SCANNING ELECTRON MICROSCOPE STUDIES OF STEINERNEMA GLASERI (NEMATODA: STEINERNEMATIDAE)1

BY

KHUONG B. NGUYEN and GROVER C. SMART, Jr.
Entomology and Nematology Department, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611-0620, USA

Scanning electron micrographs are presented of Steinernema glaseri. The male head of S. glaseri is slightly swollen and bears six labial and four large cephalic papillae. There are 11 pairs of genital papillae plus a single papilla. The spicule is unique with a short head, distinct shaft, long and narrow blade, and a spicule tip which has a ventral aperture and appears hook-like. A velum was not observed. The gubernaculum is much shorter than the spicule, with the anterior end curved ventrally, and enlarged gradually posteriorly. Usually, the capitulum and cuneus are forked anteriorly to form a Y-shaped structure. The female head has six labial and four cephalic papillae, and the vulva may be with or without a thickened flap. The lateral field pattern of the infective juvenile begins anteriorly with one incisure which after a short distance becomes three, six, seven and nine incisures which create two, five, six and eight ridges, respectively. At about the level of the phasmids, the number of ridges gradually decreases to two broad ridges.

Keywords: entomopathogenic nematode, morphology, nematode, Steinernema glaseri, taxonomy

A scanning electron microscope (SEM) study of Steinernema glaseri (Steiner, 1929) Wouts et al., 1982 was first made by Mracek & Weiser (1979). Later, several authors (Bedding, 1984; Haukerland, 1993; Kondo & Ishibashi, 1989; Kozodoi & Spiridonov, 1988; Mracek & Weiser, 1981; Mracek & Bednarek, 1991) conducted SEM studies on this and other nematode species. All of these works mainly showed face views of females and juveniles, or lateral fields of infective juveniles showing the maximum number of ridges. Only one of the papers (Haukerland, 1993) presented the head of a male, that of S. carpocapsae (Weiser, 1955) Wouts et al., 1982. Recently, Nguyen & Smart (1990, 1992, 1993a) published SEM studies of S. scapterisci Nguyen and Smart, 1990 and S. anomalii (Kozodoi, 1984) Poinar, 1990 showing structures of the male as well as the female and juvenile.

This study presents SEM micrographs of the anterior and posterior regions of males, including the spicules and gubernacula, the anterior and vulval region of the female, and the anterior region and lateral field pattern of the infective juvenile of S. glaseri. We believe that the posterior features of the male and the

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pattern of the lateral field of the infective juvenile are significant for species identification.

MATERIALS AND METHODS

The population of *S. glaseri* used in these studies was obtained from Dr. H. K. Kaya, University of California, Davis and maintained on larvae of the greater wax moth, *Galleria mellonella* (L.). Females and males of the first generation were dissected from the dead wax moth larvae 3-4 days after exposure to the infective juveniles. Infective juveniles were allowed to emerge from the wax moth cadavers into a white trap. Females, males and infective juveniles were fixed by the following method: first the nematodes were transferred into vials containing 1 ml of 0.1 M sodium cacodylate buffer 8°C, pH 7.2, then, 0.3 ml, 6% glutaraldehyde in 0.1 M sodium cacodylate buffer (8°C) was added. After 1 and 2 h, an additional 0.3 and 0.4 ml, respectively, of the latter solution was added to give a final volume of 2.0 ml. All steps were carried out under refrigeration at 8°C. After 24 h, the nematodes were washed in five changes of 0.1 M sodium cacodylate buffer for 15 min in each change, post-fixed in 2% osmium tetroxide for 12 h at 25°C, and washed in five changes of 0.1 M sodium cacodylate buffer for 10 min in each change. Next they were dehydrated in a graded ethanol series (10% to 100%) at 25°C, transferred to a mixture of 50% amyl acetate and 50% ethyl alcohol for 10 min, transferred to 100% amyl acetate, critical point dried with liquid CO₂, mounted on SEM stubs, and coated with gold. Spicules and gubernacula were processed as described by Nguyen & Smart (1993a). All specimens were examined with a Hitachi S-570 SEM operating at 15 kV.

RESULTS

Male: Head slightly swollen with a raised perioral disc; labial papillae six; cephalic papillae four, unusually large (Fig. 1A). Posterior region of body curved ventrally, mucron absent (Fig. 1B). Eleven pairs and one single, ventral preanal genital papillae (Fig. 1B). Five of the 11 pairs are preanal, subventral (Fig. 1B), pair six is lateral (Fig. 1C), pairs seven and eight are subventral anal (pair seven is sometimes preanal) (Fig. 1B, C), pairs nine and ten are subventral, subterminal (Fig. 1C, D), and pair eleven is subdorsal (Fig. 1C). Spicules unique with short head, shaft distinct, head and shaft comprise about 24% (21-25) of spicule length (Fig. 2A-D); blade long, narrow, its tip bearing a ventral aperture which may make it appear hook-like (Fig. 2C-E); velum not observed. Gubernaculum of *S. glaseri* much shorter than spicule, anterior end curved ventrally (Fig. 2A, B, F), enlarging gradually posteriorly (Fig. 2F). The two wings of corpus curved upward; usually, capitulum and cuneus forked anteriorly to form a Y-shape (Fig. 2F).