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NEPHROMONORCHA SKRJABINI (TREMATODA) AND ITS POSITION IN THE FAMILY RENICOLIDAE

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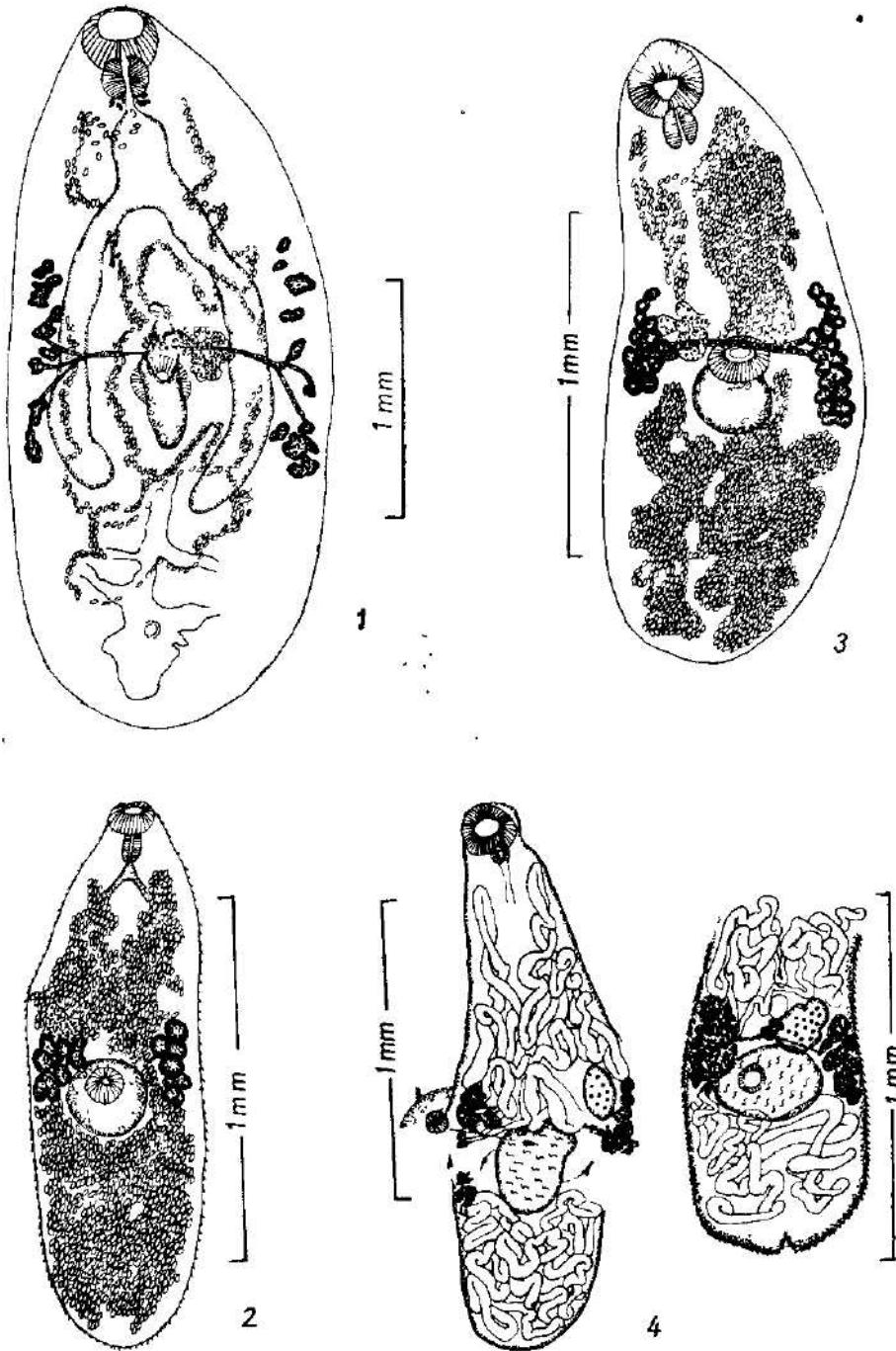
Abstract: The genus *Nephromonorcha* Leonov, 1958 has been reestablished as a valid taxon of the family Renicolidae Dollfus, 1939. The genus *Neorenicola* Odening, 1962 is considered to be a synonym of *Nephromonorcha* Leonov, 1958. All species belonging hitherto into the genus *Neorenicola* were transferred to the genus *Nephromonorcha*. The generic diagnosis is amended and a key to the species is added. Measurements and figures of all hitherto described species belonging now to the genus *Nephromonorcha* are presented.

Studying a large number of trematodes collected by Dr Morel from *Necrosyrtes monachus* in Senegal, Dollfus and Capron (1958) described a new species, which they named *Renicola monorchis*. This species differs from the other renicolids in having a single testis, other type of excretory vesicle and brightly rounded posterior part of body. At the same time Leonov (1958) described a new genus *Nephromonorcha* with the species *N. skrjabini*. He did not list this genus in any family, classifying this fluke as „Trematoda sensu lato“. This trematode possessing also only one testis has been found in *Hydroprogne tschegrava* (= *caspia*) and *Larus melanocephalus* in Ukraine (USSR). Alexeev (1969) — in Smogorzhevskaja (1976) — transferred the species *Nephromonorcha skrjabini* Leonov, 1958 to the genus *Renicola* as *R. (R.) skrjabini* (Leonov, 1958).

Odening (1962) created a new genus *Neorenicola* with the type species *Neorenicola monorchis* (Dollfus et Capron, 1958). Later further two species have been described: *Neorenicola skrjabini* Odening, 1963 from *Phalacrocorax (Haliastur) niger* from Vietnam and *Neorenicola lari* Vaidova, 1970 from *Larus ichthyaetus* from Azerbaidzhan.

Since the creation of the genus *Nephromonorcha* Leonov, 1958 is in conformity with ICZN, this taxon should be regarded as valid and herewith obtain the time priority before the genus *Neorenicola* which should be considered its synonym.

All species belonging hitherto to the genus *Neorenicola* should be therefore transferred to the genus *Nephromonorcha* as follows: *Nephromonorcha monorchis* (Dollfus et Capron, 1958) n. comb., type species of the genus: *Nephromonorcha skrjabini* (Odening, 1963) n. comb.; *Nephromonorcha lari* (Vaidova, 1970) n. comb. Including *N. skrjabini* Leonov, 1958, the genus *Nephromonorcha* is now represented by four species. Since two species of the same name *N. skrjabini* occur in this genus, the name *N. skrjabini* Odening, 1963 has become a secondary homonym of *N. skrjabini* Leonov, 1958; therefore it is replaced by the name of the author who described this species, i. e. *Nephromonorcha odeningi* nom. nov.



Figs. 1—4. 1 — *Nephromonorcha monorchis* (after Dollfus, Capron, 1958); 2 — *N. skrjabini* (after Leonov, 1958); 3 — *N. lari* (after Vaidova, 1970); 4 — *N. odeningi* nom. nov. (after Odening, 1963).

Tab. 1. Some data concerning the species of the genus *Nephromonorcha*.

	<i>N. monorchis</i>	<i>N. skrjabini</i>	<i>N. lara</i>	<i>N. odeningi</i>
Body length	2.65-4.0	1.17-1.52	1.6-1.8	1.9
Body width	1.35-2.0	0.46-0.48	0.62-0.68	0.51-0.64
Oral sucker	0.294-0.341	0.108-0.124	0.218 in diam.	0.155-0.159
Ventral sucker	0.205-0.214	0.099-0.108	0.170 in diam.	0.090-0.097 × 0.097-0.104
Pharynx	0.153-0.180 × 0.153-0.225	0.077 × 0.063	0.090-0.122 × 0.095-0.113	0.069 × 0.079
Esophag.	0.028-0.256	short	absent	three times as long as pharynx
Testes	0.180-0.263 × 0.170-0.278	0.232-0.234	0.248-0.297	0.214-0.235 × 0.311-0.317
Ovary	0.200-0.415 × 0.170-0.225	0.124 × 0.093-0.108	0.163-0.203 × 0.162	0.176-0.186 × 0.121-0.131
Eggs	0.030-0.033 × 0.016-0.018	0.027-0.031 × 0.015-0.017	0.032-0.041 × 0.016-0.024	0.030-0.035 × 0.016-0.019
Vitellaria	6-10 follicle extra-caecal in middle third of body length	large follicle in short later. fields	large follicle in short lat. fields in middle third of body length	5-8 large follicle in short lateral fields, in ovario-testicular zone
Uterus	does not reach the posterior extremity of body	reaches to posterior extremity	reaches to posterior extremity	reaches to posterior extrem. of body
Ratio of suckers	1 : 1.43-1.59	1 : 1.12	1 : 1.29	1 : 1.69
Size relation of OS : Ph : Vs	31 : 16 : 20	10 : 7 : 9	21 : 11 : 17	16 : 7 : 9
Host	<i>Necrosyrtes monachus</i> (Temm.)	<i>Hydroprogne caspia</i> (Pall.) <i>Larus melanocephalus</i> Temm.	<i>Larus ichthyæetus</i> Pall.	<i>Phalacrocorax (Halietor) niger</i> (Vieillot).
Locality	Senegal	USSR (Ukraine) (Khersonsk R.)	USSR Azerbaidzhan	Vietnam

Concerning the diagnosis of the family Rencolidae I fully accept Odening's detailed diagnosis published in 1962 including the key to the genera, amended by the same author in 1970. On the basis of recent data this communication is supplied with the amended diagnosis of the genus *Nephromonorcha* and with the key to the species.

Genus *Nephromonorcha* Leonov, 1958

Syn.: *Neorenicola* Odening, 1962

Generic diagnosis: Rencolidae. Body oval, slightly attenuated anteriorly, brightly rounded posteriorly. Testes fused into one testis, situated median in acetabular zone. Two vasa efferentia remain preserved. Vitellaria in short lateral fields, situated in ovariotesticular zone, consisting of small number of large follicles. Excretory vesicle sac-form with more than two main lateral branches or diverticles. Parasitic in kidney of birds.

Type species: *Nephromonorcha monorchis* (Dollfus et Capron, 1958) n. comb.

Key to the species of the genus *Nephromonorcha*

- 1. Ratio of suckers more than 1 : 1.40 2
- Ratio of suckers less than 1 : 1.40 3

2. Esophagus short, not longer than the length of pharynx; uterus does not reach to posterior extremity; vitellaria often overreach the ovariotesticuar zone in both directions; ratio of suckers 1 : 1.43–1.59 *N. monorchis*
 – Esophagus three times as long as pharynx; uterus reaches to posterior extremity; vitellaria located in ovariotesticular zone only; ratio of suckers 1 : 1.63 *N. odeningi*
3. Ratio of suckers 1 : 1.12 in average; length of eggs 0.027–0.031; size relations between oral sucker: pharynx: acetabulum is 11 : 7 : 10 *N. skrjabini*
 – Ratio of suckers 1 : 1.29; length of eggs 0.032–0.041; size relations between oral sucker: pharynx: acetabulum is 21 : 10 : 17 *N. lari*

The key is supplemented with further morphological and metrical data even with figures which have been taken from original publications (see Tab. 1 and Figs. 1–4).

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**SYSTEMATIC POSITION OF FOUR GYRINOCHEILUS SPECIES
(GYRINOCHEILIDAE, CYPRINIFORMES)**

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Abstract. 29 specimens of *Gyrinocheilus kaznakovi* Berg, 1906, representing a single of species of the family Gyrinocheilidae of the order Cypriniformes (Berg, 1955), were examined with regard to 22 plastic and 14 meristic characters, which were compared with Berg's (1906), Weber's and de Beaufort's (1916), Hora's (1935) and Fowler's (1937) descriptions. The validity of four species of the family Gyrinocheilidae and invalidity of the genus *Gyrinocheilops* (Fowler, 1937) seems to be apparent. A key to all described *Gyrinocheilus*-species is given.

INTRODUCTION

The systematic position of *Gyrinocheilus* (Vaillant, 1902) was till recently unsettled. Tirant (1883, according to Fowler, 1937) described the new species *Psilorhynchus aymonieri* (Fig. 2) from a small stream called Prek-Tenot in the Samrong-Tong Mountains about 75 kilometers from Phnom-Penh, Cambodia. Vaillant (1902, according to Berg, 1906) described the new genus and species *Gyrinocheilus pustulosus* (Fig. 3) from river Kapuas and Mahakam river basin from central Borneo. Vaillant (1902) classed this fish into the family Cyprinidae and subfamily Homalopterinae. Boulenger (1904, according to Berg, 1906) created the separate subfamily Gyrinocheilinae in the family Cyprinidae. Berg (1906) described, on the basis of two specimens from the border region between Thailand and Cambodia (locality Pai-lin between Battambang and Schantabun), the new species *Gyrinocheilus kaznakovi* (Fig. 1) named after discoverer A. N. Kaznakov. Fowler (1934, 1937), Hora (1935), Ramaswami (1951) misspelt the species designation as "kaznakoi". Hora (1935) identified *Psilorhynchus aymonieri* Tirant, 1883 with one species *Gyrinocheilus kaznakovi* Berg, 1906. Fowler (1937) considers Tirant's description of *Psilorhynchus aymonieri* as insufficient. He also believes that *Psilorhynchus aymonieri* Tirant can be hardly identified with Berg's *Gyrinocheilus kaznakovi*.

Regan (1911, according to Ramaswami, 1951) classed genus *Gyrinocheilus* together with genera *Garra* (Hamilton, 1882) and *Crossocheilus* (van Hasselt, 1823) into the family Cyprinidae. Hora (1923, according to Ramaswami, 1951) while studying their morphology found the relationship of genera *Garra* and *Crossocheilus*, and classed genus *Gyrinocheilus* in the separate family Gyrinocheilidae. This classification was accepted by Berg (1955). Ramaswami (1951) proved the validity of family Gyrinocheilidae in his detailed comparative osteology of genus *Gyrinocheilus*, *Garra* and *Crossocheilus*. Fowler (1937) recognized two genera in the family Gyrinocheilidae, using the following key:

Predorsal scales small, scales on caudal base small, eye well postmedian or near last third in head, 2 rows of large, dark, alternating or opposed spots along side of body
Gyrinocheilus

Predorsal scales very small and crowded, scales on caudal base large, eye slightly postmedian in head, 2 rows of large dark spots only partly or not at all alternating along side of body
Gyrinocheilops.

Fowler's (1937) description of the new genus and species *Gyrinocheilops pennocki* (Fig. 4) is based on only two specimens (78 and 145 mm) from locality Kemrat in Thailand. Fowler (1937) had at his disposal for comparison also eight specimens (54—118 mm) of *Gyrinocheilus kaznakovi* from Thailand. One *Gyrinocheilus* species was brought into European aquaria for the first time in the year 1955 (Sterba, 1977). Data concerning the reproduction in captivity are missing, and this genus and species is kept in aquaria only thanks to repeated new imports of mostly very small specimens (about 30 mm). The close study of this genus is therefore interesting; all specimens kept in tanks of several Czech aquarium hobbyists and called simply "*Gyrinocheilus aymonieri*", which I examined, come from nature, but without any mention of the locality. Nevertheless, they represent popular aquarium fishes here.

MATERIAL AND METHOD

In total I had at disposal 27 specimens of 35—50 mm of the body length, 1 specimen 107 mm and 1 specimen 121 mm of *Gyrinocheilus kaznakovi*. Material conserved at first in formalin solution was transferred into methylated spirit. All measurements were made with the accuracy of ± 0.5 mm, only the eye diameter, the length of the snout, the width of the mouth, the length of the transverse groove on the throat, the interorbital distance and the depth of the caudal peduncle were measured with the accuracy of ± 0.1 mm. The number of scales and rays was counted by the binocular microscope (magn. 17—24 times), the structure of scales and the number of gill rakers by means of the monocular microscope. Berg (1906) calculated plastic characters in % of the body length and of the eye diameter, Fowler (1937) calculated some plastic characters in % of the body length, head length, snout length, interorbital distance and pectoral fin and ventral fin lengths, and therefore it was necessary to compare my data separately using criteria cited by Berg (1906) and Fowler (1937).

Lettering to Tables

A — anal fin, AB — base of anal fin, AS — axillary scale of ventral fin, BD — body depth, BL — body length, C — caudal fin, CE — centre of eye, CP — cutaneous pad of pectoral fin, CPD — depth of caudal peduncle, DB — base of dorsal fin, ED — eye diameter, HL — head length, HW — head width, ID — interorbital distance, LL — lateral line, LS — length of snout, MW — mouth width, P — pectoral fin, TG — transverse groove on the throat, V — ventral fin, VB — base of ventral fin.

RESULTS AND DISCUSSION

The body of examined specimens is elongated and moderately compressed. The head rather small, the snout long, depressed. The eye located in the upper half of the head. Anterior on the upper surface of the snout is also a transverse groove. Behind this groove there is the protuberance of the eye diameter length with papillae (Fig. 9). This protuberance is more distinct on the bigger specimens but it is missing at the sides of the head. This agrees with Berg (1906). The upper lip is rather broad, fleshy, not emarginate medially, its outer surface papillated, the inner surface with small rasp-like papillae (Figs. 5, 6). The lower lip is almost triangular, with many transversal folds ("plicae" in

Fowler, 1937). Berg (1906) cited no details concerning the upper lip.

From figures in the literature it is evident that *Gyrinocheilus pustulosus* (Fig. 8), *Gyrinocheilus pennocki* (Fig. 4) have the upper lip medially emarginated. This character can be seen also in Hora's (1935) figure, representing the type-specimen of Tirant species *Gyrinocheilus aymonieri* (Fig. 2). On the basis of this evident character it is possible to suppose that in the tanks of Czech aquarium hobbyists species *Gyrinocheilus kaznakovi* (Fig. 1) has been recently kept.

The mouth forms the evident sucking disc. In living specimens, in aquaria, it is used for the grazing down of algae and attaching to some objects, including glass walls (Fig. 13). Gill (branchiostegal) membranes are very broadly united on the isthmus. Two gill slits serve for breathing. The lower slit is rather narrow covered by the opercle, closed inside by a movable flap formed by a prolongation of the gill membrane on the opercle (Fig. 7). No barbels, the chest and the breast are naked. Pectoral fins with the adnate cutaneous pad in the axil, ventral fins with the axillary scale. Scales are cycloid with densely arranged striae and numerous primary and secondary canals. Primary canals are visible on the oral and caudal part of the scale, secondary canals around of the whole margin of the scale. Dorsal and lateral parts of the head and the body is brownish in the specimens in the formalin solution, the ventral part, except for the preoral region of the head, unicolourly yellow. Along the back there is a row of dark spots, which are distinct on my material only in larger specimens; their number agrees with the number of spots at the side of the body. Along the body side 8—10 dark, blackish grey spots in two rows, one above the lateral and the second below. Most of spots are in rows alongside the body nearly or quite opposite. Spots on smaller specimens (35—40 mm) often fuse in the strip. Some smaller specimens have the anterior part of the body light, without spots, probably owing to the mode of conservation. Behind the upper gill slit is a dark spot, in smaller specimens not always discernible. The dorsal fin mostly with one lengthwise row of dark spots on the basal part. Sporadically I found the dorsal fin covered also with a median or distal row of spots. The caudal fin with disarranged dark spots. The other fins are without spots, transparent. Only in one specimen was found a dark row of spots on the periphery of the pectoral fin, nearly parallel with it. In no specimens pigmented ventral and anal fins were found, which agrees with *Gyrinocheilus kaznakovi* (Fig. 1); dark spots were found on the dorsal and pectoral fins, which agrees again with *Gyrinocheilus pennocki* (Fig. 4). One of the principal differing characters after Fowler (1937) is the dark spot behind the upper gill slit. After Berg (1906) and Fowler (1937), its presence proves *Gyrinocheilus kaznakovi* (Fig. 1). The absence of this dark spot is typical for *Gyrinocheilus pustulosus* (after Berg, 1906) and *Gyrinocheilus pennocki* (Fig. 4). After Weber's and de Beaufort's (1916) figure though, there is in *Gyrinocheilus pustulosus* the dark spot behind the upper gill slit (Fig. 3). In smaller specimens (35—40 mm) which I examined this spot was indistinct, apparently due to the conservation.

Fowler (1937) mentions that the form of the head is the important character for the determination of both species within genus *Gyrinocheilus*. Fowler (1937) devotes no attention to the shape and the variability of the preoral region of *Gyrinocheilus kaznakovi* and *Gyrinocheilus pennocki*, while I take them into consideration since they seem to help the determination (Figs. 5, 6).

Table 1. Proportionate characters in *Gyrinocheilus kuznakovi*

Length group	I	II	III
Body length (mm)	35-40	41-50	107-121
No. of sp.	6	21	2
EL in % of BL	27.6 (25.9-28.6)	25.6 (23.3-26.9)	23.7 (23.4-23.9)
LS in % of HL	42.2 (37.9-45.0)	46.3 (40.0-52.6)	51.9 (51.7-52.0)
BD in % of BL	17.8 (17.1-18.8)	17.9 (17.0-19.0)	22.8 (22.4-23.1)
Length of C in % of BL	27.9 (26.2-29.0)	26.5 (23.1-29.0)	20.7 (20.6-20.7)
ED in % of HL	23.8 (21.0-25.0)	21.9 (19.0-25.5)	18.6 (17.2-20.0)
ED in % of LS	56.9 (46.7-62.5)	47.5 (41.7-59.6)	35.9 (33.3-38.5)
ED in % of ID	68.9 (60.0-71.4)	57.1 (44.4-64.4)	38.7 (35.7-41.7)
MW in % of HL	18.4 (15.0-21.0)	17.4 (12.5-24.1)	24.1 -
ID in % of HL	34.6 (32.2-35.0)	38.5 (33.3-42.9)	48.2 (48.0-48.3)
CP in % of length of P	24.5 (24.0-25.0)	24.9 (20.0-31.3)	34.7 (33.3-36.0)
Length of AS in % of length of V	26.9 (22.2-33.3)	25.4 (20.0-30.8)	34.2 (33.3-35.0)
Length of 1. branched rays in D in % of HL	77.7 (74.0-85.0)	80.6 (66.7-91.3)	77.4 (72.0-82.7)
Length of 1. branched ray in A in % of HL	63.0 (60.9-65.0)	69.9 (58.1-91.3)	68.8 (65.5-72.0)
Length of TG in % of ED	147.6 (139.0-156.0)	142.3 (140.0-163.6)	160.0 -
CPD in % of HL	31.1 (29.0-35.0)	35.3 (30.0-42.9)	49.9 (48.0-51.7)
Distance of vent to extremity of V in % of V	32.3 (30.5-35.0)	46.9 (31.3-61.3)	36.7 (30.0-43.3)
Distance from end of snout to CE in % of HL	56.5 (54.5-60.0)	56.4 (49.6-68.6)	58.3 (54.0-58.6)
Distance from begin of D to vertical line from basis of V in % of DB	69.2 (57.7-85.7)	61.5 (45.5-87.5)	63.2 (44.4-61.9)
HW in % of HL	54.3 (50.0-59.4)	56.1 (50.0-61.9)	71.9 (68.0-75.9)
Length of P in % of HL	77.4 (73.0-84.2)	83.1 (76.2-95.7)	85.1 (84.0-86.2)
ED in % of BL	6.4 (5.9-7.1)	5.6 (4.1-6.6)	4.4 (4.1-4.7)
LS in % of BL	11.7 (10.5-12.7)	11.8 (10.5-13.2)	12.3 (12.1-12.4)
CPL in % of BL	14.3 (11.4-16.7)	15.1 (9.6-17.8)	15.8 (15.7-15.9)
DB in % of BL	19.1 (17.1-20.6)	20.8 (17.2-25.0)	20.9 (19.6-22.3)
AB in % of BL	7.4 (5.8-8.9)	6.3 (5.2-8.4)	6.9 (6.5-7.4)
Length of P in % of BL	21.4 (20.7-22.4)	21.2 (17.9-25.3)	20.5 (19.6-20.7)
Length of V in % of BL	17.4 (14.9-19.7)	17.4 (15.6-18.9)	15.3 (14.0-16.5)

The form of the head and mouth of examined specimens agrees with the picture of *Gyrinocheilus kaznakovi* (Figs. 1, 7, 9). Snout is pointed toward the end and a little curved upwards, the upper lip is not medially emarginated (Figs. 5, 6).

The use of the position of the eye for the determination of *Gyrinocheilus kaznakovi* and *Gyrinocheilus pennocki* is impossible because *Gyrinocheilus kaznakovi* present an evident variability of this character (the distance from the end of the snout to the centre of the eye is 49.6—68.6% of the length of the head). According to Fowler (1937), in *Gyrinocheilops* the position of the eye is somewhat posterior towards the hind margin of the head, in *Gyrinocheilus* the centre of the eye is in the last third of the head. The coloration in living specimens of *Gyrinocheilus kaznakovi* (observed in four specimens, 100—150 mm, and two specimens 40 mm of total length) is olive brown on the back and sides of the body, the ventral part is yellowish to whitish; the sides of the body with rows of spots sometimes united in a strip (Figs. 11, 12). On the back is a row of brownish-black spots. Behind the upper gill slit is a dark spot, more distinct in bigger specimens. The intensity of the coloration of specimens depends on their mood. Fins yellowish, caudal with very small irregular spots, the upper lobe with the bigger dark spot. One specimen was on the dorsal part brown with indistinct spots.

In one specimen (150 mm of total length), after several minutes of intensive scraping of algae I have observed the frequency of breathing movements of opercles of 228—276 per minute in normal aquarium conditions. Another smaller specimen (100 mm of total length), resting a longer time after algae scraping, had the frequency of breathing movements of 70—112 per minute. I made this observation not on sticking, but resting specimens, held in the water temperature of 25 °C. Smith (1945) cited the frequency of breathing as 230—240 gill opercle movements per minute.

When I compared my results with Berg's (1906) data concerning *Gyrinocheilus kaznakovi* I found an overall agreement of values in plastic characters (Table 2). The deviations are due to measurements of smaller specimens than those examined by Berg (1906). He had only two specimens at disposal (the bigger specimen measured 166 mm). The biggest difference is in the eye diameter in % of the body length (my own average 5.7%, Berg's 3.0%).

Also in the average value of the transverse groove on throat in % of eye diameter I found an agreement with Berg (1906), however, I can report a bigger variability. This groove begins in the place of the junction of the suboperculum, preoperculum and interoperculum and continues transversally to the snout.

A lower value in the length of the caudal fin in % of the body length (my own ave. 26.3%, Berg's 19.6%) is caused by smaller specimens, because the relationship of the length of the caudal fin to the body length reduces relatively with the increase of the individual length (Table 1).

When I compared plastic characters with Fowler's data (1937) concerning *Gyrinocheilus pennocki* (Table 3), I found lower data as regards the average value of the width of the mouth in % of the head length (my own ave. value 18.3%, Fowler's range 26.7—33.3%), the body depth in % of the body length (my own ave. value 18.5%, Fowler's range 23.5—23.8%). Lower values are to a certain extent due not only by the measurements of smaller specimens, but probably also by their different feeding conditions in aquaria. I found the

Table 2. The comparison of author's material with Berg's (1906) concerning the species *Gyrinocheilus kuznaki* and Weber's and de Beaufort's (1916) concerning *Gyrinocheilus pustulosus*

	Own data	Average	Berg	Weber et al.
HL in % of BL	23.3—28.6	25.9	21.7	26—28
BD in % of BL	17.0—23.1	18.5	18.7	—
ED in % of BL	4.1—7.1	5.7	3.0	—
LS in % of BL	10.5—13.2	11.8	12.6	—
CPL in % of BL	9.6—17.8	15.0	19.9	—
DB in % of BL	17.1—25.0	19.8	20.8	—
AB in % of BL	5.2—8.9	6.8	7.2	—
Length of P in % of BL	17.8—25.3	21.2	24.7	—
Length of V in % of BL	14.0—19.7	17.2	17.1	—
Length of C in % of BL	20.6—29.0	26.3	19.3	—
Length of TG in % of ED	139.0—163.6	153.3	150.0	—
HL in % of length of C	91.0—104.2	96.8	—	about 100

biggest difference in the length of the cutaneous pad in % of the pectoral fin (my own ave. value 27.5%, Fowler's 42.9%) and in the length of the axillary scale in % of the ventral fin length (my own ave. value 27.6%, Fowler's 40.0%). In both cases mentioned, values increase with the growth of the specimen (Table 1). Mutual position of the dorsal and the ventral fin is very variable. The distance from the beginning of the dorsal fin and vertical line to the basis of the ventral fin calculated in % of the length of the dorsal fin was found to be 44.4—87.5 of the length of the dorsal fin basis in my material. This mark is without use for identifying *Gyrinocheilus* and *Gyrinocheilops* species. Fowler (1937) cited for *Gyrinocheilops*: "ventral origin premedian in length of dorsal base", for *Gyrinocheilus*: "ventral origin about opposite last 2/5 of dorsal base". When I compared my results with Weber's and de Beaufort's (1916) data concerning *Gyrinocheilus pustulosus*, I found lower values in the eye diameter in % of the head length (the first numbers are from Weber and de Beaufort (1916): 10—15 (my own values 17.2—22.7), in the eye diameter in % of the snout length 17—27 (my own values 36.4—44.4) and in the depth of the caudal peduncle in % of the head length 15 (my own values 36.4—50.0).

The number of fin rays in the dorsal and anal fins does not agree with Berg's (1906), Weber's and de Beaufort's (1916), nor Fowler's (1937) data (Table 4). Berg (1906) and Weber and de Beaufort (1916) cited the following formula for the dorsal fin: III/9; Fowler (1937), II/10/I and my own values are III/9/I. In the anal fin Berg found II/5, Weber and de Beaufort III/5, Fowler III/5/I, and my own values are III/4—5/I. The first unbranched ray in the dorsal and anal fins very small, flat, placed on the groove of the second one. In all fins I found the last ray unbranched along the whole length, the preceding ray is branched (Table 4). This fact may be easily overlooked. In the pectoral fin Fowler (1937) mentioned I/13, Weber and de Beaufort (1916) I/14, my own values are I/11—12/I; in the ventral fin Fowler (1937) and Weber and de Beaufort (1916) have I/8, my own value is I/7/I. It is impossible to determine whether Weber and de Beaufort (1916) and Fowler (1937) added this last unbranched ray in

Table 3. The comparison of author's material with data of Fowler (1937) concerning the species *Gyrinocheilus pennocki* and of Weber and de Beaufort (1916) concerning *Gyrinocheilus pustulosus*

	Own data	Average	Fowler	Weber et al.
HL in % of BL	23.3-38.6	25.9	26.3-31.3	26-28
BD in % of BL	17.0-23.1	18.5	23.5-23.8	19-26
LS in % of HL	37.9-52.6	44.4	42.9-44.4	-
ED in % of HL	17.2-25.5	22.1	17.2-22.7	10-15
ED in % of LS	33.3-62.5	48.6	36.4-44.4	17-27
ED in % of ID	35.7-71.4	56.4	40.0-50.0	26-40
MW in % of HL	12.5-24.1	18.3	26.7-33.3	-
ID in % of HL	32.6-48.3	38.3	36.4-50.0	-
Length of CP in % of length of P	20.0-36.0	27.5	42.9	-
Length of AS in % of length of V	20.0-35.0	27.6	40.0	-
Length of 1. branched ray in D in % of HL	60.7-91.3	79.6	75.0-80.0	-
Length of 1. branched ray in A in % of HL	60.9-91.3	66.8	60.0-71.4	-
Length of C in % of BL	20.6-29.0	26.3	30.8-35.7	-
CPD in % of HL	29.0-51.7	35.6	36.4-50.0	-
Length of P in % of HL	75.0-95.7	82.2	75.0-83.3	less than 100
Distance of vent to extremity of V in % of length of V	30.0-61.3	45.7	33.3-40.0	-
Distance from end of snout to CE in % of HL	49.6-68.6	56.3	50 and more	-
HW in % of HL	50.0-75.9	56.8	53.2-59.9	-
Distance from begin of D to vertical line from VB in % of length of DB	44.4-87.5	64.8	50 and less	-

pectoral and ventral fins to the total number of branched rays, or if this represents an actual difference within both species.

My findings of the number of scales in the lateral line are in agreement with Berg (1906), Weber and de Beaufort (1916) and Fowler (1937), but I found broader ranges (39-43 scales). Berg (1906) counted 4 scales, Weber and de Beaufort (1916) counted about 12 scales below the lateral line, Fowler (1937) counted 6 scales below the lateral line towards the anal fin and 5 scales towards the ventral fin. In the direction to the insertion of the ventral fin I found 5-6 scales, in the direction to the anal fin 4-6 scales. Above the lateral line both Weber and de Beaufort (1916) and Fowler (1937) counted 8 scales, Berg (1906) 6 scales, my own values are 6-8 scales.

A broader variability was found in the number of scales in the predorsal distance (22-27 scales), Fowler (1937) found 23-24 scales. Fowler (1937) cited only that *Gyrinocheilus* differs from *Gyrinocheilops* in larger and less numerous predorsal scales. Apparently this character is also dubious. The variability of the number of scales is given together with the variability of the size of single scales (Fowler, 1937 used this character erroneously for the differentiation of two genera) and with the individual variability of the region

Table 4. The comparison of meristic characters of author's material with data of Berg (1906) concerning *Gyrinocheilus koznakovi*, Weber and de Beaufort (1916) concerning *Gyrinocheilus pustulosus*, and Fowler (1937) concerning *Gyrinocheilus pennocki*

	Own data	Average	Berg	Weber et al.	Fowler
Number of rays in D	III/9/I	III/9/I	III/9	III/9	II/10/I
Number of rays in A	III/4-5/I	III/5/I	II/5	III/5	III/5/I
Number of rays in P	I/11-12/I	I/12/I	—	I/14	I/13
Number of rays in V	I/7/I	I/7/I	—	I/8	I/8
Scales in LL	39-43	41	39-40	40-41	39-40+2
Scales above LL	6-8	7	6	8	8
Scales below LL towards V	5-6	5	—	—	5
Scales below LL towards A	4-6	5	—	—	6
Scales in predorsal region	22-27	25	—	—	23-24
Number of gill rakers	about 140	—	—	—	40
Scales round caudal peduncle	16	16	—	16	—
Number of scales in LL to vertical line from origin of D	9-10	10	—	11	—
Number of scales in LL to vertical line from A	30-32	31	—	31	—
Number of branched rays in D to vertical line from origin of V	5	5	—	5	—

near the basis of the ventral and anal fins, where small scales may or may not appear in single specimens.

The number of gill rakers on the first gill arch is about 140. Fowler (1937) found 40 gill rakers, which is apparently a misprint. Gill rakers are compressed, flexible, united distally. The problem of pearl organs was not studied, because this character is connected with the sex and the size of males (males mature in the size 120-150 mm, Nikolskij (1971). According to Fowler (1937) pearl organs in the genus *Gyrinocheilops* are of different arrangement and apparently more numerous. Ramaswami (1951) does not mentioned differences between *Gyrinocheilus* and *Gyrinocheilops* (sensu Fowler, 1937), because he tried to prove the validity or invalidity of family Gyrinocheilidae. The validity of this family was recognized by Berg (1955), Hora (1923, according to Ramaswami, 1951), McInnery (1974), Kreisch (1967), Lindberg (1971), Ramaswami (1951), Smith (1945), Sterba (1977), Suvorov (1948).

SUMMARY

A key to the determination of the four species of the family Gyrinocheilidae was combined from Berg's (1906), Hora's (1935), Fowler's (1937) descriptions together with the author's own results, using specimens kept in aquaria.

In my opinion Czech aquarium hobbyists keep specimens of *Gyrinocheilus koznakovi* in their tanks. I suppose, at the same time, that the validity of the genus *Gyrinocheilops* established by Fowler (1937) is dubious.

I presume we can recognize only the four following species within genus *Gyrinocheilus*:

1. *Gyrinocheilus aymonieri* (Tirant, 1883),
synonym *Psilorhynchus aymonieri* Tirant, 1883

2. *Gyrinocheilus pustulosus* Vaillant, 1902
3. *Gyrinocheilus kaznakovi* Berg, 1906
4. *Gyrinocheilus pennocki* (Fowler, 1937),
synonym *Gyrinocheilops pennocki* Fowler, 1937

Key to the determination of the above-mentioned *Gyrinocheilus* species

- | | |
|--|--|
| 1 (6) Upper lip medially emarginated | |
| 2 (3) Large proboscide dorsally on snout | <i>Gyrinocheilus aymonieri</i> (Fig. 2) |
| 3 (2) Large proboscide dorsally on snout is absent | |
| 4 (5) Below lateral line about 12 scales, behind the upper gill slit dark spot | <i>Gyrinocheilus pustulosus</i> (Fig. 3) |
| 5 (4) Below lateral line towards anal fin 6 scales, towards ventrals 5 scales, no dark spot behind the upper gill slit | <i>Gyrinocheilus pennocki</i> (Fig. 4) |
| 6 (1) Upper lip not medially emarginated | <i>Gyrinocheilus kaznakovi</i> (Fig. 1) |

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The Figures 1-13 will be found at the end of this issue.

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CONTRIBUTION TO THE KNOWLEDGE OF OLIGOCHAETA FROM THE LAKE BAIKAL

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Abstract: Analysis of the material collected in the lake Baikal by Prof. Dr. M. M. Kožov*) (Irkutsk) has revealed certain taxonomically important results. These results relating to several families of Oligochaeta have been briefly described in this paper, including the following species: *Nais tygrina* Izosimov, 1949, emend. Hrabě (Naididae); *Isochaetides excavatus* sp. n., *I. acapillatus* (Finogenova, 1972) comb. n., *Pelosclex inflatus* (Michaelsen, 1901), *Lycodrilus dybowski* Grube, 1873, *Lycodrilides schizochaetus* (Michaelsen, 1901) g. n. (Tubificidae); *Pseudolycodrilus parvus* (Michaelsen, 1905), *Lamprodrilus novikovae* sp. n., *Telescolex glaber* sp. n., *Kozovetta miranda* g. n. sp. n., *Pseudorhynchelmis olchonensis* (Burov et Kožov, 1932) (g. n.) and *Styloscolex solzanicus* sp. n. (Lumbriculidae).

INTRODUCTION

The collection of Oligochaeta from the lake Baikal was obtained by the courtesy of the late Prof. Dr. M. M. Kožov from Irkutsk. The material was collected during July — October 1962 and in October 1965, using various sampling methods. The locality was indicated as the vicinity of Solzan, e. g. the southernmost part of the lake Baikal. The samples were taken from the depth of 1 to 59 m (99 samples) and from 50 to 120 m (21 samples). The collected specimens appeared to be mostly immature, especially those of the genus *Lamprodrilus*. The material contains certain taxonomically more important or even hitherto unknown species of the *Oligochaeta*. Some of them have been described in this paper.

RESULTS

Nais tygrina Izosimov 1949, emend. Hrabě
(Tab. I, Figs. 1—10)

1949 *Nais tygrina* Izosimov. Autor's dissertation. Kazan.

Taxonomic considerations: According to Sokolovskaja (1952), Izosimov was the first author to observe and name *N. tygrina*. Without any more detailed description of the species he only noted that there were dark blue strips on the dorsal side of the segments, large dimension of the body and duplicate number of the (ventral) setae, in contrast to that of *N. barbata* (= *obtusa*).

Description: The body of mature individuals consists of 33—49 segments. It is 4 mm long, 0.4 mm wide in the clitellar region, without traces of paratomy in 146 sexually mature specimens. In 12 immature specimens $n = 15—19$ seg-

*) I transliterate the Russian alphabet according to the International normalization commission (Kent Fr. L. 1956. Progrès internationaux dans le domaine de la translittération. Bull. Unesco Bibl., vol. 10. No 5—6: 135—141).

ments. The prostomium short, its basis wide. Eyes black. Two transversal dark-blue strips on the dorsal and lateral sides beginning by the 4th (3rd, 5th) and the following segments (see Tab. I. Fig. 1). Longitudinal and transversal sections reveal accumulations of dark-blue pigment granules within the internal part of the body wall on both sides of the dissepiments, while the centre of the segments is void of them (Tab. I. Fig. 2).

There are (7) 8—12 forked ventral setae on segments 2—5, the 6th segment of mature specimens contains 8 (rarely 9) modified penial setae (Tab. I. Figs. 6—7) and the 7th segment has up to 13 forked setae. The number of ventral setae gradually diminishes to 7—8 on the posterior segments. The dorsal setae appear first on segment 6. In all the bundles there are only 1—2 hair setae and 2—3 needles, which is in contrast to *N. barbata*. The forked ventral setae have an equal form on all segments. They merely differ by the length and position of the nodulus (Tab. I. Figs. 3, 4). The strongly curved upper prong is two times longer than the lower one being equally wide on the basis as proximally. Lower prong is perpendicular to setal axis. Ectal part of the ventral setae is longer than the ental one on segment 2, with the nodulus in the ratio of 1.4: 1. This difference diminishes towards the posterior segments so that on 26th segment the proportion is equal 1: 1. The ental part of the setae has a sharp end which is tapering off gradually towards the tip (Tab. I. Fig. 4). The ventral setae measure 180—215 μm on segment 2, 180 μm on 6, or 140 μm on 25 respectively. Hair setae are smooth, slender, up to 320 μm long. On the 30th segment they still measure 265 μm . Needles about 60 μm with rather sharp tip (Tab. I. Fig. 5). Penial setae are arranged by 8—9 in bundles, 185—205 μm with dilated palmate ectal end (Tab. I. Figs. 6, 7).

One pair of spermathecae open in the 5th segment near the dissepiment $\frac{4}{5}$ within the line of the ventral setae. There is one pair of the male pores in the transversal depression of the ventral side of the 6th segment, just behind the penial setae and within the line of the ventral setae. One pair of testes in segment 5 on the dissepiment $\frac{4}{5}$, one pair of ovaries in segment 6 on the dissepiment $\frac{5}{6}$. Spermathecae are formed by large, ovoid, thin-walled ampulla and by a considerably long (170 μm) duct with high cylindrical epithelial lining on the ental end. Its ental lumen is very narrow. The spermathecal ampullae are filled with spermatozoa (Tab. I. Fig. 9). One pair of male funnels opens into the sperm-sacs originating from an evagination of the dissepiment $\frac{5}{6}$. Rather large spermducts, covered at the ental part by the minute prostate cells (15 μm), open into the oblong, pear-shaped atrial ampullae (Tab. I. Fig. 9). Their epithelial lining is formed only on the ectal end by high epithelium everted in the form of conical or cylindrical penis up to 35 μm long (Tab. I. Fig. 10). Both the penes lie in rather deep median invagination on the ventral side of segment $\frac{5}{6}$. They are covered with the normal epithelium that is distinctly different from the high clitellar glandular cells. The ectal ends of the penial setae protrude out in front of the male pores.

Habitat: Lake Baikal, vicinity of Solzan, depth 1—2 m, large cobble stones, algae. July 18th and August 27th, 1963. 146 mature and 12 individuals multiplying by paratomy; No. Hr. 1724—17, 1737—70 and 82.

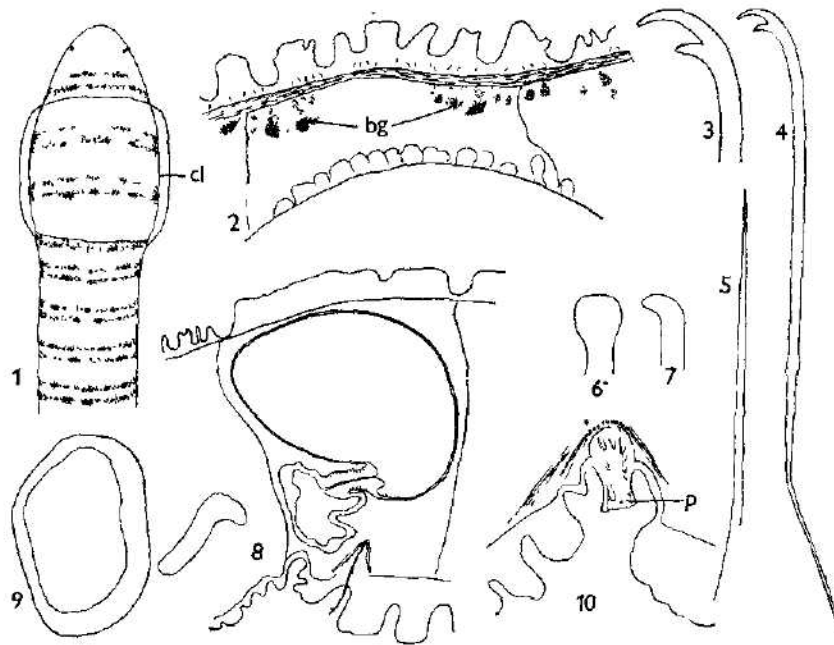
Isochaetides excavatus sp. n.

(Tab. II. Figs. 1—4)

Description: All setae forked. The dorsal crochets similar to the ventral ones without intermediate denticles. Upper prong equally long as the lower

one but much narrower. Lower prong perpendicular to setal axis (Tab. II, Fig. 4). There are 5—6 (7) setae per bundle on the anteclytellar segments, 3 (2, 4) setae on segment 10. In the mature specimens the ventral setae are missing on 11 th segment while they are 2 per bundle on this segment in the immature ones.

One pair of spermathecae opens on the lateral line of segment 10. A pair of

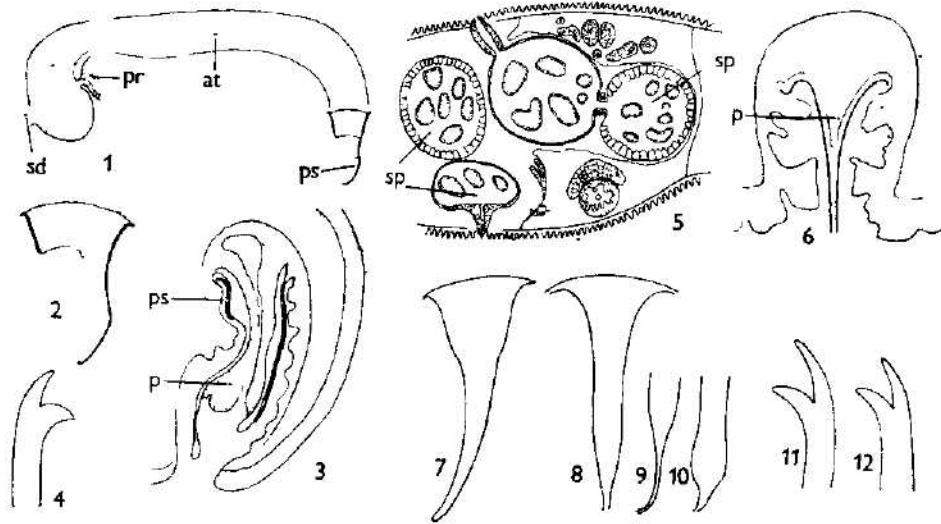


Tab. I, Figs. 1—10. *Nais tygrina* Izos.

Fig. 1. Anterior end of the body, cl — clitellum. — Fig. 2. Longitudinal section of the body-wall of segment 7—9, bg — blue granules. — Fig. 3. Ectal end of ventral seta. — Fig. 4. Ventral seta of middle segments. — Fig. 5. Ectal end of needle. — Fig. 6—7. Ectal end of penial setae. — Fig. 8. Longitudinal section of spermatheca. — Fig. 9. Atrial ampulla and part of sperm duct. — Fig. 10. Longitudinal section of ectal end of male duct, p — penis.

male pores is located in place of the ventral setae on 11th segment. Dissepiments are considerably thick. One pair of testes in segment 10 on dissepiment $9/10$, one pair of ovaries in segment 11 on dissepiment $10/11$. One pair of male funnels on dissepiment $9/10$. Long spermducts with ciliated ental part open to the dorsal side of the atrial ampulla (Tab. II, Fig. 1), the prostate gland being on the opposite side. Atrium long, retort-shaped, terminating with a large cylindrical penis surrounded by cuticular sheath. The latter appears as an ental circlet 50 μm long extending into a rounded, shovel-shaped ectal process 170 μm long. These sheaths have been found in all 6 specimens (Tab. II, Figs. 2, 3). Spermathecae consist of a large ampulla filled with spermatozeugmata and a short duct.

Taxonomic considerations: *Isochaetides excavatus* sp. n. has no modified spermathecal setae on the 10th segment as do *I. newaensis* (Mich., 1902), *I. neotropicus* (Čern., 1939), *I. acapillatus* (Fin., 1972) and *I. pusillus* (Timm, 1977). The spermathecae open in the lateral line only in *I. newaensis*, *I. acapil-*



Tab. II. Figs. 1-4. *Isochaetides excavatus* sp. n.

Fig. 1. Male duct, at - atrium, pr - prostate, ps - penial sheath, sd - spermduct. - Fig. 2. Penial sheath. - Fig. 3. Longitudinal section of ectal end of male duct, p - penis, ps - penial sheath. - Fig. 4. Ectal end of ventral seta of segment 7.

Figs. 5-12. *Isochaetides acapillatus* Fin.

Fig. 5. Longitudinal section of segment 10-11, sp - spermatheca - Fig. 6. Longitudinal section of ectal end of male duct, p - penis, - Fig. 7-10. Penial sheaths of various individuals. - Fig. 11-12. Ectal end of dorsal seta of segment 5 and 7.

latus and *I. excavatus*. Moreover, *I. newaensis* is large (45 mm long, 1-1.6 mm wide) and its setae have a short upper prong. *I. acapillatus* and *I. excavatus* are smaller, their setae have the upper prong longer than that of *I. newaensis*. Finally, *I. excavatus* differs from *I. newaensis* as well as from the other members of this genus by special form of the penial sheaths.

Habitat: Lake Baikal, vicinity of Solzan, depth 25 m, clayey sand, July 6th, 1961. 6 fragments of anterior 12-15 segments; No. Hr. 1737-94, 1737-95.

Isochaetides acapillatus (Finogenova) comb. n.

(Tab. II, Figs. 5-12)

1972 *Tubifex acapillatus* Finogenova. Tr. zool. inst. AN SSSR 51: 1883-1885.

This species possessing only the forked dorsal setae has been originally described as *Tubifex acapillatus* from the Caspian Sea by Finogenova (1972). According to my observations this species should belong to the genus *Isochaetides*. At present I have found 17 individuals in the material from Baikal that

correspond by all diagnostical features to the Caspian species described by Finogenova (1972).

Description: The upper prong of setae is in both cases longer than the lower one (Tab. II, Fig. 11). Spermathecae open in the lateral line, male pores are located in the line of the ventral setae. Spermducts very long, their ectal diameter is 16 μm in the Caspian and 17 μm in the Baikal worms, in the median portion of the spermducts the diameters are 33.6—42 and 30—38 μm and at the ectal end 28 and 29 μm respectively. Atria spindle-shaped, ducti ejaculatorii only 12 μm long. The funnel-shaped penial cuticular sheaths show identical form. They are 109.2 μm long in the Caspian species and 104—107 μm in the Baikal ones (Tab. II, Fig. 6—10). Spermathecal ampullae constricted at the middle (Tab. II, Fig. 5). Only the number of the anterior setae is larger in the Baikal specimens (3) 4—6 (7) in comparison to the Caspian ones (2—4). The dissepiments 4 (5—8) 9 are thickened in the Baikal worms, however, their thickness has not been recorded in the Caspian individuals.

Taxonomical considerations: *Isochaetides acapillatus* is characterized by the long funnel-shaped penial sheaths. This feature distinguishes the species from other members of the genus having no modified spermathecal setae as well as from those that do possess these setae.

Habitat: Lake Baikal in the vicinity of Solzan, depth 4—60 m, June 10, 1961; June 19 and July 27, 1963; fine or coarse sand containing silt and detritus. 17 fragments of the anterior segments, No. Hr. 1737—3, —14, —95, —102, —103.

Peloscolex inflatus (Michaelsen, 1901)

(Tab. III, Figs. 1—12)

1901 *Tubifex inflatus* Mich. Bull. Ac. St. Pétersbourg, 15: 141—145

1903 *Tubifex (Peloscolex) inflatus* Mich. Mitt. nathist. Mus. Hamburg, 19: 196—212

1905 *Tubifex (Peloscolex) inflatus* Mich. Wiss. Erg. zool. Exp. Baikal — S., I: 23—34.

The previously described specimens from the lake Baikal (Michaelsen 1901, 1903, 1905) had the body covered with numerous small papillae of secretion ("Hilsenpapillen" of Michaelsen 1909) and only the posterior segments with narrow strips of the secretory products mixed with detritus. The specimens contained in my material from Solzan have also the body covered with small secretory papillae and the posterior $\frac{3}{4}$ or $\frac{1}{5}$ of the body shows the stripes of secretion in transversal furrows of the contracted epidermis (Tab. III, Fig. 10). The papillae are 17—23 μm high being compressed in the antero-posterior direction (Tab. III, Figs. 6—7). On the transversal section they appear as an ovoid of $7 \times 13 \mu\text{m}$ up to $10 \times 26 \mu\text{m}$. On 3rd to 5th segment the papillae are arranged in 5 transversal rows, on other segments there are about 20 such rows. In the mature specimens the papillae are so numerous that they form almost continuous layer and the separate papillae can only be distinguished on sections.

In addition to these specimens corresponding to the Michaelsen (1901) description, there have been also specimens possessing the rings of secretion all over the body or, rarely, some having these rings only on the posterior part of the body while other segments being covered with a continuous film of the secretion without papillae. After shedding off the cuticle with the old papillae, the new cuticle shows new papillae of smaller size (7—13 μm). The new papillae are less abundant than on the segments with the old cuticle and old papillae whose size is $13 \times 23 \mu\text{m}$.

Two rows of the sensory papillae ("Sinnespapillen" of Michaelsen 1909),

(Tab. III. Figs. 7, 9) and four large glandular tubercles ("Borstentuberkeln" of Michaelson 1909), (Tab. III. Figs. 8, 10, 11) are present on each segment in addition to the described secretory papillae. The sensory papillae containing sensory cells at the level of the secretory papillae are displaced in two rows on each segment, as has been described by Michaelson (1903) (Tab. III. Fig. 9). The glandular tubercles, four in each segment, occur just before the setal bundles (Tab. III. Figs. 8, 9, 10, 11). They are also oval with the longer axis crosswise to the body axis. Their secretory product seems to be dissolved by formaldehyde fixative.

According to Michaelson (1901) the ventral setae are 3—4 per bundle on segments 2—3 (4) and 2 per bundle on other segments. In my material the ventral setae are 2—5 per bundle on segments 2—6 (8) and on segments 10, 12 and all other there is only one forked seta in each bundle. The ventral setae are missing on 11th segment. On the antecitellial segments the ventral setae occur in two forms: a) forked with upper prong much shorter than the lower one and, b) simple-pointed ones (Tab. III. Figs. 2, 3). The seta which is nearest to the lateral line is always forked, the next is mostly simple-pointed, the third is either forked or simple and only rarely it may be observed that all the 4 setae are simple-pointed on 2nd segment. Within the dorsal bundles of 2nd to 6th segment there are (2) 3 (4) short hair setae maximally 320 μm long and 4 forked setae with short prongs and some intermediate teeth (Tab. III. Figs. 4, 5). From 7th segment onwards there is only one hair and one short forked seta in most specimens investigated.

Prostomium and 2nd segment retractable. Clitellum over the $1/2$ 10—12 segment. A pair of spermathecae open before the ventral setae of 10th segment, one pair of the male ducts open in the line of the ventral setae of 11th segment. One pair of testes is in segment 10 and one pair of ovaries in segment 11. One pair of the male funnels on dissepiment $10/11$. The investigated specimens from Solzan as well as those described by Michaelson (1901) have narrow spermduct in ental part (17—20 μm). In ectal part the spermduct are about twice as wide as in the foregoing portion (34—48 μm). They lead into the apical end of the atrium. Atrium is successively widened up to the entry of ductuli of prostatic cells and from there it tapers to the ductus ejaculatorius. The latter knee-shaped and covered by aglandular epithelium. (Tab. III. Fig. 12). The internal epithelium of the atrium is glandular, higher than atrial lumen. The atrium is surrounded by circular muscle fibres which are not thicker than those of the atrium of *Pelosclex ferox*. The ejaculatory ducts end in a short (20 μm) penis lacking any cuticular sheaths. The narrow penial sac is about 60 μm long. Spermathecae consist of a large vesicle-shaped ampulla and a long narrow duct lined with high cylindrical epithelium. In front of the spermathecal pores this epithelium is replaced by a flat one.

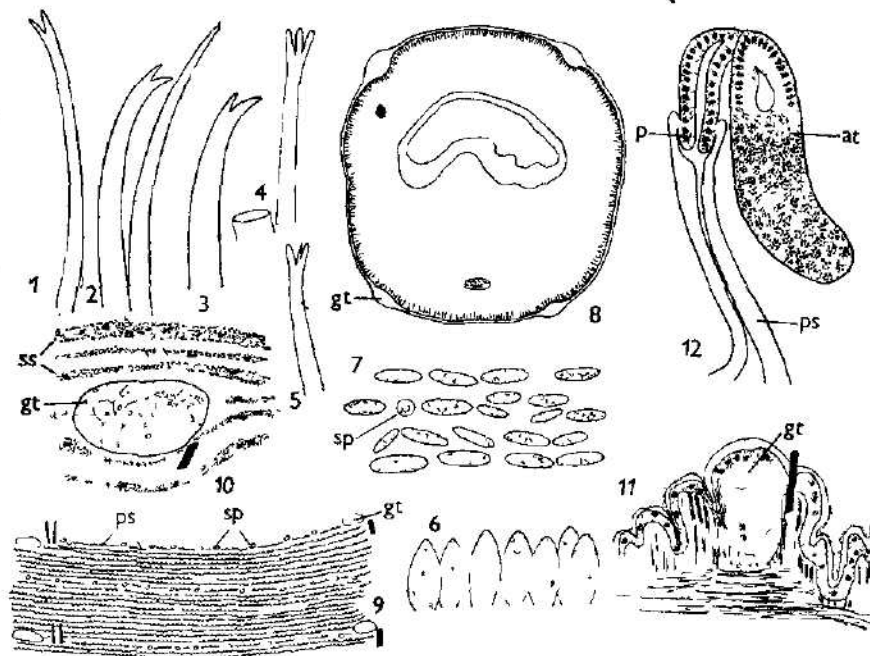
Habitat: Lake Baikal, vicinity of Solzan in numerous samples.

Taxonomic considerations: The distinction between the genera *Pelosclex*, *Spirosperma*, *Embolocephalus*, *Orientodrilus* and *Baikalodrilus* (Holmquist 1978, 1979) are according to my opinion not fully justified. The form of ventral setae, presence or absence of the modified spermathecal setae, crescent or tubular form of the atrium, ciliation of the spermaduct, or presence of thick penial sheaths do not appear to be satisfactory diagnostic characteristics for unequivocal establishment of the separate genera. According to my

opinion, all the above indicated genera should be incorporated into the common genus *Peloscolex*.

* * *

In the collection of the Baikal Oligochaeta there were some mature specimens of three species that were placed by Čekanovskaja (1962) into special fa-



Tab III. Figs 1–12, *Peloscolex inflatus* (Mich.)

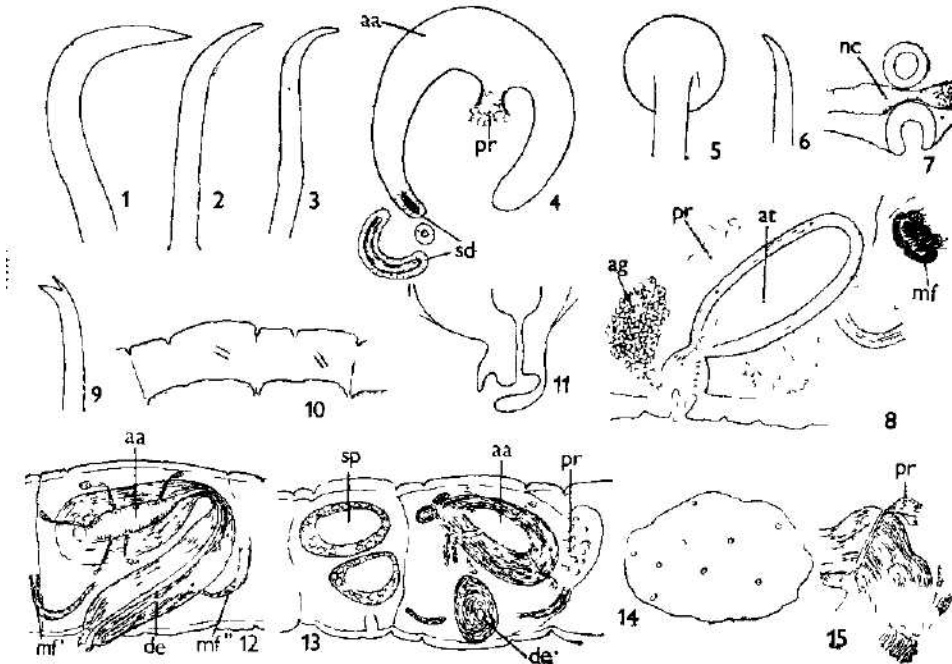
Fig. 1. Ectal end of dorsal seta of segment 3. – Fig. 2 Ectal end of two ventral setae of one bundle of segment 5 – Fig. 3. ectal end of ventral seta of segment 2. – Fig. 4–5 Ectal end of dorsal setae and transversal section of hair seta of others individuals – Fig. 6. Papillae of secrete from lateral view, sp – sensory papilla. – Fig. 7. Papillae of secrete observed from above. – Fig. 8. Transversal section of segment through 4 large glandular tubercles (gt). – Fig. 9. Structures on the surface of body, gt – glandular tubercles, ps – papillae of secrete, sp – sensory papillae. – Fig. 10 Transversal section of large glandular tubercle (gt), ss – stripes of secrete. – Fig. 11. Longitudinal section of large glandular tubercle (gt) – Fig. 12. Longitudinal section of ectal end of male duct, at – atrium, p – penis, ps – penial sac.

mily Lycodrilidae, according to the unpublished paper of P. G. Svetov. Based on the structure of the genital organs of *Lycodrilus dybowskii* Gr. and *L. schizochaetus* Mich., I came to the conclusion that these 2 taxa should belong to the family Tubificidae as the representatives of two different genera and *Lycodrilus parvus* Mich. should belong to the family Lumbriculidae. The small number of setae in the first mentioned taxa should not represent an unalterable obstacle for their classification into the family Tubificidae.

Lycodrilus Grube, 1873, emend. Hrabě

1873 *Lycodrilus* Grube. Jb. schles. Ges. vaterl. Kult., 50: 67

The setae simple pointed, ventral ones enormously long, at most 2 per bundle in antecitellial and only seta per bundle in postcitellial segments. Spermduct long, interiorly ciliated throughout the whole length. Atrium spindle-shaped crescent-shaped, ductus ejaculatorius long. Penis within cylindrical cuticular penial tube possessing characteristic round disc at the ectal end. The compact prostate large. One pair of hearts in segment 8. Spermathecae with spermathegmata.



Tab. IV Figs. 1-5. *Lycodrilus dybowskii* Mich.

Fig 1-3. Ectal end of ventral setae of segment 6, 25 and 52. — Fig. 4. Longitudinal section of atrial ampulla (aa), prostate (pr) and spermduct (sd). — Fig. 5. Ectal end of penial sheath.

Figs. 6-8. *Pseudolycodrilus parvus* Mich.

Fig. 6. Ectal end of antecitellial seta. — Fig. 7. Openings of spermathecae, nc — nerve cord. Fig. 8. Longitudinal section of atrium (at), accessory gland (ag), male funnel (mf) and prostate (pr).

Figs. 9-15. *Kozovetta miranda* g. n. sp. n

Fig 9. Ectal end of dorsal seta of segment 10. — Fig. 10. Longitudinal section of dorsal body-wall of segment 48-49. — Fig. 11. Longitudinal section of penis. — Fig. 12. Longitudinal section of male duct, aa — atrial ampulla, de — ductus ejaculatorius, mf — male funnel. — Fig. 13. Longitudinal section of segment 10-11, aa — atrial ampulla, de — ductus ejaculatorius, pr — prostate, sp — spermatheca with resorption vacuoles. — Fig. 14. Tangential section of atrial ampulla with ductuli of prostate cells — Fig. 15. Transversal section of atrial ampulle, pr — prostate cells.

Lycodrilus dybowskii Grube, 1873
(Tab. IV. Figs. 1-5)

1873 *Lycodrilus dybowskii* Grube, Jb. schles. Ges. vaterl. Kult., 50: 67
1901 *Lycodrilus dybowskii*; Michaelsen, Bull. Ac. St. Pétersbourg, 15, 183-188
1905 *Lycodrilus dybowskii*; Michaelsen, Wiss. Erg. zool. Exp. Baikal-S., 1: 15
1926 *Limnodrilus dybowskii*; Michaelsen, Rus. gidrob žur., 154-155.

Description: According to Michaelsen (1905) 2 setae occur most commonly in each bundle, rarely only one seta per bundle from segment 12. In my specimens there are 2 dorsal setae per bundle solely in some anterior segments. From segment 8 (1 case) or 9 (1 case) and more frequently from segment 10 (3 cases) or 11 (3 cases) and in all the subsequent segments there is only one seta that replaces the bundle. The ventral setae are also 2 per bundle in antecitellial segments. From segment 9 (1 case), 11 (2 cases), 12 (6 cases) there is only one seta per bundle. The ventral setae are missing on segment 11. The setae are never forked in any segment. The ventral setae of segments 2 to 10 are extraordinarily large. According to Michaelsen (1901) they measure as much as 600 μm on segments 7 and 8 and are 25 μm thick. Their long, sharp ectal end is perpendicular to the setal axis, (Tab. IV. Fig. 1). The ectal ends become shorter and straight from 12th segment (Tab. IV. Figs. 2, 3). All the dorsal setae are much smaller. Their ectal end is short slightly bent already in the anterior segments.

One pair of hearts with muscle fibres in the wall in segment 8.

Clitellum on segments 11 and 12. One pair of spermathecae opens before the ventral setae on segment 10, one pair of male ducts in place of ventral setae on segment 11. One pair of testes on dissepiment $9/10$ in segment 10, one pair of ovaries on dissepiment $11/12$ in segment 11. One pair of male funnels on dissepiment $10/11$. Spermducts very long, 30 μm wide, ciliated throughout their length. They are twisted in segment 11 and open into the narrowing ental end of the atrial ampulla (Tab. IV. Fig. 4). Each atrium of *L. dybowskii* is spindle-shaped, crescent-curved and gradually narrowed. Ductus ejaculatorius long, narrow. Penis narrow, as long as the cuticular penial tube (Tab. IV. Fig. 5). It is cylindrical, 240 μm long and about 40 μm wide on ental end, gradually narrowing to 30 μm with the characteristic disc of 85 μm in diameter at the ectal end. The penial tubes have been studied in 2 mature specimens but in toto and on one series of longitudinal sections.

Habitat: Lake Baikal, vicinity of Solzan, 10 m deep, grey sand, 8 specimens (2 mature) No. Hr 1737-46, -84, -96, -98, -99, -100

Taxonomic considerations: Michaelsen only in 1926 described the developed genital apparatus of this species. According to him, the spermduct opens into the wide rounded ental end of the pear-shaped atrium. Ductus ejaculatorius long, narrow, rolled into an incompact ball like the long spermiduct, too. Penis tubular, filling almost completely the long penial sac, the latter being furnished with a thick layer of muscle fibres. Penis and the penial sac are interiorly covered with cuticle of equal thickness. It has to be pointed out that the 2 mature specimens from Solzan have the atrium spindle-shaped (Tab. IV. Fig. 4) not pear-shaped, penis is in the cuticular penial tube and the penial sac is not covered with a thick cuticle. In spite of all these differences I am convinced that the 2 specimens from Solzan are *Lycodrilus dybowskii*.

Lycodrilides g. n.

Only the forked ventral setae of large size in some anterior segments, they are 2 to 3 per bundle, the postclitellial setae single. Spermduct long. Compact prostate large. Atrial ampulla globular. Ectal part of the male duct simple, tubular, not differentiated into 3 portions that is characteristic for the genus *Psammoryctides*. Penial tubes absent.

Type-species: *Lycodrilus schizochaetus* Michaelsen, 1901

Lycodrilides schizochaetus (Michaelsen, 1901)
(Tab. V. Figs. 1-11)

1901 *Lycodrilus dybowskii* var. *schizochaeta* Michaelsen. Bull. Ac. St. Pétersbourg, 15: 184, 187

1903 *Lycodrilus schizochaetus* Michaelsen. Geogr. Verbr. Olig.: 49

1905 *Lycodrilus schizochaetus* Michaelsen. Wiss. Erg. zool. Exp. Baikal-S., 1: 12-15.

Description: The body of one immature specimen is 36 mm long, 0.4 mm wide in segment 10 and it is composed of 125 segments. Two specimens with reduced genital organs are 0.4 mm wide in segment 10 while the width of one mature specimen is 0.8 mm in the same segment. Prostomium conical nearly as long as it is wide at the base. Antecitellial segments slightly convex, intersegmental furrows indistinct. All setae forked with a long lower prong and a rudimentary upper one which is occasionally rubbed down (Tab. V. Figs. 1, 2). In segment 2 there are 2-3 dorsal setae per bundle whereas in other segments there is only one. Ventral bundles in segments 2-4 contain 2 setae, other segments only one. Ventral setae of segments 10, 11 are missing in mature specimen although there are present in 2 specimens with the reduced genital organs. The ventral setae of 6-9th segment are unusually long and thick (Tab. V. Figs. 3-7). In one specimen they measure respectively 113, 113, 113 and 138 μm in segments 2 to 5; 169, 179, 179, 179 μm in segments 6 to 9; and 154 μm in 10, 135 μm in 11, 113 μm in 12 and 103 μm in each of the 13 to 16 segments. In fully mature specimen they are 203 μm in segment 9 and 68 μm in segment 46. The dorsal setae are shorter than the ventral ones, being 87-92 μm in segments 6 to 8.

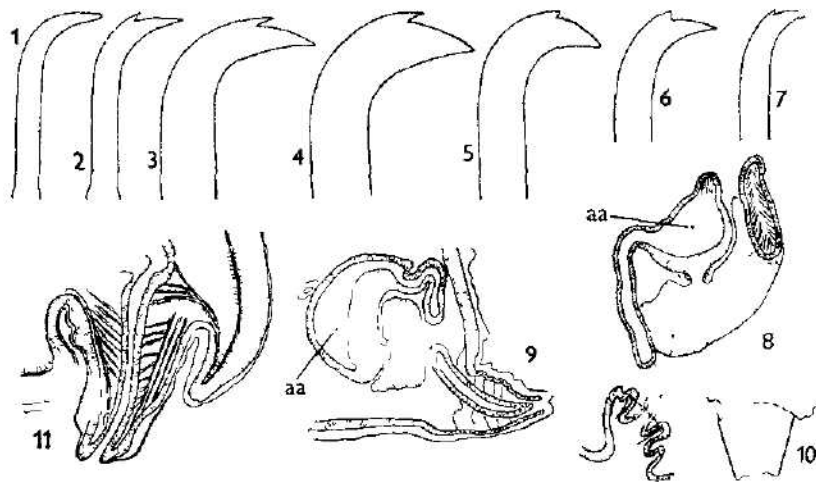
One pair of spermathecal pores above the ventral setae between the line "ab" and the lateral line. One pair of male pores in place of the ventral setae on segment 11. Dissepiments $4/5$ to $10/11$ are thick, especially the $8/9$ one. The dissepiments $10/11$ and the next are thin again. Each of the segments 2 to 7 possesses a pair of dorsoventral vessels which are especially large in the segments 4 to 7. One pair of hearts whose muscle fibres show similar structure as in the subfam. Tubificinae. Dorsoventral vessels of segments 9-11 are narrower in diameter. They are located in the posterior half of the segments. These vessels disappear after the 12th segment. The dorsal vessel from the 12th segment runs through the left side of the body.

One pair of testes on dissepiment $9/10$ in segment 10, one pair of ovaries on dissepiment $10/11$ in segment 11. One pair of male funnels on dissepiment $10/11$. Spermducts are 30 μm wide behind the funnels, further from the funnels they are 50 μm . The spermducts are in the 11th segment not extending into the 12th. They enter the rounded apex of the globular atrial ampullae just opposite

the ductuli of a large prostate (Tab. V. Fig. 8). The long, narrow ductus ejaculatorius is sharply distinguished from the ampulla. Penis is covered by the cuticle that is slightly thicker than the cuticle of the body surface (Tab. V. Figs. 10, 11).

Habitat: Lake Baikal, vicinity of Solzan, Bolšyje Koty, Utulik-Murino, depth 3 to 20 m. 16 individuals No. Hr. 1724-5, -22, 1759-12.

Taxonomic considerations: *Lycodrilides schizochaetus* has globular atrial ampullae rather like the atrial ampullae of *Psammoryctides* spp., but the ectal part of the male duct is simple. It differs by the form of atrial ampullae, absence of penial tubes and by the shape of the ectal end of setae from *Lycodrilus dybowskii*. For this reason I consider *L. schizochaetus* as the type of a separate new genus *Lycodrilides* g. n.



Tab. V. Figs. 1-11. *Lycodrilides schizochaetus* (Mich.)

Fig. 1-2. Ectal end of 2 ventral setae of one bundle of segment 4. - Fig. 3-7. Ectal end of ventral setae of segment 6, 7, 8, 11 and 12 - Fig. 8. Male duct, aa - atrial ampulla. - Fig. 9. Longitudinal section of atrial ampulla (aa) and everted penis. - Fig. 10. Cuticle of penis. - Fig. 11. Longitudinal section of ectal end of male duct.

FAMILY LUMBRICULIDAE

Pseudolycodrilus g. n.

Setae simple-pointed arranged in pairs in all bundles as common in the fam. Lumbriculidae. The edges of the longitudinal muscle bands are not curled. There are two pairs of testes in segments 9 and 10 on dissepiments $8/9$ and $9/10$, one pair of ovaries in segment 11 on dissepiment $10/11$. One pair of spermathecae in segment 8 and two pairs of male funnels on dissepiments $9/10$ and $10/11$. One pair of male ducts open in segment 10, their ampullae covered with a diffuse prostate glands. One pair of female funnels on dissepiment $11/12$.

Type-species: *Lycodrilus parvus* Michaelsen, 1905

Pseudolycodrilus parvus (Michaelsen, 1905)
(Tab. IV. Figs 6-8)

1905 *Lycodrilus parvus* Michaelsen, *Wiss. Erg. zool. Exped. Baikal-S*, 1: 18-20

Description: The body approx. 12-22 mm long, 0.4-0.6 mm wide; consisting of 65-75 segments. Prostomium rounded, shorter than the width of the metastomium. Intersegmental furrows $\frac{2}{3}$ and the following distinctive. Segments convex. Setae simple-pointed slightly curved. in 2 ventral and 2 dorsal pairs (Tab. IV. Fig. 6).

One pair of spermathecae open in segment 8 behind the ventral setae close to the ventral median line (Tab. IV. Fig. 7). One pair of male pores in segment 10 behind ventral setae and centrally from their line. too. Chloragogen cells cover the alimentary canal from segment 6. Two pairs of testes in segment 9 and 10, one pair of ovaries in segment 11. Spermathecae with large oval ampullae filled with spermatozoa and rather long distinctly delimited ducts dilated towards the end. Two pairs of the male funnels attached to the dissepiment $9/10$ and $10/11$ in segments 9 and 10. Spermducts are 8 μm wide. The second pair runs backwards into the 11th segment and before its posterior part returns to segment 10. They enter through the muscular layer of the atrial ampulla at the middle of its length. The atrial ampullae are oval, about 120 μm long 50 μm wide, with a thick layer of the muscle fibers (Tab. IV. Fig. 8). They are covered by bundles of long prostate cells. A narrow and relatively short ductus ejaculatorius has an appearance of a dome-like bulb. It ends in the oblong penis 25 μm long. lying in a penial sac of almost the same length. Proximally to the ventral setae in segment 10 and the male pores there is a bundle of dark accessory glandular cells 78 μm long. They probably supply their products into the penial sac or just in front of it on the body surface but not into the atrial ampulla. One pair of female funnels on dissepiment $11/12$ in segment 11.

Habitat: Lake Baikal, vicinity of Solzan, depth 41 m, Sept. 29, 1961. Two anterior fragments of mature specimens, 3 complete immature specimens. No. Hr. 1724-1.

Taxonomic considerations: The described specimens show some important common characters with *Lycodrilus parvus* Michaelsen, 1905: 2 single pointed setae per bundle in all segments (as in Lumbriculidae but not in Tubificidae!), one pair of spermathecal pores in segment 9 medial to the line "a", one pair of male pores in segment 10 and one pair of the particular accessory glands before the male ducts. Moreover, according to Michaelsen (1905) *Lycodrilus parvus* has one pair of ovaries in segment 10, but one pair of female funnels in segment 11. I have several reasons to doubt the reliability of these data as well as especially the exact number of the male gonads and male funnels. Although Michaelsen (1905) had available many mature specimens from 5 localities of the Lake Baikal, he established the indicated data on a single series of sections.

Pseudolycodrilus possesses spermathecae and male pores in the segments 8 and 10 respectively like in the genus *Rhynchelms* and *Rhynchelmoides*. It differs from these genera by the atria, by the approached pores of the spermathecae and by some other characters. In addition, it also differs from *Rhynchelmoides* by 2 pairs of the spermducts. The palaearctic genus *Rhynchelms* is characterized by very long tubular atria. Spermducts enter into the atrial wall near the apical end of the atrium and directly open into its lumen. The body

is trapezoid and only some anterior segments are cylindrical. The bands of longitudinal muscles are curled. Long proboscis is present in all species except *Rhynchelmis komareki* f. *brevisrostra* which lives in the depths of 100—200 m in the lake Ochrida where individuals having short rounded-off prostomium predominate (Hrabě 1931). Similar exception is *Rhynchelmis brachycephala* from the lake Baikal (Michaelsen 1905). It appears, however, that the length of the proboscis depends primarily on the depth of the habitat and not on contraction of the muscles, as previously assumed by Michaelsen (1905).

The nearctic *Rhynchelmoides* Hrabě (1936: 11) with the species *elrodi* (Smith and Dickey), *glandula* (Altman), *alascana* (Holmquist) and *brooksi* (Holmquist) differs quite significantly from the eurasiatic *Rhynchelmis*. Their tubular atria are much larger than spermducts. In *Rhynchelmoides* there are only posterior male funnels and spermducts. The spermducts enter the atrial wall already at the ectal part of atrium and continue inside the wall to the ental end of the atrium where they open into the lumen subapically (In *R. brooksi* they enter the atrial wall subapically before the ental end). The spermducts are thin and inconspicuous as stated by Holmquist (1979). Longitudinal muscles are not curled. Their body is cylindrical as in *Thinodrilus ambiguus* (= *Lumbri-culus variegatus*). I feel that these differences between *Rhynchelmis*, *Rhynchelmoides* and *Pseudolycodrilus* are sufficient to substantiate the distinction of the separate genera.

Lamprodrlus novikovae sp. n.*

(Tab. VII. Fig. 1.)

Description: The body of one mature specimen is 30 mm long, 1.3 mm in maximum width and consists of 79 segments. The second specimen has 102 segments and it is 1.5 mm wide. Prostomium elongated, longer than the width at its basis. Antecleithelial intersegmental furrows distinctive. The anterior and median segments are not convex but flat. Setae not forked, slightly curved to the ectal end. Two pairs of male ducts open posterior to the ventral setae in segments 10 and 11 (in another specimen in 9 and 10). Two pairs of spermathecal pores posterior to ventral setae in segment 13 and 14 (in the other specimen in 12 and 13). Epidermis is 17, 10 and 9 μm thick in segments 23, 40 and 60 respectively. The longitudinal muscular layer is 103, 93 and 86 μm thick in the same segments, i. e. the epidermis is 6, 9 and 10-fold thinner than the longitudinal muscular layer. These values are not true for the whole segmental surface because the thickness of the longitudinal muscular layer is smaller on the dorsal side than on the lateral one. Pharyngeal glands in segment 3 and 4.

The dorsal vessel communicates with the ventral one by one pair of dorso-ventral vessels in each of the 2 to 30 (35) segments. These vessels are not provided with the chloragogen cells. They originate of the dorsal vessel near the posterior dissepiment of the indicated segments. From segment 35 up to the distal end there are 2 pairs of vessels covered by the chloragogen cells in each segment. These are at first short without special outgrowths but further on they are branched into several vessels, often very long and without the blind outgrowths (Tab. VII. Fig. 1). The anterior pair communicates with perivisceral

*) I dedicate this species to the memory of biochemist, candidate of science M. A. Novikova-Smirnova (1900—1982).

plexus through one branch at the level of the lateral line, similarly like in many other species of the genus *Lamprodrilus*. The lateral vessels are especially well developed in the posterior segments.

First pair of nephridial funnels on dissepiment $6/7$. Two pairs of testes and cylindrical atria in segment 10 and 11 (or in 9 and 10), their male funnels on dissepiment $10/11$ and $11/12$, (or $9/10$ and $10/11$). One pair of ovaries in segment 12 (or 11), one pair of female funnels on dissepiment $12/13$ (or $11/12$). Two pairs of spermathecae in segment 13 and 14 (or 12 and 13), one pair of the sperm sacs filled with spermatocytes reaches the dissepiment $13/14$. Copulatory glands missing.

Habitat: Lake Baikal vicinity of Solzan, 41 m deep, detritus, Sept 29, 1961. 3 mature specimens among several immature ones. No. Hr 1724-1.

Taxonomic considerations. The new species differs from the hitherto described species of the genus *Lamprodrilus* by the number of spermathecae. Only the form *tetratheca* of *Lamprodrilus satyriscus* has 2 pairs of these organs as well, but it has 3 pairs of atria and special copulatory glands. Neither Michaelsen (1901) nor Izosimov (1962) have stated the diagnostic characters of the various forms of *L. satyriscus*, except the differences in the number of components of the genital organs. I expect, therefore, that all the forms of this species would have a similar vessel system as *L. satyriscus satyriscus*, namely only one pair of the lateral vessels in the median segments, whereas the newly described species has two pairs.

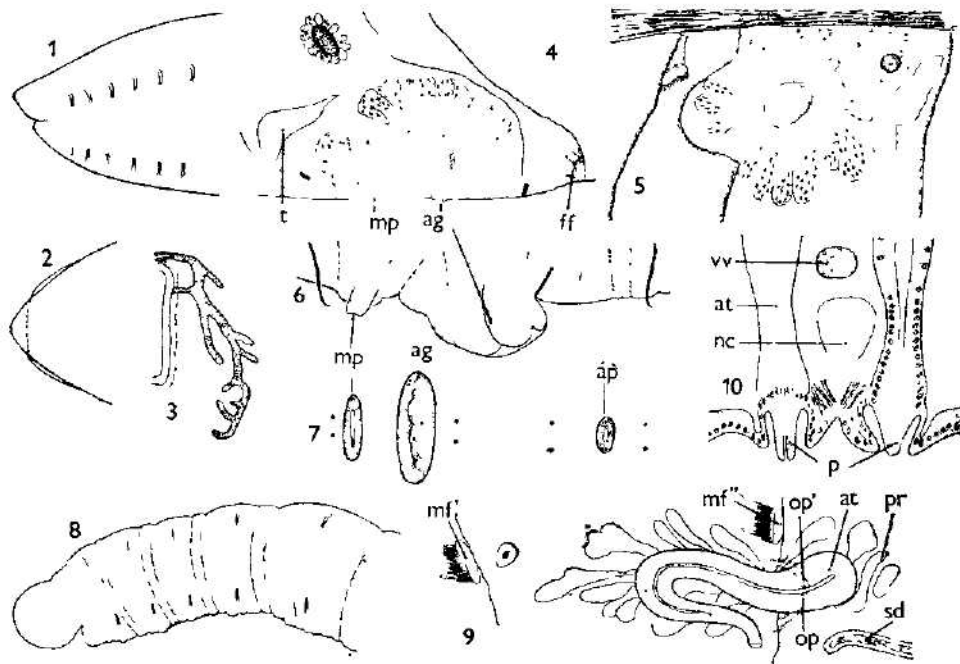
Teleuscolex glaber sp. n.
(Tab. VI Figs 1-7)

Description. The body of 9 specimens is smooth, reminiscent to that of a Nematoda. Intersegmental furrows not visible even on longitudinal sections. Fragments of the anterior end of mature specimens are 1.7-2 mm wide. The cylindrical body consists of up to 130 segments. Prostomium conical, very short (Tab. VI Figs 1-2). Ventral setae of segments 7, 10 and 35 are respectively 237, 273 and 185 μm long, simple-pointed, somewhat bent at the ectal end. One pair of male pores in form of a transversal slit located posterior to the ventral setae of 10th segment (Tab. VI Fig. 7). One pair of large oval accessory copulatory glands posterior to the male pores on the same segment. One pair of spermathecal pores behind the ventral seta of segment 12.

Cuticle thin, epidermis 8.6 μm in segment 10, circular musculature 4.3 μm and longitudinal musculature maximally 8.5 μm thick. The integumental wall very thin relative to rather large diameter of the segments. One pair of transversal dorsoventral vessels in each of the 2 to 18 segments without chloragogen cell covering. From the segments (16) 18-19 there is one pair of lateral vessels in each segment and these are coated by the chloragogen cells. In segments 35-40 there are two pairs of the lateral vessels in each segment and these contain numerous blindly ending appendages (Tab. VI Fig. 3). The posterior pair of the vessels has fewer appendages and it is shorter than the preceding one.

One pair of testes on dissepiment $9/10$ in segment 10. One pair of ovaries on dissepiment $10/11$ in segment 11. One pair of the male funnels on dissepiment $10/11$. Spermducts about 30 μm wide are running along dissepiment $10/11$ to the ventral side. They do not enter segment 11 but turn upwards and enter

the wall of atrial ampulla in its upper quarter opening into its cavity at the apical end. Atria tubular, long and narrow, either rolled up in segment 10 or extended into 11th segment. Their diameter is approx. 65–77 μm . Epithelial layer is 13 μm , muscle layer 6–9 μm . Prostate glands 45 μm long covering the whole surface of the atrial ampulla. Atria narrowing towards the ectal end open to the body surface without forming a fold, i. e. the first stage of the growing penis. Only one specimen shows everted cylindrical penes. Ectal part of the male duct is surrounded by scarcely visible tissue without glandular cells but possibly with fine muscle fibres.



Tab. VI Figs. 1–7. *Teleuscolex glaber* sp. n.

Fig. 1–2. Anterior end of the body from lateral and ventral face. — Fig. 3. Lateral vessel. — Fig. 4–5. Longitudinal and transversal section of male pore (mp), accessory gland (ag), ff — femal funnel and testes (t). — Fig. 6. Ventral side of segment 11, ag — accessory gland, mp — male pore. — Fig. 7. Opening of male pore (mp), of accessory gland (ag) and of spermatheca (sp).

Figs. 8–10 *Pseudorhynchelmis olchonensis* (Bur.-Kož.)

Fig. 8. Anterior end of body. — Fig. 9. Atrium (at), male funnel (mf), opening of spermatheca (op, op') into the atrium (at), prostate (pr) and spermatheca (sd). — Fig. 10. Transversal section of ventral part of segment 11, at — atrium, nc — nerve cord, p — penis, vv — ventral vessel.

One pair of large accessory copulatory glands posterior to male pores in segment 10 (Tab. VI. Fig. 4–7). The glands are formed by bundles of pear-shaped glandular cells up to 130 μm long with rather homogeneous protoplasm and

with ovoid nuclei. The glands discharge some secretory products between the epithelial cells (50 μm long) of the fissure-shaped invagination which is 170 μm deep. Spermathecae not fully developed.

Habitat: Lake Baikal, vicinity of Solzan, depth 7 and 14m, sand containing silt, Oct 13, 1965; 9 specimens No. Hr. 1753-1, 1753-9

Taxonomic considerations: So far only 3 species of the genus *Teleuscolex* have been known. The segments of *T. korotneffi* Mich. and *T. grubei* Mich. are convex with deep intrasegmental furrows. In *T. baicalensis* (Gr.) the furrows are hardly visible and in the new species *T. glaber* they are completely absent. *T. glaber* differs from *T. baicalensis* by the presence of one pair of large copulatory glands in 10th segment, similarly as in *T. grubei*. The glands are developed already in the specimens lacking spermatozoa on the male funnels and in the sperm sacs.

Kozovetta g. n.

Setae in pairs. One pair of spermathecae in segment 9, one pair of male ducts ending in segment 10. Two pairs of male funnels displaced freely in the cavity of segments 9 and 10. Each spermduct is considerably wide at the ental end, then it is constricted and again widened towards its entry to the ectal end of the atrial ampulla. The ampulla cylindrical, thick-walled, covered with sparse prostate glands. It is constricted towards the ectal end extending thus into the pointed end of ductus ejaculatorius which is likewise thick-walled and longer than the atrial ampulla (Tab. IV. Fig. 10). Penis inconspicuous, beak-like. Lateral vessels absent in postclitellial segments. The new genus differs remarkably from the other genera of Lumbriculidae by special form of the male ducts.

Type-species: *Kozovetta miranda* sp. n.

Kozovetta miranda sp. n.

(Tab IV Figs. 9-15)

Description: Body about 10 mm long, 0.3 mm wide at most, consisting of 50 segments. The inter- and intrasegmental furrows are significantly deep all over the body (Tab. IV. Fig. 10). All setae arranged in pairs, with upper prong narrow and slightly longer than the half of the lower wider prong (Tab. IV. Fig. 9). The lateral vessels in the postclitellial segments are not developed.

One pair of spermathecae open behind the ventral seta within the "a" line of segment 9; one pair of male ducts open behind the ventral setae of segment 10 slightly more medially from the line "ab". Two pairs of testes on dissepiment $8/9$ and $9/10$ in the segments 9 and 10. One pair of ovaries on dissepiment $10/11$ in segment 11. Two pairs of male funnels unattached to the dissepiments are situated freely in the segments 9 and 10. The anterior pair occurs in front of the dissepiment $9/10$, the posterior is before the $10/11$. Each funnel is continued into a wide spermduct which is suddenly constricted in segment 10, running further to the ductus ejaculatorius and opening finally as wide duct into the ectal end of the atrial ampulla. The ampullae are long, oval, with very thick (35 μm) muscle layer. The prostate cells on the atrial ampulla are not numerous (Tab. IV. Figs. 13-15). The cavity of the atrial ampulla is transformed at the ectal end into a short narrow duct protruding into the conical ental end of the cylindrical wide ductus ejaculatorius. The ductus ejaculatorius is longer than the atrial ampulla. Its cavity is inconspicuous, the wall contains similar muscles

as the ampullae. The ampullae are 320 μm long and maximally 135 μm wide. Ductus ejaculatorius is 400 μm long, 103 μm in diameter, its muscle layer up to 40 μm thick.

At the end of the male duct on the surface of 10th segment there is a small (28 μm) beak-like penis which is covered by integumental cuticle. The male duct of one specimen is in the coelom of segment 10 (except for the male funnel), the duct of the opposite side occupies the coelom of 3 segments; atrial ampulla is in segment 12 and ductus ejaculatorius from dissepiment $11\frac{1}{2}$ in segment 11 to segment 10. Spermathecae have a spherical ampulla and the ducts are longer than the diameter of the ampulla. One pair of female funnels on the anterior side of dissepiment $11\frac{1}{2}$. The anterior pair of the sperm sacs expands from dissepiment $8\frac{1}{9}$ into the 8th segment. One pair of ovisacs reaches segment 15.

Habitat: Lake Baikal, vicinity of Solzan, depth 41 and 54–60 m, sand containing silt; June 10 and Sept 29, 1961 14 fully mature specimens, No. Hr. 1724–1, 1737–102

Pseudorhynchelmis g. n.

Prostomium rounded without forming a proboscis. Longitudinal muscles of the body do not curl inwards at their margin. The spermathecal segment (8th) is separated by another segment from the atrial one (10th). Spermathecae do not communicate with the oesophagus. Two pairs of testes in segment 9 and 10. Two pairs of spermducts open into long, pear-shaped atria directly in their lumen near the apex. The posterior pair of the spermducts is longer than the atria. Spermducts much wider at the ental part than at the ectal one. Penes distinctly developed in the penial sacs.

These characters seem to be quite sufficient for distinguishing this new genus from *Rhynchelmis*, *Rhynchelmoides* and from other genera of the fam. Lumbriculidae.

Type-species: *Rhynchelmis olchonensis* Burov et Kožov, 1932

Pseudorhynchelmis olchonensis (Burov et Kožov, 1932)

(Tab. VI. Figs 8–10)

1932 *Rhynchelmis olchonensis* Burov-Kožov. Trudy vost. sibir. Univ., 1: 82–84

Description: Cylindrical body 14 mm long and 0.36 mm in maximum width, consists of 73–75 segments. Prostomium rounded, shorter than the width at its basis (Tab. VI. Fig. 8). Setae simple-pointed with slightly curved ectal end. Clitellum well developed on segment 10–13. One pair of spermathecal pores in 5 specimens posterior to the ventral setae and slightly medially from the line "ab" occur on segment 8 (in 6th specimen on segment 9). One pair of male pores at the end of conical penes, posterior to ventral setae in segment 10 (in the 6th specimen in 11). One pair of female funnels in intrasegmental furrows $11\frac{1}{2}$ (in the 6th specimen in $12_{1,1}$).

The longitudinal muscles are not divided into 7 bands that curl inwards. Pharyngeal glands in segments 4 to 8. Lateral vessels absent from the post-clitellial segments.

Two pairs of testes on dissepiment $8\frac{1}{9}$ and $9\frac{1}{10}$ in segment 9 and 10. One pair of ovaries on dissepiment $10\frac{1}{11}$ in segment 11. Spermathecae with large oblong ampullae and distinctly separated long ducts. One ampulla commonly fills the upper half of the coelom in segment 8, the other occupies equal space in segment

9. The ampullae do not communicate with oesophagus. Male funnels on dissepiment $^{10}/_{10}$ and $^{10}/_{11}$. Spermducts are $30\ \mu\text{m}$ wide at the ental half and $17\text{--}21\ \mu\text{m}$ at the ectal one. They are longer than the atria. The second pair of the spermducts extends into the posterior quarter of the 11th segment returning then into the 10th segment as a narrow ectal part which runs parallel with the ental portion of the first pair. The anterior and posterior spermduct enter directly the atrium near its apical end (Tab. VI. Fig. 9).

Atria long, pear-shaped (not tubular) located to segment 10 and prolonged in most specimens into segment 11. They are covered with bundles of prostate cells. Penes short (μm), conical, occurring in shallow penial sacs (Tab. VI. Fig. 10). No bundles of any glandular cells have been seen around the ventral setae of 10th segment indicated by Bur ov (1932).

Habitat: Lake Baikal, vicinity of Solzan, depth 3–4.6 and 36 m, grey sand, detritus, sand stones; July 15, 1962 and June 6, 1963. 8 specimens No. Hr. 1724–2, 1724–5.

Styloscolex solzanicus sp. n.

(Tab. VII. Figs. 2–6)

Description: Mature specimens 25 to 30 mm long, max. width 1.4 mm, consisting of at least 130 segments. Antecitellial intersegmental furrows are not clearly expressed or are virtually absent (Tab. VII. Fig. 2). The intra- and intersegmental furrows are clearly visible only on the posterior somewhat convex segments while the anterior segments are flat. Prostomium conical, much shorter than its basis. Simple-pointed setae slightly curved at ectal end. Dorsal setae of one mature specimen 236, 265 and $295\ \mu\text{m}$ long in the 4th to 6th segment respectively, ventral setae $283\ \mu\text{m}$ long in segment 6.

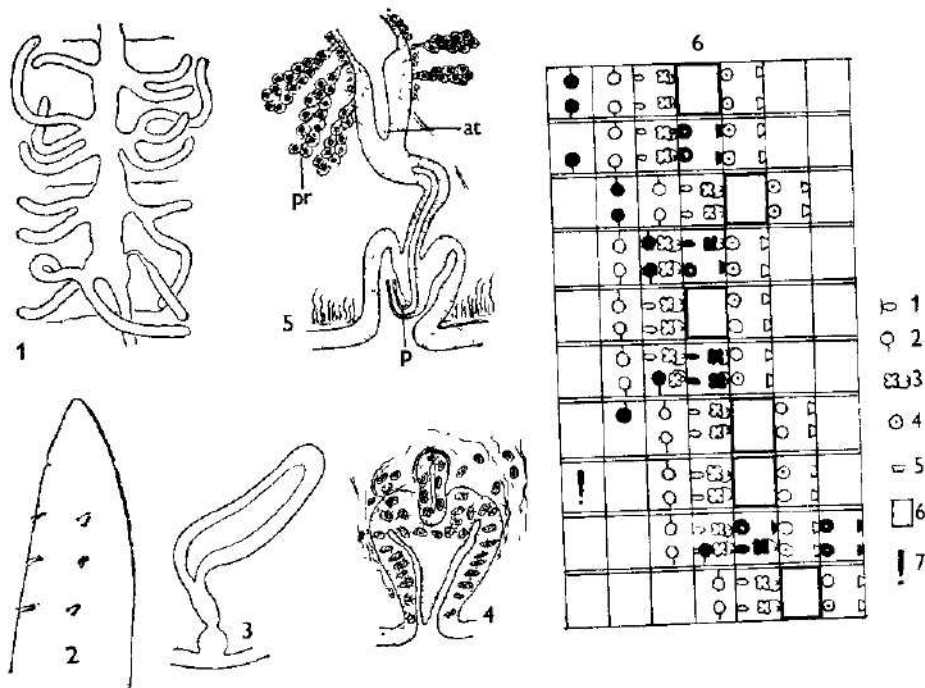
The thickness of epidermis is $13\text{--}21\ \mu\text{m}$ in 7th to 8th segment, circular muscles $10\text{--}18\ \mu\text{m}$ and longitudinal muscles of segment 8–12 are $80\text{--}120\ \mu\text{m}$ thick. Chloragogen cells covering the alimentary tract are narrow, $80\text{--}125\ \mu\text{m}$ long. Very long dorsoventral vessels form several closed loops; they do not form a dense network in anterior segments, they are shorter posteriorly and from 25th segment are not present.

The number and position of the separate portions of the genital system are considerably variable (Tab. VII. Fig. 6). Out of 14 sectional specimens only 5 had the arrangement of the genital system that would correspond to usual situation in this genus. The genital organs of 9 specimens are situated in other than usual segments and, in addition, the number of certain components of the genital system is increased. Thus, for example, 7 individuals have one or two additional spermathecae in the segment that precedes or follows the segment with the normally placed receptacula. Most commonly there is one pair of the male ducts but exceptionally 3 specimens have one or two supernumerary male ducts.

In 10 specimens the ovaries are separated from the testicular segment by an intercalary segment (without testes). Only in 2 specimens the ovarial segment follows the testicular one and, in 2 specimens the testicular segment appears to be followed by a segment containing one additional testis and one supernumerary ovarium.

Each funnel of the male ducts is situated on the anterior surface of the dissepiment at posterior part of the testicular segment. The narrow ($20\ \mu\text{m}$) spermduct runs along the anterior surface of the indicated dissepiment to ventral side of the body. It does not enter other segment but penetrates directly

the wall of atrium at its ektal end and opens into its cavity. The atrial ampulla is tubular, narrow and considerably prolonged. In some specimens it occupies 3 segments. The cavity of the ampulla is approx. 55 μm . The ampulla is covered interiorly with cuboidal epithelium 9–12 μm high. The muscular layer is only



Tab. VII. Fig. 1. *Lamprodrilus novikovae* sp. n.

Fig. 1. Lateral vessels.

Figs 2–6. *Styloscolex solzanicus* sp. n.

Fig. 2. Anterior end of the body. — Fig. 3. Spermatheca, — Fig. 4. Penis of non fully mature individual. — Fig. 5. Ectal end of male duct of mature specimen, at — atrium, pr — prostate. — Fig. 6. Scheme of genital apparatus of various individuals, 1 — testes, 2 — spermatheca, 3 — male duct, 4 — ovarium, 5 — female funnel, 6 — intercalary segment, 7—5 normal specimens. Black figures—additional organs.

3 μm thick, the bundles of the prostate cells that cover the whole atrial ampulla are up to 110 μm long. The male ducts end up in the penis (Tab. VII. Figs. 4–5) which is not covered by cuticular sheath.

Habitat: Lake Baikal, vicinity of Solzan, Bolšyje Koty, Utulik-Murino, depth 3–60 m; 17 mature specimens No. Hr. 1724–3, –4, –5, –6, 1737–102, 1759–4, –6 and –11.

Taxonomic considerations. New species differs from the majority of *Styloscolex* species by Ascarid — like form of the body without inter- and intrasegmental furrows, from *Styloscolex* by the form of male duct, described by Michaelsen (1905), especially by the presence of thick prostate and various disposition of genital organs.

P. S. In 140 samples taken from the southern littoral of Lake Baikal by prof. M. Kožov in 1963—1965 — from the vicinity of Solzan between the mouths of the Utulik and Murino rivers, I do not found *Nais variabilis*, *Tubifex tubifex*, *Pelosclex velutinus*, *Stylodrilus heringianus*, *Stylodrilus parvus* and *Lumbri-culus variegatus*, recently (1978) recorded from the same localities by hydro-biologist.

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ENERGY VALUES OF THREE SIZE GROUPS OF SOME INDIAN AND EXOTIC MAJOR CARPS (PISCES)

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Abstract: Energy values of groups of small, medium and large size fishes of some Indian and exotic major carps were determined using wet-oxidation method. The caloric values did vary greatly between three size groups of each fish tested; the inter specific variation in the young stage was not significant while such variations were distinct in the medium and large sized fishes. The energy content of the fishes, in general, increased linearly with rise in organic carbon, organic matter and total nitrogen of the body.

INTRODUCTION

Energy values in different species of Indian major carps at their prespawning maturity stages have seldom been measured. Q a s i m et al (1973) have, however, reported the calorific values of some Indian marine fishes and the food ingested by them. The purpose of this study was to compare the calorific values of the body muscles of different size members of Indian and exotic major carps.

MATERIAL AND METHODS

Different size-groups of major carps viz., catla (*Catla catla*), rohu (*Labeo rohita*), calbasu (*L. calbasu*), mrigal (*Cirrhinus mrigala*), common carp (*Cyprinus carpio*) and silver carp (*Hypophthalmichthys molitrix*) grown in a local fish farm were collected. These fishes were classed into three groups on the basis of their length and weight viz, (i) 3 to 250 g, (ii) 250 to 800 g and (iii) 1.3 to 3.0 Kg. The body muscles (somatic tissue) were taken from various parts of body which were then heated in a hot air oven set at 80° C until constant weights were obtained. The loss in weights by drying was taken as the weights of water. Dried tissues were homogenized and the calorific values were determined according to wet oxidation method (Winberg, 1971). The results were then compared in a Bomb calorimeter, which always exceeded within 5%. At least six to eight specimens of the same weight group of each species were examined and three estimations were made for each test-fish. The mean caloric content per gram dry weight of the tissue were obtained. Measurements of organic carbon, organic matter and total nitrogen of the soma of these fishes were made using standard methods.

RESULTS AND DISCUSSION

The results of the measurement of energy contents in different species of major carps are given in Table 1. The energy values found among three size-groups of each species was compared by using one-way variance analysis. The variance ratio ($F \geq 4.67$; $P < 0.001 < 0.05$) showed that the calorific values differed greatly in three size groups of each test fish. In general, there was an increase with weight in the caloric content of the muscle (Table 1). The energy

Table 1. Calorific values of dry tissue (Kcal g⁻¹) in different fishes

Species tested	Small			Medium			Large		
	No. of fishes	Kcal g ⁻¹	No. of fishes	Kcal g ⁻¹	No. of fishes	Kcal g ⁻¹	No. of fishes	Kcal g ⁻¹	
<i>Catla catla</i>	6	4.5731 ± 0.2054	6	4.9808 ± 0.1075	8	5.547 ± 0.3821			
<i>Cirrhinus mrigala</i>	8	4.8221 ± 0.0027	8	5.0281 ± 0.0538	6	5.7494 ± 0.4692			
<i>Labeo rohita</i>	6	4.6866 ± 0.0675	6	5.06154 ± 0.0798	6	5.8748 ± 0.7706			
<i>Labeo calbasu</i>	6	4.4836 ± 0.7693	6	6.1527 ± 0.2343	7	7.0534 ± 0.2145			
<i>Cyprinus carpio</i>	8	4.5669 ± 0.1782	6	4.9764 ± 0.0473	8	5.3259 ± 0.1590			
<i>Hypophthalmichthys molitrix</i>	7	4.4651 ± 0.1685	6	5.8388 ± 0.0589	6	6.0583 ± 0.2666			

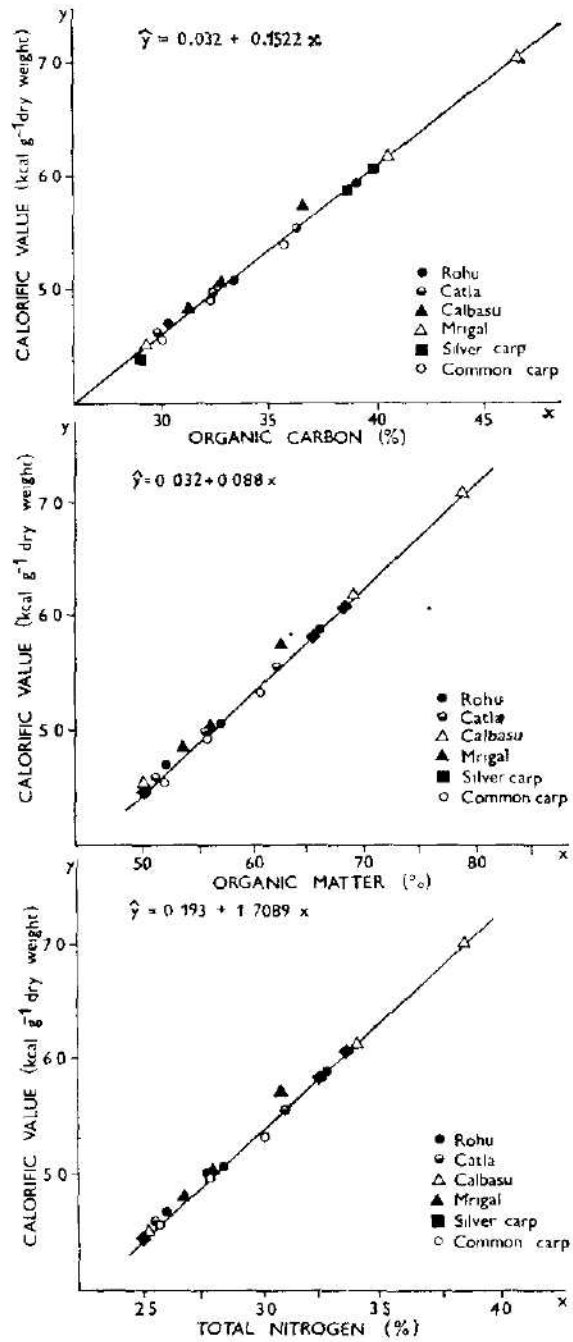


Fig. 1. Relationships between calorific value and main body constituents in different species of major carps.

values of the medium size-group of common carp was as high as 1.08 fold than the smaller fishes ($P < 0.05$) but these two groups did not differ in catla and mrigal ($P > 0.05$). Further, common carp and silver carp failed to show significant difference ($P > 0.05$) between the medium and large size fishes. By contrast, the energy content in larger fishes of mrigal, calbasu and rohu was always high as compared with members of medium size ($P < 0.05$). Again, calorific difference was significant ($P < 0.01$) between the medium and small groups of both silver carp and calbasu. The energy values found in various stages of maturity proved very responsive to changed main body constituents. Evidently, calorific differences between physiological states of individual are very common (Paine, 1971).

The calorific values of dry body weight hardly differed ($F = 0.402$; $P > 0.05$) during early stages between six species while the values varied quite in terms of fresh biomass ($F = 6.186$; $P < 0.01$). Calorific values of both dry and fresh muscle remained fairly distinct in the medium ($F \geq 56.54$; $P < 0.001$) and large ($F \geq 5.96$; $P < 0.001$) sized fishes of major carps. Among all fishes, calbasu and common carp contained the maximal and minimal energy values respectively. Common carp, catla, mrigal and rohu were grouped together as no calorific differences were observed in these fishes either in the medium sized ($P > 0.05$) or in the larger fishes ($P > 0.05$); the differences were high ($P < 0.01$) between the fishes of this group and any of silver carp and calbasu. In case of larger fishes, there was no significant difference between calbasu and silver carp, despite such a difference was pronounced in the medium sized fishes. Again, calbasu contained fairly high energy ($P < 0.01$) than that of silver carp irrespective of size.

It is known that caloric values of an animal is dependent primarily on the fat and mineral content of the body (Slobodkin and Richman, 1961; Cummins and Waycheck, 1971). Thus Craig (1977) has observed the energy values of perch were the functions of both water and fat content of the body since an inverse relationship between them exists. In the present study, however, the relationship between calorific values in dry tissue and water content of the body did not yield any convincing result ($r = -0.144$; $P > 0.05$). Here, in all these fishes of major carps, with increase in organic carbon, organic matter and total nitrogen of the body the calorific values showed corresponding rise; the best fit equations for predictions of calorific value (Y) from these three constituents are linear as follows:

$$Y = 0.0323 + 0.15222 X \quad (1)$$

$$Y = 0.0322 + 0.0885 X \quad (2)$$

$$Y = 0.1933 + 1.7089 X \quad (3)$$

Since the greatest (1.7089) and lowest slopes (0.0885) are obtained in the third and second equations, apparently, energy value of these fishes was dependent primarily on total nitrogen and organic carbon of the body to a lesser extent. Similar linear relationships between the calorific values and the chemical components of the body in a number of animals are also reported (Ostapenya and Sergeev, 1963; Salonen et al, 1976; Grodzinski et al, 1975; Wiegert, 1965; Jana and Pal, 1980 and 1981).

The ratio of energy content to organic carbon was independent of the percentages of organic carbon of the fish body ($r = -0.0418$; $P > 0.05$) and also of the energy values of somatic tissue ($r = 0.028$; $P > 0.05$). Salonen et al

(1976) have, however, observed the dependence of the ratio of energy content to organic carbon to the percentage of organic carbon in a number of aquatic invertebrates.

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TAXONOMISCHE IDENTITÄT DER ANAS SUBMAJOR JÁNOSSY, 1979 (AVES: ANSERIFORMES) AUS DEM OBERPLIOZÄN UNGARNS

Jiří MLÍKOVSKÝ

Eingegangen am 16. Oktober 1980

Abstract. Bone remains described as *Anas submajor* have been restudied. *Anas submajor* is shown to be a synonym of the recent *Tadorna tadorna*.

EINLEITUNG

Im August 1980 hatte ich Gelegenheit im Rahmen meiner Revision der fossilen Anseriformes der Welt in der Jánossy-Sammlung im Ungarischen Nationalmuseum (Magyar Nemzeti Múzeum) in Budapest (weiter nur MNMB) den Typus und das gesamte referierte Material der *Anas submajor* Jánossy (1979: 11) zu untersuchen. Diese aus dem oberen Villanium des Villányi Gebirges in Ungarn beschriebene Art soll nach ihrem Autor den Vorläufer der rezenten Stockente *Anas platyrhynchos* Linné, 1758 darstellen. Die Überprüfung des Materials ergab allerdings, daß es heterogen ist und daß es in seiner Mehrheit gar nicht der Gattung *Anas* angehört. Es ist die Aufgabe dieser Arbeit dieses Material zu revidieren.

MATERIAL

Das von Jánossy (1979) als *Anas submajor* bezeichnete und von mir sämtlich untersuchte Material ist wie folgt verteilt: 3 fast komplette und 43 fragmentäre Coracoidea, 36 Humerusfragmente, 67 Ulnafragmente, 25 fragmentäre Carpometacarpi, 3 fast komplette und 51 fragmentäre Femora, 17 Tibiotarsusfragmente, 6 Tarsometatarsusfragmente und 20 Phalangen. Dazu kommt eine komplette Ulna (MNMB Ut 83), die als Holotypus der Art von Jánossy (1979) bezeichnet wurde. Insgesamt wurden also 272 Knochen bzw. Knochenfragmente untersucht.

ERGEBNISSE

Der Vergleich der vorhandenen Knochen mit allen rezenten paläarktischen Arten ergab folgende Ergebnisse:

Klar unterschiedlich von *Anas submajor* ist ein proximales Fragment eines rechten Humerus, ein distales Fragment eines rechten Tibiotarsus und ein proximales und zwei distale Fragmente der linken Tibiotasi. Morphologisch entsprechen sie vollkommen der Gattung *Anas*. Die Tibiotarsi gehören höchstwahrscheinlich der rezenten Spießente *Anas acuta* Linné, 1758. Ihre Incissura intercondylaris ist bei ähnlich großen Arten der Gattung *Anas* entweder deutlich schmaler (*Anas strepera*, *A. penelope*, *A. clypeata*) oder merklich breiter (*Anas platyrhynchos*). Am Femur konnte ich zwar keine genügend klaren Unterscheidungsmerkmale finden, der Fund stammt jedoch seinem Aus-

sehen nach von der gleichen Fundstelle wie die Fragmente der Tibiotarsi, so daß ich ihn gemeinsam mit ihnen als *Anas acuta* bestimme. In der Größe entsprechen alle diese Fragmente der rezenten *Anas acuta*: die Extremitates distales der Tibiotarsi messen $8,0 \times 7,6$, $7,9 \times 7,1$ und $7,6 \times 7,1$ mm, während die Breite der Extremitas proximalis des Femurs 10,2 mm beträgt. Die 24 vergleichbar gemessene Extremitates proximales rezenter Männchen der *Anas acuta* messen nach Woelfle (1967) i. D. 10,14 mm (Grenzwerte: 9,2—10,8 mm).

Ein proximales Humerusfragment aus dem zur *Anas submajor* referierten Material entspricht in allen morphologischen Einzelheiten sowie in der Größe der rezenten *Anas platyrhynchos*, zu der ich es demzufolge referiere. Damit wurde dieses Fragment zum ersten Nachweis dieser in der ganzen Europa heute ganz gemeinen Art im Oberpliozän (Stratigraphie nach Horáček, 1979) des ganzen Karpathenbeckens (vgl. Jánossy, 1979).

Alle anderen Knochen der „*Anas submajor*“ einschließlich des Typus dieser Art unterscheiden sich in mancher Hinsicht von der Gattung *Anas*. Sie haben im Vergleich mit *Anas*:

- am Femur (1) die Fovea ligamenti capitis breit und flach; (2) die Fossa trochanteris deutlich ausgebildet; (3) die Facies articularis antitrochanterica schmal und tief; (4) die Crista tibiofibularis im Vergleich zum lateralen Teil des Condylus lateralis weit mehr entwickelt;
- am Tibiotarsus (5) den Condylus medialis schmaler aber viel größer als den Condylus lateralis; (7) die Extremitas distalis in einem deutlich spitzeren Winkel zur Achse des Corpus gestellt;
- am Tarsometatarsus (8) die Trochlea metatarsi II deutlich mehr lateral gedreht; (9) den lateralen Teil der Trochlea metatarsi IV mehr hervorragend als ihren medialen Teil;
- am Humerus (10) die Crista bicapitalis an das Corpus allmählich ansetzend (bei *Anas* setzt sie in einem deutlichen Bogen an); (11) die Incisura capitis flach und breit; (12) die Fossa musculi brachialis flach und breit; (13) den Processus supracondylaris dorsalis deutlich (auch wenn sehr klein — bei *Anas* fehlt er fast);
- an der Ulna (14) das Tuberculum carpale in einem sehr offenen Winkel zur Querachse der Trochlea carpalis stehend (bei *Anas* ist der Winkel spitzer — fast 90°);
- am Carpometacarpus (15) die Synostosis metacarpalis distalis schmal; (16) den Bogen zwischen dem Processus extensorius und der Trochlea carpalis offener; (17) den äußeren (proximo-cranialen) Rand der Trochlea carpalis eckiger; (18) den Processus pisiformis mehr lateral gedreht; (19) den Processus extensorius viel mächtiger und am Ende schmaler; (20) die Fossa supratrochlearis deutlich; (21) den Processus supratrochlearis deutlich (bei *Anas* ist er fast unbemerkbar); und
- am Coracoideum (22) die Impresio ligamenti acrocoracohumeralis groß und länglich (bei *Anas* ist sie klein und rundlich); und (23) den Bogen zwischen dem Processus acrocoracoides und dem Processus procoracoides von oben gesehen merklich geschlossener als bei *Anas*.

In allen diesen Merkmalen entsprechen die von Jánossy (1979) als *Anas submajor* bezeichneten Knochen der Gattung *Tadorna*, insbesondere der rezenten Brandente *Tadorna tadorna* (Linné, 1758), mit der sie auch in den metrischen Daten übereinstimmen. So mißt die Breite der proximalen Epiphyse des Femur bei *Anas submajor* $11,93 \pm 0,33$ mm (11,2—12,4 mm, n = 28), bei *Tadorna ta-*

dorna 12,87 mm (11,2—14,1 mm, n = 43, nach Woelfle 1967), die Breite der proximalen Epiphyse des Humerus beträgt bei *Anas submajor* 15,41 \pm 0,50 mm (14,6—16,1 mm, n = 19), bei *Tadorna tadorna* 15,57 mm (13,7—17,0 mm n = 37, nach Woelfle 1967). Die Typus-Ulna mißt etwa 90 mm, was in die Variationsbreite der *Tadorna tadorna* fällt (M = 94,83 mm, 78,2—103,7 mm, n = 20, nach Woelfle 1967). Im Ganzen scheinen die als *Anas submajor* bezeichneten Reste im Durchschnitt etwas kleiner als die rezente *Tadorna tadorna* zu sein, sie fallen jedoch alle in die Variationsbreite dieser Art.

Indem also weder in der Morphologie, noch in der Größe Abweichungen der *Anas submajor* Reste von der rezenten *Tadorna tadorna* festgestellt werden konnten, möchte ich alle diese als *Anas submajor* bezeichneten Knochen (einschließlich des Typus, jedoch mit Ausnahme der oben diskutierten 6 Knochenfragmente, die zur *Anas acuta* bzw. zur *Anas platyrhynchos* gehören) zu der rezenten *Tadorna tadorna* stellen.

Zu dieser Art können wahrscheinlich auch die 21 Knochenfragmente gerechnet werden, die Jánossy (1979: 19) als *Tadorna* sp. bezeichnet hat und die von derselben Lokalität und derselben Schicht wie die „*Anas submajor*“ — Reste stammen. Zu *Tadorna tadorna* mochte ich auch ein Schädelfragment, der ebenso aus derselben Lokalität und Schicht stammt, referieren (vgl. auch Mlíkovský, 1981).

Die Brandente ist heute in Europa ein Vogel flacher, sandiger oder schlammiger Meeresküsten und der Mündungsgebiete größerer Ströme. In Mittel-Asien kommt sie allerdings auch im Binnenland an salzhaltigen Steppenseen vor (Dolgušin 1960, Bauer und Glutz von Blotzheim 1968, Kolbe 1972, Kiščinskij 1979). Man konnte also annehmen, daß im Villányi-Gebiet im Oberpliozän solche Seen vorhanden waren, wo die Brandenten leben konnten. Interessant ist in dieser Hinsicht allerdings, daß in der Gegenwart die Brandenten binnenländische Süßwasserseen Englands (Boyd 1963) sowie der BRD und der DDR (Wille und Eberhardt 1962, Loose und Lipfert 1967, Panzke 1980) zu besiedeln begannen.

Anmerkung: Die anatomische Nomenklatur habe ich nach Baumel et. al. (1979) verwendet, die stratigraphische Einteilung des mitteleuropäischen Plio-Pleistozän nach Horáček (1979). Das Terminus Processus supratrochlearis ist hier neu und bezeichnet einen gegenüber dem Processus extensorius in der Gegend der Fossa supratrochlearis liegenden Fortsatz.

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Herrn Prof. Dr. D. Jánossy (Budapest) bin ich für das Erlaubnis, seine osteologische Kollektionen untersuchen zu dürfen sehr dankbar. Herrn Prof. Dr. Z. Veselovský (Praha) danke ich für die Durchsicht des Manuskripts sowie für seine wertvolle Bemerkungen und Herrn Dr. P. Švec (Praha) für die Diskussion dieser Arbeit, wobei ich natürlich für meine Schlußfolgerungen selbst verantwortlich bin.

ZUSAMMENFASSUNG

Die von Jánossy (1979) als *Anas submajor* beschriebenen Reste wurden neu untersucht, wobei es sich herausstellte, daß sie meistens der rezenten Brandente *Tadorna tadorna* gehören (einschließlich des Typus). Die *Anas submajor* Jánossy, 1979 ist demnach ein Synonym der *Tadorna tadorna* Linné, 1758.

Außerdem wurde ein Humerusfragment zur *Anas platyrhynchos* und ein Femur und vier Tibiotarsusfragmente zur *Anas acuta* referiert.

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**MORPHOLOGY OF THE POST-EMBRYONAL STAGES OF LIACARUS NITENS
(ACARINA: ORIBATEI, LIACARIDAE)**

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Abstract: All five post-embryonal stages of *Liacarus nitens* (Gervais, 1844) (Oribatei, Liacaridae) were described, measured and drawn, including their leg-chaetotaxy.

INTRODUCTION

This article is part of a series of papers regarding morphology of the post-embryonal stages of the family Liacaridae Sellnick, 1928. The first article of this series (Trávníček, 1977) deals with *Liacarus coracinus* (C. L. Koch, 1841), the second (1982) with *Liacarus subterraneus* (C. L. Koch, 1841). The article presented deals with *Liacarus nitens* (Gervais, 1844).

The present author's object is to describe all post-embryonal stages of *L. nitens* including their leg-chaetotaxy on one hand, and to establish differential characters of the corresponding immature stages among *L. nitens*, *L. coracinus*, and *L. subterraneus*, on the other hand.

Cultivation of immature stages of the family Liacaridae is difficult, as shown in preceding papers. No juvenile stage of *Liacarus xylariae* (Schränk, 1803) was obtained, and that is why only 3 European species of genus *Liacarus* Michael, 1898 could be compared in this paper. Unsuccessful cultivation corresponds to the fact, that only a few morphologic descriptions of juvenile stages of the family Liacaridae were published up to this time. Costesèque et Taberly (1961) described some juvenile stages of *Xenillus clypeator* Robineau-Desvoidy, 1839, and *X. tegeocranus* (Hermann, 1804). Later Arlian et Wooley (1969) described juvenile stages of American species *Liacarus cidarus* Wooley, 1968. My above mentioned papers follow up with descriptions of *L. coracinus* and *L. subterraneus*.

MATERIAL AND METHODS

All the examined larvae, nymphs and adults were obtained from laboratory culture. The initial material for cultivation were adult individuals *L. nitens*, picked up from the forest litter (*Querceto-Carpinetum primuletosum* with admixture of *Acer platanoides*, *Fagus sylvatica*, *Cornus sanguinea*, *Corylus avellana*, *Crataegus oxyacantha* and *Cotoneaster vulgaris*) in the Czech Karst near Karlštejn, about 40 km south-west of Prague.

Preservation and treatment of the objects for examination by means of optic microscope, as well as measuring and drawing, were done identically through the same operations in *L. coracinus* (Trávníček, 1977) and *L. subterraneus* (1982). Designation of setae and organs in drawings is also the same as in these foregoing papers, according to Grandjean (various work cited) and Travé (1961).

DESCRIPTION OF DEVELOPMENTAL STAGES

Larva (Fig. 1—2)

The shape of the body is bag-like, slightly flattened, of middle width. *L. nitens* has largish to largest larvae among the family Liacaridae. Five larvae were measured. Minimal and maximal sizes see in Table 1. Great diversity

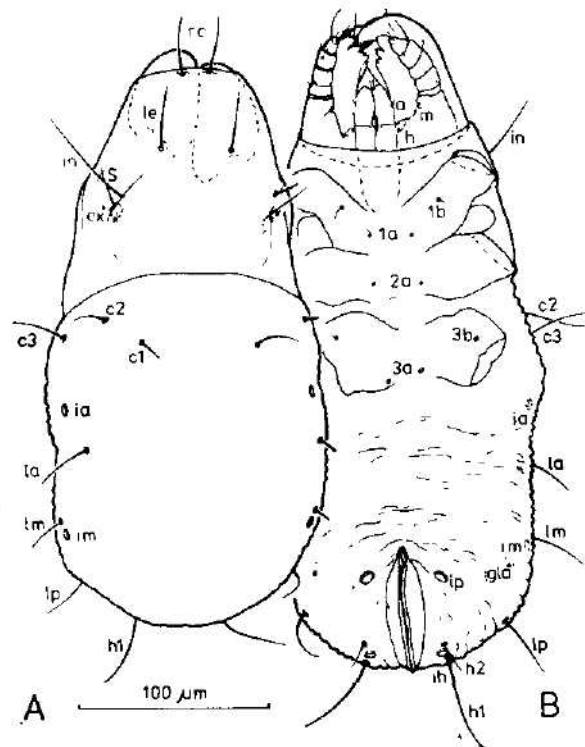


Fig. 1: Larva of *Liacarus nitens*, without legs. A -- dorsal view, B -- ventral view.

of size takes place, the same as in other species studied. Possible causes of this phenomenon have been mentioned in my preceding work (Trávníček, 1977, p. 284).

Larva *L. nitens* differs from other studied species within the family Liacaridae in two very conspicuous characters: absence of centrodorsal setae on notogaster and bristle-like glabrous sensillum, instead of the clavate roughened sensillum in other species. Bristle-like glabrous sensillum persists in all juvenile stages of *L. nitens*.

Integument of various parts of the body is thin to fairly thick. It resembles that of *L. coracinus* in its thickness, colour and surface (Ibid., p. 283).

Gnathosoma

Its structure conforms to that of *L. subterraneus* (Trávníček, 1982). There are also two apophyses carrying a spine-like point f, on the paraxial

Table 1. A comparison of sizes (min.—max.) in developmental of *Lizacarus nitens* (µm)

Organs measured	Larva	Protonymph	Deutonymph	Tritonymph	Adult
Length of the body (total)	286-440	605-882	814-1013	990-1177	946-1260
Length of the body (from rostrum)	255-418	561-616	759-990	946-1110	945-1199
Width of the body	105-161	244-260	341-473	400-506	605-803
Height of the body	112-161	229-275	319-447	396-517	473-640
Length of the prodorsum	104-140	166-187	180-209	230-242	270-338
Length of the tarsus I without abulacrum	26-42	47-52	48-57	62-83	94-132
Length of the chelicera	88-114	89-125	187-198	176-229	213-270
Length of the pediculp	37-45	52-68	73-94	99-118	120-160
Width between setae ro	12-14	18-23	36-38	37-47	57-78
Width between setae le	32-41	42-47	58-62	47-67	50-73
Width between setae in	71-99	120-130	143-161	144-175	104-140
Width between sensilli	74-112	140-151	176-192	172-229	270-341
Diameter of the bothridiums	4-7.8	5.3-7.8	6.5-10	9.2-13.5	24-34
Diameter of the sensillus	0.4-0.8	0.7-0.8	1.3-1.8	1.6-1.9	2.4-3.9
Length of genital plates	—	62-73	94-120	114-154	84-144
Width of genital plates	—	26-31	42-47	42-55	110-154
Length of anal plates	62-99	109-133	151-198	203-253	190-265
Width of anal plates	21-31	33-52	31-68	57-62	187-230
Length of the setae ro	41-52	41-63	94-99	99-119	73-109
Length of the setae le	62-65	66-73	115-124	125-166	124-172
Length of the setae in	86-93	87-99	130-140	135-203	210-240
Length of the setae ex	5-5.2	5.5-6	7-8	6.5-10.5	—
Length of the sensillus*	30-41	40-45	52-53	52-73	78-94
Length of the setae c2	52-57	84-98	109-120	99-166	3-4
Length of the setae h	17-18.3	26-36	46-62	50-68	55-88
Length of the setae la	5.2-7.8	7-8	6-8	6-8	26-52
Length of the setae lb	26-31	45-50	52-68	57-73	52-94

* over the top level of the bothridium

side of each chelicera, instead of one only in *L. coracinus*. Other characters of chelicers are identical with those in *L. coracinus* (Trávníček, 1977, p. 285).

Segments of pedipalp are very wide and short in *L. nitens*. Chaetotaxy of pedipalp is identical with that of *L. coracinus* and *L. subterraneus*, but setae of pedipalp in *L. nitens* are short. Formula of the pedipalp chaetotaxy is (0-1-1-3-9).

The shape of infracapitulum is the same as in *L. coracinus* (Ibid., p. 286) and *L. subterraneus*. Its form persists in all nymphal stages. Setae a, m, h on infracapitulum are fairly long, glabrous, pointed at the tips.

Proterosoma

is very long. It occupies more than 1/3, sometimes 1/2 of the length of the body. The shape of proterosoma is the same as in other species in the family Liacaridae. There is no naso in front of rostrum. Cuticular ribs called by Grandjean (1954b) are strong, wide and long, reaching or overlapping the bothridiums.

Interlamellar setae are longest on proterosoma, lamellar setae are almost of the same length. Rostral setae are similar, but shorter (0.6—0.8 lamellar). All these setae are whip-like, glabrous, pointed at tips, and very slender. Their insertional pores have the usual position and are of a middle size. Distance between implantations of rostral setae is shorter than a half of the distance between implantations of lamellar setae. Exobothridial setae are very short and thin, but they are not vestigial.

Bothridiums are cup-like, almost sphaerical, small, and they are submerged under the surface of the body. Their openings are bordered with an almost circular cuticular ringlet. Sensilli of larva and nymphs in *L. nitens* are bristle-like and glabrous, as mentioned above. They are fairly thin and short in contradistinction of all other species studied within the family Liacaridae, having clavate-shaped sensilli covered with fine spines except on the basis of their stalks.

Notogaster

Hysterosoma is scarcely wider than proterosoma. These are mutually separated with sejugal suture in the same way as in *L. coracinus*. Notogaster is not discernible from ventral plate, its boundary is not even indicated. There are transversal wrinkles on notogaster. These fine wrinkles disappear in the course of growing up. The boundary of segments C-D and a more distinct suture between segments D-E are visible in younger larvae. Notogaster may be glass-transparent in newly born larvae, later it becomes mat-whitish.

No centrodorsal setae are developed, i. e. larva *L. nitens* is dorsedeficient. Neither seta on segment D, marked by Grandjean (1934a) as D3, nor seta h3 are developed. There exist 8 pairs of setae on notogaster (Ng = 8) only. All notogastral setae are short, slender, glabrous, pointed at the tips. Their insertional pores are small, having usual position.

Cupules ia, im, ip, ih are normally situated and have usual form and size, being funnel-shaped, inserted into the integument. Cupulus ip lays normally in the ventral plate.

Ventral plate

fuses with notogaster. It is a little more sclerotised in epimeral and anal region, other parts are soft like notogaster. Apodemes 1, 2, 3 are long, but they

do not merge with each other in the middle. Apodemes 4 are short, inexpressive. Epimeres are well divided. Claparède's organ is short, conic, terminally oval. Its size is $16-23 \times 4-6 \mu\text{m}$.

Epimeral formula is normal (2-1-2). Epimeral setae are short, except setae 1b. Setae 3a are drawn a little nearer. They are all glabrous, pointed at tips. Anal region does not differ from that of *L. coracinus* (*ibid.*, p. 289).

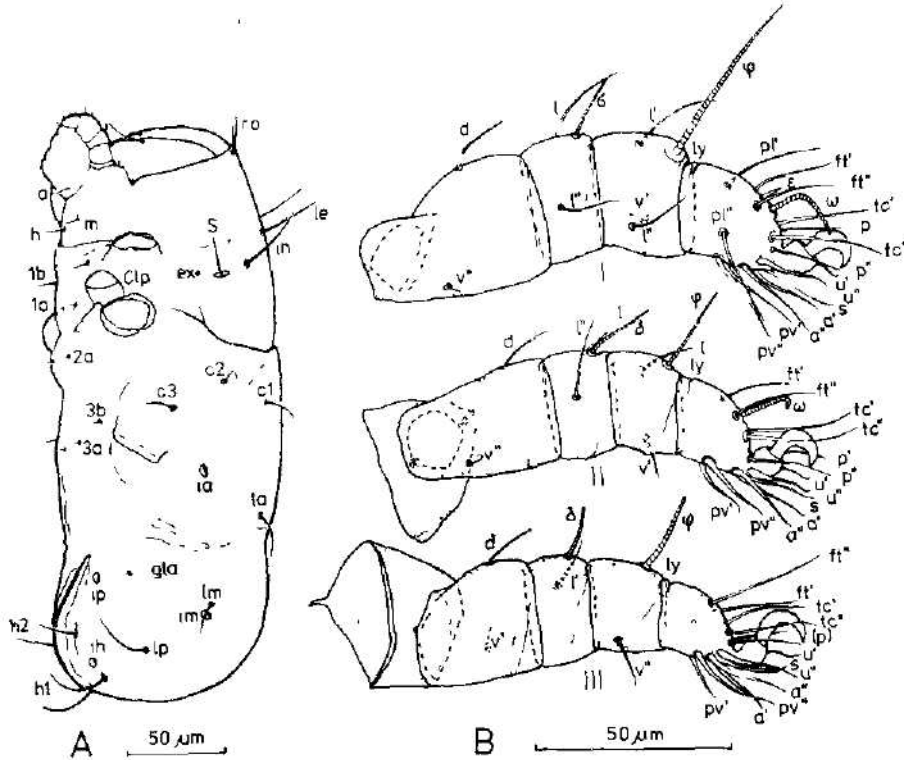


Fig. 2: Larva of *Luacarus nitens*. A - lateral view, without legs. B - legs I-III.

Legs

Leg-segments are very short, cylindrical, slightly sclerotised. Tarsi are conspicuously short. Length of the tarsus I without ambulacrum in relation to its height is about 1.1-1.5 : 1. Lyrifissure reaches about 1/5 of the height of tarsus. Ambulacrum is normal. It looks as a thin-walled wide arched transparent cuff, embracing a single glabrous claw.

Chaetotaxy of leg-segments is indicated by formulas in Table 2. Solenidions and famulus are not included in the number of setae. Solenidions have the normal formula (1-1-1) (1-1-1) (1-1-0). Tarsal formula (15-13-13) is normal, too. Setal pattern of leg-segments including solenidions and famulus is presented by notations in Table 3. Legs of larva see in Fig. 2B.

Solenidions are fairly short, except φ on tibia I. They are long-cylindrical or long-conic and blunt at tips, except solenidion φ on tibia I. It is whip-like,

Table 2. Formulas of the leg-chaetotaxy of the developmental stages of *Liaccarus isidens*
(Without solenidions and famulus)

Leg	Larva	Protonymph	Deutonymph	Tritonymph	Adult
I	0-2-2-3-15-1	0-2-2-3-15-1	1-3-2-3-15-1	1-4-3-4-17-1	1-5-3-4-19-3
II	0-2-2-2-13-1	0-2-2-2-13-1	0-3-2-2-13-1	1-4-2-3-15-1	1-4-2-4-16-3
III	0-2-1-1-13-1	0-2-1-1-13-1	1-3-1-2-13-1	2-3-1-3-15-1	2-3-1-3-15-3
IV	—	0-0-0-0-7-1	0-2-2-1-12-1	1-2-2-3-12-1	1-2-2-3-12-3

Table 3. Leg chaetotaxy of the developmental stages of *Licarcus nitens*. Notations of solenidions, famulus, eupathidia, and true setae

Leg	Segment	Larva	Protonymph	Deutonymph	Tritonymph	Adult
I	Trochanter					
	Femur	d, v ^o	d, v ^o	d, l', v ^o	l'	l'
	Genu	σ, l', l ^o	σ, l', l ^o	σ, l', l ^o	σ, l', l', v ^o	d, l', l', v', v ^o
	Tarsus	φ1, l', l', v' ω1, s, p', p', tc' tc', ft', ft', u', u' s, a', a', pv', pv' pl', pl'	φ1, ω2, s, p', p' tc', tc', ft', ft', u' u', s, a', a', pv' pv', pl', pl'	φ1, φ2, l', l', v' ω1, ω2, s, p', p' u', u', tc', tc', ft', ft' u', u', s, a', a', pv' pv', pl', pl'	φ1, φ2, l', l', v', v' ω1, ω2, s, p', p' u', u', tc', tc', ft', ft' u', u', s, a', a', pv' pv', pl', pl'	φ1, φ2, l', l', v', v' ω1, ω2, s, p', p' u', u', tc', tc', ft', ft' u', u', s, a', a', pv' pv', pl', pl', A, A
II	Trochanter					
	Femur	d, v ^o	d, v ^o	d, l', v ^o	l'	l'
	Genu	σ, l', l ^o	σ, l', l ^o	σ, l', l ^o	σ, l', l ^o	d, l', l', v'
	Tarsus	φ1, l', v' ω1, p', p', tc', tc' ft', u', u', s, a', a', pv', pv' a', a', pv', pv'	φ1, p', p', tc', tc' ft', ft', u', u', s, a', a', pv', pv'	φ1, ω2, p', p', p', tc' tc', ft', ft', u', u', s, a', a', pv', pv'	φ1, l', l', v' ω1, ω2, p', p', p', it' it', tc', tc', ft', ft' u', u', s, a', a', pv', pv'	φ1, l', l', v', v' ω1, ω2, p', p', p', it' it', tc', tc', ft', ft' u', u', s, a', a', pv', pv', pl'
III	Trochanter					
	Femur	d, v ^o	d, v ^o	d, l', v ^o	l', v ^o	l', v ^o
	Genu	σ, l'	σ, l'	σ, l'	σ, l'	d, l', v'
	Tarsus	φ, v ^o p', p', tc', tc', ft', ft', u', u', s, a', a', pv', pv'	φ, v ^o p', p', tc', tc', ft', ft', u', u', s, a', a', pv', pv'	φ, v', v ^o p', p', tc', tc', ft', ft', u', u', s, a', a', pv', pv'	φ, v', v ^o , l' p', p', it', it', tc', tc', ft', ft', u', u', s, a', a', pv', pv'	φ, l', v', v' p', p', it', it', tc', tc', ft', ft', u', u', s, a', a', pv', pv'
IV	Trochanter					
	Femur					
	Genu					
	Tarsus		p', p', ft', u', u', pv', pv'	p', p', tc', tc', ft', ft', u', u', s, a', a', pv', pv'	φ, l', v', v' p', p', tc', tc', ft', ft', u', u', s, a', a', pv', pv'	φ, l', v', v' p', p', tc', tc', ft', ft', u', u', s, a', a', pv', pv'

extended to a pointed tip, with regard to its tactile function. Nevertheless it is shorter than in other species compared, because its top does not overlap the claw if bent down. This ability is common in other species within the family Liacaridae. Famulus is fairly long, slender, pointed at tip.

Tectal setae are not too long, either. They exceed proral setae only by 1/4 of their own length. Proral setae are eupathidiums. Insertion of seta pl'' is normal. All true setae are whip-like, glabrous, pointed at tips, except setae primiventral, antelateral and proral on tarsus II. They are thorn-like on the bottom.

Protonymph (Fig. 3—4)

resembles a larva. Its bag-like body is sometimes wider in the shoulder part. Five protonymphs were obtained and measured. Their dimensions are presented in Table 1.

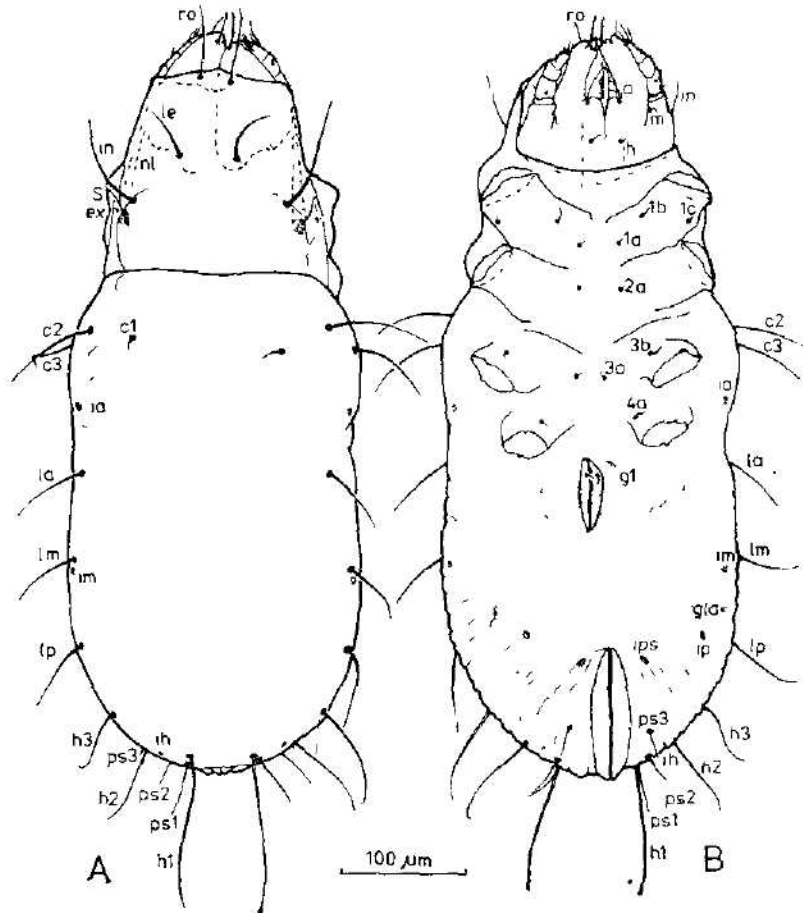


Fig. 3: Protonymph of *Liacarus nitens*, without legs. A - dorsal view, B - ventral view.

Gnathosoma

is the same as in larva, except an additional seta v'' on femur of pedipalp, so that the formula of pedipalpal chaetotaxy changes to (0-2-1-3-9). In this formula solenidion ω is not included. This same phenomenon occurs in all species of the family Liacaridae

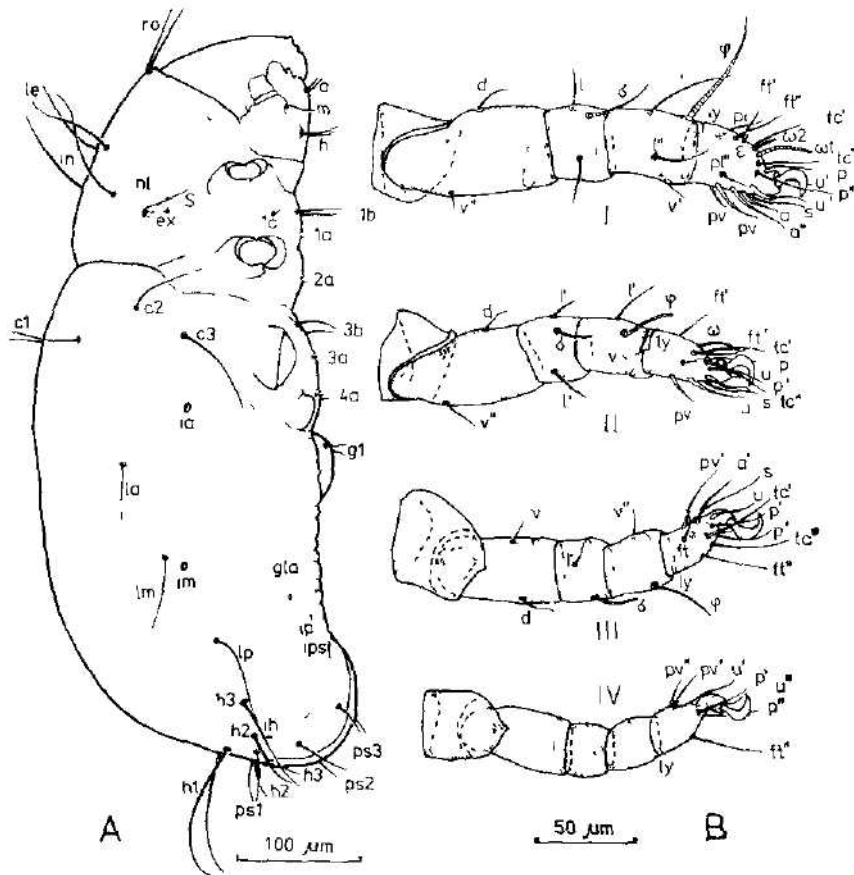


Fig 4. Protonymph of *Liacarus nitens*. A — lateral view, without legs. B — legs I—IV

Proterosoma

is relatively shorter in the protonymph than in the larva. Its length is about 1/3 of the total length of the body and it seems to be narrower than in the larva. An egg-shaped rostral body (*Ibid.*, p. 292) appears below a slightly developed naso and persists in all nymphal stages. Other organs of proterosoma are identical with the larval ones, except disappeared Claparède's organ and seta lc newly formed. Bothridiums have the same size and form as in the larva.

Hysterosoma

is of the usual form, as in other related species. Because of the appearing seta h3 and protonymphal setae, protonymph *L. nitens* is quadrideficient keeping conformity with related species. All hysterosomal setae are glabrous, pointed at tips. They are short or of medium length. Only terminal setae h1 are usually long.

Apodemes 5 are short, epimeres 4 are inexpressive. Setae 1b and partially setae 3b are extended, in contradistinction of the larva. Other epimeral setae remain short, including newly appearing setae 1c and 4a. Setae 3a remain drawn a little nearer. Epimeral formula is normal (3-1-2-1). All epimeral setae are glabrous, pointed at tips.

Newly formed genital valves with one pair of genital setae and one pair of genital disc-suckers have the usual form. Genital setae are short, glabrous, pointed at tips. They are implanted in the first quarter of the length of the genital valves.

Legs

are similar to those of the larva, but their segments are slightly longer. Solenidial formula (1-1-2) (1-1-1) (1-1-0) (0-0-0) is normal. Newly appearing solenidion ω_2 is short, only a half of ω_1 , blunt at the tip. Proral setae are longer, almost as long as tectal ones. Chaetotaxy of legs is normal, i. e. the same as in related species. Tarsal formula (15-13-13-7) is normal in this way. All setae of legs are glabrous, pointed at tips, including setae of tarsus II being thorn-like on the bottom in the larval stage.

Deutonymph (Fig. 5-6)

resembles the protonymph, but its hysterosoma is more voluminous, with characters of the deutonymph. 3 deutonymphs obtained from culture were measured. Their dimensions are presented in Table 1.

Gnathosoma

does not change from the protonymphal stage.

Proterosoma

occupies about 1/4 of the length of the body and seems to be relatively narrower in relation to hysterosoma. Alteration of proterosoma is inexpressive. Bothridiums and sensilli remain almost of the same size as in the larval and protonymphal stages, in contradistinction of major size of these organs in related species in higher developmental stages. Distance between implantations of rostral setae seems to be longer (about 3/4 of the distance between lamellar setae), because lamellar setae draw nearer.

Hysterosoma

presents normal changes of this developmental stage. It enlarges, beginning to take slightly flattened oval form. Intersegmental boundary lines are invisible. They can be indicated only in newly hatched deutonymphs on ventral plate, as shallow groves between segments D-E and E-F.

Notogastral setae seem to be shorter in consequence of greater width of the notogaster. Their length is about a quarter of the width of notogaster. Newly

appeared adanal setae are shorter than protonymphal setae, but they are also glabrous, pointed at tips.

Surroundings of anal and genital valves tend to be wrinkled, later the integument of these parts of the body is levelled, too. Cupules have the usual position, but they are very small. Genital setae g2 and g3 arise at the same time on enlarged genital valves. The first pair is implanted almost on the rear edge of the valves, the second one on the frontal edge. Newly developed ad-genital setae are implanted on the level of setae g2.

Epimeral formula is (3-1-2-2). Newly formed seta 4b is short, in the paraxial row of epimeral setae 1a — 2a — 4b. because setae 3b remain close together.

Legs

retain the form of their segments as in the protonymph, but the upper part of tarsi II—IV is much vaulted, similarly to the form of tarsus I. Lyrifissure is shallower.

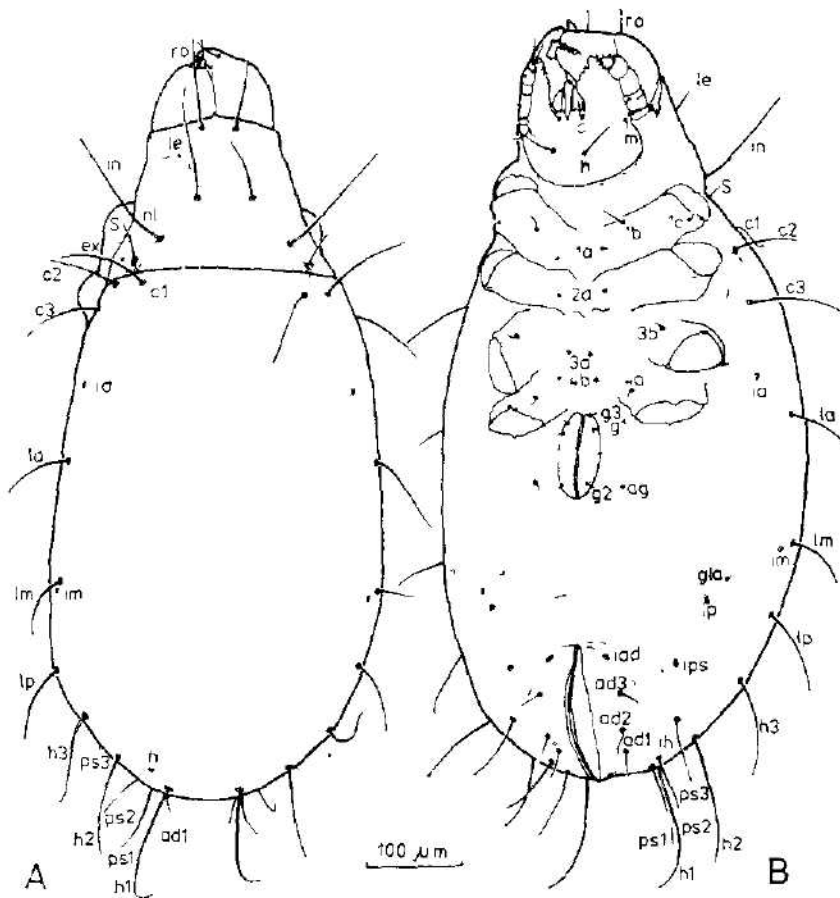


Fig. 5: Deutonymph of *Liacarus mtens*, without legs A — dorsal view, B — ventral view.

Solenidial formula (1-2-2) (1-1-2) (1-1-0) (0-1-0) is normal, because of newly appearing solenidions $\varphi 2$ (short, conic, blunt at tip) on tibia I, $\omega 2$ (the same as on tarsus I) on tarsus II, and φ (short, conic, shortly point-tipped) on tibia IV.

Sixteen true setae appear on leg I—IV. Tarsal formula (15-13-13-12) is normal. Formulas of setae on all segments of leg I—IV are presented in Table 2, designation of all setae and solenidions in Table 3. Legs of a deutonymph are depicted in Fig. 6B.

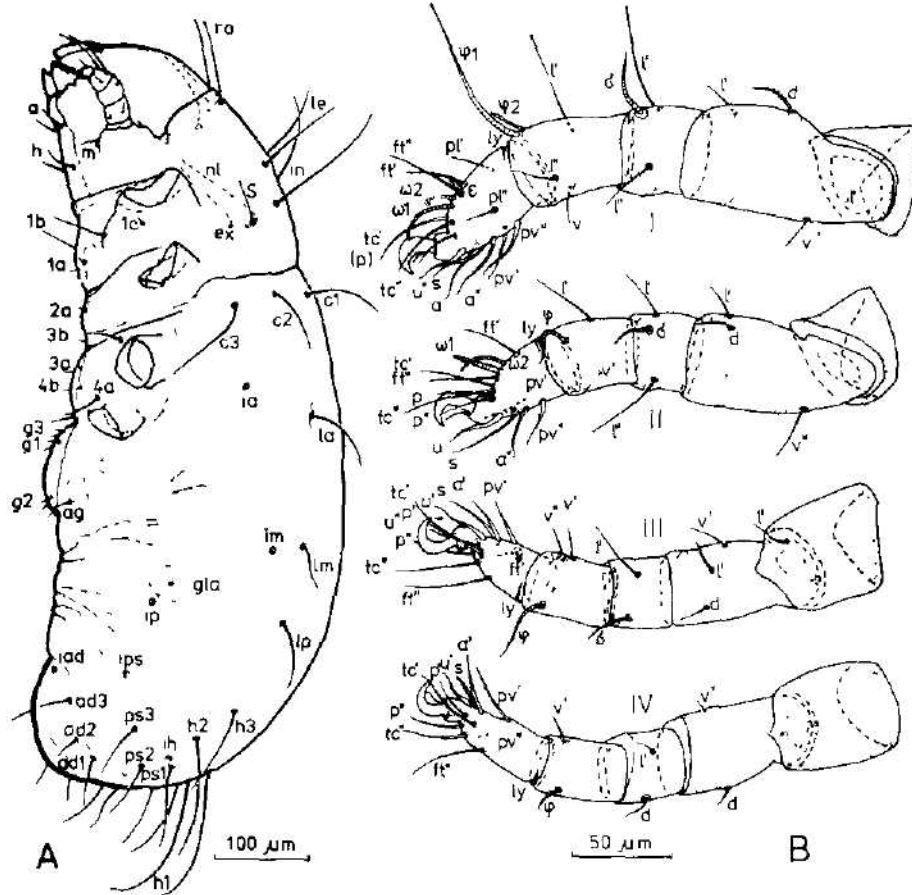


Fig 6: Deutonymph of *Liacarus nitens*. A — lateral view, without legs. B — legs I—IV.

Proral setae are shorter than tectal ones by about a quarter, but they have equal length on tarsus IV. Dorsal setae of femur I and II are thick, conic, thorn-like on the top. Other setae of legs are fairly slender and glabrous, pointed at tips.

Tritonymph (Fig. 7—8)

Dimensions of 3 individuals obtained by cultivation are presented in Table 1.

Gnathosoma

does not differ from the proto- and deutonymphal stages, till being more bend down. Its colour is light-brown, except for very dark brown distal parts of chelicers and rutells.

Proterosoma

is fairly short and narrow, occupying about 1/5 of the length of the body. Dorso-sejugal suture is usually well developed. Naso of rostrum remains very

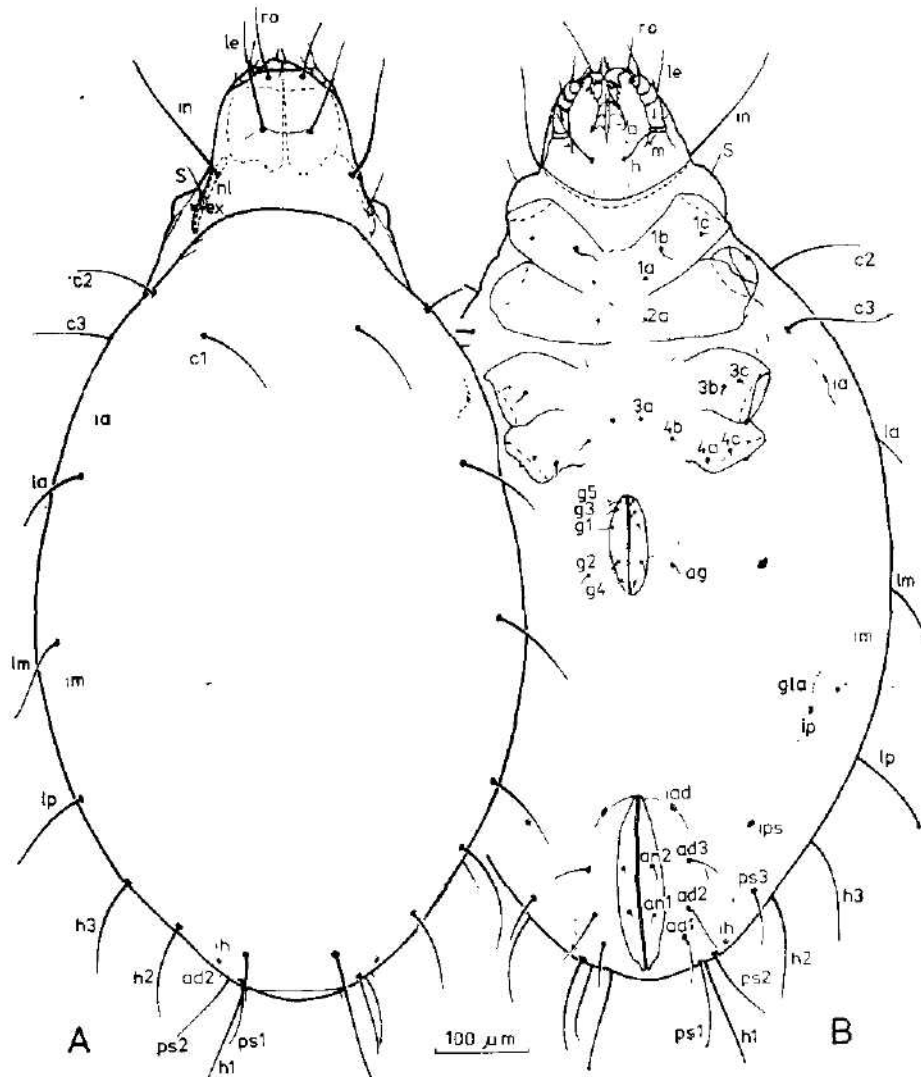


Fig. 7: Tritonymph of *Liacarus nitens*, without legs. A — dorsal view, B — ventral view.

small, almost indiscernible. Rostral body preserves its size from the deutonymphal stage. It is egg-shaped to pear-shaped, with its sharper part directed frontally. Ribs *nl* overpass the bothridiums, which remain very small, with short and fine bristle-like sensilli. Proterosomal setae do not undergo any change, either.

Hysterosoma

is very widespread. Before hatching it is egg-shaped and flattened, or widely spindle-shaped with rounded ends. Colour of hysterosoma is much lighter than

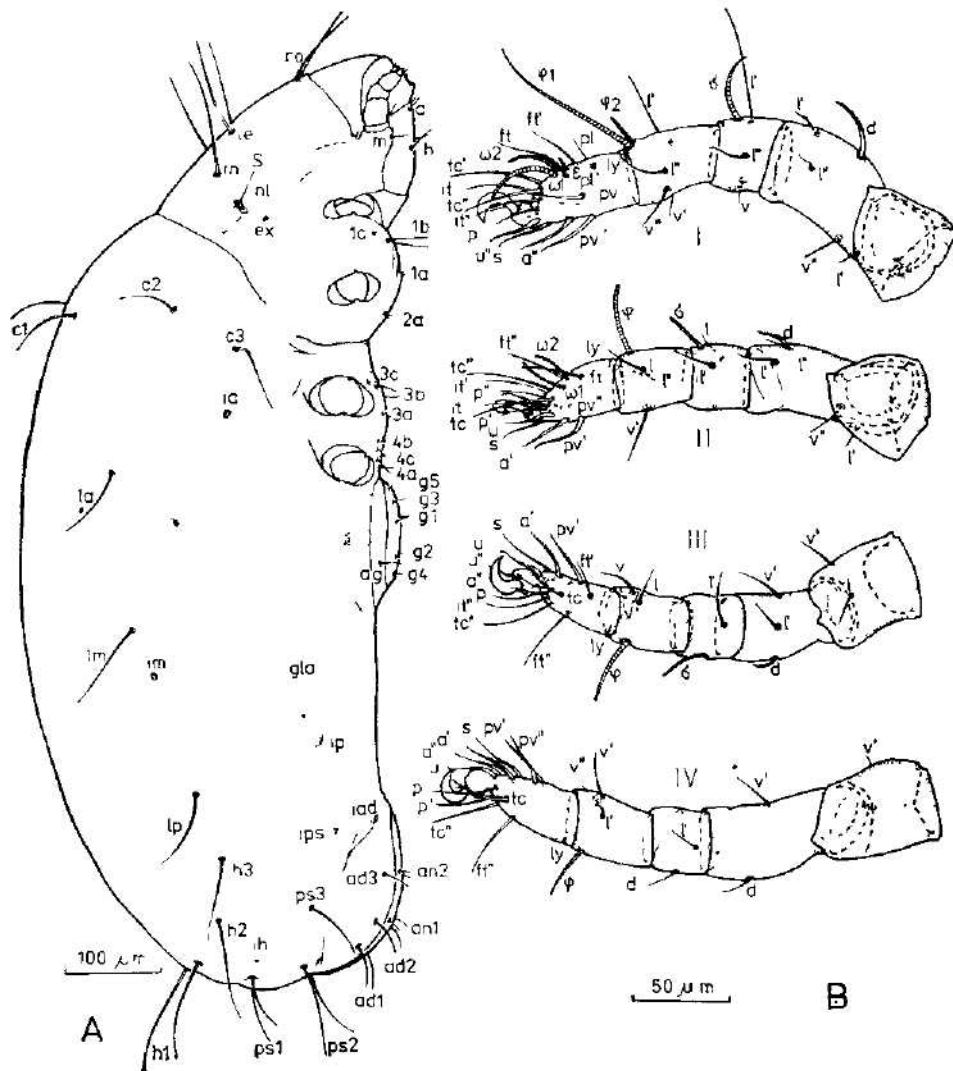


Fig. 8: Tritonymph of *Liacarus nitens*. A — lateral view, without legs. B — legs I—IV.

in proterosoma, but after moulting from deutonymphal exuvia it is already milky-white or pergamen-translucent. Cupules have the usual location, but they remain small. Lateral glands shift a little forward, but they remain in their latero-ventral position.

Notogastral setae are the same as in the deutonymph. They seem to be short, growing on widespread notogaster, although they are of the same length or longer than the setae on proterosoma. Mutual relation of lengths of the hysterosomal setae does not change. Newly formed anal setae are very short. Both pairs are implanted close to each other. Position of anal opening is already quite ventral.

Genital setae g4 (at the rear end of genital valves) and g5 (frontally, before setae g3) appear at the same time. Setae g5, g3, g1 form a group being near each other, whereas setae g2 and g4 are drawn away from this group of setae. Third pair of genital disc-suckers originate normally. Adgenital setae persist in the position occupied in the deutonymphal stage.

Arrangement of epimers and apodemes is the same as in the preceding developmental stage. Implantation of epimeral setae in paraxial and medial rows is also the same as in the deutonymph. Newly formed setae 3c and 4c complete the antiaxial row. They are brought near to setae 3b and 4a. Epimeral setae in the paraxial and antiaxial rows are short, but setae 1b are extremely long. They are about four to five times longer than setae 1a. Sometimes they may be even longer. Setae 3b have half the length of setae 1b. Setae 3b have equal length with hysterosomal setae on infracapitulum. All setae on hysterosoma are glabrous, pointed at tips. Epimeral formula is (3-1-3-3).

Legs

are relatively smaller than in the deutonymph. Seventeen new true setae appear on leg I—IV. Number of setae of each segment of the legs is presented by formulas in Table 2. Tarsal formula is (17-15-15-12), iterall formula (n3-n3-n3-0). Solenidional formula does not change. Designation of all setae and solenidions of legs is indicated in Table 3. Legs of a tritonymph are depicted in Fig. 8B.

Newly formed iterall setae are shorter than tectal, but longer than proral setae. Seta 1' on tibia IV is newly developed, whereas in *L. coracinus* and in *L. subterraneus* it appears only in the adult stage. Dorsal setae of femur I and II are the same as in the deutonymph. Dorsal seta on femur III is similar to them, but it is smaller. Seta 1' on femur I is barbed on external side. Primito-ventral and antelateral setae of tarsus III are thorn-like on the bottom. The same are primito-ventral setae on tarsus IV. All other setae on legs remain glabrous.

Adult (Fig. 9—10)

Dimensional data of 14 measured individuals are presented in Table 1.

Form of the body is egg-shaped, flattened dorso-ventrally, but it undergoes great variability. There exist slender individuals on one hand, and quite wide ones on the other hand. The rear part of hysterosoma is always more tapering than the frontal part. The colour of the body is pergamen-like till brownish after moulting from tritonymphal exuvia except black-brown distal tips of chelicers and rutells. After about 2 days the colour of the body-surface changes to very dark red-brown up to black-brown, being smooth and lustrous.

Gnathosoma

Infracapitulum is diarthric with pantelebasic implantation of rutells, in contradistinction of juvenile stages, although other parts of gnathosoma are identical with those of nymphal stages, except the immersion in samerostome and heavy sclerotisation.

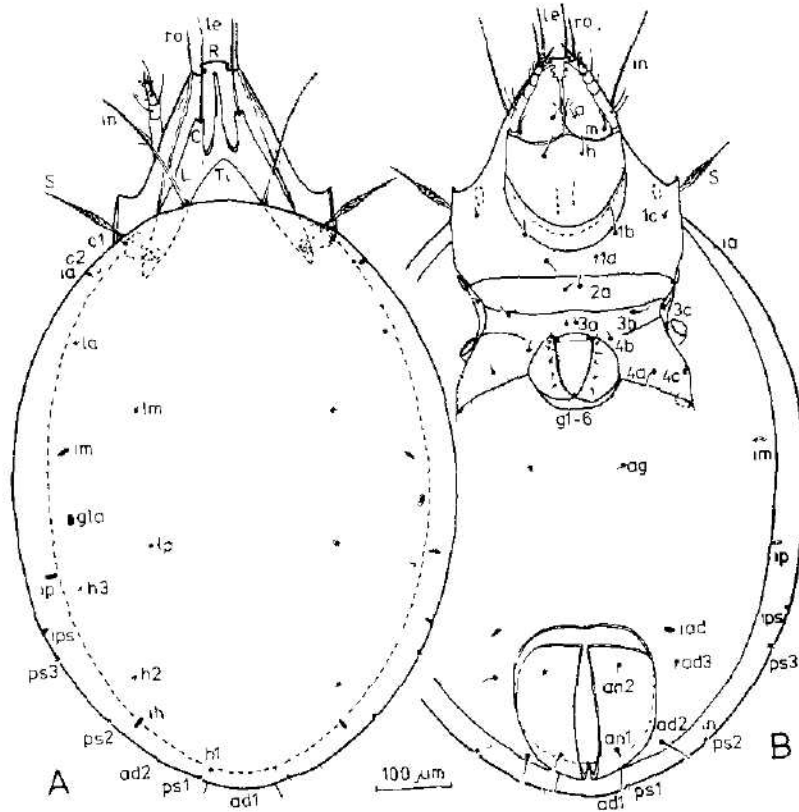


Fig. 9: Adult of *Liacarus nitens*, without legs. A - dorsal view, B - ventral view.

Proterosoma

Very conspicuous is translamella, protruding in large central macro (blunt pointed), which nearly reaches the tip of rostrum, overpassing cuspids of lamells. Lamells are of middle width, grown on to the surface of prodorsum with their inner edges almost horizontally, whereas their external edges are thickened and upraised. Proximally they reach till beyond bothridiums under the notogastral shield, distally they are converging and joining with a translamella in the second third of prodorsum.

Lamellar setae are implanted in the middle of the distal part of long cuspids. There are two little teeth beside the place of implantation of lamellar seta. Lamellar setae are long-conic, pointed at tips. They are long, passing far

beyond the tip of rostrum, being finely and scarcely barbed from the first third of their own length to the tip. Inaterlamellar setae are the same, but much longer. They grow up from the inner edge of lamells and almost under the notogastral shield. Rostral setae have the same shape, but they are much shorter than lamellar ones, not reaching the tips of lamellar setae. They are implanted over the fairly wide and deep notches of rostrum. A naso is formed in this way, sometimes with a small protuberance in the middle of naso. External point of the notch is sharp. Tutorium runs out from this area. It is rib-like, narrow, but before its bow it is fairly high, tapering again to its end near the pore of vestigial exobothridial seta.

Bothridiums are much larger than in juvenile stages, but they are cup-like, partially surpassing the surface of the body. They are partially covered with the shoulder edges of notogastral shield from above. Sensilli have a spindle form with an elongated point, and except the basis of the stalk all their surface is covered with fine teeth. In contradistinction of *L. coracinus* and *L. subterraneus*, widening of sensills is not so prominent. Some individuals *L. nitens* have sensilli almost setiform, looking as in the genus *Rhaphidosus* Wooley, 1969.

The surface of cuticle is glabrous on all proterosoma, except under the external edges of lamells, under the tutoriums, bothridiums, and pedotectums 1. There is a thick stratum of cerotegument on these places and their surface is covered with coarse warts.

Notogaster

Its anterior edge is always arched forward and slightly ribbed. The surface of notogaster is glabrous and lustrous. No cuticular pattern is seen, but very fine granulation, by detailed observation. Only the openings of lateral glands are well visible. They are round with a low ridge, placed in the middle of notogastral shield in lateral view. Cupules are inconspicuous, having fissure openings and normal position. Cupulus ia is placed on the lower side of the shoulder edge.

Notogastral setae (Ng = 11) are almost invisible, being very fine and short. Protonymphal setae solely surpass the outline of notogaster, but only very little. Position of notogastral setae is usual. Coronal setae are brought near, humeral seta disappears. Insertional pores of notogastral setae are very small, looking as if they were doubled down.

Epimeral region

Apodemes 1—3 are long, merging in the middle. Apodemes 4—5 are short, but they can reach genital opening. Carina circumpedialis extends from acetabulum of leg II to that of leg IV, but it does not exceed it. Seta 3c is implanted down, on the outer side of carina circumpedialis, but seta 4c on the inner side of it. Seta 1c grows from the bottom of pedotectum 1. Epimeral setae are fairly long, glabrous, shortly pointed at tips. Their formula is the same as in the tritonymph, similarly as their implantations.

Discidium in form of cuticular fillets raises from acetabulums 3 and 4, joining over the acetabulum 3 and reaching bothridium. These fillets divide and partially protect legs III and IV, when set up in thanatosis.

Genito-anal region

The shape of both genital valves is pentagonal with rounded corners. In the adult stage genital setae g6 appear on the frontal edge of genital valves.

They multiply the group of setae g5, g3, g1 formed in the stage of the tritonymph, whereas setae g2 and g4 remain drawn away from this group of setae. The length of genital setae is approximately equal to that of epimeral setae in the paraxial row. The same is the length of adgenital setae. These are implanted in the first third of distance between genital and anal openings. Their mutual distance also increase in the adult stage, reaching the width of both

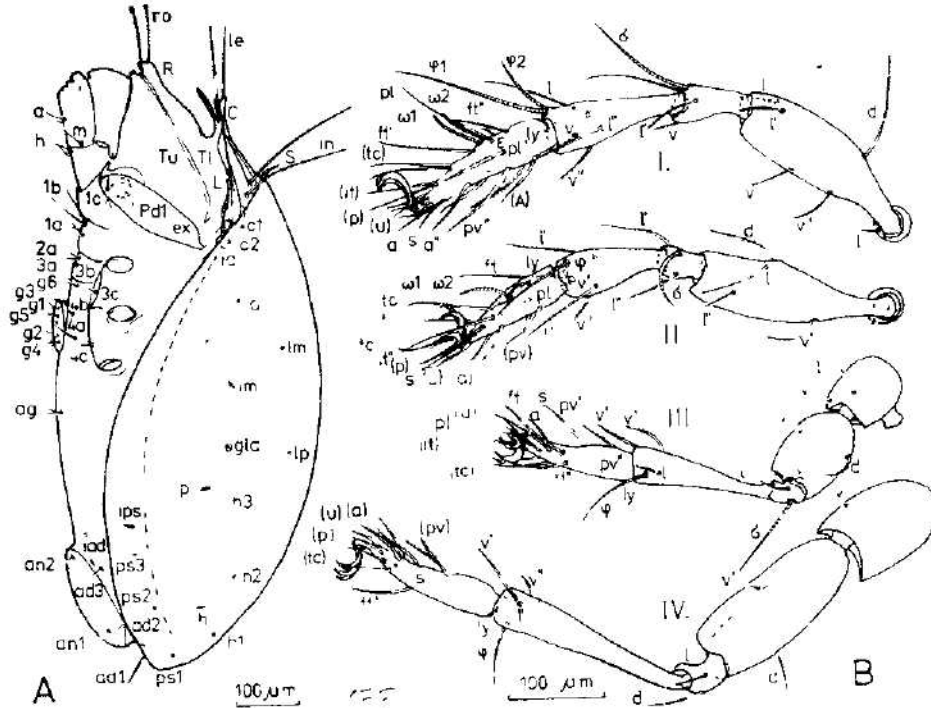


Fig. 10: Adult of *Liacarus nitens*. A - lateral view, without legs and palps. B - legs I-IV.

genital valves. Anal setae are fairly longer. Setae ad1 and ad2 usually surpass the outline of the body. All setae of genito-anal region are glabrous, slender, shortly pointed at the tips. Praeanal claps is ampoulaceous.

Legs

Legs of adult *L. nitens* resemble legs of adult *L. coracinus* (Trávníček, 1977, p. 289) and other species of the family Liacaridae, i.e. the form of leg-segments differs conspicuously from those in juvenile stages, as well as the sclerotisation. The colour of legs resembles the colour of the ventral plate of the body. Cuticle is finely grained, but no pore-field is present. Ambulacrum does not form a cuff. Legs are heterotridactylous, claws are glabrous.

Five true setae appear on segments of leg I-IV in the adult stage. Tarsal formula is (19-16-15-12). Formulas of leg-chaetotaxy see in Table 2. Solenidial formula remains unchanged from the tritonymphal stage, the same as iteral

formula. Notations of all true setae, eupathidiums, solenidions and famulus are indicated in Table 3, their implantation and form of the legs are depicted in Fig. 10B.

Seta $\rho 1'$ is formed on tarsus II in the adult stage *L. nitens*, in contradistinction of other examined species within genus *Liacarus*, where it does not occur. Seta $1'$ on femur II changes place. It is implanted on antiaxial side, below dorsal seta.

Solenidions ρ and δ are long, whip-like, pointed at tips. Solenidion $\rho 2$ reaches only one third of the length of $\rho 1$. Solenidions ω are short, blunt pointed. Solenidion $\omega 2$ is only a little shorter than $\omega 1$. Famulus is fairly long and slender. Eupathidiums are proral and subunguinal setae of tarsus I.

Dorsal setae of femurs I and II remain strongly thorn-like on the top. Slightly thorn-like on the top remains dorsal seta on femur III and newly on femur IV. All lateral setae are slightly thorn-like on external side, except trochanters I and II, where they remain thin and glabrous. Similarly ventral setae are slightly thorn-like on the bottom, except femurs and trochanters III and IV which are thin and glabrous. Setae implanted dorsally on tarsi are slightly thorn-like on the top, only proral setae remain glabrous. Setae implanted on ventral side of tarsi are slightly to strongly thorn-like on the bottom, except all unguinal setae and subunguinal seta I—III, which remain glabrous.

Post-embryonal development and exuviae

Post-embryonal development in *L. nitens* resembles in all aspect that of *L. coracinus* (Ibid., pp. 301—303), and, similarly, of *L. subterraneus* (1982).

Leg-chaetotaxy is the same in these 3 species in the larva and in the protonymph, but there are some differences from the deutonymphal stage. In the stage of deutonymph 11 new true setae appear in *L. coracinus*, whereas 13 in *L. subterraneus*, and 16 in *L. nitens*. In the tritonymphal stage there appear 21 new setae in *L. coracinus*, while 18 in *L. subterraneus*, and 17 in *L. nitens*. In the adult stage 4 new setae are added in *L. coracinus*, 6 in *L. subterraneus*, and 5 in *L. nitens* (cf. Table 6 in the paper regarding *L. coracinus* with Table 3 of the article dealing with *L. subterraneus*, and Table 3 of this paper).

Leg-chaetotaxy is progressive. All setae developed in preceding developmental stages persist in all successive stages.

Body chaetotaxy is analogous with other species studied within genus *Liacarus*, except for the absence of centrodorsal setae in *L. nitens* in the larval stage.

Exuviae of nymphs and the adult stage of *L. nitens* are similar to those of *L. coracinus* and *L. subterraneus* (Ibid., p. 303). Their walls seem to be thicker than in *L. coracinus*, but thinner than in *L. subterraneus*. They are also more lustrous.

SUMMARY

Many characters of developmental stages of *Liacarus nitens* correspond to those in *L. coracinus* and *L. subterraneus*, but there are following differences:

1. Sensillus in juvenile stages is bristle-like and glabrous, fairly short. In the adult stage it is usually spindle-shaped with an elongated point, covered with fine teeth, but there exist some individuals with bristle-like sensilli.

2. Bothridium is small, almost spherical, submerged under the surface of the body in juvenile stages. In the adult stage it is of usual size, cup-like, partially surpassing the surface of the body.
3. Exobothridial seta is fine and short in juvenile stages, but vestigial in the adult stage.
4. Interlamellar setae are longest in all developmental stages. They are whip-like, pointed at tips and glabrous in juvenile stages, but they are barbed and shortly pointed in adult stage.
5. Lamellar setae are identical with interlamellar setae, but shorter (0.7--0.9 in).
6. Rostral setae are the same as lamellar ones, but shorter (0.6--0.8 le).
7. Rostral body of nymphs is egg-shaped.
8. There is no naso in front of rostrum in juvenile stages, or it may be very small. But in the adult stage two deep notches in rostrum form a naso. Conspicuous translamella protruding in large central mucro overpassing long cuspids is characteristic of the adult stage.
9. Two spear-like points f are formed on each chelicera in all developmental stages.
10. Cuticular ribs nl in juvenile stages are wide and long, reaching or overlapping bothridiums. Tutoriums in adult stage are rib-like, long.
11. Centrodorsal setae in larva are not present (larva is dorsedeficient).
12. Notogastral setae in juvenile stages are fairly short, fine, glabrous, pointed at tips. But they are almost invisible in the adult stage. Only protonymphal and adanal setae can surpass the outline of the body in adult stage.
13. Epimeral setae in the medial row are very long, mainly setae 1b, being even 6 times longer than setae 1a in nymphs. Epimeral setae of adult stage are of normal shape and length. Setae 3c are implanted on the outer side of circumpedial lines, but setae 4c on their inner side.
14. Seta pl' on tarsus II appears in the adult stage, but it is missing in *L. coracinus* and in *L. subterraneus*.

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COCCIDIA IN RED DEER AND ROE-DEER (CERVUS ELAPHUS AND CAPREOLUS CAPREOLUS) IN THE REGION OF BRDY HILLS

Dalibor ZAJÍČEK

In honour of the 60th anniversary of the birthday of Academician B. Ryšavý

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Abstract. In the 1975–1980 period the findings of coccidia in *Cervus elaphus* L. and *Capreolus capreolus* L. were followed in two neighbouring hunting-grounds in the Central Bohemian range of Brdy hills. The prevalence of individual coccidia species of the genus *Eimeria* was determined on the basis of examination of 16 guts and 676 samples of faeces from *C. elaphus* and 41 guts and 460 samples of faeces from *C. capreolus* of all age groups.

Five species of coccidia were found in *C. elaphus*. *Eimeria elaphi* was found in 3.1%, *E. austriaca*, *E. robusta*, *E. sordida*, and *E. wapiti* in 1.03–1.9% of cases. The findings of the species *E. elaphi*, *E. austriaca*, *E. sordida*, and *E. wapiti* indicate an increase in the number of parasite species occurring in red deer in Czechoslovakia. The intensity of infections was very low.

There were found five different coccidia species in *C. capreolus*. *E. capreoli* was found in 22.6%, *E. ponderosa* in 10%, *E. panda* in 7.4%, *E. superba* in 6.08%, and *E. rotunda* in 1.1% of cases. The intensity of infections varied from findings of sporadic oocysts to serious infections, particularly in fawns that died from coccidia infection.

Numerous finding of coccidia oocysts were made in *C. elaphus* calves, hinds, fawns and does, and only sporadically in stags and roebucks, which is caused by the way of life of both sexes. The females with their young stay in closed areas in contrast to male animals which roam about a wider area, particularly during oestrus. No exchange of coccidia between red deer and roe-deer has been demonstrated in both hunting-grounds at resting places and feeding racks commonly used by both animal species.

Coccidia (Sporozoa, Telospora) belong to sporozoan parasites which are often found in free living deer. At present, we know 12 species of coccidia belonging to the genus *Eimeria* which occur in red deer and 8 species of coccidia belonging to the genus *Eimeria*, 1 species of the genus *Isospora* and 1 species of the genus *Wenyonella* (Pellérdy, 1974) which occur in roe-deer.

First reports on coccidia in *Cervus elaphus* L. were published by Galli-Valerio (1927 — *E. cervi*), Rastegajev (1930 — *E. hoegneri*, *E. gallivalerioi*) and Yakimoff (1935 — *Eimeria* spp.). Reports on the distribution of coccidia in European countries and description of new species were published in Austria by Supperer and Kutzer (1961 — *E. assymetrica*, *E. austriaca*, *E. robusta*, *E. sordida*), in Germany by Boch and Lucke (1961). *E. schoenbuschi* was described by Boch (1963) in Germany, *E. elaphi* by Jansen and van Haften (1966) in Holland. Brglez and Bidovec (1978) described findings of *E. robusta* in red deer in Yugoslavia. First information on the distribution of coccidia in red deer in Czechoslovakia was published by Ryšavý (1954). He described 6 coccidia species of the genus *Eimeria* specific for domestic ruminants. Volf and Volfová (1974) also found

2 species of the genus *Eimeria*. Chroust (1975) found sporadic cases of low-grade infection with *E. asymetrica* and *E. robusta*.

The occurrence of coccidia in *Capreolus capreolus* L. in Europe was described by Galli-Valerio (1927 — *E. capreoli*) and Wetzel (1942 — *E. ponderosa*). Pellérdy (1955) described the species *E. rotunda* and *E. superba*, Svanbajev (1958) *Isospora capreoli*, Boch and Lucke (1961) new *Eimeria* spp., Supperer and Kutzer (1961) *E. panda*. Further species were found in Italy by Mantovani et al. (1970). The occurrence and distribution of coccidia in roe-deer was studied on the basis of this knowledge in the U. S. S. R. by Pužauskas and Arnastauskiene (1968), Arnastauskiene et al. (1970, 1974), in Germany by Boch and Lucke (1961), Minck (1968), in Austria by Kutzer and Knaus (1969), in Yugoslavia by Brglez and Bidovec (1978). Ryšavý (1954) in Czechoslovakia studied the composition of coccidia species, Dyk and Chroust (1973, 1974, 1975) engaged in problems of the interrelationship between the composition of coccidia species and simultaneously occurring infections in moufflons and roe-deer, and Volf and Volfová (1974) studied the same interrelationship in red deer and roe-deer. The distribution of coccidia in roe-deer and their effect on the health condition of roe-deer in CSR was studied by Zajíček et al. (1980).

MATERIAL AND METHODS

The paper presents an evaluation of coccidia findings in *C. elaphus* L. and *C. capreolus* L. in the 1975–1980 period (July 1975 — September 1980) in two neighbouring hunting-grounds of VSL Hořovice and LZ Zbiroh situated in the Central Bohemian range of Brdy hills (550 m above sea level). A total of 16 guts and 676 samples of faeces from *Cervus elaphus* L. and 41 guts and 460 samples of faeces from *Capreolus capreolus* L. were examined in this period.

The guts of red deer originated from older age groups, the guts of roe-deer from all age groups of these animals. The samples of faeces were collected from all age groups of both animal species. The greater part of the evaluated material was obtained in winter on the occasion of dehelminthization of animals with pre-medicated feed. In the winter period, the samples of faeces were collected around the feeding racks and resting places of animals, in the course of the year on the known trails and resting places in the hunting-grounds under observation.

A helminthologic post-mortem examination of the guts was made and in addition, scrapings from different sections of intestinal mucosa were examined, and a faecal examination of samples from the rectum was made in order to demonstrate coccidia oocysts. The faeces were examined by an ovscope method according to Breza (1959). The results of examination were evaluated according to criteria commonly used in veterinary parasitologic diagnosis. In case of more numerous findings of oocysts, a quantitative coprologic method according to Wetzel (1951) was used to calculate the number of oocysts per 1 gram of faeces using the McMaster's chamber (OPG — oocysts per gram). Time of sporulation of oocysts under laboratory conditions was determined in a solution of 2.5% potassium dichromate and 1% chloroamine into which we placed the concentrated coccidia oocysts. The sporulation was evaluated after 24 hours and afterwards at intervals of 2 days.

RESULTS

The findings of coccidia species in red deer and roe-deer are presented in Table 1. The findings in faeces were in accordance with general occurrence of coccidia in red deer and roe-deer. The small number of examined guts caused a misrepresentation of results. The oocysts of coccidia were in accordance with respective morphologic data as given in literature.

Red deer (*C. elaphus* L.)

The oocysts of coccidia found in the examined guts and samples of faeces from red deer included the following: *E. austriaca* Supperer, Kutzer, 1961, *E. elaphi* Jansen, van Haaften, 1966, *E. robusta* Supperer, Kutzer, 1961, *E. sordida* Supperer, Kutzer, 1961, and *E. wapiti* Honess, 1955. From the results of examination of faeces it is evident that the occurrence of oocysts in red deer was very low — 9.2%. The species *Eimeria elaphi* occurred most frequently (3.1%). The occurrence of other species (*E. robusta*, *E. sordida*, *E. wapiti*, and *E. austriaca*) was at the same level, i. e. 1.9—1.03%. The findings of oocysts in faeces corresponded with the findings of coccidia species in guts, where the species *E. elaphi* also prevailed. The findings of *E. austriaca*, *E. elaphi*, *E. sordida*, and *E. wapiti* complete the present knowledge of parasites occurring in *Cervus elaphus* L. in Czechoslovakia.

The intensity of coccidia findings in red deer was usually very low. There were found sporadic oocysts or a low-grade infection mostly with one coccidia species. Mixed infections with two coccidia species were found very rarely. The findings of sporadic oocysts did not make it possible to use a quantitative coprologic method and to localize the infection in certain sections of the intestinal tract.

It was possible to follow the prevalence of coccidia in individual age groups of animals during the collection of samples of faeces in winter. There were no significant differences in the occurrence of species and numbers of coccidia in calves and hinds, but only sporadic findings were made in stags. There were found only the species *E. elaphi*, *E. sordida* and *E. robusta*.

Roe-deer (*C. capreolus* L.)

The oocysts of coccidia found in the examined guts and samples of faeces from roe-deer included the following: *Eimeria capreoli* Galli-Valerio, 1927, *E. panda* Supperer, Kutzer, 1961, *E. ponderosa* Wetzel, 1942, *E. rotunda* Pellérdy, 1955, and *E. superba* Pellérdy, 1955. The occurrence of coccidia in samples of faeces from roe-deer was more frequent — 47.2%. The species *Eimeria capreoli* occurred most frequently (22.6%), and *E. ponderosa* (10%), *E. panda* (7.4%), *E. superba* (6.1%), and only sporadically *E. rotunda* (1.1%). These findings of coccidia species corresponded with the results of examination of guts. Mixed infections of roe-deer with 2—3 oocysts species were common and the species as follows were found: *E. capreoli*, *E. ponderosa*, *E. superba*, and *E. panda*.

The intensity of infections varied from sporadic findings of oocysts to serious infections particularly in dead roes and fawns, especially in winter in the first months of the year. Heavy coccidiosis as the cause of death which was complicated by a lungworm infection *Capreolus capreoli* (Stroh and Schmid, 1938) was diagnosed in two fawns. Oocysts of the species *E. ponderosa* and *E. superba* predominated in this case over *E. capreoli*. Quantitative findings of oocysts of individual species were as follows: *E. ponderosa* up to 1260 O. P. G., *E. superba* up to 1067 O. P. G., *E. capreoli* up to 996 O. P. G., i. e. up to 2323 O. P. G. per animal. In examining dead animals and guts of killed roe-deer, we did not succeed in localizing the infection in certain sections of the intestinal tract but only in the small intestine.

Table 1. Occurrence of coccidia in red deer and roe deer in the region of Brdy Hills (Central Bohemia) in the 1975-1980 period

Year	<i>Cervus elaphus</i>										<i>Capreolus capreolus</i>									
	Examun. Number	au	el	<i>Eimeria</i> rob	so	wa	Total posit.	Examun. Number	ca	pa	po	rot	su	Total posit.						
Guts:																				
1975	1	-	-	-	-	-	-	2	1	1	-	-	-	2						
1976	2	-	-	-	-	1	1	11	5	2	4	-	1	12						
1977	4	-	-	-	-	-	-	16	5	1	1	-	1	8						
1978	4	-	1	-	1	-	2	4	2	2	2	-	-	6						
1979	3	-	1	1	-	-	2	3	1	1	-	-	-	2						
1980	2	-	-	-	-	-	-	5	1	-	2	-	2	2						
1975-80	16	-	2	1	1	1	5	41	15	7	9	-	4	35						
%			12.5	6.2	6.2	6.2	31.2		36.6	17.1	21.9	-	9.7	85.4						
Faeces:																				
1975	24	-	2	1	-	1	4	36	11	3	5	-	1	20						
1976	64	1	4	3	2	2	12	64	22	5	7	-	5	39						
1977	86	-	6	2	4	2	9	51	9	3	6	1	3	22						
1978	145	3	2	3	3	2	13	104	21	8	11	-	5	45						
1979	285	-	5	2	2	4	13	130	32	15	11	4	6	68						
1980	72	3	2	2	2	2	11	75	9	-	6	-	8	23						
1975-80	676	7	21	13	13	13	62	460	104	34	46	5	28	217						
%		1.03	3.1	1.9	1.9	1.9	9.2		22.6	7.4	10.0	1.1	6.1	47.2						

Explanations: au - *Eimeria austriaca*; el - *E. elaphi*; rob - *E. robusta*; so - *E. sordiae*; wa - *E. waiphi*; ca - *E. capreoli*; pa - *E. panda*; po - *E. ponderosa*; rot - *E. rotunda*; su - *E. superba*.

The prevalence of coccidia in individual age groups of roe-deer was followed in the course of all seasons in the 1975—1980 period. The results of the study show that the findings were more numerous in roes and fawns, which is due to their adherence to a certain area and locality, in contradistinction to roebucks particularly during oestrus. One of the primary factors in the process of infection are the feeding possibilities of roe-deer, which essentially influence the transmission and surviving of oocysts.

We succeeded in ascertaining the time of sporulation of coccidia of roe-deer owing to more frequent findings of oocysts, but it was ascertained only in sporadic cases in red deer because the intensity of infections was very low. The sporulation of oocysts under laboratory conditions was studied in the species *E. capreoli*, *E. ponderosa*, *E. superba* and *E. elaphi*. It was in accordance with the respective data in literature.

In the hunting-grounds under observation, both animal species live together. There was not found any transmission of coccidia from one animal species to another neither in examined guts nor in samples of faeces collected at common feeding racks, resting places or common pastures.

DISCUSSION

The occurrence of coccidia in red deer and roe-deer is not often a subject of study since, with few exceptions, they usually are not the only causing agents of parasitic infections but they occur together with helminthiasis. The species of coccidia occurring in red deer and roe-deer in both huntinggrounds in Central Bohemia are the same as those usually found in deer in the neighbouring countries, according to the reports of Boch, Lucke (1961), Supperer, Kutzer (1961), Jansen, van Haaften (1966), Kutzer, Knaus (1969), and Brglez, Bidovec (1978).

Chroust (1975) reports only sporadic findings of *E. asymetrica* and *E. robusta* in faeces of red deer in our country. Supperer, Kutzer (1961) and Jansen, van Haaften (1966) also mention sporadic findings of coccidia they have described. A comparison of the obtained results with those of the above mentioned authors indicate that they are only sporadic findings which are of no great pathogenic importance in *C. elaphus*. Our findings have completed the number of coccidia species occurring in red deer in CSR with three additional species, which probably occur in the whole territory inhabited by red deer.

Coccidia in roe-deer in our country was studied by Chroust (1975). He reported on the occurrence of *E. capreoli*, *E. panda*, *E. ponderosa*, and *E. superba* with different prevalence. *E. capreoli* occurs most frequently in young animals up to one year of age. The extensity of findings is much lower in older roes. *E. ponderosa* is found at serious infections the intensity of which conforms to clinical conditions in young domestic ruminants. It affects mostly fawns up to the age of 6 months but it is common in roes, too. *E. superba* was found to be (Chroust 1975) the commonest coccidia species in roe-deer, particularly in fawns up to the age of months, causing serious infections, but low-grade infections are found in all age groups. The species *E. panda* was found by Chroust in 30% extensity. The above mentioned data were confirmed by our findings. It is true that the major part of coccidia findings belonged to the species *E. capreoli* but we hold the pathogenicity of this

species for much lower than that of the species *E. ponderosa* and *E. superba*, as it was demonstrated on more ample material from the whole territory of CSR (Zajiček et al., 1980). Up to the present time, lethal infections in winter connected with high quantitative findings of oocysts were only found in roe-deer reared in captivity (Minck, 1968) but not in free living roe-deer. Pellérdy (1974), Kutzer, Knaus (1969) and Arnastauskiene (1974) also expressed the view that the pathogenicity of *E. superba* and *E. ponderosa* is higher than of other coccidia species.

Unlike the original view that an exchange of coccidia between ruminants is possible, Dyk, Chroust (1973, 1974, 1975) presented data supporting the fact that roe-deer in two neighbouring hunting-grounds with different ecologic conditions were affected with the same species of coccidia, and that there occurred no transmission of specific coccidia species from roe-deer to moufflons living in the same hunting-ground. The coccidia occurring in these animals were specific for each animal species. The same fact has been demonstrated in huntinggrounds with roe-deer and red deer coming into contact with each other at common resting places and feeding racks.

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TWO NEW SPECIES OF HYPOASPIDINAE (ACARI: MESOSTIGMATA: DERMANYSIIDAE) ASSOCIATED WITH ANTS

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Abstract. A description is given of the mite *Hypoaspis deinos* sp. n. found in the nest of *Lasius flavus* and of *Cosmolaelaps thysanifer* sp. n. found in the nest of *Formica fusca*, both from Bohemia (Czechoslovakia).

The subfamily Hypoaspidinae Vitzthum, 1941 comprises a number of free-living and insectiphilic forms as well as the species inhabiting the nests of vertebrates. This group has been regarded as a source of evolution of further nidicolous and parasitic forms of Dermanyssidae (Radovsky, 1968). The classification of the species of the *Hypoaspis*-complex is not stable. Generally the complex has been conceived as the genus *Hypoaspis* Canestrini, 1885 with a number of subgenera (Evans and Till, 1966; Bregetova, 1977). A rather different classification was suggested by Karg (1965, 1971). The attempts to arrange logically such a numerous genus as *Hypoaspis* Can. s. lat. were not successful, as pointed out by Evans and Till (1966) and Costa (1968), as they were based only on material from the Palearctic region. The review of most world-known species with a new suggestion for their arrangement has been recently published by Karg (1979). He divides the genus *Hypoaspis* Can. into 8 subgenera: *Hypoaspis* Can. s. str., *Hypohasta* Karg, 1979, *Cosmolaelaps* Berlese, 1903, *Alloparasitus* Berlese, 1920, *Geolaelaps* Trägårdh, 1952, *Pneumolaelaps* Berlese, 1920, *Holostaspis* Kolenati, 1858 and *Laelaspis* Berlese, 1903, subdivided into species-groups.

Evans and Till (1979) have lately conceded generic status for their formerly proposed subgenera. According to this concept the described species are placed in taxa with generic status.

♂

Hypoaspis deinos sp. n.

Female: Chelicera with basal segment 65, second segment 179 and movable digit 72 μm long. The structure of gnathosoma typical of the genus. Deutosternum with 6 files of denticles with about 17 denticles in each file. Pedipalp (2—5—6—14) with two-tined apotele. The form of chelicera and tectum are shown in Fig. 2.

Dorsum: Dorsal shield 610 μm long and 345 μm wide bears 39 pairs of setae and one unpaired accessory seta. The form of shield and its chaetotaxy are presented in Fig. 1 (A).

Venter: Tritosternum with base 54 μm , laciniae 90 μm . Sternal shield 170 μm long, 102 μm wide between coxae II. and 184 μm wide on the level of gap

between coxae II. and III. The shield bears three pairs of setae and two pairs of pores. Distances: between st. 1 = 70 μm , between st. 2 = 87 μm and between st. 3 = 110 μm . Genital shield 180 μm long and 87 μm wide bears one

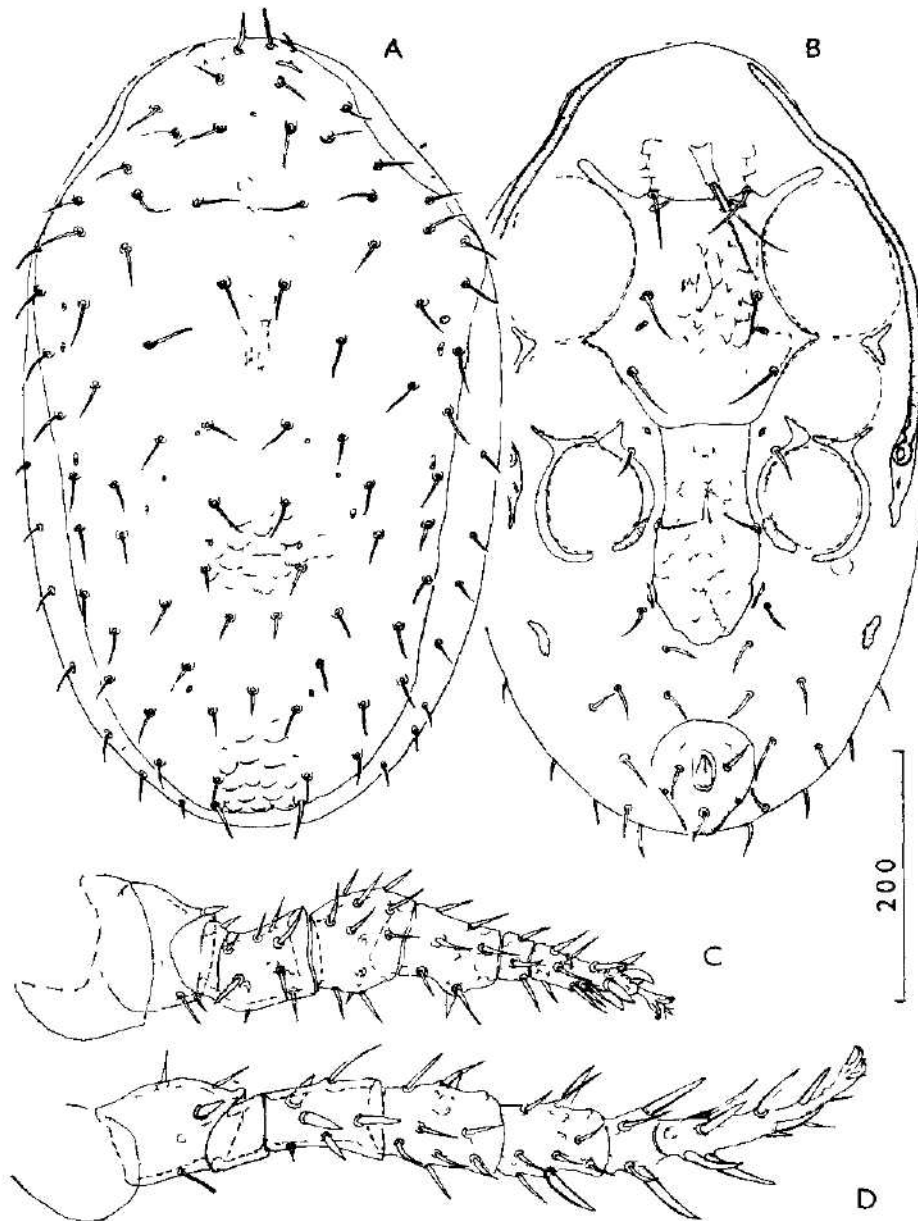


Fig. 1.: *Hypoaspis demos* sp. n. female: A - dorsal side, B - ventral side, C - leg. II., D - leg. IV.

pair of genital setae on its lateral margins. The lines of ornamentation of the genital shield are winding in the distal part (Fig. 1 (B)). Anal shield 103 μm long, 83 μm wide, bears three perianal setae.

Legs with normal chaetotaxy. There are stout and spine-like setae on legs II.–IV. as typical of *Hypoaspis aculeifer* — group. The chaetotaxy of legs II. and IV. is seen in Fig. 1 (C, D).

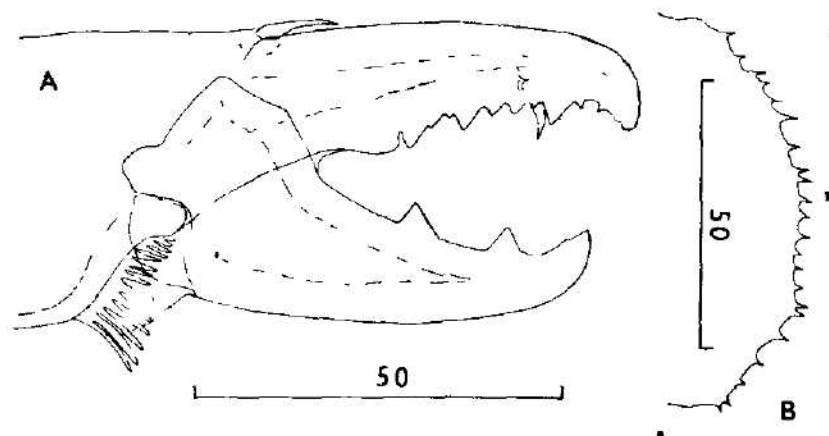


Fig. 2.: *Hypoaspis deinos* sp. n. female: A — chelicera, B — tectum.

Male: Chelicera with basal segment 47, second segment 114 and movable digit 42 μm long, spermatodactyl is 24 μm long. The form of chelicera with spermatodactyl as in Fig. 3 (D). Other structures of gnathosoma are similar to those of female.

Dorsum: Dorsal shield 485 μm long and 290 μm wide bears 39 pairs of setae and one accessory seta as in female (Fig. 3) (B)).

Venter: (Fig. 3 (A)) Holoventral shield is 400 μm long and 82 μm wide on the level between coxae II. resp. 205 μm in the widest part beyond coxae IV. The shield bears two pairs of pores, four pairs of sternal setae and one pair of genital setae. Distances: between st. 1 = 58 μm , between st. 2 = 75 μm and between st. 3 = 87 μm . In the opistonotal region of holoventral shield there are 5 pairs of ventral setae and three perianal setae. The chaetotaxy of legs is the same as in female.

Diagnosis: *H. deinos* sp. n. reveals close relations with *H. aculeifer* (Canestrini, 1883) and related species (*H. angustus* Karg, 1963, *H. queenslandicus* (Womersley, 1956), *H. neoaculeifer* Hirschmann, 1966). This new species differs from them mainly in the following characters: one unpaired accessory seta on dorsal shield, shorter and stronger chaetotaxy of dorsal shield and legs, winding ornamentation of distal part of genital shield and different denticulation of chelicera.

Material: Holotype ♀ (No. Pa. Ú. ČSAV 1888) nest of *Lasius flavus* (Fabricius, 1781) in garden soil, orchard, Prague, Czechoslovakia, 17. 6. 1978.

Allotype ♂ (No. Pa. Ú. ČSAV 1889) with the same data as holotype.

Cosmolaelaps thysanifer sp. n.

Female: Chelicera with basal segment 28 μm long, second segment 85 μm long and movable digit 25 μm long. Denticulation of chelicera is seen in Fig. 5 (B). Deutosternum with 8 files of denticles. The ridges Q1 and Q8 without denticles, in the ridges Q2—Q5 there are 8—9 denticles and Q6 and Q7 both with 11 denticles. The formula of palpal chaetotaxy is 2—5—6—14. Two-tined apotele is seen in Fig. 6 (C) and tectum as in Fig. 5 (A). Other structures of gnathosoma are typical of the genus.

Dorsum: Dorsal shield 408 μm long and 255 μm wide bears 39 pairs of setae

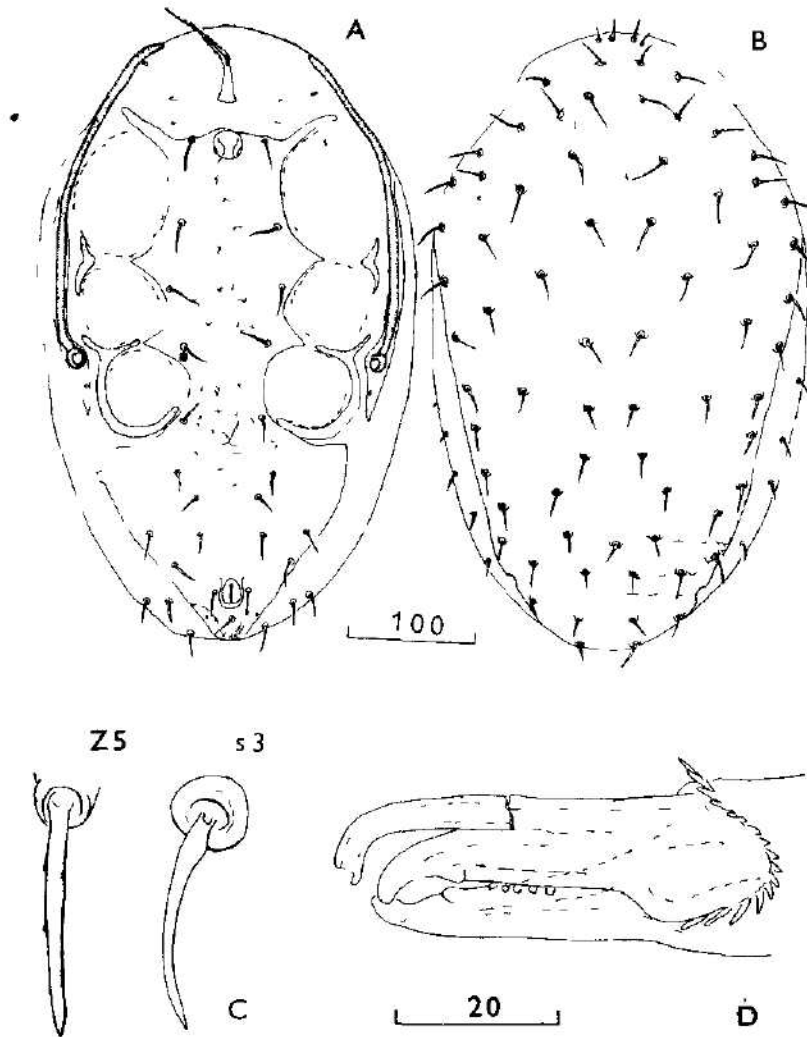


Fig 3.: *Hypoaspis deinos* sp. n.: A — ventral side of male, B — dorsal side of male, C — setae Z5 and s3 of female, D — chelicera of male.

and two unpaired accessory setae. Majority of the dorsal setae are scimitar-like and relatively long, distributed as in Fig. 4 (A). The setae Z5 are brush-like (Fig. 4) (C)).

Venter: (Fig. 4 (B)). Tritosternum with base $20\ \mu\text{m}$, laciniae $61\ \mu\text{m}$. Sternal shield $94\ \mu\text{m}$ long, $76\ \mu\text{m}$ wide between coxae II. and $130\ \mu\text{m}$ wide in the

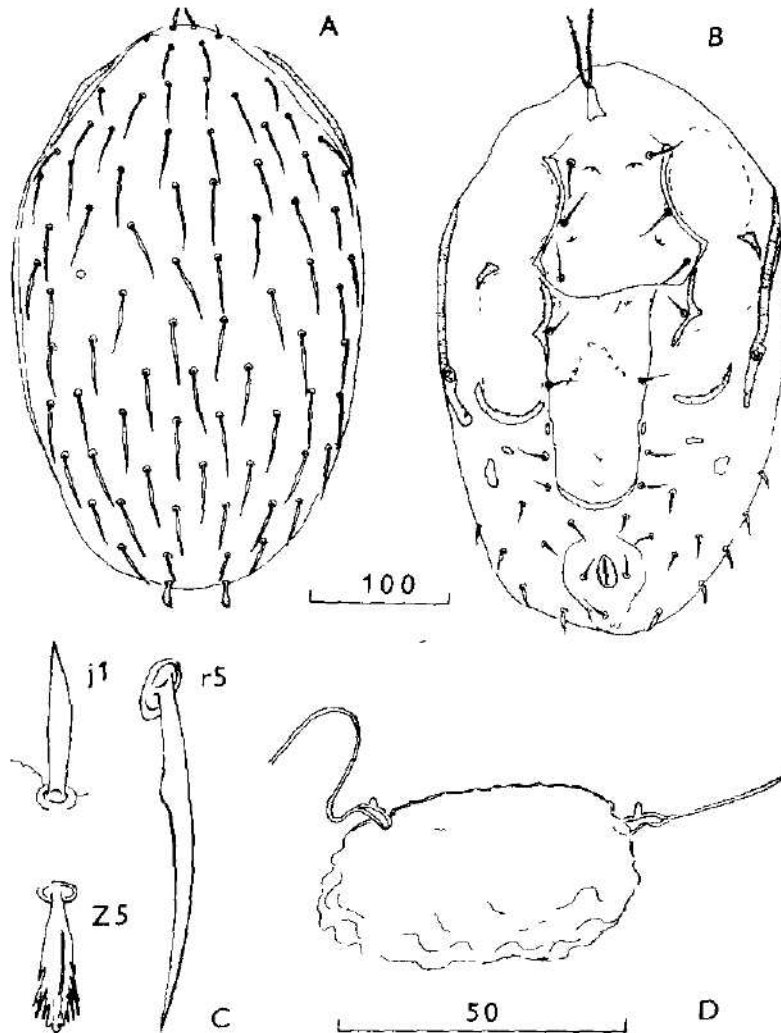


Fig. 4.: *Cosmoiaelaps thysanifer* sp. n. female: A - dorsal side, B - ventral side, C - setae j1, r5 and Z5, D - spermatheca.

widest part on the level between coxae II. and III. The shield bears three pairs of setae and two pairs of pores. Distances: between st. 1 = $58\ \mu\text{m}$ between st. 2 = $78\ \mu\text{m}$, between st. 3 = $92\ \mu\text{m}$, between pst. 1 = $33\ \mu\text{m}$ and between pst. 2 = $69\ \mu\text{m}$. Genital shield is $134\ \mu\text{m}$ long and $65\ \mu\text{m}$ wide on the

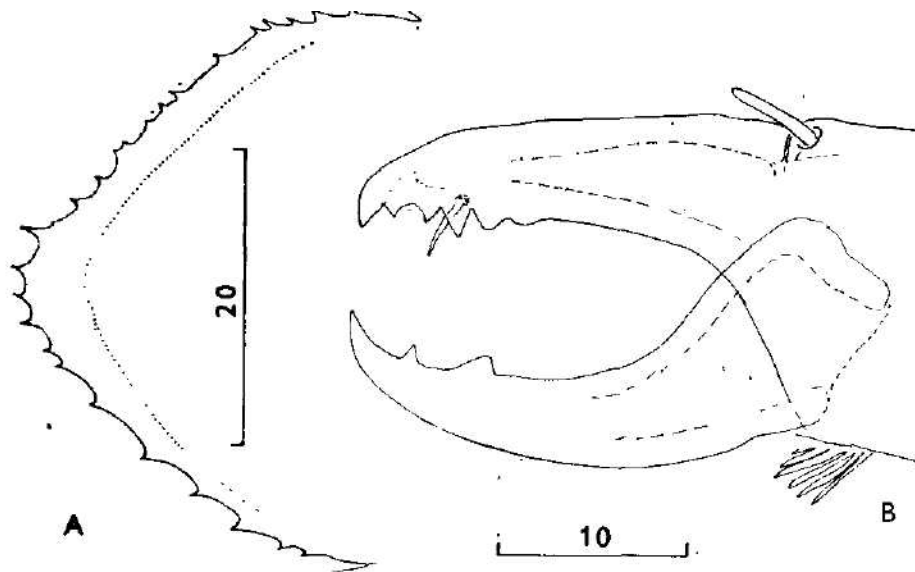


Fig. 5.: *Cosmolaelaps thysanifer* sp. n. female: A — tectum, B — chelicera.

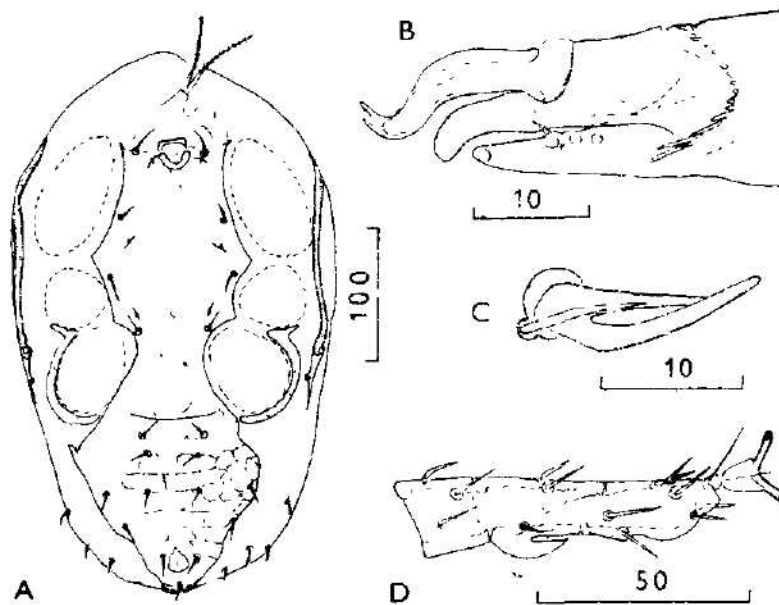


Fig. 6.: *Cosmolaelaps thysanifer* sp. n.: A — ventral side of male, B — chelicera of male, C — apotele of female, D — tarsus of male.

level of genital setae. A pair of genital setae is situated on parallel margins of shield. Anal shield 56 μm wide and 67 μm long, bears two paraanal setae 16 μm long and a postanal seta 20 μm long. Legs with normal chaetotaxy.

Male: Chelicera with basal segment 22 μm , second segment 85 μm , movable digit 28 μm long and spermatodactyl 16 μm long (Fig. 6 (B)). Other structures of gnathosoma similar to those of female.

Dorsum: Dorsal shield 393 μm long, 224 μm wide, has the same chaetotaxy as female.

Venter: (Fig. 6 (A)). Holoventral shield is 327 μm long and 67 μm wide between coxae II. and 138 μm wide in ventral part beyond coxae IV. The shield bears in the podonotal region four pairs of sternal setae, one pair of genital setae and three pairs of pores. Distances: between st. 1 = 51 μm , between st. 2 = 75 μm and between st. 3 = 87 μm . In the opistonotal region of the holoventral shield there are 5 pairs of ventral setae and three perianal setae.

Legs with normal chaetotaxy. Sickle-like process of tarsus IV. is seen in Fig. 6 (D).

Diagnosis: *C. thysanifer* sp. n. has a number of features similar to *Cosmolaeps vacua* (Michael, 1891) and related forms. The new species can be most easily distinguished by the following characters: long and narrow dorsal setae and the brush-like setae Z5.

Material: Holotype ♀ (No. Pa. Ú. ČSAV 1890) nest of *Formica fusca* L., 1758, meadow near Bubovice-village, district Beroun, central Bohemia, Czechoslovakia, 7. 7. 1978.

Allotype ♂ (No. Pa. Ú. ČSAV 1891) and paratypes: 4♀ and 4♂ with the same data as holotype.

The type material is deposited in the collection of the Arachnoentomological department, Institute of Parasitology, Czechoslovak Academy of Sciences in Prague.

Acknowledgement

I wish to thank to Dr. K. Samsíňák (Institute of Parasitology, Czechoslovak Academy of Sciences) for lending me the comparative material.

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REVIEWS — RECENSE

Hrabě S., 1981: *Vodní máloštětinatci (Oligochaeta) Československa*. Acta Universitatis Carolinae, Biologica, 1979: 1–167, 9, 1981. Cena 20,— Kčs.

V sérii Biologica spisů UK vyšel v roce 1970 samostatný svazek věnovaný určování larev pakomárů našich vod (Lellák). Redakce časopisu zařadila nyní do tisku další determinanční práci o vodních bezobratlých — Oligochaeta, která je výsledkem dlouholetého badání a celoživotních zkušeností autora, našeho mezinárodně uznávaného specialisty prof. dr. Sergěje Hraběte, DrSc.

Naše veřejnost již dlouho postrádala podobnou českou příručku k určování této skupiny, protože poslední souborný klíč máloštětinatců (in Fauna CSR I., 1954) je již dávno rozebrán a v systematice i v rozšíření řady druhů nastalo mnoho změn. Vydání takového klíče je o to hodnotnější, že máloštětinatci obývají všechny vodní systémy, jsou tedy hojně rozšířeni a většinou tvoří také husté populace, zejména v prostředí bohatém na organické látky. S tímto materiálem se dostávají do styku pracovníci základního výzkumu a další odborníci v praxi — hydrobiologové, rybáři, vodohospodáři aj., pro něž je určovací klíč vítaným pomocníkem.

Klíč je koncipován klasickým způsobem, obsahuje úvodní kapitoly o sběru, konzervaci a zpracování materiálu a umožňuje „dvouetapovou“ determinaci. Kromě detailního klíče obsahuje ještě stručný klíč pro hrubou orientaci v nejdůležitějších čeledích a v nejběžnějších druzích našich máloštětinatců. Klíč byl vypracován na základě bohatého, převážně domácího materiálu, všechny jednoduché a názorné kresby, umístěné v 19 tabulích na konci práce, jsou rovněž původní.

Určovací příručka zahrnuje celkem 9 čeledí, z nichž čeledě Branchiobdellidae, Enchytraeidae a Lumbriculidae nejsou rozváděny do nižších taxonů. Pomocí klíče můžeme determinovat celkem 108 druhů vodních máloštětinatců včetně některých u nás dosud nenalezených druhů, např. olejnušky *Aelosoma viride* Stephenson, *Rhemorpha neizvestnovae* (Lastočkin), naidky *Homochaeta setosa* (Moszynski), *Pristina bilobata* (Bretscher), nitěnky *Aulodrilus pigueti* Kowalevski, *Potamothrix henscheri* (Bretscher) aj. Oproti staršímu klíči máloštětinatců (Fauna CSR I.) autor zde podrobněji zpracoval zejména čeleď Naididae, rozšířil popisy ostatních čeledí, provedl řadu revizí a podal také popis nového druhu naidky *Nais stolci* Hrabě, 1981.

Některé popisy druhů byly rozšířeny o nové autorovy poznatky, např. vznik celomocytů u *Rhyacodrilus coccineus* (Vejdovský), nebo popis pohlavního aparátu moravských dospělců *Aulodrilus japonicus* Yamaguchi a další.

Klíč je uzavřen bohatým seznamem literatury (147 citací) a dvoustránkovým jmenným rejstříkem. Vydání tohoto klíče je hodnotným přínosem pro celou naši odbornou veřejnost a patří za to dík jak autorovi tak i vydavatelům. Vzhledem ke své širší než československé platnosti zasluhoval by klíč překlad do některého z kongresových jazyků.

Časopis Acta Universitatis Carolinae nejde do běžné knižní distribuční sítě, lze jej však objednat na adrese: Knižovní středisko biologických kateder, Pffr. fak. UK, Viničná 5, Praha 2, PSČ 128 44.

F. Kubiček

Jarvik E., 1980: *Basic Structure and Evolution of Vertebrates*. Volume 1: xvi + 576 pp., 385 figs; volume 2: xiv + 338 pp., 142 figs. Academic Press Inc. Price for both volumes 151 US dollars.

The past decades have been characterized by a re-assessment of opinions on some important moments in the evolution of vertebrates, which have necessarily brought about some modifications in the systematics of this comprehensive and heterogeneous group. Let us remember only the problem of the monophyletic or polyphyletic origin of amphibians and thus of all terrestrial tetrapods. This question has been vigorously discussed since the forties, when the Swedish paleontologist Erik Jarvik published the first of his papers presenting very detailed anatomical proofs for the second alternative. At the beginning, his views were quite unacceptable for a number of conservatively thinking vertebratologists, but with advancing time it becomes ever clearer that Jarvik's theories prove to be correct in many lines.

Recently, Jarvik summarized his lifelong scientific results in a comprehensive publication which will undoubtedly represent a counterbalance in the discussion

with the today relatively obsolete but still very widely used Romer's textbooks. Jarvik proceeds in his considerations from his profound knowledge of the Upper Devonian lobe-fin fish *Eusthenopteron foordi* which undoubtedly represents an anatomical stage which had to be passed through by the ancestors of terrestrial tetrapods. In interpreting the individual anatomic structures of *Eusthenopteron*, Jarvik starts from the anatomy of the most closely related recent fish, *Amia calva*. Two chapters of Jarvik's book are devoted to the anatomy of both above-mentioned fishes. The remaining two comprehensive chapters of the first volume deal with the earlier phases of the evolution of Cyclostomata and Gnathostomata. It is worth noting that in these chapters is presented a description of the most ancient known terrestrial tetrapods, i. e. the Devonian amphibians *Ichthyostega*, *Ichthyostegopsis* and *Acanthostega*. This part is the more valuable, as publications with original descriptions of these key evolutionary stages are today hard to come by, so that many interested rearders acquire their knowledge of this kind from non-original compilation papers which in some cases are not quite accurate. In addition, Jarvik supplemented his reconstructions with the latest findings, as e. g. the position of the ribs in the case of *Ichthyostega* (fig. 170).

While the first volume is interesting particularly for zoologists engaged in the evolution and systematic of lower vertebrates, the second volume brings a number of valuable findings useful also for embryologists and all researchers studying evolutionary morphology. Interesting opinions are given on the development of the nervous system and sensory organs, on the origin of the individual cranial structures, and on the origin and development of paired limbs. In connection with this it is necessary to point out Jarvik's new theory on the origin of all auditory ossicles from the hyoid arch only, which is based on the analysis of the topographic relations of the nervus facialis branches (particularly chorda tympani) and of the muscles in the area of the jaw- and hyoid arch of mammals and *Eusthenopteron*. There is no doubt that these opinions will provoke violent discussion and will stimulate more intense interest in this problem, as up to now it had seemed that there were no objections to the original Reichert-Gaupp theory (cf. e. g. Stark 1979, pp. 336-345).

The conclusion of this book is devoted to a brief survey of the phylogeny of vertebrates. The book is supplemented by comprehensive references, which together with numerous figures of quality warrant that the book will become a good add also for those who are only beginning to deal with the above-mentioned problems. For all these reasons, the book ought to be at hand in all fairly important libraries.

Z. Roček

Holloway J. D., 1979: *A Survey of the Lepidoptera, Biogeography and Ecology of New Caledonia*. X + 551 pages, 152 figs., 87 plates. Dr. W. Junk bv Publishers, The Hague, US \$ 85.35.

The author opens his book with a comprehensive synopsis of geographical and ecological conditions of New Caledonia. Especially, the introductory review of vegetation and biogeography represents an excellent background for a general study of New Caledonian nature, not only for entomological investigations.

Dr. Holloway spent four months in New Caledonia in 1971, making a quantitative survey of nocturnal macrolepidoptera which were collected in a network of 82 light-trap sites of the main island's ecosystems. All data on the recorded species are discussed, and a selected large proportion of the species were subject to a sophisticated numerical analysis. The analytical results are well based and used for an outline of evolutionary biogeography and synecology of the Melanesian islands, Australia, Norfolk Island and New Zealand. Some other animal groups of the South-West Pacific are briefly treated as well. A systematic part of Holloway's book is a detailed account of 380 New Caledonian macroheterocera, including a large number of newly described taxa. Unfortunately, a review of rhopalocera (64 butterfly species) is not published here but separately (Holloway and Peters 1976). The taxa of microlepidoptera seem to be an important subject of further research.

The book has been arranged and printed very neatly, well illustrated with plain photos of habitats and lepidopteran species. The maps, computer-analysis figures and other illustrations (e. g., taxonomical diagnosis) are mostly very instructive. The publication is extremely interesting and represents an essential contribution to the natural history of New Caledonia. Not only lepidopterists but all students of the Pacific island biogeography and nature conservation will find this modern treatment highly stimulating.

K. Spitzer

Cloudsley-Thompson, J. L. *The Water and Temperature Relations of Woodlice*. Patterns of Progress, Series Zoology 5, Meadowfield Press Ltd., Shildon, 1977, 84 stran, 19 obr., 5 tab. v textu, § 7.

Stínky a jim příbuzné čeledi jsou jedinými korýši z velmi homogenní skupiny stejnoonožců, kteří jako slepá vývojová větev vystoupily úspěšně na souši a jsou schopny zde žít a rozmnožovat se. Jejich přechod z moře přes litorální zónu až po pouště byl umožněn a provázen rozvojem řady morfo-fyziologických adaptací a způsobů chování. Představují tedy modelovou skupinu na jejichž příslušnicích je možno sledovat řadu obecných problémů od srovnávací morfologie po fyziologii, ekologii a etologii a jsou tedy vhodným objektem pro komplexní studia.

Brožura je uvedena krátkou prvou kapitolou o stejnoonožcích, přinášející i vyobrazení se základními, později užívanými morfologickými pojmy. Podstatná část dalších krátkých kapitol je zaměřena na nejdůležitější faktory, ovlivňující přechod z vody na souš, tj. ztráta vody transpirací, dýcháním, exkrecí, defekací a osmoregulací, dále přijímání vody a hospodaření s ionty. Krátce je probrána i regulace teploty. Plná čtvrtina textu je věnována otázkám chování, smyslové fyziologii a cirkadiánním i sezonním rytmům. Autor se pak krátce dotýká i ekologie terestrických stejnoonožců, jejich vztahu k mikroklimatu a strategii chování v tomto směru.

Knížka je psána velice stručně, jasně, bez zbytečných a rozvláčných podrobností. Velké pedagogické zkušenosti a dokonalá znalost tématu spojená s vlastními pracemi umožnily autorovi vybrat nejpodstatnější problémy a vhodně je dokumentovat. Je potěšitelné, že v textu cituje i práci našich zoologů Jandy a Langa. Celou brožurou proniká evoluční hledisko, kterým jsou posuzovány všechny sledované adaptace. Cenné je dále, že autor neváhá upozornit i na dosud neobjasněné otázky funkční morfologie, fyziologie a ekologie a naznačit i další možné směry výzkumu.

Závěrem je připojena i poměrně obsáhlá bibliografie a jmenný i věcný rejstřík. Přes poměrně úzké téma můžeme doporučit prostudování brožury nejen specialistům, ale všem zoologům a ekologům. Je totiž návodem pro strategii výzkumu v kterékoliv skupině terestrických živočichů a obsahuje řadu podnětných myšlenek pro příbuzné oblasti zoologie a ekologie. Její nízká cena, příhodný formát, a nepřilís velký rozsah podtrhují ještě výše uvedené klady.

M. Kunst

Hanel L.: Systematic position of four *Gyrinocheilus* species

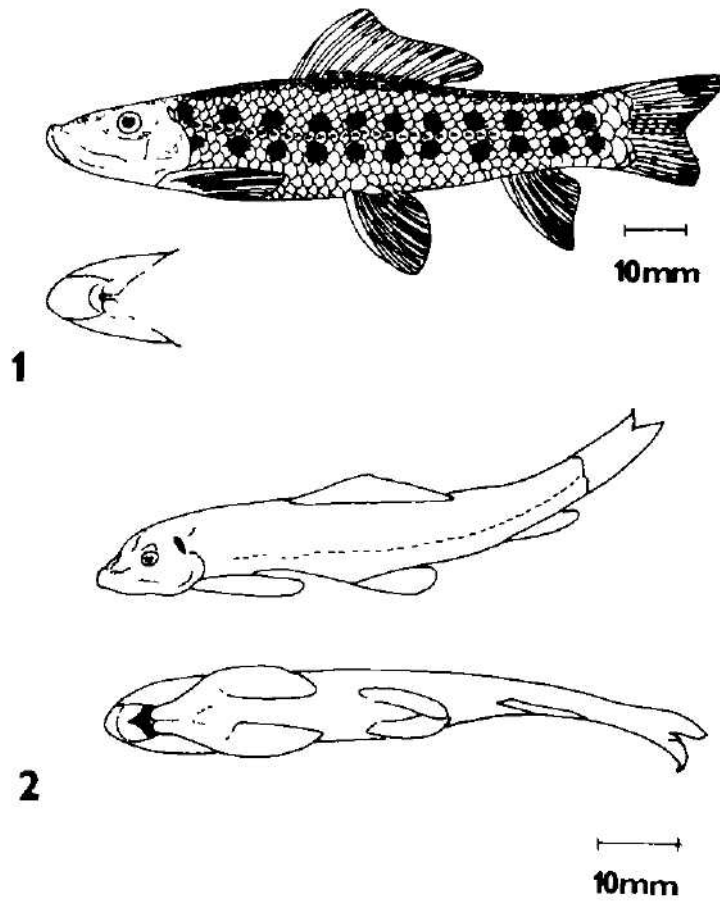


Fig. 1 - *Gyrinocheilus kaznakovi*, after Fowler (1937)
Fig. 2 - *Gyrinocheilus aymonieri*, after Hora (1935)

Hanel L.: Systematic position of four *Gyrinocheilus* species

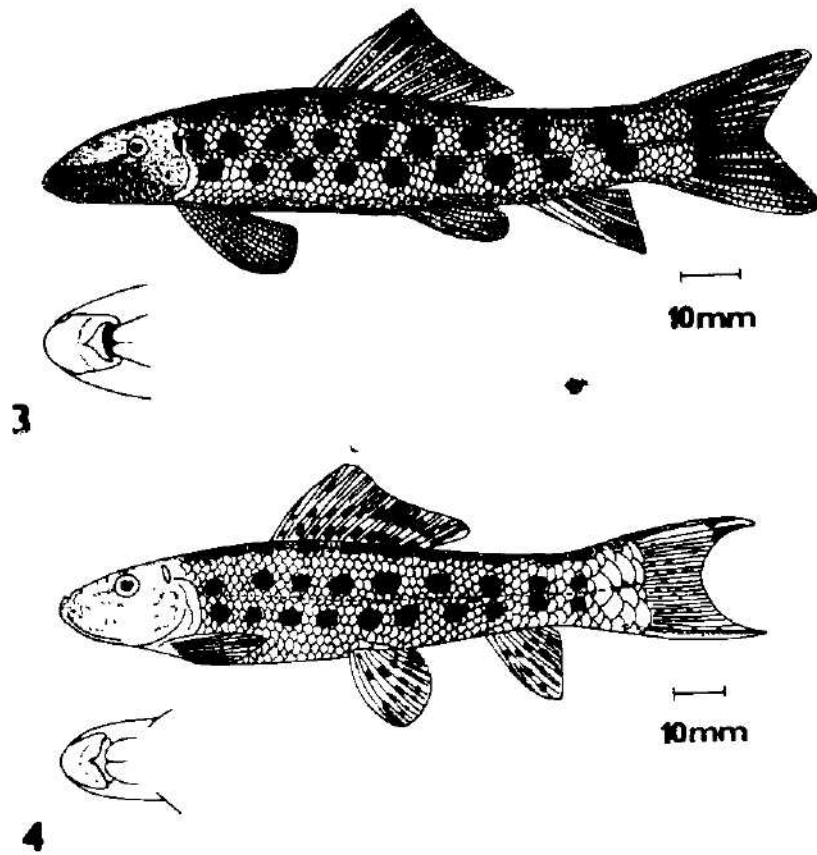


Fig. 3 - *Gyrinocheilus pustulosus*, after Weber and de Beaufort (1916)
Fig. 4 - *Gyrinocheilus pennocki*, after Fowler (1937)

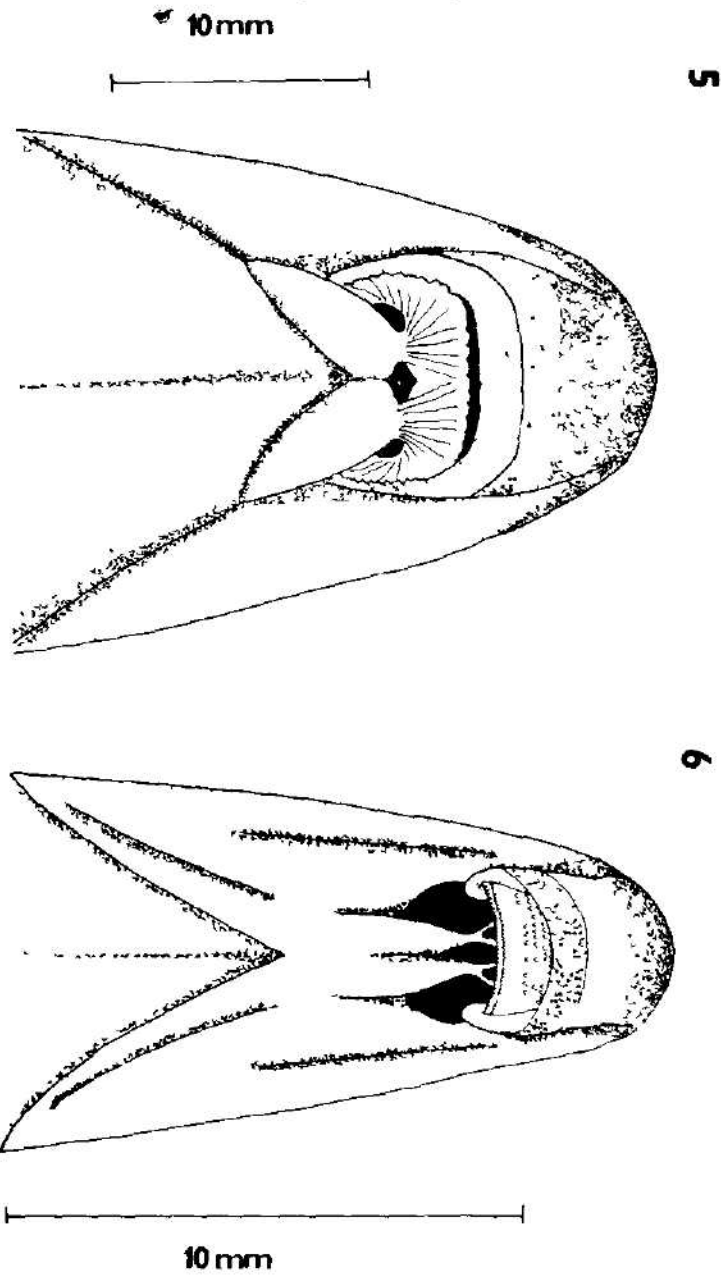


Fig 5 - The detail of the head from below of the specimen *Gyrinocheilus kaznakovi* (121 mm of the body length) Orig

Fig 6 - The detail of the head from below of the specimen *Gyrinocheilus kaznakovi* (45 mm of the body length) Orig

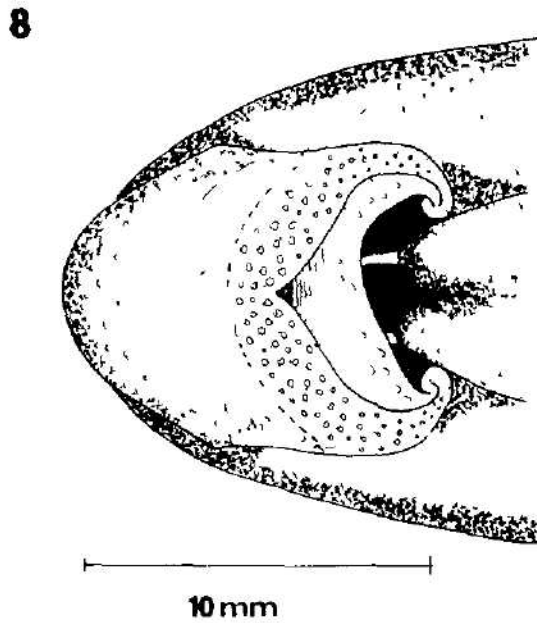
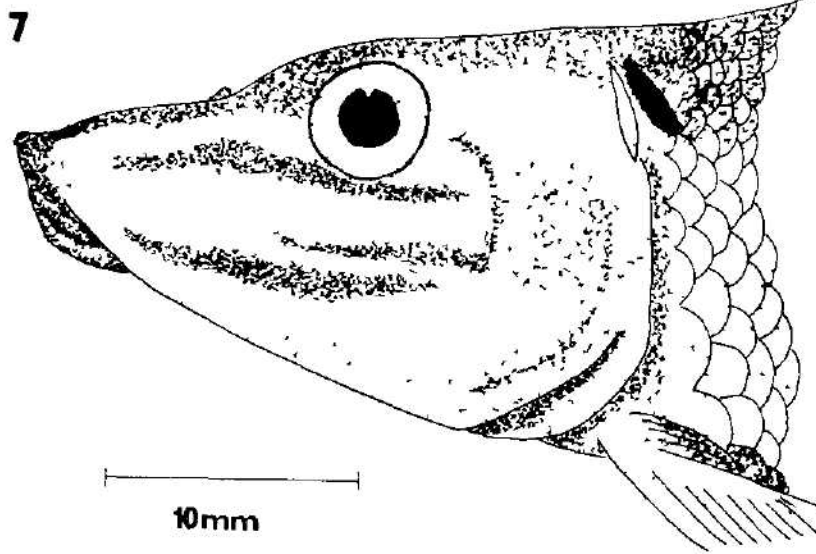
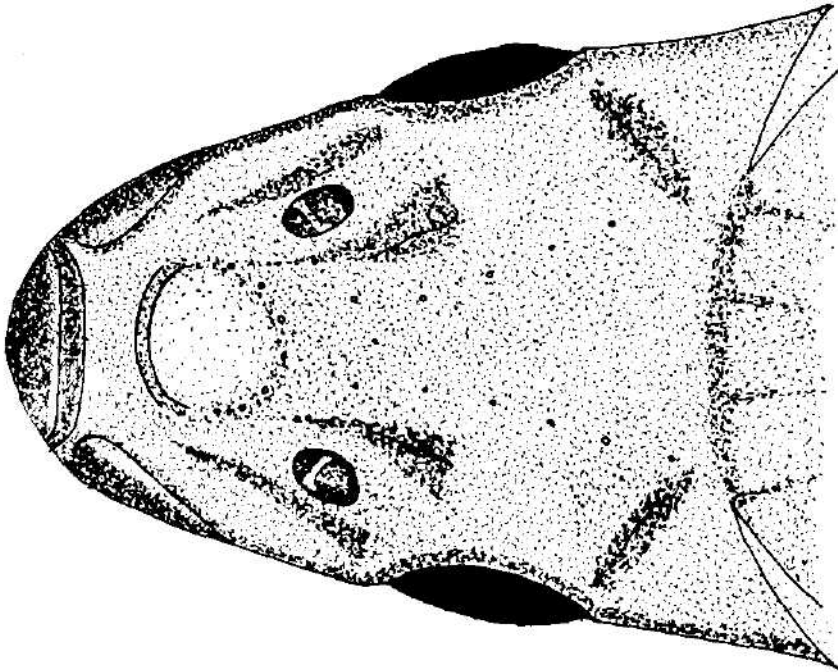


Fig 7 — The detail of the head from the side of the specimen *Gyrinocheilus kaznakovi* (121 mm of the body length) Orig
Fig 8 — The detail of the head from below of the specimen *Gyrinocheilus pustulosus*, after Weber and de Beaufort (1916)



10 mm

Fig. 9 — The detail of the head from above of the specimen *Gyrinocheilus kaznakovi* (107 mm of the body length). Orig.

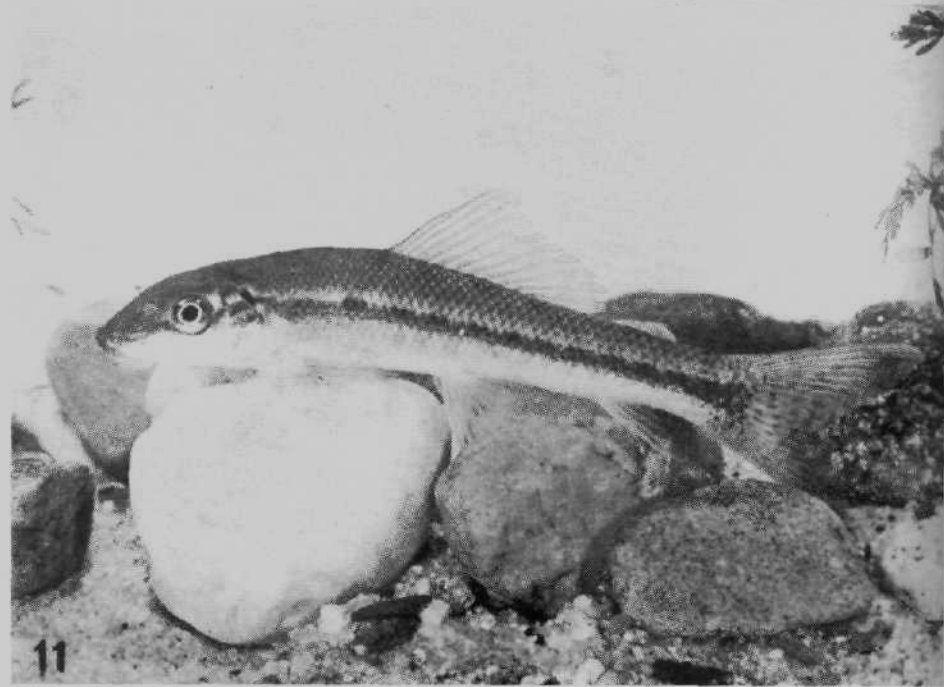
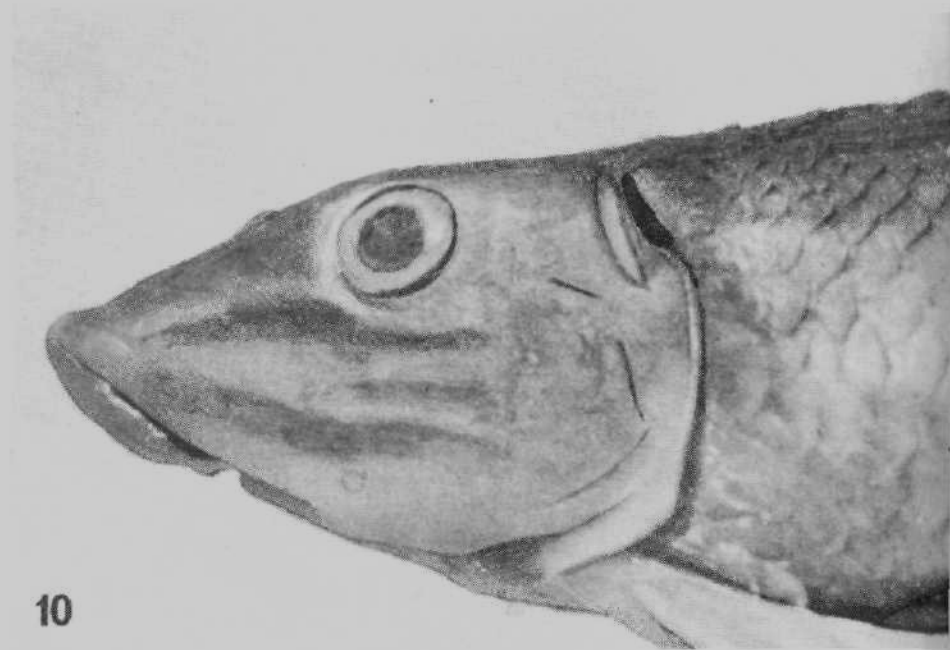


Fig. 10 — The detail of the head from the side of the specimen *Gyrinocheilus kaznakovi* (121 mm of the body length). Orig.
Fig. 11 — The living small specimen of *Gyrinocheilus kaznakovi* (photo M. Chvojka)

Hanel L.: Systematic position of four *Gyrinocheilus* species

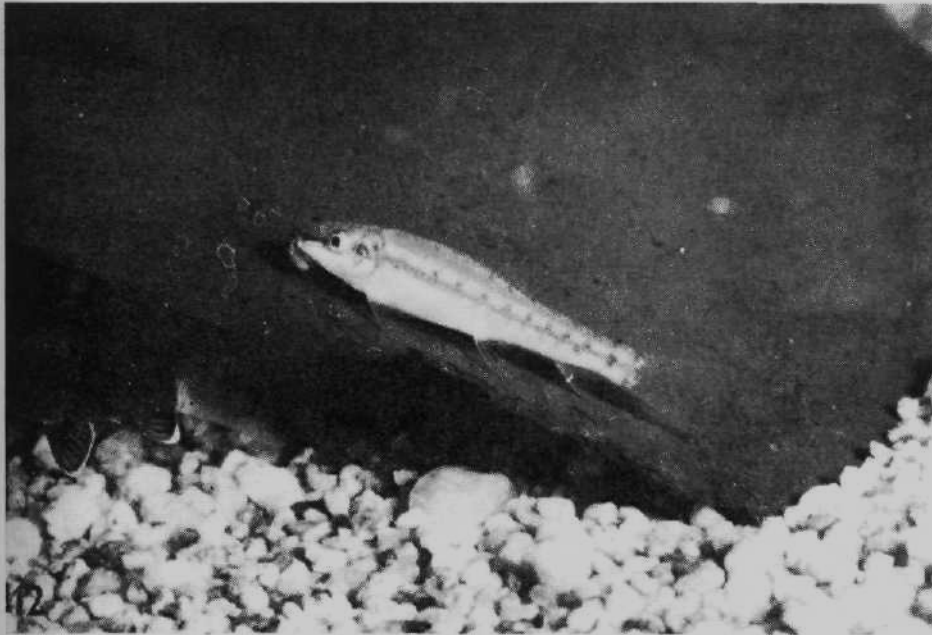


Fig. 12 — The living specimen of *Gyrinocheilus kaznakovi* (photo R. Zúkal)

Fig. 13 — The living specimen of *Gyrinocheilus kaznakovi* (photo R. Zúkal)