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OBSAH—CONTENTS

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THE GROWTH OF THE BROWN TROUT, SALMO TRUTTA M. FARIO (OSTEICHTHYES: SALMONIDAE) IN THE VALLEY WATER RESERVOIR MORÁVKA

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A b s t r a c t. 307 specimens of the brown trout, *Salmo trutta* m. *fario* (Linnaeus, 1758) collected in the Morávka Valley water reservoir between 1982 and 1984 provided the data basis for the calculation of the backlengths and weights. The specimens collected belonged to 8 age classes. Their length ranged from 100—600 mm. The study ascertained the linear relationships between the oral radius of the scale and the length of the body. The relationship between total length and body length was $l_t : l_c = 1.137$. The average value of Fulton's coefficient (F) = 1.165. The value of Bank's start is 34.7 mm.

INTRODUCTION

In Czechoslovakia, the growth of the brown trout was studied in several natural waters, e.g. by F r a n k (1959) in the Kličava reservoir and L o h n i s k ý (1963) in the Divoká Orlice river. L e o n t o v y č and V o s t r a d o v s k ý (1974) studied brown-trout growth in the Hubenov Valley reservoir, K i r k a (1964) in the spring section of the Poprad river and F r a n k (1962) in the Morávka river. The last-mentioned locality is now filled by the waters of the Morávka Valley reservoir.

MATERIAL AND METHODS

The scales providing the data basis for the study of growth were acquired between 1982 and 1984 from adult specimens fished in spawning places; incidence area: the main tributary of the Morávka river. For this purpose gill nets (size: 3 × 3 cm, length: 20 m, height: 3 m) were used. The catch totalled 318 items of trout. Of these approximately 250 specimens were obtained from spawning places through the electrofishing method. After the completion of the measurement, weighing and scale-sampling procedures, the catch was released back into water. Scale-sampling involved the extraction of 10—15 scales from each specimen and the scales were extracted from the area close below the lateral line above the base of the anal fin. The measurements were affected with an accuracy of ± 1 mm on a small measuring board. Fish up to 500 g were weighed on a paper balance with an accuracy ± 1 g. Fish over 500 g were weighed on the kitchen type of weighing balance with an accuracy ± 5 g.

The length of body (longitudo corporis) and total length (longitudo totalis) were measured. The scale structure was studied with the use of Meoflex RI 21 Pallowing for 29.7 — fold magnification. All in all, 307 samples were analyzed. The 11 remaining samples were excluded from analysis as they only contained regenerated scales. The measurements were conducted on the oral radius of the scale. In the back length calculation of growth the R. Lee method was applied. The correction value was calculated on the basis of linear regression.

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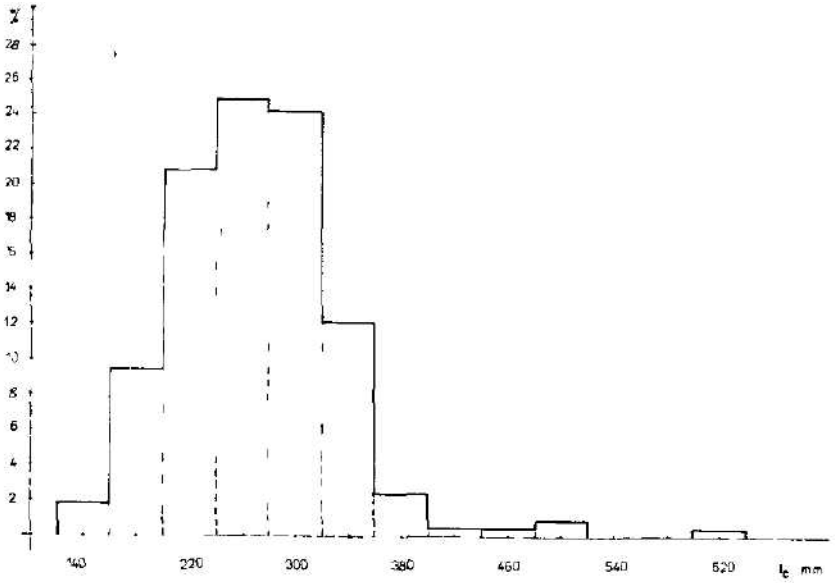
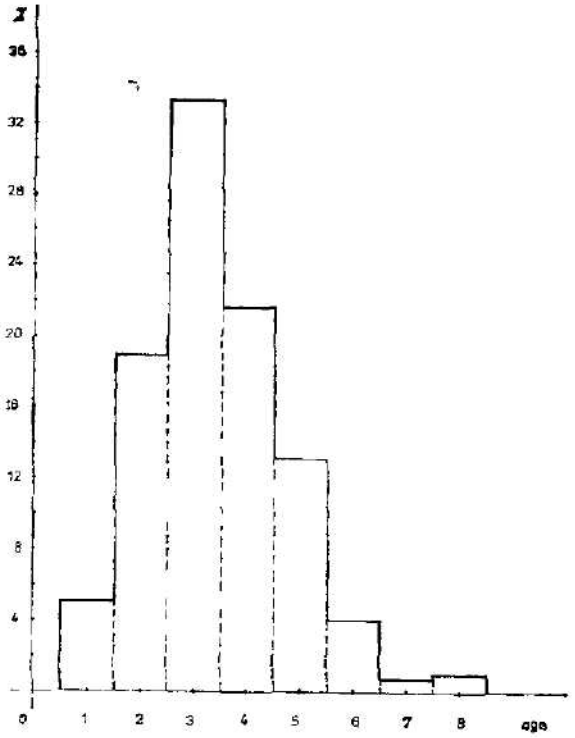
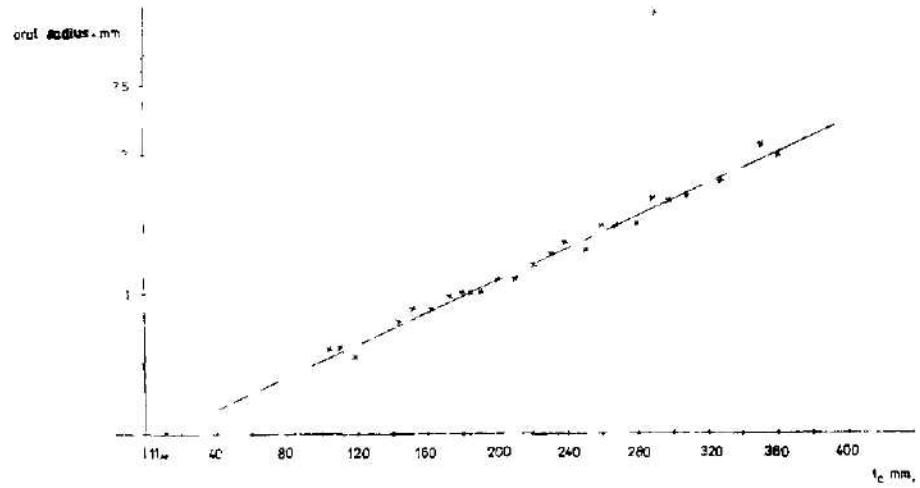


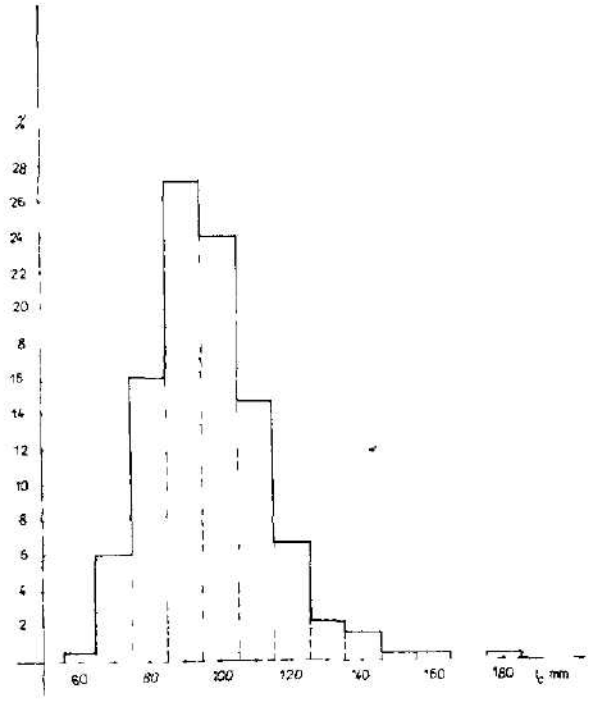
Graph 1. The number of the trouts in length groups expressed in per cent of all trouts caught.



Graph 2. The age composition of the trout expressed in per cent of the total number of sampled trouts.



Graphs 3. The relationship between the length of the body and the oral radius of the scale of the trout from the reservoir Morávka.



Graph 4. Back calculated lengths of trouts to the first annulus expressed in per cent from the whole sample of 307 trouts.

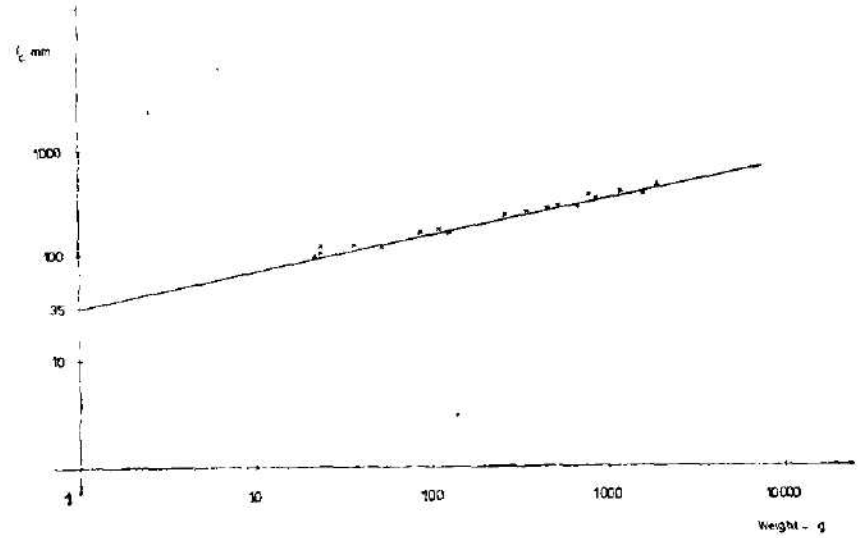
Table 1. The average back calculated lenghts of trouts in the reservoir Morávka during single years of life with ranges of minimal and maximal values

	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8
	93	149	194	238	260	320	370	395
min.	60	100	128	162	196	212	285	305
max.	181	268	338	418	498	550	420	417

Table 2. The average length growth of the trout in Czechoslovak waters ($l_1 - l_8$ — the length of the body in single years of life)

Locality — author	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8
Reservoir Rozkoš Lohniský (1966)	63	101	162	—	—	—	—	—
Poprad River Kirka (1964)	63	97	122	143	167	182	215	—
Stěnava stream Lohniský (1961)	69	111	163	193	—	—	—	—
Nitrica Sedlár (1964)	72	135	204	260	320	—	—	—
Biela Orava Holčík (1969)	73	129	199	212	—	—	—	—
Přimda Frank (1962)	77	140	182	—	—	—	—	—
Svratka n. Bírem Peňáz (1968)	78	122	156	197	236	—	—	—
Morávka Frank (1962)	79	126	159	178	196	—	—	—
Vrica Kirka (1962)	79	128	156	202	218	—	—	—
Svratka n. Bírem Peňáz (1968)	83	129	178	238	301	—	—	—
Jelešná Holčík (1964)	85	140	192	—	—	—	—	—
Reservoir Hnilec Balon (1959)	88	178	259	—	—	—	—	—
Moravice Hochman (1957)	89	149	203	248	287	—	—	—
Reservoir Orava Holčík, Bastl (1970)	102	181	324	402	509	613	703	—
Reservoir Klíčava Frank (1959)	109	184	318	407	451	—	—	—

The length of fish to each annulus was calculated on the Lea board of the ... of the corresponding correction value. The linear regression principle was also applied in the calculation of the constants of the equation expressing the length-weight relationship. Further calculations yielded Fulton's coefficient of condition (K) and the relation $l_t : l_c$.



Graph 5. The relationship between the length and weight of the trout from the reservoir Morávka in the logarithmic scale.

RESULTS

The number of fish in length groups with intervals of 40 mm is expressed in graph 1. These values indicate that over 65 % of sampled trouts belonged to the 200—300 mm range.

The age composition of sampled trout is given in graph 2. Eight age classes are represented. The largest number of trouts (34,2 %) belong to age class 3. After evaluation of the length pattern the relationship between the length of

Table 3. The average weight growth of the trout in the reservoir Morávka during single years of life with ranges of minimal and maximal values

	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8
		53	108	187	239	421	625	746
min.	4.5	18	35	66	111	137	308	369
max.	89	260	489	843	1401	1835	881	865

the body and the oral radius of the scale, was calculated by means of the values obtained from trouts up to 360 mm. For trouts from the river Morávka this relationship is expressed by the equation

Table 4. The average weight of the trout in Czechoslovak waters
($g_1 - g_9$ — the average weight of single trout according to the age)

Locality — author	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9
Rokytenka									
Lohniský (1966)	4	12	54	92	163	435	560	740	—
Divoká Orlice									
Lohniský (1963)	4	25	58	104	182	285	400	490	570
Reservoir Rozkoš									
Lohniský (1966)	6	23	86	—	—	—	—	—	—
Lušová stream									
Lusk, Zdražilek (1969)	7	25	44	72	102	—	—	—	—
Čichovský brook									
Lohniský (1966)	15	34	58	164	—	—	—	—	—
Loučka stream									
Libosvárský (1968)	15	55	118	—	—	—	—	—	—
Reservoir Kličava									
Frank (1959)	16	83	547	1219	1670	—	—	—	—
Loučka, middle part of the stream									
Libosvárský (1968)	16	62	92	—	—	—	—	—	—
Klapovský brook									
Lohniský (1966)	20	48	104	203	434	818	—	—	—
Loučka, lower part of the stream									
Libosvárský (1968)	24	66	107	—	—	—	—	—	—
Hincův brook									
Kirka (1969)	55	69	92	112	136	—	—	—	—

$y = -1.93503 + 0.17028 . l$ (see graph 3).

The length of the body on the start of scale formation calculated from this equation was 11.4 mm. This value does not tally with the actual facts, as in the trout, scales are formed at larger size (Frank 1962). Therefore I used the correction value 25 mm used by Frank (l.c.). The frequency distribution of the back-calculated body lengths to the first annulus is shown in graph 4. The calculated length growth is given in Tab. 1. For comparison see data on growth in other localities (Tab. 2). The relationship between total length and the length of the body: the body length to the hind margin of last scales end is 1.137.

The length-weight relationship was also calculated from the values obtained from trouts with the length of body up to 360 mm and can be expressed as follows:

$\log w = -4.19255 + 2.72122 \log l$ (see graph 5)

The length of the fish with a weight of 1 g corresponds to Bank's start 34.7 mm. Weight growth determined by regression is listed in Table 3. For comparative purposes the growth of trout as recorded in other localities in Czechoslovakia is given in Table 4. The average value of Fulton's coefficient for all years of life is 1.165.

DISCUSSION

I based the study of my material on earlier findings concerning the existence of the growth of oral radius of scale with regard to the length of the body

(Frank 1959, 1962, Lohnisky 1963, Kirka 1964, Balon 1959). My own results confirmed this relationship. The correlation coefficient is 0.98945. Only 6 trout specimen measured in length over 360 mm and yet the calculations based on the values obtained from these specimens yielded a negative correction value.

This fact, in my view, is due to the absence of trout of the first age class in the catch. The value of correction 11,4 mm seems likewise untenable. Kirka (1964) used the 25 mm value. Lohnisky (1963) reported 15—20 mm values and for the back calculation he used a 30 mm correction. Frank (1962) used the 25 mm value, but reported scales are formed in the length of body 30—40 mm. Comparing the length growth of trout in the Morávka Valley water reservoir with the growth data recorded in other localities, we can estimate it in fairly positive terms. The weight growth revealed by comparison with the data in Table 6 can be evaluated as average growth. The value of Bank's start 34,7 mm comes, as I see it, very close to the actual situation. Lohnisky (1963) faund values of 38.40 and 22 mm in the river Divoká Orlice, Kirka (1964) reports 39 mm value for trout from the spring area of the river Poprad. Frank (1962) determined the value of Bank's start for trout occurring in the Morávka river as 39 mm.

CONCLUSION

1. The relation between the body length and the oral radius of the scale is linear. It is expressed by the following equation
   $y = -1.93503 + 0.17028 . l$
2. The average length growth of the brown trout in the Morávka reservoir is as follows:

l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8
93	149	194	238	260	320	370	395

3. The ratio $l_t : l_c = 1.137$.
4. The length-weigth relationship is expressed by the equation
   $w = 0.0001558 \times l^{2.72122}$
5. The average weight growth is

g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8
30	53	108	187	239	421	625	746

6. The value of Bank's start is 34.7 mm.
7. Fulton's condition index decreases with increasing age. The average value is $K = 1.165$.

Acknowledgements

The study of growth was part of my work on a dissertation thesis presented at the Department of Systematic Zoology, Faculty of Natural Science, Charles University, Prague. Dr. O. Oliva, Ph.D., who also contributed valuable critical comments on the manuscript, inspired my first interest in this particular problem. During my work I benefitted a great deal from the support and assistance extended by the "Povodí Odry" hydrological institute. I also thank Mr. Jan Tureček, guard of the Morávka water reservoir, for efficient services rendered throughout my fieldwork.

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ACANTHOCEPHALANS OF FRESHWATER FISHES FROM NORTH VIETNAM

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A b s t r a c t. The present paper comprises a systematic survey of the acanthocephalans collected from 16 species of freshwater fishes from North Vietnam (the Red River near Hanoi). A total of 7 species was recorded: *Neosentis celatus*, *Pallisentis ophiocephali*, *Dendronucleata petruschewskii*, *Pseudorhadinorhynchus vietnamensis* sp. n., *Paradentitruncus longireceptaculis* gen. et sp. n., *Cathayacanthus bagarii* sp. n. and *Cleaveius longirostris* sp. n. The new genus *Paradentitruncus* (fam. Illiosentidae) differs from the closely related *Pseudorhadinorhynchus* and *Dentitruncus* principally in the character of proboscis hooks and the situation of the cephalic ganglion. *Rhadinorhynchus arii* has been transferred to *Paradentitruncus as P. arii (Wang, 1966) comb. n.* None of the species recorded has so far been reported from Vietnam. The findings also include several new host records. All the acanthocephalans have been briefly described and illustrated and some problems concerning their taxonomy and geographical distribution have been discussed.

The acanthocephalan fauna of freshwater fishes in Vietnam is hitherto little-known. As far as the present authors know, the only papers dealing with these freshwater fish parasites in North Vietnam are those published by D e m s h i n (1965) and H a K y (1969) who have reported altogether three acanthocephalan species *(Micracanthocephalus hemiculterus, Pallisentis gaboes* and *Quadrigyrus* sp.).

In 1984, during his visit to Vietnam, the junior author (O. Sey) examined for helminths a number of fixed freshwater fishes collected in 1960—1975 from the Red River near Hanoi and deposited in the collections of the Department of Vertebrate Zoology, Hanoi University, in Hanoi. The results of the systematic evaluation of amphistome trematodes and nematodes of these materials have been reported by S e y (1985, 1986), S e y and M o r a v e c (1986) and M o r a v e c and S e y (1988 a, b, c), whereas those concerning acanthocephalans are the subject of this paper.

MATERIALS AND METHODS

Of a number of fishes examined, originating from the Red River near Hanoi, altogether 16 fish species of 7 families proved to harbour acanthocephalans. A total of 7 acanthocephalan species was recorded. The acanthocephalans were fixed *in situ* in 10% formaldehyde; later the specimens were placed in distilled water for 24 h and then, slightly pressed between two glasses, were re-fixed in 10% formaldehyde. After staining in carmine, the specimens were dehydrated and mounted in Canada balsam as permanent preparations. All specimens have been deposited in the helminthological collection of the Institute of Parasitology, Czechoslovak Academy of Sciences, in České Budějovice, Czechoslovakia. In the following account of the species encountered, measurements are given in millimetres. The classification of Acanthocephala is mostly in accordance with that presented by A m i n (1985, 1987).

REVIEW OF SPECIES

Fam. Quadrigyridae Van Cleave, 1920

1. *Neosentis celatus* Van Cleave, 1920 (Fig. 1)

Description: Body cylindrical, tapering to both ends. Proboscis composed of anterior knob-like portion bearing hooks and posterior smooth neck which may be withdrawn. Collar spines forming six complete rings consisting of 29—40 spines each; an additional incomplete ring of spines present in some

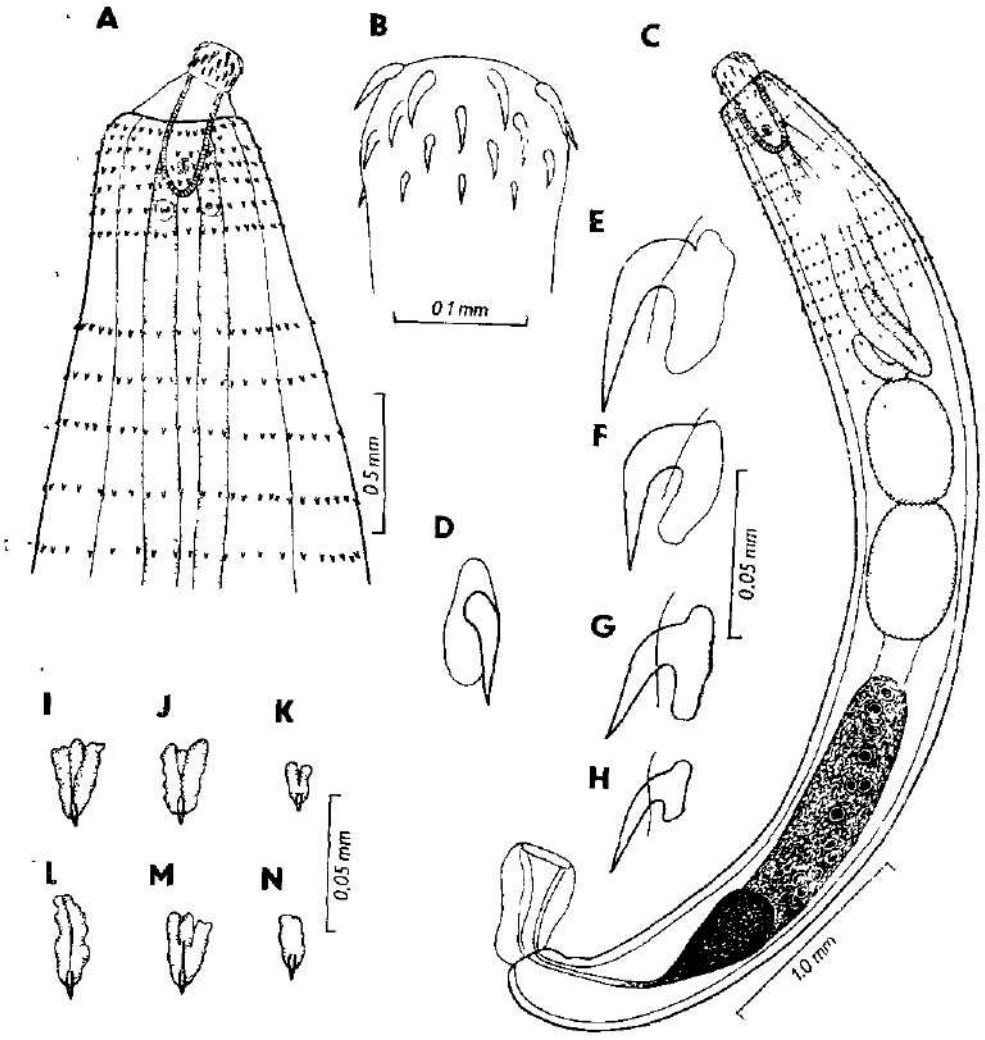

Fig. 1. *Neosentis celatus* Van Cleave, 1928. A — anterior end of male body; B — proboscis; C — male, general view; D — hook of third circle, subapical view; E-H — proboscis hooks of first to fourth circles; I-N — variation in shape of collar and trunk spines.

specimens. Trunk spines arranged in 8—13 complete transverse rings, consisting of 30—41 spines each, and additional 3—4 incomplete rings. Both collar and trunk spines consisting of a relatively small spine proper and its sclerotized, variously shaped, comparatively large bed. Proboscis receptacle short, cephalic ganglion located in its posterior half. Proboscis armed with four circles of eight hooks each; hooks provided with marked oval roots forming anterior process; size of hooks posteriorly decreasing. Lemnisci long.

Male (2 specimens): Length of body 6.38—13.90, maximum width 0.76—1.56. Length of anterior part of proboscis bearing hooks 0.218—0.313, width 0.218, length of neck in larger specimen 0.122 Length of hooks in first circle 0.066, in second circle 0.060, in third circle 0.039—0.042, and in fourth circle 0.033—0.042. Length of collar spines 0.015—0.024, of trunk spines 0.015—0.030. Length of proboscis receptacle 0.408—0.503, width 0.190—0.204. Lemnisci 2.04—3.13 long and 0.109—0.163 wide. Testes oval, tandem, situated in middle part of body; size of anterior testis 0.707—1 904 × 0.476—0.612. of posterior testis 0.775——1.464 × 0.476—0.694. Cement glands forming syncytial mass of uniform diameter, possessing 14 nuclei. Cement reservoir saccular, continued up to bursal cap by long tubular duct. Size of evaginated genital bursa in smaller specimen 0.612 × 0.381.

Female (body fragment of 1 specimen): Length of body fragment of young female 2.18, width 0.585. Anterior part of proboscis bearing hooks 0.326 long and 0.204 wide, length of neck 0.136. Length of hooks in first circle 0.075, in second circle 0.063, in third circle 0.045—0.048, and in fourth circle 0.042. Length of collar spines 0.012—0.015, that of trunk spines 0.015—0.018. Eggs not yet present in body.

Host: *Monopterus* (= *Fluta*) *albus* (Synbranchidae).
Localization: intestine.
Comments: — The morphology of Vietnamese specimens corresponds on the whole to the original species description. Van Cleave (1928) was first to describe this parasite in China, reporting as hosts *Monopterus javanensis*, *Anguilla pekinensis* and *Parasilurus assotis*. Later it was reported from China also by Wang (1966, 1981) and Chen (1973), mainly from the swamp eel *Monopterus albus*, but also from other fish species and from frogs. It is reported for the first time from Vietnam.

2. *Pallisentis ophiocephali* (Thapar, 1931) (Fig. 2)

Syn.: *Farzandia ophiocephali* Thapar, 1931; *F. nagpurensis Bhalerao*, 1931; *Pallisentis nadai* Sarkar, 1953; *P. allahabadi* Agarwal, 1958; *P. buckleyi* Tadros, 1966; *P. magnum* Saeed et Bilqees, 1971.

Description: Body very elongate, somewhat broader at anterior end in region of lemnisci. Proboscis consisting of anterior knob-like portion bearing hooks and posterior smooth, elongate neck. Proboscis armed with four circles of ten hooks each; hooks in first circle largest, those in second circle only slightly smaller; hooks in two posterior circles distinctly smaller than those in two anterior ones; hooks in third circle slightly larger than those in last one. Proboscis receptacle relatively short, single-walled; cephalic ganglion situated at its posterior half. Lemnisci rather long, narrow. Collar spines arranged in 18—21 transverse rings, each ring being composed of 20—24 spines. Trunk spines marked, arranged in transverse rings starting below short gap, covering major part of body surface

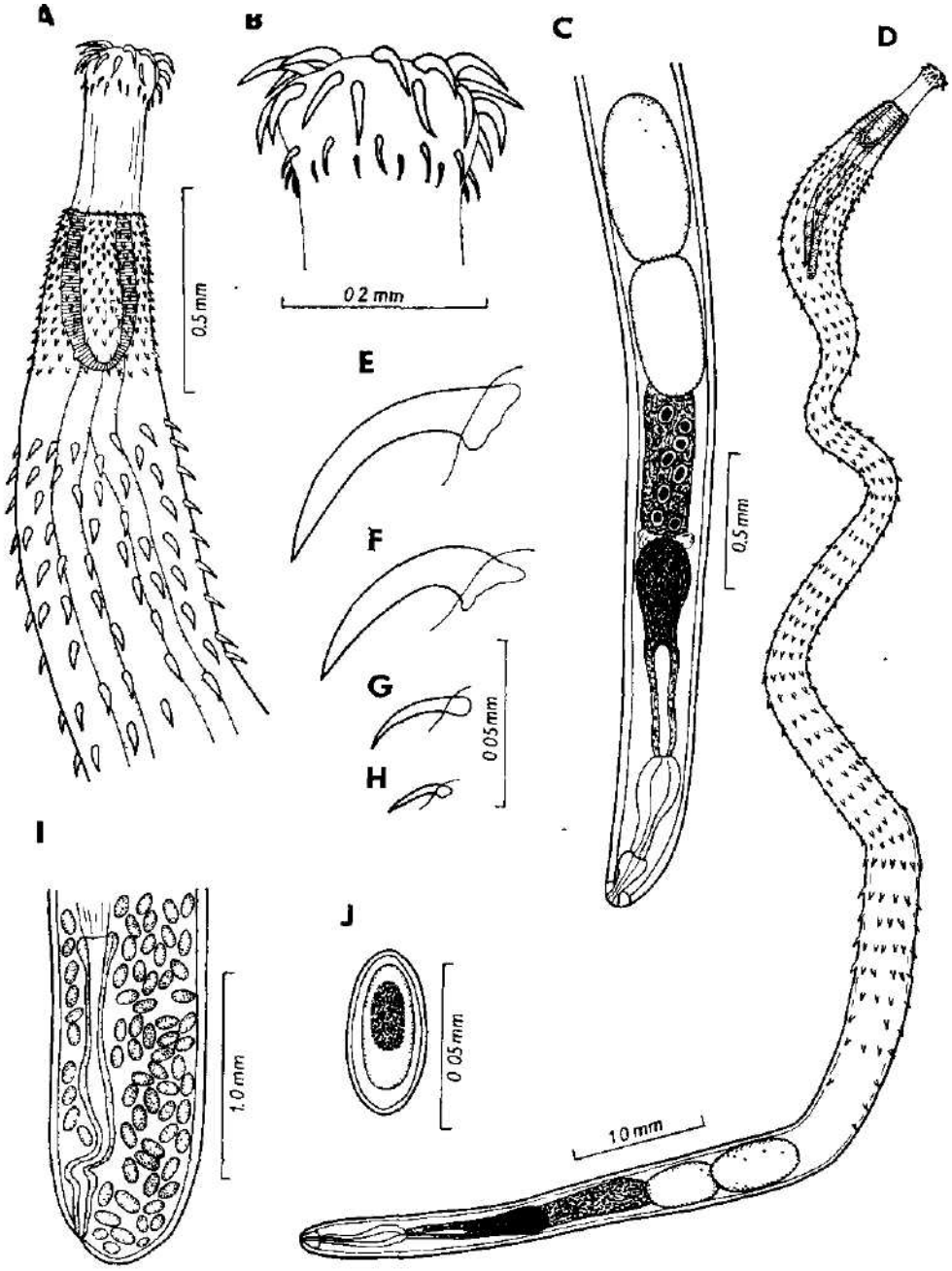

Fig. 2. *Pallisentis ophiocephali* (Thapar, 1931). A — anterior end of body; B — proboscis; C — posterior end of male; D — male, general view; E-H — proboscis hooks of first to fourth corcles; I — posterior end of female; J — mature egg

Male (9 specimens): Length of body 6.74—14.55, maximum width 0.408—0.503. Anterior part of proboscis bearing hooks 0.163—0.177 long and 0.204—0.245 wide, length of neck 0.272—0.367, its width 0.177—0.204. Length of hooks in first circle 0.081—0.084, in second circle 0.072—0.075, in third circle 0.036—0.042, and in fourth circle 0.030. Collar spines arranged in 18—21 transverse circles of 20—22 spines each; length of collar spines 0.027—0.030. Trunk spines 0.021—0.030 long, arranged in 57—86 transverse rings; spination on body extending posteriorly to a short distance in front of anterior testis, in smaller males up to posterior end of posterior testis. Length of proboscis receptacle 0.340—0.517. Lemnisci 1.06—1.90 long, slender, uniform in diameter. Testes oval, tandem, situated in posterior half of body; size of anterior testis 0.449—0.767 × 0.218—0.313, of posterior one 0.449—0.721 × 0.218—0.313. Cement glands forming syncytial mass of uniform diameter, possessing eight large nuclei. Cement reservoir saccular, continued up to bursal cap by long tubular duct. Evaginated genital bursa 0.258 in diameter.

Female (5 specimens): Length of body of one complete gravid female 17.64; body fragments of other females 14.42—20.54; maximum width of body 0.544—0.571. Anterior part of proboscis bearing hooks 0.177—0.204 long and 0.218—0.258 wide, length of neck 0.258—0.422, its width 0.190—0.218. Length of hooks in first circle 0.087—0.099, in second circle 0.075—0.084, in third circle 0.039, and in fourth circle 0.030. Collar spines arranged in 21 circles of 22—24 spines each; length of collar spines 0.024—0.030. Trunk spines 0.045—0.066 long, arranged in about 120 transverse circles; spination on body extending posteriorly almost along whole body length, most posterior rings being, however, incomplete, sometimes represented by single spines. Entire body cavity filled in with large number of eggs. Posterior end of body rounded, female genital opening subterminal. Uterus cylindrical, its anterior end forming convulated uterine bell. Fully developed eggs oval, 0.075—0.084 long and 0.030—0.033 wide.

Hosts: *Ophicephalus maculatus* (Channidae) and *Acanthorhodeus fortunensis* (Cyprinidae) (only 1 juvenile ♀ was found in the latter host)

Localization: intestine

Comments: — The taxonomy of members of the genus *Pallisentis* Van Cleave, 1928 is rather problematic at present, because a number of species have been described, mainly from the Indian Subcontinent, on the basis of features that are apparently subject to a considerable intraspecific variability. Recently Soota and Bhattacharya (1982) have attempted to solve this unsatisfactory situation; they consider *P. ophiocephali* (Thapar, 1931) and *P. colisai* Sakar, 1954 to be the only valid species in India and neighbouring countries with which they synonymized nine other species. The authors admit an intraspecific variability in the number of hooks on the proboscis and, for both the species, they report the presence of four rows of either 8 or 10 hooks each. Additional five species (*P. cavasii, P. fasciati, P. garuai, P. gomtii, P. guptai*) described from India by Gupta and Verma (1980) and Gupta and Fatma (1986) have not been included in the paper by Soota and Bhattacharya (1982), but it is apparent from their descriptions that also the validity of these species is doubtful and that they are only extending the numbers of synonyms of *P. ophiocephali* and *P. colisai*.

Our Vietnamese specimens considerably differ from the type species of this genus, *P. umbellatus* Van Cleave, 1928, described from *Ophicephalus argus*

and some other fish species from China, mainly in substantially greater number of proboscis hooks, more than doubled number of rings of collar spines and other features. Their morphology seems to be closest to that of Indian t a c h a r y a (1982), we assign them to the species *P. ophiocephali*. However, it t a c h a r y a (1982), we assign them to the species *P. ophiocephali*. However, it is necessary to remark that the number of proboscis hooks was stable in our specimens, these being always arranged in four circles of ten hooks each.

From the same host species (*O. maculatus*) from Vietnam, H a K y (1969) has reported *Pallisentis gaboes*, the oldest species of the genus. The original description of this species, which was found in an undetermined fish in Borneo (M a c C a l u m 1918), is very poor and, therefore, it should be considered a *species inquirenda*. Specimens reported by H a K y (1969) were apparently conspecific with the present material.

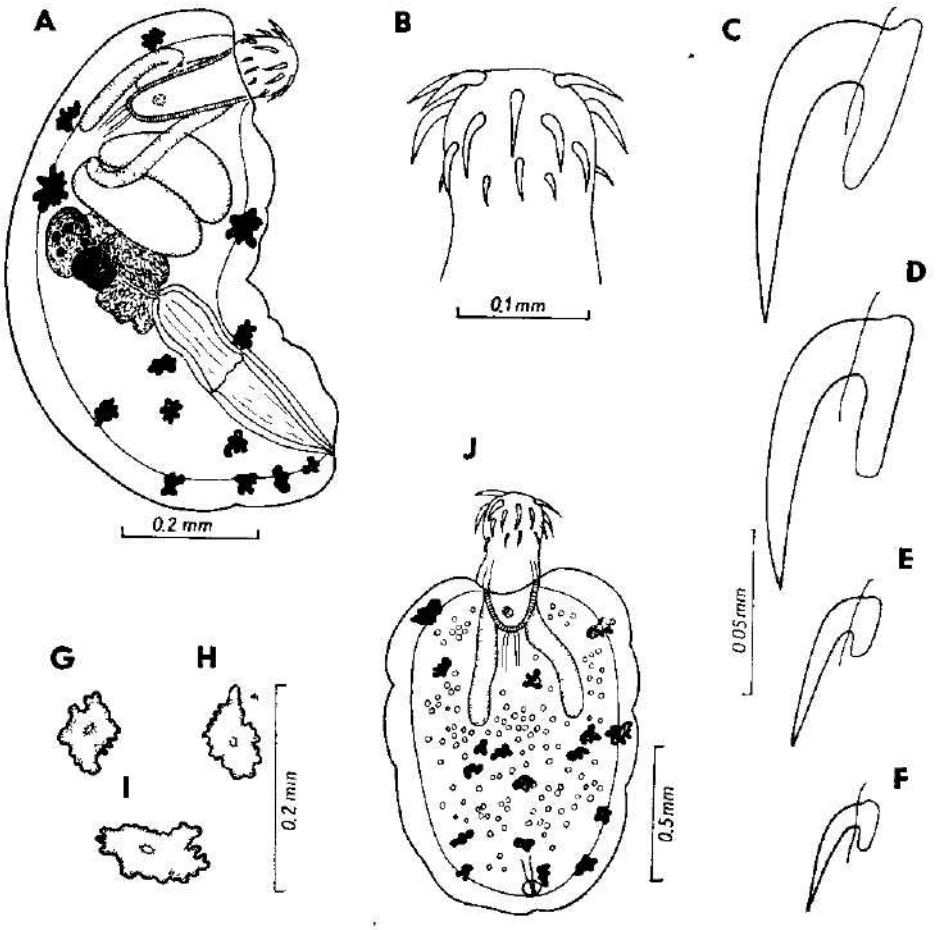

Fig. 3. *Dendronucleata petruschewskii* Sokolovskaya, 1962. A — male, general view; B — proboscis of male; C-F — proboscis hooks of one spiral row; G-I — dendritically branched hypodermic nuclei; J — young female, general view.

Fam. Dendronucleatide Sokolovskaya, 1962

3. *Dendronucleata petruschewskii* Sokolovskaya, 1962 (Fig. 3)

Description: Body short, plump, with about 20 dendritically branched giant hypodermic nuclei. Small proboscis armed with hooks arranged in six spiral rows of 4 hooks each. Size of hooks posteriorly decreasing; roots of hooks with small anterior process. Proboscis receptacle short, cephalic ganglion situated at its posterior part. Lemnisci relatively short.
Male (10 specimens): Length of body 1.63—2.72, maximum width 0.680—1.12. Length of proboscis 0.204—0.367, of which length of neck 0.040—0.136; width of proboscis 0.218—0.272. Length of first hooks 0.132—0.150, of second hooks 0.120—0.123, of third hooks 0.081—0.084, and of fourth hooks 0.051—0.054. Proboscis receptacle 0.517—0.585 long and 0.163—0.299 wide. Lemnisci about 0.82 long and 0.038 wide. Testes in middle part body, size of anterior testis 0.163—0.218 × 0.367—0.517, of posterior one 0.204—0.272 × 0.367—0.639. Cement glands syncytial, forming almost spherical mass below posterior testis.
Female (10 specimens): Body length of young females without eggs 1.43—3.56, width 1.09—1.90. Length of proboscis 0.408—0.544, of which length of neck 0.163—0.204; width of proboscis 0.286—0.313. Length of hooks: first hooks 0.150—0.186, second hooks 0.138—0.156, third hooks 0.087—0.111, and fourth hooks 0.048—0.054. Proboscis receptacle in smallest specimen 0.286 long and 0.177 wide. Length of lemnisci some 0.80. Eggs not present, only moderately developed ovarian balls.

Hosts: *Cirrhina molitorella, Hemiculter leucisculus, Opsariichthys uncirostris, Squaliobarbus curriculus, Gymnostomus lepturus, Megalobrama terminalis* (all Cyprinidae), *Pseudobagrus vachelli* and *Hemibagrus elongatus* (both Bagridae).
Localization: intestine.

Comments. — The morphology of Vietnamese specimens corresponds to the species *D. petruschewskii*, described by Sokolovskaya (1962) from *Erythroculter erythropterus* from Lake Bolon of the R. Amur basin in the USSR, but their bodies are generally somewhat smaller and all females are hitherto without eggs: apparently, the specimens represent only young forms. Another congeneric species, *P. dogieli*, was described from the R. Amur basin by Sokolovskaya (1982) who had distinguished it from *D. petruschewskii* principally on the basis of differences in body sizes and the degree of the observability of hypodermic nuclei. In our opinion, both the species are identical, this being also indicated by the present record of young *D. petruschewskii* from *Megalobrama terminalis*, a type host of *D. dogieli*. If it is proved, then *D. dogieli* will be the valid specific name with *D. petruschewskii* being its junior synonym. *D. petruschewskii* was described from only four, probably young specimens (2 males and 2 females — see Sokolovskaya 1971).

Now *D. petruschewskii* is for the first time reported from Vietnam and all the named fish species represent new host records for this parasite.

Fam. Illiosentidae Golvan, 1960

4. *Pseudorhadinorhynchus vietnamensis* sp. n. (Fig. 4)

Description: Body elongate, broadest in its anterior part and distinctly narrowed posteriorly. Trunk spines, ensheathed in cuticular folds, arranged in

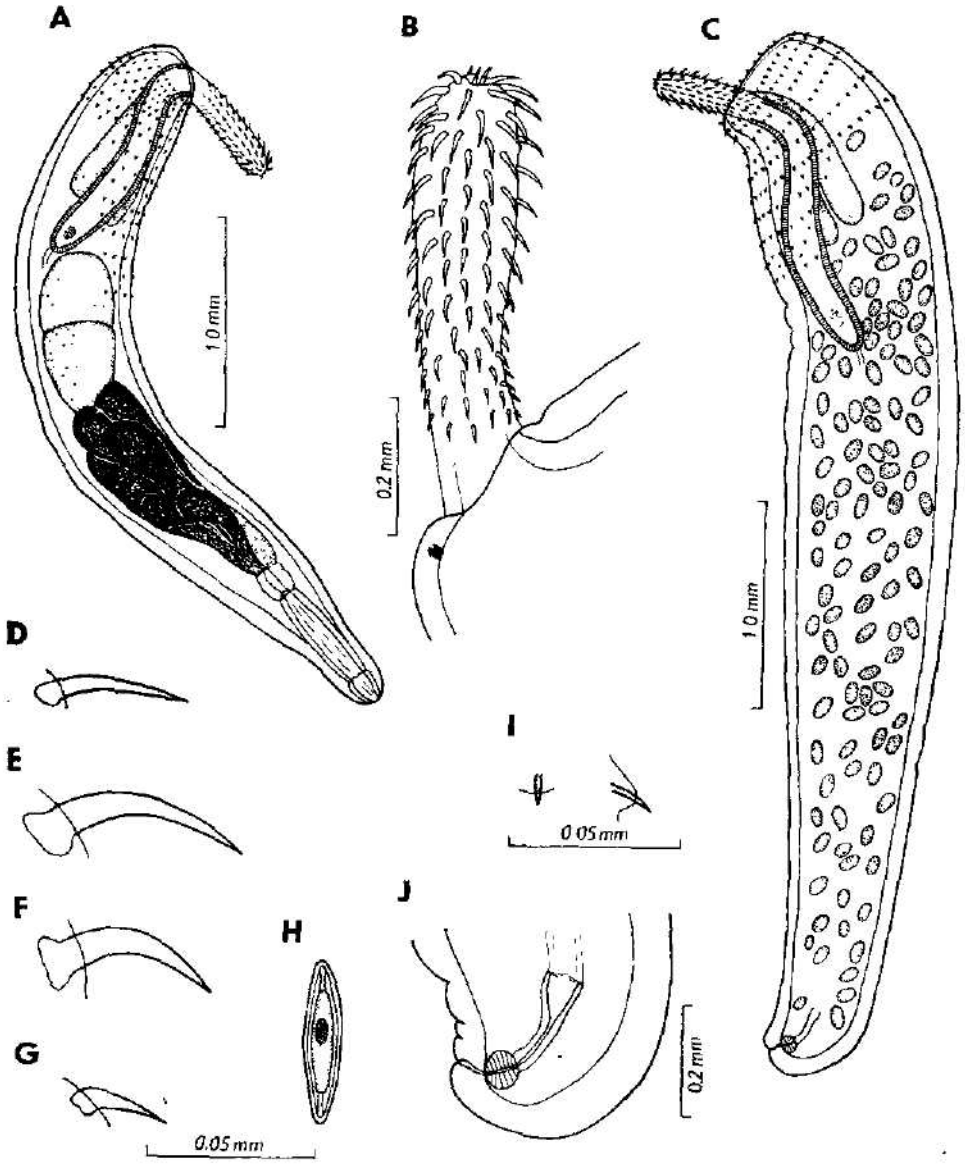

Fig. 4. *Pseudorhadinorhynchus vietnamensis* sp. n. A — male, general view; B — proboscis; C — female, general view; D-G — proboscis hooks (D — anterior hook, E, F — middle hooks, G — posterior hook); H — mature egg; I — trunk spines; J — posterior end of female.

transverse rows of which anterior 6—9 forming complete rings around body (some 20 spines in each ring), whereas posterior 6—11 rows being located only on ventral and subventral regions of body (incomplete rings containing only 8—13 spines each). Proboscis narrow, cylindrical, provided with 12 longitudinal

rows of hooks; each row formed by 12 hooks with moderately developed roots. Largest hooks present in anterior part of proboscis, diminishing gradually in posterior direction. Proboscis receptacle narrow, fairly long, two-layered, with cephalic ganglion situated near its base. Lemnisci short, wide not reaching length of proboscis receptacle.

Male (2 specimens; measurements of holotype in parentheses): Length of trunk 4.26—5.51 (4.26), maximum width 0.653—0.789 (0.653). Length of trunk spines including their submerged parts 0.015—0.021 (0.015—0.021), length of their protruding parts 0.003—0.006 (0.006). Length of proboscis 0.680—0.707 (0.680), its width 0.150—0.163 (0.150). Length of anterior hooks 0.051—0.054 (0.051), of middle hooks 0.060—0.066 (0.066) and that of posterior hooks 0.024—0.027 (0.027). Proboscis receptacle reaching up to testes, its length being 1.16 (1.16), width 0.177—0.204 (0.204). Lemnisci 0.748—0.911 (0.884—0.911) long and 0.109—0.177 (0.109—0.122) wide. Testes in middle part of body, closely one after another; size of anterior testis 0.490—0.544 × 0.326—0.394 (0.490 × 0.394), of posterior one 0.435—0.571 × 0.354—0.394 (0.435 × 0.354). Eight pyriform cement glands forming compact group situated immediately below testes.

Female (3 specimens; measurements of allotype in parentheses): Trunk of gravid females 5.92—6.32 (5.92) long and 0.884—0.979 (0.979) wide. Length of trunk spines including their submerged parts 0.021 (0.021, 0.721), length of their protruding parts 0.003 (0.003). Length of proboscis 0.612—0.721), its width 0.163 (0.163). Length of anterior hooks 0.054 (0.054), of middle hooks 0.069 (0.069) and that of posterior hooks 0.030 (0.030). Length of proboscis receptacle 1.50—1.56 (1.50), its width 0.245 (0.245). Lemnisci in one paratype 0.680 long and 0.150 wide, in allotype indistinct. Whole body densely filled in with eggs and ovarian balls. Spherical vaginal sphincter distinct, terminal. Eggs spindle-shaped, size 0.060—0.066 × 0.012 (0.060 × 0.012).

Host: *Squaliobarbus curriculus* (Cyprinidae).
Localization: intestine.
Type locality: Red River near Hanoi, Vietnam (date of collection not exactly determined — 1960—1975).
Deposition of type specimens: Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice, Helm. Coll. No. A - 33 (holotype, allotype and 3 paratypes).
Etymology: The specific name *vietnamensis* relates to the country of the origin of this new species.

Comments: — According to Amin (1985), the genus *Pseudorhadinorhynchus* Akhmerov et Dombrovskaya-Akhmerova, 1941 includes a total of 9 species. Of them, only *P. markewitchi* Akhmerov et Dombrovskaya-Akhmerova, 1941, *P. pseudaspii* Akhmerov et Dombrovskaya-Akhmerova, 1941, *P. leuciscus* (Krotov et Petrochenko, 1956) and *P. samegaiensis* Nakajima et Egusa, 1975 are parasitic in freshwater fishes, being known from some cyprinids and salmonids from the R. Amur basin in the USSR (see Bauer 1987) and from Japan (Nakajima and Egusa 1975, Machida and Araki 1982). *P. vietnamensis* sp. n. differs distinctly from the four above mentioned species in the number and arrangement of proboscis hooks; while the proboscis of the new species is armed with hooks distributed in 12 longitudinal rows of 12 hooks each, in *P. markewichi* there are 14 longitudinal rows of 13—14 hooks, in *P. leuciscus* 14 rows of 8—9 hooks, in *P. pseudaspii* only 10 rows of 7—8 hooks, and in *P. samegaiensis* 14 rows of 9—11 hooks. Moreover, the lemnisci of *P. leuciscus* and *P. pseudaspii* are very long, exceeding far the length of the

proboscis receptacle, whereas these are very short, not reaching the end of the receptacle in *P. vietnamensis* sp. n.; in *P. markewitchi* the lemnisci are allegedly long in males and short in females. By the character of its lemnisci *P. vietnamensis* sp. n. reminds members of the related genus *Telosentis* Van Cleave, 1923, but these are noted for the presence of spines on the posterior end of the body.

All species from marine fishes expressively differ from *P. vietnamensis* sp. n. in the numbers and arrangements of proboscis hooks (*P. ernakulensis* Gupta et Gupta, 1971 — 22-26 longitudinal rows of 4-7 hooks, *P. dussamicietatum* Gupta et Gupta, 1971 — 20 rows of 12-13 hooks, *P. cinereus* Gupta et Naqvi, 1983 — 22 rows of 14—18 hooks, *P. mujibi* Gupta et Naqvi, 1983 — 16-18 rows of 16-18 hooks, and *P. cochinensis* Gupta et Naqvi, 1983 — 18-22 rows of 14-17 hooks) (see Gupta and Gupta 1971, Gupta and Naqvi 1983).

In 1965, Demshin described from the cyprinid *Hemiculter leucisculus* in Vietnam a new acanthocephalan species, *Micracanthocephalus hemiculterus*, resembling *P. vietnamensis* sp. n. in the arrangement and number of proboscis hooks and general measurements. However, in addition to other features, both these species markedly differ from each other in the number of cement glands (six versus four) in the male.

5. *Paradentitruncus longireceptaculis* gen. et sp. n. (Fig. 5)

Description: Body elongate, almost cylindrical. Anterior end of body provided with 22-24 transverse rows of small trunk spines ensheathed in cuticular folds. Proboscis narrow (invaginated in all specimens), long, armed with numerous hooks arranged in 20 longitudinal rows of more than 30 (probably 32) hooks each; size of hooks gradually increasing from anterior to posterior end of proboscis, hooks at proboscis base markedly longer and more straight than others. Proboscis receptacle very long, two-layered, cephalic ganglion situated somewhat below its mid-length. Lemnisci long and narrow.

Male (12 specimens; measurements of holotype in parentheses): Length of trunk 2.24—3.55 (3.55), maximum width 0.557—0.612 (0.612); length of its withdrawn part 0.177—0.204 (0.177). Length of trunk spines including their submerged parts 0.018—0.024 (0.018—0.021). Length of invaginated proboscis 0.734—0.952 (0.952), its width 0.095—0.109 (0.109). Length of anterior hooks 0.030 (0.030), of middle hooks 0.036—0.039 (0.039), and of basal hooks 0.069——0.078 (0.078). Proboscis receptacle reaching level of cement glands, its length 1.80—2.04 (2.04), maximum width 0.218—0.258 (0.218). Length of lemnisci 1.74——2.44 (2.44), width 0.054 (0.054). Testes oval, tandem, situated in middle of body; size of anterior testis 0.313—0.408 × 0.163—0.249 (0.408 × 0.163), of posterior testis 0.258—0.666 × 0.163—0.204 (0.666 × 0.163). Eight claviform cement glands forming compact group present. Seminal vesicle elongate, Saefftigen's pouch well developed. Bell-shaped bursa well developed.

Female (15 specimens; measurements of allotype in parentheses): Body of gravid females 5.09—8.57 (8.57) long and 0.734—0.816 (0.816) wide. Length of trunk spines including their submerged parts 0.024—0.036 (0.024—0.036). Length of invaginated proboscis 1.03—1.09 (1.03), its width 0.122—0.150 (0.150). Length of anterior hooks 0.030—0.039 (0.039), of middle hooks 0.045—0.060 (0.060), and of basal hooks 0.090—0.099 (0.099). Length of proboscis receptacle 2.31——2.52 (2.52), its width 0.340—0.422 (0.422). Lemnisci 1.63—2.86 (2.86) long and 0.054 (0.054) wide. Whole body filled in with eggs and ovarian balls. Spherical

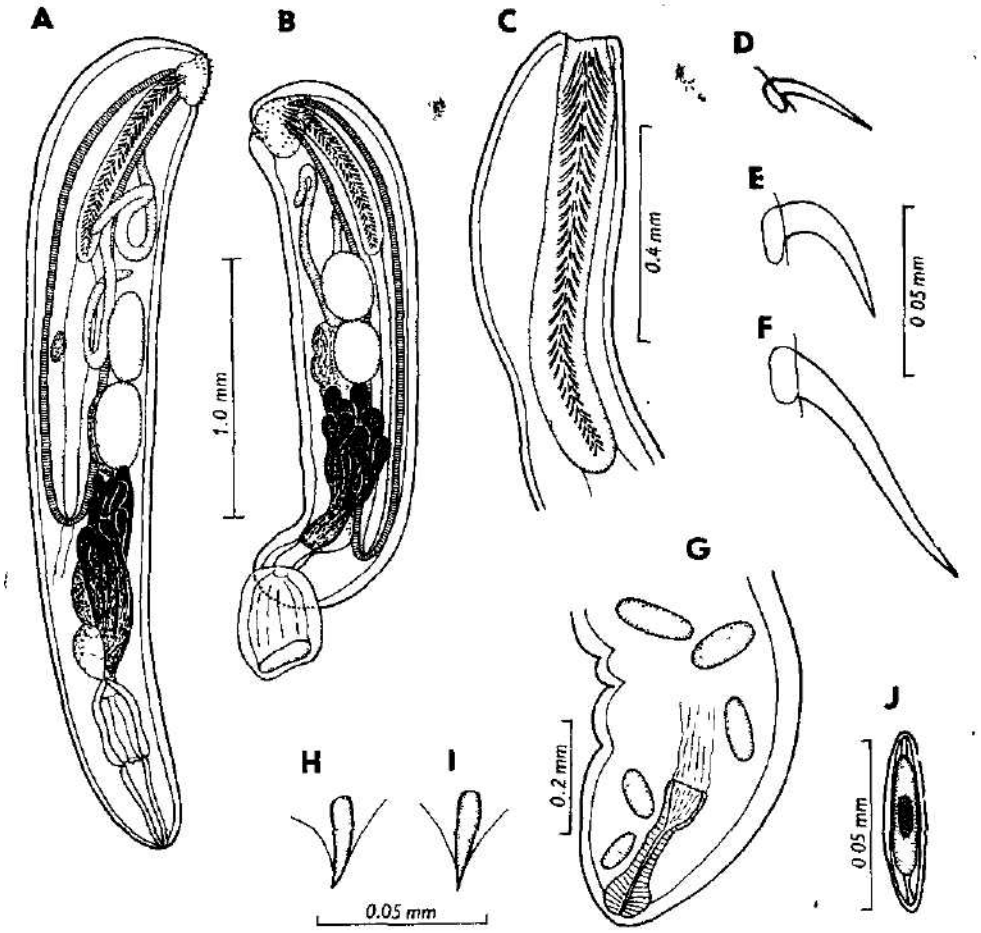

Fig. 5. *Paradentitruncus longireceptaculis* gen. et sp. n. A, B — male, general view; C — invaginated proboscis; D-F — proboscis hooks (D — anterior hook, E — middle hook, F — posterior hook); G — posterior end of female; H, I — trunk spines; J — mature egg.

vaginal sphincter terminal. Eggs spondle-shaped, size 0.060—0.069 × 0.009—0.012 (0.060—0.069 × 0.009—0.012).

Host: *Arius sinensis* (Ariidae).
Localization: intestine.
Type locality: Red River near Hanoi, Vietnam (date of collection not exactly determined — 1960—1975).
Deposition of type specimens: Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice, Helm. Coll. No. A-34 (holotype, allotype and 25 paratypes).
Etymology: The specific name *longireceptaculis* relates to the most characteristic feature of this acanthocephalan, i.e. an unusually long proboscis receptacle.

Comments: — In 1966, Wang described from the hosts *Arius falcarius* and *Pseudobagrus fulvidraco* from China a new species *Rhadinorhynchus arii* that was morphologically very similar to *P. longireceptaculis* sp. n. Considering the newer taxonomic system of Golvan (1969), it is apparent that the first species is not a member of *Rhadinorhynchus* (it possesses more numerous cement glands) and, in our opinion, it is necessary to place it in the genus *Paradentitruncus* gen. n. as *P. arii* (Wang, 1966) comb. n.; although the presence of only "six prostatic glands" has been reported in the original description of *P. arii*, the drawing indicates that there may well be present eight cement glands.

P. longireceptaculis sp. n. differs from *P. arii* principally in the shape and equipment of the proboscis, this being markedly narrower (0.095—0.150 versus 0.304—0.336 mm) and bearing only 20 longitudinal rows of more than 30 hooks each (24 rows of 21-22 hooks in *P. arii*) in the new species. In contrast to *P. arii*, the proboscis receptacle of *P. longireceptaculis* sp. n. is relatively longer, reaching up to the level of cement glands in males. The eggs of the new species are conspicuously narrow in comparison with those of *P. arii* (size of eggs 0.060—0.069 × 0.009—0.012 mm versus 0.052—0.070 × 0.052—0.058 mm).

Genus *Paradentitruncus* gen. n.

Diagnosis: Illiosentidae. Body cylindrical, its anterior part with several transverse rows of small trunk spines. Proboscis long, with numerous hooks arranged in longitudinal rows; size of hooks increasing posteriorly; basal hooks markedly longer than others. Proboscis receptacle very long, reaching level of cement glands in male. Cephalic ganglion siuated slightly below mid-length of receptacle. Lemnisci long, slender. Testes oval, tandem, situated in middle of body. Cement glands claviform, 8 in number. Seminal vesicle elongate; Saefftigen's pouch present. Vaginal sphincter terminal. Eggs spindle-shaped. Intestinal parasites of fishes.

Type species: *P. longireceptaculis* sp. n.

Differential diagnosis: From the majority of genera of the family Illiosentidae known from marine fishes the genus differs in the absence of genital spines. By its morphology, *Paradentitruncus* gen. n. is closest to the genera *Pseudorhadinorhynchus* Akhmerov et Dombrovskaya-Akhmerova, 1941 and *Dentitruncus* Sinzar, 1955, which are considered by Golvan (1969) to be indistinguishable, but the validity of the latter genus was later proved by Manilla et al. (1976); both these genera contain freshwater forms. *Paradentitruncus* gen. n. can be distinguished from the first genus on the basis of the character of proboscis hooks (these attain their maximum size at proboscis base in the new genus, while, on the contrary, basal hooks are smallest in *Pseudorhadinorhynchus*), whereas from the second one mainly by the location of the cephalic ganglion (below mid-length of receptacle versus near base of receptacle) and vaginal sphincter, the latter being terminal in the new genus and situated at a certain distance from the body end (a short tube is present between it and posterior extremity) in *Dentitruncus*. Moreover, *Paradentitruncus* gen. n. differs from both these genera as well as from all remaining genera in the family in possessing the markedly long proboscis receptacle, reaching up to the level of cement glands in males.

In 1969, Golvan established an independent genus *Indorhynchus* to accommodate the species *Rhadinorhynchus indicus* Tripathi, 1959 that had been

described from marine catfishes of the family Ariidae from India. This genus differs from *Paradentitruncus* gen. n. mainly in the dorso-ventral asymmetry of hooks on the proboscis, the presence of small basal hooks and in the relatively short proboscis receptacle.

Etymology: The new generic name is derived from the name of the related genus *Dentitruncus*.

Fam. Rhadinorhynchidae Travassos, 1923

6. Cathayacanthus bagarii sp. n. (Fig. 6)

Description: Body elongate, broadest at its anterior part. Anterior end of body in available specimens withdrawn, armed with tiny trunk spines arranged in 25—34 transverse rings of about 30 spines each; spines ensheathed in cuticular folds. Proboscis narrow (invaginated in all specimens), long, armed with numerous hooks arranged in 14 longitudinal rows of 33-35 hooks each. Largest hooks present in middle part of proboscis, gradually diminishing posteriorly; most posterior hooks smallest, thorn-shaped. Large specialized basal hooks absent. Dorsoventral asymmetry of hooks indistinct. Proboscis receptacle two-layered, conspicuously longer than invaginated proboscis; cephalic ganglion situated in its posterior half. Lemnisci relatively long, exceeding proboscis receptacle.

Male (2 specimens and body fragments of additional three; measurements of holotype in parentheses): Length of trunk 8.36—8.84 (8.84), maximum width 0.97—1.13 (1.09). Length of withdrawn anterior part of body 0.88—1.22 (1.22). Length of trunk spines including their submerged parts 0.021—0.063 (0.030), of their protruding parts 0.006—0.012 (0.009). Length of invaginated proboscis 1.13—1.16 (1.16), its width 0.122—0.136 (0.136). Length of anterior hooks 0.030 (0.030), of middle hooks 0.036—0.039 (0.036) and that of basal hooks 0.018 (0.018). Proboscis receptacle 1.63—1.89 (1.82) long and 0.299—0.345 (0.313) wide. Testes oval, tandem or oblique, situated in front of mid-length of body; in speciment with withdrawn anterior end of body testes reaching level of proboscis receptacle; size of anterior testis 0.857—1.105 × 0.505—0.612 (0.115 × 0.544), of posterior one 0.721—1.156 × 0.503—0.558 (1.156 × 0.503). Four very long tubular cement glands present, reaching up to level of posterior testis. Seminal vesicle elongate.

Female (1 complete specimen allotype and body fragments of 2 others; measurements of allotype in parentheses): Length of trunk of female without eggs (10.00), maximum width 0.802—1.06 (1.06). Length of withdrawn anterior end of body 1.16—1.36 (1.16). Length of trunk spines including their submerged parts 0.027—0.045 (—), of their protruding parts 0.009—0.012 (—). Length of invaginated proboscis 1.27—1.39 (1.39), its width 0.150 (0.150). Length of anterior hooks 0.030—0.036 (0.030), of middle hooks 0.039—0.042 (0.039), and that of posterior hooks (0.021—0.027 (0.021). Length of proboscis receptacle 1.86—1.93 (1.86), its width 0.218—0.381 (0.218). Lemnisci 2.65—2.72 (2.72) long and 0.068—0.095 (0.068) wide. Whole body filled in with ovarian balls, in one body fragment also with mature eggs. Eggs spindle-shaped, size 0.063—0.075 × 0.012—0.015 (—).

Host: *Bagarius bagarius* (Sisoridae).
Localization: intestine.

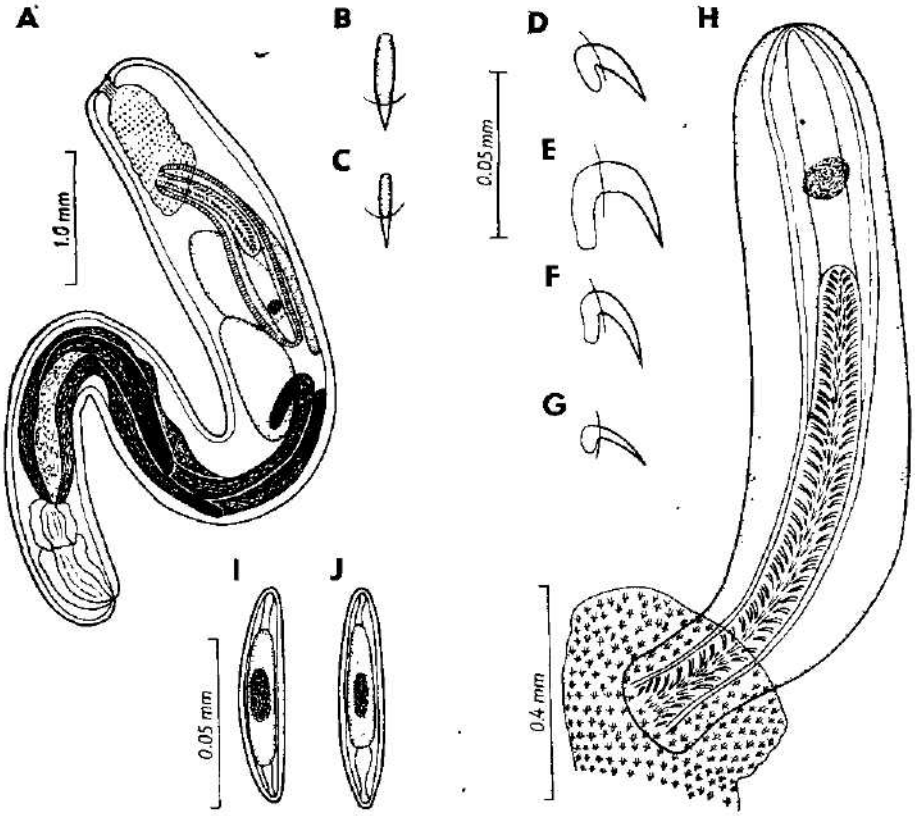

Fig. 6. *Cathayacanthus bagarii* sp. n. A — male, general view; B, C — trunk spines; D-G — proboscis hooks (D — anterior hook, E, F — middle hooks, G — posterior hook); H — proboscis receptacle with invaginated proboscis; I, J — mature egg.

Type locality: Red River near Hanoi, Vietnam (date of collection not exactly determined — 1960—1975).

Deposition of type specimens: Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice, Helm. Coll. No. A-35 (holotype, allotype and 6 paratypes).

Etymology: The specific name of this species is derived from the generic name of its type host.

Comments: — In 1928, Van Cleave described a new species *Rhadinorhynchus exilis* on the basis of four females obtained from *Carassius carassius* from China; however, the existing description is inadequate and, mainly, there are no data concerning the male morphology. Later, principally on the basis of the absence of large specialized basal hooks and the allegedly dorsoventral asymmetry of proboscis hooks, Golvan (1969) created an independent genus *Cathayacanthus* to accomodate it; at the same time the author expressed his doubt as to the belonging of this species to the family Rhadinorhynchidae (i.e. whether there are only four cement glands in the male).

The specimens of the present material show a distinct resemblance to members of *Rhadinorhynchus* Lühe, 1911 that includes the parasites of marine fishes (see Golvan 1969); but our specimens differ from this genus in possessing no specialized basal hooks on the proboscis. However, by this feature they resemble the species *Cathayacanthus exilis* that was also described from the freshwater fish, and namely from the nearby geographical region; the biometrical data concerning both these forms are similar too. A substantial difference between our specimens and *C. exilis* should be the allegedly dorsoventral asymmetry of proboscis hooks in the latter, but it is not too expressive according to the original drawing (Van Cleave 1928) and, in our opinion, this can hardly be considered a generic feature. Therefore, we take our specimens for the representatives of the hitherto monotypic genus *Cathayacanthus* that should be listed within the Rhadinorhynchidae. *C. bagarii* sp. n. differs from *C. exilis*, in addition to the already mentioned asymmetry of hooks, by the greater number of longitudinal rows of hooks on the proboscis (14 versus 12), by somewhat smaller measurements of hooks and also by the host types (Siluriformes versus Cypriniformes).

7. *Cleaveius longirostris* sp. n. (Fig. 7)

Description: Body cylindrical, its anterior end armed with 11-20 transverse rows of small trunk spines forming complete rings composed of 16-22 spines each. Proboscis cylindrical, conspicuously long, provided with 14 longitudinal rows of 17-20 hooks each. Proboscis receptacle two-layered, occupying approximately anterior third of body length; cephalic ganglion situated approximately at border of second and third thirds of receptacle length. Lemnisci long, narrow, reaching to anterior testis in males.

Male (8 specimens; measurements of holotype in parentheses): Length of trunk 2.58—3.26 (2.65), maximum width 0.462—0.639 (0.585). Length of trunk spines including their submerged parts 0.015—0.021 (0.018—0.021), of their protruding parts 0.003—0.006 (0.003—0.006). Length of proboscis 1.09—1.36 (1.06), its width 0.136—0.177 (0.136); length of neck 0.163—0.272 (0.272). Length of anterior hooks 0.030—0.045 (—), of middle hooks 0.039—0.057 (0.039—0.045), and that of posterior hooks 0.027—0.036 (0.027—0.033). Proboscis receptacle 0.82—1.22 (0.95) long, maximum width 0.109—0.272 (0.272). Length of lemnisci 1.43—2.38 (2.38), their width 0.041—0.068 (0.041). Testes spherical or oval, tandem, situated in posterior third of body length; size of anterior testis 0.109—0.245 × 0.095—0.163 (0.163 × 0.163), of posterior one 0.095—0.231 × 0.095—0.190 (0.136 × 0.136). Four small pyriform cement glands present, reaching to posterior testis. Saefftigen's pouch well developed. Genital opening terminal, size of evaginated genital bursa 0.218—0.408 × 0.272—0.449 (0.218 × 0.299).

Female (7 specimens; measurements of allotype in parentheses): Length of trunk of nongravid females 3.26—4.65 (4.65), maximum width 0.530—0.748 (0.748). Length of trunk spines including their submerged parts 0.015—0.021 (0.015—0.018). Length of proboscis 1.22—1.70 (1.61), its width 0.177—0.231 (0.218); length of neck 0.136—0.367 (0.313). Length of anterior hooks 0.036—0.045 (0.036—0.039), of middle hooks 0.030—0.045 (0.036—0.042). Proboscis receptacle 0.93—1.70 (1.43) long, maximum width 0.218—0.326 (0.313). Length of lemnisci 2.31—2.72 (2.58), their width 0.027—0.068 (0.027). Eggs not yet present, only small ovarian balls.

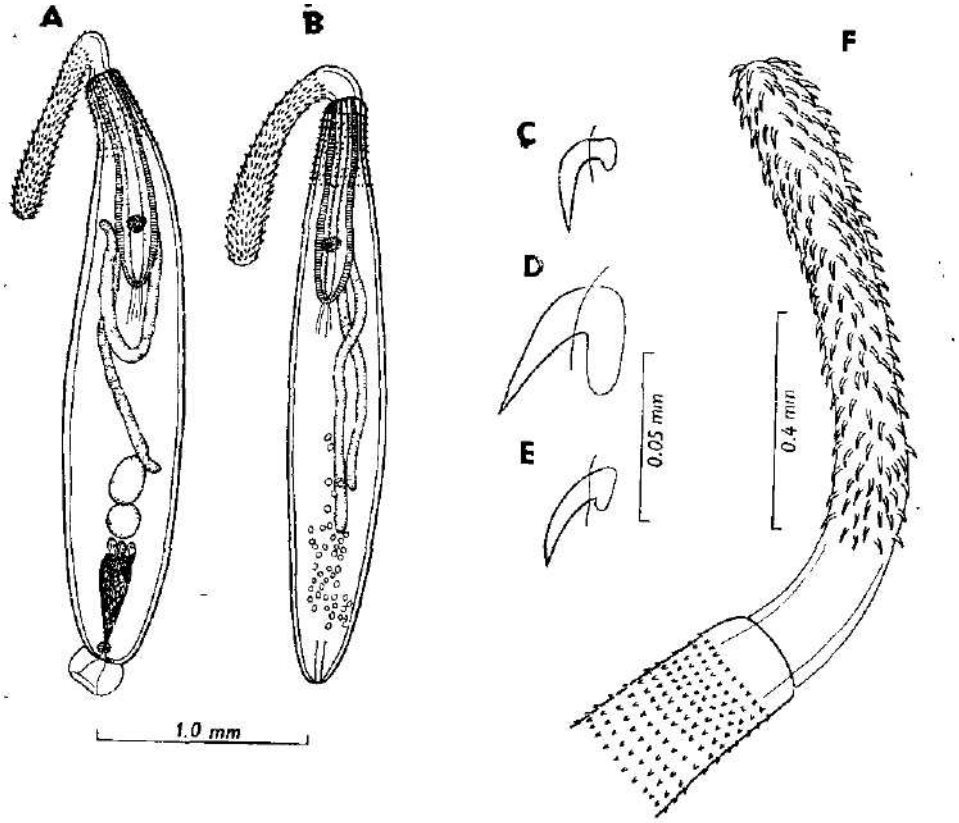

Fig. 7. *Cleaveius longirostris* sp. n. A — male, general view; B — young female, general view; — C-E — proboscis hooks (A — anterior hook, D — middle hook, E — posterior hook); F — proboscis.

Hosts: *Cirrhina molitorella* (type host), *Erythroculter recurvirostris* (both Cyprinidae), *Rhinogobius hadropterus*, and *Glossogobius giurus* (both Gobiidae).
Localization: intestine.
Type locality: Red River near Hanoi, Vietnam (date of collection not exactly determined — 1960—1975).
Deposition of type specimens: Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice, Helm. Coll. No. A-36 (holotype, allotype and 13 paratypes).
Etymology: The specific name *longirostris* emphasizes the characteristic feature of this species, i.e. the conspicuously long proboscis.

Comments: — All females of the present material were nongravid. This species has been assigned to the genus *Cleaveius* Subramanian, 1927 only provisionally and it cannot be excluded that in future it will be necessary to create a new indepedent genus for it. In contrast to other *Cleaveius* species, the new species is noted for a very elongate proboscis, being, however, very similar to them in other features. It has been placed in this genus mainly because of the presence of dorsoventrally indistinguished hooks on the proboscis and only complete rings of trunk spines on the anterior end of body, the

situation of the cephalic ganglion, the character and number of cement glands, a well developed Saefftigen's pouch, and the localization of testes in the posterior part of body.

At present the genus *Cleaveius* includes six species known from various freshwater fishes in Burma and India (see Golvan 1969; Amin 1985). As it has already been mentioned, *C. longirostris* sp. n. differs from all its congeners mainly by the conspicuously long proboscis which is armed with hooks arranged only in 14 longitudinal rows of 17-20 hooks each (*C. circumspinifer* Subramanian, 1927 — 18 rows of 4 hooks each, *C. leiognathi* Jain et Gupta, 1979 — 11 rows of 4-5 hooks, *C. mysti* Sahai et Sinha, 1971 — 14-18 rows of 15-17 hooks, *C. portblairensis* Jain et Gupta, 1979 — 11 rows of 6 hooks, *C. prashadi* (Datta, 1940) — 20-22 rows of 12-14 hooks, and *C. secundus* (Tripathi, 1959) — 16-20 rows of 16-18 hooks); by the number and arrangement of proboscis hooks, *C. longirostris* sp. n. is closest to *C. mysti*, but in contrast to the new species the anterior hooks of *C. mysti* are largest and the proboscis in this species is distinctly shorter (0.84—0.94 mm versus 1.09—1.70 mm).

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A NEW GENUS AND SPECIES OF HELOTREPHIDAE FROM AFGHANISTAN AND IRAN (HETEROPTERA: NEPOMORPHA)*

Dedicated to the eminent Czechoslovak hemipterist Dr. Ludvík Hoberlandt on the occasion of his 70th anniversary

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Abstract. *Mixotrephes hoberlandti*, gen. n., sp. n. (Helotrephinae) is described (male, female, larvae) from Afghanistan (Nuristan) and Iran (Makran) and compared with related genera (*Limnotrephes, Paralimnotrephes, Idiotrephes, Tiphotrephes*). It is the first record of the family from the transitional area between the Palaearctic and Oriental regions as well as its first record (the locality in Iran) from an extremely arid area.

Almost all species of the aquatic family Helotrephidae occur in the Oriental, Afrotropical, Madagascan and Neotropical regions (cf. Papáček, Štys & Tonner, 1988; Štys & Jansson, 1988), and only *Heterotrephes admorsus* Esaki & Miyamoto, 1959 is a genus and species endemic to the Amami Islands (southern Japan) in the Eastern Palaearctic. We describe now a new genus and species collected in NE Afghanistan (Nuristan) in 1953 by J. Klapperich and in SE Iran (Makran) in 1973 by the expedition of the National Museum in Prague. These are first records of the family from the western transitional areas between the Palaearctic and Oriental zoogeographical regions; the latter find from Iran is also a first record of the family in an arid area. Some zoogeographic and ecological aspects of this discovery are mentioned in Discussion jointly with the assessment of a peculiar mixture of morphological characters of the new genus. Our morphological and taxonomic terminology follows that used by Esaki & China (1928) and Papáček, Štys & Tonner (1988).

Mixotrephes gen. n.

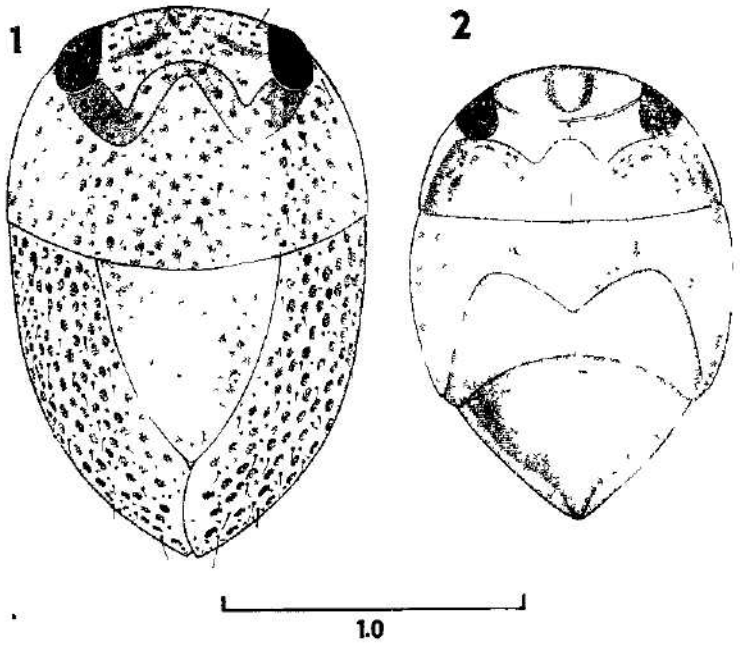
Type species: *Mixotrephes hoberlandti* sp. n.

Etymology: from Greek *mixis*, mixing + *trephes* (latinized form of non-classical Greek *trephos*, inhabitant); gender: masculine.

Diagnosis: Median length of cephalonotum not exceeding half the length of the body (dorsal view, Fig .1). Medial arch of W-shaped cephalonotal sulcus not exceeding the level of posterior margins of eyes in frontal and dorsofrontal views (Figs. 3, 4). Lateral carina of cephalonotum sharp, rather

*The paper is partly based on material collected by the Second Czechoslovak-Iranian entomological expedition to Iran, organized by the Department of Entomology, National Museum (Nat. Hist.) Prague.

broad and distinct throughout, penetrating onto the ocular area arrowwise (Figs. 1, 5), but not continuous across eye. Inner margin of lateral pronotal plate without insinuation at the meeting point with genal plate; propleural plate triangular, basally long, without transverse ridge, apex acuminate (Fig. 5). Labium short, reaching between fore coxae, its segment 4 strikingly narrow, longer than the preceding segments. Antennae two-segmented, distal segment with 4 long apical setae (Fig. 4). Mesoscutellum as long as its basal width or slightly longer; lateral margins moderately convex. Insertions of setae on



Figs. 1, 2. ***Mixotrephes hoberlandti***, **dorsal view. 1 — Adult brachypterous ♂. 2 — Larva of 5th instar.**

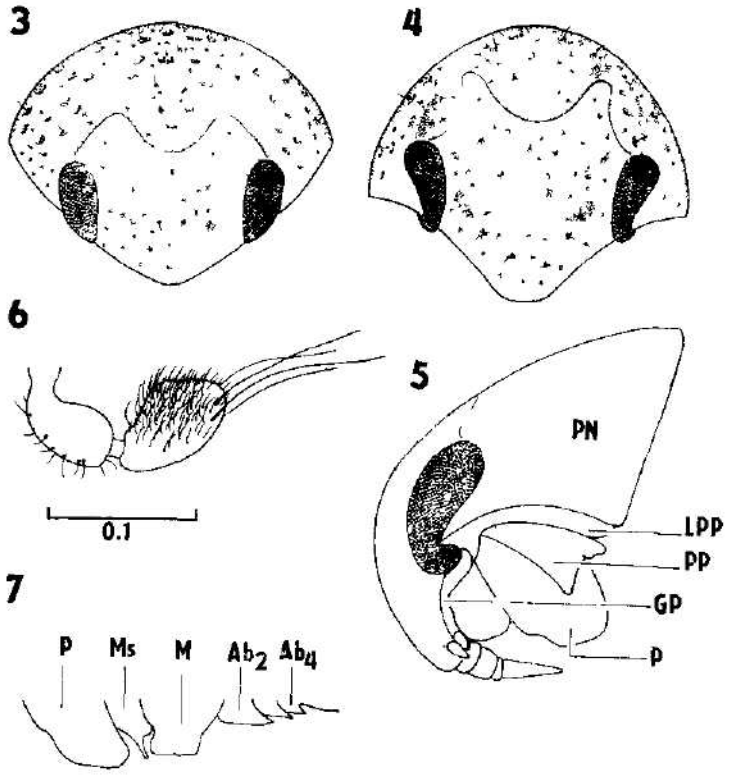
hemelytra mostly outside the pits. Mesosternal carina narrow, pointed, as high as metasternal or slightly higher, slightly lower than prosternal (Fig. 7). Dorsal base of middle femur with a spinous projection parallel with dorsal margin of trochanter and directed towards coxa (Figs. 9, 10). Abdominal carina extending onto sternum 4. Male left dorsal laterotergite 7 dome-shaped, strongly sclerotized and pigmented. Pygophore with a strongly developed posterodorsal spur-like process (Fig. 17). Phallosoma distally narrowly pointed vesica with a coiled processus gonopori (Fig. 13). Female abdominal segment 7 moderately asymmetrical, sternum 7 produced into a large, medial, subrectangular lobe (Fig. 23). Ovipositor moderately asymmetrical, its axis directed dextrocaudad. Valvifers and valvulae 1 flat, plate-shaped, without any conspicuous sclerotizations. Valvulae 2 arcuately fused, without apical process.

Differential diagnosis: Shape of propleural plate and lateral pronotal plate, course of cephalonotal suture and a short rostrum of *Mixo-*

trephes range it in the group of genera ("*Limnotrephes*-group") characterized by China (1935: 612) in the first thesis of couplet 3 of his key. This distinct group of largely monotypic genera includes now *Limnotrephes* Esaki & China, 1928 (*L. campbeli* Esaki & China, 1928 from India and *L. stuckenbergi* Poisson, 1960 from South Africa), *Paralimnotrephes* Poisson, 1950 (*P. villiersi* Poisson, 1950 from Ivory Coast; insufficiently described), *Tiphotrephes* Esaki & China, 1928 (*T. indicus* (Distant, 1910) from India and Burma) and *Idiotrephes* Lundblad, 1933 (*I. chinai* Lundblad, 1933 from Sumatra, Malaya and Indochina).

Mixotrephes differs

(a) from all genera of the *Limnotrephes*-group by the presence of a pointed process on the base of middle femur;

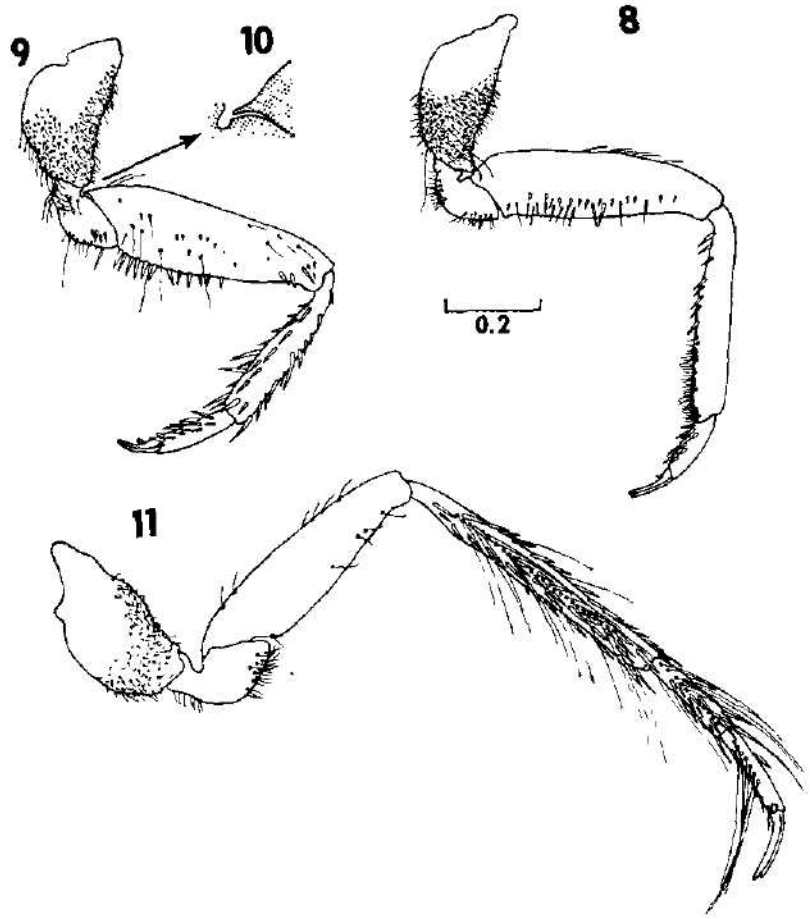


Figs. 3—7. *Mixotrephes hoberlandti*, ♂. 3 — Cephalonotum, dorsofrontal view. 4 — Cephalonotum, frontal view. 5 — Cephalonotum, lateral view. 6 — Left antenna, anterior face. 7 — Sternal carina, lateral view from left.

Lettering: Ab_2, Ab_4 — sternal carina of abdominal sterna 2, 4; GP — genal plate; LPP — lateral pronotal plate; M — metasternal carina; Ms — mesosternal carina; P — prosternal carina; PN — pronotal region of cephalonotum; PP — propleural plate.

(b) from *Limnotrephes* by (1) the presence of a spur-like process on male pygophore (absent in *Limnotrephes*). (2) sharply pointed slender apical process of phallosoma (the process is strong, short and apically rounded in *Limno-*

trephes), (3) asymmetry of female abdominal segment 7, (4) quite different shape of female sternum 7 (symmetrical in both *Limnotrephes* species, with broadly arcuate posterior margin and a pair of short subapical insinuations, the medial process not exceeding the outline of sternum), (5) abdominal carina extending onto sternum 4 (onto sternum 5 in *Limnotrephes*);



Figs. 8—11. *Mixotrephes hoberlandti*, ♂, anterior face of left leg. 8, 9, 11 — Fore (8), middle (9), and hind (11) leg respectively. 10 — Proximodorsal edge of middle femur (scheme, without scale).

(c) from *Paralimnotrephes* by (1) the shape of lateral cephalonotal carina (its extension onto ocular area in *Paralimnotrephes* not arrow-shaped, but arcuate and narrower), (2) a shorter cephalonotum (exceeding half the length of body in dorsal view in *Paralimnotrephes*), (3) shorter and broader mesoscutellum (strikingly longer than wide in *Paralimnotrephes*), (4) the presence of long apical setae on distal antennal segment (absent in *Paralimnotrephes*), (5) the presence of long swimming hairs on hind tibiae and tarsi (according to

Poisson (1950) absent in *Paralimnotrephes*, and not illustrated by Poisson (1951)), (6) ? the presence of spur-like process on pygophore (not mentioned by Poisson (1950, 1951) in *Paralimnotrephes*);

(d) from *Idiotrephes* by (1) mesosternal carina at least as high as metasternal (lower than metasternal in *Idiotrephes*), (2) much lesser degree of asymmetry of female sternum 7 (the latter with large dextral emargination of posterior margin in *Idiotrephes*), (3) absence of costal lobe on the right female hemelytron (large and distinct in *Idiotrephes*). (4) abdominal carina extending onto sternum 4 (onto sternum 5 in *Idiotrephes*), (5) tip of propleural plate acuminate (rounded in *Idiotrephes*);

(e) from *Tiphotrephes* by (1) the shape of cephalonotal carina (in *Tiphotrephes* narrow and only slightly penetrating the ocular area as a flat rounded lobe), (2) the shape and length of labial segment 4 (in *Tiphotrephes* about as long as preceding segments and only slightly more slender). (3) mesosternal carina at least as high as metasternal (lower than metasternal in *Tiphotrephes*). (4) the shape of apical process of phallosoma (in *Tiphotrephes* strong and apically more or less rounded), (5) asymmetry of female abdominal sternum 7 and absence of its lateral lobes (sternum 7 symmetrical and with a suggestion of paired lobes attached to its medial process — cf. Esaki & China (1928)); (6) ? the presence of coiled processus gonopori of phallus (absent according to illustration by Esaki & China (1928)).

Mixotrephes hoberlandti sp. n.

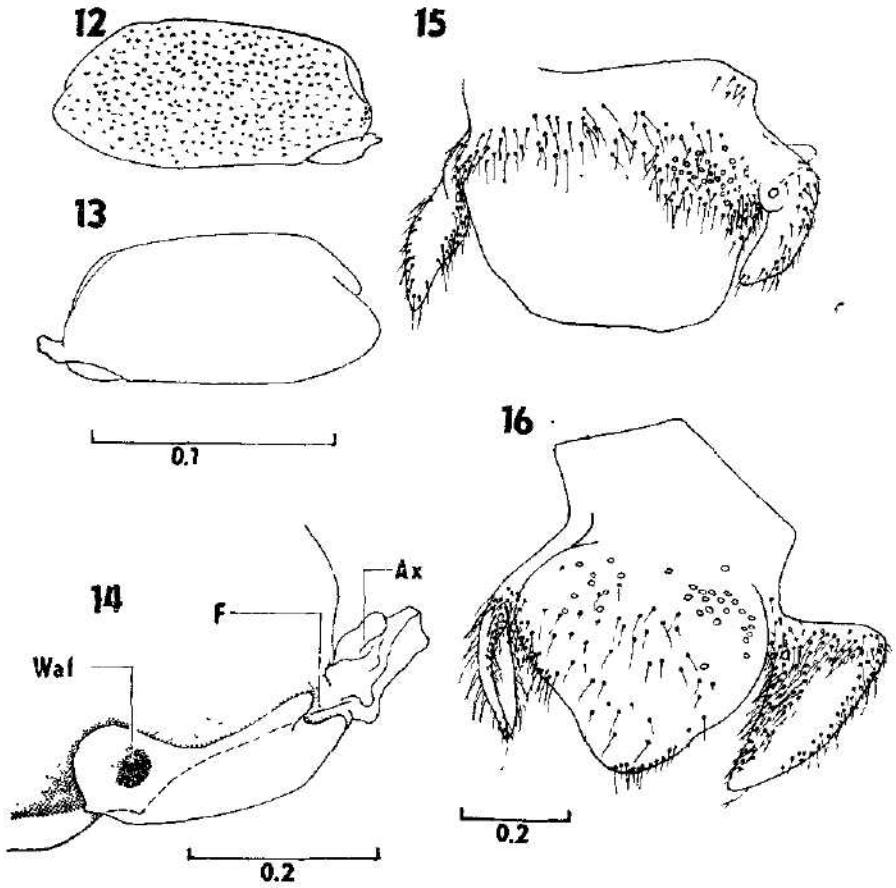
Etymology: Named after Dr L. Haberlandt.

Body length 1.7—2.1 mm (for other morphometric data see Tables 1 and 2). Body shape as in *Limnotrephes;* occurring in brachypterous and macropterous morphs.

Ground colour yellowish brown; colour patterns variabed. Cephalonotum mostly light brown with a darker transverse stripe generally following the course of cephalonotal suture and 4 darker spots in front of this suture. Frontoclypeal region (up to eyes), spots near angles of the W of the cephalonotal suture, lateral margins of pronotal parts of cephalonotum and a medial cephalonotal spot (triangular or arrow-shaped, situated behind the dark transverse stripe) bright yellow. Hemelytra and scutellum largely yellow with brown spots around the pits (Fig. 1). Venter pale to dark brown (depending on the general degree of pigmentation), legs yellow-brown. Macropterous form always darker, its brown spots more extensive and shades of coloration darker.

Cuticle lustrous, cephalonotum and hemelytra with shallow pits and fine short pilosity. Legs with some spiniform setae; no scale-like setae.

Cephalonotum (Figs. 1, 3, 4, 5) with fine setae situated in pits. Medial arch of the W-shaped suture not reaching to the level of the hind margins of eyes in frontal or dorsofrontal view; the diameter of medial arch equals approximately 1/3 of the width of cephalonotum at the level of hind angles of the suture; lateral arms of the suture slightly shorter than half the length of the curve of its medial arch. Lateral carina of the pronotal part of cephalonotum rather broad and laminar throughout, distinct in both dorsal and lateral view; sharply arrow-wise penetrating onto the ocular space, but not continuous across eye. Lateral pronotal plate, pleural plate and labium as in generic diagnosis. Proximal segment of antenna with sparse, isolated short hairs; distal segment



Figs. 12—16. *Mixotrephes hoberlandti*, brachypterous ♂. 12, 13 — Outline of right (12) and left (13) hemelytron; note the delimited clavulus and the delimited smooth subarea of claval region. 14 — Ventral surface of basal part (clavulus and axillary region; schematized) of left hemelytron; dashed line indicates a boundary between clavulus and corium on dorsal surface. 15 — Abdomianl sternum and laterotergites 7. 16 — *Abdominal sternum and laterotergites 8.*

Lettering: Ax — axillary apparatus; F — medial fracture; Waf — wing-anchoring fovea of ventral ridge of clavulus.

almost completely covered by short hairs on ventral sides, with 4 long apical setae (2 of them distinctly longer); a distinct cylindrical internodal structure present (Fig. 2).

P t e r o t h o r a x. Mesoscutellum as in generic diagnosis, insertions of setae situated in pits (Fig. 1). Mesosternal and metasternal carinae as in generic diagnosis and as illustrated (Fig. 7).

H e m e l y t r a (Figs 1, 12, 13; described as in situ) of both sexes and both morphs slightly asymmetrical, the right one distally overlaping the left. Right costal lobe not developed in females. Basal part of claval region with scale-like microsculpture; a smooth, well-delimited area along the proximal anal margin

Table 1. *Mixotrephes hoberlandti*: somatic measurements of adults in mm (N = 16)

	Esaki & China's (1928) symbols	$\bar{x}$	Range
Total length	A–B	1.83	1.70–2.02
Humeral width	L–M	1.14	1.08–1.18
Minimum interocular width	G–H	0.59	0.59
Maximum transocular width	F–K	0.88	0.84–0.90
Basal width of mesoscutellum	P–Q	0.56	0.54–0.65
Medial length of mesoscutellum	N–O	0.62	0.60–0.71
Maximum length of cephalonotum	C–E	1.09	1.05–1.15
Height from costal margin to base of mesoscutellum	C–D	0.63	0.56–0.71

of clavus situated beneath the posteiror margin of cephalonotum. Setal insertions mainly outside the pits, sporadically inside them, more frequently so distally. Both left and right membranes represented by small interlocking structures; right membrane larger than the left; terminal lobe of corium (situated laterad of membrane) of right hemelytron slightly shorter and less rounded than that of the left. Wing-anchoring apparatus of both macropterous and brachypterous morphs formed by (1) smooth claval areas fitting the ventral surface of posterior margin of cephalonotum; (2) a distinct (under magnification 250×) knob on the ventral surface of right membrane fitting into a pit of the overlapped dorsal surface of left membranes; (3) a knob at the hind angle of the ventral mesepimeral lobe fitting the fovea in the hind margin of the ventral surface of clavulus.

Table 2. *Mixotrephes hoberlandti*: measurements of legs of adults in mm (from slide preparations; 1♂, 1♀)

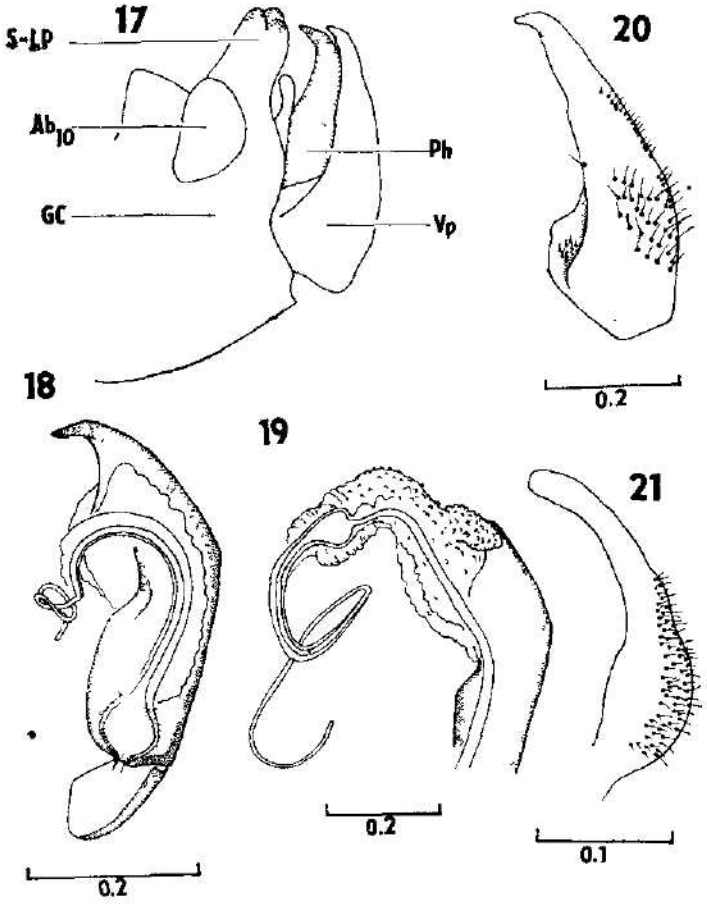
	cx	tr	fe	ti	ta	ta_1	ta_2	claws
Fore leg								
– male	0.32	0.13	0.53	0.43	0.16	–	–	0.09
– female	0.32	0.13	0.48	0.38	0.14	–	–	0.08
Middle leg								
– male	0.26	0.16	0.53	0.53	0.17	–	–	0.08
– female	0.25	0.13	0.51	0.32	0.18	–	–	0.09
Hind leg								
– male	0.36	0.20	0.53	0.61	0.41	0.21	0.20	0.14
– female	0.36	0.18	0.51	0.56	0.43	0.23	0.20	0.14

Macropterous morph. Hemelytra with a well-delimited short clavus; clavulus indistinctly delimited by concave impressionsý inner surface with a ridge provided with a posterior fovea of the wing-anchoring apparatus Hindwings well developed, longer than abdomen, at rest folded in a dome covering the

whole abdominal dorsum. Venation not sclerotized, distinctly visible only near axillary sclerites.

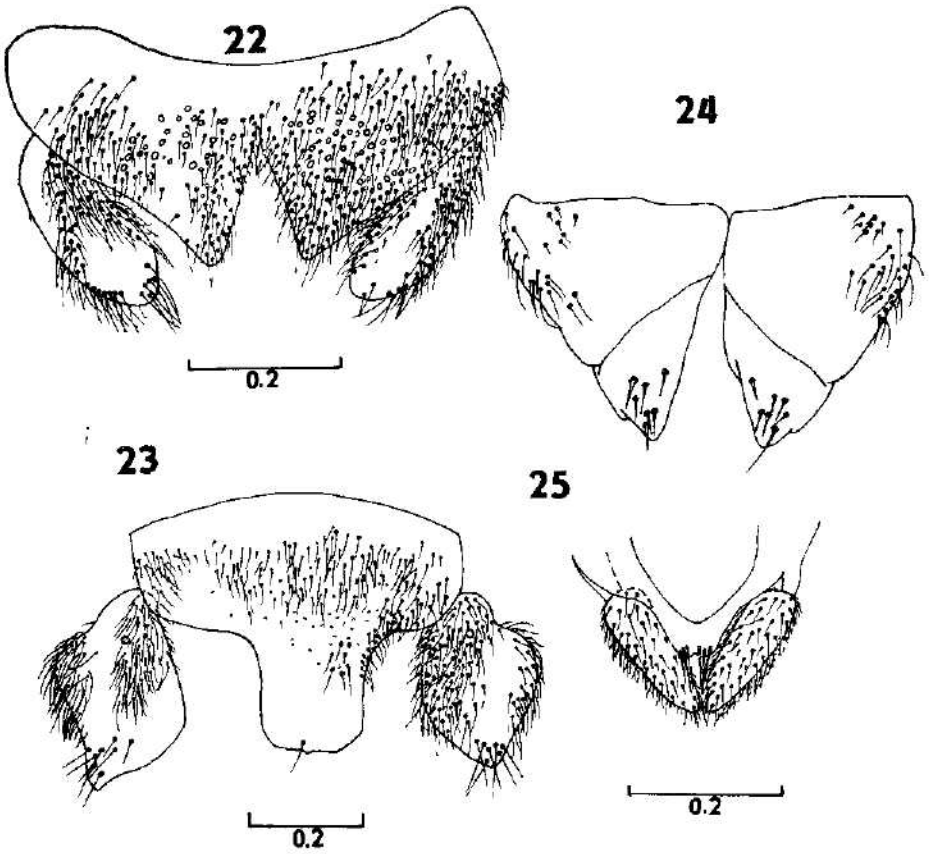
Brachypterous morph. Clavus not delimited, even ventral surface of hemelytron with no indication of claval fracture. Clavulus distinctly delimited by a sharp impression, surface of clavulus sunken below the level of surrounding parts of corium. Ridge on the ventral surface of clavulus broader than in macropters. Hindwings shorter than abdomen, probably folded along jugal fold only, reaching the hind margin of tergum 6 to extending onto tergum 7; hindwings tending to adhere to the ventral surface of hemelytra. Venation even less distinct than in macropters.

Leggs (for measurements see Table 2). All coxae with tubercles and fine



Figs. 17—21. *Mixotrephes hoberlandti*, brachypterous ♂, terminalia (all illustrations in the most exposed, i.e. topographically ventral view). 17 — Terminal part of pygophore and associated structures. 18 — Phallus in non-inflated state. 19 — Terminal part of phallus in inflated state. 20 — Left (ventral) paramere, morphologically lateral view. 21 — Right (dorsal) paramere; morphologically mesal view.

Lettering: Ab_{10} — abdominal segment 10; GC — pygophore (genital capsule); S-LP — spur-like process; Vp — left (ventral) paramere.



Figs. 22-25. *Mixotrephes hoberlandti*, ♀. 22 — Mediotergite 7 and dorsal laterotergites. 23 — Sternum 7 and ventral laterotergites. 24 — Valvifers 1 and valvulae 1, ventral view. 25 — Valvulae 2 and gonostyloids, ventral view.

setae. Fore leg (Fig. 8): Coxa with 3 long trichoid setae. Anterior face of femur with a long row of short conical spines and an adjacent row of long spiniform setae. Tibia of males on anterior face with a ventral row of spines replaced in distal half by a dense row of setae; in female with a row of spines throughout. Middle leg (Figs. 9, 10): Femur with basidorsal spinous projection (cf. generic diagnosis) as illustrated, ventral edge with a row of about 12 spines. Spinose armature of tibia and tarsus as illustrated; no sexual dimorphism. Hind leg (Fig. 11): Anterior face and ventral edge of femur with a few trichoid setae only. Tibia and both tarsal segments with spines or spiniform setae and long swimming hairs as illustrated. Tarsal segment 1 as long as 2 in male, slightly longer in female. Pretarsus symmetrical on all pairs of legs.

Abdomen (DLTG = dorsal laterotergite or dorsal surface of LTG; LTG = = laterotergite; MTG = mediotergite; S = sternum; VLTG = ventral laterotergite or ventral surface of LTG). Dorsum sclerotized. S 2—4 with narrow medial carina (Fig. 7). S 2—6 (both sexes) connate, forming a compact struc-

Table 3. *Mixotrephes hoberlandti*, measurements of larvae in mm

	Instar 4	Instar 5 (N = 4)	
		$\bar{x}$	range
Total lenght	1.24	1.59	1.50—1.61
Maximum width	0.86	1.11	1.08—1.15
Minimum interocular width	0.43	0.52	0.50—0.56
Maximum transocular width	0.80	0.85	0.83—0.87

ture covered with dense, long pilosity (apparently of a macroplastron type) with a silky lustre. VLTG distinctly delimited from S.

Male pregenital modifications. Segments 6—8 asymmetrical; MTG 7,8 and S 7,8 with many campaniform sensilla. LTG 7 and 8 forming separately produced appendage-like asymmetrical lobes with stalked bases ventrally bearing the spiracles. Right DLTG and VLTG 7 identical in shape, whereas left DLTG and VLTG 7 different; the same situation obtains for LTG 8. Segment 7 (Fig. 15). MTG 7 irregularly rectangular. Right LTG 7 rather narrow, apex directed caudad, exceeding apex of S 7. Left LTG 7 broader,

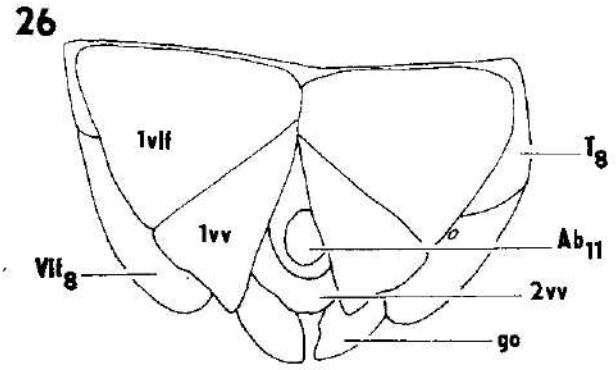


Fig. 26. *Mixotrephes hoberlandti*, ♀, ovipositor, semischematical ventral view.
Lettering: Ab_{11} — abdominal segment 11; go — gonostyloid; 1 vlf — valvifer 1; Vlt 8 — ventral laterotergite 8; 1 vv and 2 vv — first and second valvulae (the latter fused in an arcus).

curved, apex directed mesocaudad, the base of DLTG with a dome-shaped, strongly sclerotized and pigmented process directed laterad to anterolaterad. S 7 broadly arcuate, its posterior margin with an irregular outline. Segment 8 (Fig. 16). MTG 8 narrowly rectangular. Right LTG 8 narrowly falciform, its stalked base strikingly long. Left LTG 8 much larger than right, broadly falciform, proximally dilated, the base of DLTG with an inconspicuous, dome-shaped, unpigmented tubercle. S 8 irregularly cordiform.

Female pregenital modifications. Segment 7 moderately asymmetrical. MTG (Fig. 22) with many campaniform and trichoid sensilla, posterior margin deeply triangularly excised. Both DLTGs tongue-shaped. Sternum (Fig.

23) slightly asymmetrical, with a long subrectangular projection; proximal part with irregularly distributed trichoid setae (distribution individually variable). Right VLTG subrhomboidal, left VLTG irregularly cordiform.

Pygophore and male genitalia. Pygophore asymmetrical; its posterodorsal apex (situated sinistrally in situ owing to partial rotation of pygophore) with a long spur-like process (Fig. 17) terminating by three tubercles and diverging from the longitudinal axis of pygophore by about 60°; ventrocaudal apex of pygophore minutely pointed (distinct in lateral and posterior views). Phallus (Figs. 17—19) in non-inflated state almost as long as ventral paramere; phallosoma sclerotized, apically produced into a spiniform, slender process (directed cephalad in situ), posterior (ventral) margin of phallosoma broadly obtusangular; ejaculatory reservoir subspherical; conjunctiva finely microtuberculate, with an indistinct lobe; vesica produced in a thin, coiled processus gonopori (almost 2.5 times as long as phallosoma). Basal sclerite of phallus articulating direct with parameres. Left (ventral) paramere (Fig. 20) about twice as long as right (dorsal) paramere; shape and pilosity of parameres as illustrated.

Ovipositor (Figs. 24—26) moderately asymmetrical, its axis diverging by *10—15° dextrocaudad from the body axis. VITG 8 free, not fused with* valvifers, bearing spiracles. Valvifers 1 irregularly subtrapezoidal, with trichoid setae in lateral areas. Valvulae 1 plate-shaped, flat, irregularly elongate triangular, distally with 7 spiniform setae each, without sclerotized struts. Valvulae 1 localized caudad of valvifers; partly fused with them. Valvulae 2 fused in an arcus, its apex with 3 + 3 subspiniform setae. Gonostyloids associated with paired basal parts of valvulae 2, broadly styliform, with trichoid setae.

Larvae (Fig. 2) of instar 4 and 5. Broadly drop-shaped, cuticle lustrous with small pits and short pilosity. For measurements see Table 3. Ground coloration dark brown; two darker spots in frontoclypeal region, smaller darker spots on dorsum of pterothorax; abdominal dorsum black. Conspicuous yellow spoth behind eyes, lateral cephalonotal carina yellow-brown; some individuals with a transverse, oval mesonotal spot. Ventral *surface brown, legs pale brown to yelow. Instar 4 generally paler.*

Cephalonotal suture distinct, complete, its lateral arms shorter than half the length of the curve of the medial arch; the latter extending to about the level of posterior margins of eyes. Lateral carina of cephalonotum distinct and broad, its anterior arrow-shaped termination penetrating onto the ocular area; sharp lateral margins of mesonotum and mesonotal wing pads form a continuation of this carina. Instar 4 without distinct metathoracic wing pads (brachypterous individual?); lateral margin of mesonotum 3.5 times as long as lateral margin of metanotum (measured in lateral view including the wing pads; the same applies to larva 5 below). Larva 5 with mesothoracic wing pads only incompletely covering the metathoracic ones, the latter distinct; lateral margin of mesonotum about 6 times as long as that of metanotum. Sternopleural thoracic region rather compact, sternal carina similar to that adults. Tarsus of hind legs one-segmented. Abdominal segmentation indistinct (under cca 75× magnification).

Material examined (for details on localities and habitats see Discussion). E. Afghanistan, Nuristan, "Bashgultal" (label in German; = Valley of Bashgul River), 1300 m, 24. v. 1953 ,leg. J. Klapperich; holotype: brachypterous male (fully dissected and dry-mounted); paratypes: 7 ♂ (5 brachypterous, 2 macro-

pterous), 10 ♀ (9 brachypterous, 1 macropterous), 5 larvae (one instar 4, four instar 5); all dry-mounted, three fully dissected. S. Iran: Makran, 2 km SE Minab, 21. v. 1973, leg. Expedition of National Museum (Nat. Hist.) in Prague (locality no. 204), 1♀ paratype (brachypterous, dry-mounted, fully dissected).

Holotype and some of the paratypes deposited in the collection of Department of Entomology, National Museum (Nat. Hist.), Praha; other paratypes in the collections of Department of Zoology, Charles University, Praha (P. Štys), Department of Biology, Pedagogical Faculty, České Budějovice (M. Papáček), and University of Colorado Museum, Englewood (J. T. Polhemus).

DISCUSSION

(1) Data on localities, ecological and zoogeographical considerations

(a) The valley of the Bashgul (or Bash Gal) River in Afghanistan (cf. Klapperich, 1954; Hassinger, 1968) is situated in E. Nuristan in the altitude of 1100 — 2800 m; the Bashgul flows from N to S, and joins the Kunar which is a tributary of the Kabul River flowing E through Jalalabad Valley and eventually reaching the Indus. Hassinger (1968) includes the locality in the "Monsoonal natural area" of Afghanistan and into its phytogeographical Indo-Himalayan Forest Province; he describes the locality as follows: "This locality is in that part of Afghanistan which receives precipitation sufficient to sustain forest from the left flank of the Indian monsoons. The terrain is mountainous with steep valleys and sheer cliffs ... The climate and vegetation are unique for Afghanistan; nowhere else ... can Afghan mountainside vegetation of comparable density be found". No details of the habitat of *Mixotrephes hoberlandti* are known.

(b) Minab is situated in coastal S. Iran, near the Strait of Hormuz, in W Makran area. It is an arid coastal plain, with occasional ephemeral water-courses, irrigated areas and oases, essentially with semidesert to savanna-like xerophilous vegetation of scattered trees and shrubs, with a steppe-like ground cover (Hoberlandt, 1981); phytogeographically the vegetation belongs to Saharian-Arabian and Nubo-Sindhian groups. Precipitation is extremely low (2—12 cm yearly). *Mixotrephes hoberlandti* was collected (Hoberlandt, 1981; Jelínek, pers. comm. based on field diary) in a dry river bed fringed by *Tamarix* in a savanna with predominant *Prosopis spicigera* and *Salvadora persica*. The actual find was made probably under stones near dried-out pools; definitely neither in water nor at light.

The find of *M. hoberlandti* in S. Iran is so far the only find of a helotrephid in an arid zone, all others seem to be confined to humid tropics or subtropics. Circumstances of the find in Iran suggest that the species lives there in ephemeral waters, and that it is able to aestivate (or, generally, be dormant) in the adult or possibly egg stage, probably for a considerable part of the year, in a non-aquatic situation.

The entire territories of Afghanistan and Iran are included in the Palaearctic region in most of the existing zoogeographical classifications, probably more on the grounds of simplicity than on any other consideration. However, e.g. Kryzhanovskiy (1965) in his detailed discussion of the zoogeography of Middle* Asia included the Iranian Makran in the Khuzestan-Baluchistan area of the Saharo-Sindhian superprovince of the Saharo-Gobian subregion of the Palaearctic, and the Nuristan in the Afghano-Turkestanian province of the Middle Asiatic subregion of the Palaearctic. Consequently we could consider *M. hoberlandti* a "palaearctic" species.

* In accordance with the present usage of Soviet biologists and geographers we apply the term Middle Asia (= "Srednaya Aziya") to the Turkmenistan, Uzbekistan, Tadzhikistan, Kirgizia and adjacent areas while the term Central Asia (= "Tsentral'naya Aziya") is reserved for a more eastern area comprising Altai, Mongolia, etc.

However, the South of Iran should better be included (e.g. Müller, 1977; Štys, 1984) in a transitional Saharo-Sindhian belt, an arid transitional area between the Palaearctic, Afrotropical and Oriental regions containing a mixture of the respective faunistic elements as well as many endemics even of a high taxonomical rank (e.g. the heteropteran family Joppeicidae). On the other hand, the monsoon areas of E Afghanistan (and the whole Jalalabad Valley and all the valleys of eastern tributaries of the Kabul River) ought to be regarded as truly Oriental, or at most as belonging to a narrow submontane and montane Oriental-Palaearctic buffer zone (Gaisler, pers. comm.) characterized by a predomiannt occurrence of Oriental, often very striking faunistic elements.

Just to illustrate the last point we may mention the occurrence in Nuristan of typically Oriental mammal species, e.g. the flying squirrels *Petaurista petaurista* (Pallas, 1766) and *Hylopetes fimbriatus* (Gray, 1837) (see Niethammer (1967)) and of the Indian false vampire *Megaderma lyra* E. Geoffroy, 1810 (see Gaisler (1970)). For a good entomological example of the penetration of an Oriental subspecies just into the Jalalabad Valley see the case of an ischnopsyllid flea *Rhinolophopsylla unipectinata indica* Jordan & Rotschild, 1921 described by Hůrka (1970).

At present we do not know whether *Mixotrephes* is more closely related to Afrotropical (e.g. *Paralimnotrephes*) or Oriental taxa of the family, and whether it represents an Oriental, Afrotropical or stationary element (a Palaearctic origin is excluded). The geographic logic and lack of occurrence of Afrotropical elements in Nuristan suggest rather its Oriental origin; however, the fauna of Baluchistan and Makran in Iran is characterized by the presence of numerous Afrotropical elements (Kryzhanovkiy, 1965) — as an example may serve the occurrence in S. Iran (Hoberlandt, in press) of a coreid *Clavigralla scutellaris* (Westwood, 1842), an Afrotropical element distributed from Sudan and Kenya through the Arabian Peninsula up to Pakistan and penetrating into India. The question must remain open, but it is noteworthy that the known area of *Mixotrephes hoberlandti* is confined to transitional areas forming a S fringe of the Palaearctic at its contact with the Oriental region, and that the two known localities are situated in zoogeographically, phytogeographically and climatically very different territories.

(2) Pterygopolymorphism in Helotrephidae

The brachypterous morph of *Mixotrephes hoberlandti* is the only known case of true brachyptery of hindwings (HW) in the family. The forewings (FW) are always subcoleopterine, long, covering the whole abdomen, and their structure is variable (cf. Papáček, Štys & Tonner, 1988): claval fracture is present or absent, clavulus (an exocorial area, identical with "embolium" and delimited by the confluence of medial and costal fractures) is either delimited or not, and the membrane is either represented by variously shaped vestiges or completely absent. Hindwings are either fully developed, or brachypterous (*M. hoberlandti* only), micropterous (reaching onto tergum 2 to 3), or absent. In species with a dimorphic condition of hindwings, are forewings also dimorphic and can be termed "macropterous" and "brachypterous" for convenience; the "macropterous" and "brachypterous" condition of forewing may be different in different taxa. At the level of individual morphs, we can distinguish 4 situations in the family:

(a) FW "macropterous", HW macropterous;
(b) FW "brachypterous", HW brachypterous;
(c) FW "brachypterous", HW micropterous;
(d) FW "brachypterous", HW absent.

Some taxa are known to occur in a monomorphic condition (a), (b) or (d) only (we suppose that mainly owing to accidental sampling and lack of representative records). The dimorphic condition (a) and (c), with the prevalence of the latter morph seem to be a mode. The dimorphic condition (a) and (b) is unique so far for *M. hoberlandti* (a : b — ♂ 6 : 2, ♀ 10 : 1).

(3) Generic characters in the Helotrephinae and similarities of *Mixotrephes*

Generic limits in *Limnotrephes*-group are not firmly estabilished and besides some striking autapomorphies of some taxa (e.g. striking asymmetry of female terminalia in *Idiotrephes*) the genera, as presently conceived, are rather narrowly understood and characterized mainly by a mosaic of often intergrading characters. The generic characters will be compared in a paper by J. T. Polhemus (in prep.) where new taxa will also be described. At present we accept a narrow conception of genera and accord *Mixotrephes* a generic status, also considering its unique area.

China (1935) enumerated ten most important characters which can serve for delimitation of genera in the Helotrephinae. We can add to them (11) construction of male laterotergites 7 and 8, (12) presence or absence of a spur-like process on pygophore and (13) basic structure of ovipositor (symmetry x asymmetry, shape of fussed 2nd valvulae — simple arcus x presence of an apical process, etc.). Some characters that had originally been throught to be of generic value proved later to be of limited importance; e.g. Esaki & China (1928) characterized the genus *Limnotrephes* by combined length of hind tarsus and claws exceeding the length of hind tibia, but this character is not valid for *Limnotrephes stuckenbergi* Poisson, 1960; Esaki & China (1928) and Poisson (1950, 1951) thought that in *Limnotrephes* the setae on hemelytra are inserted only outside the pits, but this observation had already been refuted by Lundblad (1933).

In *Limnotrephes, Paralimnotrephes, Idiotrephes* and *Mixotrephes*, lateral cephalonotal carina is extended onto the eye surface. However, the width and degree of lamination of this carina differ in individual genera, and in the South African *Limnotrephes stuckenbergi* its shape approaches that encountered in *Tiphotrephes* (pers. comm. by J. T. Polhemus).

Swimming hairs on hind legs are present in *Mixotrephes, Limnotrephes, Idiotrephes* and *Tiphotrephes*. Abdominal carina extending only onto sternum 4 (not 5) is a character shared by *Mixotrephes, Paralimnotrephes* and *Tiphotrephes*.

Tiphotrephes, Idiotrephes and *Mixotrephes* have in common the presence of a spur-like process on pygophore (a structure homodynamic to left laterotergites?); the condition is unknown in *Paralimnotrephes*. Judging from published illustrations, only *Mixotrephes, Idiotrephes* and *Paralimnotrephes* share the presence of coiled processus gonopori on phallus.

Shape of female sternum 7 in *Mixotrephes* is different from all genera in the *Limnotrephes*-group, but it is almost identical with that of *Trephotomas com-*

pactus Papáček, Štys & Tonner, 1988 (Trephotomasinae) and very similar to some species of *Esakiella* China, 1932 (Helotrephinae, "*Helotrephes*-group"). Although the female sternum 7 of *Mixotrephes* is slightly asymmetrical, it is more similar in this respect to the symmetrical sterna of *Tiphotrephes* and *Limnotrephes* (condition unknown in *Paralimnotrephes*) than to the strikingly asymmetrical sternum of *Idiotrephes*.

At the present state of knowledge no cladistic conclusions can be derived from the most important similarities reviewed above.

(4) Female terminalia

The fusion of 2nd valvulae of *Mixotrephes hoberlandti* into a simple pilose arcus is similar to the situation occurring in the subfamilies Trephotomasinae and Idiocorinae (cf. Papáček, Štys & Tonner, 1988) and differs, also by the absence of a distal unpaired process, from that existing in many genera of the Helotrephinae. It should be noted that the absence of the apical process might be a character common to all helotrephine genera belonging to the "*Limnotrephes*-group"; the absence is indicated by illustrations of *Limnotrephes campbelli* and *Tiphotrephes indicus* by Esaki & China (1928). However, the situation remains unknown in *Idiotrephes chinai*, *Paralimnotrephes villiersi* and *Limnotrephes stuckenbergi* (cf. Lundblad, 1933; Poisson, 1950, 1951, 1960).

Comparative study of female terminalia in the helotrephine genera will undoubtedly reveal many characters useful for delimitation of genera or genus-groups, and many situations different from our earlier simplified characterization (Papáček, Štys & Tonner, 1988) of the Helotrephinae.

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We are greatly indebted to Dr. L. Hoberlandt (National Museum (Nat. Hist.), Prague) for allowing us to study and describe the new genus and species from material at his disposal, the more so that he has already begun to study it. Dr. J. Jelínek (National Museum, Prague) has kindly provided some unpublished data on the locality in Iran, and Dr. J. Buchar and Dr. K. Hůrka (Charles University, Prague), and Dr. J. Gaisler (University of J. E. Purkyně, Brno) and Dr. J. L. Stehlík (Museum, Brno) have pointed out to us the literature on the zoogeography of Nuristan. We also thank Dr. J. T. Polhemus (University of Colorado Museum, Englewood, Colorado) for sharing with us his knowledge of the comparative morphology of the helotrephine genera; some of his valuable unpublished data have been used in comparative parts of this paper.

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ÜBER DIE PUPPEN DER MITTELEUROPÄISCHEN GELECHIIDAE (LEPIDOPTERA). 5. TEIL. TRIBUS GNORIMOSCHEMINI

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A b s t r a c t. The pupae of accessible Central European *Gnorimoschemini (Lepidoptera, Gelechiidae)* are characterized, described and pictured on base of their pupae and a key for determining the genera and species as well as some biological data are added. The present system of this group is discussed from the point of view of pupal characters.

Die vorliegende Arbeit stellt eine Fortsetzung deren von Patočka (1987 a—d) vor, welche mehrere Gruppen der Familie Gelechiidae, u.a. die Tribus Teleiodini und *Gelechiini* aus der Unterfamilie *Gelechiinae* auf Grund der Puppenmerkmale behandelt haben. Jetzt folgt eine weitere Tribus dieser Unterfamilie, die Gnorimoschemini. Das System, die wissenschaftliche Nomenklatur und puppenmorphologische Terminologie, sowie die Methodik entsprechen den zitierten Arbeiten des Verfassers. Viele Arten dieser Tribus sind selten und wenig verbreitet, deshalb ist es mir gelungen, nur einen Teil der Taxone zu beschaffen.

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Tribus GNORIMOSCHEMINI Povolný, 1964

Gehört in die Unterfamilie Gelechiinae (vgl. P a t o č k a, 1987 a, b). Puppen rel. klein, 3—6, selten 7 mm lang, schlank bis ziemlich gedrungen. Körperform etwas keilförmig, im Vorderteil am breitesten, nach hinten sich verschmälernd, vorne und hinten ± abgerundet (Abb. 46, 50, 73), seltener mehr spindelförmig (Abb. 1, 7), vorne dorsoventral komprimiert. Färbung rot-, gelb-, selten schwarzbraun. Exuvie heller, manchmal recht hell. Skulptur meist nich allzu deutlich ausgeprägt. Mikroborsten, oder -stacheln bei 100× Vergrösserung selten sichtbar. Frontoclypealsutur meist frontalwärts konkav (Abb. 22, 40, 92), wenigstens im Mittelteil (bei Gelechiini und Teleiodini fast immer konvex, bogig, oder winkelig gebrochen). Labrum meist kurz und breit mit geschwungenen Seiten, die gewöhnlich recht schräg sind (Abb. 2, 60, 86). Labium (zum Unterschied von vielen Gelechiini) fast immer ganz verdeckt (Abb. 2), ausnahmsweise — bei *Ephysteris* Meyrick — sichtbar (Abb. 71). Endteile der Hinterbeine sichtbar, meist ähnlich wie bei den Teleiodini und zum Unterschied von vielen Gelechaiini rel. kurz (Abb. 18, 73). 5. Abdominalsegment ventral (zum Unterschied von Teleiodini und vielen Gelechiini) meist bis zum Kaudalrand (zuweilen noch etwas darüber) verdeckt (Abb. 1, 73, 91), das 6.

schon (ganz oder vorwiegend) frei. Am 5 Abdominalsegment also (wie bei Teleiodini, aber zum Unterschied von vielen Gelechiini) die Spuren der Abdominalbeine nicht sichtbar. Am 6., ausnahmsweise auch 7. Abdominalsegment sind sie jedoch fast immer deutlich (Abb. 7, 39). Metanotum (zum Unterschied von den sonst ähnlichen Teleiodini) rel. schmal und im Mittelteil stark (meist zu 1/2 oder mehr) verschmälert (Abb. 4, 17). Metanotum vorne rel. breit ausgeschnitten. Hinterflügel reichen meist zu 1/3 des 3. Abdominalsegmentes. 7. Segment mit- oder ohne Haarfransensaum (Abb. 18, 74, 80), in ersterem Falle aber ohne Dorsalforsatz am 10 Abdominaltergit, welcher sonst oft entwickelt ist (Abb. 5, 10, 19). Segmente 8—10 schlanker und weniger stark verwachsen als bei Teleiodini. Abdominalende meist stumpf abgerundet. Kremaster fehlt, Häkchen meist entwickelt, wobei L_1 frontalwärts von D_2 (bei Teleiodini schräg) entspringt (Abb. 24).

Die mitteleuropäischen Vertreter dieser Tribus sind (zum Unterschied zu den meisten Teleiodini und vielen Gelechiini) nicht dendrophil und leben oft stenophag an Vertretern der beschränkten Zahl der Pflanzenfamilien (Chenopodiaceae, Dianthaceae, Lamiaceae, Solanaceae, Asteraceae, Poaceae u.a.). Deshalb bewohnen sie auch ausgeprägte Standorte (ruderale, salzhaltige, Steppen, Unterwuchs der Waldbestände usw.). Mehrere Arten sind Schädlinge der Kulturpflanzen (Kartoffeln, Tomaten, Rüben usw.). Verpuppung meist im Boden, Überwinterung in verschiedenen Stadien, zuweilen sogar als Falter.

Bestimmungstabelle der Gattungen

(Von den 9 mitteleuropäischen Gattungen lagen Vertreter von 4 vor. Zwei weitere konnten nur an Hand der aussermitteleuropäischen Arten charakterisiert werden.)

1 — 10. Abdominalsegment mit einem Dorsalfortsatz (Abb. 5, 10, 19) . . . 2
— — 10. Abdominalsegment ohne einen Dorsalfortsatz (Abb. 105, 108) . . . 4

2(1) Dorsalfortsatz niedrig, höckerartig (Abb. 10). An der Basis der Vorder- und Hinterflügel runde Erhabenheiten, 1. und 2. Abdominalsegment mit Längs- und Quereinschnitten (Abb. 8) . . . . . *Gnorimoschema*
— — Dorsalfortsatz lang und spitz (Abb. 5, 19). Ohne Erhabenheiten an der Flügelbasis und Einschnitte an basalen Abdominalsegmenten 3

3(2) Körper spindelförmig, Antennae grenzen kurz miteinander (Abb. 1). Dorsalfortsatz fast nach hinten gerichtet Abb. 5) . . . . . *Phthorimaea*
— — Körper bei 1/3 am breitesten, Antennae grenzen lang miteinander (Abb. 18, 64) und (oder) Dorsalfortsatz empor-, seine Spitze meist schräg nach vorn gerichtet (Abb. 19, 31, 37) . . . . . *Scrobipalpa*

4(1) Labium sichtbar (Abb. 71). Antennae grenzen mit der Proboscis länger als miteinander (Abb. 73) . . . . . *Ephysteris*
— — Labium nicht sichtbar (Abb. 29). Antennae grenzen miteinander länger als mit der Proboscis (Abb. 74) 5

5(4) Mikroskulptur am Abdomen (100 × Vergr.) aus rel. dünnen, länglichen, quergestellten Grübchen (Abb. 76). Grenze der Palpi maxillares mit den Genae steilt (Abb. 77) . . . . . *Cosmardia*
— — Mikroskulptur anders, fein. Grenze der Palpi max. mit den Genae schräger Abb. 117) . . . . . *Caryocolum*

Gattung PHTHORIMAEA Meyrick, 1902

Puppe rel. gross (über 6 mm lang), ziemlich spindelförmig, im Mittelteil am breitesten (Abb. 1). Frontoclypealsutur konkav, bogig (Abb. 2). Labium verdeckt. Palpi maxillares grenzen mit den Mittelbeinen auffallend lang (Abb. 3), Proboscis mit den Mittelbeinen deutlich kürzer als mit den Antennae. Diese mit Leistengebilden an der Basis des Flagellums (Abb. 3), ihre Grenze mitein-

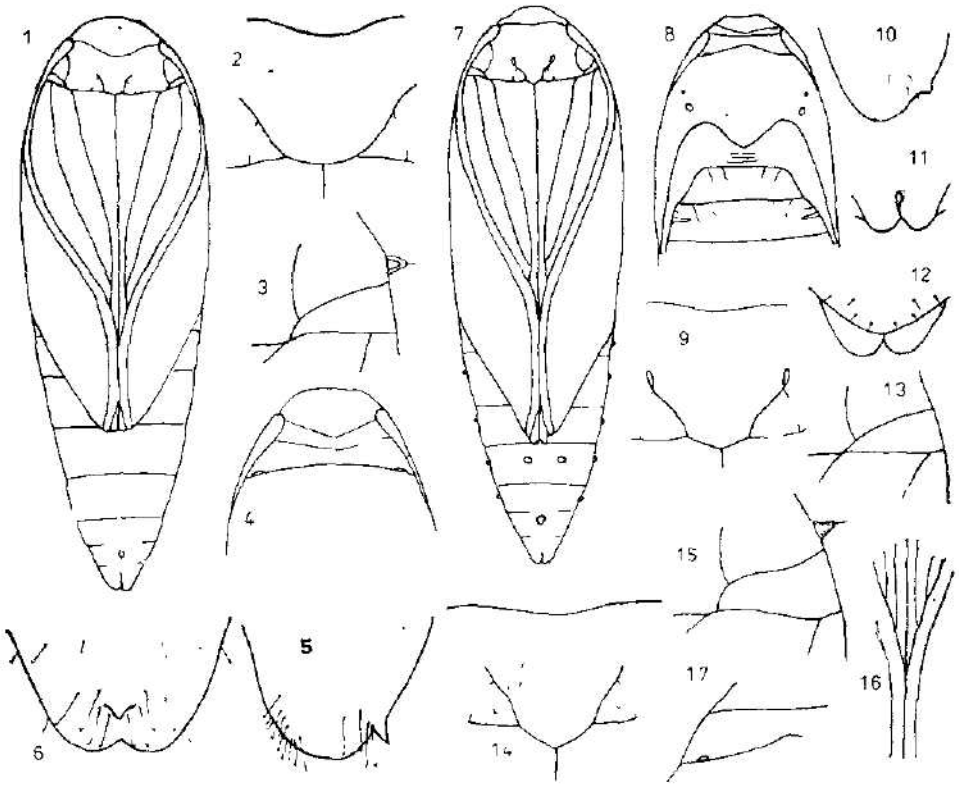

Abb. 1—6 *Phthorimaea operculella*, 8—13 *Gnorimoschema sp.*, 14—17 *Scrobipalpa acuminatella*. 1, 7 Habitusbild der Puppe, ventralansicht, 2, 9, 14 (Frontoclypealsutur, Labrum, Mandibulae, 3, 13, 15 Palpi maxillares und Umgebung, 4, 8 Vorderteil der Puppe von oben, 5, 10 Puppenende von der Seite, 6, 12 von oben, 11 von unten, 16 Endteil der Proboscis und Umgebung, 17 Pronotum.

ander rel. kurz, freie Enden der Hinterbeine rel. lang (Abb. 1). 6. Segment ohne Spuren der Bauchbeine, 7. ohne Haarfransen, 8—10. laufen stark zusammen (Abb. 1). 10. Abdominalsegment mit einem langen, spitzen Dorsalfortsatz, der etwas schräg nach hinten orientiert ist (Abb. 5). Häkchen deutlich, mittellang (Abb. 5, 6).

An Solanaceae gebunden. Raupe miniert, verpuppt sich im Boden. Nur eine Art in südlichstem Mitteleuropa.

Phthorimaea operculella (Zeller, 1873)

Puppe 6,2—6,6 × 1,6—1.9 mm (1 ♂ und 1 ♀ unbekannter Provenienz von Dr. Šedivý, Praha), gelblich braun, Exuvie braungelb. Skulptur mittelfein gerunzelt, am Abdomen chagriniert, mässig glänzend. Borsten mittelkurz, bleich. Mandibulae breit, spitz, Labrum abgerundet mit schrägen Seiten (Abb. 2). Vorderseite der Palpi maxillares regelmässig gebogen (Abb. 3). Pronotum am Vorderrand etwas konkav, Hinterrand kaum geschwungen, thorakales Spiraculum länglich (Abb. 4). Ende des Abdomens bei der Analnaht winklig ausgeschnitten (Abb. 6), bei der Lateralsicht stark bauchig (Abb. 5).

Ruderale Standorte, Felder, Gärten. Kosmopolit in wärmeren Gebieten. Schadling der Kartoffeln, Tomaten, des Tabaks usw. Raupe miniert in Blättern und Knollen.

Gattung GNORIMOSCHEMA Busck, 1900

Puppe spindelförmig, im Mittelteil am breitsten, auch nach vorn rel. spitz (Abb. 7). Frontoclypealsutur sanft gebogen, im Mittelteil konkav. Seiten des Labrums deutlich geschwungen, oben verdickt (Abb. 9). Labium ganz verdeckt. Palpi maxillares an der Frontalseite sanft, regelmässig gebogen (Abb 13) Proboscis grenzt mit den Mittelbeinen viel kürzer als mit den Antennae. Diese ohne deutliches Leistengebilde an der Basis, grenzen rel. kurz miteinander, teilen die Vorderflügel von den rel. langen Enden der Hinterbeine vollstandig ab (Abb. 7). An der Basis der Flügel sanfte Erhabenheiten. Am 1—2 Abdominalsegment längliche und schräge Schramme (Abb. 8). Abdominale Spiracula erhaben (Abb. 7). 6. Segment mit Spuren der Bauchbeine, 7. ohne Haarfransen, 8—10 Segment stark zusammenlaufend (Abb. 7). Abdominalende von unten und oben tief ausgeschnitten, von der Seite stark bauchig. Dorsalfortsatz kurz, höckerartig, darunter etwas konkav. Häkchen als kurze Borsten (Abb. 10—12).

Bemerkung: Charakteristik der Gattung nur an Hand einer noch unbeschriebenen *Gnorimoschema*-Art (J. Powell lgt) aus Kalifornien, die von Gallen an *Aster* sp. erzogen wurde (von prof. Povolný ubergeben). Die rd. 3 mitteleuropäischen Arten standen mir nicht zur Verfugung. Raupen, soweit bekannt, an Lamiaceae, Solanaceae und Asteraceae.

Gattung SCROBIPALPA Janse, 1951

Puppen mehr keilförmig, bei 1,3 am breitesten, vorne abgerundet, hinten zusammenlaufend, am Ende oft ± stumpf (Abb 22, 46, 64). Frontoclypealsutur deutlich bis stark bogig konkav, Labrum breit mit schragen, geschwungenen Seiten. Labium verdeckt (Abb. 14, 22, 33, 40). Grenze der Palpi maxillares mit den Mittelbeinen mittelkurz bis kurz, Vorderseite ganz sanft bis mittelstark geschwungen (Abb. 23, 42, 66). Proboscis grenzt mit den Mittelbeinen kürzer als mit den Antennae (Abb. 18, 19). Diese mit Leistengebilden nahe der Basis (Abb. 23, 34) grenzen rel. lang, seltener mittellang oder mittelkurz miteinander (Abb. 18, 21, 46). Die freien Enden der Hinterbeine kurz bezw. mittelkurz Das 6., selen auch 7. Segment mit Spuren der Bauchbeine (Abb. 36, 39). Dorsalfortsatz am 10. Segment stark und meist spitz, emporstehend, Spitze vorwiegend frontalwärts gebogen (Abb. 19, 31), selten etwas schräg nach hinten gerichtet (Abb. 37). Häkchen deutlich (Abb. 24, 30), oder rückgebildet (Abb 61, 68).

An ruderalen, salzhaltigen, aber auch Steppen-Standorten, Feldern und Garten. Raupen, soweit bekannt an Polygonaceae, Chenopodiaceae, Juncaginaceae, Plantaginaceae, Lamiaceae, Solanaceae und Asteraceae, oft minierend. Zuweilen Schädlinge an Kulturpflanzen.

Bestimmungstabelle der Arten

(Von den wenigstens 15 mitteleuropäischen wurden 9 untersucht.)

1 Endhäkchen winzig, bei 100 × Vergr. kaum- od. nicht sichtbar (Abb. 61, 68) 2
— Endhäkchen deutlich, bei 20 × Vergr. sichtbar (Abb. 24, 30) 3

2(1) Dorsalfortsatz stumpf, dahinten (Lateralsicht) noch ein Höcker (Abb. 69). Frontalseite der Palpi maxillares sanft gebogen (Abb. 66) . . . . . *S. nitentella*

— Dorsalfortsatz spitz, dahinten (Lateralsicht) kein Höcker mehr (Abb. 62). Frontalseite der Palpi max. geschwungen, Grenze an die Genae rel. steil (Abb 59) . . . . . *S. atriplicella*

3(1) Puppe rel. dickschalig und dunkel (rotlich-, Exuvie hell braun). Abdomen bei 100 × Vergr. oft mit Mikrobörsten od. -stacheln besetzt 4

— Puppe dünnschalig, hell, gelbbraun, Exuvie braungelb. Bei 100 × Vergr. keine Mikrobörsten sichtbar 7

4(3) Grenze der Antennae miteinander etwa 2 × länger als die mit der Proboscis (Abb 21). Abdominalende (Lateralsicht) hinter dem Fortsatz kaum konkav (Abb. 25) . . . . . **S.** *artemisiella*

— Grenze der Antennae miteinander viel länger als die mit der Proboscis (Abb. 18, 27). Abdominalende (Lateralsicht) hinter dem Fortsatz deutlich konkav (Abb. 19, 31) 5

5(4) Dorsalfortsatz schräg nach hinten gerichtet, Spitze kaum frontalwärts gebogen. Dahinten (Lateralsicht) das Abdomen winkelig ausgeschnitten (Abb. 37) . . . . . *S. samadensis ssp. plantaginella*

— Dorsalfortsatz emporstehend, Spitze frontalwärts gebogen, dahinten (Lateralsicht) nur eine sanfte Ausbuchtung (Abb. 19, 31) 6

6(5) Mittelbeine im Endteil kaum verschmälert, viel länger als die Vorderbeine (Abb. 27) . . . . . *S. stangei*

— Mittelbeine im Endteil stark verschmälert und wenig länger als die Vorderbeine (Abb. 18), oder auch verdeckt und kürzer als diese (Abb. 16) . . . . . *S. acuminatella*

7(3) Puppe rel. gedrungen, keilförmig (Abb. 50), nur 3—4 mm lang . . . . . *S. chrysanthemella*

— Puppe schlank, 5—6 mm lang (Abb 39, 46) 8

8(7) Ende des Abdomens rel. stumpf (Abb. 39, 43, 44), Palpi max. mit sanft gebogener Vorderseite (Abb. 42) . . . . . *S. clintoni*

— Ende des Abdomens rel. spitz (Abb. 46, 48, 49). Palpi max. mit stark geschwungener Vorderseite (vgl. Abb. 59) . . . . . *S. proclivella*

Scrobipalpa acuminatella (Sircom, 1850)

Puppe 4,2—5,2 × 1,4—1,6 mm (10 Puppen aus Österreich), mittelschlank (♂ schlanker als ♀), rel. dickschalig, rötlich braun, Exuvie hellbraun. Mikrostacheln bei 100 × Vergr. kaum wahrnehmbar, Borsten klein. Frontoclypealsutur im Mittelteil nur sanft geschwungen (Abb. 14), Labrum mit schrägen, rel. wenig geschwungenen Seiten, hinten winkelig, die spitzen Mandibulae deutlich überragend. Palpi maxillares grenzen mit den Genae rel. steil, mit den Mittelbeinen mittellang (Abb. 15). Antennae mit rel. schwachen Leistengebilden an der Basis, grenzen rel. lang miteinander, erreichen oft die Spitze der Vorderflügel nicht ganz, Enden der Hinterbeine kurz. Endteile der Mittelbeine stark verschmälert (Abb. 18) oder ganz verdeckt (Abb. 16). Thorakales Spiraculum klein, oval (Abb. 17). Ende des Abdomens rel. spitz (Abb. 18, 20), Hakchen stark, bei der Lateralsicht der grosse Fortsatz im Spitzenteil frontalwärts gebogen, dahinten eine sanfte Ausbuchtung (Abb. 19).

Offene Landschaft, Waldlichtungen, bes. im Bergland. Raupe miniert an *Cirsium, Carduus, Centaurea* u.a. Asteraceae.

Scrobipalpa artemisiella (Treitschke, 1833)

Puppe 4,5—6 × 1.3—1.7 mm (10 Puppen aus der Slowakei), Färbung *S. acuminatela* ähnlich. Mikrostacheln deutlicher, Borsten rel. deutlich. Frontoclypealsutur stark geschwungen. Labrum mit schragen Seiten, hinten stumpf abgerundet, die rel. schmalen Mandibulae kaum überragend (Abb. 22). Palpi max.

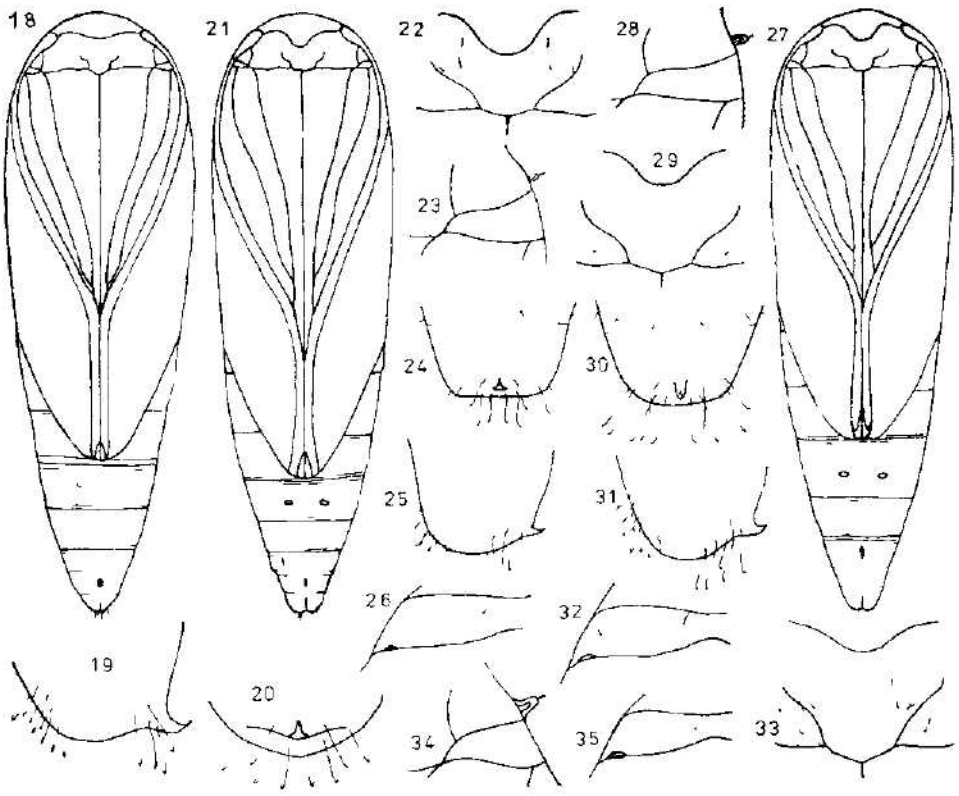

Abb. 18—20 *Scrobipalpa acuminatella*, 21—26 *S. artemisiella*, 27—32 *S. stangei*, 33—35 *S. samadensis* ssp. *plantaginella*. 18, 21, 27 Habitusbild der Puppe, Ventralansicht, 19, 25, 31 Puppenende von der Seite, 20, 24, 30 von oben, 22, 29, 33 Frontoclypealsutur, Labrum, Mandibulae, 23, 28, 34 Palpi maxillares und Umgebung, 26, 32, 35 Pronotum.

denen der vorigen ähnlich, Grenze mit den Mittelbeinen etwas kürzer (Abb. 23). Antennae grenzen rel. kurz miteinander, rel. lang mit der Proboscis, teilen die Spitze der Vorderflügel von den mittellangen Enden der Hinterbeine vollständig ab. Endteile der Mittelbeine rel. wenig verschmälert (Abb. 21). Thorakales Spiraculum klein, schmal (Abb. 26). Abdominalende in der Dorsalsicht abgestumpf, in der Lateralsicht schwach bauchig, unter dem Dorsalfortsatz kaum konkav, dieser emporstehend, Spitze frontalwärts gebogen. Endhäkchen grösser als die Perianalhakchen (Abb 24, 25).

Sonnige Steppenstandorte. Raupe an *Thymus* Überwinterung als Ei od. junge Raupe.

Scrobipalpa stangei (E. Hering, 1889)

Puppe, wie die vorigen, mittelschlank, 5,4—6.3 × 1,4—1.9 mm (2 ♂♂, 2 ♀♀ aus dem Mus. Kopenhagen), braun, Exuvie hellbraun. Kopf und Thorax vorwiegend quer gerunzelt, Abdomen mit Punktgrubchen und Mikrostacheln. Borsten deutlich. Frontoclypealsutur, Labrum, Palpi max. ziemlich ähnlich der

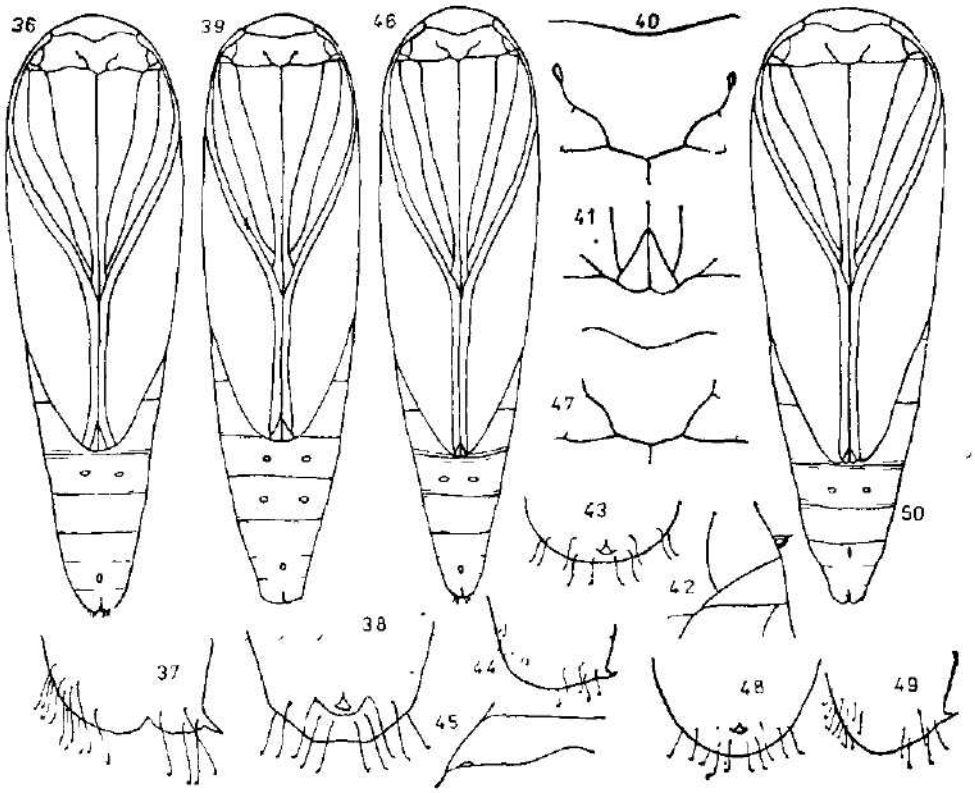

Abb. 36—38 *Scrobipalpa samadensis* ssp. *plantaginella*, 39—45 *S. clintoni*, 46—49 *S. proclivella*, 50 *S. chrysanthemella*. 36, 39, 46, 50 Habitusbild der Puppe, Ventralansicht, 37, 44, 49 Puppenende von der Seite, 38, 43, 48 von oben, 40, 47 Frontoclyalsutur, Labrum, Mandibulae, 41 Endteile der Hinterbeine und Umgebung, 42 Palpi maxillares und Umgebung, 45 Pronotum.

vorigen Art (Abb. 28. 29). Antenae grenzen länger miteinander, erreichen meist die Spitze der Vorderflügel nicht, Grenze mit der Proboscis rel. kurzer. Endteile der Mittelbeine wenig verschmalert (Abb. 27). Thorakales Spiraculum unauffällig, langlich (Abb. 32). Zwischen dem 7—8 Abdominalsegment eine Querrinne angedeutet, jedoch ohne Haarfransen. Ende des Abdomens von oben ziemlich abgestumpft, von der Seite unter dem Fortsatz schwach ausgebuchtet, dieser mit frontalwärts gebogener Spitze. Häkchen deutlich (Abb. 30, 31).
Nur im Norden Mitteleuropas. Raupe miniert in *Troglochin*.

Scrobipalpa samadensis (Pfaffenzeller, 1870) ssp. *plantaginella* (Stainton, 1883)

Puppe 6,2 × 1,8 mm (1 ♂ Mus. Kopenhagen), rel. schlank (Abb. 36), braun. Exuvie heller. Am Abdomen mit Mikrostacheln. Borsten deutlich. Frontoclypealsutur schwächer als bei vorigen gebogen, Labrum hinten starker winkelig, die breiteren Mandibulae überragend (Abb. 33). Palpi maxillares kürzer und breiter, sonst denen der vorigen ähnlich (Abb. 34). Antennae grenzen rel.

lange miteinander, teilen die Spitzen der Vorderflugel von den mittelkurzen Enden der Hinterbeine ab, grenzen mit der Proboscis rel. kurz Endteile der Mittelbeine stark verschmalert (Abb. 36). Thorakale Spiracula rel. deutlich, elliptisch (Abb. 35). Ende des Abdomens von unten mehr abgerundet (Abb. 35), von oben fast eckig (Abb. 38) ,von der Seite mit schräg nach hinten gerichtetem, kaum geschwungenem Fortsatz und einem rel. tiefen, winkeligen Ausschnitt dahinten. Häkchen stark, die End- und perianalen fast gleichlang (Abb. 37).
Lokal, insbes. an Meerküsten, Raupe an *Plantago*.

Scrobipalpa clintoni Povolný, 1968

Puppe 5,4 × 1,2 mm (1 ♂ von Danmark), recht schlank (Abb. 39) hellbraun. Exuvie braungelb, mässig glänzend, Skulptur sehr fein. Borsten vorne ganz klein. Frontoclypealsutur sanft geschwungen. Labrum breit, Seitennähte schrag und geschwungen, oben verdickt, Hinterrand stumpfwinklig (Abb. 40). Palpi maxillares dreieckig, Vorderseite ganz sanft geschwungen. Grenze mit den Mittelbeinen kurz (Abb. 42). Antennae grenzen lang miteinander, rel. kurz mit der Proboscis, erreichen die Spitze der Vorderflugel nicht. Enden der Mittelbeine massig verschmalert (Abb. 39, 41). Thorakales Spiraculum klein, oval (Abb. 45). Reste der Bauchbeine auch am 7. Segment sichtbar (Abb. 39). Abdominalende von oben und unten stumpf, von der Seite schwach bauchig, Fortsatz emporstehend, Spitze frontalwärts gebogen, dahinten kaum konkav. Endhäkchen rel. kurz, länger als die Perianalhäkchen, L_1 stärker und länger als D_1 (Abb. 43 ,44).

Raupe von Karsholt Anf. 9. an *Rumex crispus* gefunden. Die Puppe überwintert.

Scrobipalpa proclivella (Fuchs, 1886)

Puppe 5,5 × 1,4 mm (2 ♂♂ aus Danemark) hellbraun, schwach sklerotisiert, fein skulpturiert, Borsten vorne klein. Abdomen etwas spitzer als bei der vorigen (Abb. 46). Frontoclypealsutur etwas starker gebogen, Seitennahte oben nicht verdickt (Abb. 47). Palpi maxillares mit geschwungener, an der Grenze mit den Genae rel. steiler Vorderseite (vgl. Abb 23), Grenze mit den Mittelbeinen kurz. Antennae grenzen miteinander recht lang, erreichen meist die Spitze der Vorderflügel nicht (vgl. Abb. 41), freie Enden der Hinterbeine recht kurz. Endteile der Mittelbeine kaum verschmälert (Abb. 46). Nur am 6 Abdominalsegment gibt es Rudimente der Bauchbeine. Thorakales Spiraculum recht klein, oval (Abb 51). Ende des Abdomens von oben ziemlich spitz abgerundet, von der Seite stark bauchig, hinter dem kleinen, spitzen, wenig gebogenen Fortsatz kaum konkav. Häkchen mittelkurz, die End- etwas langer als die Perianalhakchen (Abb. 49, 49).

Raupe miniert an *Artemisia, Chrysantheum* und *Achillea*.

Scrobipalpa chrysanthemella (Hofmann, 1867)

Puppe 3,6 × 1,2 mm (1 ♀ aus der Slowakei), viel kleiner und gedrugener als die vorigen (Abb 50), braun, Exuvie trub braungelb, rel. matt. Kopf und Thorax massig gerunzelt, Abdomen mit dunnen langlichen Punktgrübchen (Abb. 52) ohne sichtbare Mikrostacheln. Borsten rel. klein. Frontoclypealsutur nur massig geschwungen, Labrum breit mit sehr schragen Seiten, hinten schwach stumpfwinklig. Mandibulae rel. schmal (Abb. 53). Palpi max. dreieckig, frontalseite

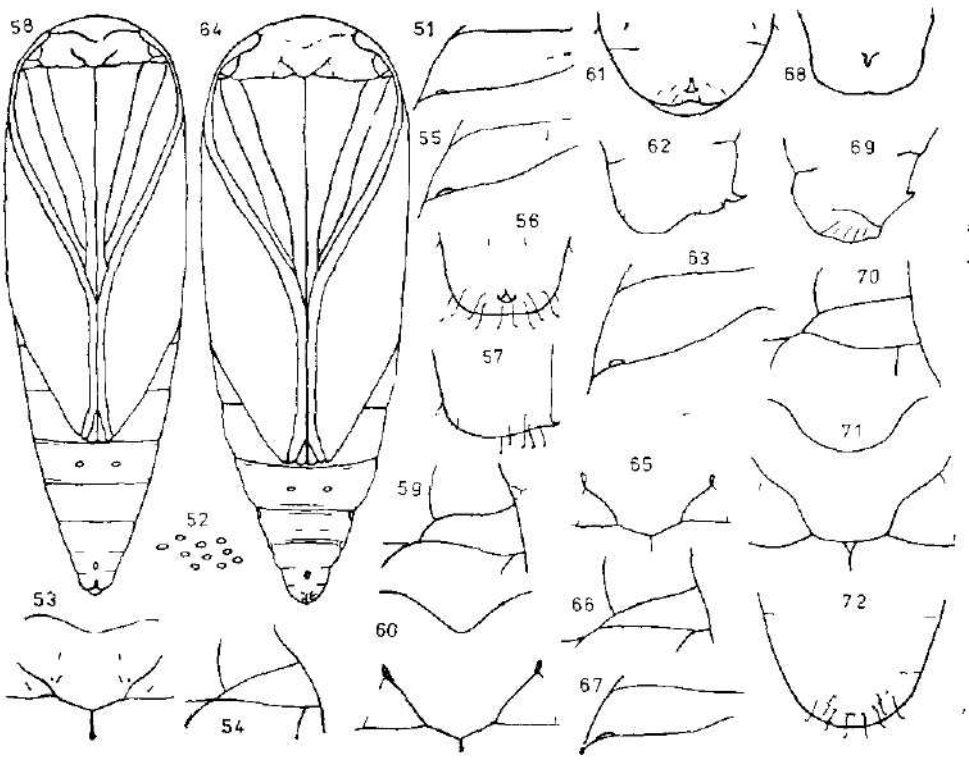

Abb. 51 *Scrobipalpa proclivella*, 52—57 *S. chrysanthemella*, 58—63 *S. atriplicella*, 64—69 *S. nitentella*, 70—72 *Ephysteris subdiminutella*. 51, 63, 67 Pronotum, 52 Mikroskulptur am Abdomen, 53, 60, 65, 71 Frontoclypealsutur, Labrum, Mandibulae, 54, 59, 66, 70 Palpi maxillares und Umgebung, 56, 61, 68, 72 Puppenende von oben, 57, 62, 69 von der Seite, 58, 64 Habitusbild der Puppe, Ventralansicht.

sanft gebogen, Grenze mit den Genae kurz (Abb. 54). Proboscis rel. kurz. Enden der Mittelbeine deutlich verschmalert. Antennae mit weniger deutlichen Leistengebilden, grenzen miteinander sehr lang, erreichen die Spitze der Vorderflügel nicht ganz. Freie Enden der Hinterbeine recht kurz (Abb. 50). Thorakale Spiracula langlich oval, ziemlich gross (Abb. 55). Reste der Abdominalbeine nur am 6. Segment. Ende des Abdomens von oben ziemlich stumpf, von der Seite schwach bauchig, unter dem frontalwärts gebogenen Fortsatz kaum konkav. Häkchen mittelklein (Abb. 55, 56).

Raupe miniert an *Chrysanthemum*, die Puppe überwintert.

Scrobipalpa atriplicella (Fischer von Roeslerstamm, 1841)

Puppe 4,8—6 × 1,4—1,7 mm (6 Puppen aus Mus. Berlin, 3 aus Mus. Kopenhagen), mitteldick (Abb. 58), braun, Exuvie rel. dunnschalig, trüb hell braungelb Skulptur fein: Kopf und Thorax gerunzelt, Abdomen mit feinen Mikrostacheln. Borsten sehr kurz. Frontoclypealsutur stark und rel. scharf bogig. Labrum mit schragen, wenig geschwungenen Seiten, die am Frontalende verdickt sind, hinten stumpfwinklig, die dreieckigen Mandibulae überragend (Abb.

60). Palpi maxillares mit stark geschwungener, an der Grenze mit den Genae steiler Frontalseite, Grenze mit den Mittelbeinen kurz (Abb. 59). Antennae mit schwachen Leistengebilden nahe der Basis, grenzen mittellang miteinander, teilen die mittellangen Endeile der Hinterbeine von der Vorderflügeln ab. Ende der Mittelbeine mittelstark verschmälert. 6 Segment mit Beinrudimenten (Abb 58). Pronotum rel. breit, Thorakales Spiraculum klein, oval (Abb. 63). Ende des Abdomens von oben mittelspitz abgerundet,, von der Seite mit einem spitzen, frontalwärts gebogenen Fortsatz und seichter Ausbuchtung dahinten, Häkchen winzig, borstenförmig (Abb. 61, 62).

Ruderale Standorte. Raupe an *Atriplex* und *Chenopodium*, die Puppe überwintert.

Scrobipalpa nitentella (Fuchs, 1902)

Puppe 5 × 1.7 mm (1 ♂, Museum Kopenhagen), gedrungener als die vorige (Abb. 64), Abdomen stark, etwas stufenweise zusammenlaufend. Farbung braun. Exuvie hell gelbbraun. Querrunzelung auch am Abdomen ziemlich stark Borsten ganz winzig, auch die Endhäkchen bei 100 × Vergr. kaum wahrnehmbar. Ihre Haftfunktion übernimmt offensichtlich die letzte Raupenhaut, die am Ende der Puppe fest haften bleibt. Frontoclypealsutur wenig deutlich, konkav. Labrum dem von *S. atriplicella* ähnlich (Abb. 65). Palpi maxillares schmal, sensenförmig (Abb. 66). Antennae ohne deutliche Leistengebilde nahe der Basis, grenzen lang miteinander, mittellang mit der Proboscis, teilen die Vorderflugel von den rel. kurzen Enden der Hinterbeine ab. Enden der Mittelbeine deutlich verschmälert. 6. Abdominalsegment mit Beinrudimenten (Abb. 64). Pronotum rel. schmal, thorakales Spiraculum schmal, wenig auffällig (Abb 67) Ende des Abdomens schmal, abgestumpf, in der Lateralansicht der Dorsalfortsatz kurz und rel. stumpf., dahinten noch ein Höckerchen. Analfeld radial gerunzelt (Abb. 68, 69).

An Salzböden, Raupe in Früchten der Chenopodiaceae, die Puppe überwintert.

Gattung EPHYSTERIS Meyrick, 1908

Puppe klein, plump, rel. gedrungen, vorne und hinten abgerundet (Abb. 73). Frontoclypealsutur bogenförmig, tief konkav (Abb. 71). Labrum lateral stark geschwungen begrenzt, hinten stumpf. Mandibulae recht breit. Lebium als kleines Dreieck sichtbar (Abb. 71). Palpi maxillares von ungewöhnlicher Form, Vorderrand fast gerade, nur an der Grenze mit den Genae steil, Hinterrand geschwungen, Grenze mit den Mittelbeinen ziemlich lang (Abb. 7). Antennae nur mit undeutlichen Leistengebilden nahe der Basis, berühren sich miteinander sehr kurz, reichen über die Basis der freien Enden der Hinterbeine (welche ganz kurz sind) nicht. Proboscis reicht weit über die Mittelbeine, welche im Endteil kaum verschmälert sind. 5. Abdominalsegment ventral bis zum Kaudalrand verdeckt, 6. Segment mit Beinrudimenten. 7. Abdominalsegment ohne Haarfransen (Abb. 73). Thorakale Spiracula unauffällig, oval. Ende des Abdomens abgerundet, in der Lateralsicht nicht konkav, dorsal ein bisschen sklerotisiert, ohne Kremaster und Dorsalfortsatz, Häkchen rel. klein, L_1 schräg frontal von D_2 entspringend (Abb. 72).

Charakteristik der Gattung an Hand der Art *Ephysteris subdiminutella* (Stainton, 1867) bearbeitet (1 ♂ von Kanarischen Inseln, sonst auch in Südwesteuropa), während die Puppen der etwa 3 mitteleuropäischen Arten nicht

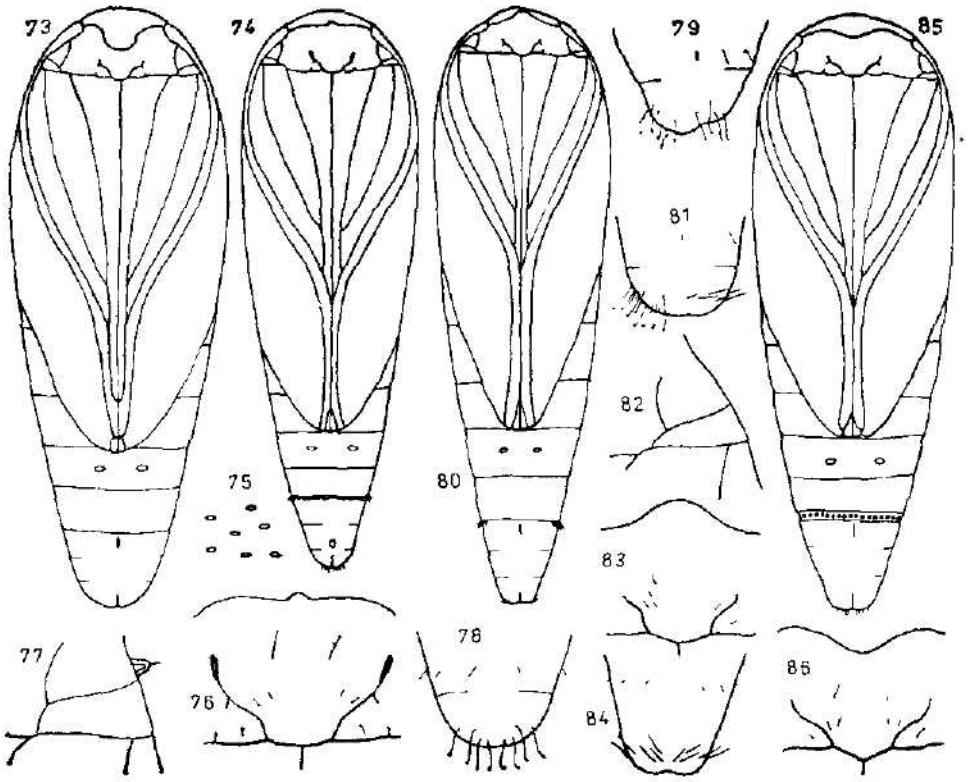

Abb. 73 *Ephysteris subdiminutella*, 74—79 *Cosmardia moritzella*, 80—84 *Caryocolum petryi*, 85—86 *C. fraternellum*. 73, 74, 80, 85 Habitusbild der Puppe, Ventralansicht, 75 Mikroskulptur am Abdomen, 76, 83, 86 Frontoclypealsutur, Labrum, Mandibulae, 77, 82 Palpi maxillares und Umgebung, 78, 81, 84 Puppenende von oben, 79, 81, von der Seite.

zur Verfügung standen. Puppe 3,5 × 1.2 mm, gelbbraun. Exuvie blass braungelb, dünnschalig, ziemlich glänzend, Skulptur sehr fein, Dorsalseite des 10. Abdominalsegments und Umgebung der Analnaht deutlicher chagriniert.

An Steppenstandorten der wärmsten Lagen, Raupen, soweit bekannt, an Poaceae.

Gattung COSMARDIA Povolný, 1965

Puppenmorphologisch der Gattung *Caryocolum* ähnlich. Rel. gedrungen (Abb. 74). Thorax dorsoventral komprimiert. Skulptur rel. grob, Abdomen mit ziemlich grossen, dünnen länglichen Punktgrübchen (Abb. 75). C_3 grösser als die übrigen Kopfborsten (Abb. 76). Frontoclypealsutur wenig geschwungen, im Mittelteil ein bisschen konkav mit einem frontalwärts orientierten Vorsprung. Kaudalrand des Laburums gerade (Abb. 76). Grenze der Palpi max. mit den Genae sehr steil (Abb. 77). Proboscis grenzt mit den Mittelbeinen länger als mit den Antennae, diese mit deutlichen Leistengebilden nahe der Basis (Abb. 77). 6. Abdominalsegment mit Spuren der Bauchbeine, 7. mit deutlichem

Haarfransensaum (Abb. 75). Abdominalende von oben abgerundet, von der Seite konkav, ventralwärts davon stark bauchig, ohne Kremaster oder Dorsalfortsatz, mit deutlichen Häkchen, L_1 fast frontal von D_2 entspringend (Abb. 78, 79). In Mitteleur. nur eine Art.

An sandigen Standorten. Raupe in Blüten und Früchten der Dianthaceae. Der Falter überwintert.

Cosmardia moritzella (Treitschke, 1835)

Puppe 5,0—5,6 × 1,6—1,9 mm (9 Puppen aus dem Zool. Mus. Berlin), dunkel rotbraun, Exuvie heller, Endteil des Abdomens dunkler. Borsten sehr klein, nur C_3 gross. Lateralsuturen des Labrums oben verdickt, schrag, deutlich geschwungen. Mandibulae rel. schmal, spitz (Abb 76). Grenze der Palpi maxillares mit den Oculi massig geschwungen, die mit den Mittelbeinen rel. lang (Abb 77). Mittelbeine in Endteil kaum verschmalert, Antennae grenzen mittellang miteinander, teilen die Vorderflügel von den kurzen Enden der Hinterbeine ab (Abb. 75).

Raupe lebt an *Melandryum*.

Gattung CARYOCOLUM Gregor et Povolný, 1954

Puppen mittelschlank bis mitteldick, etwas keilförmig (Abb. 80, 85). Frontoclypealsutur verlauft vorwiegend quer oder mässig konvex-bogig, im Mittelteil meist etwas konkav (Abb. 86, 92), bei *C. petryi* Hofmann stärker konvex (Abb. 83). Borsten C_3 kaum stärker als die übrigen. Labium verdeckt. Palpi maxillares meist mit schrager Grenze an die Genae (Abb. 82, 112, 117). Antennae mit Ausnahme von *C. petryi* mit Leistengebilden nahe der Basis (Abb. 112) Sie grenzen ± lang miteinander. Proboscis grenzt mit den Mittelbeinen länger, (Abb. 114), sletener so lang wie mit den Antennae (Abb. 111). Die sichtbaren Enden der Hinterbeine kurz oder mittelang. 5. Abdominalsegment ventral meist bis zum Kaudalrand verdeckt. Seltener nur zu 2/3, oder auch die Basalhälfte des 6 Segments verdeckt (Abb. 91, 100). Nur am 6 Segment sichtbare Reste der Abdominalbeine, diese jedoch bei *C. tricolorellum* Haworth teilweise verdeckt (Abb. 91). 7 Segment wenigstens dorsal (bei *C. petryi*), meist aber auch ventral mit einem Haarfransensaum (Abb. 80, 91). Bei *C. fraternellum* Douglas ist am Kaudalrand des 7. Segments nur eine Rinne mit Grubchen, jedoch keine Haarfransen (Abb. 85). Thorakales Spiraculum meist klein, oval (Abb. 109, 118). Ende des Abdomens meist stumpf abgerundet mit deutlichen Häkchen. L_1 entspringt fast frontal von D_2. Kremaster und Dorsalfortsatz fehlen (Abb. 106, 120).

In Waldern und Steppen, im Gebirge, bei Gewassern, an Rainen usw. Raupen ausschliesslich an Dianthaceae, in den Herztrieben, zwischen Blattern, manchmal minierend oder Gallen bildend, auch in Bluten und Samen. Überwinterung meist als Ei oder junge Raupe, zuweilen als Falter.

Bestimmungstabelle der Arten

(Von den fast 30 mitteleuropäischen Arten, von denen viele lokal und selten sind, wurden 8 untersucht.)

1 Puppe schwarzbraun, Exuvie dunkelbraun. Antennae nahe der Basis ohne Leistengebilden (Abb. 82). Endhäkchen borstenförmig, emporgerichtet (Abb 84) . . . . . *C. petryi*

— Puppe braun, Exuvie hell- oder gelbbraun. Antennae nahe der Basis mit Leistengebilden (Abb. 117), Endhäkchen hakenförmig, nach hinten gerichtet (Abb. 103) 2

2(1) 6. Abdominalsegment ventral und die Reste der Abdominalbeine frei (Abb. 97) 3

— 6. Segment etwa zu 1/2 und Abdominalbeine teilweise verdeckt (Abb. 91) . . . . . *C. tricolorellum*

3(2) 7. Abdominalsegment mit Haarfransen gesäumt (Abb. 100, 110) 4

— 7. Abdominalsegment ohne Haarfransen, nur von einer Querrine mit Grübchen gefolgt (Abb. 85) . . . . . *C. fraternellum*

4(3) Puppe rel. schlank (Abb. 97, 100). Abdominalende von oben stumpf abgestutzt (Abb. 102, 105), von der Seite rel. tief, oft winklig ausgeschnitten (Abb. 103, 106) 5

— Puppe rel. gedrungenn (Abb. 101) Abdominalende von oben abgerundet, von der Seite auch abgerundet oder sanft ausgebuchtet (Abb. 110, 115, 121, 108, 116, 120) 6

5(4) Ende des Abdomens in der Lateralsicht dorsal rel. spitzig vorgezogen (Abb. 103) . . . . . *C. vicinellum*

— Ende des Abdomens in der Lateralsicht dorsal stumpf abgerundet (Abb. 105) . . . . . *C. kroesmanniellum*

6(4) Puppe 4,5—5,2 mm lang. Proboscis grenzt wenig länger mit den Mittelbeinen als mit den Antennae (Abb. 111) 7

— Puppe 5,2—5,7 mm lang. Proboscis grenzt deutlich — wenigstens um 1/3 — langer mit den Mittelbeinen als mit den Antennae (Abb. 114) . . . . . *C. fischerellum*

7(6) Ende des Abdomens in der Lateralsicht dorsal rel. spitz (abgerunden) vorgezogen, dahinten sanft konkav (Abb. 108). Grenze der Palpi maxillares mit den Mittelbeinen mittellang (Abb. 112) . . . . . *C. cauligenellum*

— Ende des Abdomens in der Lateralsicht stumpf abgerundet, dahinten nicht konkav (Abb. 120). Grenze der Palpi maxillares mit den Mittelbeinen kurz (Abb. 119) . . . . . *C. blandelloides*

Caryocolum petryi (Hofmann, 1899)

Puppe 4,2—4,6 mm (8 Puppen aus Schweden), rel. schlank (Abb. 80), schwarz-. Exuvie dunkelbraun, ziemlich glanzend, rel. fein skulpturiert. Vorderflügel deutlich quergerunzelt, Abdomen mit feiner Zellskulptur. Borsten deutlich. Frontoclypealsutur frontalwarts konvex bogig. Labrum mit stark geschwungenen Seiten, hinten stumpfwinklig (Abb. 83). Palpi maxillares mit massig geschwungener Vorderseite. Grenze mit den Genae schräg, die mit den Mittelbeinen ziemlich lang (Abb. 82). Proboscis grenz deutlich langer mit den Mittelbeinen als mit den Antennae. Diese ohne Leistengebilde nahe der Basis, grenzen lange miteinander, teilen die Spitzen der Vorderflügel vollständig von den mittelkurzen Enden der Hinterbeine ab. 7. Abdominalsegment nur dorsal und lateral mit Haarfransen gesaumt (Abb. 80). Thorakales Spiraculum klein, oval. 10. Abdominalsegment von oben im Mittelteil etwas ausgeschnitten, von der Seite abgerundet. Perianalhäkchen normal hakenartig, Endhakchen borstenförmig, steil emporstehend (Abb. 81, 84).

Sandige und steppenartige Standorte, sehr lokal. Raupe zwischen versponnenen Blättern von *Gypsophila*.

Caryocolum fraternellum (Douglas, 1851)

Puppe 5,2—6,0 × 1,8—2,0 mm (2 ♂♂, 2 ♀♀ aus Danemark), rel. gross und gedrungen (Abb. 85), braun, Exuvie braungelb, mässig glanzend. Thorax mittelfein gerunzelt, Abdomen fast ohne Skulptur. Borsten klein, am Abdominalende grösser. Frontoclypealsutur im Mittelteil rel. deutlich konkav. Labrum mit schrägen, geschwungenen Seiten, hinten stumpfwiklig, Mandibulae rel.

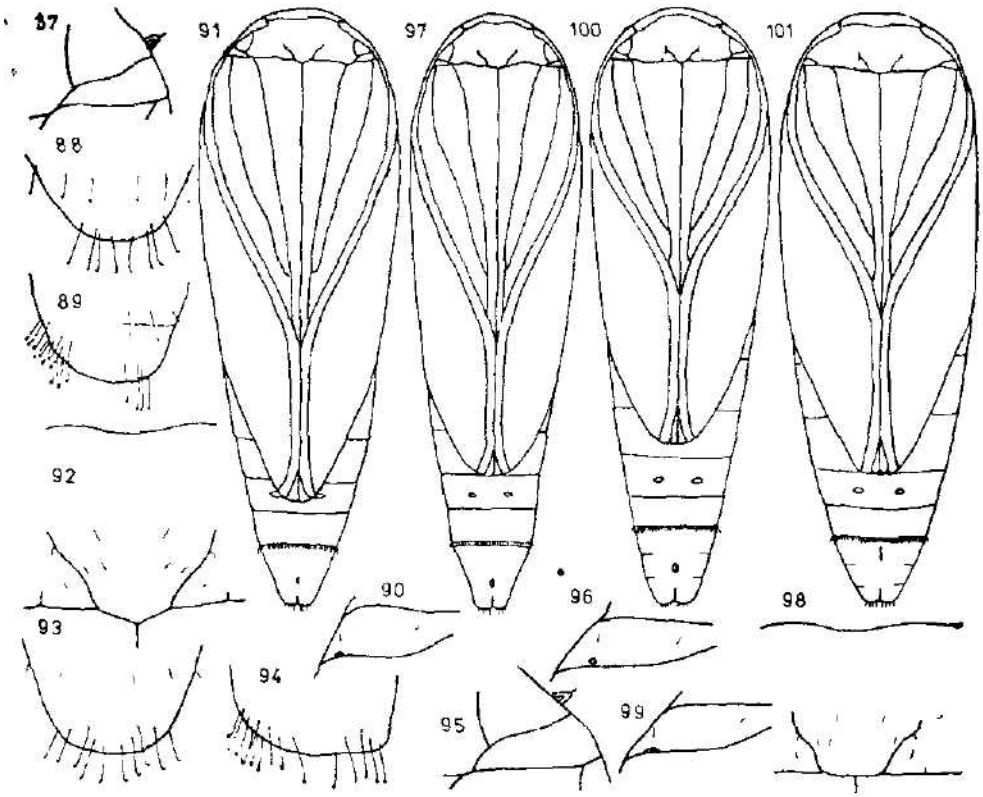

Abb. 87—90 *Caryocolum fraternellum*, 91—96 *C. tricolorellum*, 97—99 *C. vicinellum*, 100 *C. kroesmanniellum*, 101 *C. fischerellum*. 87, 95 Palpi maxillares, 88, 93 Puppenende von oben, 89, 94 von der Seite, 90, 96, 99 Pronotum, 91, 97, 100, 101 Habitusbild der Puppe, Ventralansicht, 92, 98 Frontoclypealsutur, Labrum, Mandibulae.

schmal (Abb. 86). Palpi maxillares mit deutlich geschwungener Vorderseite, Grenze mit den Mittelbeinen kurz (Abb. 91). Proboscis grenzt mit den Mittelbeinen etwas länger als mit den Antennae. Diese mit Leistengebilden an der Basis des Flagellums, grenzen mittelang miteinander, erreichen die Spitze der Vorderflügel nicht. 7. Abdominalsegment ohne Haarfransen, von einer Querrinne mit Punktgrübchen gefolgt (Abb. 85). Thorakales Spiraculum klein, kurz, breit oval (Abb. 90). Abdominalende von oben, sowie von der Seite abgerundet, Häkchen hakenartig, mittelgross, D_2 und L_1 nahe beieinander entspringend (Abb. 88, 89).

Waldlichtungen, Schlagflächen, Wiesen, vorwiegend an frischen Standorten. Raupe zwischen versponnenen Blättern von *Stellaria graminea*.

Caryocolum tricolorellum (Haworth, 1812)

Puppe 4,7—5,2 × 1,5—1,8 mm (10 Puppen aus der Slowakei und aus Dänemark), etwas schlanker als die vorige (Abb. 91), braun, Exuvie gelbbraun, ziemlich glänzend, fein skulpturiert. Bei 100 × Vergr. am Abdomen winzige, ziemlich dünne Punktgrübchen mit Mikrostacheln. Borsten klein, deutlich.

Frontoclypealsutur fast quer, im Mittelteil sanft konkav. Labrum an den Seiten schräg, mässig geschwungen begrenzt, hinten stumpfwinklig. Mandibulae mittelbreit, spitz (Abb. 92). Palpi maxillares mit etwas längerer Grenze an die Mittelbeine als bei *C. fraternellum* (Abb. 95). Proboscis grenzt mit den Mittelbeinen deutlich länger als mit den Antennae. Diese mit deutlichem Leistengebilde nahe der Basis, grenzen mittellang miteinander, teilen die kurzen Enden der Hinterbeine von den Vorderflügeln ab. 6. Abdominalsegment ventral etwa zu 1/2 und die Spuren der Bauchbeine teilweise verdeckt. 7. Abdominalsegment mit deutlichen Haarfransen auch an der Ventralseite (Abb. 91). Thorakales Spiraculum klein, fast kreisrund (Abb. 96). Ende des Abdomens von oben abgerundet, von der Seite dorsal stumpf abgerundet vorgezogen, dahinten kaum konkav. Häkchen deutlich, hakenartig (Abb. 93, 94).

Schattige Laub- und Mischwälder, insbes. ihre Randzone. Raupe an *Stellaria holostea*, im Herbst minierend, schon im April zwischen versponnenen Gipfelblättern.

Caryocolum kroesmanniellum (Herrich-Schäffer, 1854)

Puppe 5,1—5,5 × 1,5—1,8 mm (10 Puppen aus der Slowakei und aus Dänemark), Körperform der vorigen ähnlich, Färbung rötlich braun, Exuvie — gelbbraun. Mikroskulptur wie bei *C. tricolorellum*. Borsten deutlich. Frontoclypealsutur bogig konvex, im Mittelteil etwas konkav, Clypeus rel. hoch. Seiten des Labrums schräg, mittelstark geschwungen, Kaudalseite fast gerade, kaum winklig. Mandibulae spitz (Abb. 104). Palpi maxillares denen bei der vorigen ähnlich. Proboscis grenzt mit den Mittelbeinen und Antennae fast gleichlang. Antennae mit deutlichen Leistengebilden nahe der Basis, grenzen ziemlich lang miteinander, teilen die mittellangen Endteile der Hinterbeine von den Vorderflügeln ab. 5. Abdominalsegment ventral oft nur zu rd. 2/3 verdeckt, 7. mit deutlichen Haarfransen (Abb. 100). Thorakale Spiracula klein, oval. Ende des Abdomens von oben stumpf abgerundet abgestutzt, von der Seite abgerundet, im Mittelteil seicht winklig ausgeschnitten. Häkchen deutlich (Abb. 105, 106).

Standorte und Lebensweise wie bei der vorigen Art. Raupe ebenfalls an *Stellaria holostea*, Erscheinungszeit später.

Caryocolum vicinellum (Douglas, 1851)

Puppe 4,7—5.2 × 1,4—1,6 mm (8 Puppen aus der Slowakei), etwas schlanker als die vorigen (Abb. 97), Färbung braun, Exuvie gelbbraun, mässig glänzend, Skulptur den vorigen ähnlich, Vorderfügel etwas stärker glänzend. Borsten klein. Frontoclypealsutur mässig bogig, im Mittelteil ganz sanft konkav. Labrum mit geschwungenen Seiten, hinten fast gerade (Abb. 98). Proboscis grenzt mit den Mittelbeinen etwas länger als mit den Antennae. Diese mit Leistengebilden nahe der Basis, grenzen mittellang miteinander, teilen die kurzen Endteile der Hinterbeine von den Vorderflügeln ab. 5. Abdominalsegment ventral bis zum Kaudalrand verdeckt. Haarfransensaum am 7. rel. schwach, insbes. dorsal (Abb. 97). Thorakales Spiraculum klein, länglich oval (Abb. 99). Abdominalende von oben stumpf abgestutzt, von der Seite dorsal abgerundet vorgezogen und dahinten konkav. Häkchen schlank (Abb. 102, 103).

An sonnigen Steppenstandorten, Raupe an *Silene, Viscaria, Tunica* in Trieben, die verkümmern.

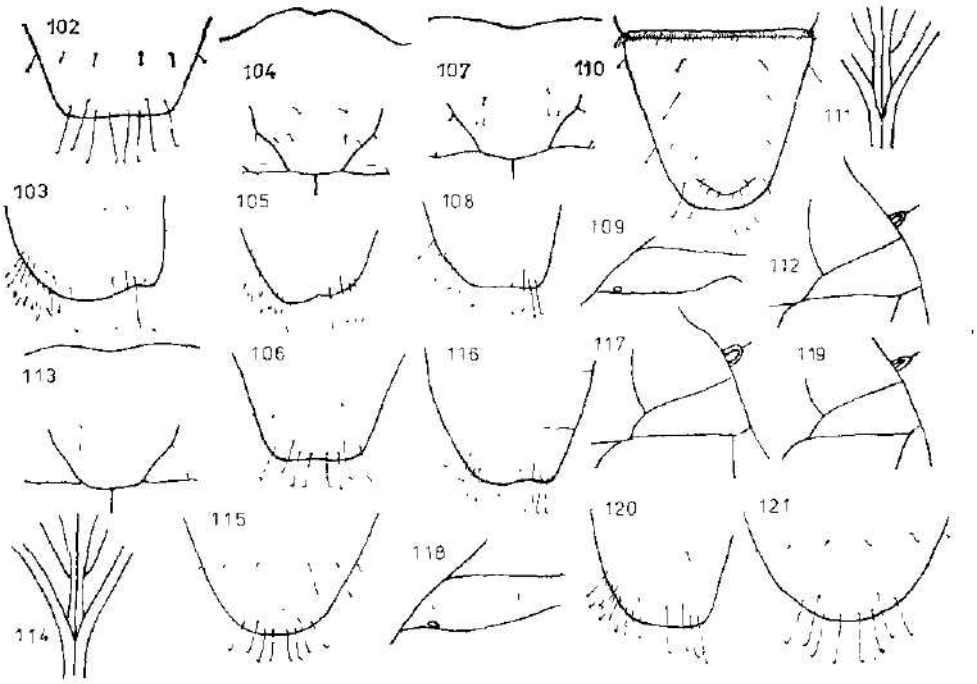

Abb. 102—103 *Caryocolum vicinellum*, 104—106 *C. kroesmanniellum*, 107—112 *C. cauligenellum*, 113—118 *C. fischerellum*, 119—121 *C. blandelloides*. 102, 106, 110, 115, 121 Puppenende von oben 103, 105, 108, 116, 120 von der Seite, 104, 107, 113 Frontoclypealsutur, Mandibulae, Labrum, 109, 118 Pronotum, 111, 114 Ende des Proboscis und Umgebung, 112, 117, 119 Palpi maxillares und Umgebung.

Caryocolum cauligenellum (Schmid, 1863)

Puppe 4,5—5,2 × 1,6—1,9 mm (6 Puppen aus der Slowakei, 3 aus Dänemark). rel. gedrungen, hellbraun. Exuvie blass braungelb. Skulptur fein, ähnlich der vorigen. Borsten klein. Frontoclypealsutur fast quer, im Mittelteil mässig konkav. Labrum hinten schwach winkelig (Abb. 107). Palpi maxillares mit schräger Grenze an Genae und rel. langer an Mittelbeine (Abb. 112). Antennae mit deutlichen Leistengebilden, grenzen mittellang miteinander, teilen die rel. kurzen Endteile der Hinterbeine von den Vorderflügeln ab. Proboscis grenzt mit den Mittelbeinen wenig od. kaum länger als mit den Antennae (Abb. 111). 5. Abdominalsegment ventral bis zum Kaudalrand verdeckt. 7. auch dorsal mit deutlichen Haarfransen (Abb. 110). Thorakales Spirakulum klein, oval (Abb. 109.) Abdominalende von oben abgerundet, von der Seite dorsal stumpf abgerundet vorgezogen und dahinten kaum merklich konkav. Häkchen deutlich (Abb. 108, 110).

Waldsteppe, Randzone lichter Heine an warmtrockenen Standorten. Raupe in Stengelgallen an *Silene nutans*.

Caryocolum fischerellum (Treitschke, 1833)

Puppe 5,2—5,7 × 1,7—2 mm (10 Puppen aus der Slowakei), rel. gross und gedrungen (Abb. 101), der vorigen ähnlich. Färbung rotbraun, Exuvie bleicher,

Runzelung am Thorax etwas deutlicher. Borsten kurz. Frontoclypealsutur im Mittelteil schwach konkav, Seiten des Labrums mässig geschwungen, Hinterrand fast gerade (Abb. 113). Palpi maxillares grenzen mit den Genae etwas steiler, mit den Mittelbeinen kürzer als bei der vorigen (Abb. 117). Proboscis grenzt mit den Vorderbeinen deutlich länger als mit den Antennae, diese ragen über die mittelkurzen Endteile der Hinterbeine meist etwas. 5. Abdominalsegment ventral bis zum Kaudalrand verdeckt, 7. mit starken Haarfransen (Abb. 101). Thorakales Spiraculum klein, oval (Abb. 118). Abdominalende rel. stark zusammenlaufend abgerundet, von der Seite dorsal schwach, abgerundet vorgezogen, dahinten deutlich ausgebuchtet. Häkchen deutlich (Abb. 115, 116).

Hauptsächlich an Unfern von Gewässern der Auelandschaft. Raupe in versponnenen Triebenden von *Saponaria*.

Cariocolum blandelloides (Karsholt, 1981)

Puppe 4,5—5 × 1,5—1,7 mm (2 ♂♂, 1 ♀ aus Österreich), rel. gedrungen, Körperform den vorigen ähnlich. Dünnschalig gelbbraun, Exuvie hell gelbbraun oder (♂) braungelb, mässig glänzend, fein skulpturiert. Borsten recht klein. Frontoclypealsutur im Mittelteil schwach konkav. Labrum kurz mit schrägen, stark geschwungenen Seiten. Mandibulae schlank, spitz. Palpi maxillares mit kurzer Grenze an die Mittelbeine (Abb. 119). Proboscis grenzt mit den Mittelbeinen etwa gleichlang wie mit den Antennae (vgl. Abb. 111). Freie Enden der Hinterbeine mittelkurz, von den Vorderflügeln abgeteilt. 5. Abdominalsegment ventral bis zum Kaudalrand verdeckt, 7. mit feinen Haarfransen. Abdominalende von oben abgerundet, von der Seite dorsal wenig, stark abgerundet vorgezogen, dahinten nicht konkav. Häkchen deutlich (Abb. 120, 121).

An trockenen Standorten sehr lokal. Raupe an *Cerastium semidecandrum*.

DISKUSSION

Die Tribus Gnorimoschemini kann man puppenmorphologisch gut charakterisieren und abgrenzen. Sie nimmt eine Zwischenstellung zwischen Gelechiini und Teleiodini ein. Puppenmorphologisch zerfällt sie in drei Gruppen: die eine (Gattungen *Gnorimoschema, Phthorimaea* und *Scrobipalpa)* zeichnet sich z. B. durch die stark konkave Frontoclypealsutur, längere Vorderbeine, Mangel an Haarfransen am 7. Abdominalsegment und einem Dorsalfortsatz am 10. Diese Gruppe bewohnt oft ruderale, öde, versalzte, Steppen- und sekundär Feldstandorte und ist an die Vertreter der Pflanzenfamilien wie Polygonaceae, Chenopodiaceae, Lamiaceae, Solanaceae, Asteraceae u. a. gebunden. Die andere Gruppe mit der Gattung *Ephysteris* weist ebenfalls eine extrem konkave Frontoclypealsutur auf, besitzt aber sichtbares Labium (welches sonst nie bei dieser Tribus, jedoch geläufig bei Gelechiini auftritt) und keinen Fortsatz am 10. Abdominalsegment. Vertreter dieser Gruppe sind Steppenbewohner an *Poaceae* gebunden. Schliesslich ist es *Caryocolum, Cosmardia* u. a., bei welchen die Frontoclypealsutur nur mässig konkav, zuweilen auch konvex ist, sie besitzen kürzere Vorderbeine und fast immer einen Haarfransensaum am 7 Abdominalsegment, während der Fortsatz am 10. fehlt. Die Mehrzahl bewohnt Haine, Auen, Lehnen und Waldsteppe, einege sind Gebirgsarten. Sie sind ausnahmslos an Dianthaceae gebunden.

Im Rahmen der zwei grossen mitteleuropäischen Gattungen *Scrobipalpa* und *Caryocolum* kann man auf Grund der Puppenmerkmale Artengruppen unter-

scheiden, die von den Bestimmungstabellen ersichtlich sind. Alle untersuchten Taxone kann man auf Grund der Puppenmerkmale gut charakterisieren und bestimmen.

ZUSAMMENFASSUNG

Die zur Verfugung stehenden Puppen der mitteleuropäischen Vertreter der Tribus Gnorimoschemini Povolný, 1964, insgesamt 6 Gattungen und 18 Arten, wurden charakterisiert, durch Federzeichnungen dargestellt, Bestimmungstabellen der Gattungen und Arten beigefügt. Die Biotope, Nährpflanzen der Raupen bzw. Art der Überwinterung und endere bionomische Angaben werden kurz erwähnt. Die Stellung der untersuchten Taxone in dieszeitigem System wird auf Grund der Puppenmerkmale diskutiert.

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MONOCYSTID GREGARINES (PROTOZOA, APICOMPLEXA) OF SOME CZECHOSLOVAK EARTHWORMS

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Abstract. Twenty five monocystid species, all new to Czechoslovakia, are reported from 14 species of earthworms. Diagnosis, hosts and data from literature about its distribution are given for each species.

INTRODUCTION

Monocystid gregarines, parasites of lumbricomorph oligochaetes, have been studied by many authors (Hesse, 1909; Cognetti de Martiis, 1923, 1925; Berlin, 1924; Grassé, 1953; Loubatières, 1955; Meier, 1956; Segun, 1968, etc.), especially from taxonomic point of view. At present, classification of monocystids is based on following characteristics of trophozoites: size, shape, location in the host (vesicular or coelomic) and possession of ectoplasmic cytopilia, spines, or other processes. These characteristics are rather few and consequently there are great confusion with regard to species determination.

Over 190 species belonging to the family Monocystidae (Sporozoa, Gregarinida) have been described from invertebrates all over the world, 106 of these occur in hosts of the family Lumbricidae (Levine, 1977). Our present knowledge of geographical distribution of this group is far from complete and indicates the locations of the people who published on it rather than the distribution of parasites themselves. For instance, 46 species have been identified from British (Segun, 1971 a, b), 24 from Bulgarian (Duhlinska, 1977 a, b) and 10 from Polish (Marek, 1967) earthworms, but no records are known from many other countries. Up to now, only two monocystids have been recorded from Czechoslovakia (Hahn, 1928; Erhardová, 1955), infecting lumbriculid worms and oribatid mites, respectively.

The present paper is concerned with report of some monocystid species found in Czechoslovakia, all of which are parasites of lumbricid earthworms.

MATERIAL AND METHODS

In all, 1570 adult specimens of lumbricid earthworms were collected at 24 localities in Czechoslovakia during 1983—1985 (Tab. I). The earthworms examined belong to following 14 species: *Allolobophora chlorotica* (Savigny, 1826); *Aporrectodea caliginosa* (Savigny, 1826); *A. rosea* (Savigny, 1826); *Dendrobaena octaedra* (Savigny, 1826); *Dendrodrilus rubidus* (Savigny, 1826); *Eisenia fetida* (Savigny, 1826); *Eiseniella tetraedra* (Savigny, 1826); *Lumbricus castaneus* (Savigny, 1826); *L. meliboeus* Rosa, 1884; *L. polyphemus* (Fitzinger, 1833); *L. rubellus* Hoffmeister, 1843; *L. terrestris* Linnaeus, 1758; *Octolasium lacteum* Örley, 1881 and *O. montanum* (Wessely, 1905).

After the earthworms were identified, each was dissected and perivisceral coelom, blood vessels, spermathecae and seminal vesicles were examined immediately for

monocystid gregarines. Subsequently, smears were prepared from the lobes of seminal vesicles. Isolated trophozoites were observed, measured and photographed alive. Permanent smears fixed in sublimat-alcohol, stained in Ehrlich's hematoxylin and eosin, and mounted in Canada balsam were used in the study of morphological details.

Localities

The survey of localities in the following part contains date and brief characteristic of the place of collections. Code numbers given in parentheses after the names of localities indicate respective quadrangles on the faunistic map of Czechoslovakia (see Buchar 1982). Where there is no other indication, leg. V. Pižl applies. We took quantitative and qualitative samples from the localities listed bellow.

1. Bohemia mer., Bavorov (6850) — meadow and apple orchard (24. 3., 12. 4., 13. 5., 22. 6., 21. 9., and 30. 11. 1983; 26. 4., 7. 5. and 20. 11. 1984).
2. Moravia mer., Bílovice nad Svitavou (6766) — typical beech forest at Svitava river (2. 7. 1983).
3. Bohemia mer., Branišov (7052) — mixed forest (16. 6. 1984).
4. Moravia mer., Brno (6865) — mixed deciduous forest with maple, beech and alder (8. 4. 1984).
5. Bohemia mer., České Budějovice (7052) — Stromovka park, sparce poplar stand (21. 3. and 21. 6 1983; 30. 3., 3. 4., 17. 4., 18. 4., 8. 5., 8. 6., 20. 6., 28. 6., 5. 7., 19. 8., 30 8., 31. 8., 3. 9., 12. 9., 17. 9., 18. 9. and 24. 10. 1984; 23. 3., 27. 3., 10. 4., 12. 4., 6. 5., 17. 5., 27. 6., 9. 7. and 18. 7. 1985).
6. Bohemia mer., Český Jílovec (7251) — wet depression in the spruce forest in the walley (9. 7. 1984).
7. Bohemia mer., Dobrná (7251) — garden and meadow (22. 7. 1984 leg. J. Starý)
8. Moravia bor., Dolní Benešov (6073) — garden (22. 4. 1984).
9. Bohemia mer., Doubravice (7053) — wet depression in mixed forest (29. 10. 1984).
10. Moravia mer., Drválovice (6565) — garden (22. 4. 1984 leg. K Tajovský).
11. Bohemia mer., Chelčice (69503) — various orchards (24. 3. 1984; 9. 4. and 18. 4. 1984; 16. 5. 1985).
12. Bohemia mer., Hluboká nad Vltavou (6952) — spruce forest in the valley (28. 5. 1985).
13. Moravia mer., Křtiny (6666) — oak-beech forest (23. 6. 1984).
14. Bohemia mer., Libějovice (6950) — hornbeam-oak forest (3. 4. 1985).
15. Bohemia mer., Litvínovice (7052) — bank of Dolní pond (10. 7. 1985).
16. Slovakia or., Nová Sedlica (6901) — old beech forest (30. 9. 1983).
17. Bohemia centr., Praha (5953) — garden (20. 4. and 15. 5. 1983 leg. J. Rusek).
18. Bohemia mer., Purkarec (6852) — wet depression and various parts in spruce forest along the Vltava river (20. 5. 1985).
19. Moravia mer., Rakvice (7166) — alder-oak forest (17. 8. 1984).
20. Bohemia mer., Rudolfov (7053) — garden (4. 5. and 6. 5. 1985 leg. E. Chrastinová).
21. Moravia or., Sidonia (6974) — beech forest (28. 4. 1984 leg. J. Rusek).
22. Moravia occ., Telč (6758) — meadows along the Třeštice river (31. 3 1985 leg. K Tajovský).
23. Bohemia mer., Zavadilka (7052) — garden (26. 3. 1985 leg. V. Krištůfek).
24. Bohemia mer., Zlatá koruna (7152) — margin of the spruce forest (5. 7. 1983).

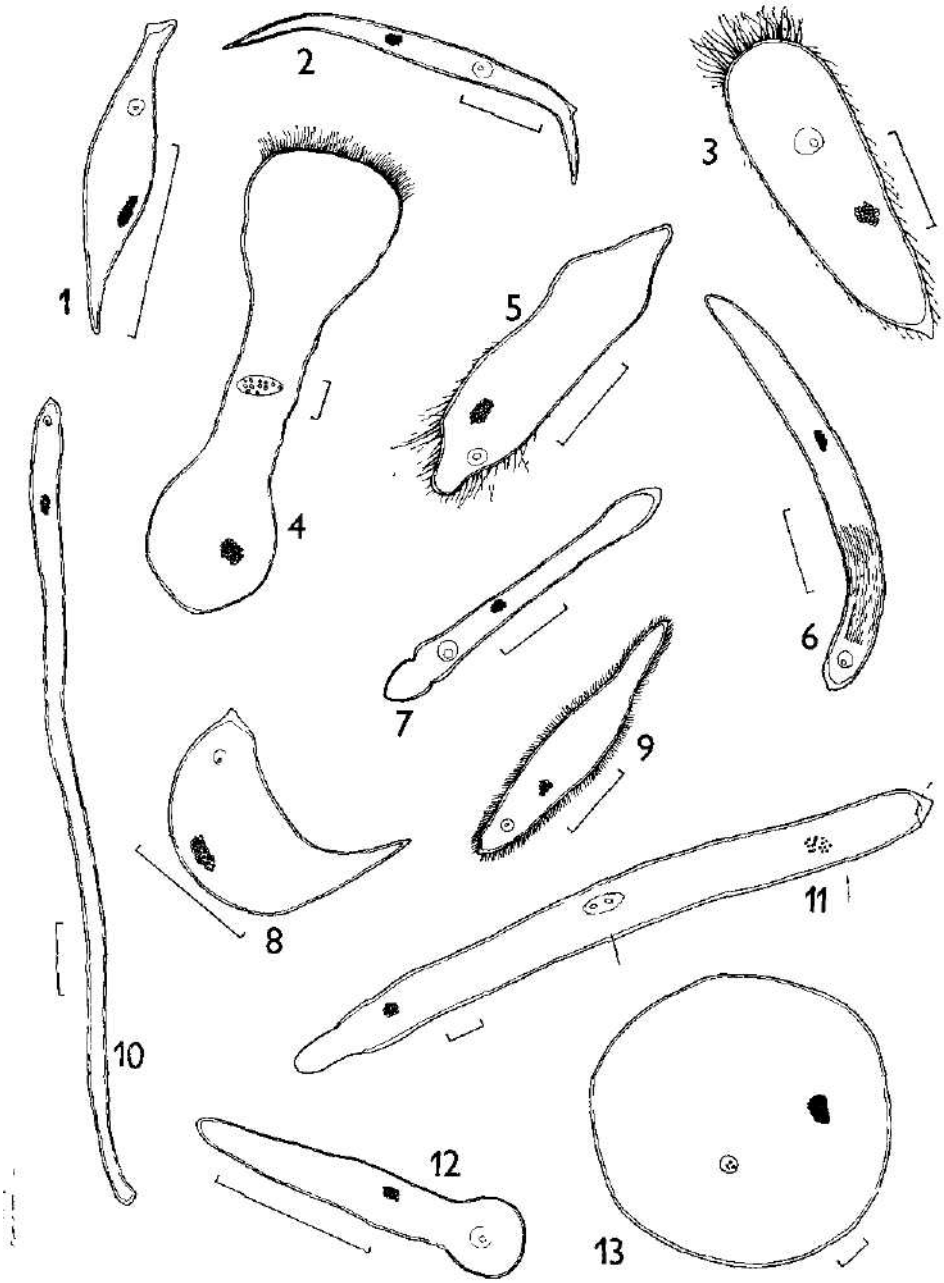
LIST OF SPECIES

In every form there is a short diagnosis based on our own observations, hosts we found it in, localities of findings in Czechoslovakia and data from literature about its distribution.

Monocystis agilis Stein, 1848 (Plate 1, Fig. 1)*

Hosts: *Lumbricus castaneus, L. meliboeus, L. polyphemus, L. rubellus, L. terrestris,* seminal vesicles

* Plates 1—3 will be found at the end of this issue.



Figs. 1—13 1 — *Monocystis agilis*, 2 — *M. arcuata*, 3 — *M. hirsuta*, 4 — *M. lumbrici*, 5 — *M. polymorpha*, 6 — *M. striata*, 7 — *M. tubiformis*, 8 — *M. ventrosa*, 9 — *M. wallengrenii*, 10 — *Nematocystis elmassiani*, 11 — *N. magna*, 12 — *Rhabdocystis claviformis*, 13 — *Apolocystis herculea*. (Scale = 0 1 mm)

Distribution: Bulgaria, England, France, Germany, Hungary, Poland, Sweden, USSR
Body length varied from 140 to 350 μm, maximum breadth 56 μm, paraglycogen granules 2 × 5 μm, length of nucleus 12 μm, breadth 6—10 μm. Common species in *L. terrestris* where 97 % of specimens studied were infected. Infection of *L. castaneus, L. meliboeus, L. polyphemus* and *L. rubellus* was lower and reached 44 %, 25 %, 32 % and 45 %, respectively.
Localities of findings: 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, 20, 23

Monocystis arcuata Boldt, 1910 (Plate 1, Fig. 5)
Host: *Lumbricus castaneus*, seminal vesicles
Distribution: England, Germany, Sweden
Elongate, bow-curved trophozoites, length from 348 to 465 μm, breadth from 17 to 36 μm at the widest part. Nucleus ovoid, 12 to 24 × 9 μm. Paraglycogen granules about 1.5 μm in diameter. Relatively rare species, incidence of infection was 7 %.
Localities of findings: 5, 13

Monocystis hirsuta Hesse, 1909 (Plate 1, Fig. 4)
Host: *Lumbricus castaneus*, seminal vesicles
Distribution: Bulgaria, France, Germany
Trophozoites elipsoidal or elongated oval-shaped covered with dense ectoplasmic processes. Body length 80—350 μm, breadth 40 to 160 μm. Spherical nucleus 30 μm in diameter with large elipsoidal nucleolus. Incidence of infection was 26 %.
Localities of findings: 1, 5, 23

Monocystis lumbrici (Henle, 1845) (Plate 1, Fig. 3)
Host: *Lumbricus terrestris*, seminal vesicles
Distribution: Bulgaria, England, France, Germany, Poland, Sweden, USA
Trophozoites oval and cylindrical in shape with sets of hairlike processes terminally. Body size: length 210—1206 μm, breadth 50—295 μm. Length of nucleus 42—95 μm, breadth of nucleus 28—57 μm. Granule size 3 × 2 μm. Total 16 earthworm specimens were infected.
Localities of findings: 5, 20

Monocystis polymorpha Berlin, 1924 (Plate 2, Fig. 11)
Host: *Lumbricus castaneus*, seminal vesicles
Distribution: Poland, Sweden
Trophozoites irregular in shape, without mucron. Body length 80—165 μm, breadth 30—55 μm. Nucleus (9.5—15.7 μm in diameter) contain only one nucleolus. Paraglycogen granules varying in shape, 1—3 μm. Incidence of infection was 12 %.
Localities of findings: 1, 5, 11

Monocystis striata Hesse, 1909 (Plate 2, Fig. 9)
Host: *Lumbricus castaneus*, seminal vesicles
Distribution: Bulgaria, England, France, Germany
Trophozoites long and narrow, with longitudinal ectoplasmic striations. Length 400—445 μm, breadth 31—34 μm, length of nucleus 24 μm, paraglycogen granules 5 × 2.5 μm. Incidence of infection was 20 %.
Localities of findings: 5, 10, 12, 15

Monocystis tubiformis Berlin, 1923 (Plate 2, Fig. 10)
Host: *Lumbricus rubellus*, seminal vesicles
Distribution: Sweden
Elongate trophozoites, length 619 μm, breadth 47 μm. Nucleus 42 × 16 μm, paraglycogen granules small, 3—4 μm. In one host specimen only.
Locality of finding: 13

Monocystis ventrosa Berlin, 1924 (Plate 1, Fig. 2)
Hosts: *Lumbricus castaneus, L. rubellus, L. terrestris*, seminal vesicles
Distribution: Bulgaria, England, France, Germany, Hungary, Sweden
Body thick and broad, always bulging at one of its site. Length 114—181 μm, breadth 56—110 μm, nucleus 17 μm in diameter, nucleolus 5 μm, paraglycogen granules 5—6 μm. Different authors differ in their opinion on this species whether it should be regarded as a valid species. My observations certified previous opinion of Miles (1963) that swollen appearance of *M. ventrosa* is characteristic for moribund specimens of *M. agilis*.
Localities of findings: 1, 2, 3, 4, 5, 6, 12, 15, 24

Monocystis wallengrenii Berlin, 1924 (Plate 1, Fig. 6)
Hosts: *Aporrectodea caliginosa, Lumbricus rubellus*, seminal vesicles
Distribution: England, France, Germany, Poland, Sweden
Elongate trophozoites covered with numerous ectoplasmic processes, longer ones at the end of body and shorter ones in the middle. Body size: length 235—442 μm, breadth 29—45 μm, diameter of nucleus 16 μm, diameter of nucleolus 12 μm, paraglycogen granules 4—5 × 3 μm. This parasite was found in 18 specimens of *L. rubellus* and 3 of *A. caliginosa*.
Localities of findings: 5, 11

Nematocystis elmassiani (Hesse, 1909) (Plate 2, Fig. 13)
Hosts: *Lumbricus castaneus, L. rubellus*, seminal vesicles
Distribution: England, France, Germany, Sweden, USA
Trophozoites elongated, very slim, with mucron at anterior end. The measurements vary from 460 to 912 μm long and 38 to 52 μm wide. Nucleus 40 × × 25—30 μm, paraglycogen granules 3—4 μm in diameter. Incidence of infection was 11 % in *L. rubellus*, in *L. castaneus* only two specimens were infected.
Localities of findings: 5, 11, 15

Nematocystis magna (Schmidt, 1854) (Plate 2, Fig. 12)
Host: *Lumbricus terrestris*, testis
Distribution: Bulgaria, England, France, Germany, Scotland, Sweden
Trophozoites large, length 630—3870 μm., breadth 50—90 μm. Nucleus ovoid, 70 × 40 μm in the largest specimens. Paraglycogen granules 6—8 μm. Incidence of infection was 27 %.
Locality of findings: 5

Rhabdocystis claviformis Boldt, 1910 (Plate 3, Fig. 23)
Host: *Octolasium montanum*, seminal vesicles
Distribution: England, France, Germany
Elongate trophozoites with club-shaped anterior part. Body length 206—214 μm, breadth 30—32 μm, length of nucleus 24 μm, nucleolus 16 μm in diameter. Paraglycogen granules 2—4 × 2 μm. Incidence of infection was 56 %.
Localities of findings: 1, 20

Table 1. Localities and numbers of the hosts examined (in brackets numbers of hosts parasited by monocystids)

Locality \ Host	*A. chlorotica*	*A. caliginosa*	*A. rosea*	*D. octaedra*	*D. rubidus*	*E. fetida*	*E. tetraedra*	*L. castaneus*	*L. meliboeus*	*L. polyphemus*	*L. rubellus*	*L. terrestris*	*O. lacteum*	*O. montanum*	Total number
Bavorov	—	53 (16)	37 (0)	4 (0)	2 (1)	—	—	20 (15)	—	—	13 (10)	4 (4)	52 (36)	12 (8)	196 (90)
Bílovice n. Svit.	—	—	—	—	—	—	—	1 (1)	—	—	3 (1)	1 (0)	5 (3)	—	10 (5)
Branišov	3 (0)	1 (0)	5 (0)	1 (0)	1 (0)	—	—	3 (1)	—	—	4 (1)	1 (1)	3 (2)	—	22 (5)
Brno	—	2 (1)	1 (0)	—	1 (1)	2 (0)	—	—	—	—	2 (2)	—	2 (2)	—	10 (6)
České Budějovice	44 (7)	83 (56)	51 (4)	7 (2)	27 (20)	19 (9)	—	108 (92)	—	1 (0)	58 (42)	47 (47)	83 (79)	—	528 (358)
Český Jílovec	—	—	14 (0)	1 (0)	—	1 (1)	7 (0)	—	—	10 (3)	22 (13)	—	4 (4)	—	59 (21)
Dobrná	—	4 (0)	1 (0)	—	—	—	—	1 (0)	—	1 (0)	4 (2)	1 (1)	3 (1)	—	15 (4)
Dolní Benešov	—	12 (12)	—	—	—	—	—	2 (0)	—	—	1 (1)	1 (1)	1 (1)	—	17 (15)
Doubravice	—	1 (1)	1 (0)	1 (0)	20 (18)	22 (21)	—	1 (0)	—	—	15 (3)	—	4 (1)	—	65 (44)
Drválovice	—	4 (3)	2 (0)	—	—	—	—	3 (1)	—	—	1 (0)	2 (1)	3 (2)	—	15 (7)
Chelčice	—	15 (6)	15 (0)	8 (1)	1 (1)	1 (0)	—	2 (2)	—	—	25 (20)	—	32 (30)	2 (0)	101 (60)

Hluboká n. Vlt.	—	21 (0)	10 (0)	11 (0)	7 (3)	—	15 (6)	4 (1)	18 (5)	9 (1)	45 (32)	—	34 (21)	—	174 (69)
Křtiny	—	—	—	—	—	—	—	3 (2)	—	—	2 (1)	1 (1)	—	—	6 (4)
Libějovice	—	1 (0)	3 (0)	—	1 (0)	—	—	2 (0)	—	—	10 (2)	—	9 (4)	—	26 (6)
Litvínovice	—	2 (0)	1 (0)	1 (0)	1 (1)	—	15 (7)	3 (1)	—	—	27 (9)	—	1 (1)	—	52 (19)
Nová Sedlica	—	—	2 (0)	5 (0)	9 (2)	—	—	—	—	—	1 (0)	—	7 (2)	—	28 (4)
Praha	3 (0)	10 (4)	3 (0)	—	—	—	—	—	—	—	1 (1)	4 (4)	7 (6)	—	28 (15)
Purkanec	—	—	14 (0)	6 (0)	20 (7)	—	15 (4)	1 (0)	14 (3)	7 (5)	21 (10)	—	—	—	98 (29)
Rakvice	—	3 (0)	—	5 (0)	3 (1)	—	—	—	—	—	7 (1)	—	5 (1)	—	23 (3)
Rudolfov	—	2 (2)	3 (0)	—	—	—	—	—	—	—	5 (4)	1 (1)	9 (7)	2 (1)	22 (15)
Sidonia	—	1 (0)	2 (0)	—	9 (1)	—	—	—	—	—	2 (0)	—	2 (1)	—	16 (2)
Telč	—	1 (0)	—	—	1 (0)	—	—	3 (1)	—	—	—	—	1 (0)	—	6 (1)
Zavadilka	—	4 (4)	3 (0)	—	1 (0)	—	—	8 (7)	—	—	2 (2)	1 (1)	13 (12)	—	32 (26)
Zlatá Koruna	—	—	1 (0)	8 (0)	4 (2)	—	—	—	—	—	3 (1)	—	5 (3)	—	21 (6)
Total	50 (7)	220 (107)	169 (4)	58 (3)	108 (58)	45 (31)	56 (17)	165 (124)	32 (8)	28 (9)	274 (158)	64 (52)	285 (219)	16 (9)	1570 (814)

Apolocystis herculea (Bosanquet, 1894) (Plate 2, Fig. 16)
Hosts: *Lumbricus rubellus, L. terrestris, Octolasium lacteum*, seminal vesicles and coelom
Distribution: Bulgaria, England, France, Germany, Sweden, Wales
Spherical trophozoites do not possess any polar differentiation, largest specimens 1400 μm in diameter. Nucleus spherical, 60—80 μm in diameter. Ectosarc narrow and poorly defined, 2—4 μm thick. Paraglycogen granules up to 8 μm. No epicytic striation present. Common parasite in *O. lacteum* (incidence of infection was 77 %), other hosts infected rarely.
Localities of findings: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 23, 24

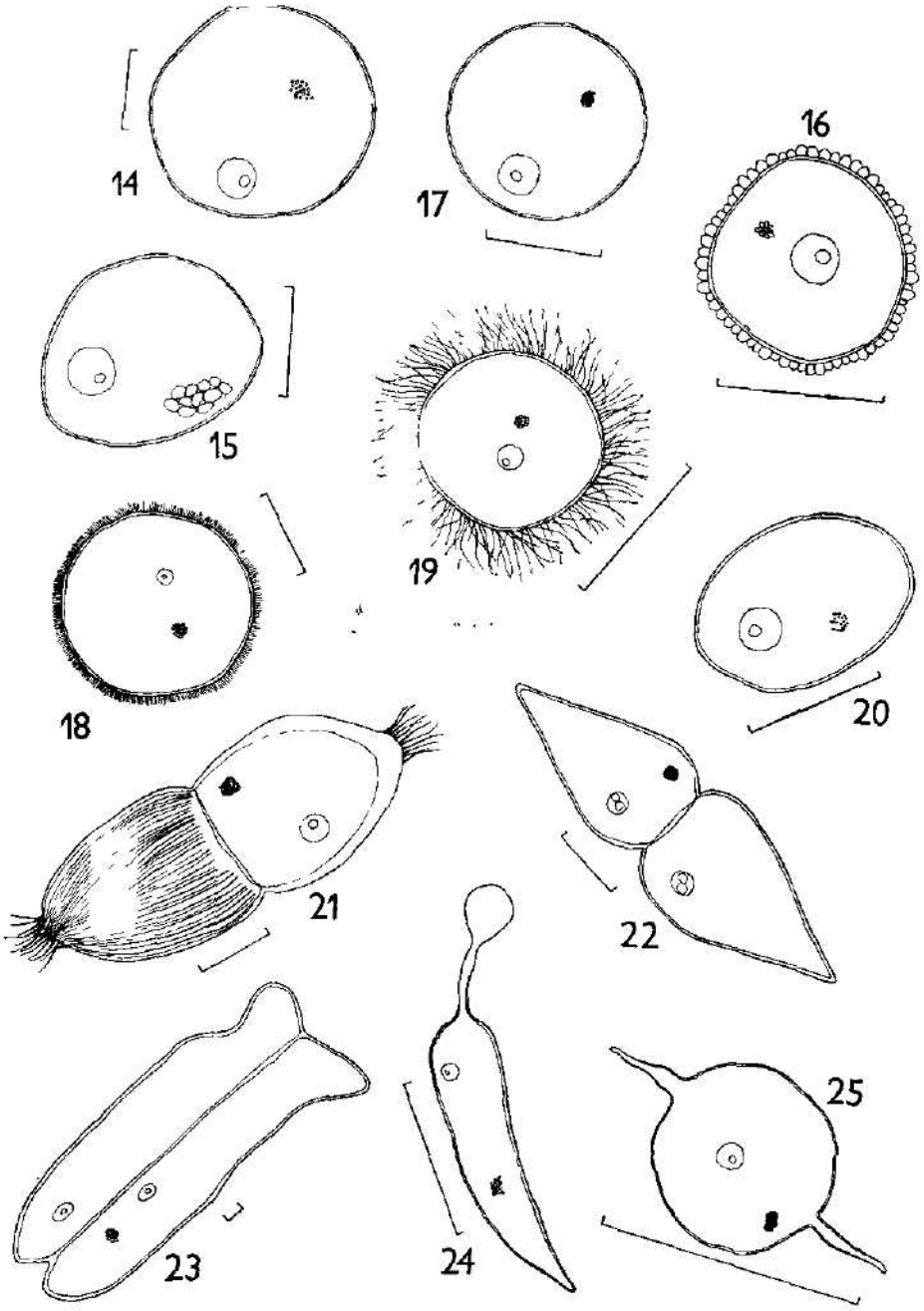
Apolocystis lumbriciolidi (Schmidt, 1854) (Plate 3, Fig. 17)
Hosts: *Dendrobaena octaedra, Dendrodrilus rubidus*, semianl vesicles
Distribution: England, France, Germany, Poland
Trophozoites ovoid-spherical in shape, 135—210 μm in diameter. Nucleus vary from 25 to 55 μm, one nucleolus 19 μm in diameter. Paraglycogen granules spherical and fine, 2.5—5 μm. Incidence of infection in *D. rubidus* was 48 %, only three specimens of the second host were infected.
Localities of findings: 1, 3, 4, 5, 9, 11, 12, 15, 16, 18, 19, 21, 24

Apolocystis megagranulata Segun, 1971 (Plate 2, Fig. 15)
Host: *Dendrodrilus rubidus, seminal vesicles*
Distribution: England
Trophozoites spherical or ovoid, without polar differentiations. Adult trophozoites 87—228 μm in diameter, ovoid forms vary from 122 to 185 μm by 151 to 187 μm. Nucleus large, 58 μm in diameter. Paraglycogen granules very large, ovoid, 14 by 10 μm. Seventeen specimens were found infected by this parasite.
Locality of findings: 18

Apolocystis perfida Rees, 1963 (Plate 3, Fig. 20)
Host: *Allolobophora chlorotica*, coelom
Distribution: Wales
Spherical trophozoites, 153—360 μm in diameter. Nucleus large and spherical, centrally located, 47—61 μm in diameter. One nucleolus 19—20 μm in diameter. Characteristic feature is that specimens are completely covered in a dense layer of host amoebocytes. This amoebocytic covering may be 20—30 μm thick. Only two host specimens were infected.
Locality of findings. 5

Apolocystis pertusa Loubatiéres, 1955 (Plate 3, Fig. 18)
Hosts: *Allolobophora chlorotica, Aporrectodea rosea*, seminal vesicles
Distribution: France, Germany
Trophozoites spherical, 162—165 μm in diameter, diameter of nucleus 73 μm, nucleolus 10 μm. Incidence of infection was 8 % in *A. chlorotica* and 2 % in *A. rosea, respectively.*
Locality of findings: 5

Apolocystis pilosa Meier, 1956 (Plate 3, Fig. 22)
Hosts: *Lumbricus rubellus, L. terrestris*, seminal vesicles
Distribution: Bulgaria, England, Germany, Hungary
Trophozoites hairy and normally spherical, often in irregular ovoid form. Body diameter varies from 124 to 217 μm, ectoplasmatic hair-like processes from 3 to 7 μm. Nucleus spherical with diameter of 9—30 μm, nucleolus 4—12 μm. Para-



Figs. 14—25. 14 — *Apolocystis lumbriciolidi*, 15 — *A. megagranulata*, 16 — *A. perfida*, 17 — *A. pertusa*, 18 — *A. pilosa*, 19 — *A. spinosa*, 20 — *A. vivax*, 21 — *Zygocystis cometa*, 22 — *Z. suecica*, 23 — *Pleurocystis cuenoti*, 24 — *Rhynchocystis porrecta*, 25 — *Dirrhynchocystis minuta*. (Scale = 0.1 mm)

glycogen granules 3—8 μm. Incidence of infection was 7 % (*L. rubellus*) and 12,5 % (*L. terrestris*), respectively.
Localities of findings: 5, 12, 15

Apolocystis spinosa Rees, 1963 (Plate 3 ,Fig. 21)
Host: *Allolobophora chlorotica*, seminal vesicles
Distribution: England, Wales

Table 2. Parasites and their new hosts

Parasite	New hosts
M. agilis	*L. meliboeus*
M. polymorpha	*L. castaneus*
N. elmassiani	*L. castaneus*
R. claviformis	*O. montanum*
A. lumbriciolidi	*D. octaedra*
Rh. porrecta	*O. montanum*

Spherical trophozoites do not possess any polarity and attain a diameter of 117 μm. Body with dense cover of ectoplasmis processes (59 μm long). Nucleus spherical, 26 μm in diameter, with a single nucleolus of 8.5 μm. This uncommon parasite was found in 6 % of the hosts examined.
Locality of findings: 5

Apolocystis vivax (Berlin, 1924) (Plate 3, Fig. 19)
Host: *Eiseniella tetraedra*, seminal vesicles
Distribution: Germany, Sweden
Trophozoites of oval to spherical shape, length 110—174 μm, breadth 86—124 μm (oval trophozoites) or 130—143 μm in diameter (spherical trophozoites), nucleus 25—39 μm, paraglycogen granules 5—7 μm. Seven specimens of *E. tetraedra* of 56 examined were infected with this parasite species.
Localities of findings: 12, 15, 18

Zygocystis cometa Stein, 1848 (Plate 1, Fig. 7)
Host: *Aporrectodea caliginosa*, seminal vesicles
Distribution: Bulgaria, France, Germany, Hungary, India, Sweden, USA
Trophozoites piriform, early in frontal syzygy, solitary specimens uncommon. Body with longitudinal ectoplasmic striations and with ectoplasmic processes at the end. Length 136—790 μm, breadth 46—200 μm. Incidence of infection was 48 %
Localities of findings: 1, 4, 5, 8, 9, 10, 11, 17, 20, 23

Zygocystis suecica Berlin, 1924 (Plate 1, Fig. 8)
Host: *Eisenia fetida*, seminal vesicles
Distribution: Sweden
Piriform trophozoites in frontal syzygy, length vary from 295 to 567 μm, breadth from 102 to 567 μm. Nucleolus 32 μm in diameter, with two endosomes (8 μm). Incidence of infection was 69 %.
Localities of findings: 5, 6, 9

Pleurocystis cuenoti Hesse, 1909
Host: *Aporrectodea caliginosa*, seminal vesicles and coelom

Distribution: England, France, Germany, Italy
Large trophozoites paired in lateral syzygy. Body length 2250—2650 μm, breadth 260—360 μm, length of nucleus 60—80 μm. Sporadically found (only in 3 host specimens).
Locality of findings: 5

Rhynchocystis porrecta (Schmidt, 1854) (Plate 2, Fig. 14)
Host: *Octolasium montanum*, seminal vesicles
Distribution: Bulgaria, France, Germany, Hungary, Sweden, USA
Trophozoites with rostrum elongated into cylindroconical trunk, body length 484 μm, breadth 47.3 μm in widest region. Only in one host specimen.
Locality of finding: 1

Dirrhynchocystis minuta Rushton, 1959 (Plate 3, Fig. 24)
Host: *Lumbricus terrestris*, seminal vesicles
Distribution: England
Trophozoites with projections at both ends of subspherical or spherical body. According Rushton (1959) this species possesses a body almost spherical in shape, meauring 28—52 μm in length and 21—45 μm in breadth. Our trophozoites reached 65—118 μm length and 48—68 μm in breadth, nucleus 4.7 μm in diameter. Incidence of infection was 6 %.
Locality of findings: 5

CONCLUSIONS

During investigatibn of the earthworm parasites in Czechoslovakia, twenty five species of monocystid gregarines were identified, all new for the Czechoslovak fauna. Most common parasite species are *Monocystis agilis* and *Apolocystis herculea*, for which high incidences of infection were established in several host species. *Monocystis arcuata*, *M. tubiformis*, *Apolocystis perfida*, *Pleurocystis cuenoti* and *Dirrhynchocystis minuta* are demonstrated as rare. New hosts were established for 6 species (Tab. 2). Monocystid gregarines of *Lumbricus meliboeus* and *Octolasium montanum* are reported for the first time.

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REMARKS ON THE AGE AND GROWTH OF LABEO CALBASU (PISCES, CYPRINIDAE) FROM RAJASTHAN, INDIA

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A b s t r a c t. Age, growth and growth parameters based on the scale studies of forty six specimens ranging between 37.40 — 58.50 cm total fish length of *Labeo calbasu* (Hamilton) from the river Ghagger at Rang Mahal, Rajasthan, India (longitude 73°54′ E; latitude 29°18′ N) have been described. Linear relationship existed between total fish length and lateral scale radius. The present sample showed better growth rate than the previously described samples from lakes and rivers indicating that this fish is essentially a riverine fish. The annual increment and the specific rate of linear growth decreased with the increase in age. Values obtained using average growth constant indicated that the fish has two phases of life in this water body and never enters the phase of 'old age' indicating optimum rate of exploitation. Minimum theoretical harvestable size has been found to be 34.00 cm total fish length. Using Walford's graph the maximum size of the fish has been found to be 59.00 cm of total fish length.

INTRODUCTION

Labeo calbasu (Hamilton) occurs throughout India, Pakistan, Burma, Bangladesh and Nepal (J a y a r a m, 1981). This species occurs in almost every type of freshwater body of India. Accodring to D a y (1878) the fish attains the size of 90.00 cm of total fish length, but during the last three decades this size has not been reported. T a n d o n and J o h a l (1982) stated that the stocks of *Labeo calbasu* and other Indian major carps are showing declining trend due to extensive use of pesticides, weedicides in the catchment areas and the introduction of exotic fishes. Out of four Indian major carps, *Labeo calbasu* appears to be most affected due to its bottom feeding habits.

Labeo calbasu being a commercial and fast growing fish various workers e.g., A l i k u n h i (1957), P a t h a k (1975), P r a s h a d (1976), P a t h a k and Jhingran (1977) have studied different aspects of fishery biology, whereas R a o and R a o (1972), G u p t a and J h i n g r a n (1973) and J o h a l and K i n g r a (1987) used scales for age and growth studies. The persual of literature has revealed that much work has not been done on the age and growth of this species as compared to other Indian major carps, hence, the present problem was undertaken.

The present paper deals with age determination using scales. Growth parameters such as specific rate of linear growth, species average size, growth charakteristics, growth constant, harvestable size and the maximum size attained by the fish have been calculated.

MATERIAL AND METHODS

Scales from forty six specimens ranging between 37.40 — 58.50 cm total fish length collected during January 1978 — July 1979 from the river Ghagger at Rang Mahal, Rajasthan, India (longitude 73°54′ E; latitude 29°18′ N) have been studied. The

methods of scale collection, their preparation for study, age determination including the growth parameters have already been described by Johal and Tandon (1983a, b; 1985; 1987a, b) and Tandon and Johal (1983a, b). Topography of the river Ghagger at Rang Mahal is described by Johal et al. (1984).

OBSERVATIONS AND DISCUSSION

The cycloid scales of *Labeo calbaeu* are almost elongated than broad. On each scale there are present concentric rings called circuli. The distance between the circuli decreases during winter and increases during summer indicating the slow and fast periods of growth respectively. During south-west monsoon period, the circuli show breaks or irregular arrangement. These breaks of irregular appearance are called annuli. As *Labeo calbasu* has been found to breed during south-west monsoon, therefore spawning act could be considered as one of the important causes of annulus formation. The annulus formed during the months of July-August is called '*true annulus*'. In addition the scales also record false and larval annuli. True annulus is characterized by light bands in the form of grooves extending to all sides of the scale. Each annulus is preceded by comparatively thinner and narrower circuli, followed by comparatively thicker and wide spaced circuli. False annuli or marks are formed due to various reasons such as scarcity of food, abrupt variations in the water level and sudden changes in water temperature or electrolyte, therefore, the formation of false annulus is irregular and it does not run around the scale. Larval mark is situated almost in the centre, inside the first annulus and formed during the first year of life. This mark may often be confused with the first annulus. Inside the larval annulus, the circuli are poorly formed. In large size scales, it is difficult to locate the larval annulus.

Linear relationship has been observed between total fish length and lateral scale radius (Fig. 1). The line cuts the abscissa at 38 mm. indicating that the scale made its appearance when the fish attained that size. This value has been used as a correction factor for the calculation of back-calculated lengths.

As far as shape of scale, appearance of true, false larval mark, caused for annulus formation, linear relationship between scale radius and total fish length are concerned, these confirm the earlier observations on Indian cyprinids from Northern India (Gupta and Jhingran, 1973; Singh, 1978, Johal and Tandon, 1981; 1983 a, b, c; Tandon et al., 1989).

Rao and Rao (1972) observed the annulus formation in the months of May-July in *Labeo calbasu* from the river Godavari, in the months of May-June from the river Yamuna (Gupta and Jhingran, 1973). In the present sample annuli are formed during the months of July-August. Late annulus formation in the present sample may be attributed to the delayed onset of the south-west monsoon in 'Thar-Desert' area. Correction factor has not been described earlier in this species except in the sample studied by Johal and Kingra (1987). In the present sample a little high value of correction factor has been recorded, when compared with other Indian major carps (Johal and Tandon, 1987 a, b) from the same area. It may be due to the fact that the present sample does not include the age classes 0^+ and 1^+. In other cyprinids this value never exceeds 20 mm (Johal and Tandon, 1981; 1983 a, b, c; 1985, 1987 b; Johal et al., 1984; Tandon et al., 1989).

In Table 1, back-calculated lengths and the annual increment in each age class are given. The present sample belonged to the age classes $2+$ to $5+$. The

Table 1. Back-Calculated lengths of *Labeo calbasu* from Rang Mahal

Age Class	Number of Specimens	Back-Calculated lengths (cm.)				
		l_1	l_2	l_3	l_4	l_5
2+	10	21.70 (15.20–30.00)	35.35 (30.20–42.40)			
3+	18	25.18 (15.20–34.40)	38.30 (27.20–47.50)	46.80 (35.70–57.00)		
4+	17	20.50 (15.10–27.80)	32.50 (25.00–39.60)	40.90 (36.00–46.40)	49.00 (43.04–53.51)	
5+	3	20.20 (17.40–24.60)	29.70 (23.90–33.00)	42.10 (36.10–46.30)	47.00 (40.50–50.70)	52.10 (48.40–54.70)
	46	21.89 (15.10–34.40)	33.96 (23.90–47.50)	43.26 (35.70–57.00)	48.00 (40.50–53.52)	52.10 (48.40–54.70)

maximum number of specimens belonged to the age classes 3+ and 4+. Annual increment decreases with the increase in age, which is characteristic feature of most of the cyprinids (Chugunova, 1963). In Table 2, back-calculated lengths (without correction factor) from different localities and the present sample (using correction factor) are given. It is evident that the present sample showed better growth up to age classes 4+, in the later age classes the population from the river Yamuna had better growth rate. Minimum linear growth has been found in the sample from Jaismund Lake (Johal and Kingra, 1987). For the present observations and the earlier published data it is clear that the populations of *Labeo calbasu* from the rivers had better growth rate than from the reservoirs lakes. Better growth in the population from the river Ghagger at Rang Mahal may be due to the prolonged summer

Table 2. Growth data of *Labeo calbasu* from Rang Mahal

	Age Class				
	1	2	3	4	5
L (cm)	21.89	33.96	43.26	48.00	52.10
Annual increment (h)	21.89	12.07	9.30	4.74	4.10
Specific rate of linear growth (C_l)		55.14	27.38	10.96	8.54
Index of species average size (4 h)			10.42		
Growth characteristic (C_{ls})		9.63 — 8.92 —	8.22 —	4.46 — 4.19 —	3.93 —
Growth constant (C_{lt})		0.6596	0.3629	0.1544	0.1230
Average growthconstant (Av.C_{lt})		— 0.5112 —		— 0.1387 —	

Table 3. Comparison of growth data of *Labeo calbasu* from different localities

Locality	Author(s)	Age Class				Back-calculated lengths (cm.)			
		I	II	III	IV	V	VI	VII	VIII
River Godavari	Rio & Rao, 1972*	20.22	30.18	38.21	45.15	50.94	54.73	61.62	
River Yamuna	Gupta & Jhingran 1973*	18.85	29.10	38.10	46.85	54.35	61.85	68.10	73.10
Jaismand Lake	Johal & Kingra 1987	14.81	21.27	27.82	33.36	39.14	41.34		
River Ghagger	Present observation	21.89	33.96	43.26	48.00	52.10			

* Back-calculated lengths without using corrector factor

season corresponding to fast growth period and more availability of nutrients in the water.

In Table 3, other growth parameters such as specific rate of linear growth rate, index of species average size, growth characteristics, growth constant and

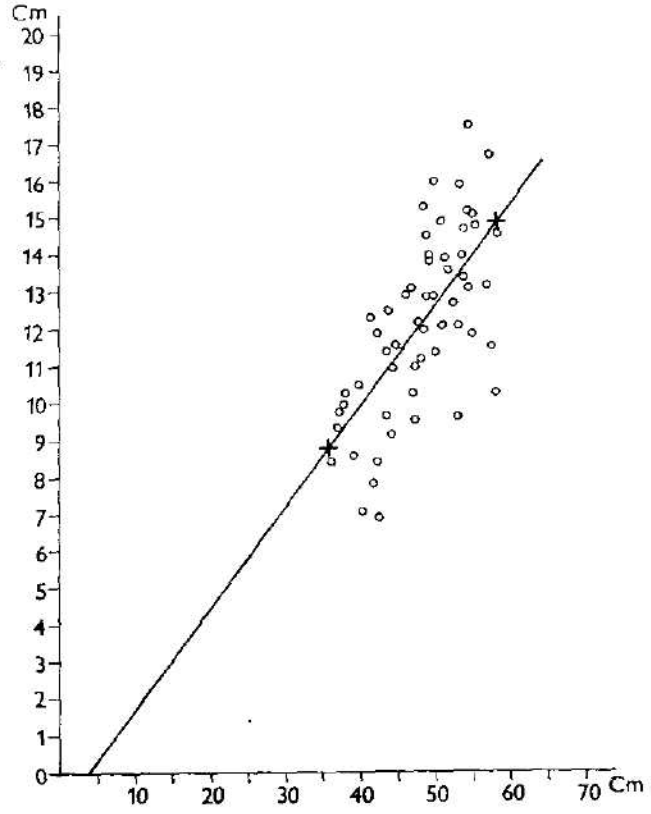

Fig. 1. Linear relationship between total fish length (along abscissa) and lateral scale radius (along ordinate) of Labeo calbasu from the river Ghagger at Rangh Mahal.

average growth constants are presented. Specific rate of linear growth decreases with the increase in age.

The value of growth characteristics are useful in determining the periods where the first ends and second begins. From Table 3, it is observed that the fish enters the second period in the third year of life.

It has been reported earlier using this value from growth data (Johal and Tandon, 1985; 1987 b; Tandon et al., 1989) that carps enter the second period at this stage. This fact has also been confirmed by Chugunova (1963) and she observed regularities in using growth characteristics in the members of cyprinidae. Vasnetsov (1958) described that the first period of growth characteristics varies considerably under the influence of external conditions, whereas the second period characterizes the hereditory fixed rates. Tandon and Johal 1985, 1987) and Tandon et al., (1989) recorded similar observations on other cyprinids from Northern India.

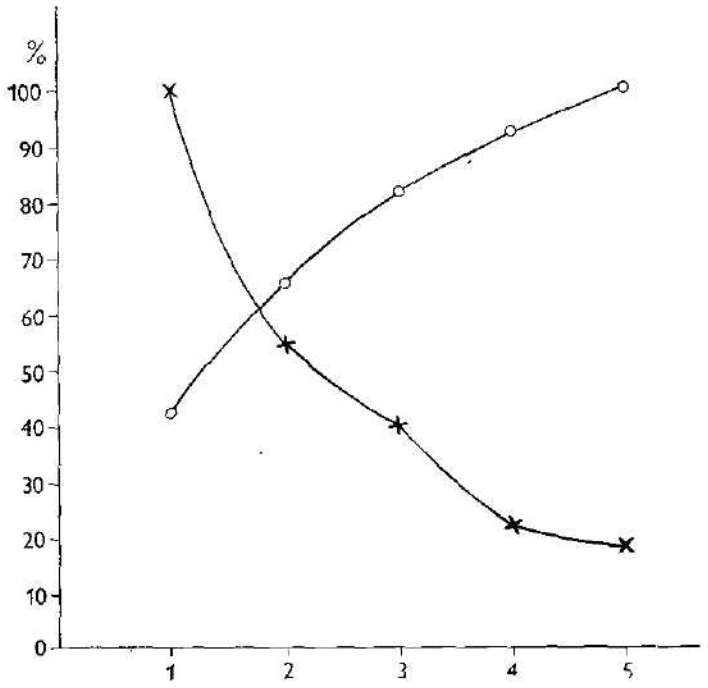

Fig. 2. Harvestable size of Labeo calbasu from the river Ghagger at Rang Mahal, Rajasthan, India. Crosses: Length increment in percentage of the length of the first growth season. Circles: Length in percentage of the length of the final growth season. Age classes along abscissa.

Values of average growth constants have indicated two phases of life in *Labeo calbasu* from the river Ghagger at Rang Mahal. According to Chugunova (1963) majority of the fishes have two phases and very rarely some populations have even third phase. The first and second phase include asexual and sexual maturity stages respectively, whereas the third phase indicates the 'old age'. Most of the Indian cyprinids have two phases, very rarely Indian

major carps do enter third phase also (Johal and Tandon, 1985, 1987 b) indicating under exploitation. As the present sample show two phases, it can be presumed that *Labeo calbasu* from the river Ghagger at Rang Mahal is exploited at the optimum level and does not enter 'old age'.

Value of index of species average size (4 h) has been found to be 10.42. The calculated value of the index of species average size from the earlier published data has been found to be 9.31 from the river Yamuna at Allahabad

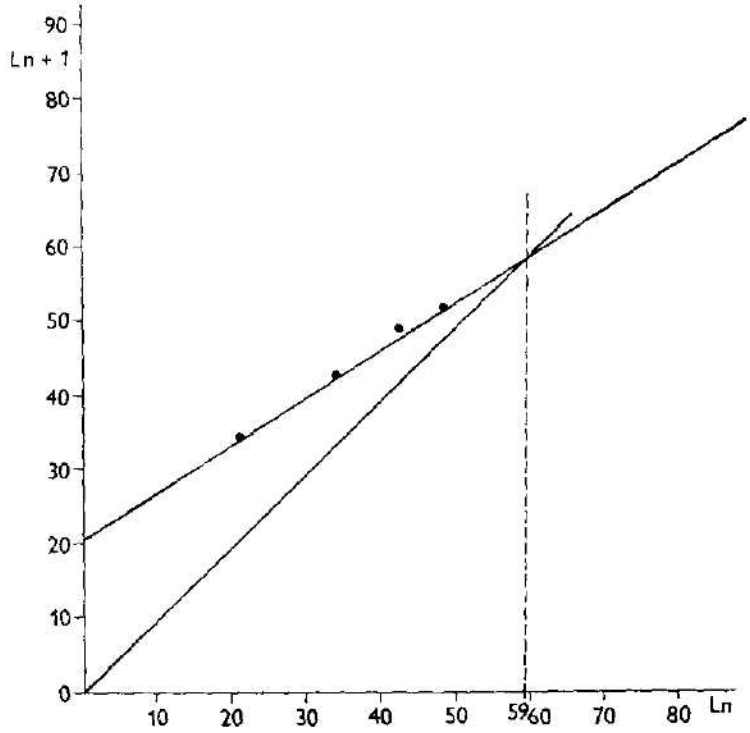

Fig. 3. Walford's graph for the determination of maximum size attained by Labeo calbasu in the river Ghagger at Rang Mahal, Rajasthan, India. L_n along abscissa and L_{n+1} along ordinate.

(Gupta and Jhingran, 1973). 8.60 from the river Godavari (Rao and Rao, 1972) and 6.81 from Jaismund lake (Johal and Kingra, 1987). From the above data it is clear that the population size of *Labeo calbasu* from the river Ghagger at Rang Mahal is certainly better. This growth parameter and the back-calculated lengths show that overall growth and population size of this species are certainly better in rivers as compared to lakes/reservoirs.

Based on growth data, the minimum harvestable size has been found to be in the last period of the second year's life, it means that this species should be harvested after the completion of second year when it attains the size of 34.00 cm total fish length (Fig. 2). The harvestable size of Indian carps has been described by Singh (1978), Johal and Tandon (1983, 1987 a, b) and Tandon et al. (1989). The present and earlier observations indicate

that most of the Indian major carps are harvested below their real harvestable size, therefore, it is one of the major factor responsible for the depletion of their stocks from North- Indian waterbodies. Considering this aspect the legal fishing limit of *Labeo calbasu* from the river Ghagger at Rang Mahal be modified at least to 34.00 cm total fish length (desirable 40.00 cm total fish length). It has been further observed that the harvestable size depends upon the growth rate of the fish, therefore separate harvestable size should be recommended for each waterbody.

The ultimate length attained by *Labeo calbasu* has been determined by plotting Walford's graph (Walford, 1946). The length l_n attained in each age class has been plotted along 'X' axis and l_{n+1} along 'Y' axis (Fig. 3). Another line is drawn at an angle of 45° from the zero mark. The intercept of the two lines give the maximum attainable length by the fish in this water body, which has been found to be 59.00 cm total fish length. In the present collection the largest specimen has the total length of 54.70 cm total fish length, indicating thereby that in the river Ghagger at Rang Mahal, there exists fishes of higher size/age groups or classes not included in the present sample. The exclusion of the higher sized fishes in the present sample may be due to the non-selectivity of the fishing gear in this water body.

SUMMARY

Age and growth of *Labeo calbasu* (Hamilton) from the river Ghagger at Rang Mahal, Rajasthan have been determined from its scales. Annulus formed during the months of July-August is considered valid for age determination. Spawning act during the south-west monsoon has been considered to be one of the causative factors responsible for the annulus formation.

Linear relationship exists between total fish length and scale radius. A correction factor of 38.00 mm has been used for the back-calculations. The annual increment decreases with the increase in age.

Other growth parameters such as specific rate of linear growth, index of species average size, growth characteristics and average growth constants have also been described. Specific rate of linear growth decreased with the increase in age. The study of growth characteristics showed the existance of two periods in the life history of *Labeo calbasu*, a characteristic feature of most of the cyprinids. The fish does not enter 'old age' indicating its optimum exploitation.

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Formální úprava prací:

Rukopis (originál a 1 kopie) musí být psán na stroji s většími typy obřádek, na stránce 30 řádek, řádky po 60 úhozech, bez větších oprav. Rukopisy, které by neodpovídaly těmto formálním požadavkům budou vráceny k přepsání.

Hlavička práce. 1. Název práce (u prací taxonomických v závorce za názvem systematické zařazení druhu nebo skupiny — např. Ostracoda: Cyprinidae), obojí v řeči, v níž je práce psána. 2. Jméno a příjmení autora. 3. Název pracoviště a adresa.

Vlastní práce: 1. Velmi stručný abstrakt, v rozsahu nejvýše 15 řádek, v angličtině. 2. Úvod do problematiky (stručné). 3. Materiál a metodika (u známých metod pouze odkaz). 4. Vlastní část experimentální nebo popisná. 5. Diskuse. 6. Závěr. 7. Seznam citované literatury (nikoliv bibliografie!). 8. Tabulky, texty k obrázkům a grafům. Celý rukopis je průběžně stránkován.

Citace prací proveďte podle jednotného vzoru: autor, rok, název, časopis (mezinárodními bibliografickými zkratkami), ročník, sešit pouze v případě, že ročník není průběžně stránkován, stránky. U knižních titulů nakladatel a místo vydání. Např.: Hrabě S., 1975: Second contribution to the knowledge of marine Tubificidae (Oligochaeta) from the Adriatic Sea. *Věst. čs. Společ. zool.*, 39: 111—119.

Přepis cyrilice proveďte podle mezinárodních pravidel transliterace (nikoliv fonetické transkripce — viz ISO Recommendation R 9, International system for the transliteration of cyrilic character 1. Ed. October 1955, nebo Zekalle, R., 1964: *Pedobiologia*, 4: 88—91, Jena.

Obrázky a grafy kreslete černou tuší na kladívkový nebo pausovací papír v poměru 4 : 1 až maximálně 1 : 2, u taxonomických prací musí mít obrázky měřítko. Obrázky kreslete pokud možno tak, aby mohly být všechny stejným způsobem zmenšeny. Fotografie musí být ostré, kontrastní, na lesklém papíře. Obrázky sestavte do tabulí, které by bylo možno reprodukovat na šíři strany (126 mm), nebo s textem na celé zrcadlo (126 × 188 mm). Obrázky nebo obrazové tabule průběžně číslujte a v rukopise vyznačte místo, kam mají být zalomeny.

Tabulky jsou tištěny jako otevřené, tj. bez svislých linek. V tabulkách oddělte vodorovnými linkami jen záhlaví tabulky a dolní okraj. Tabulky protokolárního charakteru nebo opakující údaje z textu, případně tak velké, že by je nebylo možné vytisknout na dvě protilehlé strany nebudou přijímány.

V taxonomických pracích dodržujte zásady, ustanovení a doporučení mezinárodních pravidel zoologické nomenklatury.

V rukopisu nepředpisujte zásadně žádné typy písma, označte pouze tužkou po straně části, které mají být vysazeny petitem.

Práce zasílejte na adresu: Doc. Dr. K. Hůrka, CSc., výkonný redaktor Věstníku čs. Společ. zool., Viničná 7, 128 44 Praha 2.

Redakční rada

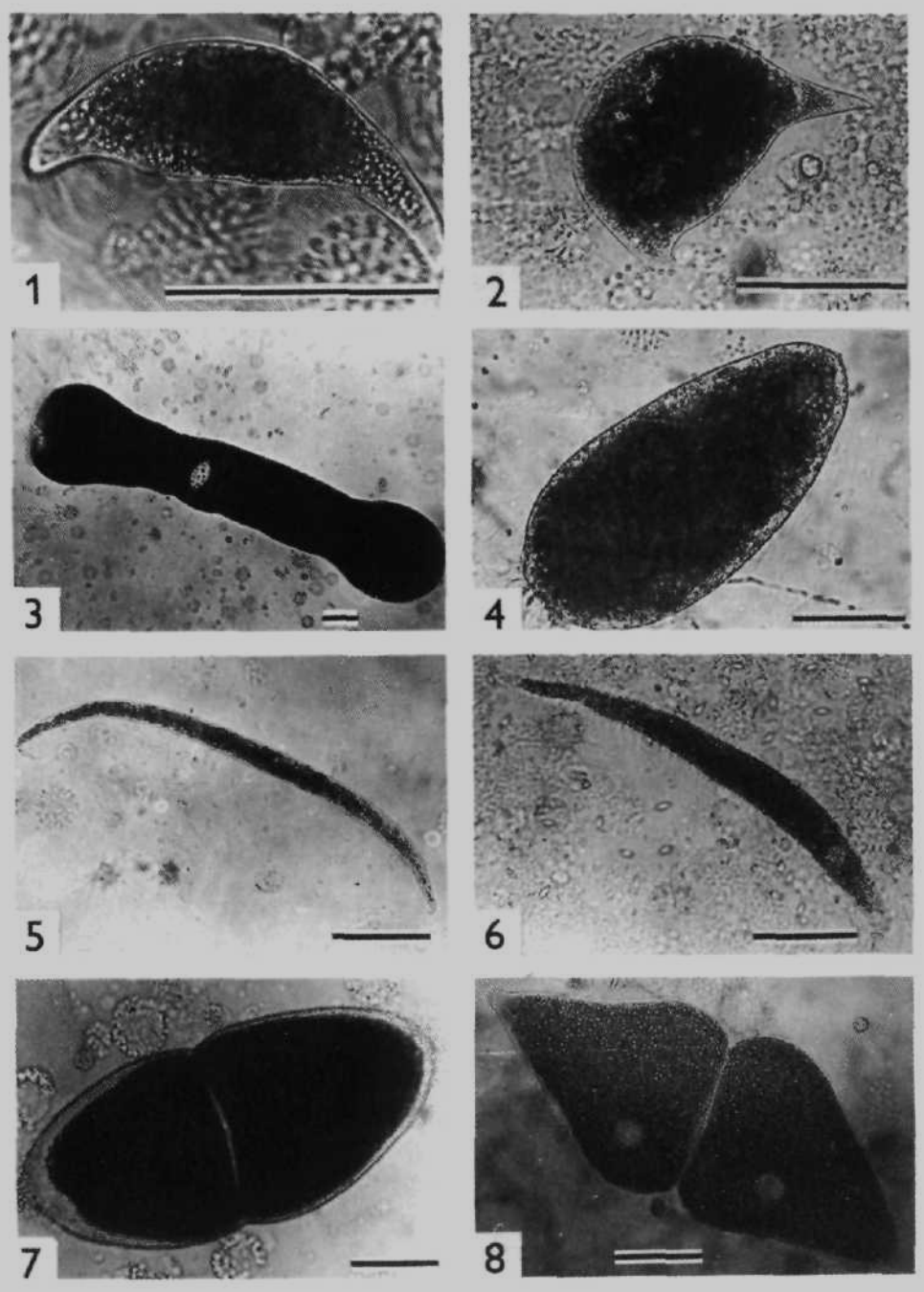

Plate 1. 1 — *Monocystis agilis*, 2 — *M. ventrosa*, 3 — *M. lumbrici*, 4 — *M. hirsuta* 5 — *M. arcuata*, 6 — *M. wallengrenii*, 7 — *Zygocystis cometa*, 8 — *Z. suecica*. (Scale = 0.1 mm)

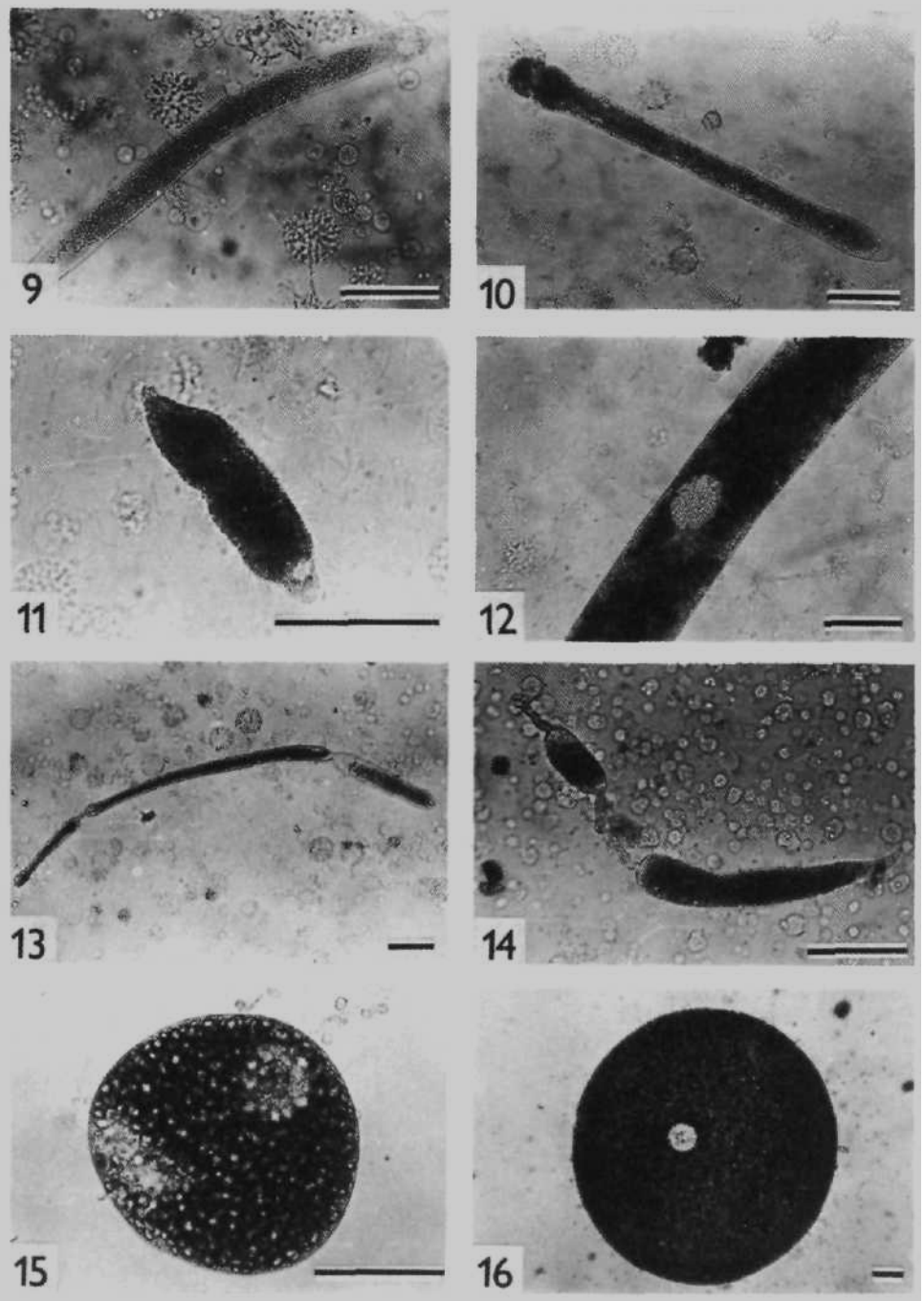

Plate 2. 9 — *Monocystis striata*, 10 — *M. tubiformis*, 11 — *M. polymorpha*, 12 — *Nematocystis magna*, 13 — *N. elmassiani*, 14 — *Rhynchocystis porrecta*, 15 — *Apolocystis megagranulata*, 16 — *A. herculea*. (Scale — 0.1 mm)

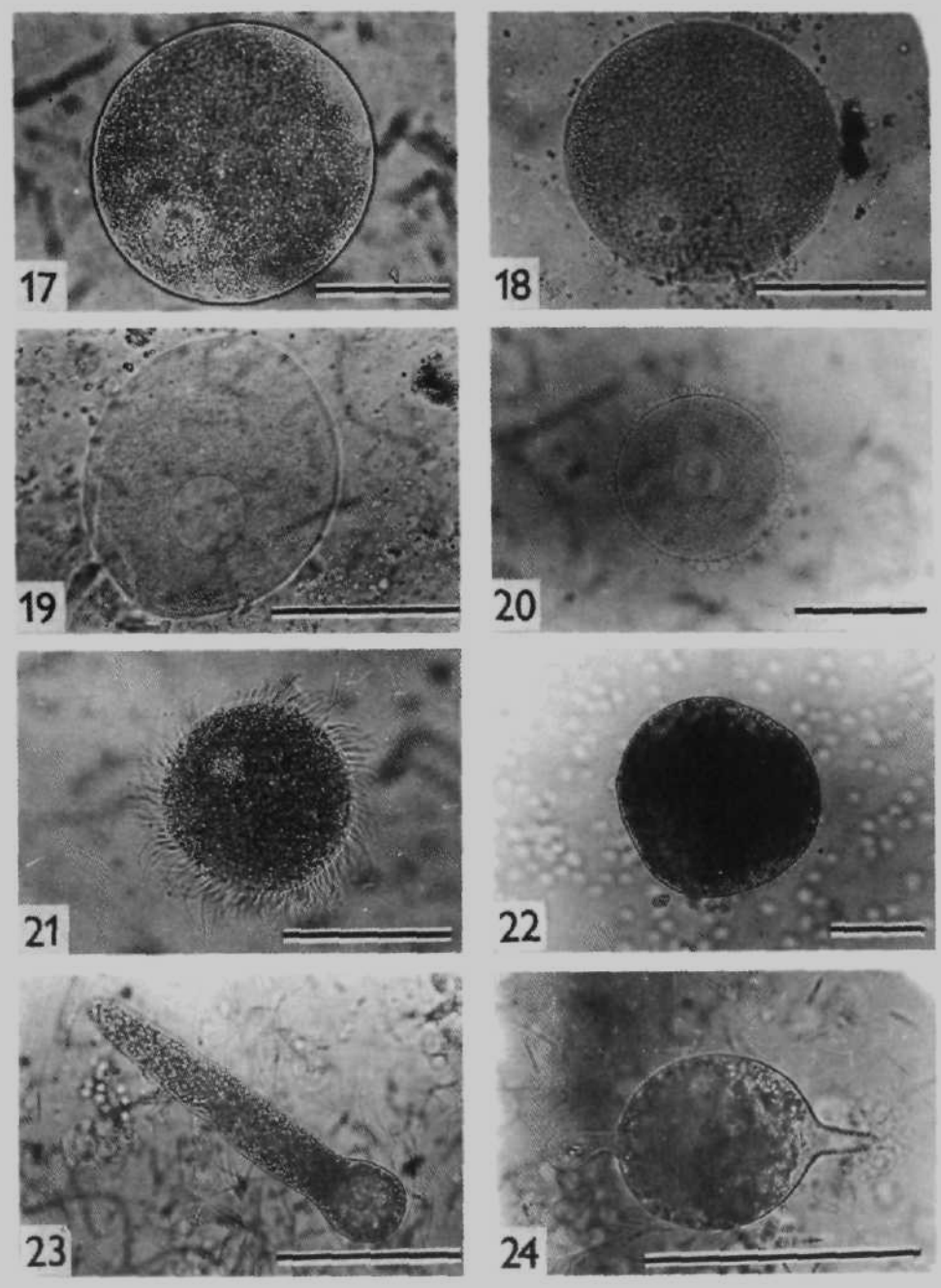

Plate 3. 17 — *Apolocystis lumbriciolidi*, 18 — *A. pertusa*, 19 — *A. vivax*, 20 — *A. perfida*, 21 — *A. spinosa*, 22 — *A. pilosa*, 23 — *Rhabdocystis claviformis*, 24 — *Dirrhynchocystis minuta*. (Scale = 0.1 mm)