

SCANNING ELECTRON MICROSCOPE OBSERVATIONS OF ADULT *HETEROBILHARZIA AMERICANA*

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The integumental surfaces of adult *Heterobilharzia americana* collected from naturally infected raccoons (*Procyon lotor*) were studied by scanning electron microscopy. The inner surface of the male oral sucker possesses many spines which extend to the pharyngeal opening. The ventral sucker possesses spines which abruptly end at the rim margin. The lining of the gynecophoric canal is densely and uniformly spined. The integument is void of elevations but possesses spines which are uniformly distributed. The integument of the female is similar to that of the male except that the posterior end possesses prominent, anteriorly directed spines. Anterior to the acetabulum, the integument of both sexes is devoid of spines.

INTRODUCTION

The integument of human schistosomes has been studied extensively by transmission electron microscopy (TEM) (1, 2) and by scanning electron microscopy (SEM) (3, 4, 5, 6, 7). With the exception of *Schistosoma bovis* (8), studies of the surface architecture of nonhuman schistosomes have not been reported.

The present report describes the integument of adult *Heterobilharzia americana* as observed by SEM and compares these findings with those of adult *Schistosoma mansoni*, *S. haematobium*, *S. japonicum*, and *S. mattheei*.

MATERIALS AND METHODS

Adult male and female *Heterobilharzia americana* were obtained from the hepatic veins of naturally infected raccoons (*Procyon lotor*) which were live-trapped in Florida. After they were washed in saline, the worms were fixed in alcohol, formalin, and acetic acid (AFA). Specimens were then placed in 2% glutaraldehyde in 0.27 M sodium cacodylate buffer, washed in sodium cacodylate buffer (0.27 M) and postfixed in 2% osmium tetroxide in 0.27 M cacodylate buffer (pH 7.2). Finally, they were dehydrated in graded alcohols, dried in a carbon dioxide critical point drying apparatus, placed in a DV-502 laboratory evaporator overnight, coated with gold-palladium, and observed with a JEOL 35 scanning electron microscope.

RESULTS

The integumental surface of adult *Heterobilharzia americana* is smooth in appearance. The oral sucker of the male possesses numerous spines of uniform size, directed toward the esophagus (Fig. 1). The acetabulum of the male has a distinct rim covered with variable-sized spines (Fig. 2). The spines end abruptly at the ventral edge of the rim. The central aspects of the acetabulum contain uniformly distributed spines. Distribution of spines on the oral and ventral suckers of the female are similar to those of the male, but they are smaller in size.

Body surfaces of male and female worms differ. The surface of males lack elevations but possess large, randomly distributed spines (Fig. 3). The inner surface of the gynecophoric canal contains large, uniformly distributed spines (Fig. 4). In the female *H. americana* the dorsal integumental surface is similar to that of the male with scattered spines. Neither elevations nor protuberances are present. The posterior ventral surface of females possesses large spines directed anteriorly; they are uniform in size and distribution and interdigitate with spines in the male's gynecophoric canal.

DISCUSSION

The greatest differences observed between *H. americana* and other schistosomes that have been studied by SEM are in the

integumental surface and the lining of the gynecophoric canal. In *Schistosoma mansoni*, prominent knoblike protuberances or bosses are present on the male, along with large spines distributed throughout the length of the worm (2, 5). The bosses on *S. haematobium* are small and consist of blunt, low elevations but are present over the entire body (3). *S. japonicum* possesses prominent and conspicuous depressions and ridges. Elevations and spines are absent on the dorsal surface (6). *S. mattheei* has noticeable bosses but lacks spines and integumental thickenings (7). In the male *H. americana*, large scattered spines are present throughout the length of the worm. Notable integumental elevations are absent. In species other than *H. americana* the gynecophoric canal is characterized by a roughened lining covered with small spines or elevations while in *H. americana* the canal is lined with large prominent spines.

The surface of the female is generally similar to that of the male. *S. mansoni* females are free of elevations but the posterior end of this species is covered with large, prominent, anteriorly directed spines (2, 7).

The female *S. haematobium* has small bosses and small spines scattered over the entire surface (3). *S. japonicum* females lack elevations, but spines are present over most the body anterior to the ventral sucker (6). *S. mattheei* has an essentially smooth integument with some elevations (7). The surface of the female *H. americana* is similar to that of the male except that the posterior end possesses numerous anteriorly directed spines which are uniform in size and distribution.

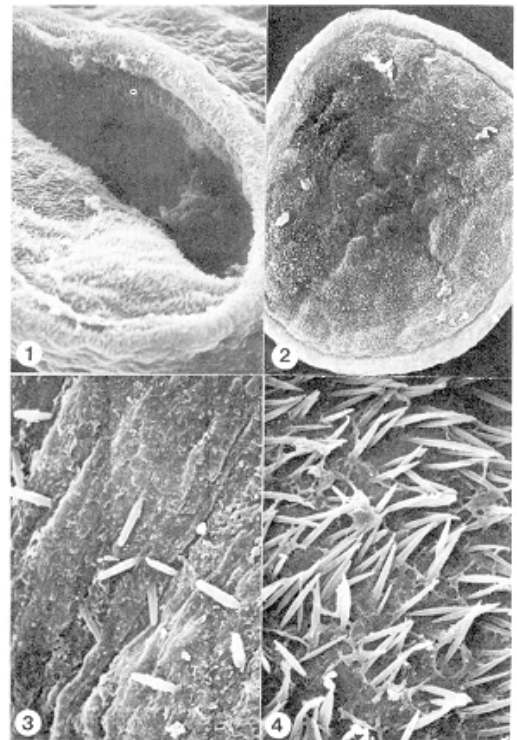
The results of this and similar studies indicate that noticeable differences exist among the various schistosome species. The differences between *Heterobilharzia* and other schistosomes suggests that additional studies of nonhuman schistosomes are warranted. Findings from such studies could lead to a better understanding of structural and functional relationships among the blood-dwelling flukes.

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FIGURES 1-4. 1. Scanning electron micrographs of oral sucker of male *Heterobilharzia americana*, $\times 600$. 2. Acetabulum of male, $\times 300$. 3. Dorsal surface of male near midbody showing arrangement of spines, $\times 1,000$. 4. Spines in gynecophoric canal of male, $\times 2,000$.