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***Mémoire.***

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# MORPHOLOGY AND CHAETOTAXY OF *ECHINOCHASMUS* SP. CERCARIA (TREMATODA, ECHINOCHASMIDAE)

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SUMMARY

Gymnocephalous zygocercous cercariae were shed by naturally infected snail prosobranch Hydrobiidae: *Bithynia tentaculata,* collected in Lithuania. Their morphology is described; they are closely related to that of several species of *Echinochasmus,* mainly displaying two subegal spiny suckers, excretory ducts with 15-20 large granulations, a double excretory vesicle, 16 flame cells and allow the generic determination as *Echinochasmus* sp.

The chaetotaxy is completely carried out and shows a peculiar disposition in $C_{II}$, $C_{IV}$, S and U levels; in $C_{II}$, $C_{IV}5$ and S levels the sensillae reveal a relationship with Psilostomidae, in U level, the sensillae are different.

*Echinochasmus* genus seems to belong to a valid family Echinochasmidae, as proposed by Sudarikov and Karmanova (1977). This family appears more closely related to Psilostomidae than to Echinostomatidae.

RÉSUMÉ : **Morphologie et chétotaxie de la cercaire d'*Echinochasmus* sp. (Trematoda, Echinochasmidae).**

Des cercaires gymnocéphales zygocerques ont été émises par des Mollusques Prosobranches Hydrobiidae naturellement infestés : *Bithynia tentaculata,* récoltés en Lithuanie. La morphologie est décrite et montre une grande ressemblance avec celle de plusieurs espèces d'*Echinochasmus* : deux ventouses subégales épineuses, des canaux excréteurs contenant 15 à 20 grosses granulations, une vessie excrétrice bipartite, 16 protonéphridies, et permet la détermination générique d'*Echinochasmus* sp.

La chétotaxie est décrite et montre une disposition particulière aux niveaux $C_{II}$, $C_{IV}$, S et U; les niveaux $C_{II}$, $C_{IV}5$ et S suggèrent des relations avec les Psilostomidae, cependant la chétotaxie caudale est différente.

Le genre *Echinochasmus* semble appartenir à une famille particulière, celle des Echinochasmidae, proposée par Sudarikov et Karmanova (1977); cette famille paraît plus proche des Psilostomidae que des Echinostomatidae.

## INTRODUCTION

The cercaria described in the present paper represents the genus *Echinochasmus* Dietz, 1909 or *Monilifer* Dietz, 1909 *. It ressembles the most *Cercaria helvetica* XVII Dubois, 1929 and *Echinochasmus spinosus* (Odhner, 1911) described by Karmanova (1971). However, its identification with any one of these cercariae is risky due to some reasons which will be discussed below. Hence, until more study will be carried out, the cercaria under discussion is provisionally identified as *Echinochasmus* sp.

The life cycles of many species of the genus *Echinochasmus* have been recognized till now. The investigations carried by Alekseev (1967), Beaver (1941), Besprozvannykh (1989), Filimonova (1974), Johnston and Simpson (1944), Karmanova (1971, 1973, 1974*a, b*), Karmanova and Iljushina (1969), Koga (1952), Komiya (1951), Madhavi *et al.* (1989), Nasir and Diaz (1968), Sosipatrov (1964), Yamaguti (1941, 1951), greatly contributed to recognition of the morphology and biology of Echinochasmid cercariae which appeared to constitute a characteristic group, distinct from other Echinostomatid and Gymnocephalous cercariae (Karmanova, 1975). However, chaetotaxy of these cercariae has not yet been thoroughly studied except the records on the cercaria of *E. milvi* Yamaguti, 1939 by Besprozvannykh (1989), *Cercaria rhionica* VII by Olenev and Dobrovol'skii (1975) and *Cercaria kazachstanica* VIII by Belyakova (1979). The present paper brings the description of morphology and chaetotaxy of *Echinochasmus* sp. cercaria from

* This genus is regarded as a subgenus of *Echinochasmus* by Skrjabin and Bashkirova (1956), as a valid genus by Sudarikov and Karmanova (1977), or a synonym of *Echinochasmus* by Yamaguti (1971).

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Lithuania, which probably is the larva of a parasite of grebes, common in Europe. The chaetotaxy of this genus is important to know because *Echinochasmus* is pathogenic for man in Far East. Comparison of the chaetotaxy with other Echinochasmid cercariae is made and relations of this group with Echinostomid and Psilostomid cercariae are considered.

## MATERIAL AND METHODS

The material is composed of a pool of cercariae emitted by naturally infected *Bithynia tentaculata* L., collected in the lakes Druksiai and Asveja in the environs of Vilnius, Lithuania.

A part of the cercariae was observed alive, in egg albumin in order to reveal the morphology, especially the excretory system; a part was stained in 2 % silver nitrate, exposed to sun rays, washed in distilled water and mounted on slides in Faure fluid in order to reveal distribution of sensillae.

## RESULTS

### General morphology of the cercaria *(Fig. 1, A).*

Cercariae small, body elliptic in shape, measuring 144-180 µm in length and 64-90 µm in width. Tail about 1.5-2 times longer than the body, measuring 214-280 × 40-62 µm, highly contractile, opaque. Body covered with thick, unarmed tegument. Adoral disc feebly developed, 40-52 µm large. Only 3 corner spines are hardly visible, other ones look at least as small points projecting over the tegument. Subterminal oral sucker measures 28-31 µm in diameter. Dorsally to it 3 small vesicles are seen, being formed probably by dilated outlets of penetration glands. Well developed ventral sucker, measuring 29-31 µm in diameter, is situated in the posterior third of the body, at the distance of 110-120 µm from the anterior end. Borders of both suckers are deeply wrinkled. Large cystogenous glands containing rod-like or laminar secretion in parallel sets, extending from the pharynx to the posterior border of the ventral sucker.

Alimentary tract not yet completely developed, consists of a bulbous prepharynx, pyriform pharynx 15 × 13 µm large, and a fairly long oesophagus bifurcating in front of the ventral sucker. Caeca are not visible except their anterior portions.

The excretory system is composed of a transversely elongate vesicle giving rise at opposite corners to two dilated ducts which contain 14-16 large and 4-5 small irregular concretions. At the level of the pharynx these ducts become narrow and turn back. They bifurcate at the level of the ventral sucker into the anterior and the posterior ducts, each collecting capillaries of 4 flame cells *(Fig. 1, B).* The flame cell formula: 2 [(1 + 1 + 1 + 1) + (1 + 1 + 1 + 1)] = 16. The caudal excretory duct is dilated in its anterior portion during forming a vesicle-like structure; it runs almost to the end of the tail being probably bluntly ended.

Genital primordia are composed of little differentiated aggregations of germinal cells situated at the anterior and the posterior margins of the ventral sucker.

## CHAETOTAXY

— *Cephalic sensillae (Fig. 1, C, D, E, F).*

$C_I$ = 1 $C_I$2, 3 $C_I$4, 1 $C_I$5

$C_{II}$ = 1 $C_{II}$0, 1 + 1 $C_{II}$2, 3 $C_{II}$4, 12 (or 13 to 17) $C_{II}$5

$C_{III}$ = 1 + 2 (or 3) $C_{III}$2, 2 (or 3) + 1 $C_{III}$4, 1 $C_{III}$5

$C_{IV}$ = 3 (or 4) + 2 (or 3) $C_{IV}$2, 2 (or 3 to 5) + 4 $C_{IV}$4, 6 (or 7 to 8) + 3 $C_{IV}$5

$C_I$2 is located at the inner margin of the mouth.

— *Body sensillae (Fig. 2, A, B, C).*

$A_I$ = 1 $A_I$V, 2 $A_I$L, 1 $A_I$D

$A_{II}$ = 1 $A_{II}$V, 1 $A_{II}$L, 1 $A_{II}$D

$A_{III}$ = 1 $A_{III}$V, 3 $A_{III}$L, 1 $A_{III}$D

$P_{III}$ = 0 ou 1 $P_{III}$D

$A_{III}$D is situated in the outline of the acetabular level; however it seems that it belongs to the $A_{III}$ ring slightly shifted by the dorsal convexity of the cercaria.

— *Acetabular sensillae (Fig. 2, A, C).*

S = 6 $S_I$ (or 5), 1 $S_{II}$

In the case of 5 $S_I$, the postero-medial papilla is lacking.

— *Tail sensillae (Fig. 2, D).*

U = 5 to 7 UV pairs, 5 to 6 UD pairs, 1 to 2 UL pairs a total of 22 to 30 sensillae, usually 28.

## DISCUSSION

### a — Comparison of the cercarial morphology

According to Karmanova (1975), the cercariae of the genus *Echinochasmus* form a compact group morphologically distinct from other Echinostomatid cercariae, resembling rather gymnocephalous cercariae.

The main diagnostic characters of particular species are body proportions and number of large granules in excretory ducts. Differences observed by various authors in the flame cell formula may be subjected to an error or misinterpretation. In various species 12-20 flame cells were counted, most frequently 16. Usually the cercaria has a fairly short tail, equal to or slightly longer than the body, except *E. spinosus,* the tail of which is 2.5 times longer (Karmanova, 1971) and *E. shigini* with the tail 4-5 times longer (Karmanova, 1974 *a*). Cercariae with a very large tail as *C. gigantocerca* Szidat, 1937 and *C. kazachstanica* VIII Belyakova, 1979 belong also to this group as well as those having « Rattenkönig » tail (e. g. the cercaria of *E. milvi* according to Besprozvannykh, (1989), and*C. rhionica* VII Olenev and Dobrovol'skii (1975).

By the body dimensions and proportions our cercaria resembles the best *C. helvetica* XVII described by Dubois

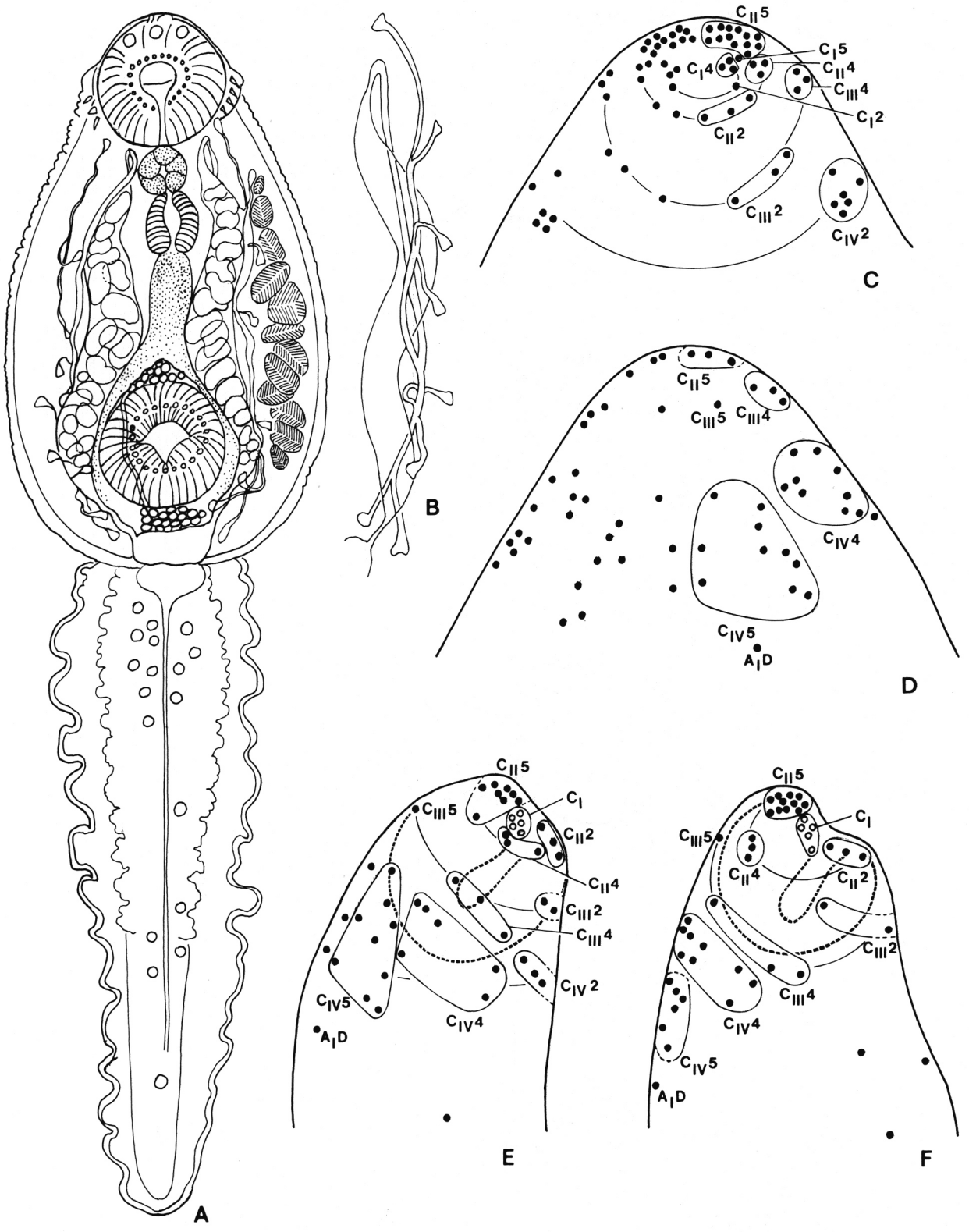


FIG. 1. — A: General morphology of *Echinochasmus* sp. cercaria.
B: Detail of flame cells; C, D, E, F: Cephalic chaetotaxy; C: ventral view, D: dorsal view; D, F: lateral views.

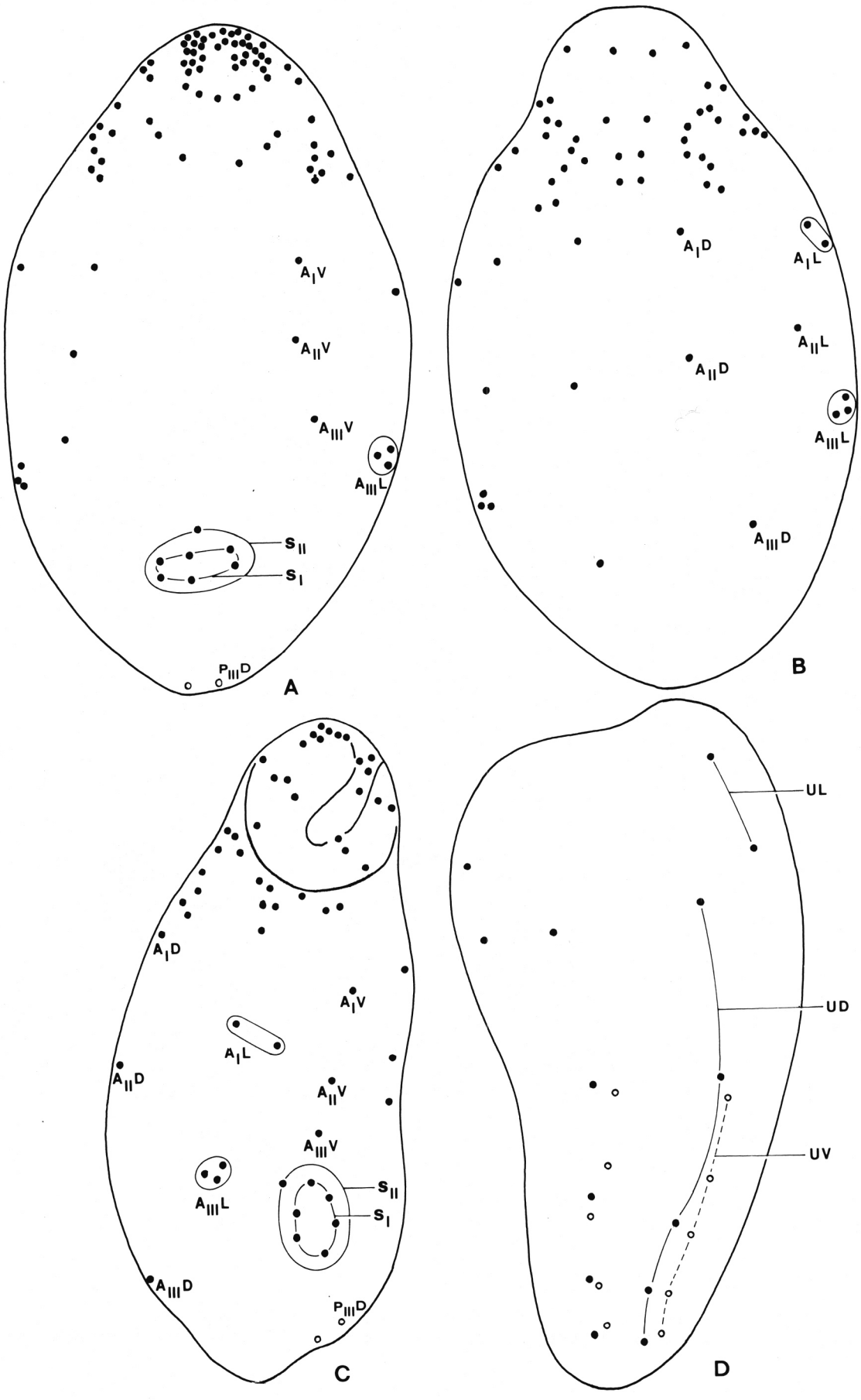


FIG. 2. — A, B, C: Chaetotaxy of the body; A: ventral view, B: dorsal view, C: lateral view. D: Tail chaetotaxy.

(1929) from the region of Neuchâtel in Switzerland, and by Szidat (1937) from Kurisches Haff (wrongly identified as the larva of *Sphaeridiotrema globulus*). In both descriptions, however, the number of excretory granules has not be mentioned. It resembles also *Echinochasmus spinosus* cercaria as described by Karmanova (1971) from the Volga delta, but differs from the latter by shorter tail (280 µm in contrast to 380) and slightly smaller number of excretory granules (14-16 viz. 17-18). Fairly frequent occurrence of this cercaria (or a very similar one) seems to suggest that it represents a larval form of a parasite of grebes, common in northern part of Europe, e. g. *Monilifer spinosus* (Rud., 1809). However the life cycle of this species has not been recognized till now.

### b — Comparison of cercarial chaetotaxy

Besides the chaetotaxy of *Echinochasmus* sp., this of *Echinochasmus milvi* is described by Besprozvannykh (1989) as these of two undetermined cercariae, respectively *Cercaria rhionica* VII by Olenev and Dobrovol'skii (1975) and *Cercaria kazachstanica* VIII Belyakova (1979). In Olenev and Dobrovol'skii, sensillae have been drawn without nomenclature.

Cercarial chaetotaxies of representants of Echinostomatoidea were summed up by Richard (1971) and Bayssade-Dufour (1979). Since these data, new descriptions have been published, mainly these of the Psilostomidae *Psilotrema spiculigerum* by Samnaliev and Dimitrov (1980), *Sphaeridiotrema globulus* by Dimitrov and Kanev (1984) Echinostomatidae: *Echinostoma revolutum* and *E. echinatum* by Kanev *et al.* (1987) and Cathaemasiidae: *Cathaemasia hians* by Grabda-Kazubska *et al.* (1990).

Thus, numerous data are available to discuss the systematic relationships of *Echinochasmus* within the Echinostomatoidea.

A taxonomic comparison of the members of this superfamily can be made, according to Richard (1971) using six chaetotaxical levels: $C_I$, $C_{II}$, $C_{III}$, $A_ID$, S and U; Bayssade-Dufour *et al.* (1989) divides the complex level $C_{III}$V-L in $C_{III}$2-4 and $C_{IV}$2-4.

Kanev *et al.* (1987) show that the level called $A_ID$ by Richard (1971) belongs to the $C_{IV}$ cephalic ring.

So, the comparison of $C_I$, $C_{II}$, $C_{III}$, $C_{IV}$, $A_ID$ (or St-$A_ID$, St-DL-$A_ID$, H-HL-$A_ID$). S and U levels with the homologous ones of all the other Echinostomatoidea reveals:

— in $C_I$: a common or closely related chaetotaxy to the various families of Echinostomatoidea: Echinostomatidae, Psilostomidae, Fasciolidae, Cathaemasiidae, Petasigeridae and Echinochasmids, with respectively

0 to 1 $C_I$2, 2 to 4 $C_I$4, 1 $C_I$5 (= 0 to 1 $C_I$V, 2 to 4 $C_I$L, D)

— in $C_{III}$2 and $C_{III}$4: a relatively common pattern with 1 + 2 $C_{III}$2, 2 + 1 $C_{III}$4 (= 1 to 2 + 2 $C_{III}$V, 3 $C_{III}$L) few different of all the other Echinostomatoidea.

— in $C_{II}$2 and $C_{II}$4: affinities between Echinochasmids and Psilostomidae, and large differences between Echinochasmids and Echinostomatinae; Echinochasmids have a total of 10-11 ventral and lateral $C_{II}$ sensillae, Psilostomidae have 12, Echinostomatinae 16-20;

— in $C_{IV}$5-$A_ID$ (= St-, D-$A_ID$; St-DL-$A_ID$; H and HL-$A_ID$): a relationship between Echinochasmids and Psilostomidae; they possess 3 to 4 + 5 to 7 vertically aligned sensillae in a similar pattern, meanwhile the Echinostomatinae and Himasthlidae show 2 to 7 + 3 to 5 transversely lined up sensillae; the Fasciolidae, only 2 sensillae, the Cathaemasiidae and Petasigeridae transversely alined sensillae in the medio-dorsal part and vertically ones in the lateral parts;

— in S: the chaetotaxy may be unstable; however, usually Echinochasmids and Psilostomidae show 6 to 9 acetabular sensillae, Echinostomatinae 4 to 6, Himasthlidae and Petasigeridae 3, Cathaemasiidae 1 to 3 and Fasciolidae 0 to 3;

— in U : differences between Echinochasmids and the other Echinostomatoidea; for each group the number of UV, UL and UD pairs is:

. in Echinochasmids: 5-7 UV, 1-2 UL, 5-6 UD,
. in Psilostomidae: 0 UV, 5 UL, 2 UD,
. in Cathaemasiidae: 6 UV, 13-18 UL, 3 UD,
. in Petasigeridae: 17 UV, 1 UL, 15 UD,
. in Himasthlidae: 2-5 UV, 14 UDL,
. in Fasciolidae: 17-26 UV, 13-17 UL, 0-3 UD,
. in Echinostomatinae: 0-4 UV, 0 UL, 19-28 UD.

The caudal chaetotaxy suggests that Echinochasmids belong to a peculiar family.

## CONCLUSION

According to the morphological and chaetotaxical data on *Echinochasmus* cercariae, this genus appears to belong to a peculiar group very different of the *Echinostoma* genus and more closely related to *Psilotrema* and *Sphaeridiotrema.*

In the same way, the life-history of the Echinochasmids and Psilostomidae admit for first intermediate host a prosobranch snail meanwhile the Echinostomatinae admit a pulmonate mollusc.

Our observations allow to conclude, as Sudarikov and Karmanova (1977), to the validity of an Echinochasmidae family; this one appears in relationship with Psilostomidae.

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