

SENSILLAE OF THE CERCARIAE OF *ECHINOSTOMA TRIVOLVIS* (CORT, 1914) (TREMATODA: ECHINOSTOMATIDAE)

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Summary :

The precise location of sensillae of the cercaria of *E. trivolvis* is described. This study allows one to distinguish *E. trivolvis* from *E. revolutum*, *E. echinatum*, *E. caproni*, *E. jurini* and *E. parvocirrus* on the basis of the arrangement of the argentophilic structures of their cercariae. The arrangement of the tegumentary receptors of the circle AI dorsal (AID) complex allows for clear differentiation of the cercariae of *E. trivolvis* from the cercariae of all trematode species studied by silver nitrate staining in the genera *Echinoparyphium*, *Hypoderaeum*, *Moliniella*, and *Paryphostomum* in the family Echinostomatidae.

KEY WORDS : *Echinostoma trivolvis*, cercariae, tegumentary papillae.

Résumé : PAPILLES ARGYROPHILES TÉGUMENTAIRES DE CERCARIES DE *ECHINOSTOMA TRIVOLVIS* (CORT, 1914) (TREMATODA: ECHINOSTOMATIDAE)

La localisation précise des papilles tégumentaires de cercariées d'*E. trivolvis* est décrite. Les études permettent de distinguer *E. trivolvis* de *E. revolutum*, *E. echinatum*, *E. caproni*, *E. jurini* et *E. parvocirrus* selon la disposition des papilles sensorielles de leurs cercariées. La disposition des récepteurs tégumentaires du complexe AID permet une claire différenciation des cercariées d'*E. trivolvis* de celles de toutes les espèces de trématodes du genre *Echinoparyphium*, *Hypoderaeum*, *Moliniella* et *Paryphostomum* de la famille des Echinostomatidae, étudiées par coloration au nitrate d'argent.

MOTS CLÉS : *Echinostoma trivolvis*, cercariées, papilles tégumentaires.

INTRODUCTION

The identity and the life cycle of *Echinostoma trivolvis* (Cort, 1914) Kanev, 1985 were described and discussed by Kanev (1985), Huffman & Fried (1990) and Kanev *et al.* (1995). Tegumentary papillae of *E. trivolvis* cercariae were not studied in detail and described according to the internationally recognised nomenclature of Richard (1971) or that of Bayssade-Dufour *et al.* (1989). Preliminary data for a total number of 253 papillae were reported by Fried & Fujino (1987). In that study, the organism was referred to as *E. revolutum* (Froelich, 1802).

This paper presents a detailed study on the argentophilic structures of *E. trivolvis* cercariae described in accord with internationally accepted nomenclature.

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MATERIALS AND METHODS

E. trivolvis cercariae were obtained from naturally infected snails *Helisoma trivolvis* (Say) collected from Northampton County, Pennsylvania (USA). Over 100 cercariae were impregnated by the method of Combes *et al.* (1976). The arrangement of the papillae was described according to the nomenclature of Bayssade-Dufour *et al.* (1989). Examination, drawings and pictures were made with an « Opton » microscope supplied with camera lucida, videomat and automatic photcamera.

RESULTS

The arrangement of the tegumentary papillae of *E. trivolvis* cercariae is as follows:

1. Cephalic region (Figs. 1A, 2A)

CI = 1CI₁, 3CI₃

CII = 1CII₁, 2CII₂, 4-7CII₃, about 7-12CII₄

CIII = 1CIII₁, 2-3CIII₂, 4-5CIII₃, 5-7CIII₄, 2 + 2CIII₅

CIV = 5CIV₁, 2-3CIV₂, 3CIV₃

2. Body (Figs. 1B, C; 2B)

a) ventral papillae

1-3AIV, 3-4AIV, 1-2AIIIV

2MIV

3PIIIV

b) dorsal papillae

9AID = 2 + 3 + 4

3-4AIID, 2-3AIIID

2MID

1PID

c) acetabular papillae

1SI, 3SII, 2SIII

d) lateral papillae

about 35-40 for each lateral area

3. Tail papillae (Fig. 2C)

a) ventral

 $a + b = 2 + 0 - 2 = 2 - 4$

b) dorsolateral

 $x + y + 1 = 9 - 11 + 8 - 12 + 1 = 18 - 22$

The tegumentary papillae of the cephalic region are arranged in four circles; 1CI₁ and some of the 3CI₃ group are invaginated. It is difficult to determine the exact number of the receptors from the CII₄ groups. In addition to the described papillae of the first type (Lie, 1966), there are also second type papillae in the groups CII₄ and CIII₄, as well as at the level of the CIV circle. Their total number in the cephalic region is about 16. One of the argentophilic structures in each CIII₃ group is seen below the other ones, and is stained more intensely than the papillae. These structures seem to be orifices of the paraesophageal glands. The typical arrangement of the ventral papillae is 2AIV, 3AIV, 2AIIIV, 2MIV and 3PIIIV. Only the groups MIV and PIIIV have a constant number of papillae. The formula of the circle AI dorsal (AID) papillae is 4 + 3 + 4 + 3 + 4. In some cercariae among these papillae there are structures with smaller dimensions than those of the papillae, and they are seen as small dots (Fig. 2A). Two variants are observed in the number of papillae from the groups AIID (3AIID and 4AIID) and AIIID (2AIIID and 3AIIID). The groups MID and PID have a constant number and arrangement. No changes were found in the number and arrangement of the acetabular papillae.

Each lateral region of the body has 35-40 of the first type of papillae and 2 of the second type of papillae. All lateral papillae are differentiated along 4 axes (L and L').

The tail papillae have ventral and dorsolateral positions. The ventral tail papillae are differentiated in groups $a + b$, with the following three variants in their arrangement: $a + b = 2 + 1$, $2 + 2$ and $2 + 0$. At $P(t) > 99.9$ the average total number of these papillae

is $M = 3.37 \pm 0.11$ and the coefficient of variation $CV = 18.51$. The dorsolateral tail papillae are arranged in three groups $x + y + 1$. The following arrangements are identified: $x + y + 1 = 10 + 10 + 1$, $10 + 8 + 1$, $11 + 8 + 1$, $10 + 9 + 1$, $11 + 9 + 1$, $10 + 11 + 1$, $9 + 8 + 1$, $9 + 10 + 1$, $9 + 11 + 1$, $11 + 10 + 1$, $9 + 12 + 1$. The average total number and the coefficient of variation of these papillae at $P(t) > 99.9$ is: $M = 20.51 \pm 0.17$; $CV = 5.21$. The excretory pores, which are usually at the level between the third and fourth papillae from group x , are stained together with the papillae (Fig. 2C).

DISCUSSION

A total number of 312 tegumentary papillae were found in *E. trivolvis* cercariae. Their number and arrangement were compared to those of closely related 37-collar-spined species of the genus *Echinostoma*, described by Richard (1971), Kanev *et al.* (1987), Dimitrov (1987), Nassi & Dupouy (1988) and Dimitrov & Kanev (1992a) as: *E. caproni* (Richard, 1964), *E. revolutum*, *E. echinatum* (Zeder, 1803), *E. jurini* (Skvortsov, 1924) and *E. parvocirrus* (Nassi & Dupouy, 1988). The comparative evaluations are presented in Tables I and II.

The data in Table I show that the main differences between the cercariae of *E. trivolvis* on the one hand, and those of *E. caproni* and *E. echinatum* on the other, are illustrated by the number and arrangement of the papillae in the CIII₅ (= StDL by Richard, 1971) group. The cercariae of *E. revolutum* differ from those of the other trematode species by the presence of two closely related argentophilic structures with medioventral position at the level AIV. In the majority of *E. trivolvis* cercariae the CIII₂ groups consist of three papillae each, whereas all *E. jurini* cercariae in these groups have two papillae each.

In addition to the tegumentary papillae, some of the cercariae stained with silver showed the presence of the orifices of the paraesophageal glands. The orifices are located in the cephalic region and on the body, or only in the cephalic region and when impregnated with silver appear as papillae. According to Kanev (1985) and Kanev *et al.* (1994) their total number in the cercariae of *E. echinatum* varies from 60 to 64; in *E. parvocirrus* over 32; in *E. revolutum* from 16 to 20; in *E. jurini* from 8 to 10; and in *E. trivolvis* from 4 to 6. No paraesophageal glands have been identified in the cercariae of *E. caproni*.

Differences were also observed between the cercariae of *E. trivolvis* and the cercariae of the other compared species with respect to the total number of the tail papillae from the groups $a + b$ and $x + y + 1$ (Table II).

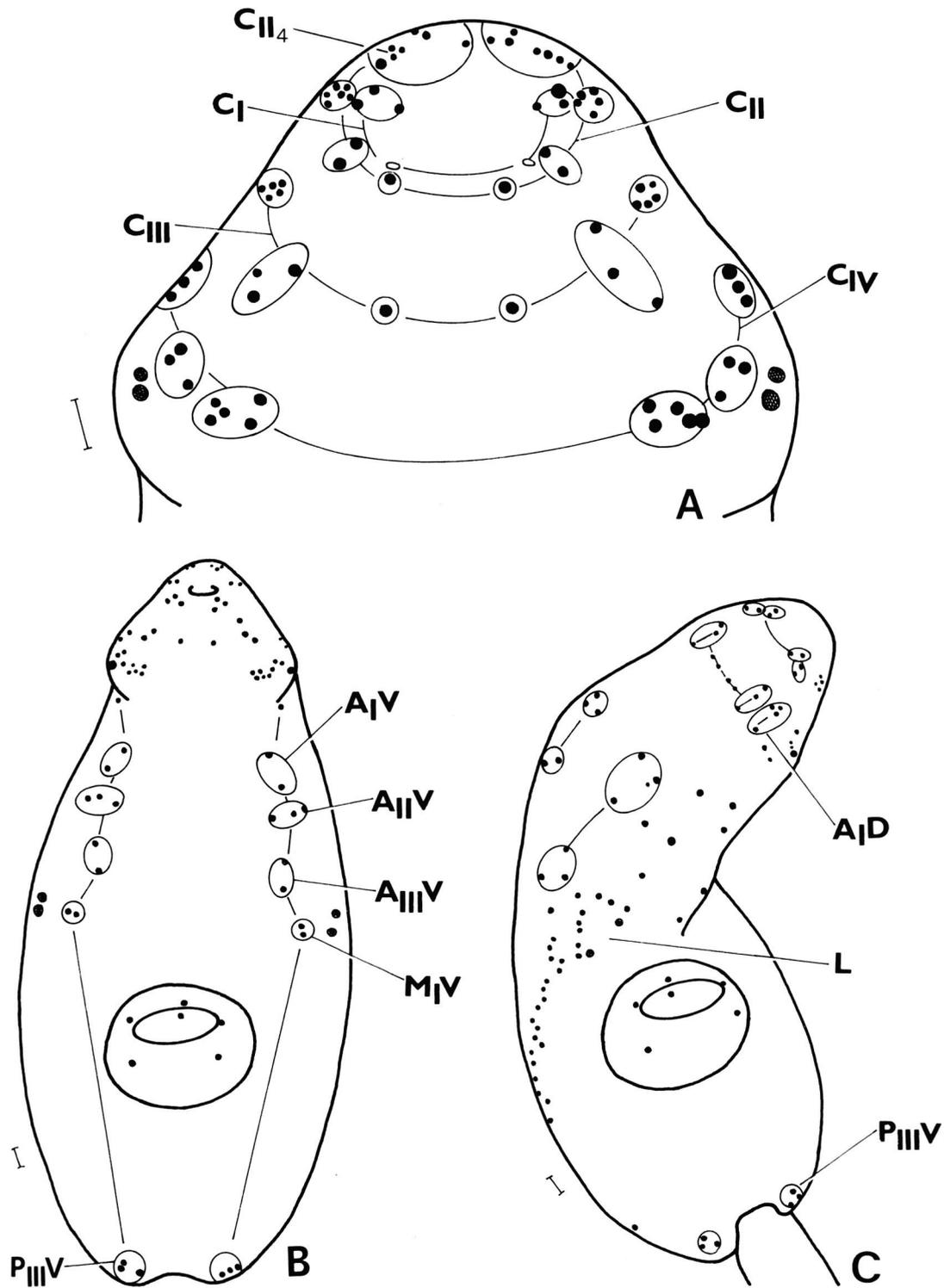


Fig. 1. — Arrangement of the tegumentary papillae of *E. trivolvis* cercariae: A — on the ventral surface of the head region. B — on the ventral surface of the body and the acetabulum. C — on the lateral area of the body. Scale bars = 10 micrometers.

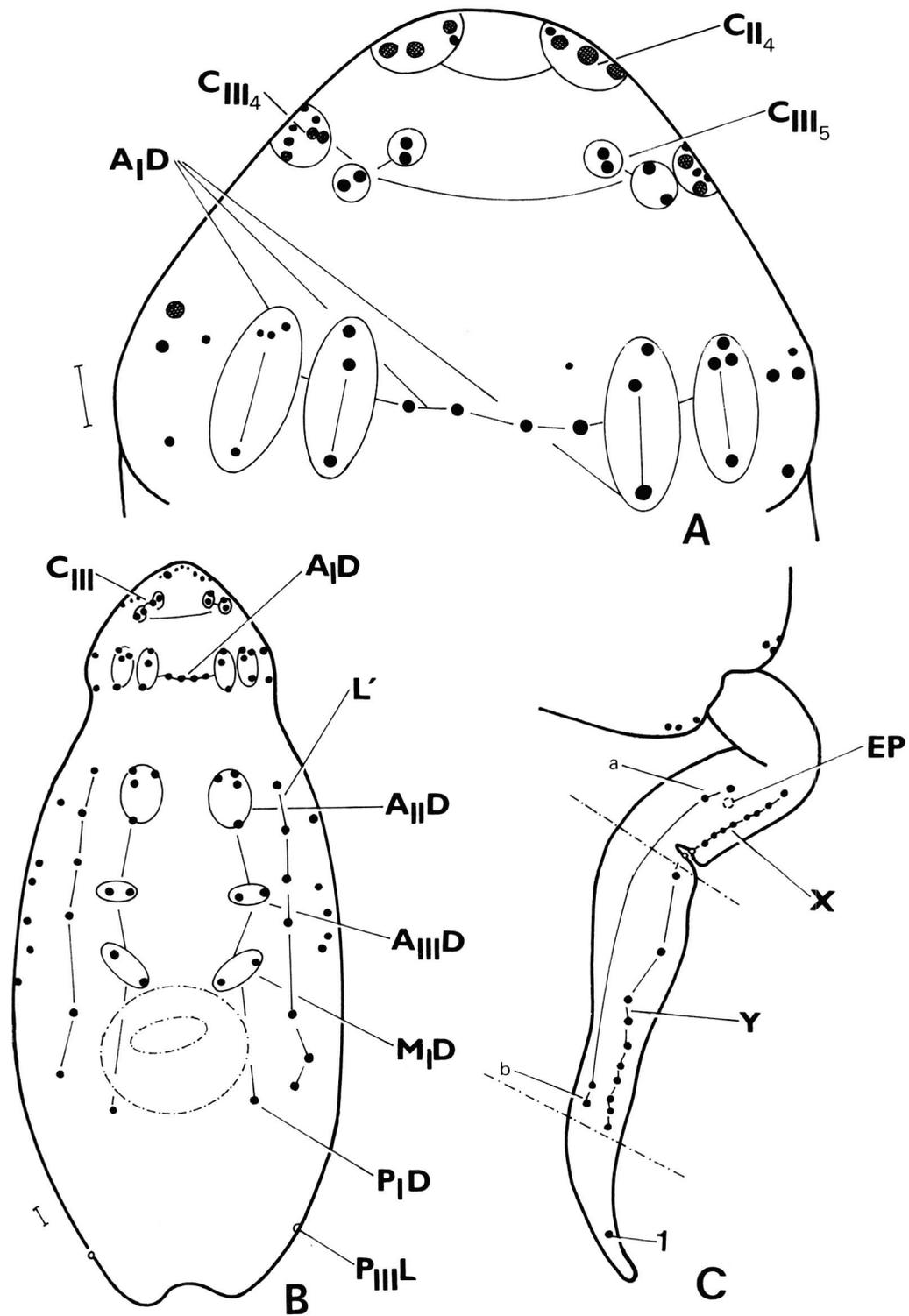


Fig. 2. — Arrangement of the tegumentary papillae of *E. trivolvis* cercariae: A — on the dorsal surface of the head region. B — on the dorsal surface of the body. C — on the tail. Scale bars = 10 micrometers.

Cercariae	CHII ₂	StDL (= CHII ₃)	PIIV	PID	Very close argentophilic structures medioventrally at AIV level
<i>E. caproni</i> (of Richard & Brygoo, 1978)	2	3	3	1-2	none
<i>E. revolutum</i> (of Kanev <i>et al.</i> , 1987)	2	4(2 + 2)	2	none	2
<i>E. echinatum</i> (of Kanev <i>et al.</i> , 1987)	3	6-7(3 + 3-4)	2-4	1	none
<i>E. parvocirrus</i> (Nassi & Dupouy, 1988)	2-3	4(2 + 2)	3	none	none
<i>E. jurini</i> (of Dimitrov & Kanev, 1992)	2	4(2 + 2)	3-4	1	none
<i>E. trivolvis</i> this paper	2-3	4(2 + 2)	3	1	none

Table I. — Comparative data on the number and arrangement of papillae on the cephalic region and body of closely related 37-collar-spined cercariae of the genus *Echinostoma*.

Cercariae	<i>a + b</i> (total number)				<i>x + y + 1</i> (total number)			
	<i>n</i>	<i>x</i> min <i>x</i> -max	M	CV	<i>n</i>	<i>x</i> min <i>x</i> max	M	CV
<i>E. caproni</i> (of Richard, 1971)	4	1-3	no data	no data	4	25-33	no data	no data
<i>E. revolutum</i> (of Kanev <i>et al.</i> , 1987)	20	3-4	3.60±0.11	13.96	20	21-23	21.70±0.16	3.37
<i>E. echinatum</i> (of Kanev <i>et al.</i> , 1987)	20	2-3	2.70±0.10	17.41	20	23-26	24.35±0.18	3.37
<i>E. parvocirrus</i> (Nassi & Dupouy, 1988)	4	1-2	no data	no data	4	23-25	no data	no data
<i>E. jurini</i> (of Dimitrov & Kanev, 1992)	24	2-7	4.08±0.23	27.89	24	19-24	22.26±0.28	6.29
<i>E. trivolvis</i> this paper	28	2-4	3.37±0.11	18.51	37	18-22	20.15±0.17	5.21

Table II. — Comparative data on the number and arrangement of the tail papillae of closely related 37-collar-spined cercariae of the genus *Echinostoma*.

The difference between the mean values (M) of the total number of the dorsolateral tail papillae in the cercariae of *E. trivolvis*, *E. revolutum*, *E. echinatum* and *E. jurini* are statistically significant ($P(t) > 99.9$).

The arrangement of the basic groups of the papillae from the circle AI dorsally (AID) complex (3 + 4 + 3) can serve as a basis for distinguishing the cercariae of *E. trivolvis* from the cercariae belonging to the genera *Echinoparyphium* (AID = 5 + 6 + 5), *Hypoderaeum* (5 + 8 + 5), *Moliniella* (4 + 4 + 4) and *Paryphostomum* (6 - 7 + 4 + 6 - 7).

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