

## SCANNING ELECTRON MICROSCOPE OBSERVATIONS ON THE MIRACIDIUM OF *SCHISTOSOMA*

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**Abstract**—LOVERDE P. T. 1975. Scanning electron microscope observations on the miracidium of *Schistosoma*. *International Journal for Parasitology* 5: 95-97. Miracidia of two species of *Schistosoma*, viz. *haematobium* and *japonicum*, were studied with the scanning electron microscope to more clearly visualize what is seen with the light microscope and the transmission electron microscope, and more specifically, to relate the structure of the apical papilla to its function in snail penetration.

The apical papilla of schistosome miracidia is composed of corrugated areas which form tiny sucker-like cups, presumably used by the miracidium to facilitate attachment to the snail during penetration. A lateral opening (secretory pore) on the apical papilla and short stubby apical cilia (tactile or sensory) are also demonstrated.

**INDEX KEY WORDS:** *Schistosoma*; miracidium; apical papilla; SEM; penetration; snail.

### INTRODUCTION

THE PENETRATION of the trematode miracidium into the snail intermediate host is an important part of a trematode life-cycle. The penetration process includes attachment of the miracidium to the snail host surface and subsequent entry through the snail dermis. The miracidium's apical papilla is thought to be of prime importance in accomplishing penetration, and some studies have been directed toward elucidating this problem. In this regard species of *Fasciola* and *Schistosoma* have received the most attention. Observations have been made with the light microscope (Dawes, 1960; Wajdi, 1966) and the transmission electron microscope (Wilson, 1969; Wilson, Pallin & Denison, 1971; Kinoti, 1971). They have been recently reviewed by Booker (1972), Hockley (1973) and Wright (1971).

Ultrastructural studies on miracidia of *Schistosoma mattheei* and *S. mansoni* have shown the apical papilla to consist of an anastomosing network of apical filaments or processes (see Kinoti, 1971, pls. I, II, III; Wright, 1971, pl. VI) which presumably are the walls of tiny sucker-like cups (Booker, 1972; Wright, 1971) that form a mini sucker pad (Kinoti, 1971) which assists in attachment of the miracidium to the snail in early stages of penetration.

The purpose of the current study was to use the Scanning Electron Microscope (SEM) to more clearly visualize what is seen at the light microscope and electron microscope levels and to relate structure of the apical papilla to its function in snail penetration. My results complement the previous studies of Booker (1972), Kinoti (1971), Wajdi (1966) and Wright (1971).

### MATERIALS AND METHODS

The SEM was employed to investigate the apical papilla of *S. japonicum* and *S. haematobium* miracidia. Materials used in this study were provided by the U.S.-Japan Cooperative Medical Science Program, NIAID. The miracidia were fixed in Párducz solution (Párducz, 1967), rinsed twice in distilled water, quick-frozen in a dry ice-acetone mixture, lyophilized, gold-coated in a vacuum evaporator by ionizing radiation and observed in a JEOL (Ltd.) JSM-U3 SEM.

### OBSERVATIONS AND DISCUSSION

The photographs show a mini sucker pad composed of tiny sucker-like cups (Figs. 1-5), as postulated by Booker (1972), Kinoti (1971) and Wright (1971).

The SEM photographs suggest that the "tangle of microvilli" observed at the ultrastructural level by Kinoti (1971) and Booker (1972) are corrugated areas which form tiny sucker-like cups used by the miracidium to facilitate attachment to the snail. Similar areas have been described for the miracidium of *Fasciola* (Wilson, 1969). It is also possible that the tip of the apical papilla can be invaginated to form a sucker-like cup as described for *F. hepatica* (Wilson *et al.*, 1971).

It is thought that both snail host location and the ability to penetrate the snail dermis involves physical and chemical activities by the miracidium. So far in those miracidia that have been examined by other authors it has been shown that the greatest concentration of receptors is on or around the apical papilla (Booker, 1972). Ultrastructural studies also have demonstrated an apical gland, secretory canals

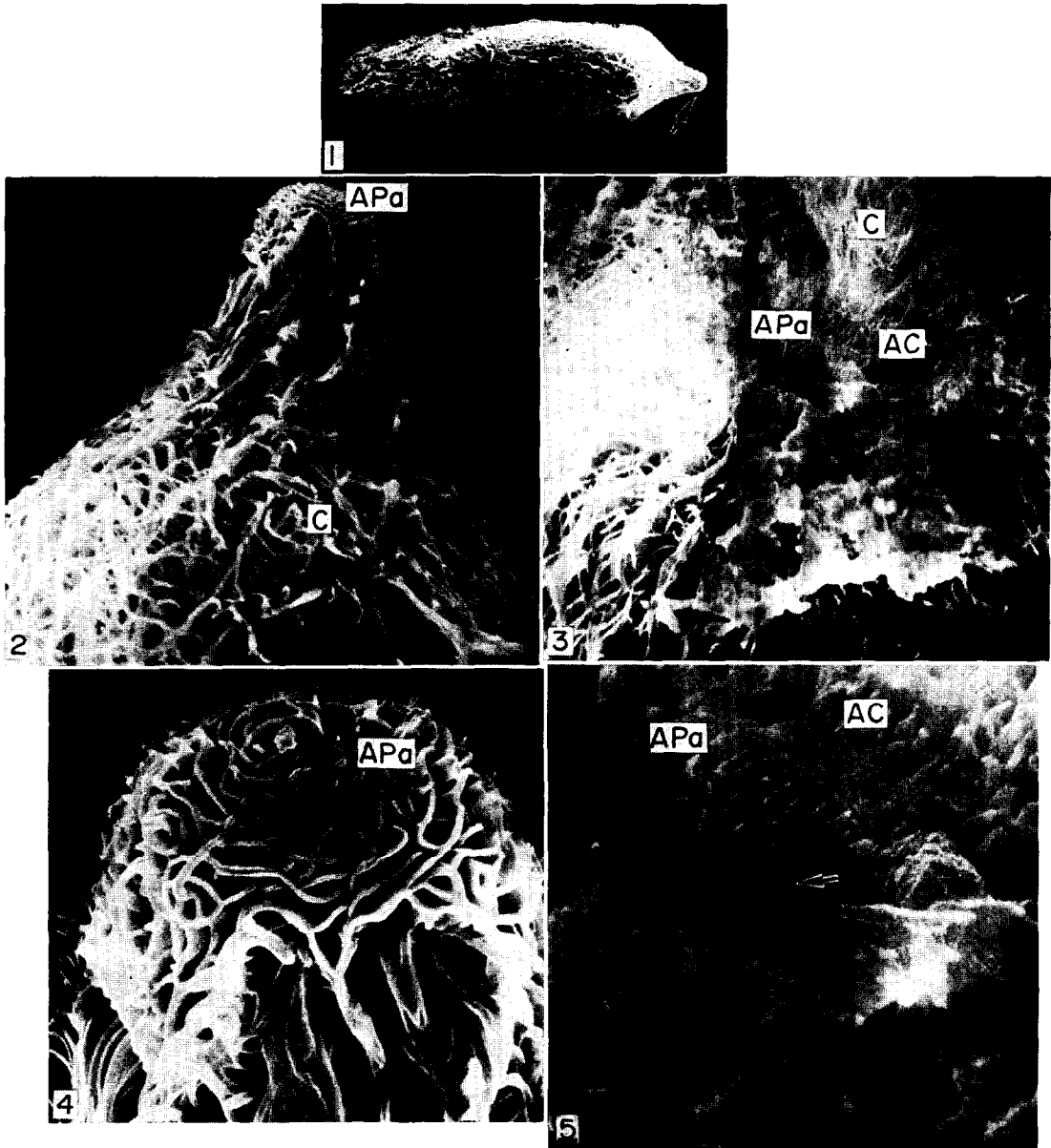


FIG. 1. Miracidium of *Schistosoma haematobium*. Arrow denotes location of apical papilla.  $\times 500$ .

FIG. 2. Apical papilla (A Pa) of *Schistosoma haematobium* miracidium surrounded by locomotor cilia (C).  $\times 3000$ .

FIG. 3. Apical papilla (A Pa) of *Schistosoma japonicum* miracidium.  $\times 3000$ .

FIG. 4. Apical papilla (A Pa) of *Schistosoma haematobium* miracidium showing a mini-sucker pad composed of tiny sucker-like cups.  $\times 10,000$ .

FIG. 5. Apical papilla (A Pa) of *Schistosoma japonicum* miracidium showing a mini-sucker pad composed of tiny sucker-like cups, with a secretory pore (arrow) surrounded by tactile apical cilia (AC).  $\times 10,000$ .

and the presence of external substances supposedly secreted by the miracidium (see Hockley, 1973). In the current study an external opening (secretory pore) communicating to the lateral side of the apical papilla has been demonstrated (Fig. 5, arrow) as well as short stubby apical cilia, which presumably

have a tactile function (Figs. 3, 5). The area of the apical papilla appears to differ between the two species of *Schistosoma* (Figs. 4, 5). However, whether this is a true genetic difference, or due to an artifact of preparation or due to different physiological states of the miracidia at the time of fixation, is not

known. The latter seems plausible to explain the pronounced nature of the excretory pore, i.e. the miracidium was most likely in the act of secretion.

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