Acta Parasitologica, 1992, (37)3, 135–137
PL ISSN 0065-1478

Stereoscan studies of two species of the genus *Oesophagostomum* (Nematoda, Chabertiidae)

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Abstract. The fine surface topography of *Oesophagostomum columbianum* and *O. aspersum*, the predominant nematode species of goats in India, has been studied by means of SEM. In *O. columbianum* the anterior end is bent like a hook; the cephalic vesicle is marked behind by a groove; the lateral alae are present throughout the anterior extremity thereby providing a dorsal curvature to the body; the external corona radiata is seen to consist of 20 elements; and the spicules are long and seen as twisted upon each other. In *O. aspersum* the external corona radiata comprises 12 elements; the vulva and the anus lie behind a constriction at the posterior extremity and quite close to one another. Characters, such as the amphids, cephalic papillae, prebursal papillae, etc., are elucidated for both species.

Introduction

Species of the genus *Oesophagostomum* are among the economically important parasites of goats and sheep. Infection with *O. columbianum* has been found most recently in India (Yadav and Tandon 1989) and in general is very common throughout the world (Soulsby 1982). The utilization of scanning electron microscopy (SEM) has enabled helminthologists to provide new information on the morphology of many nematode parasites (Gibbons 1986). A literature survey, however, revealed no information about the fine topography of *O. columbianum* and *O. aspersum*. In the present communication, the microtopographic features of these two species are elucidated with the aid of SEM.

Material and methods

The adult worms were collected after thorough washing in 0.9% physiological saline, the specimens were fixed in 5% neutral buffered formalin and processed for SEM as described by Snyder 1985 from the small intestine of goats. However, in lieu of the critical-point drying technique, the specimens were dried using tetramethylsilane following Dey et al. 1989. The specimens were then mounted on stubs and metal-coated with gold prior to examination under a Jeol-SEM 35 CF SEM at 15 kV.

Results

Oesophagostomum columbianum

The anterior end is bent dorsally in a hook-like manner. The cuticle of the cephalic region is inflated to form a distinct cephalic vesicle which is marked behind by a prominent cervical groove (Fig. 1a). A pair of cervical papillae (seen feebly in micrographs) is located at the region where the cervical groove ends. Cuticular transverse striations are evident throughout the dorsal aspect of the body, whereas the cuticle of the ventral region is smooth (Fig. 1b and c). The lateral alae are well developed, originating immediately posterior to the cervical groove and extend for most of the length of the body, forming a marked dorsal curvature which is interrupted at intervals (Fig. 1a). The mouth, in the form of a truncated cone, is markedly separated from the rest of the body. A pair of amphids is seen lying one on either lateral side of the mouth cone and appear as deep circular pits (Fig. 1c). Long and prominent cephalic papillae, four in number, are arranged peripherally on the mouth cone (Fig. 1c). The cuticle immediately surrounding the oral

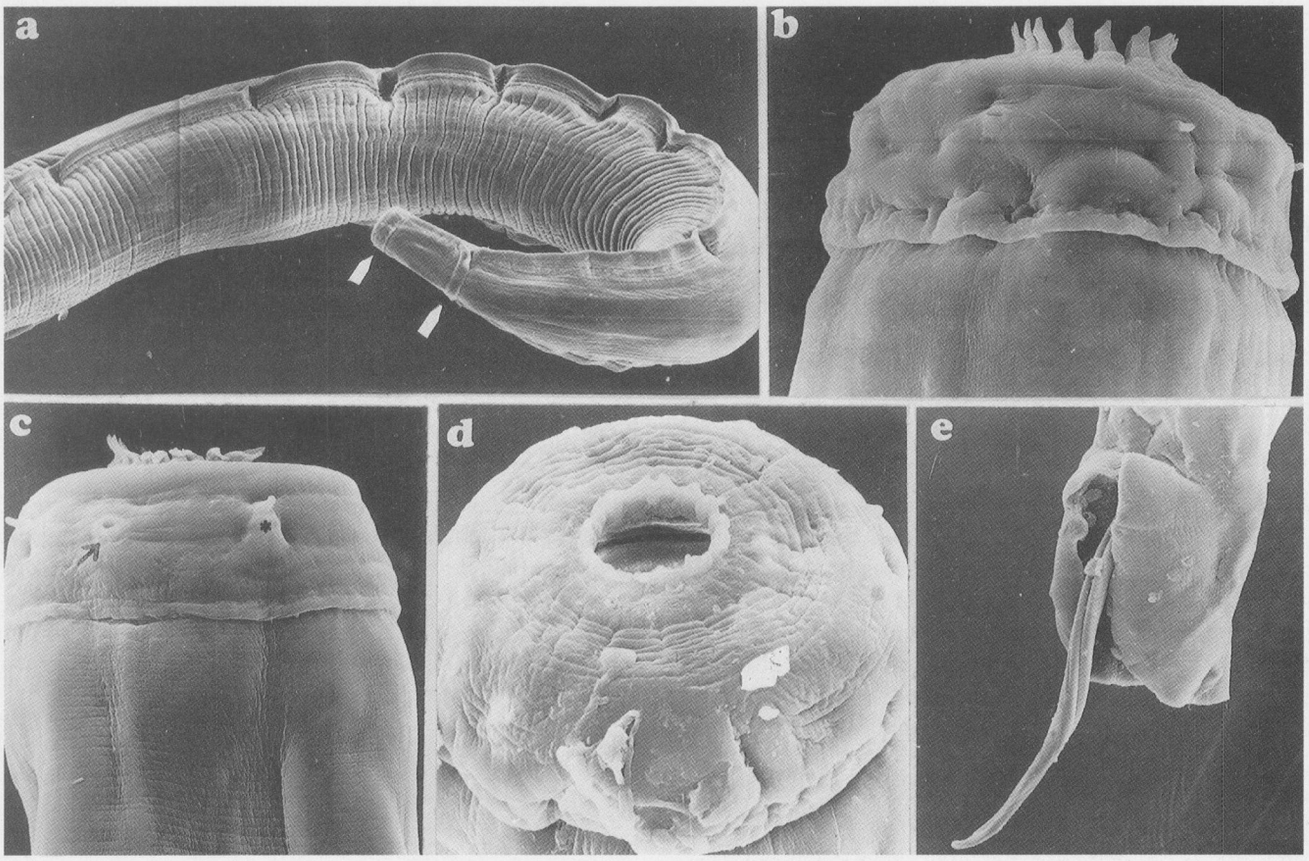

Fig. 1. Scanning electron micrographs of *Oesophagostomum columbianum*. **a** - anterior extremity, showing lateral ala and a large cephalic vesicle (between arrows) marked behind by cervical groove, × 100; **b-d** - cephalic region enlarged: **b** - in ventral view, showing elements of corona radiata, × 1000; **c** - in dorsal view, showing an amphidial opening (arrowhead) and cephalic papillae (asterisk), × 1000; **d** - en face view, showing oral opening surrounded by elements of the corona radiata, × 1200; **e** - posterior end of male, showing bursa and spicules, × 160

opening forms radially extending corrugations and, nearing the anterior edges of the mouth collar, 8 to 10 regular concentric rings of ridges. The external corona radiata comprises 20 long, leaf-shaped elements (Fig. 1b and d). In males, the bursa appears bell-shaped having two large lateral lobes. The antero-dorsal and externo-dorsal rays are seen bulging on the surface. The long twisted spicules are seen extending beyond the bursal lobes (Fig. 1e).

Oesophagostomum aspersum

The mouth collar is in the form of a truncated cone (Fig. 2a). Two oval amphidial apertures are visible, one on either lateral side of the cone (Fig. 2a). The cephalic papillae are seen situated peripherally on the mouth cone (Fig. 2b). The cuticle of the anterior region (behind the cephalic vesicle) is thrown into conspicuous ridges forming 2 to 3 consecutive tiers; however, posteriad these ridges transform into fine annular striations (Fig. 2c). The oral opening is circular with its rim having an evenly placed row of projections that form an external corona radiata consisting of 12 bluntly rounded elements (Fig. 2d). In males, the bursa consists of a larger dorsal and slightly shorter lateral lobes. A pair of small prebursal papillae lies just in front of the bursal lobe (Fig. 2e). The bursal rays show their presence as raised bead-like projections on the surface of the bursa. The long filiform spicules are curved at their tips (Fig. 2e). In females, an abrupt constriction, a little in front of the posterior extremity, marks off a conical terminal end where are found the vulva and the anus (Fig. 2f).

Discussion

The morphology of the head, particularly the mouth cone, and the number and shape of the elements of the coronae radiatae have been employed as primary taxonomic characters in the identification of various *Oesophagostomum* spp. The latter are often not visualized and/or not countable in light microscopic studies. In the present study the external corona radiata of *O. aspersum* is found to comprise 12 elements and the general appearance of the anterior extremity resembles that reported for other strongylids such as *Cylicodontophorus sagittatum* (see Rahman and Waddell 1979). Also, in an unidentified *Oesophagostomum* sp., Zaman 1983 illustrated similar features, though the cephalic papillae therein appear less prominent than in *O. aspersum*. The observations on *O. columbianum* indicate that the mouth collar and the cer-

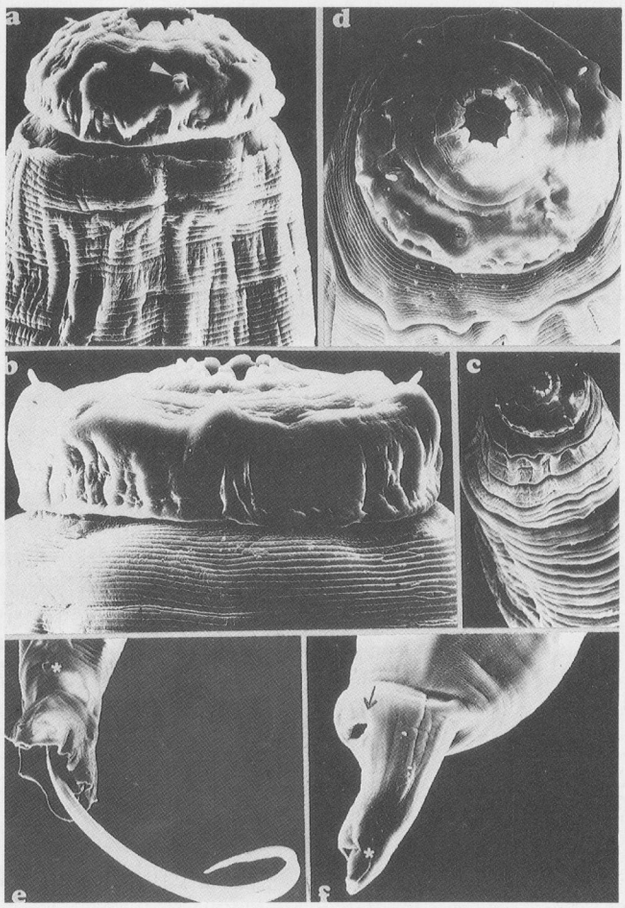

Fig. 2. Scanning electron micrographs of *Oesophagostomum aspersum*. **a-d** – anterior extremity, showing: **a** – cephalic vesicle and amphidial opening (arrowhead), × 720; **b** – cephalic papillae, × 1100; **c** – changing patterns of cuticular ridges posteriad, × 240; **d** – oral opening and elements of the corona radiata, × 720; **e** – caudal extremity of male, showing bursa, a prebursal papilla (asterisk) and spicules, × 160; **f** – posterior extremity of female, showing position of vulva (arrowhead) and anus (asterisk), × 160

vical groove are more prominent in this species than in *O. aspersum*. The external corona radiata of *O. columbianum* consist of 20 elements, whereas in earlier reports these were mentioned as varying between 20 and 24 (Railliet and Henry 1913). The amphids which have so far been overlooked by light microscopy are clearly demonstrated in the present SEM pictures, and resemble those reported in other bursate nematodes (Gibbons 1986). The absence of any cuticular ornamentation around the anus and vulva in female *O. aspersum* is a feature noticed in *Haemonchus contortus* and *Bunostomum phlebotomum*, as well (Gibbons 1986, Malan et al. 1986).

The cuticular pattern may be taken as an additional supportive character in differentiation of the two *Oesophagostomum* spp. While in *O. columbianum* the cuticular transverse striations are evident only on the dorsal aspect of the body, in *O. aspersum* these are present on both surfaces. The characteristic lateral alae of *O. columbianum* extend along almost the entire length of the body. The lateral alae may provide a degree of longitudinal stiffening that allows changes in the body diameter; these remain in contact with the substrate and, therefore, increase the efficiency of locomotion by increasing the friction and prevent rolling (Lee 1969).

Acknowledgements. This study was supported by a grant to VT under the Himalayan Eco-development Programme of Department of Environment, India in NEHU. Award of a senior fellowship to AKY by CSIR, New Delhi and SEM facilities provided by the Head, RSIC, NEHU, Shillong are gratefully acknowledged.

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(Received June 4, 1991; accepted September 3, 1991)