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## Scanning electron microscopy of *Trichuris trichiura* (Nematoda)

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### Summary

*Trichuris trichiura* was examined in the scanning electron microscope and revealed a double row of sucker-like structures at the anterior part. It is postulated that they may support the attachment of the worm in host tissues. The sheath of the spicule is covered with spikes and the vulval opening is surrounded by an elevated rim-like structure with indentations.

**Key words:** scanning electron microscopy; *Trichuris trichiura*.

### Introduction

This nematode, the causative agent of trichuriasis, is also known as whipworm because of its peculiar shape. It is about 4 cm long with an elongated anterior and a bulbous posterior section. The buccal cavity contains a small stylet (Cox, 1982). The thin anterior portion is superficially but securely threaded into the intestinal mucosa (Faust et al., 1975) and the rear portion hangs free in the gut. In the male a single lanceolate spicule protrudes through a penile sheath which is covered with spines. The vulva of the female lies at the anterior part of the bulbous section at the junction of oesophagus and intestine (Muller, 1975).

The purpose of this study was to observe various structures of the parasite in the scanning electron microscope (SEM) particularly with the view of understanding the mode of its attachment to host tissues.

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## Material and Methods

Adult *Trichuris trichiura* were obtained from human post-mortem tissues washed in physiological saline and fixed in 3% glutaraldehyde in 0.2 M sodium cacodylate buffer (pH 7.2). They were then dehydrated in graded ethanol, critically point dried, sputter coated with gold and examined in a SEM at 30 kV.

## Results

The head end reveals a small slit-like mouth opening sitting in a depression, which is surrounded by 4 cuticular elevations (Fig. 1). Only in 2 worms out of 66 (20 males and 46 females) an oral stylet was clearly seen. The stylet was pointed at its anterior end and relatively broad at its base (Fig. 2). The thin anterior portion of the parasite displays 2 types of cuticular patterns. One side is distinctly striated with transverse grooves and the other side is finely tuberculated (Fig. 3). The tuberculated part corresponds to the bacillary band. These tuberculated and striated bands run up to the bulbous portion. The tuberculated band under higher magnification reveals small circular elevated bodies which are evenly distributed (Fig. 4). Approximately 1 mm distal to the oral opening a double row of sucker-like structures is seen (Figs. 5, 6). These sucker-like structures are extensions of the cuticle and have no opening connecting them to the interior of the parasite (Figs. 7, 8). They vary in number from 40 to 90 in females (counted in a total of 6 worms). Their diameter ranges from 10 to 20  $\mu\text{m}$ . The vulval opening was surrounded by an elevated rim-like structure which was also deeply indented (Fig. 9). The spicule of the male was seen clearly protruding in some cases (Fig. 10) and was a long rigid structure with a tapering anterior end. The anterior end had a wrinkled surface and no opening (Fig. 11). The sheath of the spicule was covered with triangular spikes throughout its length (Fig. 12).

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Fig. 1. Anterior end showing a slit-like oral opening lying in a depression.  $\times 2000$ .

Fig. 2. Anterior end showing the lancet protruding from the oral cavity.  $\times 3000$ .

Fig. 3. Anterior portion showing the striated and the tuberculated bands.  $\times 2000$ .

Fig. 4. Higher magnification of the tuberculated band showing evenly placed tubercles.  $\times 6000$ .

Fig. 5. Ventral part of the anterior portion showing the double row of sucker-like structures.  $\times 2000$ .

Fig. 6. Row of sucker-like structures at higher magnification.  $\times 4000$ .

Fig. 7. Row of sucker-like structures seen from the side.  $\times 3000$ .

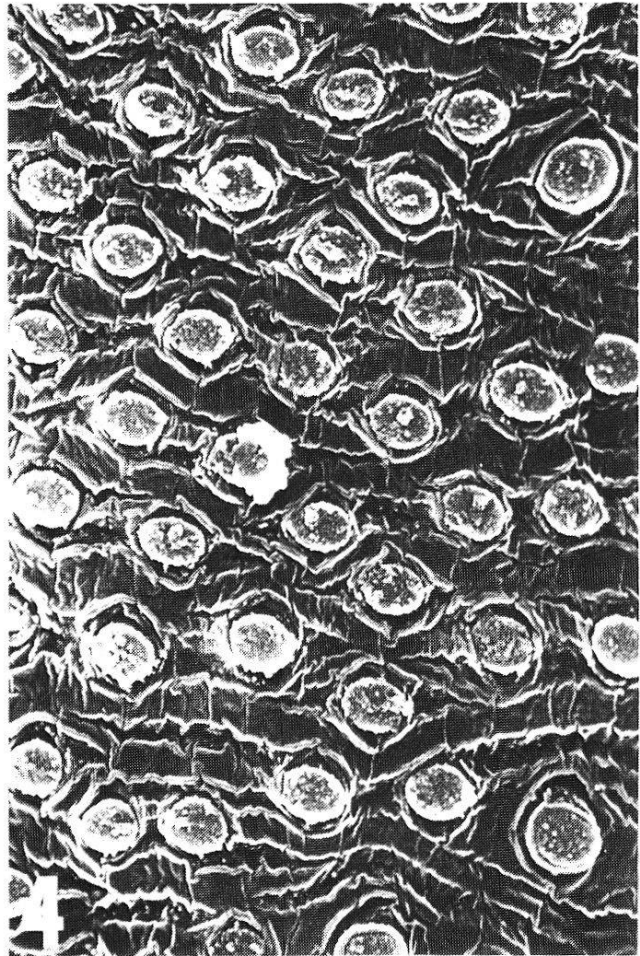
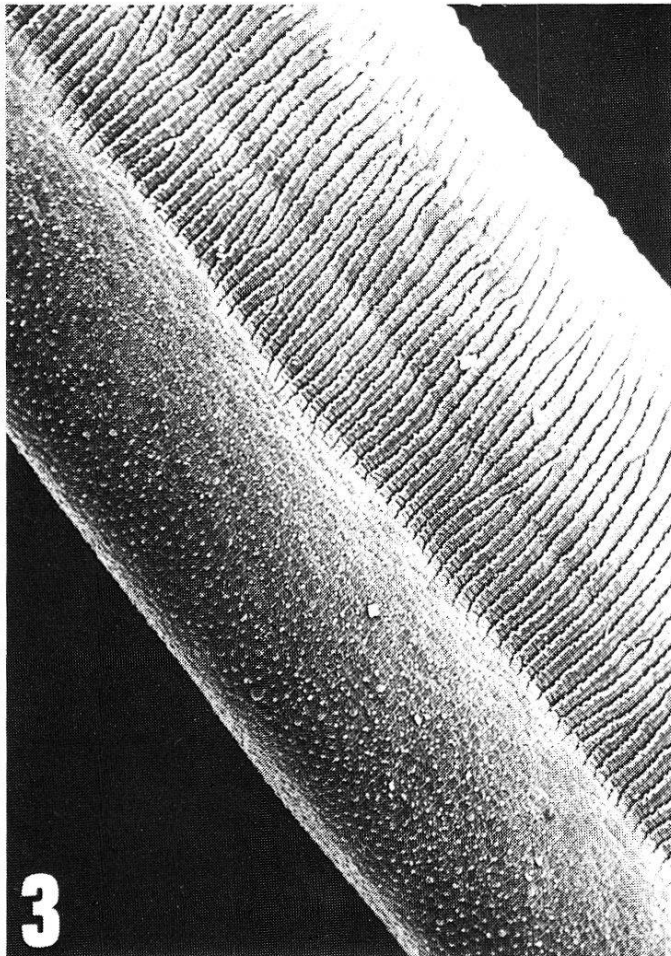
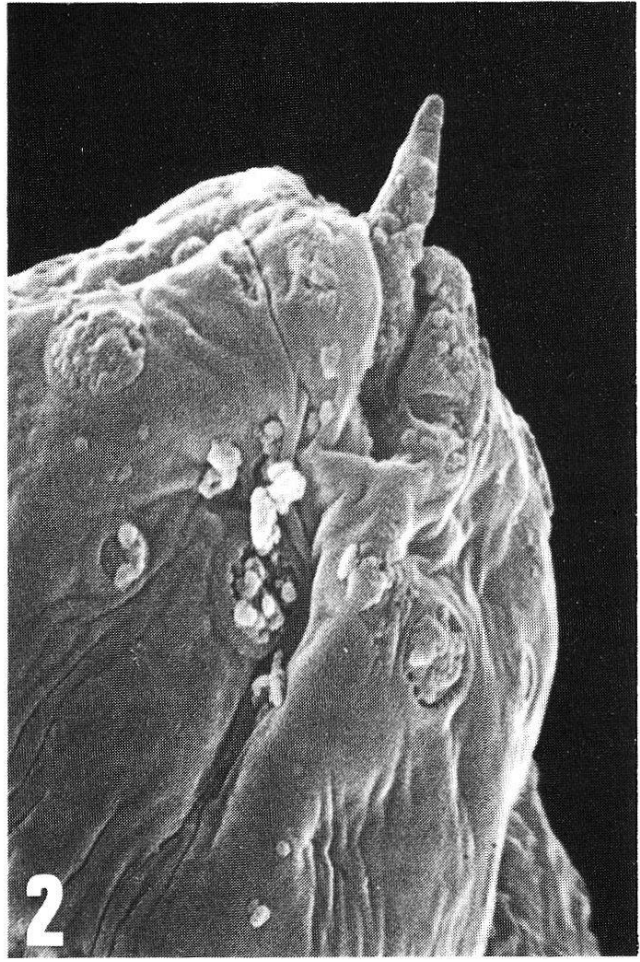
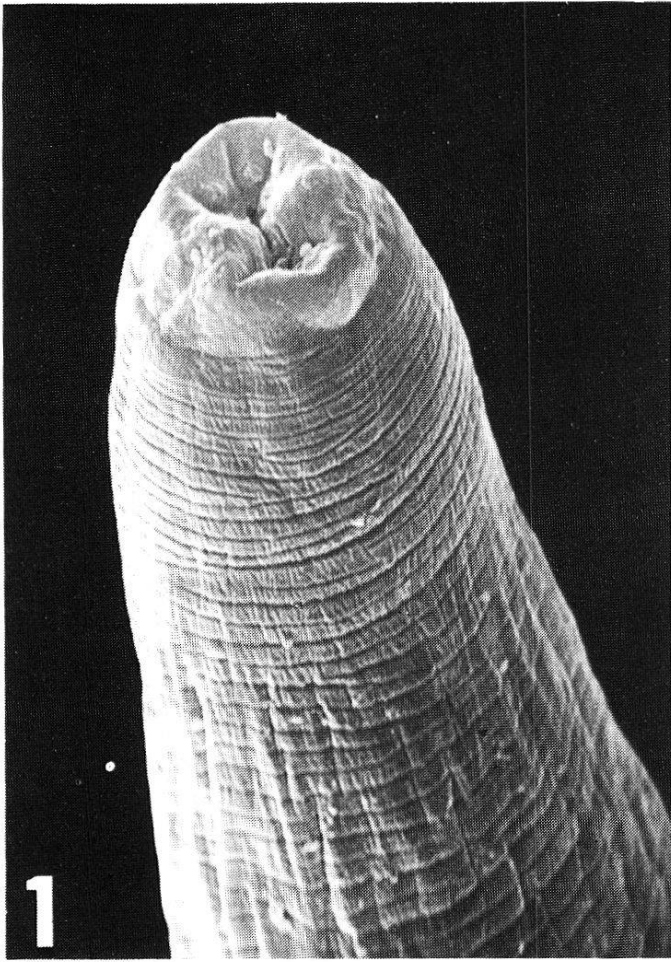
Fig. 8. A single sucker-like structure seen at a higher magnification.  $\times 6000$ .

Fig. 9. Vulva of the female showing an elevated periphery with indentations.  $\times 3000$ .

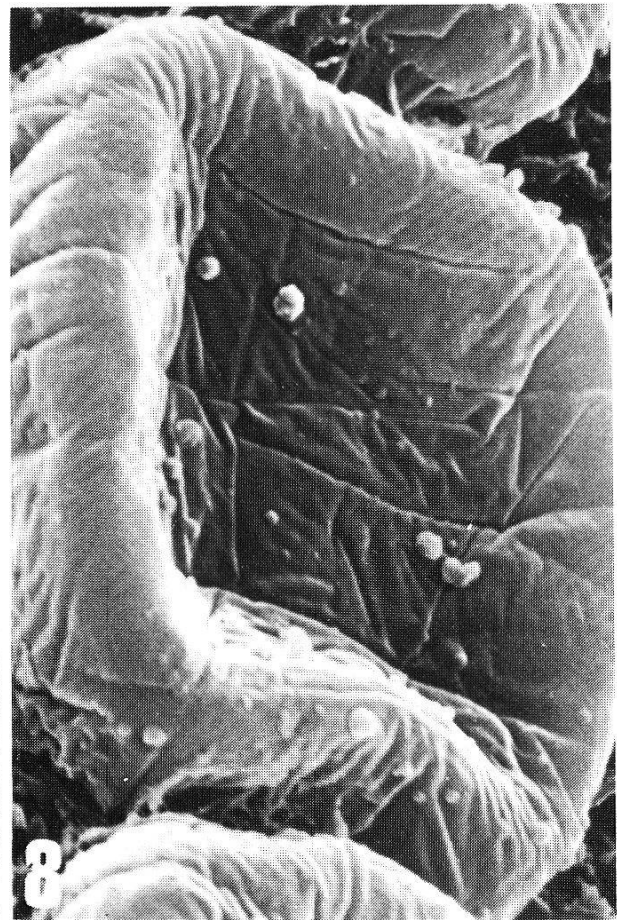
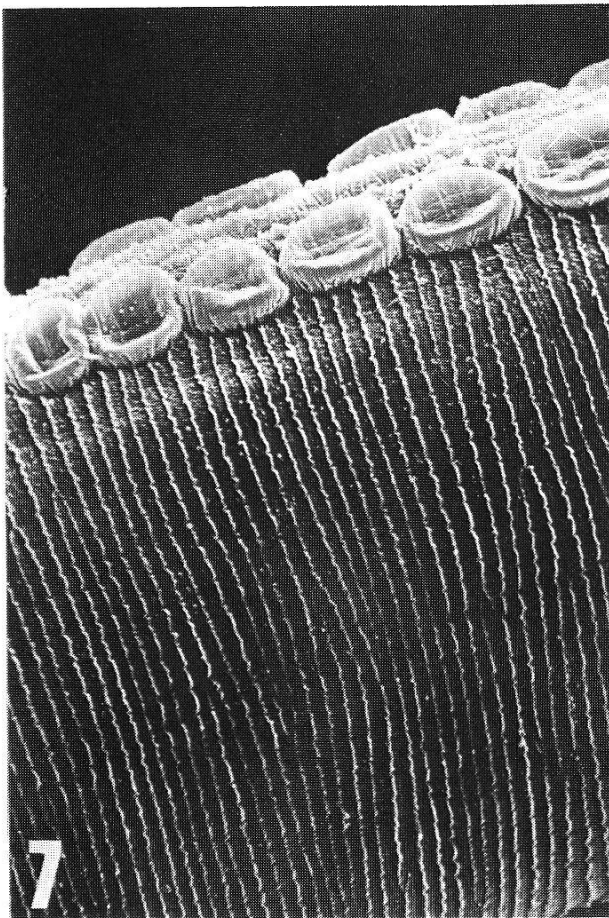
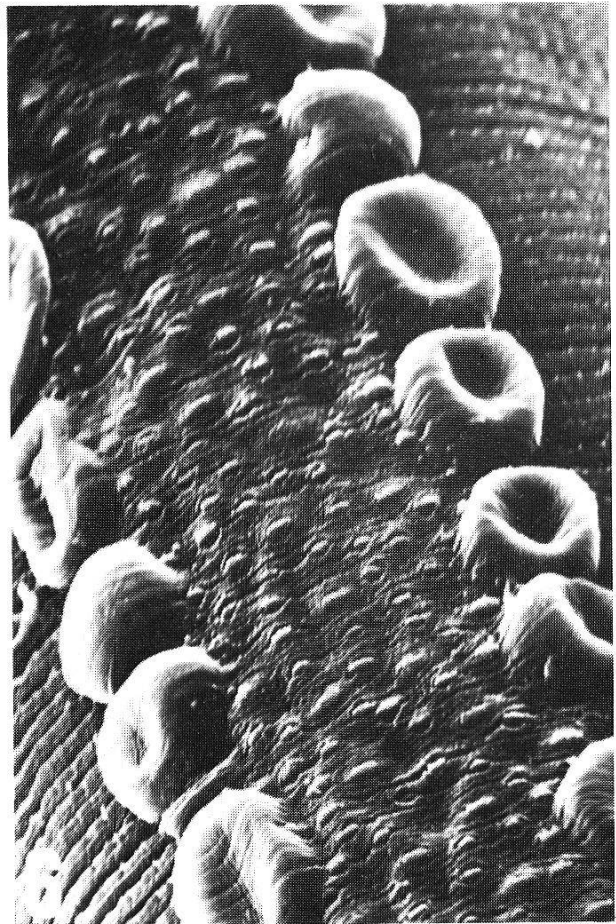
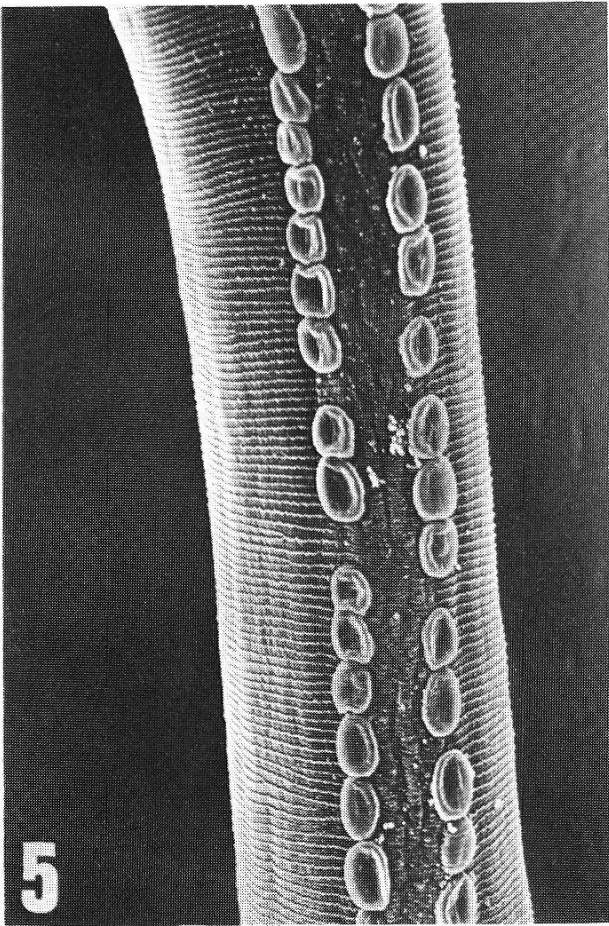
Fig. 10. Spicule which is fully extended. At the base is the sheath.  $\times 1000$ .

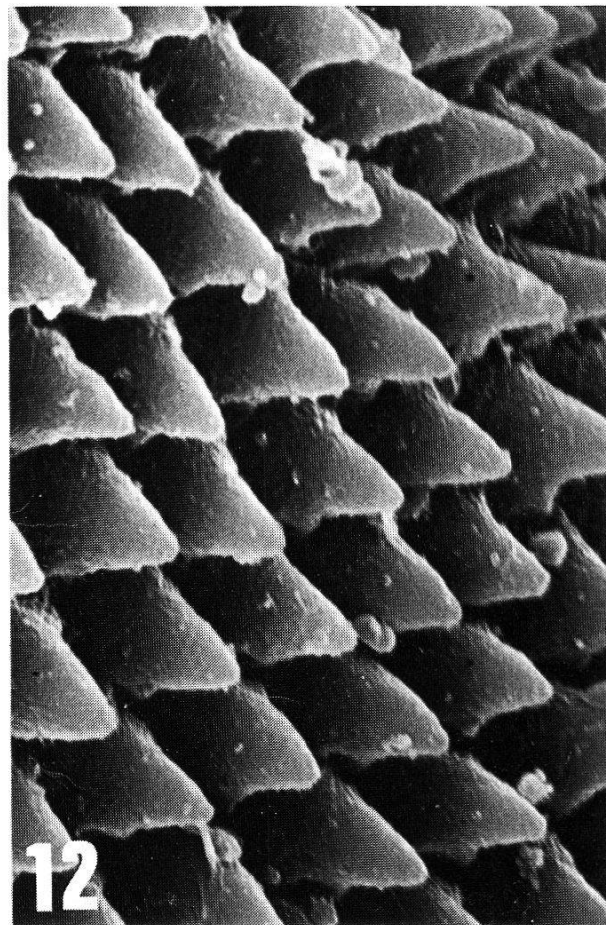
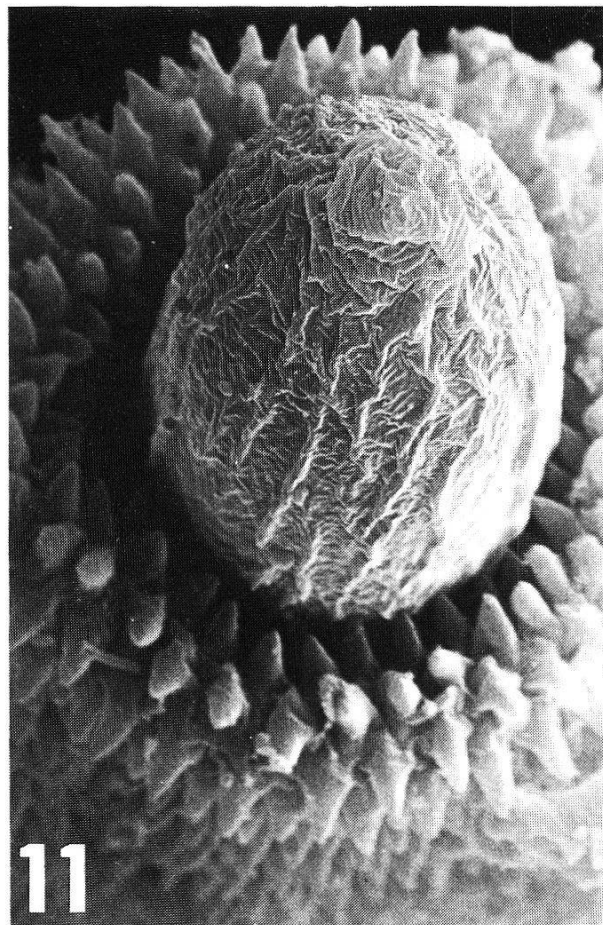
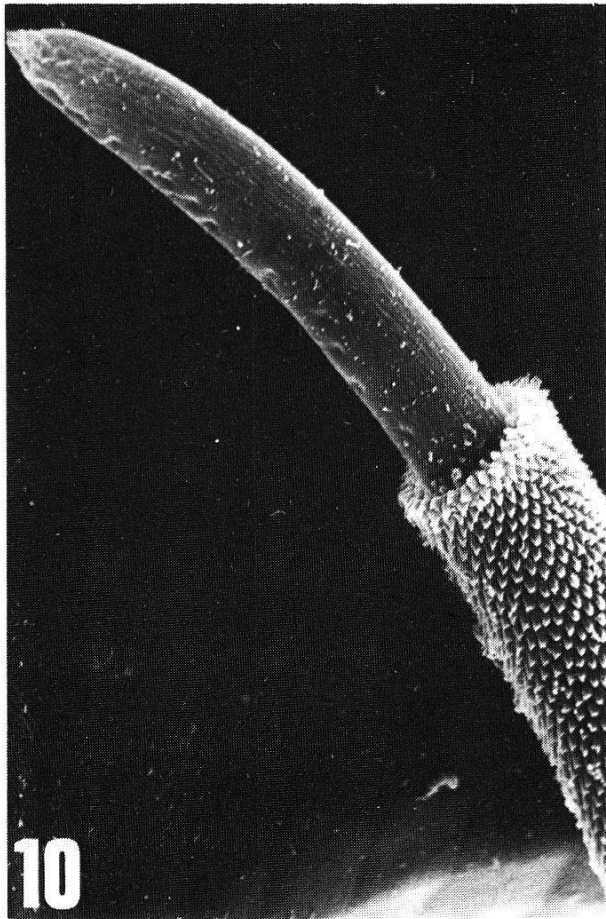
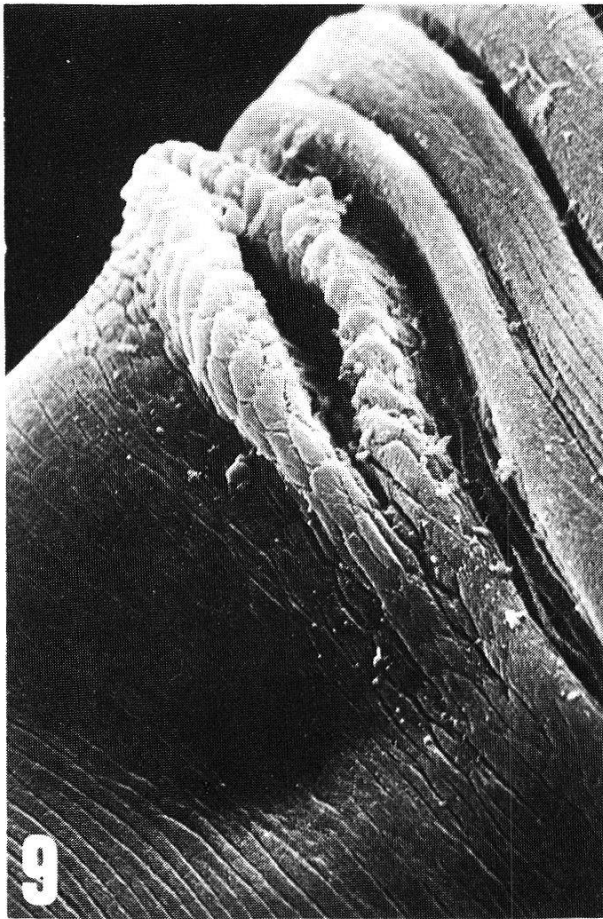
Fig. 11. Anterior end of the spicule with the surrounding sheath.  $\times 2000$ .

Fig. 12. Spicular sheath at higher magnification showing the triangular spikes.  $\times 6000$ .











## Discussion

The most interesting finding of this study is the presence of a row of sucker-like structures which run for approximately 2 mm along the thin anterior end of the parasite. This is the part which is embedded in the host tissue. Until now it was not known as to how *Trichuris* species are able to maintain their hold in the intestinal tissues although they have no lips or hooks. If one tries to pull them out of the intestine it is realized that they are not loosely attached although they are embedded only in the superficial layer of the mucous membrane. They are also not dislodged during the normal peristaltic movement. It appears that their attachment may be due to the presence of these sucker-like structures.

The oral lancet was seen only in 2 worms out of 60, indicating that it is not always protruding and plays little role, if any, as an organ for attachment. The main purpose appears to be for disruption of epithelium before penetration.

The spicule has no opening and, therefore, is not a channel for discharging sperms. It probably acts as a dilator of the vulva and the sperms enter from its sides. It is interesting that the vulvar opening has distinct indentations surrounding it. It is likely that during copulation the anterior part of the spicular sheath gets interlocked with the vulvar opening. This arrangement will then seal the vulvar opening and anchor the copulating worms to each other. The intestinal milieu which is in constant agitation is probably quite hazardous to copulating nematodes, unless some sort of anchoring mechanism, as is described here, is available to them.

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