

Calicophoron shillongensis sp. n. (Trematoda, Paramphistomidae), a new parasite from the goat (*Capra hircus* L.) in India

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Abstract. *Calicophoron shillongensis* sp. n. occurring in the rumen of *Capra hircus* in Shillong, India is described. The new species is distinguished from all other members of the genus by the structure of the terminal genitalium

(large ventral atrium with no ventral sphincter, weak genital papilla and wall of ventral atrium having no papillae) and the acetabulum (of cotylophoron type), and in having dome-ciliated papillae in the buccal region.

Introduction

Examination of material from some slaughter houses in Shillong (India) revealed the presence of a hitherto undescribed species of the genus *Calicophoron* Näsmark, 1937 from the rumen of *Capra hircus*. The observations have been made both from sagittal sections and whole mounts, and revealed some difference with the existing species of this paramphistomid genus. The present communication deals with the description of this new species.

Material and methods

The present material consists of twelve specimens collected from the rumen of a freshly slaughtered goat at a local abattoir of Shillong in Meghalaya, India. Seven specimens were processed for whole mount preparations using Mayer's carmalum and borax carmine stains. Three series of sagittal sections were prepared and stained in haematoxylin and eosin. Two specimens were processed for scanning electron microscopy to study the surface topography of the flukes.

For SEM studies, specimens were fixed in 10% cold, neutral buffered formalin and dehydrated through a graded series of acetone, treated with TMS (tetramethylsilane) as described earlier (Roy and Tandon 1990), metal coated and observed under a Jeol JSM-35 CF under electron acceleration voltage of 10–15 kV.

The description is based on the above-mentioned whole mount and sectioned specimens.

Holotype (No. IV/ERS/ZSI/306) is deposited in the Helminthological Collection of the Eastern Regional Station of the Zoological Survey of India, Shillong; paratypes and one series of sagittal sections are deposited in the Department of Zoology, North-Eastern Hill University, Shillong (No. NEHU/Z-TM/3).

Results

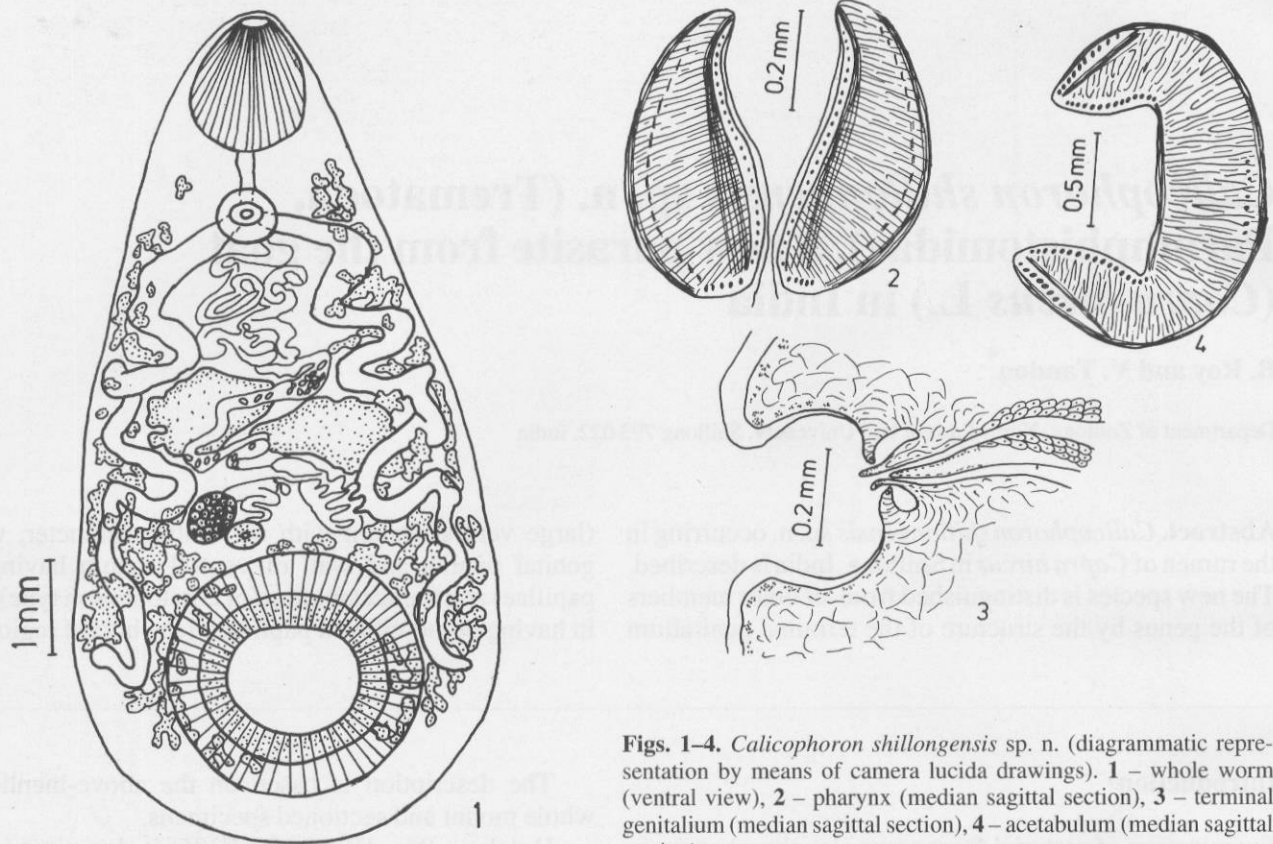
Description and measurements

Body conical, 7.23–10.39 mm long, 3.16–5.78 mm in greatest diameter, ratio of body breadth to body length 1:1.79–1:3.14 (Fig. 1).

Acetabulum posterior, subterminal, 1.58–3.02 mm in external diameter, ratio to body length 1:3.44–1:6.29; of cotylophoron type as described by Näsmark 1937; units of dorsal and ventral circular muscles on lateral sides as follows: DE, 10–15; DI, 27–34; VE, 9–13; VI, 23–28; dome 14–19 (Fig. 4).

Pharynx 0.67–1.71 mm in length, 0.67–1.71 mm in greatest diameter; ratio to length of body 1:6.3–1:10.79, to diameter of acetabulum 1:1.91–1:2.35; of calicophoron type as defined by Dinnik 1964 in median sagittal section (Fig. 2). Oesophagus 0.36–0.76 mm in length; ratio to body length 1:12.36–1:15.5, musculature of its

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Figs. 1–4. *Calicophoron shillongensis* sp. n. (diagrammatic representation by means of camera lucida drawings). 1 – whole worm (ventral view), 2 – pharynx (median sagittal section), 3 – terminal genitalium (median sagittal section), 4 – acetabulum (median sagittal section)

wall moderate in thickness and smooth, no bulb or posterior sphincter. Caeca with a few loose dorsoventral bends, extending up to middle of acetabulum, their pointed ends terminating dorsally.

Testes obliquely tandem or juxtaposed, anterior testis 1.13–2.26 × 1.58–2.48 mm, posterior testis 0.94–1.8 × 1.58–2.35 mm; seminal vesicle coiled; pars musculosa, pars prostatica well developed.

Ovary subspherical, 0.27–0.76 × 0.27–0.72 mm, post-testicular; Mehlis' gland close to ovary; Laurer's canal crossing excretory vesicle or duct, opening dorsally. Eggs 0.9–0.158 × 0.058–0.087 mm. Vitellaria in loose or small clusters, extending from level of oesophagus posteriorly up to posterior level of acetabulum, confluent dorsomedially in post-ovarian region.

Excretory vesicle dorsal to acetabulum, opening on dorsal surface, anterior to opening of Laurer's canal.

Genital pore ventral, at level of oesophageal bifurcation or behind it; ventral atrium deep, enormous, no ventral sphincter, genital papilla weakly developed, sphincter papilla weak; this new type of terminal genitalium is referred here as shillongensis type (Fig. 3).

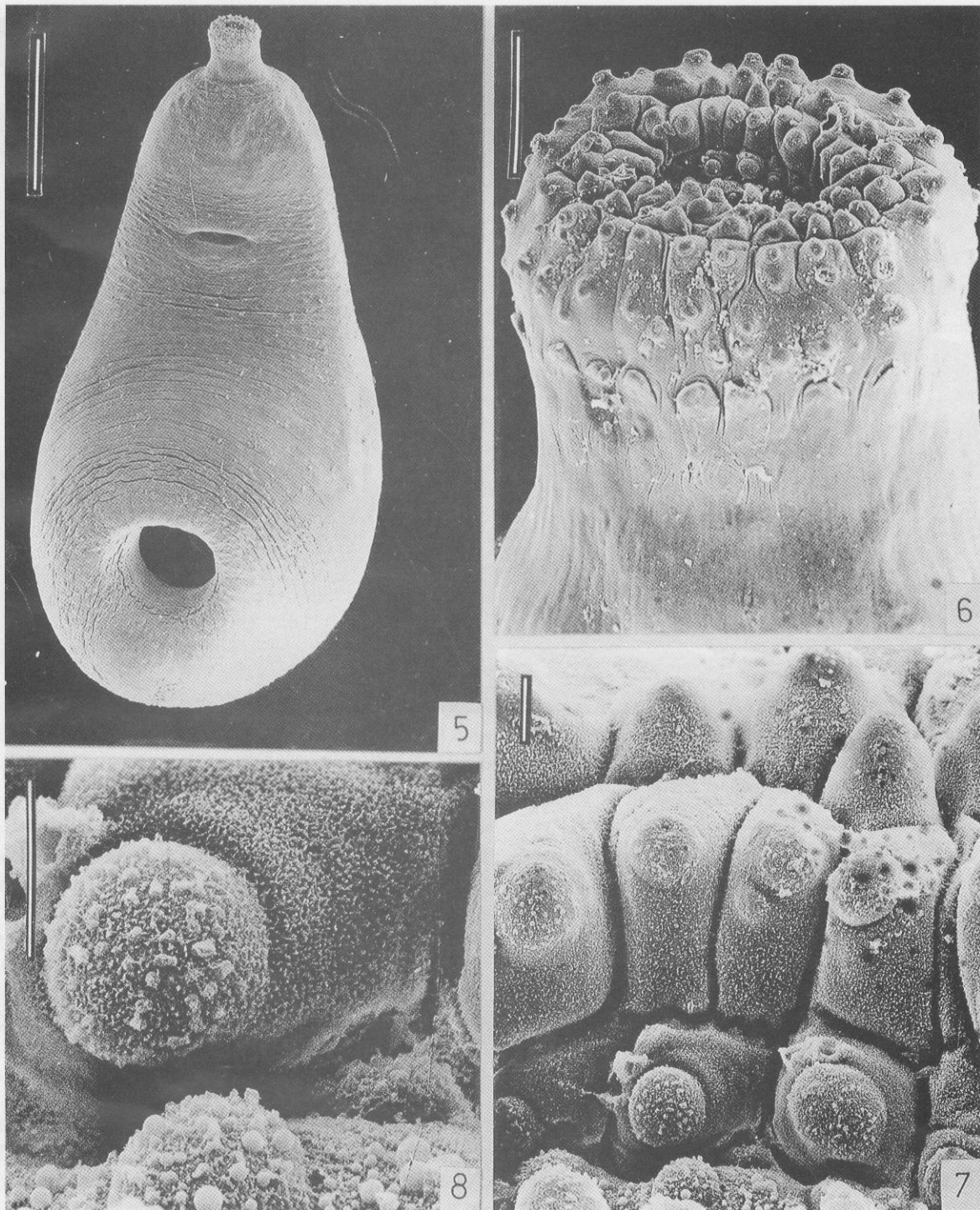
The scanning electron microscopic studies of the surface topography (Figs. 5–10) revealed the presence of sparsely scattered, minute papillae throughout the body. The oral rim has closely arranged petaloid structures

each of which is provided with two or more conspicuous dome-shaped and ciliated elevations. Similar papillate structures also abound in the buccal lining as well. The region of the genital pore and acetabulum lack any specific pattern of tegumental papillae.

Discussion

The present form belongs to the subfamily Paramphistominae of the family Paramphistomidae because of the absence of a ventral pouch and the Laurer's canal crossing the excretory vesicle or duct. It is further assigned to the genus *Calicophoron* Näsmark, 1937 on the ground of its having a conical body, which is broader posteriorly than anteriorly, a posterior subterminal acetabulum of moderate size, pharynx without a pouch or diverticula, well-developed pars musculosa and pars prostatica and in the absence of a genital sucker.

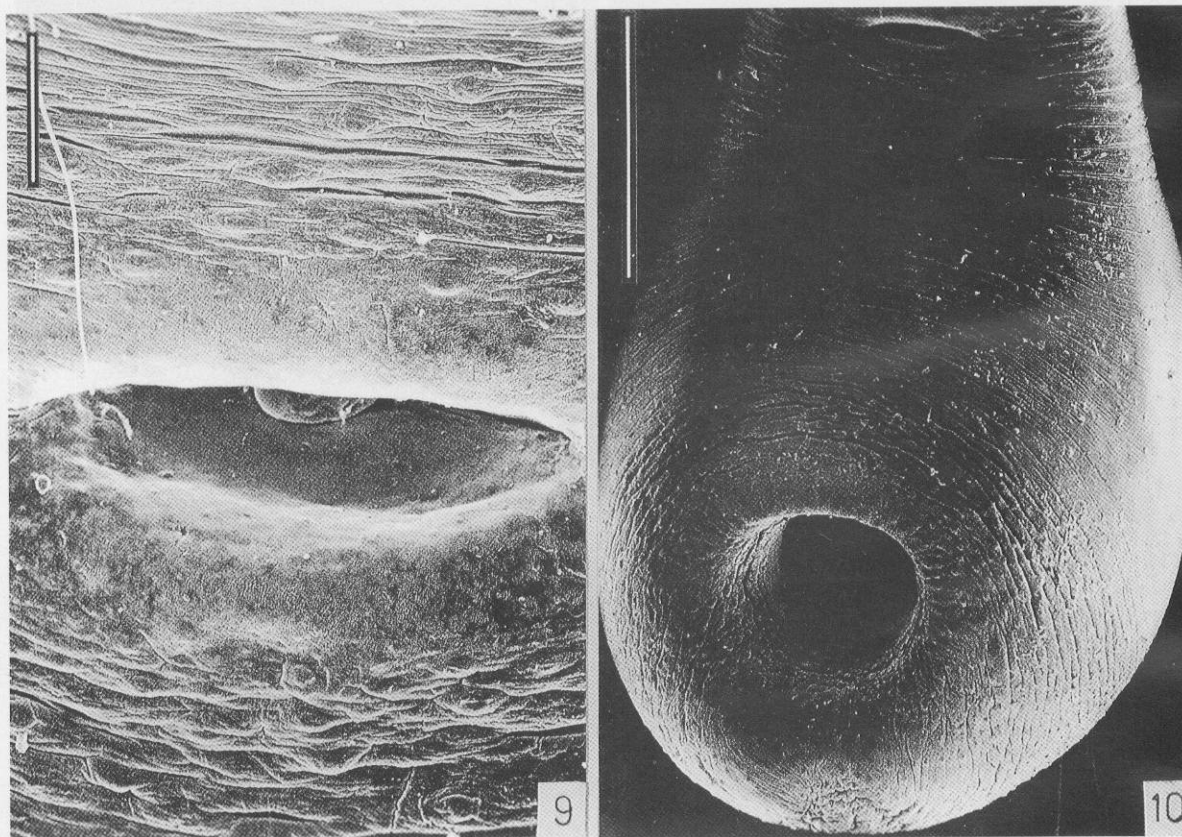
Eduardo 1983 in his revision of the genus *Calicophoron* recognised only 12 species as valid and provided a key to them. These are *Calicophoron calicophorum* (Fischöeder, 1901) Näsmark, 1937 (syn. *Paramphistomum crassum* Stiles et Goldberger, 1910; *P. cauliorchis* Stiles et Goldberger, 1910; *P. ijimai* Fukui, 1922; *P. (Cauliorchis) skrjabini* Popova, 1937; *P. erschovi*



Figs. 5–8. *Calicophoron shillongensis* sp. n. (scanning electron micrographs). **5** – whole worm, ventral view, scale bar = 1 mm; **6** – oral aperture region, scale bar = 100 μ m; **7** – inner wall of buccal lining, showing closely arranged petaloid structures with dome-shaped papillae, scale bar = 10 μ m; **8** – a closer view of a papillae, scale bar = 10 μ m

Davydova, 1959; *Calicophoron orientalis* Mukherjee, 1966; *C. wuchengense* Wang, 1979 and *Cotylophoron skrjabini* Mitskevich, 1958 in part); *C. bothriophoron* (Braun, 1892) Eduardo, 1983; *C. microbothrium* (Fischer, 1901) Eduardo, 1983; *C. papillosum* (Stiles et

Goldberger, 1910) Näsmark, 1937 (syn. *Calicophoron zhejiangense* Wang, 1979); *C. papilligerum* (Stiles et Goldberger, 1910) Eduardo, 1983; *C. raja* Näsmark, 1937; *C. clavula* (Näsmark, 1937) Eduardo, 1983; *C. microbothrioides* (Price et McIntosh, 1944) Eduardo,



Figs. 9 and 10. *Calicophoron shillongensis* sp. n. (scanning electron micrographs). **9** – ventral atrium with papillae surrounding it, scale bar = 100 μ m; **10** – enlarged view of acetabular region, scale bar = 1 mm

1983 (syn. *Ceylonocotyle petrovi* Davydova, 1961); *C. sukari* (Dinnik, 1954) Eduardo, 1983; *C. phillerouxi* (Dinnik, 1961) Eduardo, 1983 (syn. *Paramphistomum vangrembergeni* Van Strydonck, 1970; *P. togolense* Albaret et al., 1978); *C. daubneyi* (Dinnik, 1962) Eduardo, 1983 and *C. sukumum* (Dinnik, 1964) Eduardo, 1983.

The present species can be differentiated from the known species of the genus by the cotylophoron type of acetabulum and a new type of terminal genitalium and also in having plate-like elevations bearing ciliated papillae around the oral opening and in the buccal cavity.

In having a true ventral atrium the present form comes close to *C. papilligerum* and *C. bothriophoron*; it differs from *C. papilligerum* in the absence of papillae in the wall of ventral atrium and from *C. bothriophoron* in the absence of a ventral sphincter and in having a weak genital papilla. The present species deviates from all other known species of the genus and can be further differentiated from them in having a different type of terminal genitalium which is calicophoron type in *C. calicophorum*, raja type in *C. raja*, clavula type in *C. clavula*, papillogenitalis type in *C. papillosum* and microbothrium type in *C. microbothrioides*, *C. phillerouxi*, *C. sukari*, *C. daubneyi* and *C. sukumum*.

The present species also resembles *C. calicophorum* in the position of the testes; however the position of the genital opening and the direction of the caecal ends are additional characters for differentiating the two species; in *C. calicophorum* the genital opening is post-bifurcal and the terminal ends of the caeca are directed posteriorly. In having dorsally directed caecal ends the present form can also be differentiated from *C. microbothrium*, *C. papillosum*, *C. raja*, *C. sukari*, *C. daubneyi* and *C. sukumum*.

The terminal genitalium of the present species cannot be assigned to any of the "types" hitherto described by Näsmark 1937 or Eduardo 1982 and it is considered here as a new type, the shillongensis type.

The above discussed differences of the present form from the known species of *Calicophoron* merit its description as a new species under the genus.

Specific diagnosis

Oral rim and buccal lining having dome-shaped ciliated elevations; oesophageal lumen smooth throughout its length, oesophageal bulb or sphincter absent; intestinal caecal terminal ends pointing dorsally; acetabulum of cotylophoron type; terminal genitalium of shillongensis

type (true ventral atrium present, without ventral sphincter, weak sphincter papilla and genital papilla).

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