

## Intralacustrine speciation in the genus *Dina* (Hirudinea, Erpobdellidae) in Lake Ohrid (Yugoslavia)

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### Abstract

An extensive speciation within Erpobdellidae (resp. *Dina*) has been noted in the Ohridsko Ezero (Lake) (Yugoslav-Albanian border). All species are anatomically similar to *D. lineata*, but differ strikingly in their body shapes. To the already described *D. ohridana* Sket and *D. lepinja* Sket & Šapkarev, descriptions of *D. krilata* sp. n., *D. svilesta* sp. n., and *D. eturpshem* sp. n., are added.

### Introduction

Ohridsko ezero (Ohrid Lake) on the Yugoslav-Albanian border in Macedonia is of great age. It probably dates back to the Pliocene (Stanković, 1960) but this has not yet been clearly established (Serafimova-Hadžišče, pers. comm.). Its surface area is 350 km<sup>2</sup> and its greatest depth is 286 m. It is noted for its high number of endemic species. 75% of a total of c. 80 species of Gastropoda is endemic to the lake and surrounding waters (Hadžišče, 1974). Less extreme, but still important endemicity occurs in some other animal groups. A characteristic of the lake are some flocks of related species, which have obviously mostly developed by 'intralacustrine speciation'. In a number of cases such species differ in external morphology, but seem nearly identical in anatomical characters.

This is particularly interesting in groups which elsewhere exhibit anatomical diversity, but great homogeneity in external morphology. Such is the

case in some Gastropoda Hydrobioidea (Radoman, 1955, 1962), as well as in the genus *Dendrocoelum* (Turbellaria: Tricladida). Almost all European *Dendrocoelum* spp. are white and similar in shape, but differ in the structure of their reproductive complexes. A group of species in Lake Ohrid have similar reproductive complexes, but differ strikingly in color pattern, body shape, and to some extent in their ecology (Kenk, 1978).

Endemism in Lake Ohrid Hirudinea was ignored for a long time. Due to the poor condition of their material, older authors identified the Ohrid animals as common European species (Augener, 1937; Harant & Vernieres, 1932; Pawlowski, 1936; Šapkarev, 1975; Točko & Šapkarev, 1978), although Augener (op. cit.) mentioned some 'defects' in their morphology and Pawlowski (1970 in litt.) suspected the existence of some endemic taxa. Pawlowski (1936: 375–6) described and depicted an extraordinarily large specimen of '*Herpobdella octoculata*' which turned out to be *Dina ohridana*. Augener (1937: 410) remarked

upon the 'unusual shape of contracted *Nepheleis octoculata*' which might in fact only belong to *Dina krilata*; Augener's *Piscicola geometra* was also not depressed 'by action of formaldehyde' (op. cit.: 408), as it appeared to be an endemic *P. (Cystobranchus) pawlowskii*. Moreover, the endemic *Glossiphonia pulchella* was mistaken for a form of '*Clepsine complanata*, close to var. *verrucata*' op. cit.: 409).

First described were some endemic species of Rhynchobdellae (Sket, 1968, 1981). Two endemic taxa of *Glossiphonia* (*G. complanata maculosa* Sket, *G. pulchella* Sket) differ only by external characters, whilst the piscicolid *Piscicola pawlowskii* (Sket) is differentiated also anatomically.

The Erpobdellidae require more effort, including *in vivo* observation and particularly equalized treatment (preservation) of all samples. Therefore, only one taxon has previously (Sket, 1968) been recognized. With the exception of the common *Erpobdella octoculata*, all erpobdellids of the lake are anatomically similar to *Dina lineata*, whilst their shape is diverse to such an extent that sorting is hardly possible at a first attempt.

### Material and methods

For this study, the lake was visited by the author and his colleagues in September 1979 and 1981, and some samples were collected by the staff of the local Hydrobiological Institute (Hidrobiološki zavod, Ohrid). All the springs at and near the lake were sampled, as well as many sites along the entire Yugoslav shore to depths of over 100 m. Scuba diving and dredges were used in deeper locations. A total of 51 samples, containing 1,375 specimens of Erpobdellidae (along with 600 of the Glossiphoniidae) were collected.

Before preservation, all samples were observed alive, shape and color of animals were noted, and some characteristic samples were photographed in color. The animals were narcotized in 10% ethanol, and fixed in 4% formalin to preserve the color pattern for a longer period. They were transferred to 70% ethanol only after having been sorted. After superficial observation and drawing,

some specimens of each presumable species were dissected to test the constancy of shape of the reproductive complex.

To reveal the body geometry, 5 histological sections per specimen were made, with mutual distances of 2/10 of body length, and in distances of 1/10 from both ends of the body itself. The sucker is presented in the sagittal section of the posterior 1/10 of the body. For all species the series of sections are presented in the same manner (Figs. 32–35).

The type material is deposited in collections of the Institut za biologijo Univerze, Ljubljana, 3 syntypes of each new species were sent to the National Museum of Natural Sciences, Ottawa.

### Results

Apart from two species of *Erpobdella* (only *E. octoculata* [L.] reaches also the *Chara*-zone), all other repobdellids seem anatomically similar to *D. lineata* O. F. Müller. One such taxon recognized earlier and described as *D. lineata ohridana* (Sket, 1968) is really an independent species. *D. lineata* itself seems also to be present in the Lake; unfortunately, specimens with well developed reproductive systems have not yet been found. The endemic species flock should bear the name of the first described *Dina ohridana*.

In contrast to other European Erpobdellids which differ little morphologically (except in pigmentation), the Ohrid leeches differ in the body geometry, in the shape of the mouth and the sucker, coloration and transparency grade. The taxonomic importance of such unexpected characters has been confirmed by the fact that in almost any location the specimens may be clearly divided in some morphologically homogeneous groups which equal adequate groupings from other samples. However, differences are partly obscured even after careful preservation; fixation without previous narcosis makes samples almost completely useless. Depigmentation in deeper regions may also obscure some interspecific differences.

Up to now, 5 species could be clearly dis-

tinguished. Besides *D. ohridana*, another species, *D. lepinja* Sket & Šapkarev (1986) has been described. Three more species are described here. All occur in many samples from different locations, in quite high numbers. At least 2 more species are suspected to exist, but require further study.

### New species

*The Dina ohridana*-complex of species – common characteristics

The group is characterized by the *D. lineata*-type of reproductive system with: male atrium body almost as long as the cornua; cornua distant proximally and mostly parallel or convergent towards tips, sharply bent in the dorsiventral direction; ovisacs comparatively weakly developed, irregularly winding, except for the straight, parallel cranial parts; genital pores divided mostly by three or more annuli of the a and b category; male gonopore in the furrow b2/a2; female gonopore

usually in XII/XIII or behind. Pharynx euthyloematous. Four pairs of eyes unequally developed and very variable, mostly some of them reduced or without pigment. Prolongation and subdivision of b6 usually not very distinct.

Species in the *D. ohridana* complex may differ: in the position of the female pore; in the width of the mouth opening and the shape of the supraoral lobe; in the width of the body and the shape of its transverse section; in the size and the thickness of the posterior sucker; in the dorsal color pattern, color and type of pigmentation; in the skin sculpturing; in habitat type. The intensity of pigmentation varies also within species with the depth and so does the sucker development in some of them.

### *Dina svilesta* sp. n.

Material: syntypes, 35 specimens from a depth of 30 m, Bay of Ohrid, Ohridsko ezero (Makedonija, Yugoslavia); about 70 specimens from other locations in the lake.

Table 1. Some morphological characteristics of *Dina lineata* along with its relatives from Ohrid Lake

<i>Dina</i>	<i>lineata</i>	<i>ohridana</i>	<i>eturpshem</i>	<i>lepinja</i>	<i>svilesta</i>	<i>krilata</i>
Shape of supraoral lobe	semicircular	semicircular very large	rounded-triangular	semicircular small	retracted or very small	rounded-triangular
Max. body length	50 mm	65 mm	35 mm	35 mm	40 mm	40 mm
Body width in % of body length	8 (- 10)	11	8	18	17	14
<i>Transversal section near the caudal end:</i>						
Shape	ellipsoidal	ellipsoidal	rounded-trapezoidal	rounded-triangular	reverse bell-shaped	
Height : width	1 : 1.3–1.9	1 : 1.9–2.5	1 : 2	1 : 2.7	1 : 3.8	1 : 1.2
Dorsal side	equal to ventral	less convex than ventral	less convex than ventral	equal to ventral	flat	flat or concave
Pairs of dorsiventral muscles	5	7	4	8	10	5
Distance between gonopores	2 (rarely 3)	3 (to 3.5)	4 (rarely 3)	3	4 (rarely 3)	3 (rarely 4)

Remarks: *D. krilata* also with weakly developed caudal sucker.

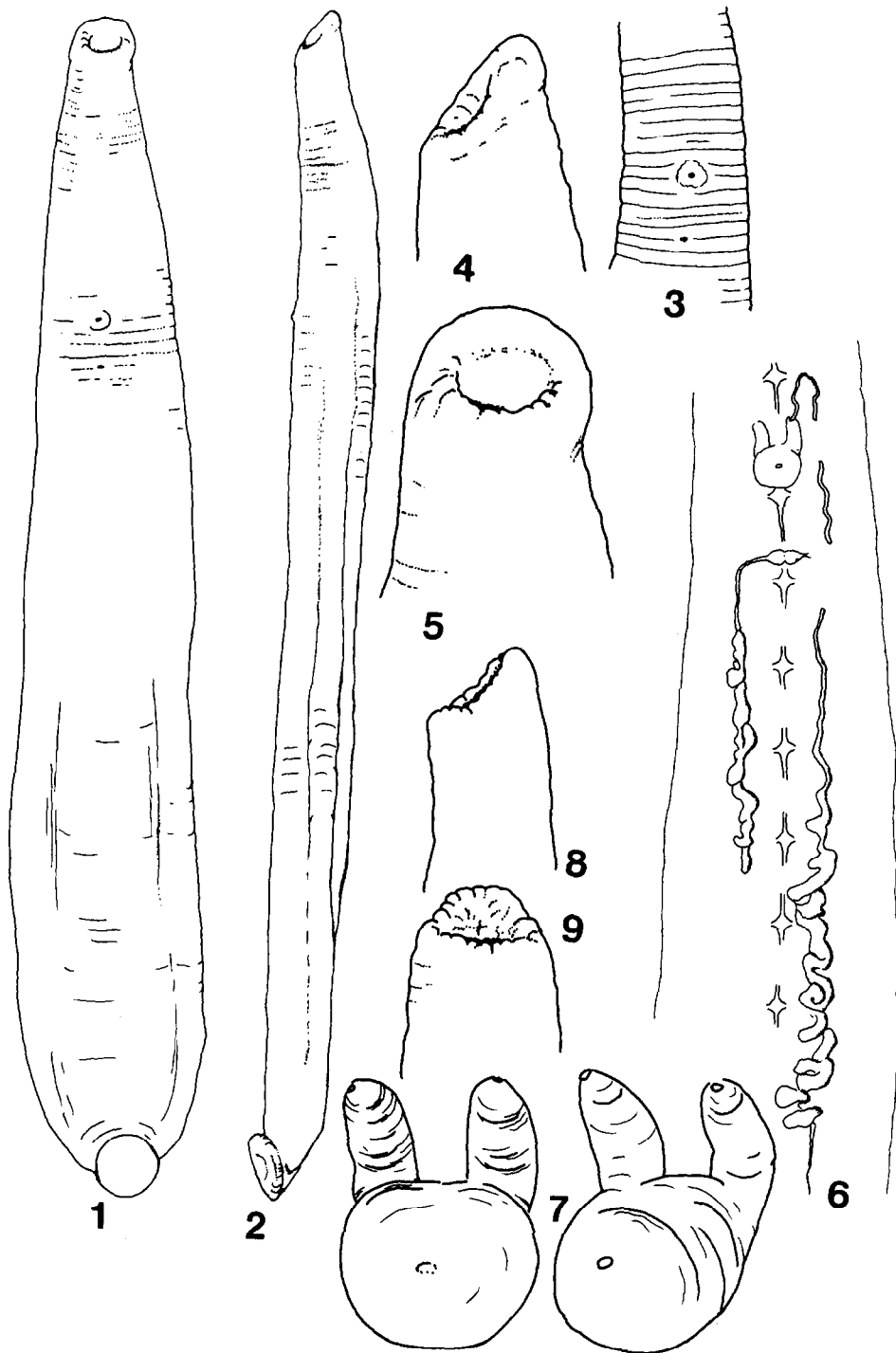


Fig. 1-9. *Dina svilesta* sp. n., lake Ohridsko ezero, off Ohrid-town, - 30 m; 1-7: two specimens of 35 mm; 8-9: 29 mm. 1-5, 8-9. Different views of the body and of its cranial and clitellar regions; 6: main parts of the reproductive system; 7: male atrium.

(all scales in fig. 31).

*Etymology*: *svilesta* – Macedonian for silky; because of the silky appearance of the body cover in preserved specimens.

*External morphology*. Body length of mature specimens about 35 mm, width/length ratio 0.16 seldom higher (up to 0.19). Body (Figs. 1–2, 34) quite broad and thick anteriorly, in caudal direction gaining width very regularly; from the middle to the last tenth the sides are nearly parallel, in the last tenth they are convergently curved. The body is cylindrical only in the anterior tenth, slightly depressed in the second, in the clitellar region its transversal section becomes rounded-trapezoidal; in the strongly depressed posterior half of the body, its dorsal side is flat or only slightly convex to slightly concave. The posterior part of the body with over 10 pairs of dorsiventral muscle strings. The ‘head’ is broad, in most preserved specimens the entire rim of the mouth is slightly contracted to form a rounded sucker (Figs. 4–5); the supraoral lobe is only very rarely broadly rounded-triangular and always short (Figs. 8–9); mouth opening large (about 50% of the body width at the same section). Clitellum not very accentuated. Male opening in b2/a2 (somite XII), only slightly prominent. Female gonopore mostly in b1/b2 (somite XII), thus the gonopores are separated by four annuli of a–b category; the female gonopore is only seldom in b6/b1 (XII/XIII) or in annulus b1. Annulus b6 of the complete somite is slightly prolonged, its subdivision in relaxed specimens not visible. Anus clearly discernible. Posterior sucker about 35–40% of the largest body width, it is muscular and normally developed.

Eyes in most specimens invisible, but 1–3 pairs present and pigmented in some specimens. Skin in live specimens translucent, pinkish, seldom with a brown tint along the mid part of the neck. In preserved specimens the longitudinal muscles are visible through the skin, giving the animal a shiny, silky appearance.

*Reproductive system* (Figs. 6–7). Similar to other species in the group. In the only mature specimen of the type series, the ovisacs are very thin, reach-

ing posteriorly beyond the ganglion XVI. In specimens from other locations in the lake, the ovisacs may nearly reach ganglion XVII or end anterior to ganglion XVI. Epididymides beginning between ganglia XVII and XX, covering the posterior parts of the ovisacs. The thinner part of the male ducts begin at ganglion XVI or anteriorly to it. The atrial cornua very distant, parallel or even divergent.

*Taxonomical position*. *D. svilesta* is a typical member of the *ohridana* group, differing from most relatives by its flat to concave dorsal side. It is much broader and more flattened than the somewhat similar *D. krilata*; it has also a stouter anterior part and normally developed posterior sucker. With respect to the position of gonopores it resembles only *D. eturpshem*, which differs completely in body shape.

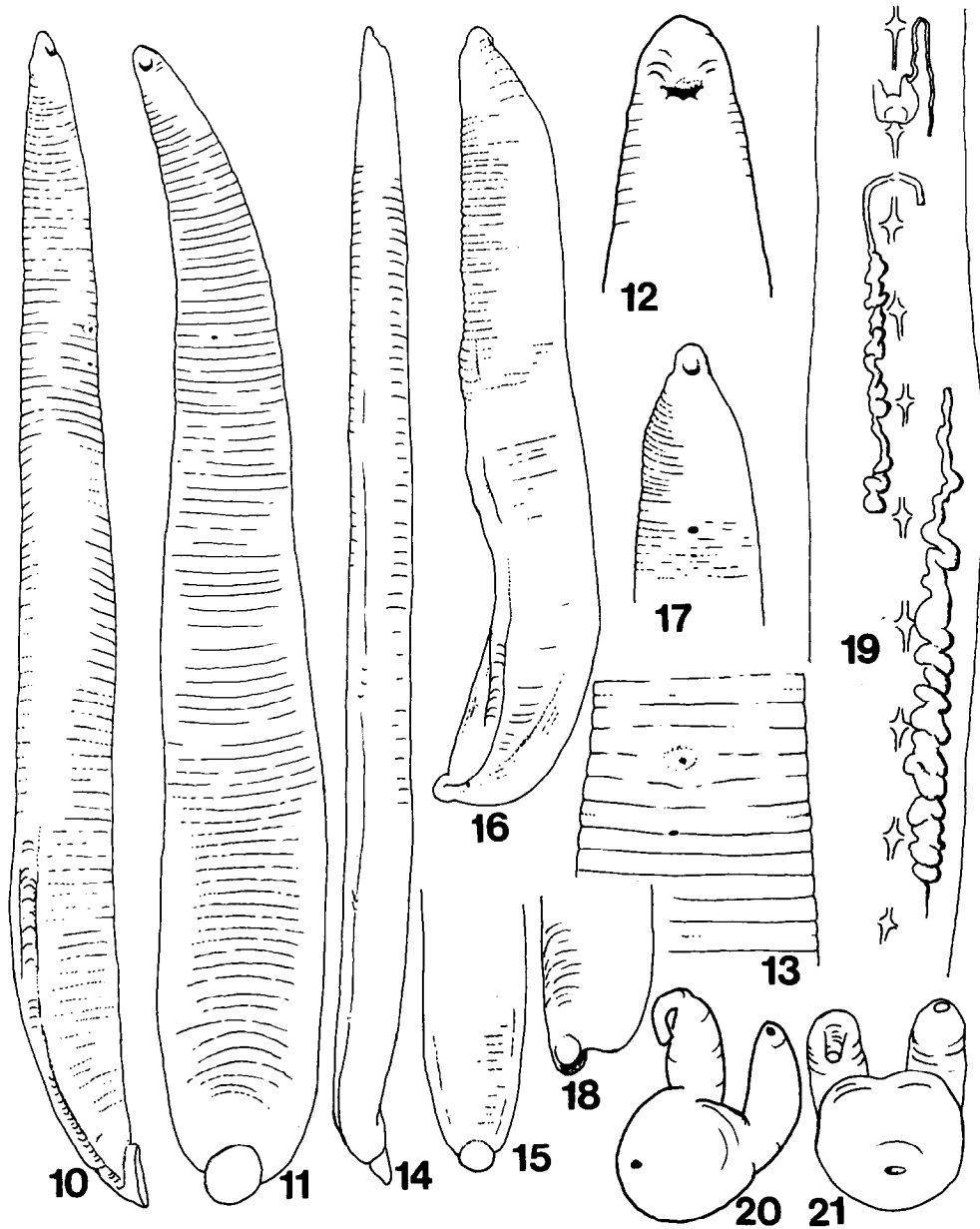
*Distribution*. The species seems to be widely distributed in the lake at moderate depths (infralittoral).

#### *Dina krilata* sp. n.

Material: 31 syntypes from a depth of 30 m, Bay of Ohrid, Ohridsko ezero (Makedonija, Yugoslavia); about 80 specimens from other depths or localities in the Lake.

*Etymology*: *krilata* – winged in Macedonian and in most Slavic languages; because of its ‘winged’ (keeled) appearance, particularly in contracted specimens.

*External morphology*. Body length about 35 mm (smallest specimen with clitellum 29 mm), width 5 mm, width/length ratio 0.13. Body (Figs. 10–11, 33) very narrow anteriorly, gaining very regularly in width over the first 7th tenths of its length and narrowing in last two tenths. It is only slightly depressed in its anterior 4 tenths; posteriorly it develops slight and rounded lateral keels which become thinner and more prominent posteriorly; because of the latero-dorsal keels the body is in its



Figs. 10-21. *Dina krilata* sp. n.; lake Ohridsko ezero; 10-13, 20: 35 mm, off Gradište, - 25 m; 14-15: 34 mm, off Ohrid, - 5 m; 16-18: a contracted specimen, off Ohrid, - 140 m; 19: 37 mm, off Ohrid, - 25 m; 21: 46 mm, off Ohrid, - 50 m. 10-18. Different views of entire bodies, of their cranial, clitellar, and caudal parts resp.; 19: main parts of the reproductive system; 20-21: male atrium.

3 posterior tenths dorsally only slightly convex to slightly concave. Posterior part of the body with about 5 pairs of dorsiventral muscle strings. The supraoral lobe is rounded-triangular, mouth opening very narrow, less than 50% of body width in

the corresponding section (Fig. 12). Clitellum distinct, but not swollen.

Gonopores separated by 3 annuli of a-b rank. Male gonopore in b2/a2 of somite XII, only slightly prominent. Female gonopore almost invariably

between b6/b2, hardly visible. The surface very smooth, annulation indistinct, annulus b6 of each complete somite only slightly prolonged and indistinctly subdivided. Anus clearly discernible. Posterior sucker attaining only 35% of the largest body width, weakly developed, with a thin rim.

In specimens fixed without previous narcosis, the dorsolateral keels are even more prominent, thinner (sharper), folded upwards (making the body's dorsum concave in its posterior part), narrowed abruptly at the body's caudal end (Figs. 16, 18). The 'head' in such specimens is very distinct, narrow, the body immediately behind it quite abruptly gaining in thickness (Fig. 17); annulation distinct.

Usually 3 pairs of eyes weakly pigmented, in some specimens all invisible. Body mostly translucent, both lateral coelomic ducts clearly visible, but not pigmented; color dark red, in the posterior part brownish. In some specimens body opaque and with some more pigmentation.

Preserved specimens may be milky white, some with a tinge of brown pigment, others are shiny (silky).

**Reproductive system** (Figs. 19–21). Ovisacs forming small loops not reaching the midline, but extending to ganglion XV or XVI posteriorly. The male ducts end caudally between ganglia XIX and XX. They are thick (epididymis) anterior to ganglion XVI. Male atrium up to half the length of the somite, being a little longer than wide (3:2) and bent dorsiventrally. Cornua shorter than the globular body, pushed apart, parallel, thick.

**Variability.** Specimens from the depths of 50 m or more are larger (up to 45 mm long); they are always translucent, and their red color is only in some parts of the body intensive. Eye pigmentation in most specimens completely absent. The caudal sucker in some specimens is less than 30% of the greatest body width and shaped like a thin lamella, without the anterior part of the rim.

**Distribution.** *D. krilata* inhabits the muddy bottoms of all zones deeper than 20 m (to at least 200 m), accompanied by some other *Dina* spp.

The identity of somewhat similar specimens from the shallow littoral has not yet been established with certainty.

**Taxonomical position.** The new species is unique among erpobdellids in its peculiar body shape. Also its caudal sucker, when reduced, takes another shape than in other species with reduced suckers (*Archaeobdella esmonti* Grimm, an undescribed species from Ohrid Lake, some terrestrial species). This is almost the only Ohrid erpobdellid species which can also be regularly recognized in samples not especially prepared for taxonomical purposes (without narcosis).

*D. krilata* resembles *D. lineata* and *D. ohridana* in the general shape of the reproductive system, and the latter also in the position of the genital pores. The ovisacs are very long, but their loops are very small in comparison with *D. lineata*.

***Dina eturpschem* sp. n.**

**Material:** 18 syntypes (mostly juveniles) from the coast at the Hidrobiološki zavod, Ohridsko ezero (Makedonija, Yugoslavia).

**Etymology:** e turpschem – Albanian for shame-faced; because of the great distance between the male and female gonopores.

**External morphology.** Body length of mature specimens around 30 mm, width/length ratio 0.08. Body (Figs. 22–25, 32) quite abruptly gaining in width in its most anterior part, cylindrical in the preclitellar parts, only very slightly depressed posteriorly, except for the posterior tenth, where the cross-section is ellipsoidal resp. rounded-trapezoidal; lateral sides broadly rounded, not keeled. With less than 5 pairs of the dorsiventral muscle strings. Supraoral lobe broad and long, rounded-triangular; mouth opening wide, exceeding 50% of body width in the same section. Clitellum in mature specimens very prominent and swollen. Annulation distinct, annuli b6 only slightly elongated, but distinctly subdivided. Gonopores separated by 4 (rarely 3) annuli of a–b category; male gonopore in b2/a2 of

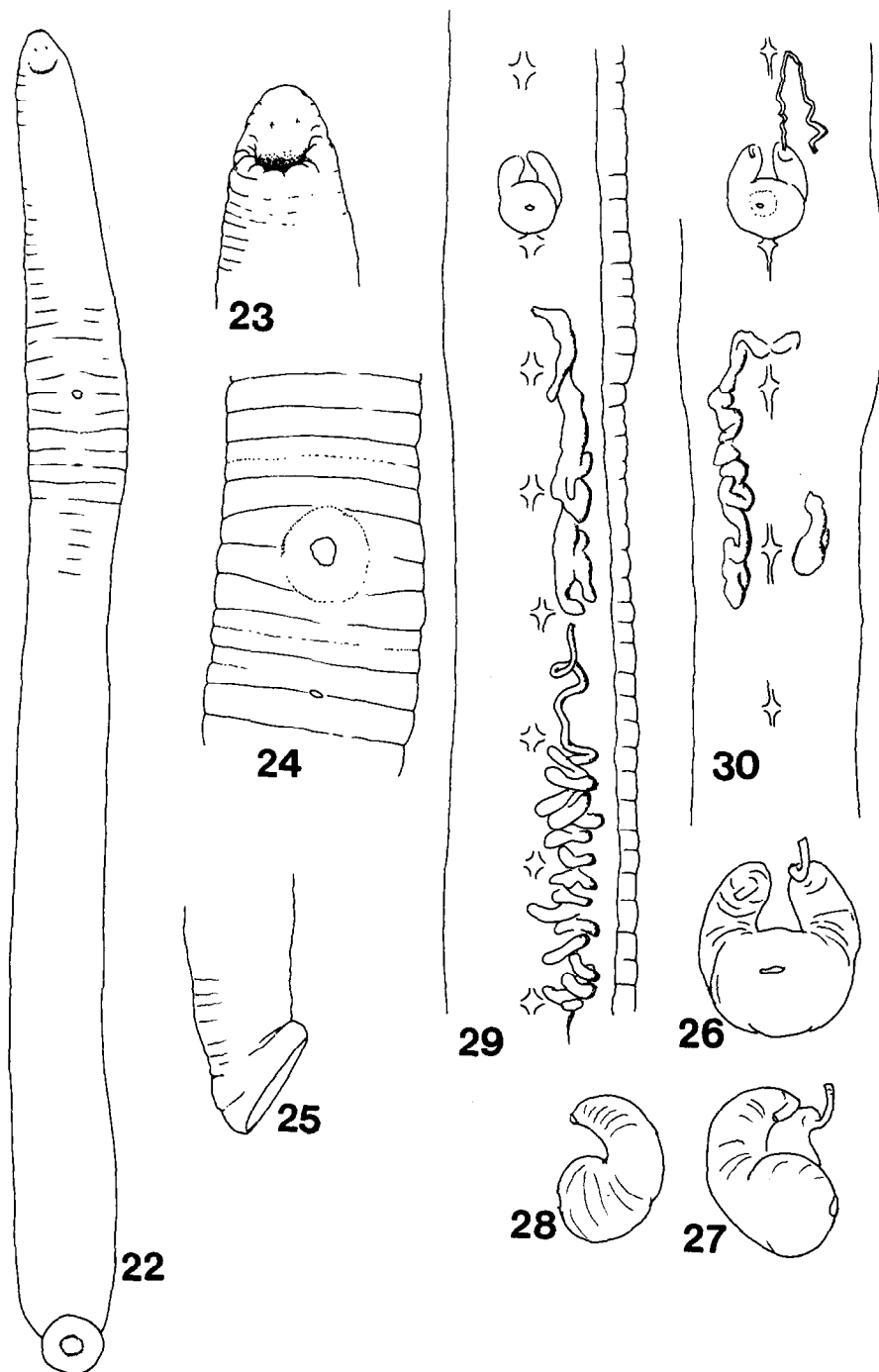


Fig. 22-30. *Dina eturpshem* sp. n., lake Ohrisko ezero, pebble shore at the Hydrobiological Institute; 22-28, 30: holotypus, 28 mm; 29: 33 mm.

22-24: ventral views of the body, its cranial part, and its clitellar region resp.; 25: lateral view of the caudal end; 29-30: main parts of the reproductive system; 26-28: different views of the male atrium.



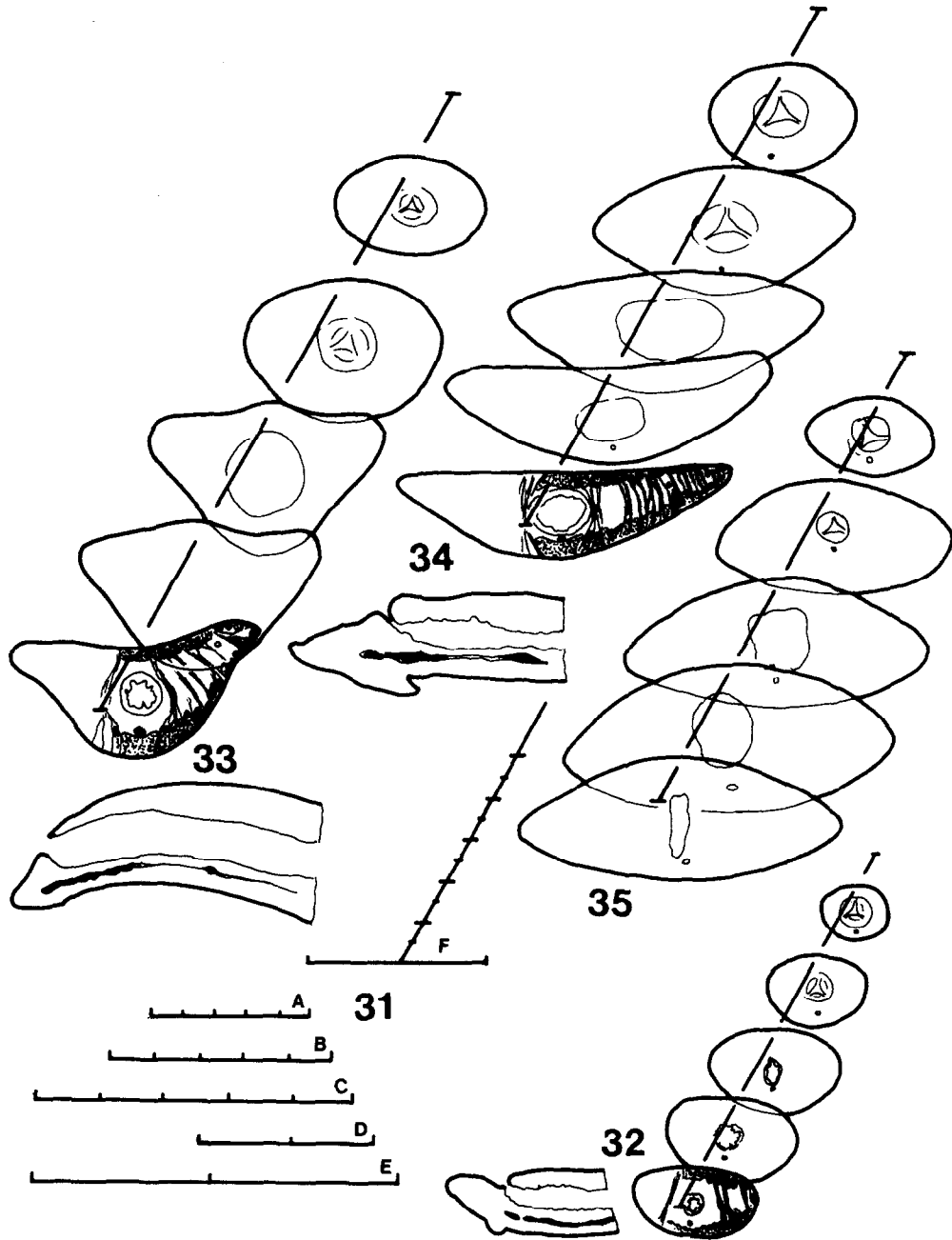


Fig. 31. Scales (subdivision in mm): A for figs. 10-11, 14-18, 22-23, 26; B for figs. 1, 19, 27; C for figs. 9, 13; D for figs. 2-5, 12, 14-15, 30-31; E for figs. 6-8, 20-21, 28-29; F for figs. 32-35.

Figs. 32-35: Diagrams of the *Dina* spp. from the Ohrid Lake (see explanation in text); 32: *D. eturpshem* sp. n., 17 mm, beach near Ohrid; 33: *D. krilata* sp. n., off Ohrid, - 50 m; 34: *D. svilesta* sp. n., off Ohrid, - 30 m; 35: *D. lepinja* Sket et Šapkarev, 22 mm, off Palas Hotel, - 25 m.

somite XII, female gonopore usually in b1/b2 of somite XIII. Anal opening large. Caudal sucker approx. 50–60% of the greatest body width, well developed, muscular, with a thick rim.

*Color* in life dark red, slightly brownish. Only some eyes lightly pigmented, others invisible or absent. Preserved specimens brownish white to light brown, clitellum always brown.

*Reproductive system* (figs. 26–30). Ovisacs irregularly winding, moderately voluminous, reaching posteriorly beyond ganglion XIV to XV. The epididymis begins at ganglion XVIII or behind it and narrows to form a sperm duct at XVI. Male atrium as wide or only slightly narrower than long; cornua stout, crescent-like curved in the dorsiventral direction, very distant at their bases and converging distally.

*Taxonomical position.* In body shape as well as in the general shape of reproductive organs the species resembles *D. lineata* and *D. ohridana*. It differs from both mentioned species by its small and differently colored body. Outside the Ohrid Lake only the American species *D. dubia* Moore & Meyer and *D. parva* Moore have the female pore back in somite XII (Soos, 1963), but none of the described species has both gonopores separated by more than 3.5 annuli (the new species commonly by 4 annuli). Also, very characteristic is the large and flat supraoral lobe.

*Distribution.* *D. eturpshem* has so far been identified with certainty only in some littoral samples from the eastern shore of the Ohrid Lake. It may be found under stones in shallow (some cm to some dm deep) water, accompanied by some other erpobdellids as well as by *Glossiphonia* spp.

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