

SURFACE FINE TOPOGRAPHY OF FOUR TREMATODES
(PARAMPHISTOMOIDEA) PARASITIZING SHEEP

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The tegumental surface topography of *Orthocoelium orthocoelium*, *O. parvipapillatum*, *O. streptocoelium* and *Carmyerius spatiosus* was studied by scanning electron microscopy.

In *O. orthocoelium* round aciliate button-like papillae are present arranged in rows in the circum-oral region and irregularly scattered elevations abound in the area surrounding the genital papilla. The general tegument of *O. parvipapillatum* is finely folded and lacks any sensory structures; however, the tegument lining the genital atrium has blister-like papillae, and smooth clustered papillae are found in the acetabular region. In *O. streptocoelium* a large number of dome-shaped papillae, densely arranged in concentric rings, occurs in the circum-oral region. The general tegument of *C. spatiosus* is intricately convoluted; the anterior extremity, particularly in the vicinity of the mouth, is provided with concentric rows of dense ciliate papillae; cobblestone-like papillae are aggregated in the region of ventral pouch opening and clusters of 6-10 minute papillae each are randomly distributed in between the radial convolutions of the tegument of the acetabular rim.

INTRODUCTION

Surface topographical features of digenetic trematodes, revealed through SEM studies have provided newer interpretations regarding the functional morphology of their surface tegument and also their taxonomy (Bakke, 1976 a, b). Stereoscan studies performed on several species of amphistomid flukes of mammalian hosts have revealed inter-specific differences in the tegumental texture and also in the nature and distribution pattern of (pupative sensory) surface structures (Eduardo, 1980 a,b; 1985; Tandon and Maitra, 1982, 1983; Sey 1984; Jones 1986; Ahmad *et al.*, 1988).

Species of *Orthocoelium* and *Carmyerius* occur as common amphistomes parasites in bovine and ovine hosts. Information is available on the surface topography of several species of these genera (Sey 1984; Tandon and Maitra, 1987). The present communication provides an account of similar aspects of three more species of *Orthocoelium*, namely *O. orthocoelium*, *O. parvipapillatum* and *O. streptocoelium* and also of *Carmyerius spatiosus*.

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MATERIALS AND METHODS

Mature specimens of all four species were obtained from the rumen of naturally infected sheep, *Ovis aries* L., slaughtered at local abattoirs. After thorough washing in normal saline, the specimens were fixed in 10% cold neutral buffered formalin, dehydrated through a graded series of ethanol, treated with TMS (Tetramethylsilane) following Dey *et al.* (1989), metal coated with gold and observed under JSM 35 CF (Jeol) scanning electron microscope using electron accelerating voltages between 10 - 15 Kv.

RESULTS

Orthocoelium orthocoelium (Figs. 1-5)

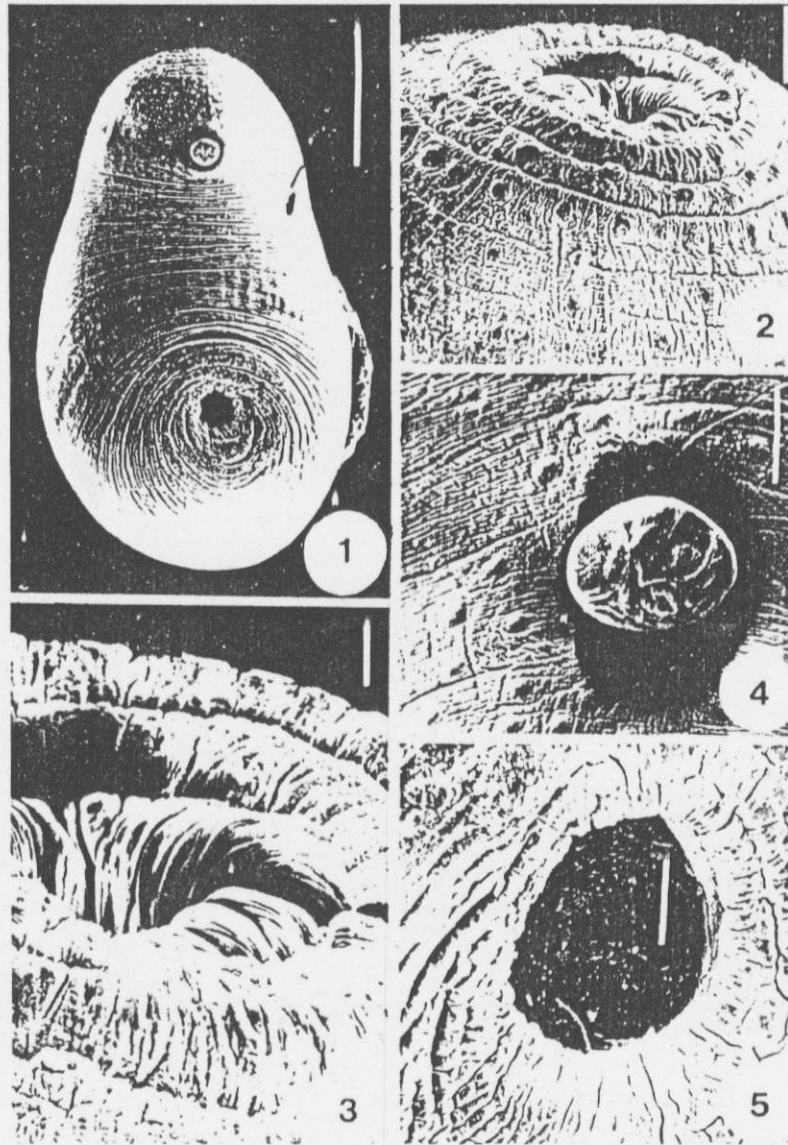
The body is provided with transverse ridges. The region surrounding the oral aperture is provided with round aciliate button-like papillae arranged at a regular distance in between two ridges or foldings of the tegument. The oral rim has radial foldings. The tegument surrounding the genital papilla is provided with tiny, irregularly scattered elevations. The acetabular region lacks any papillate structures; however, the acetabular rim shows radially corrugated surface.

Orthocoelium parvipapillatum (Figs. 6-10)

The ventral aspect of the conical body has transversely running folds or ridges which acquire a somewhat concentric pattern towards the anterior and posterior extremities. The general tegument is revealed under higher resolution to be finely and intricately folded, but lacks any papillate or pitted sensory structures in the region anterior to the genital atrium. A few coarsely scattered tuberculated structures are found on the raised area immediately surrounding the genital aperture. The tegument lining the genital atrium has blister-like papillae giving it a warty appearance. Smooth papillae, in clusters of 2-4, also abound in the acetabular region, studded in between the radial tegumental folds of the sucker rim.

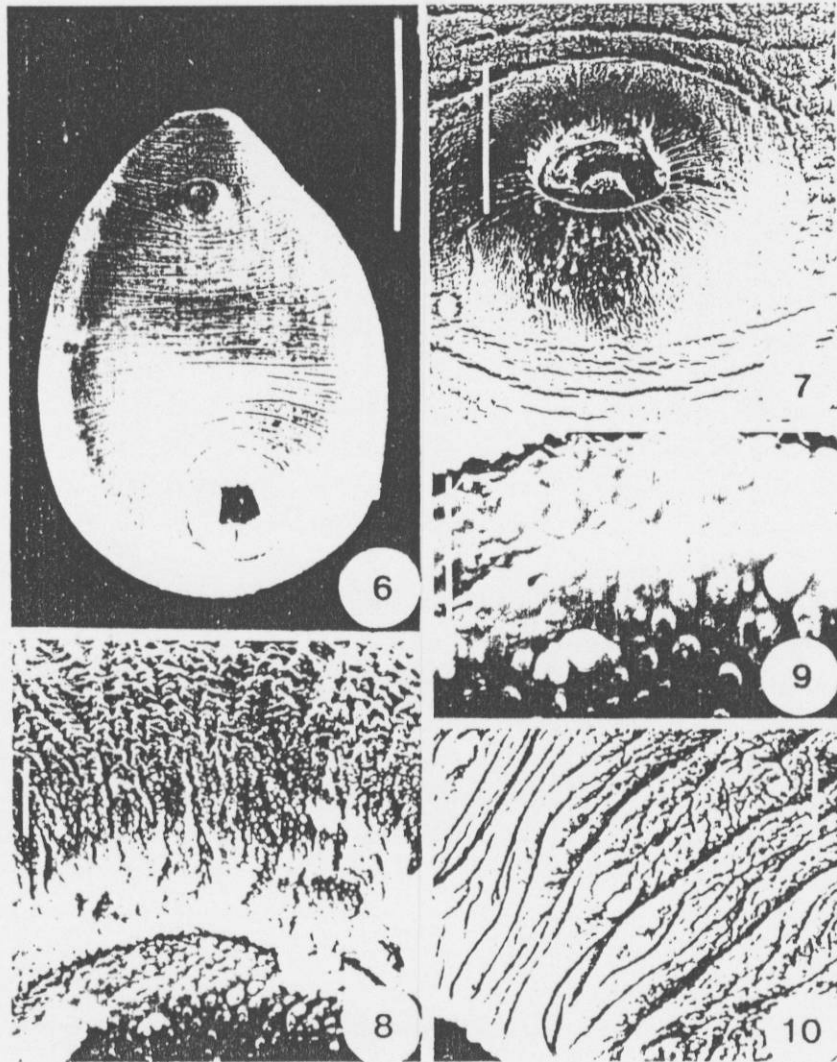
Orthocoelium streptocoelium (Figs. 11-14)

The surface shows transversely running folds for most part of the body except in the acetabular region where the tegumental folds assume a somewhat radial pattern. Several concentric rows of densely arranged domed papillae abound in the circum-oral region. Similar papillae are also present on the ventral surface in the anterior half of the body, while the dorsal general surface seems to be devoid of them. The tegument of the acetabular and genital pore regions is also free of any tuberculate structures.



Figs. 1-5 *Orthocoelium orthocoelium* - Scanning electron micrographs.

1. Whole worm, ventral view (scale bar = 1 mm) 2. Circum-oral region, showing button-shaped papillae in concentric rings (scale bar = 100 μm) 3. Circum-oral region, enlarged view showing transverse ridges approaching the opening (scale bar = 20 μm) 4. Terminal genitalium, showing minute papillae on its surrounding tegument (scale bar = 100 μm) 5. Tegument at the acetabular rim, showing radially corrugated nature (scale bar = 100 μm).



Figs. 6-10 *Orthocoelium parvipapillatum* - scanning electron micrographs.

6. Whole worm, ventral view (scale bar = 1 mm) 7. Region of genital opening (scale bar = 100 μm) 8. Rim of genital pore, under higher resolution (scale bar = 10 μm) 9. Inner wall of genital atrium in a closer view (scale bar = 10 μm) 10. Rim of acetabulum, showing tiny grouped papillae (scale bar = 20 μm).

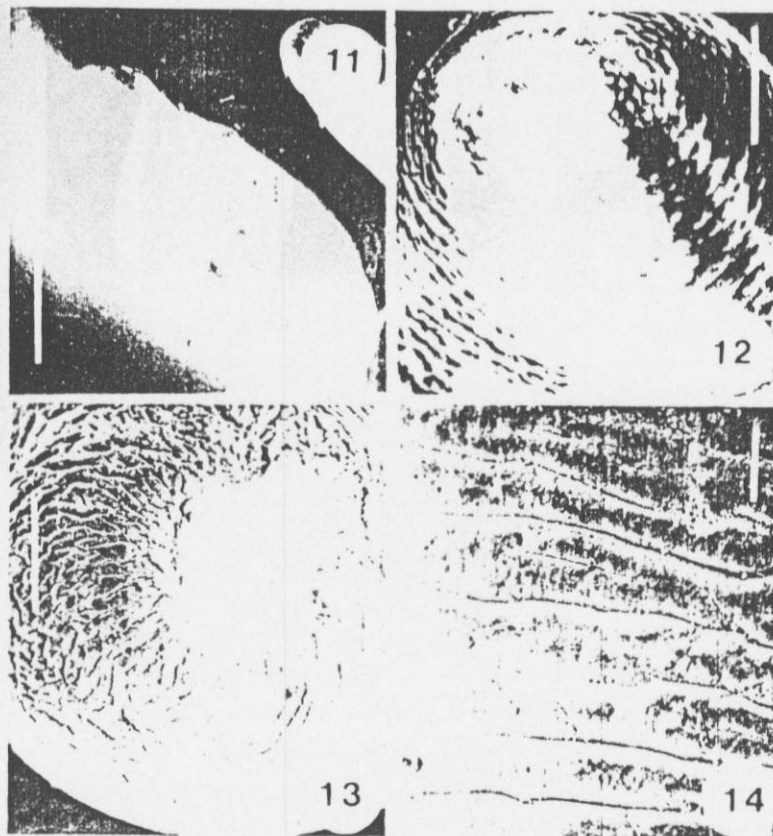
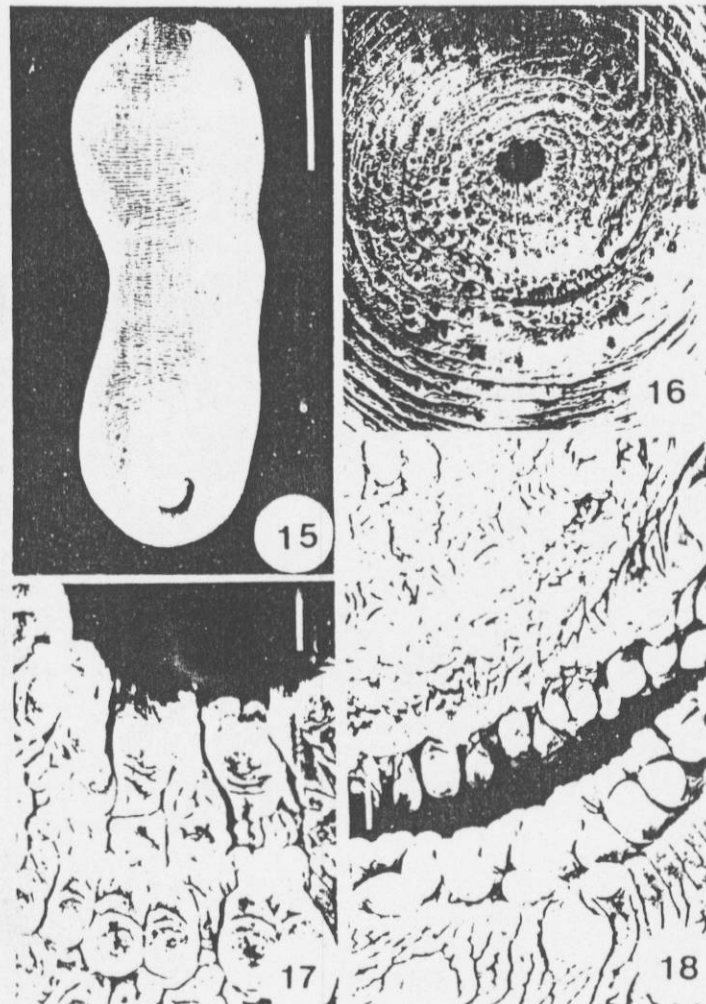


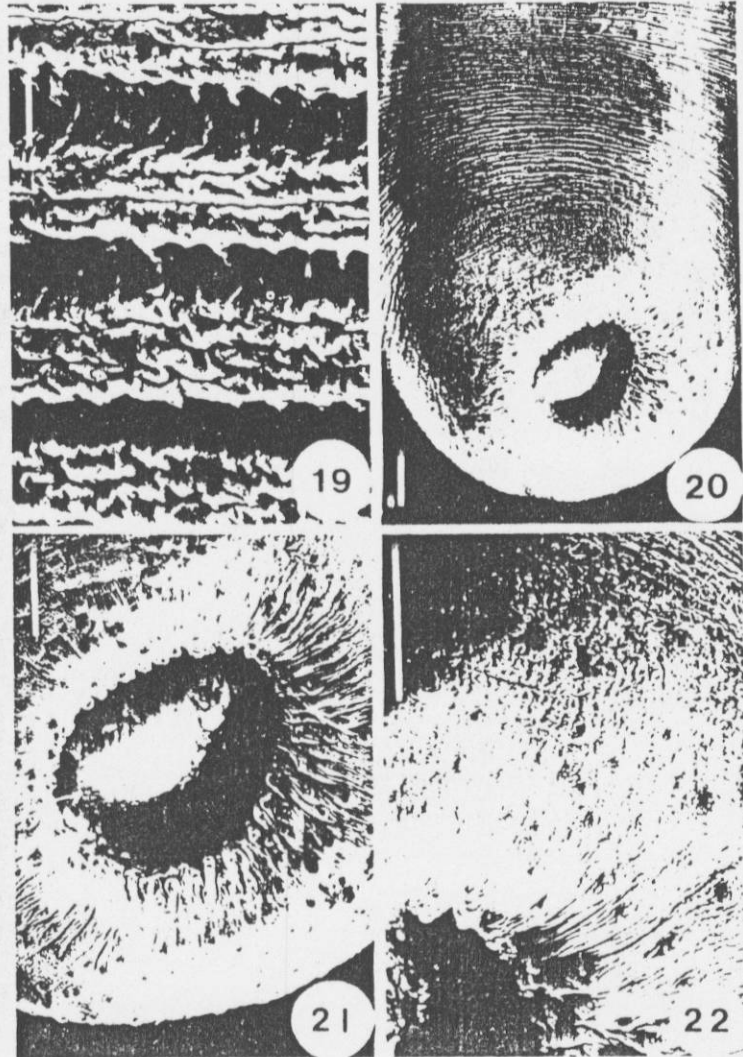
Fig. 11-14. *Orthocoelium streptocoelium* - scanning electron micrographs.

11. Whole worm, ventral view (scale bar = 1 mm) 12. Circum-oral region (scale bar = 300 μ m)
13. Acetabulum, in a closer view (scale bar = 300 μ m) 14. Tegument on dorsal surface (scale bar = 30 μ m).



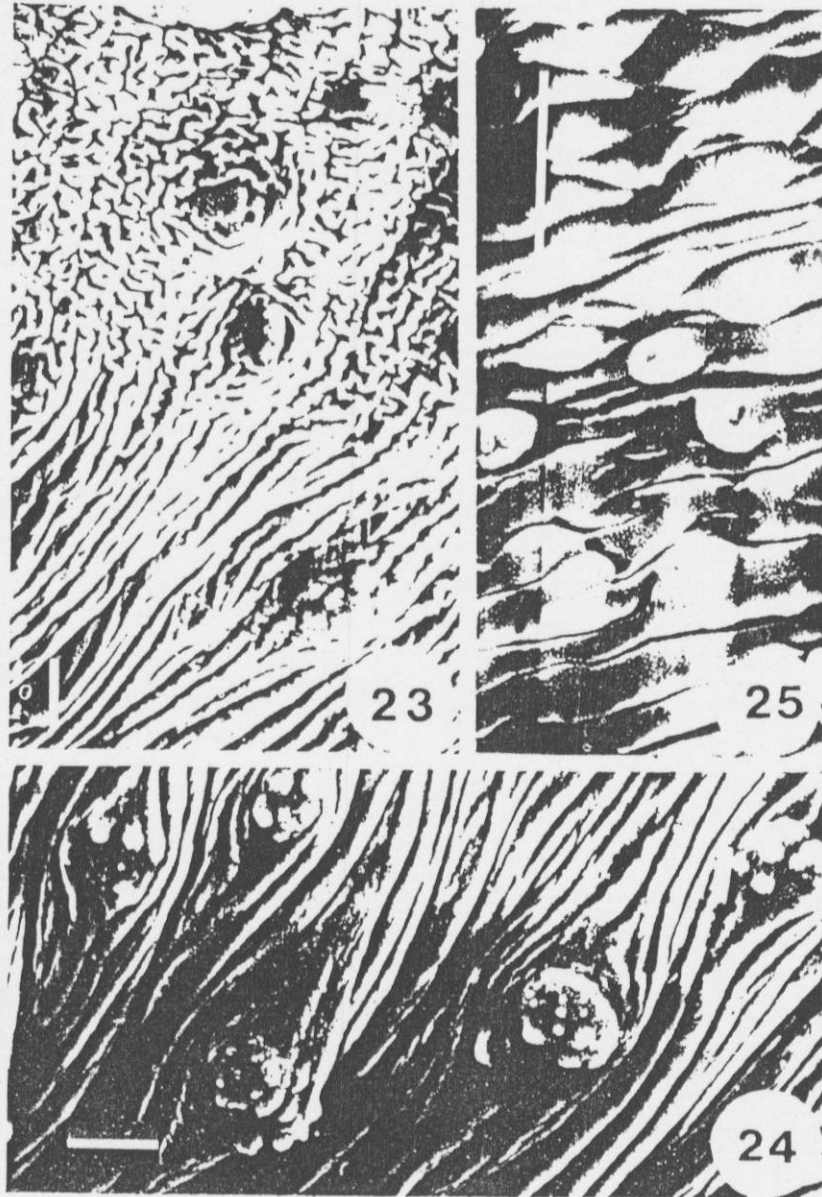
Figs 15-18 *Carmyrius spatiosus* – scanning electron micrographs.

15. Whole worm, ventral view (scale bar = 1 mm) 16. Oral aperture and ventral pouch opening, top view (scale bar = 100 μ m) 17. Tegumental papillae surrounding the mouth (scale bar = 10 μ m). 18. Opening of ventral pouch. Clustered papillae are evident (scale bar = 10 μ m).



Figs. 19-22 *Carmyerius spatiosus* – scanning electron micrographs.

19. Transverse folds and grooves on general body surface, dorsal view (scale bar = 10 μm) 20. Posterior region of body (scale bar = 100 μm) 21. Acetabulum, enlarged (scale bar = 100 μm) 22. A portion of the rim of acetabulum (scale bar = 100 μm).



Figs. 23-25 *Carmyrius spatiosus* - scanning electron micrographs.

23. Acetabular rim in a closer view, showing the pattern of tegumental foldings and papillae (scale bar = 10 μ m). 24. Clustered papillae on ridges at the rim of acetabulum (scale bar = 10 μ m) 25. Inner wall of acetabulum (scale bar = 10 μ m)

Carmyerius spatiosus (Figs. 15-25)

The whole body surface has transversely running folds of the tegument which assume a concentric pattern towards the anterior extremity. The general tegument is revealed at higher resolution as being intricately convoluted, and in the middle part of the body shows transverse broad strips separated by deep grooves. Concentric rows of elevated, ciliate papillae abound at the anterior extremity, these structures showing denser aggregation in the vicinity of the mouth. The ventral pouch opening is also provided with a cluster of cobblestone-like papillae. The posterior extremity of the body, and the acetabular rim have numerous tuberculations randomly studded in between the radial fine foldings and intricate convolutions of the tegument. These tuberculated structures, in a magnified view, are shown to comprise a cluster of 6-10 minute papillae in each; papillae similar to those of the anterior region are also present in the acetabular region. The tegument lining the acetabular aperture is also provided with papillae.

DISCUSSION

The general tegument in all the three *Orthocoelium* species exhibited a non-tuberculated nature – a feature in conformity with the observations made in other species of the genus (Tandon and Maitra, 1987). The occurrence of concentric rows of papillae around the oral aperture as observed in *O. orthocoelium* and *O. streptocoelium* is also a common feature of several other *Orthocoelium* species (Eduardo, 1980b, 1985; Sey, 1985; Tandon and Maitra, 1987). However, *O. parvipapillatum* lacks any papillae or pitted sensory structures in the circum-oral region. The presence of papillae in the vicinity of the genital pore, as in *O. parvipapillatum*, has been reported for *O. indonesiense* and *Bilatorchis papillogenitalis* by Eduardo (1980 a, b). However, the blister-like papillae on the tegument lining the genital atrium seem to be characteristic of *O. parvipapillatum*.

The strip-like transverse foldings observed on the general tegument, conspicuous clustered smooth papillae abounding the opening of the ventral pouch and clustered papillae studded in between the tegumental foldings at the acetabular rim in *Carmyerius spatiosus* seem to be peculiar features of this species, as in other species of the genus, namely *C. cruciformis*, *C. gregarius*, *C. mancupatus*, *C. schoutedeni* and *C. synethes*, the same have not been recorded (Sey, 1984, 1985). However, the ciliated circum-oral papillae of *C. spatiosus* apparently resemble those of *C. schoutedeni* and *C. synethes* (Sey, 1984, 1985).

The tegumental folds, convolutions or ridges are probably a means of increasing the absorptive surface area of the flukes (Otubanjo, 1985). The nature and pattern of distribution of sensory papillae seems to indicate their probable function. For example, domed papillae, with or without cilia-like structures, are suggestive on account of their abundant clustering in the circum-oral region of

tangoreceptive and/or chemoreceptive function with their involvement in locating the attachment sites and detection of food material (Smyth and Halton, 1983; Otubanjo, 1985). Likewise, the aciliate papillae – domed, button and rosette types, as in *O. orthocoelium* and *O. streptocoelium*, are likely to be tango - or proprioceptors (Cifrian and Garcia-Corrales, 1988). The papillae present in the vicinity of the terminal genitalium as in *O. parvipapillatum* are suggestive of a sensory role during copulation (Bakke, 1976b).

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