LIP MORPHOLOGY OF *ASCARIS SUUM* AS REVEALED BY SCANNING ELECTRON MICROSCOPY

WILLIAM G. DYER AND JUDITH A. MURPHY
Department of Zoology and Center for Electron Microscopy, Southern Illinois University, Carbondale, Illinois 62901

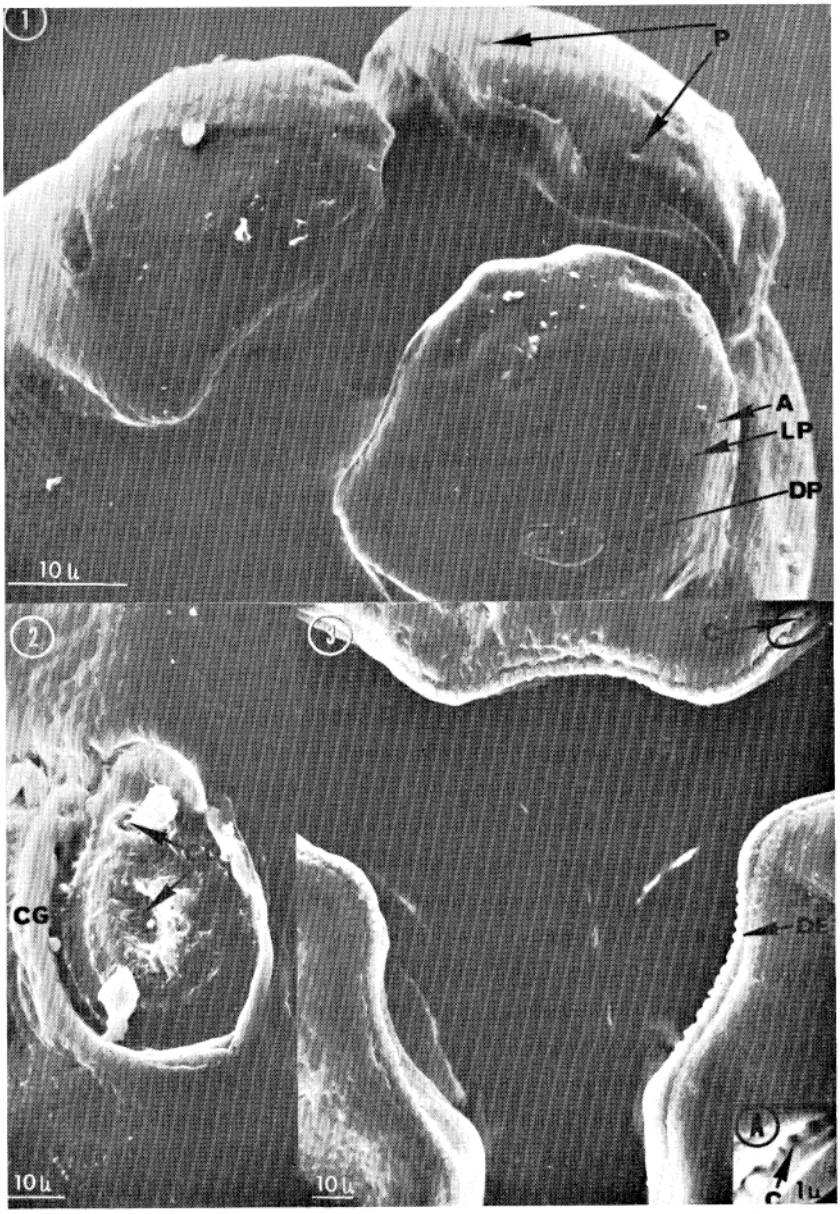
ABSTRACT.—Observations on the microtopographical detail of the labial morphology of *Ascaris suum* is presented.

The scanning electron microscope (SEM), an instrument capable of providing three-dimensional images because of the great depth of field possible with concomitant resolution and high magnification, has proved a valuable tool for examination of microtopographical detail of helminths when considering either host-parasite relationships or anatomical features of taxonomic significance. Hockley (1968) demonstrated the usefulness of the SEM in a study of the morphological adaptions of *Schistosoma mansoni* cercariae for host penetration. Other studies concerned with the surface features of *S. mansoni* as visualized with the SEM include the observations reported by Johnson and Moriearty (1969), Silk et al. (1969), Robson and Erasmus (1970), Race et al. (1970), Silk et al. (1970) and more recently Miller et al. (1972). Madden et al. (1970) utilized this technique in examining en face views of *Ascaris suum* and Allison et al. (1972) provided SEM micrographs on the anterior region of *Sulcascaris sulcatum* and *Cotylapsis insignis* confirming observations made with the light microscope and elucidating morphological detail heretofore unattainable by conventional techniques. Because labial morphology is considered a significant criterion in systematic nematology, the papillae and denticles of *A. suum* were restudied and observations on the microtopographical detail of these structures are reported herein.

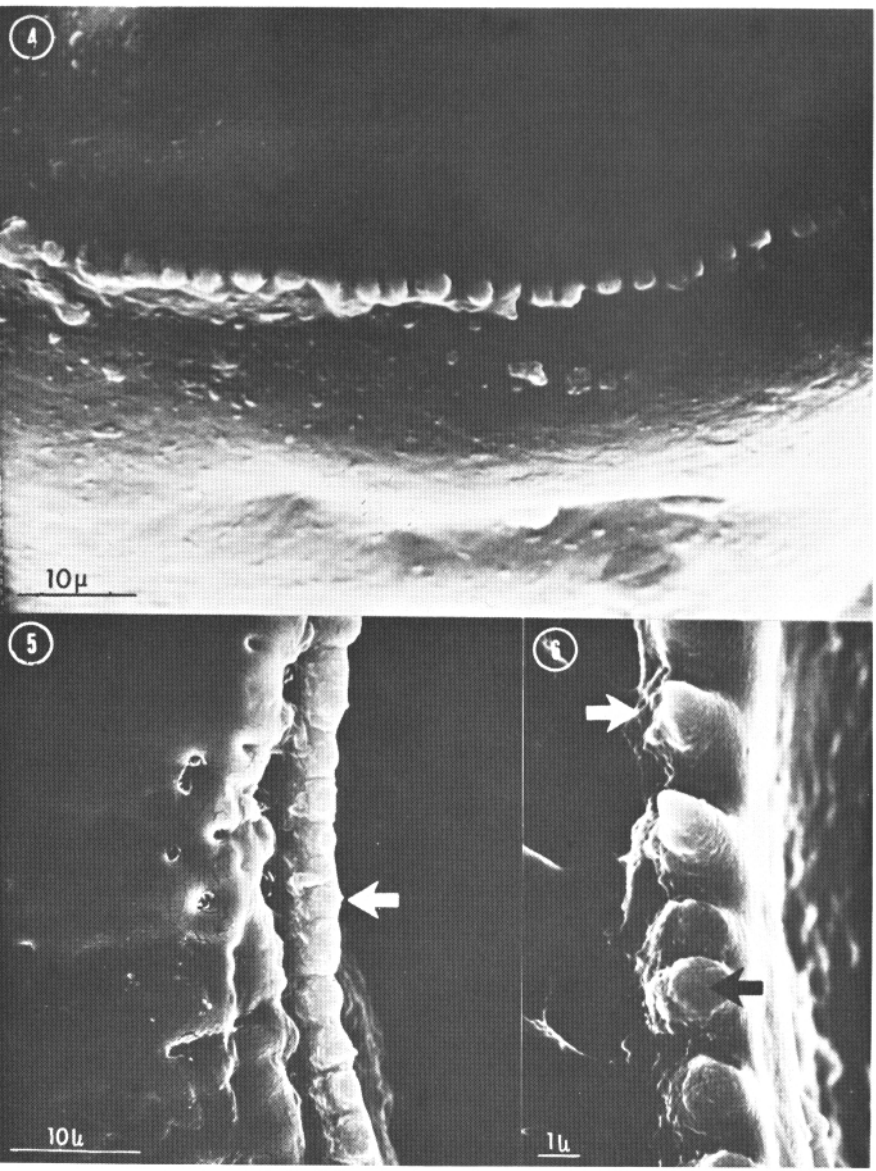
The methods for fixing, dehydrating, and supporting specimens of *A. suum* for the SEM were those reported by Madden et al. (1970). The surface of the specimens was rendered conductive by evaporating a layer (approximately 500 Å) of gold-palladium alloy (4:6) on to them in a vacuum evaporator fitted with a wobbler table to insure even coating. Specimens were examined in a Cambridge Stereoscan Mark IIA SEM at an accelerating voltage of 20 kv, 160 micro Amps beam current and a 100 micron final aperture.

The oral region of *A. suum* is characterized by a single dorsal and two ventrolateral lips surrounding the somewhat triangular mouth (Fig. 1). The inner circle of labial papillae are wanting and only small pits (two per lip) are discernible. The cuticle covering each double papilla of the outer circle appears as a raised mound surrounded by a cuticular groove. Two double papillae are visible at the base of the dorsal lip and one each on the ventrolateral lips. A small lateral papilla of the outer circle and an amphid are shown on the left ventrolateral lip.

According to Bird (1971), the outer labial and cephalic sense organs of the double papillae are stalked structures which appear to be capable of some movement. His light photomicrographs showed the labial and cephalic organs retracted and the circular canals which they oc-



FIGURES 1-3.—Scanning electron micrographs of the lips of *Ascaris suum*. 1. Entire head showing dorsal lip (D), ventrolateral lips (V), pits (P) of the inner circle, double papilla (DP) and a lateral papilla (LP) of the outer circle, and an amphid (A) X 135. 2. Double papilla with cuticular depressions (CD) surrounded by cuticular groove (CG) X 950. 3. Mouth opening with dentigerous ridges formed by rows of denticles (DE) on inner surface of each lip. Small cavities (C) on dentigerous ridge indicating the absence of teeth X 540. Insert A (enlarged portion of Fig. 3) illustrating cavities X 1100.



FIGURES 4-6.—External microtopography of the dentigerous ridge of *A. suum*. 4. Lip surface showing irregular arrangement of denticles X 1100. 5. Molar teeth forms showing small points (indicated by arrow) on the top surface of some denticles X 2200. 6. Dentigerous ridge showing conoid-shaped denticles (white arrow) and denticles flattened at the apex (black arrow) X 5600.

cupied when extended revealed. A higher magnification micrograph of a double papilla (Fig. 2) revealed two cuticular depressions encompassed by the cuticular groove. Only one of the worms examined showed this condition and in the single specimen shown here only one of the double papilla revealed a retracted cuticle. Whether this is a surface distortion due to the preparative technique employed or whether the cuticular covering is actually capable of retraction is difficult to interpret at this early stage in SEM studies.

Sprent (1952) described the denticles of *A. suum* as equilateral triangles with straight sides and rounded apices. Abdulrachman and Joe (1954) emphasized that Sprent's article gave the impression that this condition was constant. The dentigerous ridges formed by a conspicuous row of denticles on the inner surface of each lip are shown in Figures 3-6. As shown in Figure 3, the denticles of the dorsal and right ventrolateral lips of this particular specimen appeared uniform and resemble the "molar teeth" forms described by Abdulrachman and Joe (1954). At higher magnification, (Fig. 5) some of the molar teeth forms were flat on top while others contained small points (indicated by arrow).

Ubelaker and Allison (1972) described the denticles of *A. Suum* as regular in distribution and conoid in shape. The arrangement of the denticles along the ridge of some specimens was irregular and noticeably different in size (Fig. 4). Some of the denticles of the anterior portion of the dorsal lip were absent as noted by the presence of small cavities along the ridge (Fig. 3A). Denticles that were conoid-shaped were also observed and some were flattened at the apex, possibly by wear (Fig. 6).

To date there has been a paucity of observations made on the labial morphology of *A. suum* with the SEM. Now that this instrument is becoming increasingly available to more workers, examination of specimens from several geographic regions should prove valuable in determining the extent of morphological variation of the denticles.

ACKNOWLEDGMENT

The Center for Electron Microscopy of Southern Illinois University at Carbondale is gratefully acknowledged for the use of its facilities which include a Cambridge Stereoscan Mark IIA Scanning Electron Microscope purchased with the Biomedical Sciences Support Grants No. FR-1 S05 FRO7 118-01.

LITERATURE CITED

ABDULRACHMAN, S. S., AND L. K. JOE. 1954. Morphological differences between *Ascaris* from man and pigs. Doc. Med. Geogr. et Trop. 6:342-344.

ALLISON, V. F., J. E. UBELAKER, R. W. WEBSTER, JR., AND J. M. RIDDLE. 1972. Preparation of helminths for scanning electron microscopy. J. Parasit. 58:414-416.

BYRD, A. F. 1971. The structure of nematodes. Academic Press, New York. Xi + 317p.

HOCKLEY, D. J. 1968. Scanning electron microscopy of *Schistosoma mansoni* cercariae. J. Parasit. 54:1241-1243.

JOHNSON, D., AND MORIEARTY. 1969. Examination of schistosome cercariae and schistosomules by scanning electron microscopy. Proc. Electron Micr. Soc. Am. 27:50-51.

MADDEN, P. A., F. G. TROMBA, AND J. M. VETTERLING. 1970. En face views of *Ascaris suum* with the scanning electron microscope. J. Parasit. 56:202-203.

MILLER, F. H., JR., G. S. TULLOCH, AND R. E. KUNTZ. 1972. Scanning electron microscopy of integumental surface of *Schistosoma mansoni*. J. Parasit. 58:693-698.

RACE, G. J., J. H. MARTIN, D. V. MOORE, AND J. E. LARSH. 1970. Scanning and transmission electron microscopy of *Schistosoma mansoni* eggs, cercariae and adults. Am. J. Trop. Med. Hyg. 20:914-924.

ROBSON, R. T., AND D. A. ERASMUS. 1970. The ultrastructure, based on stereoscan observations, of the oral sucker of the cercaria of *Schistosoma mansoni* with special reference to penetration. Ztschr. Parasitenk. 35:76-86.

SILK, M. H., I. M. SPENCE, AND B. BUCH. 1970. Observations of *Schistosoma mansoni* in the scanning electron microscope. S. Afr. J. Med. Sci. 35:23-29.

———, ———— +, AND J. H. S. GEAR. 1969. Ultrastructure studies of the blood fluke—*Schistosoma mansoni*. I. The integument. S. Afr. J. Med. Sci. 34:1-10.

SPRENT, J. F. A. 1952. Anatomical distinction between human and pig strains of *Ascaris*. Nature 170:627-628.

UBELAKER, J. E. AND V. F. ALLISON. 1972. Scanning electron microscopy of the denticles and eggs of *Ascaris lumbricoides* and *Ascaris suum*. Proc. Electron. Micr. Soc. Am. 30:392-393.

Manuscript received 23 May, 1973.