oesophageal length. Intestine thick-walled with hexagonal cells. In its lumen nematode remains and several oligochete setae could be observed. Rectum about as long as anal body width.

Female didelphic, each gonad 3.2—3.6 times as long as body diameter. Vagina 22 µm long, vulva transverse with slightly sclerotized lips. No sphincter between oviduct and uterus. One egg: 117×54 µm; twice as long as corresponding body width.

Tail long, 585 µm, 18 anal diameters, 23% of entire length of body. Tip of tail finely rounded. Caudal glands reduced, spinneret lacking.

Male unknown.

The new species seems to be related to the representatives of the genus *Parahadronchus* MULVEY, 1978, but it differs from the known five species in having two denticulate ribs — not one — on both subventral walls. On the other hand, it shows some resemblance to the species *Hadronchulus denticulatus* (DHANACHAND, RENUBALA & MOHILAL, 1991) where the denticles are twisted, not arranged in straight lines. But in the latter species the denticles are much smaller and more scattered in arrangement, and the shape of the buccal cavity and the dorsal tooth is other.

Holotype: ♀ on the slide No. 12343-As. Paratypes: 2 juveniles.

Type locality: Vietnam, Santa Maria, 20 km from Bao Loc, soil from a secondary forest, October, 1988.

It is remarkable that all species of *Parahadronchus* have been discovered in Asia.

Anatonchus tridentatus (DE MAN, 1876) COBB, 1916

(Fig. 7 A—E)

♀: L=2.8—3.0 mm; a=27—32; b=4.5—4.6; c=7.8—8.4; V=60—63%; c'=7—7.5.

Body 94—104 µm wide at mid region. Cuticle 4—4.5 µm thick, smooth but on the posterior part of tail finely striated. Head slightly set off, 52—55 µm wide, lips conoid. Body at posterior end of oesophagus 1.5—1.6 times as wide as head. Amphids levelling with anterior end of buccal cavity.

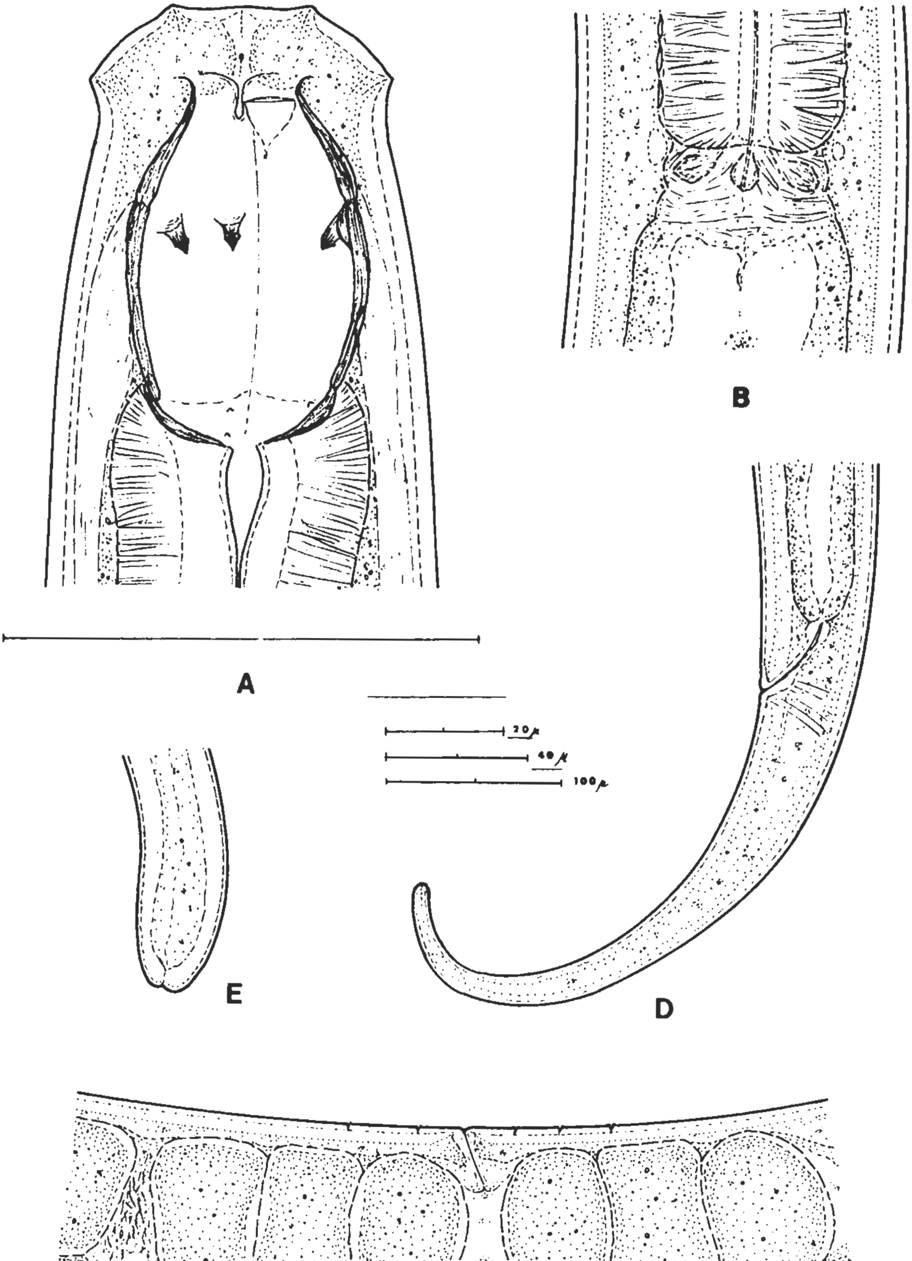

Fig. 7. *Anatonchus tridentatus* (de Man, 1876) Cobb, 1916. A: anterior end, and body width at posterior end of oesophagus; B: cardial region; C: vulval region; D: female tail; E: tip of tail. (Bars: 20 μm=A, 40 μm=B, 100 μm=C, D)

Buccal cavity comparatively thin-walled, roomy, 59—63×38—40 μm, about 1.5 times as long as wide. Proparietale long, almost 2/3 the length of interparietale. Teeth hinging on the anterior ends of interparietalia, i.e. located in the first half of buccal cavity, their apices in 42—44% of stoma. Teeth 4.5—5 μm long, sharply pointed.

Oesophagus 620—650 μm long (measured from the head). Distance between posterior end of oesophagus and vulva 1.7—1.8 times as long as oesophagus. Intestine with remains of nematodes and oligochetes.

Vulva transverse, with slightly sclerotized lips. Vagina somewhat oblique. Gonads paired, each 3.5—3.6 times as long as mid-body diameter. Eggs more or less spheroid, often wider than long, 55—82×76—84 μm, partly pressed against each other. Two females contained six, three ones seven eggs each.

Distance between vulva and anus twice as long as tail. The latter 350—360 μm, 12—12.5% of body length, 7—7.5 times anal body diameter, ventrally bent, finely annulated on its posterior part, 4 μm thick somewhat before its tip. Caudal glands small, spinneret present, practically terminal.

After DE MAN, the males are provided with 15—17 supplements.

There are several records about *Anatonchus tridentatus* in the literature; it was observed in 24 countries so far. Whether all these data refer to our species — it is not sure at all. The original animals of DE MAN were large (2.7—3.6 mm) and had comparatively long tails (♀: c=8—9; ♂: c=10—12), whereas in the literature we can find data of essentially shorter animals, too, or those of specimens provided with much shorter tails (c'=4—5). The above described females fit into the measurements given by DE MAN very vell. Also the shape and number of the eggs correspond completely to the data given by LOOF (1961) when he re-examined the type material of DE MAN.

Characteristic is for *Anatonchus tridentatus* that the proparietalia are comparatively long, the teeth lie before the middle of the buccal cavity, the vulva is transverse, the uteri contain eggs in greater number, the tail is finely annulated and the spinneret opens terminally.

Locality of the population described: Hungary, near Aggtelek, fallen leaves and wet detritus at the entrance of the Baradla Cave, September, 1980.

Anatonchus sympathicus sp. n.

(Fig. 8 A—H and 9 A—F)

Hungarian (type-) population: ♀: L=2.0—2.1 mm; a=28—30; b=4.2—4.4; c=8.7—9.1; V=63%; c'=5.4—5.6. ♂: L=1.9 mm; a=30; b=4.1; c=10; c'=4.5.

German population: ♀: L=2.3 mm; a=33; b=4.5; c=10; V=62%; c'=5.2. ♂: L=2.4 mm; a=37; b=4.5; c=12; c'=4.

Body 68—71 μm (♀) or 66—68 μm (♂) wide at mid-region. Cuticle 3—3.5 μm thick, smooth, in posterior half of tail finely annulated. Head 44—45 μm wide, slightly set off from body, lips conoid. Body at proximal end of oesophagus 1.5—1.6 times as wide as head. Amphids at level of anterior end of buccal cavity, 1/6 the corresponding body width.

Buccal cavity 48—51×33—34 (♀) or 41—48×27—30 (♂) μm, 1.4—1.5 times as long as wide, comparatively thick-walled. Prolaterale (on the dorsal side) 25—28% of entire length of buccal capsule, or nearly half as long as interparietale. Teeth at the anterior ends of interparietalia, equal in shape and location; in one male the left subventral tooth was somewhat more back (one tooth-length) than the right one. Apices of teeth located in 41—47% (♀) or in 48—56% (♂) of buccal length.

Oesophagus 450—540 μm long (measured from head end); distance between oesophago-intestinal tubercles and vulva 1.7—1.8 times as long as oesophagus. Tuber-

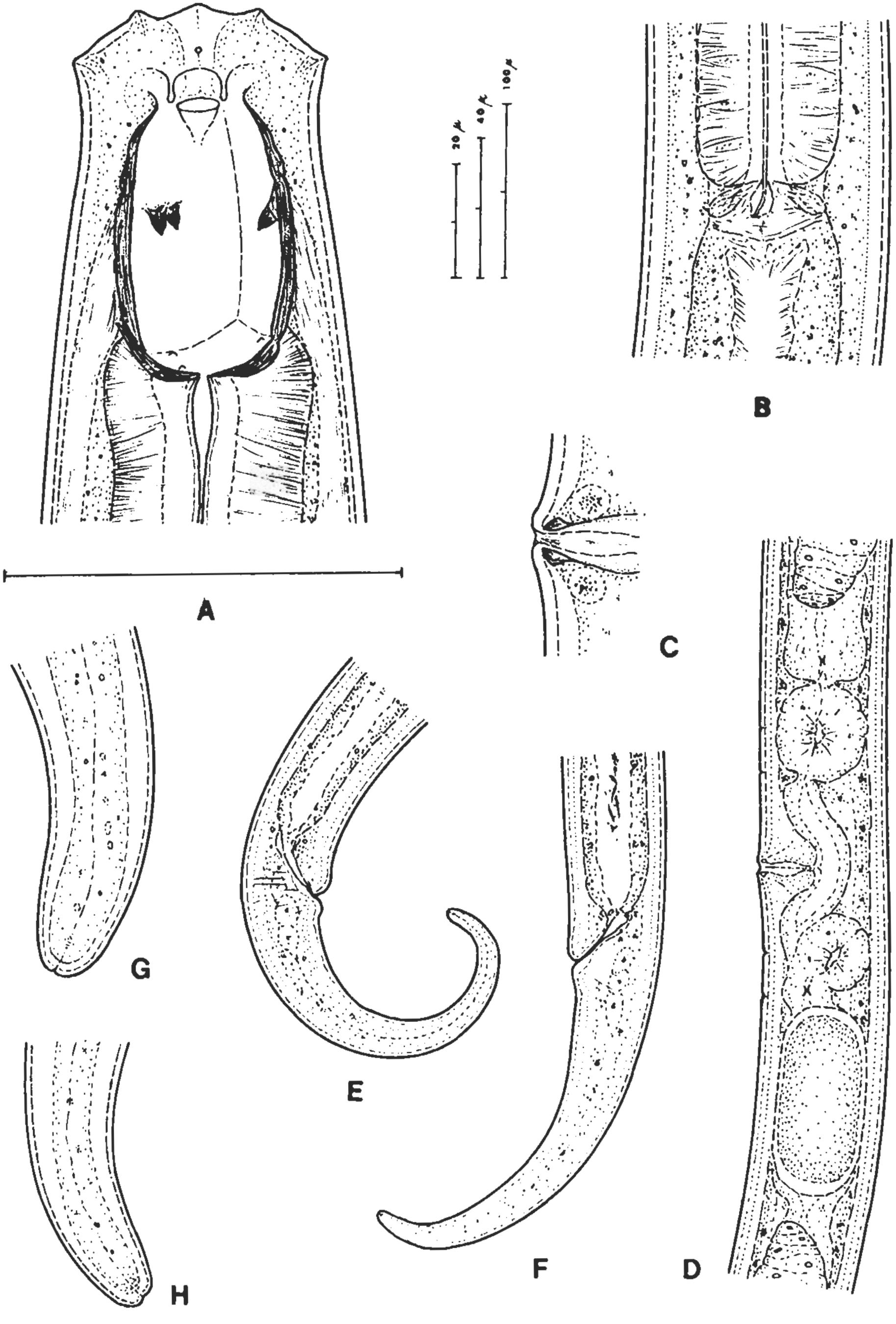

Fig. 8. *Anatonchus sympathicus* sp. n. Female. A: anterior end, and body width at posterior end of oesophagus; B: cardial region; C: vulva; D: vulval region; E—F: tails; G—H: tips of tails. (Bars: 20 μm=A, 40 μm=B, 100 μm=D, E, F)

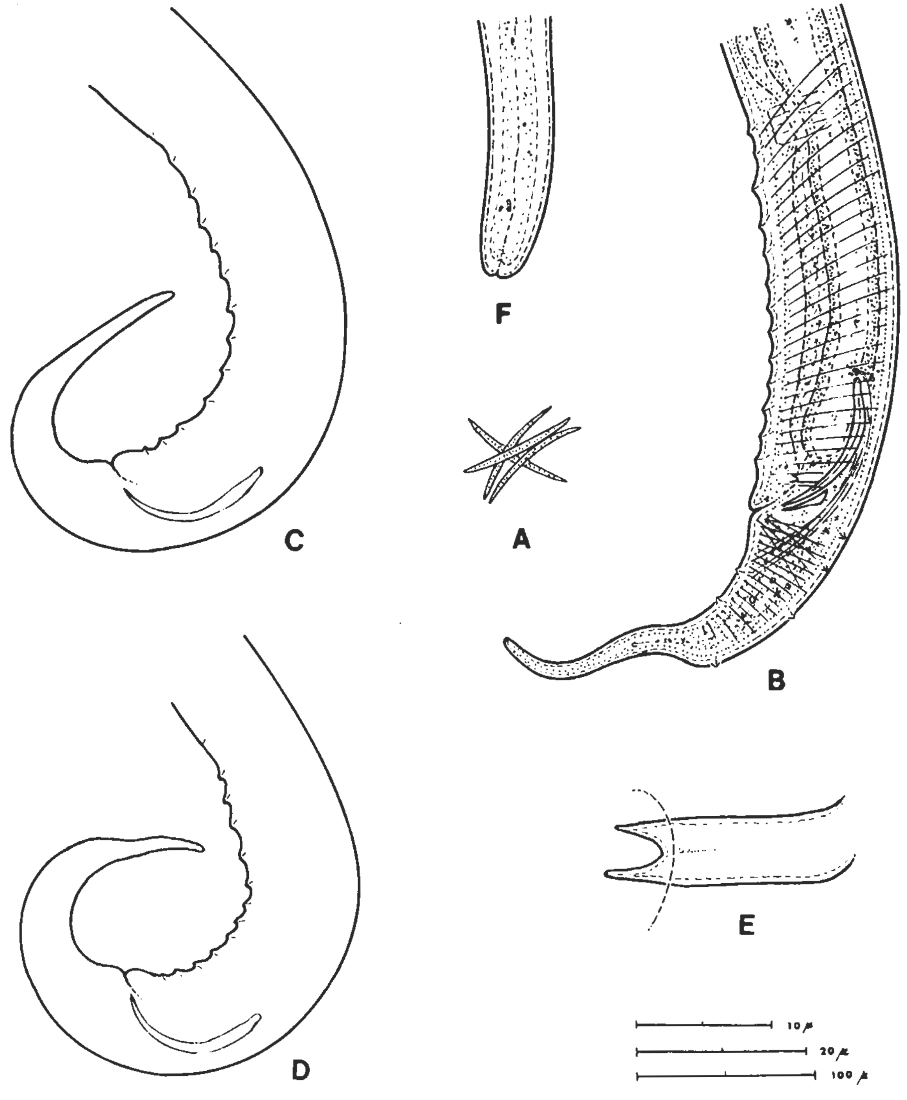

Fig. 9. *Anatonchus sympathicus* sp. n. Male. A: spermatozoa; B: posterior end; C—D: contours of posterior ends of two further males; E: lateral accessory piece; F: tip of tail. (Bars: 10 µm=E, 20 µm=F, 100 µm= B, C, D)

cles well developed. Intestine covered by large, mostly hexangular cells; its lumen contained several setae of Oligochaeta.

Vulva longitudinal, with sclerotized lips. Vagina 27—31 µm long. Gonads paired, each 4.6—5 times as long as mid-body diameter. One egg: 112×46 µm, oblong, 2.5 times as long as wide, or 1.6 times as long as corresponding body width.

Vulva—anus distance 2.2—2.8 times as long as tail. Tail 225—250 µm, 10—11% of body length, 5.2—5.6 times as long as anal body diameter, ventrally arcuate, very finely annulated, 8—10 μm thick somewhat before its rounded tip. Caudal glands small, spinneret present, terminal.

♂: Similar to female but buccal cavity somewhat smaller, teeth more back in location and tail a little shorter. Spicula 80—98 μm long, slender, slightly bent. Forked accessory pieces present. Spermatozoa very small, fusiform. Copulatory supplements 11—13+1—2 in number. Tail 185—200 μm, 4—4.5 times anal diameter, 8—10% of entire length of body, provided with 7 pairs of papillae.

In the shape of the buccal cavity and the medium-sized, on its tip finely rounded tail *Anatonchus sympathicus* sp. n. is closely allied to *A. tridentatus* (DE MAN, 1876) and *A. hortensis* ANDRÁSSY, 1973. It differs from *tridentatus* by the shorter body, the smaller buccal cavity, the longitudinal vulva, the less number and other shape of the eggs and the shorter tail, from *hortensis* by the longer body, the longitudinal vulva, the longer and slenderer female tail, the other shaped male tail and the larger spicula.

Holotype: ♀ on the slide No. 12200/H. Paratypes: 2 ♀, 1 ♂ and 2 juveniles. Other population: 1 ♀, 2 ♂.

Type locality: Hungary, Bátorliget, wet soil around the roots of an ash-tree, September, 1988.

Other locality: Germany, Köln, wet soil from a garden, with grass roots. July, 1991.

Appendix

At first I intended to order also the genus *Tectonchus* TSALOLIKHIN, 1974 (with four species) to the family Anatonchidae since the original descriptions reported on tuberculate junctions at the proximal end of the oesophagus.

Meanwhile I received type/paratype specimens from DR. TSALOLIKHIN for comparison. All they show that *Tectonchus* does possess a simple — non-tuberculate — structure in the oesophago-intestinal junction, consequently it may not be ordered to Anatonchidae. The genus is a distinct member of the family Mononchidae.

I will discuss *Tectonchus* and its species in a separate paper.

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About the thermic conditions in sediment—water zone of shallow lakes in Hungary

By

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Abstract. One of the most specific characteristics of shallow lakes is that the temperatures of their sediment are not constant. The role of the sediment in shallow waters is also different as compared with deep lakes because, on the surface of the sediment, besides decomposition, certain organic matter composition also takes place. During several years, sediment temperatures, their vertical differences were measured. Sediment temperatures and those of the water columns were compared. Investigations were carried out in two Hungarian shallow lakes (lake Velence: 24 km^2, depth: 120 cm; Neusiedlersee/Fertő: 309 km^2, depth: 110 cm) and rice fields: 30 cm depth.

There are obvious thermic differences between shallow and deep lakes. Their effects on the different nutrient cycles are known but only few thermic data series can be found in the limnological literature. Even less data have been published about the thermic conditions of the sediment in spite of its importance in decomposition.

The thermic conditions of the sediment in different Hungarian shallow water bodies have been investigated. The results on three water types are discussed (I. Lake Fertő/Neusiedlersee; II. Lake Velence; III. rice field). The same type of thermistoric thermometer (accuracy: 0.2 °C) was used. The temperature was recorded in the sediment from 2 to 45 cm depth if it is not indicated otherwise.

I. Lake Fertő/Neusiedlersee

The temperature of every one cm thick sediment layer down to 42 cm-s was measured from spring to autumn at the same spot (Fig. 1). The comparison of three-three appropriate data series from two sites situated close to each other is also presented (Fig. 2). Water temperature determined the temperature of the sediment down to 30—40 cm-s. Specific heat and smaller inhomogeneity could be detected by appropriate instruments.

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II. Lake Velence

The temperature of the air, the water surface and the upper layer (3 cm) of the sediment at the same spot based on two-year-long data series (Fig. 3) and a data set of nine spots measured on 14. 07. 1955 (Fig. 3, 4, Tab 1) are presented. The temperature of the upper sediment layer followed the temperature of the water even if its warming up and cooling down was a slower process. The second data set demonstrates a close correlation between the temperature of the water and the sediment.

III. Rice fields (around Szarvas)

The temperature of the extremely shallow water rapidly followed the changes in the air temperature (Fig. 5, 6, 7). The soil (sediment) temperature was also influenced by direct solar radiation often leading to invers stratification the soil was warmer than the water.

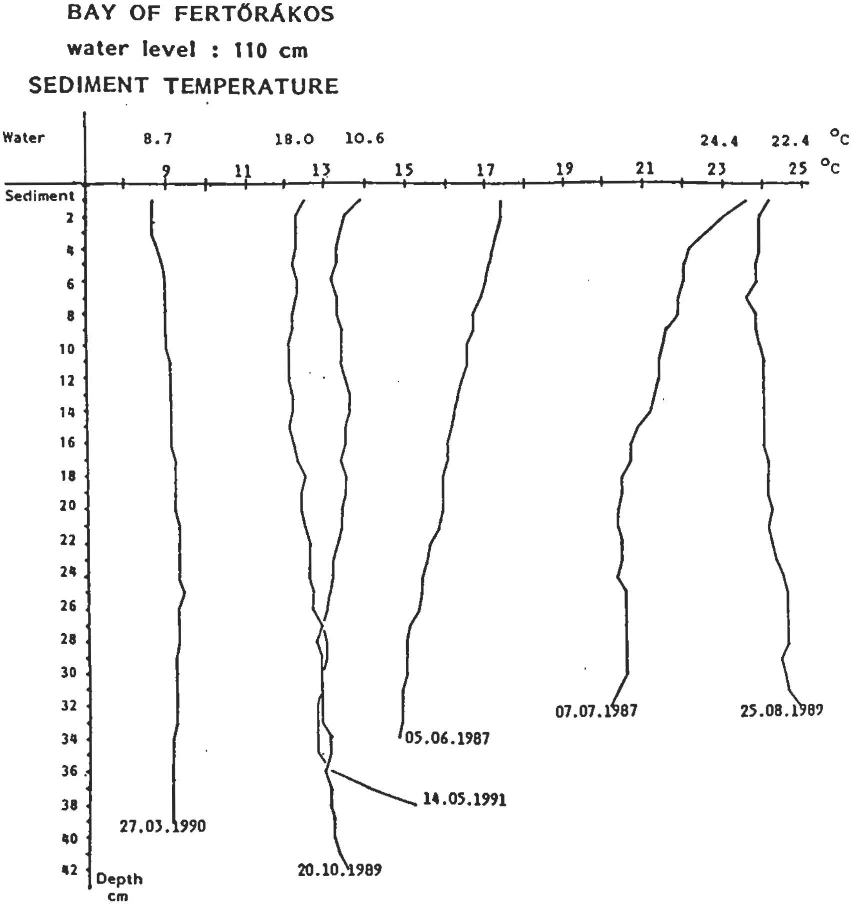
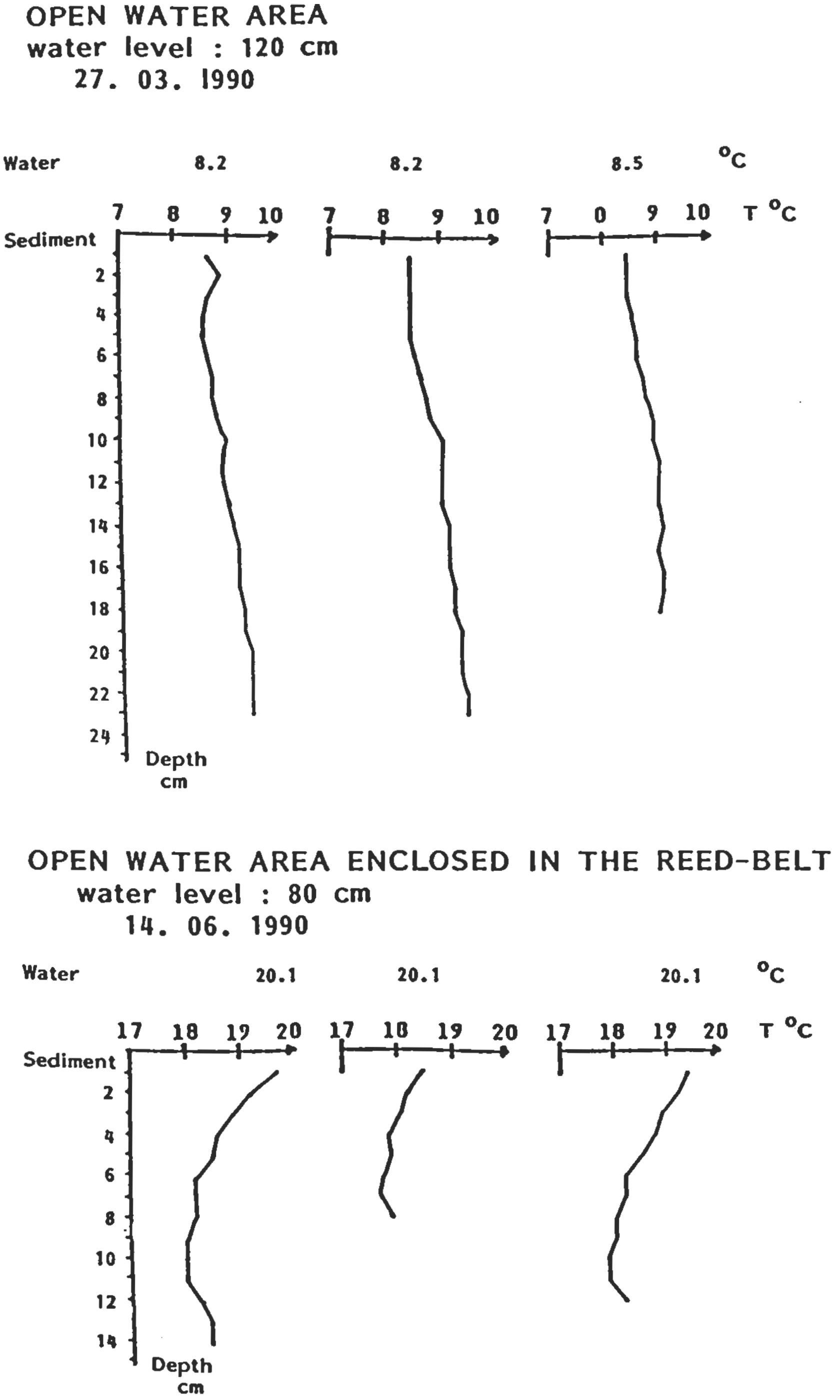


Fig. 1. Sediment temperatures data in Lake Fertő/Neusiedlersee (bay of Fertőrákos)



OPEN WATER AREA
water level : 120 cm
27. 03. 1990

OPEN WATER AREA ENCLOSED IN THE REED-BELT
water level : 80 cm
14. 06. 1990

Fig. 2. Sediment temperatures data in Lake Fertő/Neusiedlersee

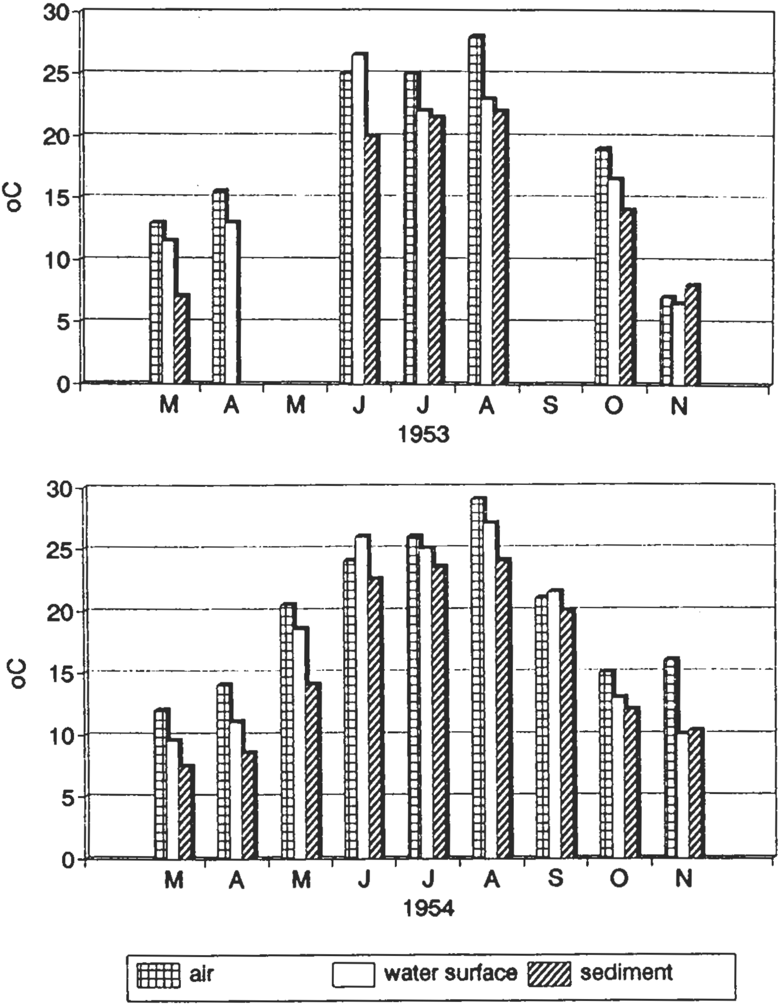


Fig. 3. Temperatures in Lake Velence ("Fürdető" water level: 140 cm)

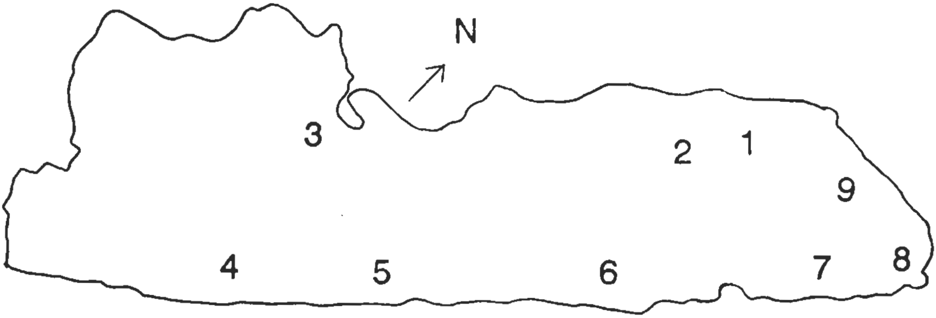


Fig. 4. Measuring sites in Lake Velence

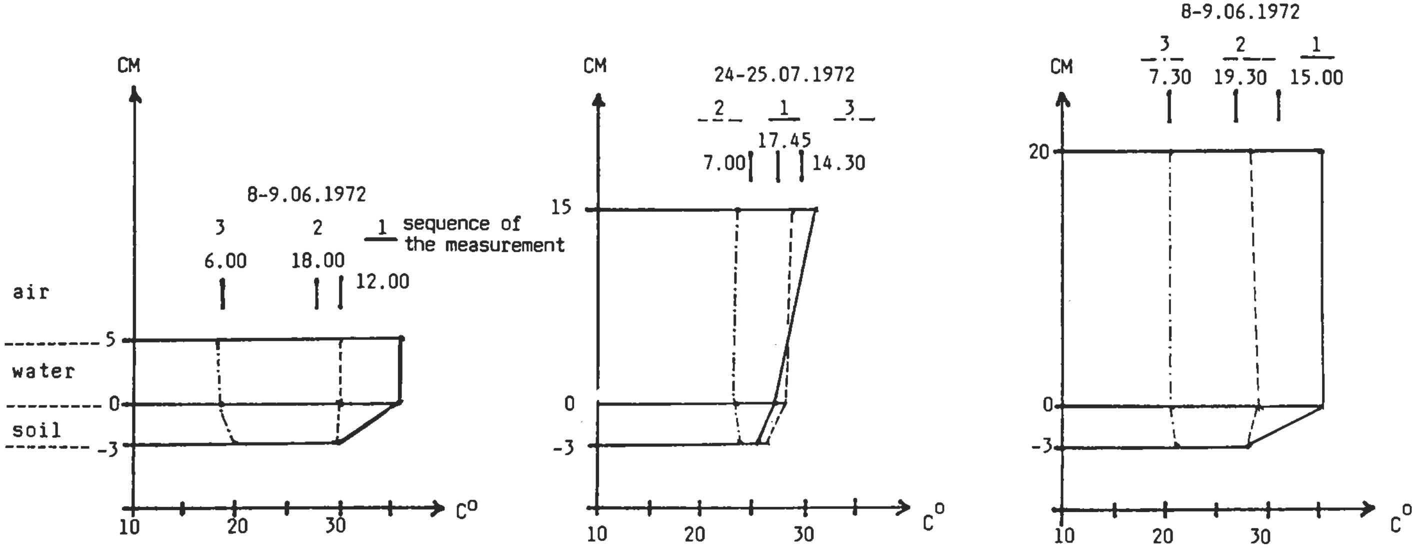


Fig. 5. Temperatures in a rice field

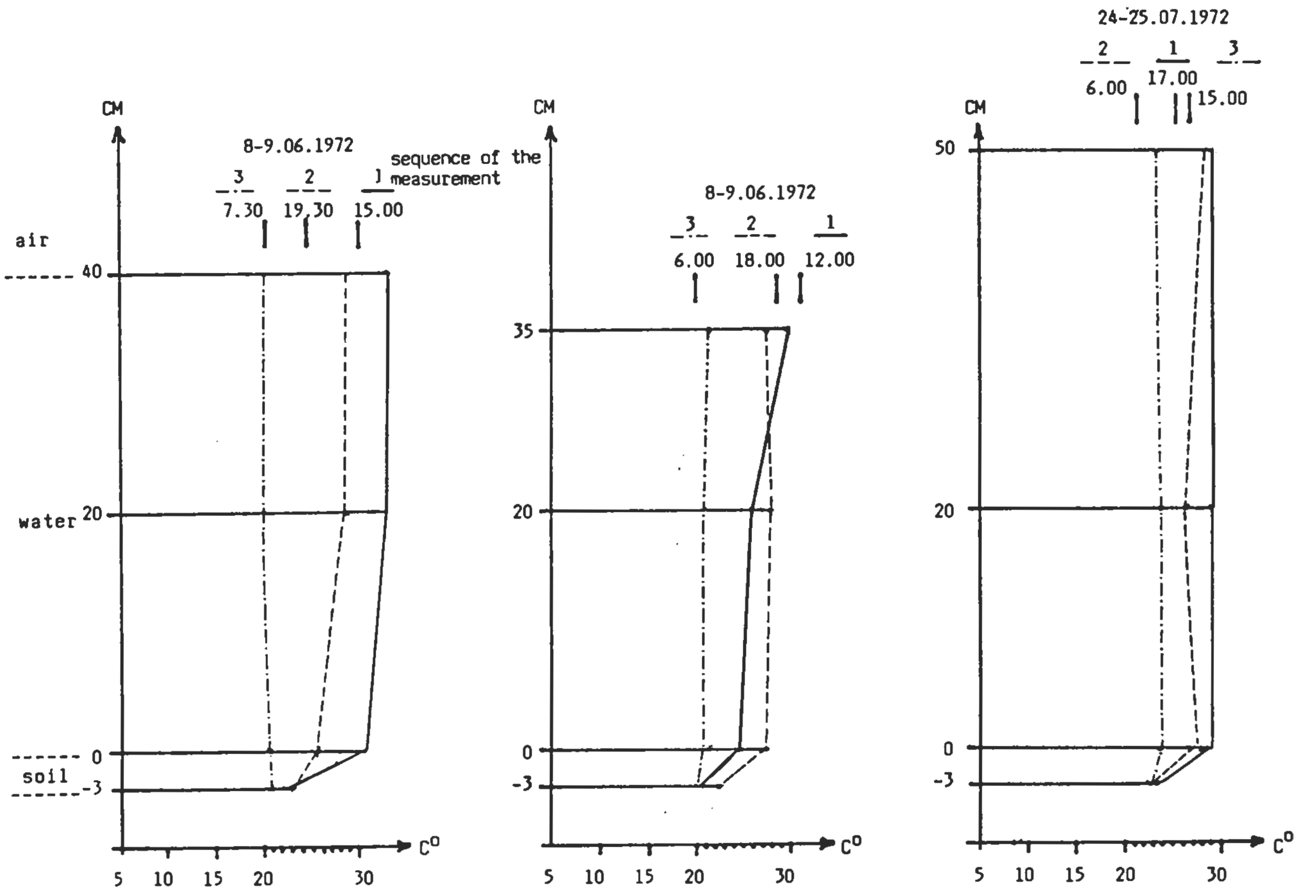


Fig. 6. Temperatures in rice fields (furrow)

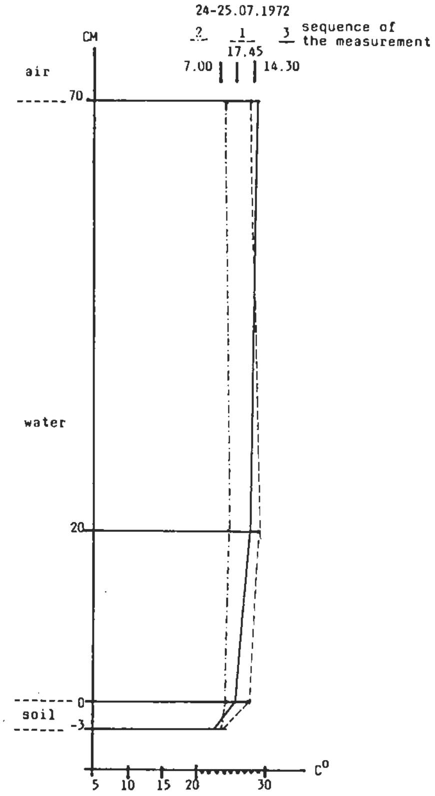


Fig. 7. Temperatures in rice field (agricultural drain)

Table 1. Temperatures data in Lake Velence — 14. 07. 1955

Measure place	Depth cm	Temperature °C		
		air	water	sediment
1.	165	23.5	24.0	20.5
2.	130	25.5	25.5	22.0
3.	170	22.0	24.0	20.0
4.	130	21.5	24.8	21.5
5.	170	23.2	24.5	22.0
6.	170	24.0	25.0	22.5
7.	130	24.0	24.5	23.0
8.	110	23.8	24.5	22.8
9.	150	24.0	25.0	22.5

Important conclusions

In shallow lakes (~ 3 m depth) the temperature of the sediment down to 20 to 40 cm followed the temperature of the water column above it. As a consequence decomposition takes place at a considerably higher temperature (20—30 °C verus 4 °C) for more than six months in the upper sediment layer in shallow lakes than in deep lakes within the temperate zone. It is of great importance in the nutrient cycling and the energy flow.

To a small extent solar energy reaches the surface of the sediment even in less shallow, more turbid waters (I. Lake Fertő/Neusiedlersee, II. Lake Velence). The sun directly heated by solar energy.

Sediment inhomogeneity dependent temperature fluctuations can be detected down to 20 to 40 cm-s.

A new limnological characterization of shallow waters could also be possible on the basis of the heat transmission ratio between direct solar radiation and indirect heat conduction.

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Ernährungswert der Biomasse von Tagfaltern der gemässigten Zone und der Tropen, I

By

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Abstract. Estimated and compared were the crude lipid and crude protein content calculated on the basic of total nitrogen content accumulated in the body of butterflies feeding in imago phase, too, and inhabiting areas of the moderate climatic zone (Hungary) as well as the tropics (Vietnam). Aim of these investigations was to clear the quantities and qualities of the biomass build up in their organism. Fat content of the butterflies *Pieris rapae* sampled in Hungary during the spring and in September was higher than that in specimens caught in mid-sommer and in October (Table 1). Body composition of the species *Pieris rapae* and *Pieris napi* seems to be different. From the butterflies collected in January in Vietnam in the northern cooler areas as well as in the southern warmer region, that ones inhabiting the cooler areas had fat substances in higher quantities in their body than that ones which were collected in a warmer area (Table 2). It can be concluded that higher temperatures — irrespectively the climatic zone — do not promote the building up of fat substances. Fat content was strongly determined by the feeding abilities of the animals. The fat content in the studied female specimens was somewhat larger thant that one of the males, except the situation when eggs have been laid down formerly by the female (this happens in Hungary in October) or the animals were forced to a temporary starvation (as in Hanoi in the middle of January).

The crude protein content of the studied butterflies varies between 47,1 and 69,2 per cent of exsiccated body weight. Butterflies from tropical areas show a higher tendency of these values than those from temperate areas.

Das Funktionieren der Lebensgemeinschaften ermöglicht jener Stoff- und Energiefluss, dessen Ausgangspunkt — mit wenigen Ausnahmen — in den grünen Pflanzen liegt, und welcher von einem streng einheitlichen Ernährungssystem verschiedenster Organismen sowie von den Individuen selbst in Bewegung gehalten wird. Die Qualität der Biomasse bestimmt grundlegend die Produktivität der ganzen Lebensgemeinschaft. Eben deshalb, wenn wir uns das Ziel setzten, eine tatsächlich gegebene Lebensgemeinschaft von diesem Gesichtspunkt aus zu charakterisieren, so müssen wir vor allem die Qualität der Biomasse an Aufbau der betreffenden Lebensgemeinschaft beteiligten Lebewesen erkennen. Auf diesem Wege weiter vorwärts dringend werden wir einmal in der Lage sein, uns ein zusammenfassendes Bild von der Produktivität der ganzen Biosphäre und auf diesem Grunde auch über ihre Belastungsfähigkeit zu schaffen.

In der Bearbeitung des aufgeworfenen Problems leitete uns der Gedanke, dass es in der Mehrzahl der terrestrischen Lebensgemeinschaften infolge ihrer grossen Art-

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und Individuenzahl die Schmetterlinge eine dominante Rolle besitzen. Der hohe Gehalt ihren Körpers an eiweiss- und stickstoffhaltigen organischen Stoffen weiterhin an Lipoiden ist nicht nur aus physiologischem Gesichtspunkt sehr wichtig, sondern hat den hohen Futterwert ihren Körpers zur Folge. Es ist schon bekannt, dass zwischen den verschiedenen Schmetterlingen in dieser Hinsicht — vor allem — ihrer Lebensweise entsprechend — grosse Unterschiede gibt, sind unsere diesbezüglichen Kenntnisse in erster Reihe hinsichtlich der auch im Imago-Zustand sich ernährenden Tagfaltern noch immer sehr lückenhaft. Wir sind uns von weitem nicht im klaren, wie die chemische Zusammensetzung ihren Körpers von dem Klima des Biotops sowie von der Jahreszeit beeinflusst wird.

Die erwähnten Probleme vor unseren Augen haltend haben wir mit einer Untersuchungsserie begonnen und als den ersten Teil dieser Serie führten wir vergleichende Untersuchungen an einigen Tagfaltern der gemässigten Zone und der Tropen durch.

Jene Tagfalter, die im Imago-Zustand sich nicht ernähren, mobilisieren zur Aufrechterhaltung ihrer Lebensvorgänge sozusagen in sämtlichen Teilen ihren Körpers die aufgestapelten organischen Substanzen (Gere, 1964). Die Männchen, die am Anfange ihrer Flüge, grosse Lipid- und Fett-Vorräte in ihrem Körper aufgestapelt haben, verbrennen diese Stoffe in erster Reihe um nur Energie zu gewinnen, und das Wasser, das als Nebenprodukt entsteht, dient ihnen zur Deckung des Wasserbedarfs. Die Weibchen dagegen verbrauchen den grössten Teil dieser Stoffe zur Produktion der Eier. Im Gegenteil zu diesen Arten jene Tagfalter, die sich auch im Imago-Zustand weiterhin ernähren, sind in der Lage den Stoff- und Energiebedarf ihren Organismus weiterhin zu decken. Das war der Fall bei den von uns gesammelten Imagines von *Lysanda coridon* (Lycaenidae) und *Melanargia galathea* (Satyridae). Sowohl das Körpergewicht als auch der Lipoid- und Wassergehalt der Tiere veränderte sich kaum mit fortschreitendem Lebensalter (Gere, 1978). Dasselbe konnten auch Gross und Owen (1970) ans Schwärmern, wie *Deilephila nerii* und *Herse convolvuli,* weiterhin Sotavalta und Lavlajainan (zit. Hanegan und Heath, 1970) an Eulenfaltern wie *Phytometra gamma,* nachweisen.

Trotz den oben dargelegten kann die Zusammensetzung des Körpers der erwähnten Tagfalter (u. a. die Menge der aufgestapelten Lipiden) den äusseren Umständen entsprechend weitgehend variieren (Mason und Mitarbeiter, 1989). Bestimmt wird dieses Variieren vor allem durch die Futterversorgung oder die Vorbereitung des Organismus auf die Diapause. Pullin (1987) fand auffallende Unterschiede hinsichtlich des Lipid-Gehaltes bei den zu der Familie Nymphalidae gehörenden Schmetterlingen und zwar vor und nach der Überwinterung. Ähnliche Beobachtungen machte auch Ito (1986) an den Wanzen *Cletus punctiger.*

Hinsichtlich der Qualität des Körpers der Insekten besitzt die Temperatur einen entscheidenden Effekt. Chandrakantha und Mathavan (1986) haben festgestellt, dass bei dem Käfer *Callosobruchus maculata* nicht nur die Zeitdauer des Wachstums und die Menge der im Tierkörper gebildeten Biomasse, sondern auch der Energiegehalt des Körpers von der Temperatur der Umwelt abhängig ist. Nach James (1986) sollen die Schmetterlinge der Art *Danaus plexippus* (Danaidae), die sich aus dem Gesichtspunkt der Fortpflanzung im Ruhestadium befinden (reproductively dormant), sowohl bei hoher (36 ±1 °C) als auch bei niedriger Temperatur (10—18 °C) organische Stoffe in ihrem Körper aufstapeln, während bei mittleren Temperaturen (20—30 °C) das nicht tun.

Unter solchen Umständen halten wir es begründet, über die Körperzusammensetzung der Schmetterlinge, die in verschiedenen klimatischen Zonen beheimatet sind, oder zu veschiedenen Jahreszeiten aktiv sind, je mehr Informationen zu sammeln.

Material und Methodik

Zur Klärung der aufgetauchten Fragen haben wir von den in der gemässigten Zone lebenden Tagfaltern zwei Arten ausgewählt, und zwar *Pieris rapae* L. und *Pieris napi* L. (Familie Pieridae). Diese Falter kommen auch in Ungarn massenhaft vor. Sie fliegen in mehreren Generationen von Frühling bis Spätherbst.

Die von uns untersuchten tropischen Schmetterlinge stammten aus Vietnam. Sie wurden im Januar einerseits in den nördlichen Gebieten Vietnams (Hanoi und Thac Bo), andererseits in südlichen Gebieten des Landes (Saigon) gesammelt. Zu dieser Zeit sind die klimatischen Unterschiede zwischen den nördlichen und südlichen Gebieten Vietnams am grössten. Im Norden schwankt die Temperatur tagsüber zwischen 14 und 18 °C, einen Niederschlag gibt es nicht, obwohl der Himmel den ganzen Tag mit Wolken bedeckt war. Im Süden des Landes erhöhte sich die Temperatur um den Mittag bis 30—34 °C und die Sonne schien fast ununterbrochen.

Für vergleichende Untersuchungen haben wir aus Nord-Vietnam die Art *Pieris canidia* SPARRMAN gewählt, die in enger Verwandtschaft mit unserer *rapae* steht. (Es scheint uns nicht ausgeschlossen, dass dieser Taxon sich von *Pieris rapae* nur auf unterartlicher Ebene unterscheidet.) In den südlichen Gebiete des Landes haben wir die Art *Delias hyparete indica* WALL. gesammelt, die ebenfalls zu der Familie Pieridae gehört. Zur Ergänzung des Untersuchungsmaterials sammelten wir im Norden Vietnams die Art *Zemeros fleggas* CR. (Erycinidae), während im Süden *Junonia atlites* L. (Nymphalidae).

Die gesammelten Schmetterlinge wurden in 96%igem Ethanol aufbewahrt. Als ersten Schritt der Laboratoriumsuntersuchungen bestimmten wir nach Abdunstung des Ethanols das Trockengewicht der Tiere. Nachdem wurde mit dem Soxlethschem Extraktionsapparat der Rohfett-Gehalt des Körpers der zur Untersuchung herangezogenen Exemplare bestimmt. Als extrahierendes Mittel wurde Petroläther gewählt. Und schliesslich wurde der Gesamt-Stickstoffgehalt mit der Kjeldahlschen Methode bestimmt. Aus den auf dieser Weise gewonnenen Gesamt-Stickstoffwerten wurde die Menge des Proteingehaltes berechnet. Es muss aber zugleich bemerkt werden, dass mit der Anwendung dieser Methode gegebenenfalls auch jene Stickstoffmenge mitbestimmt wurde, die nicht als an Eiweissstoffen gebundener Stiokstoff im Untersuchungsmaterial vorhanden war.*

Ergebnisse und deren Auswertung

Die Ergebnisse an den aus Ungarn stammenden *Pieris*-Exemplaren durchgeführten Untersuchungen sind in der Tabelle 1 zusammengefasst. Die Angaben scheinen darauf hinzuweisen, dass der Rohfettgehalt der Tiere in der Sommermitte niedriger als im Frühjahr oder im Herbst ist. Im Spätherbst nimmt die Menge des Gesamt-Fettgehaltes in den noch fliegenden Schmetterlingen wieder ab. Aller Wahrscheinlichkeit nach ist diese Abnahme die Folge des ungünstigen Wetters und der verminderten Nahrungsaufnahme der Tiere, die so sich in einem Hungerzustand befinden. Die meisten weiblichen Exemplare der Art *Pieris rapae* enthielten etwas grössere Mengen von Fettsubstanzen in ihrem Körper als die Männchen. In dieser Hinsicht sind sie den Tagfalter *Lysandra coridon* ähnlich (GERE, 1978).

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* Die chemishen Analysen wurden im Central-Laboratorium der Veterinärmedizinischen Universität durchgeführt, wofür der Autor seinen aufrichtigsten Dank aussprechen möchte.

Es ist ja bekannt, dass die Weibchen nicht nur für die Deckung des Energiebedarfes des Fluges, sondern auch für die Bildung der Eier viele Fettstoffe brauchen. Jene Weibchen, die im Spätherbst Fettreserve in kleineren Mengen enthalten, haben ihre Eier schon früher abgelegt. Es lässt sich aber damit nicht erklären, warum in den Weibchen von *Pieris napi* auch im Sommer nur kleinere Mengen von Rohfetten vorhanden waren als in den Männchen.

Es scheint uns nicht wahrsheinlich, als verkörperten diese Tagfalter in produktionsbiologischer Hinsicht einen anderen Typ. Unserer Meinung nach ist viel wahrscheinlicher, das diese Situation durch die unter Umständen aufgetretenen Schwankungen des Fett-Depots hervorgerufen wurde. Wie oben schon erwähnt wurde, und auch die an den vietnamesischen Schmetterlingen gewonnenen Angaben beweisen (siehe unten), können diese Schwankungen von besonders grossen Ausmassen sein.

Gesamt-Stickstoffgehalt der Tiere und der aus diesen berechneten Rohproteingehalt kann als ziemlich hoch betrachtet werden. Es darf aber nicht ausser acht gelassen werden, dass ein Teil des Gesamt-Stickstoffs nicht in Eiweiss-Substanzen, sondern in Form von Chitin vorhanden ist, und dieser Substanz nur schwer und langsam von den Mitgliedern der Lebensgemeinschaft ausgenutzt werden kann. Bei einer Bewertung der Schmetterling-Biomasse müssen beide vorerwähnten Umstände in Betracht gezogen werden.

Die weiblichen Exemplare enthielten in ihrem Körper etwas kleinere Mengen von Stickstoff als die männlichen. Die Exemplare der Art *Pieris napi* haben sich auch in dieser Hinsicht als abweichend erwisen.

Die Ergebnisse der an vietnamesischen Tagfaltern durchgeführten Untersuchungen sind in der Tabelle 2 zusammengefasst worden. Aus diesen Angaben geht vor allem hervor, dass der Körper der aus den nördlichen (d. h. kühleren) Gebieten stammenden Schmetterlinge enthielten im allgemeinen grössere Mengen von Rohfett als jene, die in den südlicheren Gebieten beheimatet waren. Werden diese Angaben mit den jahreszeitlichen Schwankungen des Fettgehaltes jener Schmetterlinge verglichen,

Tabelle 1. Rohfett- und Rohproteingehalt ungarischer Tagfalter

Art	Geschlecht	Stückzahl	Datum	Rohfett	Rohprotein
				Gehalt in %-en des Körpermasses	
Pieris rapae	♂	12	14. 04.	12,27	63,0
Pieris rapae	♀	6	14. 04.	18,25	59,0
Pieris napi	♂	12	14. 04.	10,63	66,1
Pieris napi	♂	13	14. 04.	12,48	64,6
Pieris rapae	♂	31	9. 07.	9,87	63,8
Pieris rapae	♀	14	9. 07.	12,5	59,0
Pieris napi	♂	11	9. 07.	14,0	52,4
Pieris napi	♀	16	9. 07.	9,35	57,6
Pieris rapae	♂	12	18. 09.	13,28	66,0
Pieris rapae	♀	12	18. 09.	13,76	62,9
Pieris rapae	♂	9	9. 10.	10,10	61,1
Pieris rapae	♀	6	9. 10.	8,16	51,6

die in der Tabelle 1 aufgezählt sind, so erscheint uns als sehr wahrscheinlich, dass die sich ernährenden Schmetterlinge, die in einer wärmeren Umwelt leben, Fettsubstanzen in kleineren Mengen aufstapeln als Schmetterlinge, die in einer kühleren Umwelt zu Hause sind. Aus dem Gesichtspunkt des Energiehaushaltes scheint dies als selbstverständlich, auch dann, wenn es berücksichtigt wird, das wir poikilotherme Tiere vor uns haben. Weitere Untersuchungen werden vielleicht zur Lösung der Frage beitragen, ob nicht diese Schmetterlinge unter kühleren Umweltverhältnissen während ihren Flieges Fettsubsanzen in grösseren Mengen verbrennen als bei höheren Temperaturen. Dieser Typ der Thermoregulation ist schon aus anderen Fällen bekannt geworden, wenn poikilotherme Tiere ihre Körpertemperatur erhöhten.

Es ist witerhin auffallend, dass der Rohfett-Gehalt im Körper von den Männchen der Art *Pieris canidia* zwischen weiten Grenzen schwankte.

Tabelle 2. Rohfett- und Rohproteingehalt vietnamesischer Tagfalter

Art	Geschlecht	Stückzahl	Datum	Fundort	Rohfett	Rohprotein
					Gehalt in %-en des Körpermasses	
Pieris canidia	♂	9	10. 01.	Hanoi	9,54	67,4
Pieris canidia	♂	13	15. 01.	Hanoi	21,60	67,5
Pieris canidia	♀	8	10. 01.	Hanoi	5,64	58,6
Zemeros fleggas	♂	5	13. 01.	Thac Bo	16,50	64,5
Delias hyparete indica	♂	16	20. 01.	Saigon	7,08	67,1
Delias hyparete indica	♂	9	21. 01.	Saigon	6,33	69,2
Delias hyparete indica	♀	8	20. 01.	Saigon	6,85	60,4
Junonia atlites	♂	17	19. 01.	Saigon	7,82	47,1

Wie oben schon erwähnt wurde, im Januar schwankten in Hanoi die Witterungsverhältnisse um die unteren Grenze der zur Aktivität der Schmetterlinge unbedingt notwendigen Bedingungen. Es gab Tage, an welchen sie überhaupt nicht flogen. Gestalteten sich jedoch die Verhältnisse günstiger für die Schmetterlinge, so suchten sie sofort Blüten auf, um Futter zu sich nehmen. Es scheint uns sehr wahrscheinlich, dass die sich auch unter solchen Umständen ernährenden Arten die verzehrten Substanzen in Form von Fetten in ihrem Körper aufstapeln, aber nötigenfalls verbrauchen. Der Fettgehalt der männlichen Exemplare von *Delias hyparete indica*, die in einer ständig warmen Ungebung leben, war viel ausgeglichener. Die Menge der Fettsubstanzen, die im Körper der weiblichen Tiere nachgewiesen werden konnten, entsprach im grossen und ganzen der erwarteten. In den Weibchen der Art *Pieris candida* konnten dagegeten Fettsubstabzen in deutlich niedrigeren Mengen nachgewiesen werden, und dies ist wieder ein Beweis eines vorübergehenden Hungerzustandes. Die Angaben über den Fettgehalt der Arten *Zemeros fleggas* und *Junonia atlites* stehen im guten Einklang mit jenen, die an den unter ähnlichen Bedingungen lebenden Pieridae-Arten gewonnen wurden.

Hinsichtlich des Rohproteingehaltes weisen die tropischen Schmetterlinge keine grösseren Unterschiede untereinander auf, aber die Mehrzahl dieser Tiere enthält Stickstoff in etwas höheren Mengen als die Schmetterlinge der gemässigten Zone. Eine Ausnahme scheint die Art *Junonia atlites* zu sein, deren Körper einen auffallend niedriger Stickstoffgehalt besitzt. Um dies erklären zu können, sind weitere Untersuchungen notwendig. Im allgemeinen haben wir den Eindruck, dass auch die Weibchen der tropischen Schmetterlinge über einen niedrigen Stickstoffgehalt verfügen als die Männchen derselben Arten.

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Fisheries ecology of the Danube in the Szigetköz floodplain

By

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Abstract. The paper presents the natural fish assemblages in the Szigetköz floodplain and summarizes the most important human impacts on the fishes such as water management, the Gabčikovo River Barrage System and fishery.

Natural waters in the Szigetköz floodplain

The primary hydraulic system of the Carpathian Basin developed in the Upper Pliocene after the Pannonian Sea had receded. In that period the Little Hungarian Plain was covered by a large lake. The primordial Danube gradually formed a large dome-shaped talus pile here by putting down some of its sediment in the area. At the beginning of the Ice Age the lake was silted up. The main arm of the Danube flows through the middle of the talus pile, which is surrounded by two long side arms, the Little Danube and the Mosoni Danube. As the loose alluvial and partly diluvial material of the talus pile is more water permeable than the hard rock forming river bed upstream a considerable amount of the water infiltrates into the ground. The water discharge decreases together with the sediment transport capacity of the river. In the loose talus pile river arms of small hydraulic radius were formed. These arms had wide and shallow river beds, which were soon filled up with the deposited sediment. As a result the water did not flow in one main arm but in a beam like anastomising side arm network uniting again at the edges of the talus pile, where the ground was less permeable. This system meant a continuous water supply for the ground water in the Bratislava—Gönyü section. The Szigetköz is the smaller geographical unit of the talus pile of the Little Hungarian Plain on the right side of the Danube. Its borders are clearly marked by a 59 km section of the Danube and the 129 km Mosoni Danube meandering on hard ground (IHRIG, 1973; GÖCSEY, 1979).

The longitudinal, vertical and lateral hydrological variability of the Szigetköz section of the Danube made possible the development of a diverse potamic biocenoses unique in Europe. There are three different sections longitudinally: a high gradient (25—35 $cm.km^{-1}$), turbulent upstream section, a shallow, braided channel in the Szigetköz area and a low gradient (8—10 $cm.km^{-1}$), narrow and deeper downstream

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section. The Holocene floodplain of the Danube continues southwards the Mosoni Danube and merges into the floodplains of river Lajta, Rába and Rábca. The Szigetköz floodplain can be divided into lower and higher regions. The lower one is 1—2 m above the mean water level of the Danube and consists of a network of branches, old channels, oxbow lakes and raised flats that are flooded annually. The higher region of the floodplain is 3—5 m above the average level of the Danube. Its surface is covered with a 0.5—1.5 m thick sand and silt sediment accumulated during the centuries (PÉCSI, 1959; GÖCSEI, 1979). The lateral variability manifests itself in the patterns of the geomorphologically different branches. On the basis of their geomorphology we can differentiate constantly flowing *eupotamic* channels; temporarily flowing *parapotamic* arms, which have a permanent connection with the river through their lower mouth; temporarily disconnected *plesiopotamic* branches; and completely disconnected *paleopotamic* waters, which have lost their direct connection with the river.

Natural fish assemblages in the Szigetköz floodplain

In accordance with the longitudinal variability of the Szigetköz section of the Danube fishes drifted from the upper stretch of the Danube and its tributaries (eg. *Salmo trutta, Hucho hucho*, etc.) relatively often occured in this area, but they have not had permanent populations in the Hungarian–Slovak floodplain. In the original fish communities there were some anadromous species, which migrate from the Lower Danube or the Black Sea to the upper stretch of the potamic zone in order to spawn (eg. *Huso huso, Acipenser gueldenstaedti, Acipenser stellatus, Acipenser nudiventris, Pelecus cultratus*, etc.)

Depending on the geomorphological features of the waters in the Szigetköz the species composition of the fish assemblages of the particular habitats can clearly be distinguished. Eupotamic river beds are characterised by rheophilic species (eg. *Acipenser ruthenus, Barbus barbus, Gymnocephalus schraetzer, Cottus gobio*, etc.). Besides rheophilic species parapotamic branches are characterised by semi-reheophilic species (eg. *Rutilus rutilus, Gobio, gobio, Stizostedion lucioperca, Perca fluviatilis*, etc.). Plesiopotamic side-arms are characterised by semi-rheophilic and limnophilic species (eg. *Esox lucius, Abramis brama, Rhodeus sericeus amarus, Gymnocephalus cernuus*, etc.). Paleopotamic waters are inhabited by limnophilic species (eg. *Umbra krameri, Tinca tinca, Carassius carassius, Misgurnus fossilis*, etc.) (see Table 1).

The hydrological variety in the Szigetköz was not favourable only for the establishment of a diverse fish fauna. In the spawning period several fluvial fishes migrate instinctively against the current, sometimes covering a distance of 100—200 km, before they find a suitable habitat for reproduction. The high gradient section of the Danube above the Szigetköz was a barrier for most of the migrating fishes. Due to the Alpine flood regime character of the Danube, the low region of the Szigetköz area was flooded during the summer inundations, where migrating fishes could spread out. The slow flowing, warm and large branch-systems functioned as ideal spawning and nursery habitats and provided a rich feeding area for the fish species of the Middle Danube for several thousand years.

The most important human impacts on the fishes in the Szigetköz

Water management

In the XIXth century the extensive regulation of the Szigetköz became necessary because of navigational problems and damages caused by inundations. The first reason was more important. The river regulation consisted of the regulation of the river bed, flood control and inland drainage. As a result of the river bed regulation a main channel was created by cutting off several bends. This allowed the unobstructed passage of ice, however the navigational problems were only partially solved, because the main channel was full of navigational obstacles during the low water period. Wingdams were built in the main channel and the upper mouth of the arms were blocked by cross-dams causing more intensive sedimentation in them then before because of the high suspended matter content of the water flushing them during floods. As a consequence of the river bed regulation five branch systems were separated (Doborgazszigeti branch system, Cikolaszigeti branch system, Bodaki branch system, Ásványrárói branch system and Bagoméri branch system).

At the turn of the century flood protection dikes were built for the prevention of flood damages. Dikes were usually raised along the outer branches, only a few large arms were cut off (eg. Gazfűi Danube arm). The dikes divided the Szigetköz floodplain into a protected area and an inundated floodplain which had an area of only 6% of the former one. The rolling and suspended alluvial sediment having been deposited on the former floodplain accumulated on the narrow (breadth 1.1—5.7 km) inundated area. This process accelerated the silting up of the branch systems (Dunai et al., 1992).

During the high-water period of the Danube a lot of water infiltrated through the permeable layers of the floodplain to the flood free-area. To prevent damages caused by the water table increased an extensive canal network was created, some times by dredging old river beds. The system leads the water back from the flood protected area to the Danube.

Due to the geological rising of the river beds on the Hungarian—Slovak floodplain another extensive channel regulation became necessary from the mid-1960s. After the regulations due to the operations of the hydroelectric dams on the Upper Danube and the large scale dredging of the river at Bratislava decreasing the bed load discharge and the kinetic energy of the water increased at low and mean water level. These interventions resulted in the deepening of the Danube-bed in the Szigetköz section from the end of the 1960s. As a result of the silting up of the inundated area and of the deepening of the river bed the flushing of the branches significantly shortened. The same discharge of the Danube meant a lower water level than formerly decreasing the water cover of the floodplain. The flushing of the two branch systems of the Lower Szigetköz lasted 35 days annually at 50% probability (water level at Dunaremete 420 cm). The flushing of the three branch systems over the higher cross-dams of the Upper Szigetköz lasted 10 days annually at 50% probability (water level at Dunaremete 460 cm) (Dunai et al., 1992).

The Gabčikovo River Barrage System

Despite the regulation of the Danube in the Hungarian—Slovak floodplain from the end of the last century the navigational problems could not completely been solved. This was one of the reasons for the construction of the Gabčikovo—Nagymaros River Barrage System. The original conception was worked out from a hydrological point of view to improve the navigation and to exploit water power. The ecological aspects of the conception were not evaluated. During the construction of the dam system the original plan was improved several times, and it resulted in the suspension of the construction works at Nagymaros. The international negotiations concerning the operation of the Gabčikovo hydroelectric power station did not result in a mutually accepted solution, and finally the Slovakian government made an arbitrary decision, carrying out the 'C' variant of the Gabčikovo River Barrage System, i.e. the damming and diversion of the Danube at Čunovo.

The dam at Čunovo was put into operation at the end of October 1992. During the first three days after the diversion, the discharge of the river decreased by 85% to 200—300 $m^3.s^{-1}$ and the water level became particularly low between river km 1850—1811, it fell 2 m at Rajka and Dunaremete. The surface of the branch systems in the Szigetköz was about 2000 ha at a mean water discharge and it diminished to 400 ha after the diversion. The connection between the main channel and the branch systems was disconnected. Most of the arms dried up, only the deeper beds remained watered (DUNAI et al., 1992).

In November 1992 a high Danubian flood wave filled up the branch systems. In the middle of January the arms dried up again and the environmental conditions became unsuitable for the wintering of aquatic organisms since the shallow waters froze again. In March another flood passed. The discharge curve was "thorn-shaped" in the Szigetköz section (i.e. the discharge rose for 1—2 days and after another 2 days the previous was restored, faster than usually). At the beginning of the growing season most of the branch systems were practically dry in the Upper Szigetköz. However, the condition of the branch systems in the Lower Szigetköz was less disadvantageous since the damming-effect of the power-canal was perceptible. The water level of the branch systems did not change downstream the lower mouth of the power-canal, though a 30—40 cm thick silt layer deposted in th Bagoméri branch system in the first half of 1993.

At the end of 1992, the North-Transdanubian Water Authority prepared a plan for mitigating the damages. This plan was based on the optimal water-level claimed by forestry and nature conservation and on former conceptions regarding irrigation, the melioration of the soil and the water-supply of the flood protection area and the floodplain. From February 1993 as a result of the water engineering works, the permanent water-supply of the Mosoni Danube (20 $m^3.s^{-1}$, from August 1993 10—12 $m^3.s^{-1}$) and the canal system in the flood protection area (5—6 $m^3.s^{-1}$) was solved. From August 1993 the branch systems also got a small amount of water (8—10 $m^3.s^{-1}$). The technical details of a more favourable watersupply of the branch systems (50—70 $m^3.s^{-1}$), claimed by fishery and nature conservation was also worked out.

Fishery

The waters of the Szigetköz used to provide safe jobs for hundreds of fishermen for centuries. Despite the considerable fishery in the XVI—XVIIIth century, there is no information about the fishing guild centres in the Szigetköz, only in Bratislava, Samorin and Komarno. Two commercial fishing companies were formed at the end of the XIXth century (the Győr-Region Commercial Fishing Company and the Mosoni Danube Commercial Fishing Company). The Győr-Region Company had 4200 ha and the Mosoni Danube Company had 750—800 ha fishing area. Presumably because of the complicated water system, the area was divided and leased to many tenants. The waters of the Szigetköz provided good fishing conditions for fishermen working with different kinds of small equipment, but were less or not suitable for groups of fishermen working with larger equipment. After the First World War the Győr-Region Commercial Fishing Company prospered, however, the number of tenants decreased. There is only little information about their catch (94.9 ton fish from 3500 ha in 1940; 0.6% pikeperch, 1.8% carp and 88% other cyprinid fish) (SOLYMOSI, 1965).

The natural waters of the Szigetköz have belonged to the "Előre" Commercial Fishing Company of Győr from 1951 till today. The company has 2418 ha fishing area on the Danube (river km 1850—1770) and its branch systems, and 730 ha on the Mosoni Danube. As a part of the Danube connected water network another 646 ha is utilised for fishing on the lower section of the tributaties of the Mosoni Danube (Rába, Marcal, Rábca) (JANCSÓ and TÓTH, 1987). Besides the commercial company 28 local sport-fishing clubs have fishing rights in the Szigetköz and another 96 ha fishing area belongs only to the sport-fishermen (BERTALAN, 1987).

The catch of the company and the fishing clubs have been documented since 1967 and 1968, respectively. The statistical data collected for fishery considerations are not suitable for the scientific analysis of the composition of the fish communities. However, as a result of a continuous and extensive sampling, they provide an opportunity for a moderate evaluation of fish abundance and distribution. Regarding the importance of fishing, the Szigetköz area was similar to the Baja region of the Danube, which is well-known for its diverse and abundant fish communities.

The statistical data of fishing between 1967 and 1992 indicated a decreasing trend of catch in the Szigetköz. The catch of the commercial company was 207.5 ton in 1967, it was only 77.4 ton in 1992 and it showed a significant decline especially from 1988. The total catch of the sport-fishing clubs increased by 75% between 1968 and 1986, but this was, above all, due to the fact that the number of sport-fishermen doubled in the Szigetköz. In this period the number of the sport-fishermen increased by 76% on the Szigetköz section of the Danube, while their catch increased only by 43%. Consequently, the annual catch per person decreased from 8.52 kg to 6.93 kg (BERTALAN, 1987).

Some species showed a declining trend, others became more common. The most striking was the decrease in carp *(Cyprinus carpio)* catching. Considering that the stocking of juveniles was the similar in each year, the population decline referred to the deterioration of the natural reproduction. The economical importance of pike *(Esox lucius)* is the same as the carp's. Its catching showed a relative stability for several years. However, pike declined from 1982. Its low density is due to the inssufficiency of spawning as well as the intensive fishing. The abundance of pikeperch *(Stizostedion lucioperca)*, which is the most popular fish on the market, varies annually, but it is relatively stable on the whole. In the last few years, a decreasing trend can be seen in the pikeperch catch of the commercial fishing company (i.e. 0 kg in 1992). However, this rather reflected a "change in the way of selling" and not the population dynamics. The catfish *(Silurus glanis)* sharply declined at the end 1960s and the beginning of the 1970s, then from 1975 it became more common, but in the 1990s it declined again. The asp *(Aspius aspius)* catch is usually rather low, though the haul was quite good at the end of the 1960s and in the second half of the 1970s. Its density propaply depended on the changes on the bleak *(Alburnus alburnus)* population, which is its main prey. The significant growth in the barbel *(Barbus barbus)* catch referred to the increase in its population density, a result of an improvement of the environmental conditions in its habitat. The sterlet *(Acipenser ruthenus)* is very sensitive to river pollution, nevertheless, its catch rose significantly from the 1980s, similarly to barbel's. Formerly the natural occurrence of the eel *(Anguilla anguilla)* in the catchment area of the Danube was sporadic. However, it has been stocked regularly into the Austrian part of Lake Fertő and Lake Balaton since 1958 and 1960 respectively. Since then, some migrating specimens were found in the fishermen's catch. The grass carp *(Ctenopharyngodon idella)* and silver carp *(Hypophtalmicthys molitrix, H. nobilis)* are important, relevant species in the fishery management of backwaters and irrigation canals. Their density depends on their stocking.

Statistical data about fishing intensity in the Szigetköz area are reserved by the Commercial Fishing Company and are not available for ichthyologists. However, it deserves attention that the fish in the catch became younger, i.e. small and young specimens got more frequent. The decline of the older age-groups of commercial fish shows that the balance between recruitment and the mortality of te older age-classes was distrubed, i.e. the populations were overfished.

Present evinronmental conditions for fish in The Szigetköz area

The century old regulation of the Danube changed the hydrological regime. It solved navigation problems and helped flood protection but restricted the habitats of the potamic communities. From the turn of the century, the standing stock diminished and the structure of fish populations was modified. Some species became rare (*Acipenser gueldenstaedti, Hucho hucho, Pelecus cultratus,* etc.) or extinct (*Huso huso, Acipenser stellatus, Acipenser nudiventris,* etc.) and a few "new' species immigrated in large number (*Carassius auratus, Lepomis gibbosus,* etc.) in the Szigetköz area. From the end of the last century the main reasons of the modifications for the fish communities have been the following:

1. Flood passes faster, consequently the spawning and nursery habitats are inundated for a shorter time.
2. Flood protection dikes diminshed the area of spawning and nursery habitats, by separating most of the original floodplain from the Danube.
3. The deposition of fine alluvial sediments was more intensive in the inundated areas and by this process the remaining spawning and nursery habitats lost their diversity.

Changes in the quantity and quality of the spawning and nursery habitats resulted in a drastic decline of the natural reproduction of fish populations. Most of the species could not find suitable habitats for spawning, so the hatch of the eggs was insufficient, and the available food sources of fries became unfavourable.

Despite the changes in the original fish assemblages, the threatened populations of the Szigetköz floodplain are extremely valuable to nature conservation. The characteristic aquatic habitats of the area form a worthy Middle Danubian unit of protection. The waters in the Szigetköz constitute an open system, in consequence, they do not have a separate fish fauna. The occurrence of 60 species (75% of Hungarian fish fauna) was documented in the area in the last few decades (Table 1). In the Carpathian basin 4 of them are endangered *(Eudontomyzon mariae, Acipenser gueldenstaedti, Hucho hucho, Gobio uranoscopus),* 10 are vulnerable *(Umbra krameri, Rutilus pigus virgo, Alburnus bipunctatus, Pelecus cultratus, Gobio kessleri, Sabanejewia aurata, Gymnocephalus schraetzer, Zingel zingel, Zingel streber, Cottus gobio)* and 7 are rare (*Salmo trutta, Pararutilus frisii meidingeri, Abramis sapa, Vimba vimba, Lota lota, Gymnocephalus baloni, Stizostedion volgense)* (Tóth, 1970, 1972, Vida, 1990; Guti, 1993).

The biomass of fish in the particular habitats was estimated on the Slovak side of the Danube. The icthyomass of assemblages depended on the flood regime of the river.

Table 1. Fish species in the Szigetköz floodplain. I Eupotamon, II Parapotamon, III Plesiopotamon, IV Paleopotamon (+++ Dominant, ++ Abundant, + Sporadic, ? Probable); V Preference of current velocity (R Rheophils, S Semirheophils, L Limnophils); VI Reproductive guild (Li Lithophils, F Phytophils, I Indifferent, P Pelagophils, Ps Psammophils, O Ostracophils); VII Evaluation of conservation status (E Endangered, V Vulnerable, R Rare, C Common, M Immigrant, X Exotic, • Endemic): VIII Commercial value (•• primary, • secondary)

Species	I	II	III	IV	V	VI	VII	VIII
Eudontomyzon mariae Berg	?	—	—	—	R	Li	E•	—
Acipenser ruthenus L.	++	+	—	—	R	Li	R	••
Acipenser gueldenstaedti Marti	+	—	—	—	R	Li	E	—
Salmo trutta L.	+	+	—	—	R	Li	R	—
Oncorhyncus mykiss Walbaum	+	+	—	—	R	Li	X	—
Hucho hucho L.	+	—	—	—	R	Li	E•	—
Umbra krameri Walbaum	—	—	—	++	L	F	V•	—
Esox lucius L.	—	++	++	++	L	F	C	••
Rutilus rutilus L.	++	+++	+++	+++	S	I	C	•
Rutilus pigo virgo Heckel	+	+	—	—	R	F	V•	—
Pararutilus frisii meidingeri Heckel	?	—	—	—	R	Li	M	—
Ctenopharyngodon idella Valenciennes	+	+	+	—	R	F	X	••
Scardinius erythrophthalmus L.	—	+	++	+++	L	F	C	•
Leuciscus leuciscus L.	+	++	—	—	R	I	R	—
Luciscus cephalus L.	++	+++	++	—	R	Li	C	•
Leuciscus idus L.	++	++	+	—	R	Li	R	•
Aspius aspius L.	++	++	+	—	R	Li	R	••
Leucaspius delineatus Heckel	—	?	+	?	L	F	V	—
Alburnus alburnus L.	++	+++	+++	++	S	I	C	•
Alburnoides bipunctatus Bloch	+	—	—	—	R	Li	V	—
Blicca bjoerkna L.	++	+++	+++	++	S	F	C	•
Abramis brama L.	++	++	++	+	S	I	C	•
Abramis ballerus L.	++	++	+	—	R	I	R	•
Abramis sapa Pallas	+	+	—	—	R	Li	R	—
Vimba vimba L.	+	++	—	—	R	I	V	•
Pelecus cultratus L.	+	+	—	—	R	P	R	—
Tinca tinca L.	—	+	+	++	L	F	C	•
Chondrostoma nasus L.	++	++	—	—	R	Li	R	•
Barbus barbus L.	+++	+	—	—	R	Li	C	••
Gobio gobio L.	++	+++	++	—	S	Ps	C	—
Gobio albipinnatus Lukasch	++	++	+	—	R	ps	R	—
Gobio uranoscopus Agassiz	+	—	—	—	R	Ps	E•	—
Gobio kessleri Dybowsky	+	—	—	—	R	Ps	V•	—
Pseudorasbora parva Bioch	—	?	+	?	N	Li	X	—
Rhodeus sericeus amarus Bloch	+	++	+++	+++	L	O	C	—
Carassius carassius L.	—	+	++	++	L	F	R	•
Carassius auratus L.	++	+++	+++	++	S	F	C	•
Cyprinus carpio L.	+	++	++	++	S	F	C	••
Hypophtalmichthys molitrix Valenciennes	+	+	+	—	R	P	X	••
Arisichthys nobilis Richardson	+	+	+	—	R	P	X	••
Barbatula barbatula L.	+	+	—	—	R	Ps	R	—
Misgurnus fossilis L.	—	+	++	++	L	F	R	—
Cobitis taenia L.	+	+	++	++	S	F	R	—
Sabanejewia aurata Filippi	+	+	—	—	R	F	V	—
Silurus glanis L.	++	++	+	+	S	F	R	••
Ictalurus nebulosus Le Sueur	—	—	—	+	L	I	X	—
Anguilla anguilla L.	+	+	+	?	S	P	M	••
Lota lota L.	+	++	—	—	R	Li	V	•
Gasterosteus aculeatus L.	+	++	?	—	S	F	X	—
Lepomis gibbosus L.	+	+	++	+++	L	I	X	—
Perca fluviatilis L.	+	++	+++	++	S	I	C	—
Gymnocephalus cernuus L.	+	++	++	+	S	I	C	—
Gymnocephalus baloni Holcik & Hensel	+	++	—	—	R	Li	R•	—
Gymnocephalus schraetzer L.	++	+	—	—	R	Li	V•	—
Stizostedion luciperca L.	++	++	+	—	S	I	R	••
Stizostedion volgense Gmelin	+	+	+	—	S	F	V	—
Zingel zingel L.	+	—	—	—	R	Li	V•	—
Zingel streber Siebold	+	—	—	—	R	Li	V•	—
Proterorhinus marmoratus Pallas	++	+++	+++	+	S	I	R	—
Cottus gobio L.	++	+	—	—	R	Li	V	—

In eupotamic branches, the mean ichthyomass was rather low, only between 30—40 kg.ha^{-1}. In parapotamic arms the ichthyomass was moderate, fluctuating between 200—370 kg.ha^{-1}. In plesiopotamic branches the ichthyomass was very high, usually fluctuating between 600 and 1400 kg.ha^{-1} with a 3000 kg.ha^{-1} the maximal value. In paleopotamic waters the ichthyomass fluctuated between 200—300 kg.ha^{-1}, inaverage. In general, the diversity of fish species was the greatest in the eupotamon and parapotamon and tend to decrease in the plesio- and paleopotamon but the ichthyomass showed an opposite trend (HOLČIK, 1991).

In the second half ot the XX. century the abiotic environment of fish has become more unfavourable in the Szigetköz floodplain. The most important human impacts were the following.:

1. As a consequence of the bed deepening of the Danube in the Szigetköz the water level of the river has become lower than it had been before at the same discharge, therefore the flood-period of the inundated floodplain is flooded les frequently and for periods. The bed deepening characteristic for nearly the complete Hungarian Danube section and it results in the deterioration of the reproduction and feeding conditions of fish.

2. In the 1980s water engineering works connected with the construction of the Gabčikovo—Nagymaros Rive Barrage System caused disadvantageous changes in the aquatic habitats. Construction works related to the planned water supply canal of the Szigetköz branch system (cross dams, ditches, etc.), made the flushing of the side armss more difficult and accelerating their siltation.

3. In consequence of the "ring-dam" at Nagymaros, which surrounds the construction area of the planned power plant, the Danube bed became narrower and the higher current velocity caused an unsuitable condition for fish passage.

4. In November 1992, when the Danube was diverted to the Gabčikovo power canal, fish populations which assembled in their winter habitats could not always follow the recession of the water. During the first three weeks after the diversion, the estimated quantity of fish that perished in the Szigetköz branch system was at least 60 ton (80% small cyprinid fish, 10% pikeperch, 5% carp, 3% pike, 2% catfisch) (NAGY, 1992; TÓTH, 1993).

5. As the side arms gradually dried out, fishes remaining in the crowded muddy pools became easy preys for water birds and wild-boars and an accessible catch for the occasional poachers. According to the moderate estimations 40 ton of fisch died because of the above mentioned reasons during the winter 1992 (NAGY, 1992). In the second half of the winter the shallow pools froze solid because of the long lasting cold, which considerably harmed the over wintering chances of fisches.

6. The water supply of the branchs systems in the Szigetköz changed significantly after the diversion of the Danube. The diversity and the nature conservation value of the fish assemblages decreased in the particular habitats.

7. Since the divesion of the Danube, the "thorn-shape" floods in the former main channel were very unfavourable for the fluvial communities.

8. In 1993 the water-cover of the floodplain did not make possible the large-scale spawning of fishes, therefore the natural recruitment of the populations considerably decreased. No improvement can be expected unless the present situation is changed. The flow through of the branch systems is only 1.5—2 days annually at a 25% probability and the full inundation is to be expected once in every 12—13 years (F. DUNAI — personal communication).

9. The operation of the Gabčikovo hydroelectric power station had another negative effects on the shoals of fish during their spawning migration. The high discharge of the power canal diverts the shoals to the hydroelectric dam, which is an insurmountable barrier for them. The downstream section of the canal is an unsuitable habitat for spawning, yet it is an ideal area for fishing (TÓTH, 1993).
10. Commercial fishing does not consider the quantity of the timely standing stock, the overfishing also contributed to the decrease of the recruitment of the fish populations.

The ichthyological and ecological prognosis of fishery in the Szigetköz can be predicted primarily on the basis of long term studies on juvenile fish communities. Researches in this field have been carried out by the Danube Research Station of the Institute of Ecology and Botany of the Hungarian Academy of Sciences. The results of the survey constitute the basis of habitat reconstructions and the rehabilitation of fishery in the Szigetköz floodplain.

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Baloghia gen. n., a new haplozetid genus from the Comoro Islands (Acari: Oribatida)

By

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Abstract. A new haplozetid (Oribatida) genus (*Baloghia* gen. n.) and two species are described from the Comoro Islands.

That small number of publications treating the extra-African fauna of the Ethiopian Region proves the difference in fauna between the main continent and the surrounding islands. Consequently, it is of paramount importance to study the distribution of species in order to be able to draw reliable zoogeographical conclusions regarding the whole of the region**.

One of these significant areas is the Comoro Islands, from which only NIEDBALA (1988) published some records on Oribatida. Thanks to DR. TAMÁS PÓCS (Eger, Hungary), bryologist, recently a fair number of soil samples were passed onto us, which yielded rich oribatid materials. The elaboration resulted in several new taxa planned to me made public continuously.

This contribution presents the description of a new haplozetid genus and two species. The main characteristics of the latter are unanimously refer both into one genus. However, one important generic feature (the number of aggenital setae) relegates them into separate generic groups. Obviously, the question arises: is the separation of the genera within the family well grounded?

The morphological terms follow the authors earlier adopted in my papares (e.g. MAHUNKA, 1993).

Baloghia gen. n.

Diagnosis: Family Haplozetidae. Body surface with sculpture. Rostrum simple. Lamellae short, without cusps, lamellar setae arising on its end. Tutorium strong, rostral setae arising on its cups, and a characteristic transverse laths present between them. Dorsosejugal suture well developed. Pteromorphae large, movable. Notogaster

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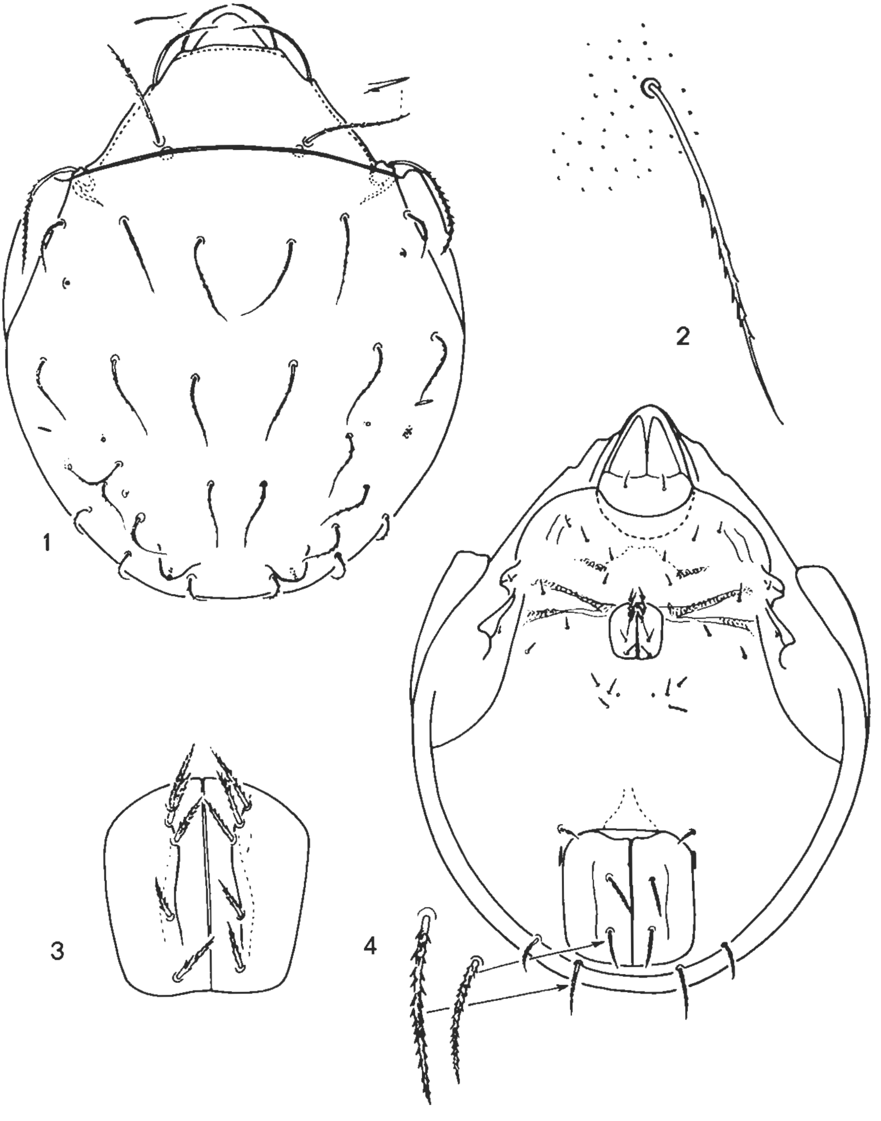
with 1 pair of conspicuously protruding tubercles, 13 pairs of long setae, 4 pairs of sacculi (one of them placed on the tubercle), 5 pairs of lyrifissures and 1 pair of glandular openings. Gnathosoma with typical "oribatuloid" characters, palpal solenidium fused with the eupathidium *acm*. Epimeral setal formula: 3-1-3-3. Aggenital neotrichy present or absent. Anogenital setal formula: 5-1-2-3. Lyrifissures *iad* in



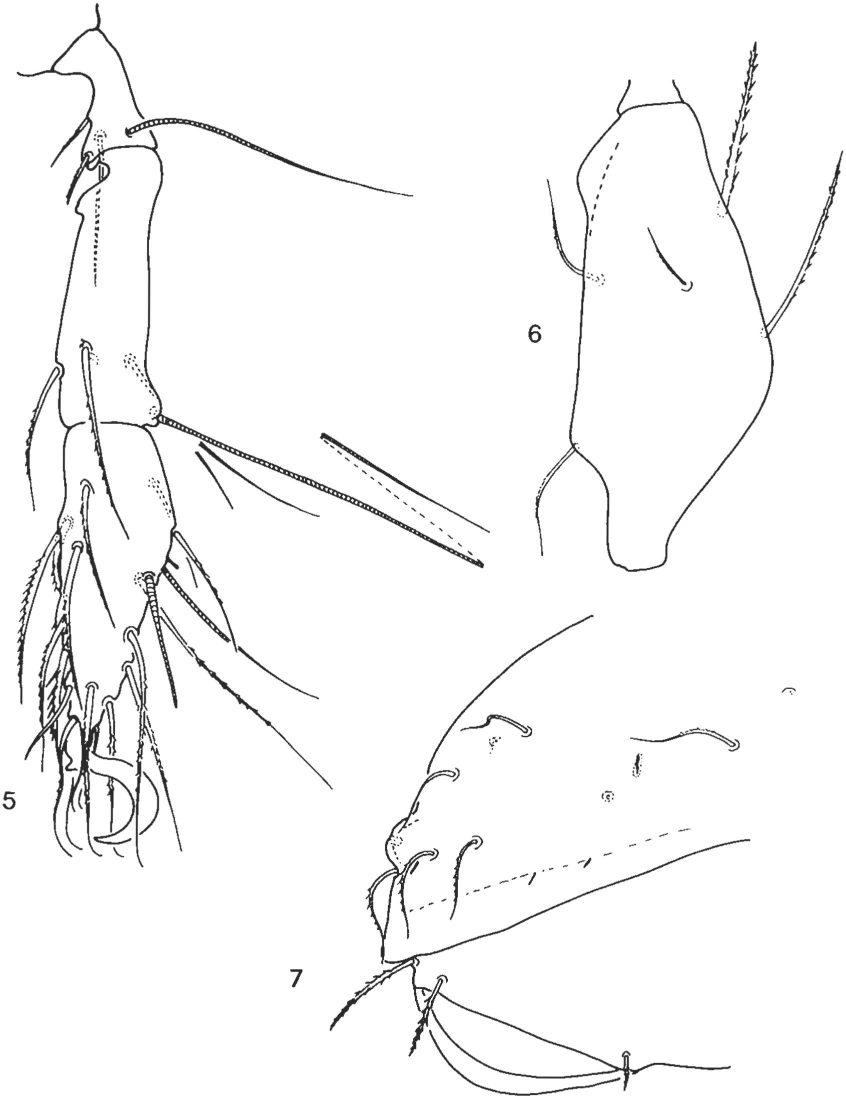
Figs 1—4. *Baloghia juditae* sp. n. 1: dorsal aspect, 2: median notogastral seta, 3: genital plates, 4: ventral aspect

adanal position. Legs monodactylous, with typical chaetotaxy. All femora with sculpture. Solenidia of tibia I arising on a low protuberance, φ_2 characteristically anterior, in the same level inside.

Type species: *Baloghia juditae* sp. n.

Remarks: The new genus doubtless belongs to the relationship of the genus *Peloribates* BERLESE, 1908. It is well charazterized and on this basis it is well distinguishable from all halplozetid taxa by the one pair of notogastral tubercles bearing the sacculi (S_3) and the transverse line between the tutoria.

This new genus is dedicated to the 80th birthday of the great acarologist, my teacher, Prof. DR. J. BALOGH.

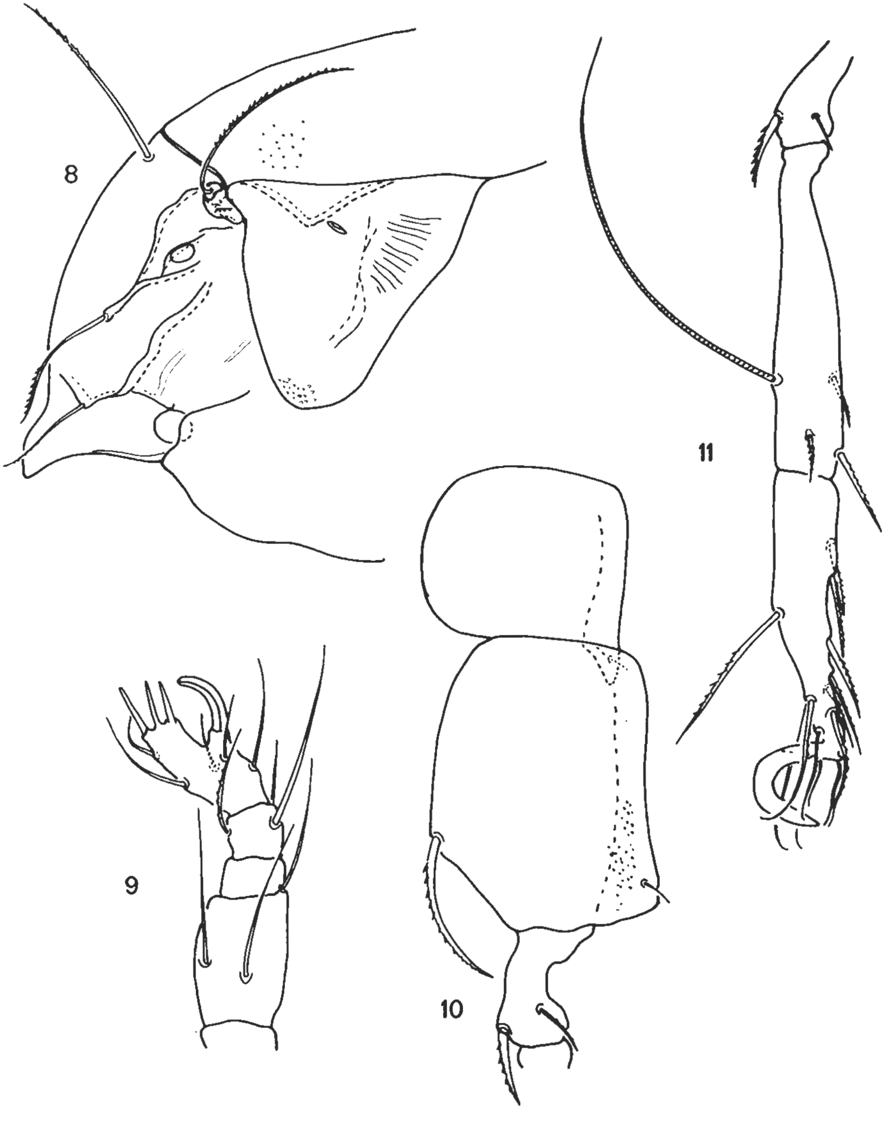


Figs 5—7. *Baloghia juditae* sp. n. 5: genu, tibia and tarsus of leg I, 6: femur of leg I, 7: posterior part of the body in lateral aspect

Baloghia juditae sp. n.

Measurements: Length of body: 931—1153 μm, width of body: 681—904 μm. Characteristic difference in the size of the male and female specimens.

Integument: The body mostly covered by a cerotegument layer, consisting of different kinds of granules or filaments. Punctures of cuticle different in size, distinctly on the prodorsum, rarely on the notogaster, again distinctly on the distal margin of the pteromorphae. Femur of all legs foveolate.



Figs 8—11. *Baloghia juditae* sp. n. 8: lateral part of podosoma in lateral aspect, 9: palp, 10: trochanter, femur and genu of leg IV, 11: tibia and tarsus of leg IV

Prodorsum: Rostrum well separated from the rest of the prodorsum, beak-shaped in lateral view (Fig. 8). Lamella weakly developed, sublamella present, prelamella absent. Tutorium resembling a lamella, rostral setae arising on its cusps. Between them a well-observable transversal line or lath observable behind the rostral region. Ratio of the prodorsal setae: *in*>*le*>*ro*. Lamellar and rostral setae setiform, without filiform end, interlamellar setae needle-shaped (Fig. 1). Rostral and lamellar setae scarcely, interlamellar setae well spiculate. Exobothridial setae minute. Sensillus setiform, reclinate, unilaterally and distintcly ciliate.

Notogaster: Dorsosejugal suture complete, moderately arched anteriorly. Posterior margin of notogaster well protruding over the ventral plate, this part well observable in lateral aspect (Fig. 7). One pair of dorsophragmatic apophyses present behind the alveoli of interlamellar setae. Thirteen pairs of setiform, long, curved notogastral setae present whose distal head filiform (Fig. 2). All four pairs of sacculi small, with wound opening. Five pairs of lyrifissure present, *ih* and *ips* in lateromarginal position.

Gnathosoma: Mentum, chelicera normal. Palpal solenidium and eupathidium *acm* of palpal tarsus arising on a common tubercle (Fig. 9).

Coxisternal region: Surface coarsely punctate and irregularly alveolate. Epimeral borders connected with each other medially, *ap. sej.* and *ap. 4* at the anterior corner of the genital aperture. Among the epimeral setae great difference exist, setae *3a* and *3b* longer thant the others. All setae more or less ciliate.

Anogenital region: Surface of ventral plate finely punctate. Genital plate with longitudinal crest, genital setae arising in this line, mostly on the edge of this crest (Fig. 3). Three (exceptionally 4) pairs of aggenital setae; all genital and aggenital setae strong, mostly erect, rarely, but then strongly pilose. Anal plates also with longitudinal crests, anal and adanal setae distinctly pilose (Fig. 4).

Legs: Trochanters III—IV and femora I—IV with longitudinal crests or blade-like formation (Figs 6, 10). On femora I and II a dorsal crest also observable. Tarsi I and II sharply narrowing dorsally. Claws of all legs with a strong tooth basally (Fig. 5). Setae *pv''* and *a''* short, stout.

Material examined: Holotype (1463-HO-93): Mwali Island (Comoro Archipelago), W end of Mwali (Moheli) Island. Secondary lowland rainforest near Miringoni village on the SSW slope of the main mountain range, at 230—400 m, 30. Aug. 1992. Leg. Dr. T. Pócs. 4 paratypes from the same sample. Holotype and 3 paratypes deposited in the Zoological Department of the Hungarian Natural History Museum, Budapest, and 1 paratype in the Museum d'Histoire naturelle, Geneva.

Remarks: See after the description of the next new species.

I dedicate the new species to Judit Csiszár (Mrs. J. Balogh), for her continous help in the scientific work of her husband.

Baloghia spinifera sp. n.

Mesurements: Length of body: 583—722 μm, width of body: 430—515 μm.

Integument: Waxy layer thinner than in the preceding species. Cuticle distinctly punctate on the prodorsum, notogaster ornamented by elongate pori or foveolae. Coxisternal region rarely punctate and the ventral plate covered by small granules.

Prodorsum: Rostrum, lamellae, tutoria and the transverse lath between he tutorial cusps are similar to those of the preceding described species. Rostral and lamellar setae setiform, but without filiform end, interlamellar setae needle-shaped (Fig. 14). All prodorsal setae well ciliate. Sensillus reclinate, slightly thicker than in the preceding species, unilaterally, distinctly pilose (Fig. 12).

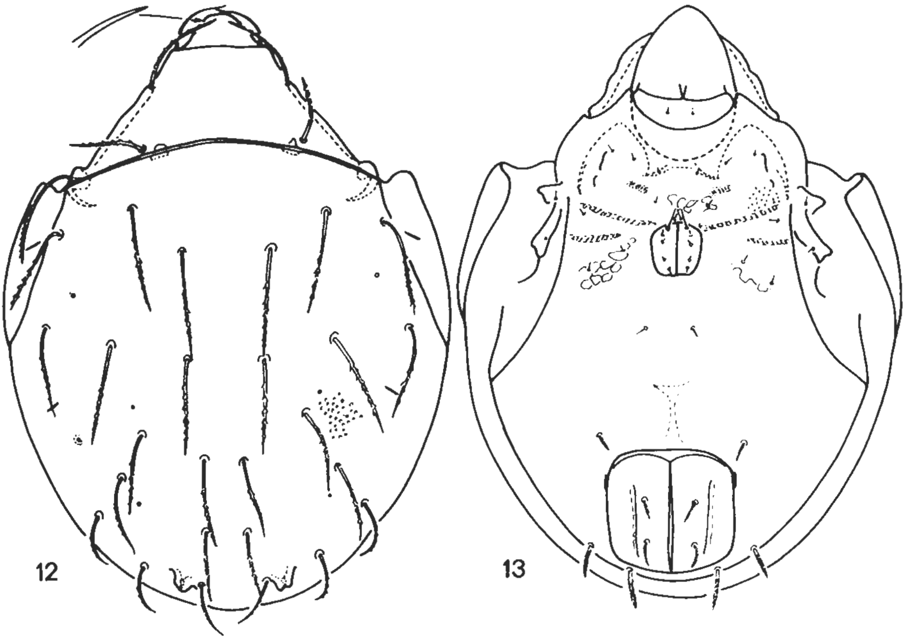


Fig 12—13. *Baloghia spinifera* sp. n. 12: dorsal aspect, 13: ventral aspect

Notogaster: Thirteen pairs of needle-shaped, well spiculate notogastral setae (Fig. 15), and four pairs of small sacculi present. S_3 located on the notogastral tubercles, which well protruding from the notogastral surface.

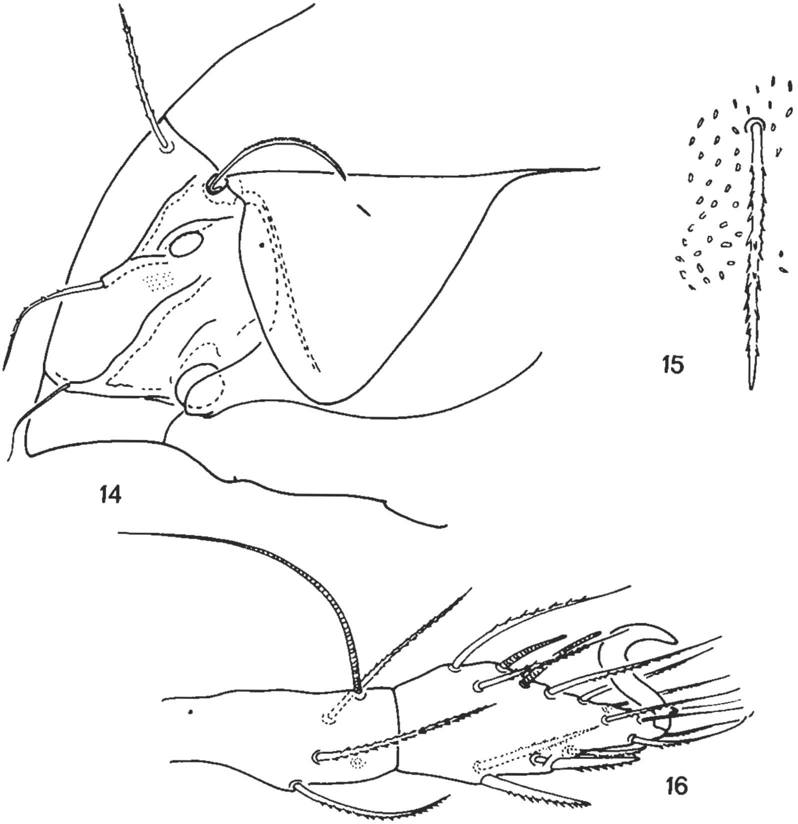
Ventral regions (Fig. 13): Epimeral borders hardly discernible. Discidium large, with a broadened inner edge. All notogastral setae short or minute, no essential difference among them. Genital plates without longitudinal crest, but the genital setae arising in longitudinal rows. Anterior pair of the genital setae much longer than the others. Only one pair of aggenital setae present. Anal plates with a longitudinal crest. Epimeral, genital and aggenital setae rarely, anal and adanal setae distinctly barbed (Fig. 13).

Legs: Similar to the preceding species, solenidia φ_1 and φ_2 arising together on the anterior margin of the tibia I, in the same level. φ_2 inserted inside.

Material examined: Holotype (1464—HO—93): Mwali Island (Comoro Arhipelago), W end of Mwali (Moheli) Island. Secondary lowland rainforest near Miringoni village on the SSW slope of the main mountain range, at 230—400 m, 30. Aug. 1992. Leg. Dr. T. Pócs. 7 paratypes from the same sample. Holotype and 6 paratypes deposited in the Zoological Department of the Hungarian Natural History Museum, Budapest, and 1 paratype in the Museum d'Histoire naturelle, Geneva.

Remarks: On the basis of some characteristic features (e.g. the form of the notogastral setae, the sculpture of the notogaster, etc.) the two new species are well distinguishable from each other. Moreover their mesurements and first of all the number of the aggenital setae and the structure of the genital plates are also different.

Derivation nominis: The species is named after the needle-shaped interlamellar and notogastral setae.



Figs 14—17. *Baloghia spinifera* sp. n. 14: lateral part of podosoma, 15: median notogastral seta, 16: tibia and tarsus of leg II

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Ecofaunistical investigations in a boggy forest in the Protected Landscape Area at Ócsa (Kiskunság National Park, Hungary)

By

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Abstract. The total number of species of the soil-living macrofauna in the Protected Landscape Area at Ócsa were 24; 9 diplopods, 7 isopods (Oniscidea) and 8 chilopods have been identified. The most abundant species were *Polydesmus schaessburgensis* VERH. (Diplopoda), *Armadillidium zenckeri* BRANDT (Isopoda-Oniscidea) and *Monotarsobius baloghi* LOKSA (Chilopoda).

Experimental studies in the Protected Landscape Area at Ócsa started as a part of a long term program. This program was instigated after 1945. Its purpose is to study the fauna of marshlands, moorlands and temporarily water-logged territories as well as to develop their conservation (KASZAB, 1982). A result of this program is a book on the faunal assembledge of Bátorliget territory.

The present study describes the faunal assembledge of a boggy forest in the Protected Landscape Area at Ócsa. In addition to obtaining faunistical data and completing the previous studies, the aim of the study was to get some knowledge on the adaptive features of the macrofauna as a whole.

Being flooded temporarily, a significant difference was expected to exist between the faunal assembledge of the study area in the case of wet conditions and dry periods.

Material and methods

The study area belongs to the Kiskunság National Park. There were several studies done on the flora of this area (BOROS, 1952; KOMLÓDI, 1958). The fauna of the national park was examined by MAHUNKA (ed.) (1986, 1987).

My research area is a strictly protected wet alder woodland (Fraxineto pannonicae-Alnetum) called "Big Forest".

Samples were taken either monthly or bimonthly from March 1989 to November 1990. Depending on the water level, samples were taken either from the trunks or between the trunks, or from both sites between 8 and 11 a.m.

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Trunks: These were outstanding trunks of alder trees and the surrounding dry area, which had a changing size during the year. This term means the trunk of the tree and its root system reaching out of the water, as well as the base of the branched trees growing from each trunks.

Between the trunks: This means the area among the trees which was temporarily covered by a varying amount of water. 10 or 20 samples were taken from the two habitats depending on the actual water level (20 when it was possible to take samples from both sites; otherwise 10). Quadrant method was used with a size of 25×25 cm. The animals were collected by mesh sieving and later identified in the laboratory.

Dates of collections: 1989: 16. 3., 7., 13. 9., 23. 10. 1990: 6. 2., 13. 3., 18. 4., 5. 6., 24. 7., 3. 9., trunks. 1989: 29. 5., 4. 7., 6. 9., 23. 10. 1990: 5. 6., 24. 7., 3. 9., between the trunks.

Two of the higher taxa examined belong to decomposers: Diplopoda and Isopoda (Oniscidea), one of them was predatorous (Chilopoda).

For identification the keys and articles of SCHUBART (1934), JERMY (1942), LOKSA (1954) [Diplopoda], GRUNER (1965, 1966), SCHMÖLZER (1965), WACHTLER [Isopoda] LOKSA (1955) [Chilopoda] were used.

Results

Altogether 16,275 specimens were found. 8751 of them were Isopoda, 7302 belonged to Diplopoda and 222 were Chilopoda specimens. Nine Diplopoda, eight Chilopoda and seven Isopoda species were found.

Diplopoda species: *Polydesmus schaessburgensis* VERH., *Polydesmus complanatus* LINNÉ, *Polydesmus denticulatus* C. L. KOCH, *Julus terrestris* PORAT, *Leptoiulus cibdellus* CHAMBER., *Glomeris hexasticha* BRANDT. Only a few specimens of *Nopoiulus kochii* GERVAIS., *Ommatoiulus sabulosus* LINNÉ, and *Haasea* sp. were found. From the latter genus there were only juveniles present, so it was not possible to identify them for species.

Isopoda species: *Armadillidium zenckeri* BRANDT, *Porcellium collicola* VERH., *Trachelipus rathkei* BRANDT, *Hyloniscus riparius C. L. KOCH, Haplopthalmus danicus* B.-L., *Asellus aquaticus LINNÉ.* From the genus *Trichoniscus* only female specimens were found, so it was not possible to identify them for species.

Chilopoda species: *Monotarsobius baloghi* LOKSA, *Monotarsobius crassipes* C. L. KOCH, *Lithobius forficatus* LINNÉ, *Lithobius muticus* C. L. KOCH, *Lithobius erythrocephalus* C. L. KOCH, *Pachymerium ferruginem* C. L. KOCH, *Geophilus proximus* C. L. KOCH, *Schendyla nemorensis* C. L. KOCH.

DIPLOPODA

Polydesmus schaessburgensis VERH. — This is a relict species occurring only on the Ócsa-Sáry area within Hungary. This species is an inhabitant of moorlands and boggy forests, as well as high mountain habitats. It was first found in Transsylvania near Segesvár by VERHOEFF (CEUCA, 1992) and also recorded from the southern steppe zone of the former Soviet Union (GOLOVATCH, 1992). This species seemed to prefer wet and cool habitats (LOKSA, 1954; KORSÓS, 1987). I found the same preference as well considering that this area can be characterized by this sort of preference. During the present study this species was found to be the most abundant one.

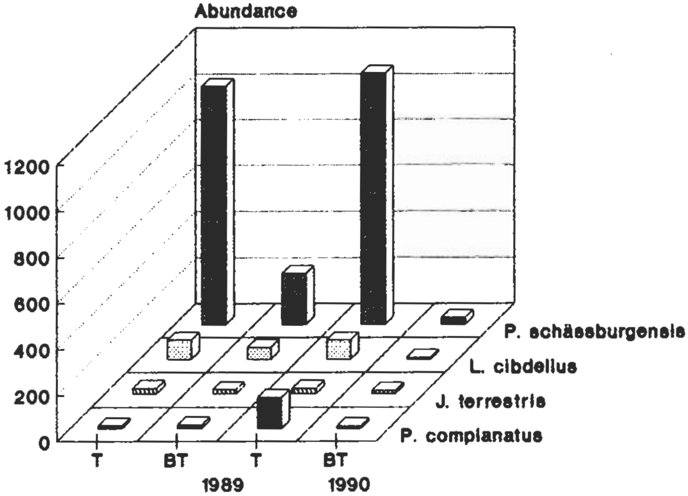

Figure 1. The three most abundant diplopod species *(P. schaessburgensis, L. cibdellus, J. terrestris)* and a common diplopod species *(P. complanatus)* in the studied period (1989—1990). The vertical axis shows the abundance of diplopods. T: trunks, BT: between the trunks

Julus terrestris PORAT. — This species occurs mostly in wet alder woods for example around Barcs (LOKSA, 1973). The distribution of this species is not known. Because of identification difficulties, it was often mixed with other species (LOKSA, 1981).

Leptoiulus cibdellus CHAMBER. — Temporarily occurs in boggy forest. This species has a Northern European distribution (JEDRICZKOWSKY, 1992). It was recorded mostly from wet woods, groves and alder woods. According to the results of ZULKA (1991), this species was found to be able to survive submersion, both in the field and in laboratory conditions. During the present study this species was found to be a permanent member of the fauna living in wet woods. It was missing only once from the territory between the trunks, but even that time it was found on the trunks. It was the second most abundant species at almost all the sites.

ISOPODA

Armadillidium zenckeri BRANDT. — This species was found to be the most abundant among isopod species. It occurred in both habitats and seemed to have a high tolerance for wet and cool conditions. This species shows a Middle European distribution. According to LOKSA (unpublished data) this species has a preference for mostly wet and cool habitats; within Hungary it is said to be a relict species. *A. zenckeri* was dominant in both habitats and was found to be the most abundant at the edge of the forest where there is no water flooding effect.

Porcellium collicola VERH. — This is a widely distributed typical forest inhabitant with a Middle European distribution (LOKSA, 1973). For example it was found in reedbanks of Lake Fertő (GRUNER, 1966). This species was recorded to be the most abundant isopod species from the Bátorliget territory (ALLSPACH & SZLÁVECZ, 1991). During the present study, this was also found to be the most abundant in the area examined.

Hyloniscus riparius C. L. Koch. — An extremely higrophyl species (Loksa, 1977, Szlávećz, 1988). Though it is a common species in Hungary, in the case of Bátorliget another species from the same genus was found: *H. transsylvanicus* (Allspach & Szlávecz, 1991). Within Oniscidea this is the most abundant species. According to the literature (Gruner, 1966) this species is able to survive more than two weeks covered by water and it also occurs in caves as well as in the upper soil layer.

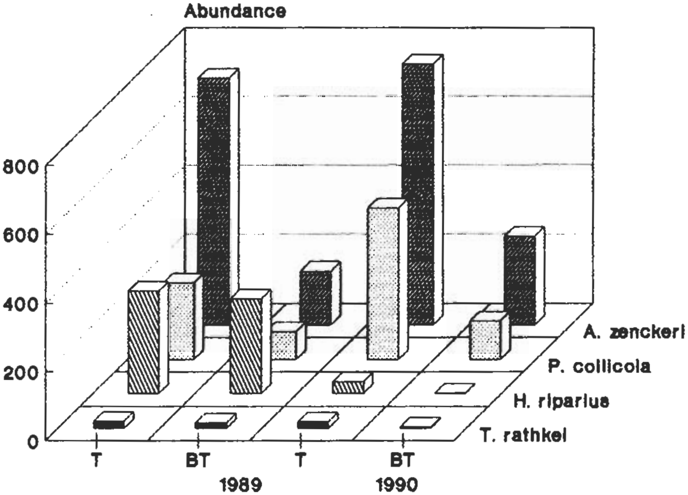

Figure 2. The three most abundant isopod species *(A. zenckeri, P. collicola, H riparius)* and a common isopod species *(T. rathkei)* in the studied period (1989—1990). The vertical axis shows the abundance of isopods. T: trunks, BT: between the trunks

CHILOPODA

Monotarsobius baloghi Loksa. — This species was described from Ócsa by Loksa (1955). It was found to be dominant on the trunks, but not always dominant among them. According to the studies of Zulka (1991) in its natural habitat this species can be tolerant of flooded conditions, but in the case of laboratory conditions when the aeration of the water is not satisfactory it can die within a few hours.

Lithobius muticus C. L. Koch. — Distributed within Europe with a wide range of ecological tolerance occurring both in wet and dry habitats. It can dig into the soil down to a 10 cm depth.

Summary

The faunal assembledge was found to be diverse but within all three taxa examined, those species which are adopted to the wet and cool microclimate of marshy habitats were found to be the most abundant ones. Among Diplopoda species *P. schaessburgensis*, among Isopoda species *A. zenckeri*, from Chilopoda *M. baloghi*. Among diplopods *P. schaessburgensis*, *P. complanatus*, *L. cibdellus* occurred in all sam-

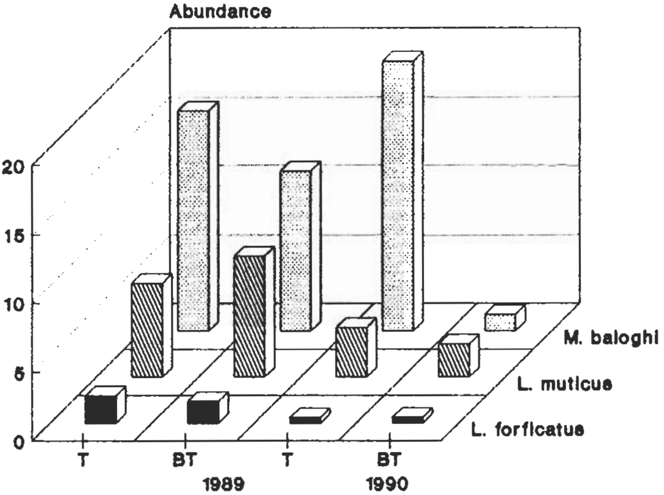

Figure 3. The two most abundant chilopod species *(M. baloghi, L. muticus)* and a common chilopod species *(L. forficatus)* in the studied period (1989—1990). The vertical axis shows the abundance of chilopods. T: trunks, BT: between the trunks

ples from the trunks. Between the trunks *P. schaessburgensis, P. complanatus, J. terrestris* was found in all samples while *L. cibdellus* was missing once. The diplopod fauna was found to be diverse. Six species were almost always found together.

Among isopods *A. zenckeri, P. collicola* and *T. rathkei* were found in all samples from the trunks while *T. rathkei* was missing once from a sample between the trunks. Among diplopods *P. schaessburgensis* was found to be the most abundant species, this seemed to be the dominant one. Among isopods *A. zenckeri* was found to be dominant in both habitats in 1989, and on the trunks in 1990. Among chilopods *M. baloghi* and *L. muticus* were found to be the most abundant dominant species.

From the nine Diplopoda species *P. schaessburgensis, P. denticulatus, P. complanatus* were primarily found in wet woods in a temporarily flooded habitat. *N. kochii, O. sabulosus, J. terrestris* were found to inhabit mostly wet habitats. *G. hexasticha* is a forest inhabitant. The varietas which was found in the study area is a small, darkly pigmented form, which had been reported only from Ócsa, Pótharaszt territories (Jermy, 1942).

According to the literature (Schubart, 1934), *P. denticulatus* is a species with a tolerance of dry conditions, living mostly between the trunks. In Hungary, however, this species occurs mostly in wetlands (Loksa, 1983) such as the moorland in Bátorliget (Korsós, 1990), alder woods at Barcs (Loksa, 1981) and wet alder woods at Ócsa (Korsós, 1987).

During the present study 8 isopod species were found. They are mostly inhabitants of wet habitats (*A. zenckeri, H. riparius, H. danicus* and the *Trichoniscus* sp.). *A. aquaticus* is a species which was found in temporarily water-covered habitats. *T. rathkei* can survive a longer period covered by water in temporarily flooded wet woods and graslands, though it is rather found in dry areas. *P. collicola* is also a species with a wide distribution occurring in wet woods (Bátorliget, Allspach & Szlávecz, 1991), and reedbanks (Gruner, 1966).

Table 1. Species, individual numbers (N) and the dominance values (D%) of the diplopods. N: the total numbers of individuals, D: the dominance value in percentage, T: trunks

T	1989	N	D%
Polydesmus schaessburgensis		559	70.31
Polydesmus complanatus		39	4.91
Polydesmus denticulatus		42	5.28
Jules terrestris		43	5.41
Leptoiulus cibdellus		111	13.96
Glomeris hexasticha		1	0.13
Nopoiulus kochii		—	—
Ommatoiulus sabulosus		—	—
Haasea sp.		—	—
		795	100

T	1990	N	D%
Polydesmus schaessburgensis		85	48.60
Polydesmus complanatus		23	13.13
Polydesmus denticulatus		—	—
Jules terrestris		35	20.00
Leptoiulus cibdellus		29	16.57
Glomeris hexasticha		3	1.70
Nopoiulus kochii		—	—
Ommatoiulus sabulosus		—	—
Haasea sp.		—	—
		175	100

Table 2. Species, individual numbers (N) and the dominance values (D%) of the diplopods. N: the total numbers of individuals, D: the dominance value in percentage, BT: between the trunks

BT	1989	N	D%
Polydesmus schaessburgensis		2596	87.230
Polydesmus complanatus		64	2.150
Polydesmus denticulatus		31	1.040
Jules terrestris		62	2.080
Leptoiulus cibdellus		205	6.890
Glomeris hexasticha		15	0.500
Nopoiulus kochii		1	0.034
Ommatoiulus sabulosus		—	—
Haasea sp.		2	0.067
		2976	100

BT	1990	N	D%
Polydesmus schaessburgensis		2753	83.880
Polydesmus complanatus		233	7.100
Polydesmus denticulatus		1	0.030
Jules terrestris		64	1.950
Leptoiulus cibdellus		218	6.640
Glomeris hexasticha		12	0.370
Nopoiulus kochii		—	—
Ommatoiulus sabulosus		1	0.030
Haasea sp.		—	—
		3282	100

Table 3. Species, individual numbers (N) and the dominance values (D%) of the isopods. N: the total numbers of individuals, D: the dominance value in percentage, T: trunks

T	1989	N	D%
Armadillidium zenckeri		1813	56.34
Porcellium collicola		576	17.90
Trachelipus rathkei		50	1.56
Hyloniscus riparius		763	23.71
Trichoniscus sp.		14	0.45
Haplophthalmus danicus		1	0.04
Asellus aquaticus		—	—
		3218	100

T	1990	N	D%
Armadillidium zenckeri		1944	61.00
Porcellium collicola		1017	32.00
Trachelipus rathkei		45	1.40
Hyloniscus riparius		167	5.20
Trichoniscus sp.		14	0.40
Haplophthalmus danicus		—	—
Asellus aquaticus		—	—
		3187	100

Table 4. Species, individual numbers (N) and the dominance values (D%) of the isopods. N: the total numbers of individuals, D: the dominance value in percentage, BT: between the trunks

BT	1989	N	D%
Armadillidium zenckeri		391	29.40
Porcellium collicola		204	15.30
Trachelipus rathkei		38	2.90
Hyloniscus riparius		691	51.90
Trichoniscus sp.		3	0.20
Haplophthalmus danicus		—	—
Asellus aquaticus		4	0.30
		1331	100

BT	1989	N	D%
Armadillidium zenckeri		155	57.2
Porcellium collicola		112	41.3
Trachelipus rathkei		3	1.1
Hyloniscus riparius		—	—
Trichoniscus sp.		—	—
Haplophthalmus danicus		—	—
Asellus aquaticus		1	0.4
		271	100

Table 5. Species, individual numbers (N) and the dominance values (D%) of the chilopods. N: the total numbers of individuals, D: the dominance value in percentage, T: trunks

T	1989	N	D%
Monotarsobius baloghi		40	60.2
Monotarsobius crassipes		—	—
Lithobius muticus		17	25.9
Lithobius forficatus		5	7.7
Lithobius erythrocephalus		—	—
Pachymerium ferrugineum		3	4.6
Geophilus proximus		1	1.6
Schendyla nemorensis		—	—
		66	100

T	1990	N	D%
Monotarsobius baloghi		49	60.5
Monotarsobius crassipes		12	14.9
Lithobius muticus		9	11.2
Lithobius forficatus		1	1.2
Lithobius erythrocephalus		4	4.9
Pachymerium ferrugineum		4	4.9
Geophilus proximus		1	1.2
Schendyla nemorensis		1	1.2
		81	100

Table 6. Species, individual numbers (N) and the dominance values (D%) of the chilopods. N: the total numbers of individuals, D: the dominance value in percentage, BT: between the trunks

BT	1989	N	D%
Monotarsobius baloghi		29	45
Monotarsobius crassipes		—	—
Lithobius muticus		22	35
Lithobius forficatus		4	6
Lithobius erythrocephalus		1	2
Pachymerium ferrugineum		4	6
Geophilus proximus		4	6
Schendyla nemorensis		—	—
		64	100

BT	1990	N	D%
Monotarsobius baloghi		3	27
Monotarsobius crassipes		—	—
Lithobius muticus		6	55
Lithobius forficatus		1	9
Lithobius erythrocephalus		—	—
Pachymerium ferrugineum		1	9
Geophilus proximus		—	—
Schendyla nemorensis		—	—
		11	100

Among chilopods *M. baloghi* and *M. crassipes* occur in wet woods.

Apparently there is a difference between temporarily flooded habitats (between the trunks) and those which are dry all the time (trunks). Both diversity and abundance were higher on the trunks than in samples between the trunks.

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Opusc. Zool. Budapest, XXVI, 1993

Study on moss-dwelling testate amoebae

By

J. TÖRÖK*

Abstract. Testate amoebae from six aerophilous moss species were observed. Forty-six testacean species were identified. Six of them are new for the Hungarian fauna. A short description is given about them. Quantitative investigations were carried out to determine the dominance and diversity of species.

Investigations on testaceans in Hungary have been made since the last decade of the XIXth century: SZELÉNYI (1896), KREPUSKA (1917), JACZÓ (1941), VARGA (1953, 1956), BICZÓK (1956), BERECZKY (1970, 1973, 1979, 1984). Their studies focused on the soil, *Sphagnum* and freshwater habitats. Remarkably less attention has, however, been paid to the testate amoebae of the aerophilous mosses, inspite of their high occurrence in almost every land biotopes. The only data on the subject were presented by ERTL (1960), VARGA (1960) and JEKKEL (1969). Considerably more articles on the same topic were published in foreign countries (BARTOS, 1936—1940, 1940, 1954; SCHÖNBORN, 1962, 1964, 1989; GOLEMANSKY, 1967a, 1967b; BEYENS et al., 1986). Their results served as references for my study, which had the purpose of getting new information about the moss-dwelling testate amoebae in Hungary.

Sampling sites, materials and methods

The moss-samples were collected in three areas near Budapest: Börzsöny Mountains, Visegrádi Mountains and Budai Mountains. The location of the sampling sites is presented in Fig. 1. Table 1 shows the list of samples and their natures. Nomenclature of mosses is according to ORBAN & VAJDA (1983).

Six moss species were collected in autumn, 1991. Fixation and sampling took place always on the following day. 1 cm^2 pieces were cut out of the mosses, then each of them was put into small glasses and filled up with 1 cm^3 destilled water. After fixation in $HgCl_2$ solution (9:1) and colouring with bromphenol-blue (BERECZKY, 1985) the material was suspended and observed under microscope.

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At the determination of species I compared the size-data of the testacean shells with those described by foreign authors. I measured only the most important characters, necessary for the determination of the testacean species.

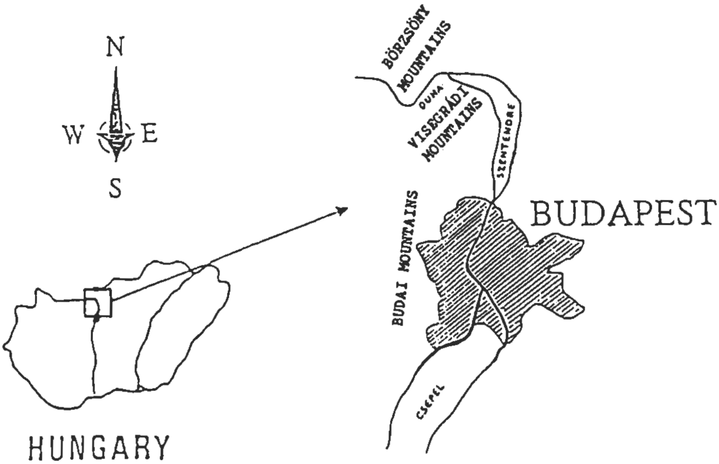

Fig. 1. Location of the sampling sites

Quantitative examination was carried out by direct counting of the coloured specimens, which seemed to be blue as a result of the colouring method. Diversity (D) values were calculated by the SHANNON-WEAVER formule:

$$D=-\Sigma\, p_i{*}\log_2 p_i \qquad p_i=\text{individual dominance of x species.}$$

In order to investigate the percentage distribution of the testaceans, I used dominance categories (intervals after MEISTERFELD, 1979).

SEM Photomicrographs were obtained using a JSM 50A scanning electron microscope operating at 15 kV.

Results

Forty-six species, belonging to eighteen genera were observed in the six moss species. The composition of the fauna is given in Table 2. Most of the recorded taxa have already been found in Hungary, however, six species are new for the Hungarian fauna. These are as follows: *Microcorycia radiata, Centropyxis orbicularis, Plagiopyxis labiata, Difflugia stoutii, Phryganella acropodia, Trinema penardi*

Microcorycia radiata PENARD, 1912

The shell is flexible, transparent and almost hemisphaerical from lateral view. From top view it is circular and long ridges radiate from the center of the aboral region. The aperture is situated at the opposite end, which is the most vulnerable part of the shell. Actually it is often missing.

Author:	Diameter:	Length:
BARTOS (1954):	30—40 μ	—
Own data:	24—35 μ	30—35 μ

Table 1. List of samples collected

Location	Moss species	Date of collection
Börzsöny soil	*Plagiomnium undulatum*	09. 11. 1991
Mountains soil	*Plagiothecium platyphyllum*	29. 09. 1991
(Oltár Valley)		09. 11. 1991
Visegrádi		
Mountains soil	*Amblystegium riparium*	30. 10. 1991
(Pap Field)		
Budai limestone	*Cirriphyllum tenuinerve*	20. 10. 1991
Mountains		08. 11. 1991
(Remete Valley)		24. 11. 1991
hornbeam		
tree	*Brachythecium velutinum*	20. 10. 1991
		08. 11. 1991
		21. 10. 1991
soil	*Atrichum undulatum*	08. 11. 1991
		24. 11. 1991

Biotop: bryobiont species, exclusively in mosses. It was observed in four of the mosses: *Plagiomnium*, *Plagiothecium*, *Cirriphyllum* and *Brachythecium*, however, with very low abundance.

Centropyxis orbicularis Deflandre, 1929

The shell consists of proteinaceous material, covered with debris and inorganic particles. From frontal view it is almost circular, from lateral view hemisphaerical. The pseudostome is oval.

Author:	Diameter:
Lüftenegger & al. (1986):	93—112 μ
Own data:	92—100 μ

Biotop: typically in wet mosses, *Sphagnum*, moor, sapropel. I found one specimen in *Plagiomnium* and another one in *Brachythecium*.

Plagiopyxis labiata Penard, 1910

The shell is ovoid, almost round, from lateral view it is hemisphaerical. Excentric and oval pseudostome is considered to be relatively large within the genus.

Author:	Diameter:
Schönborn (1964):	50—74 μ
Own data:	44—60 μ

Biotop: mosses, *Sphagnum*, soil. I found it in most of the investigated mosses (Figure 2a).

Difflugia stoutii Ogden, 1983

Table 2. Composition of the fauna in the moss samples

Testacea species	Moss species					
	Pu	*Pp*	*Ar*	*Ct*	*Bv*	*Au*
Microcorycia flava Greeff, 1866	+	+	+	+	+	—
radiata Penard, 1912	+	+	—	+	+	—
Arcella arenaria Greeff, 1866	+	—	+	—	—	—
discoides Ehrenberg, 1872	+	—	—	—	—	—
Centropyxis aerophila Deflandre, 1929	—	+	+	+	+	+
var. *sphagnicola* Deflandre, 1929	+	+	+	+	+	+
f. *kryptostoma* Schönborn, 1964	—	+	—	—	—	—
cassis Wallich, 1864	+	+	+	+	+	+
elongata (Penard, 1890) Thomas, 1959	+	+	+	—	—	—
minuta Deflandre, 1929	+	—	—	+	—	—
orbicularis Deflandre, 1929	+	—	—	—	—	—
platystoma Penard, 1902	+	+	—	—	—	—
Cyclopyxis eurystoma Deflandre, 1929	—	—	—	+	+	+
kahli Deflandre, 1929	+	+	—	+	+	—
Plagiopyxis declivis Bonnet & Thomas, 1955	+	+	—	+	+	+
labiata Penard, 1910	—	—	—	+	+	—
Hyalosphaenia subflava Cash & Hopkinson, 1909	+	—	—	—	—	—
Heleopera petricola Leidy, 1879	+	+	—	—	—	—
rosea Penard, 1890	+	—	—	+	—	—
sylvatica Penard, 1902	+	—	+	+	—	—
Nebela lageniformis Penard, 1902	—	+	—	—	—	—
Quadrulella symmetrica Wallich, 1863	+	+	—	—	—	—
Difflugia bryophila (Penard, 1902) Jung, 1942	+	—	—	—	—	—
lucida Penard, 1890	+	+	—	+	+	—
oblonga Ehrenberg, 1838	+	—	—	—	—	—
stouti Ogden, 1983	+	—	—	—	—	—
Phryganella paradoxa Penard, 1902	—	+	—	+	+	—
acropodia Hopkinson, 1909	—	+	—	—	+	—
Pseudodifflugia gracilis var. *terricola* Bonnet & Thomas, 1960	—	—	—	+	—	—
Euglypha acanthophora Ehrenberg, 1843	+	+	—	—	—	—
compressa Carter, 1864	+	+	—	—	—	—
cristata Leidy, 1879	+	—	—	—	—	—
filifera Penard, 1890	+	—	—	—	—	—
laevis Perty, 1849	+	—	+	+	+	+
rotunda Wailes, 1911	+	—	+	+	+	+
strigosa Ehrenberg, 1872	—	+	+	+	+	—
tuberculata Dujardin, 1841	+	—	—	—	+	—
Assulina muscorum Greeff, 1883	—	+	+	—	+	—
Tracheleuglypha dentata Moniez, 1888	+	+	+	—	+	—
Trinema complanatum Penard, 1890	+	+	+	—	+	+
enchelys Ehrenberg, 1838	+	+	+	—	+	+
lineare Penard, 1890	+	+	+	+	+	+
penardi Thomas & Chardez, 1958	—	—	—	+	—	—
Corythion dubium Taranek, 1882	—	+	—	+	+	+
pulchellum Penard, 1890	+	+	+	—	—	+
Difflugiella oviformis (Penard, 1890) Bonnet & Thomas, 1955	—	—	—	+	+	+

Pu=Plagiomnium undulatum
Pp=Plagiothecium platyphyllum
Ar=Amblystegium riparium
Ct=Cirriphyllum tenuinerve
Bv=Brachythecium velutinum
Au=Atrichum undulatum

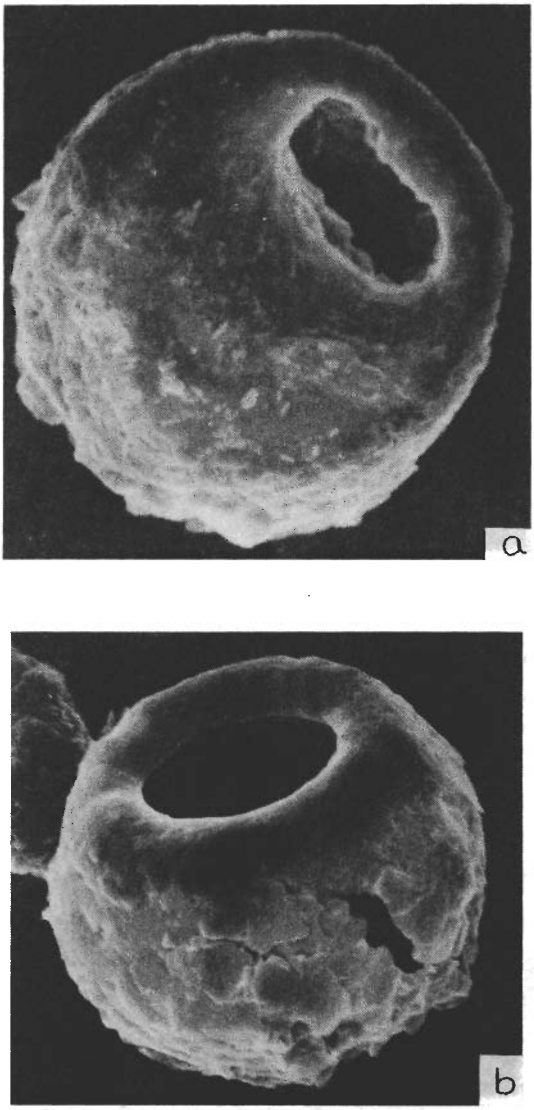

Fig. 2. Testacean shells; a: *Plagiopyxis labiata* Penard, 1910 (60 µm); b: *Phryganella acropodia* Hopkinson, 1909 (33 µm)

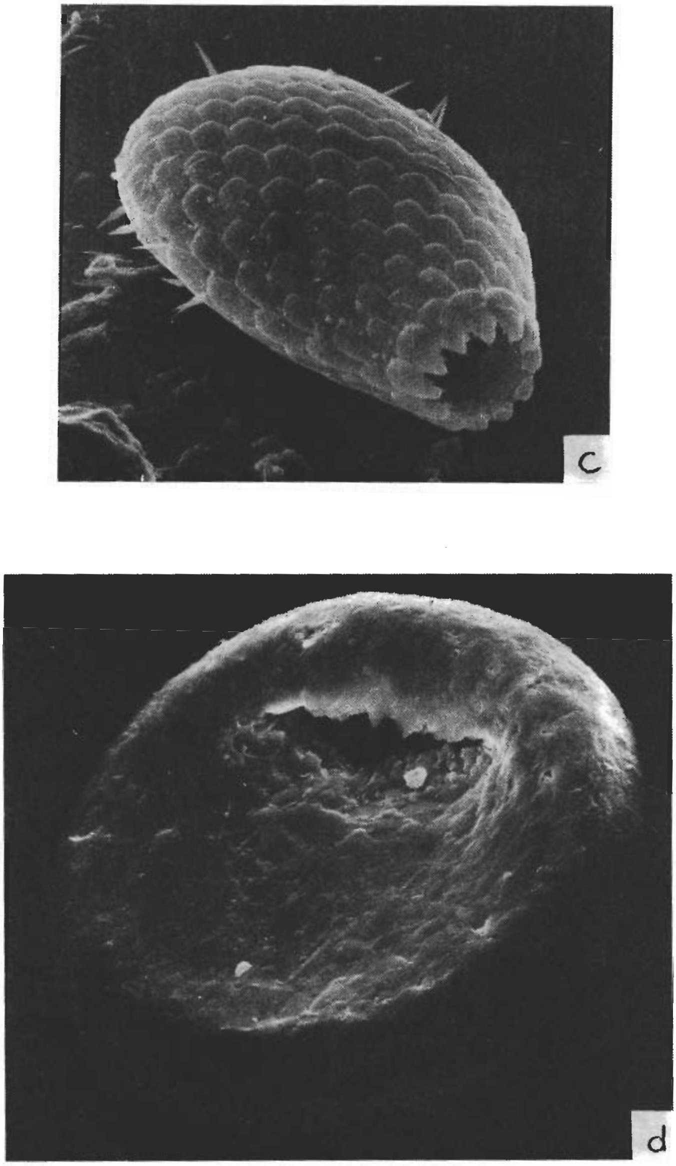

Fig. 3. Testacean shells; c: *Euglypha* sp. (65 μm); d: *Plagiopyxis declivis* BONNET & THOMAS, 1955 (78 μm)

The shell is elongated, oval, consists of relatively small xenosomes, diameter circular. Round pseudostome is situated at the end of the shell.

Author:	Length:	Width:	Pseudostome:
OGDEN (1983):	47—59 μ	33—36 μ	9—12 μ
Own data:	53 μ	36 μ	8 μ

Biotop: *Sphagnum* (OGDEN, 1983). I observed one specimen in *Plagiomnium.*

Phryganella acropodia HOPKINSON, 1909

The shell is hemisphaerical, made of xenosomes. The pseudostome is located in the flat side, surrounded by organic cement.

Author:	Diameter:
LÜFTENEGGER & al.:	32—45 μ
Own data:	31—38 μ

Biotop: it is one of the most frequent species in forest soils. This species had the highest occurrence in *Brachythecium* and in addition I found 5 specimens in *Plagiothecium* (Figure 2b).

Trinema penardi THOMAS & CHARDEZ, 1958

The oval shell consists of two diverse parts: one, above the pseudostome stands of smaller platelets in contrast with the aboral region.

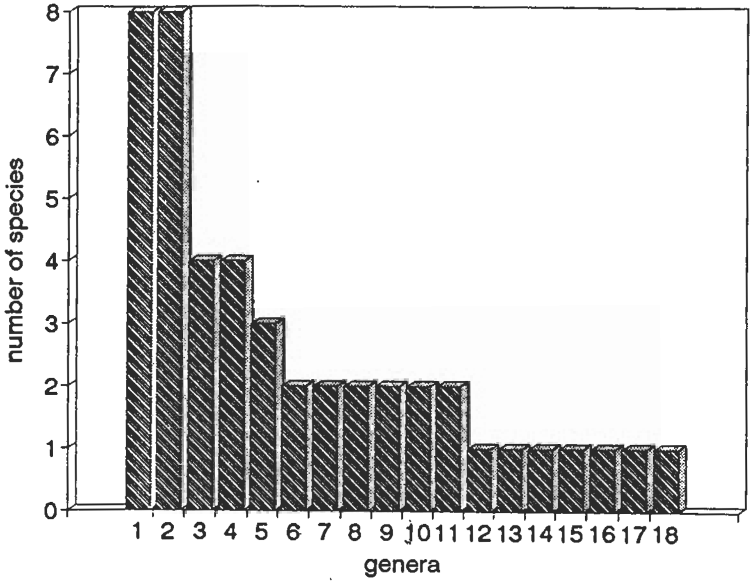

Fig. 4. Number of species according to each genus. 1: *Centropyxis*, 2: *Euglypha*, 3: *Difflugia*, 4: *Trinema*, 5: *Heleopera*, 6: *Microcorycia*, 7: *Arcella*, 8: *Cyclopyxis*, 9: *Plagiopyxis*, 10: *Phryganella*, 11: *Corythion*, 12: *Hyalosphaenia*, 13: *Nebela*, 14: *Quadrulella*, 15: *Pseudodifflugia*, 16: *Assulina*, 17: *Tracheleuglypha*, 18: *Difflugiella*

Author:	Length:	Width:	Depth:	Pseudostome:
LÜFTENEGGER & al.:	30—65 μ	16—35 μ	15—30 μ	8—16 μ
Own data:	40—44 μ	26—29 μ	18—20 μ	12—13 μ

Biotop: *Sphagnum*, mosses, soil. It was a characteristic species of *Cirriphyllum* and occurred also in *Brachythecium*.

There are also some problematic specimens, belonging to the genus *Euglypha*, which could not be identified because of the low abundance and the lack of living individuals (Figure 3c).

The highest species richness was found in the genera *Centropyxis* and *Euglypha*. This observation agrees for the most part with the data of BEYENS & al. (1986, 1990) and GOLEMANSKY (1967a). Figure 4 shows the numbers of species according to each genus.

The diversity values are considerably high and although there are no other data on moss-biotopes from this geographical area to compare with, we can conclude, that these values exceed those ones found in the arctic mosses (BEYENS & al., 1986). The results of the quantitative investigations are given in tables 3 and 4.

The species have been ranged by their dominance as well (Table 4). There are twenty-six eudominant and dominant species in the six moss species, but altogether

Table 3. Total diversity values in the six moss species

Moss species	D	S	N
Plagiomnium undulatum	4.36	34	216
Plagiothecium platyphyllum	3.65	26	471
Amblystegium riparium	2.60	14	375
Cirriphyllum tenuinerve	2.98	21	485
Brachythecium velutinum	3.52	27	844
Atrichum undulatum	2.80	14	285

D = diversity value calculated by the SHANNON-WEAVER formule
S = number of species
N = number of invividuals per 1 cm² of moss

Table 4. The most dominant testacean species in the mosses

Mosses:	*Plagiomnium undulatum*	*Plagiothecium platyphyllum*	*Amblystegium riparium*
Eudominant species	*Traccheleuglypha dentata* *Trinema enchelys* *Difflugia lucida*	*Tracheleuglypha dentata* *Trinema enchelys* *Corythion dubium*	*Trinema enchelys* *Euglypha laevis* *Trinema lineare*
Dominant species	*Plagiopyxis declivis*	*Microcorycia flava*	*Microcorycia flava* *Euglypha rotunda*
Mosses:	*Cirriphyllum tenuinerve*	*Brachythecium velutinum*	*Atrichum undulatum*
Eudominant species	*Microcorycia flava* *Plagiopyxis declivis*	*Euglypha rotunda*	*Trinema complanatum* *Trinema enchelys*
Dominant species	*Euglypha rotunda* *Trinema penardi*	*Difflugia lucida* *Euglypha laevis*	*Centropyxis aerophila* var. *sphagnicola* *Plagiopyxis declivis* *Trinema lineare* *Difflugiella oviformis*

thirteen testacean species vary between the two categories in different distribution. All the *Trinema* taxa found in the samples are present here, illustrating the well known eurytopic character of these species. *Brachythecium* is the only moss species, where the *Trinema* species do not reach such high dominance (*Trinema lineare* is subdominant there).

Majority of species complete the subdominant, recedent and subrecedent categories. Those species, described for the first time in Hungary are included in these categories because of their low abundances. *Trinema penardi* is the only exception, which is dominant in *Cirriphyllum.*

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Book review

M. S. Jairajpuri and W. Ahmad:
Dorylaimida. Free-living, predaceous and plant-parasitic nematodes

There is hardly another branch in special zoology which shows such a great development nowadays as nematology, the study of free-living and plant-parasitic nematodes. The number of scientists working on this group shows also an increasing tendency although the restricted number of manuals, summarizing works or compilations are of a heavy drawback for them.

The new book of JAIRAJPURI and AHMAD is therefore especially welcome. It deals with one of the most important and extensive groups of Nematoda, the order Dorylaimida. These animals live in soil, freshwater and on plants, and are distributed over the world, in every sort of habitats. They are very frequent everywhere, and often dominant both in number of specimens and that of species. The quantity of species and higher taxa hitherto described in this order is the highest within the Nematoda: there are about 1700 known species grouped in over 200 genera. But as in every large group of animals, an orientation in the system of Dorylaimida is very difficult, and causes much trouble even for taxonomists.

The authors have undertaken a great task indeed in summarizing, evaluating and systematizing the informations published in morphology and taxonomy of Dorylaimida. Their book is a compilation in best sense of word. Both the authors, especially the senior one, belong to the best known and most experienced authorities in the subject. The present work is a result of their multi-year studies.

"Dorylaimida" consists of two main parts: Morphology and Systematics. In the chapters on morphology (53 pages) a complete picture can be found of all the characteristics which are necessary to recognize and orientate the dorylaims. The taxonomic chapters (375 pages) give a clear and well-arranged system of the whole group, from order to genera. Well-usable identification keys serve as helping hand in recognizing the taxa. Every genus is defined by good characteristics and illustrated by pictures of one or more species. The known species are then enumerated with synonyms under the genera.

The monumental work is a true profit for science. It will remain a standard on the group for many years to come. Every nematologist may say thanks to the authors for their invaluable publication.

The voluminous handbook counts 458 pages and is very well illustrated with 159 figures containing approximately 1500 drawings in detail. It was published in 1992 by the famous publisher, E. J. Brill, Leiden, The Netherlands. It costs US $85.75.

I. ANDRÁSSY