Journal of Nematology 47(2):153–158. 2015.


# Description of *Sclerorhabditis miniata* n. sp. and First Description of Male of *Diploscapter coronatus* Cobb, 1913 (Nematoda: Rhabditidae)

Ali Asghar Shah and Shavish Vaid

*Abstract:* A population of *Sclerorhabditis miniata* n. sp. is described and illustrated from Poonch district of Jammu and Kashmir State, India. The new species is characterized by small body size, with an annulated cuticle, offset labial region, crown shaped, strongly sclerotized lips, thin lateral lips, membranous, stegostom without glottoid apparatus, cheilostom rod shaped, sclerotized, spicules free, strong and thick, gubernaculum simple, bent proximally, bursa open, peloderan with seven pairs of bursal papillae in 1+1/1+1+2+1 pattern. The males of *Diploscapter coronatus* are described for the first time. They are usually smaller than the females and have labial region similar to females. Spicules separate, with a small dorsal velum, gubernaculum simple, almost straight, bursa open, pseudopeloderan with seven pairs of bursal papillae in 1+1/1+2+1+1 pattern.

*Key words: Diploscapter*, India, morphology, new species, *Sclerorhabditis*, taxonomy.

A very interesting species, *Sclerorhabditis tridentatus* (Ahmad et al., 2007) was described from Aligarh district, Uttar Pradesh, India. The species was described without males in the type population. The second species, *Sclerorhabditis neotropicalis* was described by Esquivel et al. (2012) from Costa Rica. Both species described under the genus *Sclerorhabditis* were isolated from decaying matter of plants, associated with insects. However, the new nematode described here was isolated from humus in Dera Ki Gali Forests of district Poonch, Jammu and Kashmir State, India. *D. coronatus* Cobb, 1913 was also collected from farmyard manure in Tehsil Mendhar of district Poonch, Jammu and Kashmir State, India. Both species are commonly found at Jammu and Kashmir State of India. In this paper, a new species *S. tridentatus* n. sp. is described and the males of *D. coronatus* are reported for the first time.

## Materials and Methods

Soil samples were obtained from Dera Ki Gali forests, district Poonch, Jammu and Kashmir, India. These soil samples were processed using modifications of Cobb's (1918) sieving and decantation and Baermann's (1917) funnel techniques. Extracted nematodes were simultaneously killed and fixed in hot formalin–glacial acetic acid solution (4:1) and dehydrated in glycerine—alcohol (5 parts glycerine + 95 parts 30% alcohol). Finally the dehydrated nematodes were mounted in anhydrous glycerine (Seinhorst, 1959). All diagrams and morphological observations were made on an Olympus BX51 DIC microscope and photographed using an Olympus DP25 digital camera (Olympus Corporation, Tokyo, Japan).

Received for publication April 13, 2015.

Nematode Biodiversity Research Laboratory, School of Biosciences and Biotechnology, Baba Ghulam Shah Badshah University, Rajouri 185234, Jammu and Kashmir, India.

The financial assistance provided by the Ministry of environment and forests, Government of India, New Delhi, is gratefully acknowledged. We also thank Mr. Abid and Mr. Rakeeb for their kind support.

E-mail: shavish.vaid@gmail.com.

This paper was edited by Zafar Handoo.

## Results and Discussion

### Systematics

*Sclerorhabditis miniata* n. sp.
(Figs. 1,2; Table 1)

*Description*

*Female (n = 3):* Body small 0.3 to 0.35 mm, straight on fixation. Cuticle with visible annuli at the anterior end, rest of the body finely striated. Lateral fields with two lines. Labial region crown shaped, offset from adjoining body by constriction, 8 to 9 μm wide. Dorsal and ventral lips sclerotized, angle-like structure with points directed toward stoma. Lateral lips membranous like. Amphidial apertures indistinct. Stoma tubular 1.7 to 2.1 lip-diam. long. Cheilostom rod shaped, sclerotized; gymnostom with parallel walls; stegostom without glottoid apparatus. Pharyngeal collar covering 40% to 51% of stoma. Procorpus cylindrical and muscularized. Median bulb swelling 1.2 to 1.5 lip diam. wide. Isthmus slender. Terminal bulb well developed, 1.7 to 2.1 lip diam. wide. Anterior pharynx 56% to 60% of pharyngeal length. Nerve ring 64 to 68 μm from anterior end or at 67% to 70% of pharyngeal length. Excretory pore 64 to 81 μm from anterior end or at 68% to 83 % of pharyngeal length. Intestine granulated with distinct lumen.

Reproductive system amphidelphic, ovaries reflexed, small flexure, with two or more rows of oocytes. Oviduct short, indistinct. Spermatheca differentiated, with numerous very small spermatozoa. Uterus glandular with short muscular parts. Vagina simple. Vulva a transverse slit with slightly raised lips. Rectum tubular, 0.8 to 1.2 anal body diam. long. Tail elongate conoid, 3.4 to 4.5 anal body diam. long. Phasmids inconspicuous.

*Male (n = 2):* Similar to females in morphology but smaller in size. Testis single, ventrally reflexed. Spicules separate, strong, and thick, 24 to 25 μm long or 1.3 to 1.4 anal body diam. long and slightly curved at the distal end. Gubernaculum simple, proximally narrow, wide in the middle, and distally pointed, 11 to 12 μm long or 44% to 48 % of spicule length. Bursa

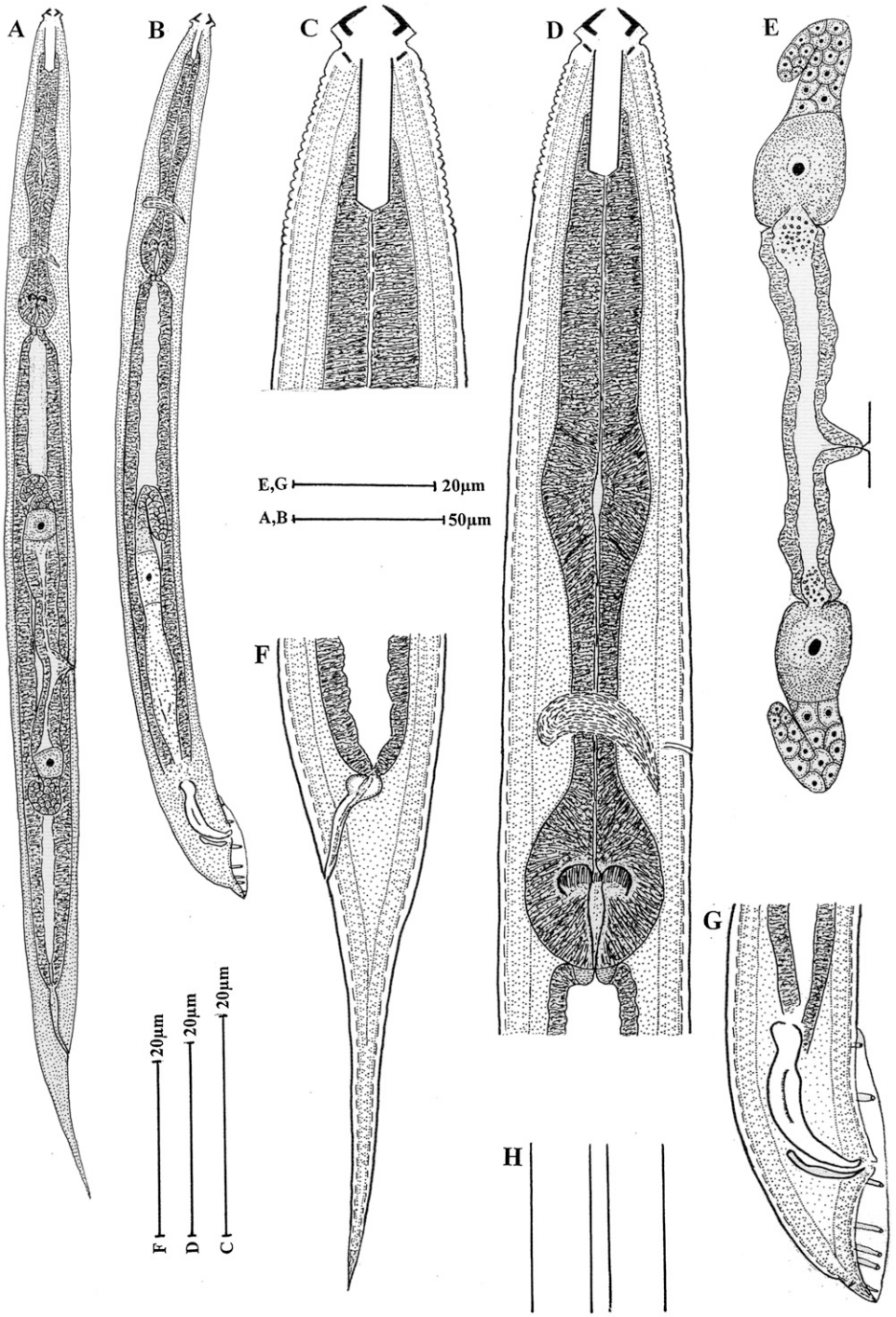


Fig. 1. *Sclerorhabditis miniata* n. sp. A. Entire female. B. Entire male. C. Anterior end. D. Pharyngeal region. E. Female genital tract. F. Female posterior region. G. Male posterior region (lateral). H. Lateral lines.

anteriorly open, peloderan, with seven pairs of bursal papillae, two pairs precloacal and five pairs post cloacal, arranged in 1+1/1+1+2+1 pattern. Tail short, conoid. Phasmids indistinct.

### Type Material and Nomenclatural Registration

The new species binomial has been registered in the ZooBank database (zoobank.org) under the identifier D45400D4-8949-4207-8E00-7019C6363BE0.

### Type Habitat and Locality

Soil collected near the roots of *Quercus leucotricophora* from Dera Ki Gali forests, district Poonch, Jammu and Kashmir, India.

### Type Material

*Holotype (female):* SLHC 1 (Studies on Lower and Higher Climatic Zones of Poonch district, Jammu and

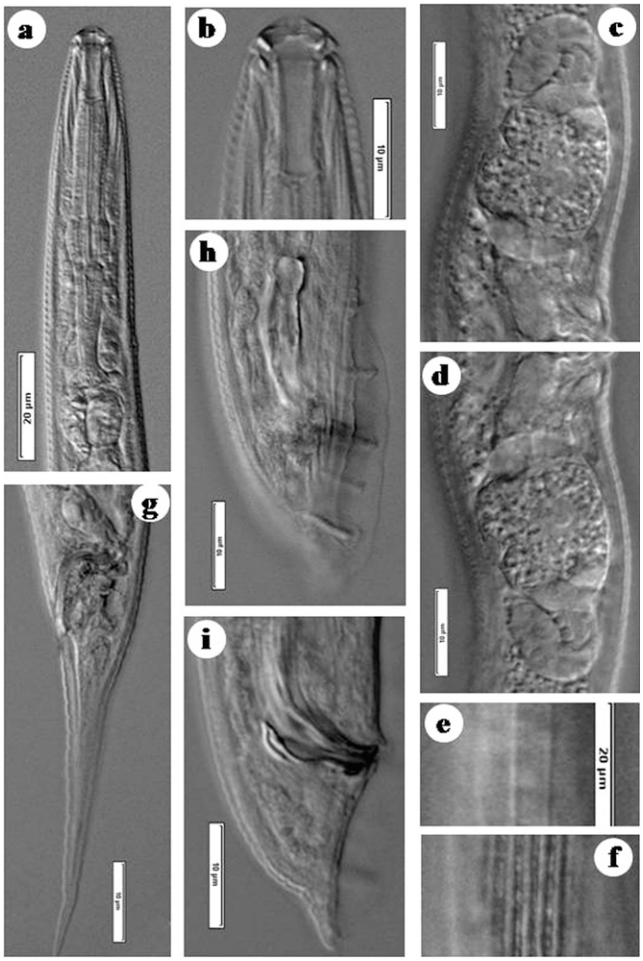


FIG. 2. *Sclerorhabditis miniata* n. sp. A. Pharyngeal region. B. Stoma. C. Anterior female genital tract. D. Posterior female genital tract. E. Lateral lines. F. Punctations. G. Female posterior end showing rectum. H. Male posterior region showing spicule and bursa. I. Male posterior region showing gubernaculum.

Kashmir State, India) deposited in the nematode collection of the Centre for Biodiversity Studies, School of Biosciences and Biotechnology, Baba Ghulam Shah Badshah University, Rajouri, India.

*Paratypes (females and males) on slide:* SLHC 2-7 deposited in the nematode collection of the Centre for Biodiversity Studies, School of Biosciences and Biotechnology, Baba Ghulam Shah Badshah University, Rajouri, India. One paratype female at the Instituut voor Dierkunde, Rijksuniversitat, Gent, Belgium.

## DIAGNOSIS AND RELATIONSHIPS

*Sclerorhabditis miniata* n. sp. is characterized by its small body, cuticle with visible annuli at the anterior end, rest of the body finely striated, labial region crown shaped, offset from adjoining body by constriction, dorsal and ventral lips with sclerotized angle-like structure with points directed toward stoma, lateral lips membranous, stoma tubular, gymnostom with parallel walls, stegostom without glottoid apparatus, cheilostom rod shaped sclerotized, spicules free, strong and thick, gubernaculum simple, bursa open, peloderan with seven pairs of bursal papillae and tail elongate and conoid in female.

TABLE 1. Morphometrics of *Sclerorhabditis miniata* n. sp. (measurements are in micrometers and in the form: mean ± SD (range).

| Characters | Holotype female | Paratype female ($n$ = 3) | Paratype male ($n$ = 2) |
|---|---|---|---|
| L | 357 | 354 ± 2.4 (352–355) | 277 ± 19.3 (264–291) |
| a | 17 | 16 ± 1.2 (15–16) | 14.2 ± 0.9 (13–15) |
| b | 3.7 | 3.6 ± 0.5 (3–4) | 3.3 ± 0.2 (3.2–3.5) |
| c | 8 | 7.5 ± 0.5 (7–8) | 12.8±2.8 (11–15) |
| c′ | 4.5 | 3.5 ± 0.5 (3–4) | 1.2 ± 0.09 (1.1–1.3) |
| V | 54 | 55 ± 2.3 (53–57) | - |
| Maximum body diam. | 22 | 22.5 ± 0.5 (22–23) | 19.5 ± 0.5 (19–20) |
| Lip width | 8 | 8.4 ± 0.56 (7–9) | 5.5 ± 0.5 (5–6) |
| Lip height | 4 | 3.5 ± 0.5 (3–4) | 2.5 ± 0.5 (2–3) |
| Length of stoma | 15 | 16 ± 1 (15–17) | 14.6 ± 0.52 (14–15) |
| Anterior pharynx | 57 | 54.5 ± 0.5 (54–55) | (47.5 ± 0.54 (47–48) |
| Posterior pharynx | 39 | 41.5 ± 0.51 (41–42) | 35.5 ± 0.5 (35–36) |
| Pharynx | 96 | 96 ± 0.9 (95–97) | 82.6 ± 0.6 (82–83) |
| Excretory pore from anterior end | 73 | 73 ± 8.3 (64–81) | - |
| Nerve ring from anterior end | 64 | 66.7 ± 2 (65–68) | 52.7 ± 0.6 (51–53) |
| Median bulb | 10 | 11.5 ± 0.5 (11–12) | 8.4 ± 0.4 (8–9) |
| Isthmus | 21 | 21.4 ± 0.5 (21–22) | 18.8 ± 2 (17–20) |
| Basal bulb | 13 | 16.5 ± 0.5 (16–17) | 12.4 ± 0.4 (12–13) |
| Anterior gonad | 58 | 55 ± 6.2 (48–58) | - |
| Posterior gonad | 47 | 50 ± 10.4 (41–61) | - |
| Vulva body diameter | 19 | 23.5 ± 0.5 (23–24) | - |
| Vulva—anus distance | 115 | 116 ± 2 (115–118) | - |
| Rectum | 13 | 11.5 ± 0.5 (11–12) | - |
| Tail | 44 | 46.5 ± 1.4 (46–47) | 22 ± 3.4 (19–24) |
| Anal body diameter | 10 | 12.5 ± 0.5 (12–13) | 17.2 ± 1.3 (16–18) |
| Testis | - | - | 92.9 ± 6.9 (88–98) |
| Spicules | - | - | 24.4 ± 0 (24.4) |
| Gubernaculum | - | - | 10.6 ± 0.6 (10–11) |
| Bursa | - | - | 38 ± 1.3 (37–39) |
| Bursal papillae | - | - | 7 |

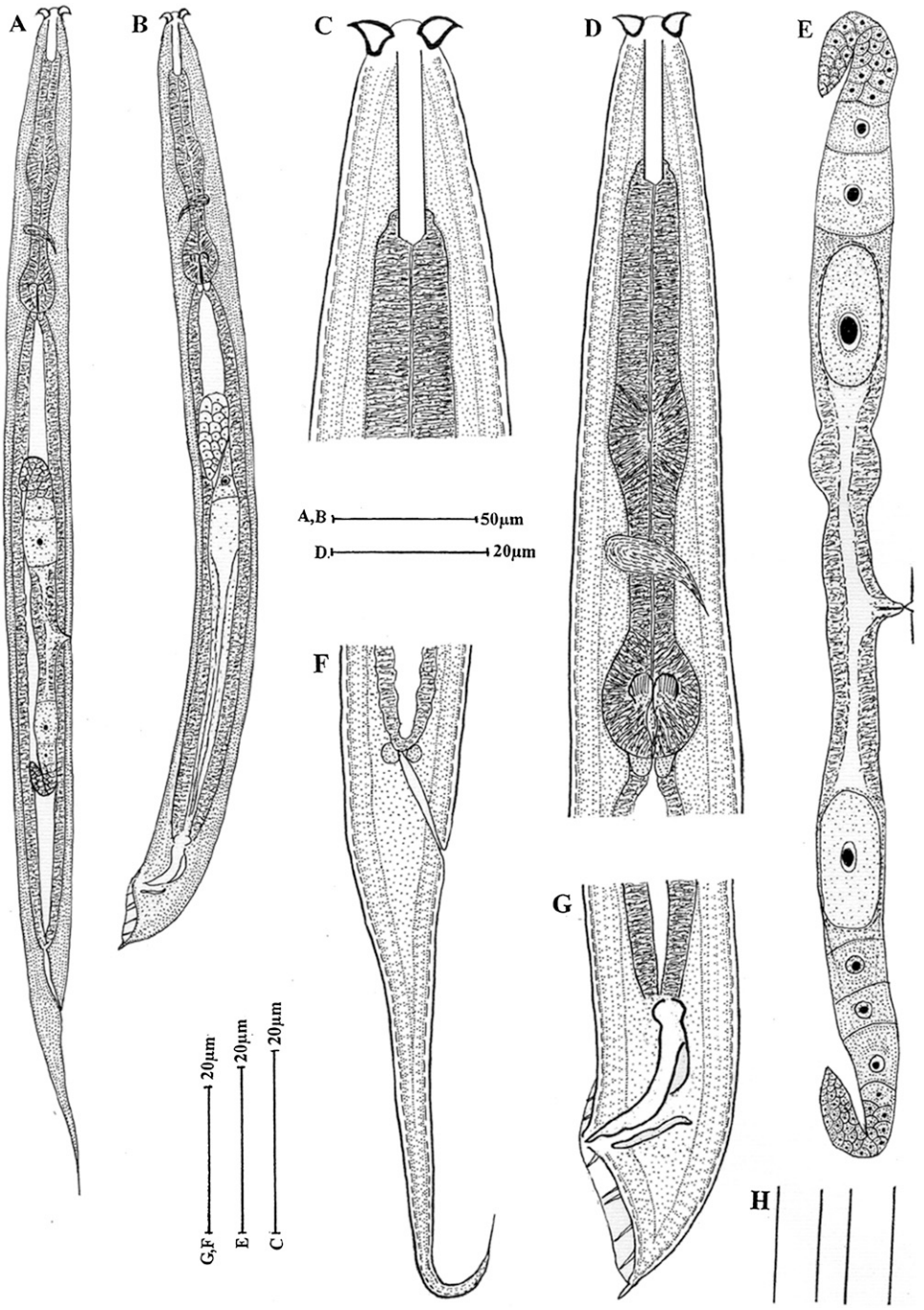


Fig. 3. *Diploscapter coronatus*. A. Entire female. B. Entire male. C. Anterior end. D. Pharyngeal region. E. Female genital tract. F. Female posterior region. G. Male posterior region (lateral). H. Lateral lines.

*Sclerorhabditis miniata* n. sp. resembles *S. tridentatus* (Ahmad et al., 2007) in the presence of sclerotized lips and other morphometric values. However, it can be differentiated from it in having small body size (0.3–0.35 vs. 0.35–0.45 mm), in the shape of labial sclerotization (angle shaped vs. fork shaped), having labial region (crown shaped vs. rounded), short female tail (44–45 vs. 45–63 µm), in the length of stoma (1.7–2.2 vs. 1.0–1.6 lip diam. long), and males in the population (present vs. absent). The new species also resembles *S. neotropicalis* (Esquivel et al., 2012) in crown-shaped labial region, position of excretory pore, number of bursal rays, and morphometric values. However, it can be differentiated from this species in the body length (0.3–0.35 vs. 0.5–0.56 mm), in the shape of labial sclerotization (angle shaped vs. thorne shaped), body width (20–22 vs. 34–42 µm), in having smaller pharynx (94–96 vs. 125–135 µm), short female tail (44–45 vs. 62–76 µm), spicules length (24–25 vs. 36–47µm), spicules shape (J shaped vs. more curved) length of gubernaculum (44–48% vs. 38–42% of spicules


FIG. 4. *Diploscapter coronata* A. Pharyngeal region. B. Stoma. C. Labial region (dorsal view). D. Anterior female genital tract. E. Posterior female genital tract. F. Female posterior region showing rectum. G. Spicules (lateral). H. Spicules (dorsoventral). I. Male posterior region showing gubernaculum. J. Lateral lines.

length), shape of gubernaculums (wide vs. narrow in the middle) and in arrangement of caudal papillae (1+1/1+1+2+1 vs. 1+1/1+1+1+1+2).

## ETYMOLOGY

The species epithet is derived from its small body size.

*Diploscapter coronatus* Cobb, 1913.
(Figs. 3,4; Table 2)

*Description*

*Male (n = 2):* Body small 0.28 to 0.32 mm, straight on fixation. Cuticle transversely striated. Longitudinal striations absent. Lateral fields with two lines. Labial region offset, 7.8 µm wide, bilaterally symmetrical; dorsal and ventral lips modified into cuticularized hook-like appendages; lateral lips membrane like flaps, with serrated margins. Stoma tubular 2.3 to 2.7 lip-diam. long. Cheilostom not cuticularized; gymnostom with parallel walls; stegostom without glottoid apparatus. Pharyngeal collar absent. Procorpus muscular, well developed. Median bulb swelling 1.1 to 1.12 lip diam. wide. Isthmus slender. Terminal bulb well developed, 1.5 to 1.6 lip diam. wide. Anterior pharynx 59% to 62% of pharyngeal length. Pharynx 27% to 28% of body length. Nerve ring 51 to 60 µm from anterior end or at 65% to 66% of

TABLE 2. Morphometrics of (in micrometers) *Diploscapter coronatus* (measurements are in micrometers and in the form: mean ± SD (range).

| Characters | Males ($n$ = 2) |
|---|---|
| L | 305.6 ± 29.7 (284–326) |
| a | 16 ± 0.9 (15–16) |
| b | 3.6 ± 0.06 (3.5–3.6) |
| c | 15.2 ± 0.9 (14–16) |
| c′ | 1.2 ± 0.2 (1–1.3) |
| Maximum body diam. | 19 ± 0.6 (18–19.5) |
| Lip width | 7.4 ± 0.4 (7–8) |
| Lip height | 3.9 ± 0 (3.9–3.9) |
| Length of stoma | 20 ± 2 (18–21) |
| Anterior pharynx | 51.3 ± 7.6 (46–57) |
| Posterior pharynx | 32.7 ± 2 (31–34) |
| Pharynx | 84 ± 9.6 (77–91) |
| Excretory pore from anterior end | 72 ± 1 (71–73) |
| Nerve ring from anterior end | 55.7 ± 6.9 (51–60) |
| Median bulb | 8.5 ± 0.5 (8–9) |
| Isthmus | 18.3 ± 3 (16–20) |
| Basal bulb | 12.5 ± 0.5 (12–13) |
| Tail | 19.5 ± 0.5 (19–20) |
| ABD | 16.6 ± 2.7 (14–18) |
| Testis | 150.6 ± 22.1 (135.166) |
| Spicules | 21.8 ± 2.3 (20–23) |
| Gubernaculum | 9.5 ± 0.5 (9–10) |
| Bursa | 25.9 ± 3.4 (23–28) |
| Bursal papillae | 7 |

pharyngeal length. Excretory pore 71 μm from anterior end or at 78% of pharyngeal length. Intestine granulated with distinct lumen.

Testis single, ventrally reflexed. Spicules separate, 20 to 23 μm long or 1 to 1.5 anal body diam. long, with small dorsal velum. Gubernaculum simple, almost straight, slightly curved at the proximal end; 9 to 10 μm long or 41% to 45% of spicule length. Bursa anteriorly open, peudopeloderan, seven pairs of bursal papillae, two pairs precloacal, and five pairs post cloacal, arranged in 1+1/1+2+1+1 pattern. Tail short, conoid.

*Female:* General morphology similar to male. Agreeing with previous descriptions of Cobb, 1913. Body small, ventrally curved on fixation. Cuticle transversely striated, longitudinal striations absent. Amphidial apertures small, on lateral lips. Stoma tubular; cheilostom not cuticularized; stegostom lacking glottoid apparatus. Procorpus muscular. Median bulb and terminal bulb well developed. Anterior pharynx 61% to 64% of pharyngeal length. Nerve ring 70% to 80% of pharyngeal length. Excretory pore 83% to 85% of pharyngeal length. Reproductive system amphidelphic, anterior branch on right, and posterior on left side of instestine. Ovaries reflexed or only slightly bent at the tip. Spermatheca not differentiated. Uterus with long glandular and short muscular parts. Vulva a transverse slit. Tail elongate conoid, 0.6 to 7.5 anal body diam. long.

## TYPE HABITAT AND LOCALITY

Farmyard manure collected from Mendhar, district Poonch, Jammu and Kashmir, India.

## TYPE MATERIAL

Male on slide *Diploscapter coronatus*/SLHC 1-2; deposited in the nematode collection of the Centre for Biodiversity Studies, School of Biosciences and Biotechnology, Baba Ghulam Shah Badshah University, Rajouri, India.

## LITERATURE CITED

Ahmad, I., Shah, A. A., and Mahamood, M. D. 2007. Nematodes of the order Rhabditida from India. Description of *Sclerorhabditis tridentatus* gen.n., sp.n. (Rhabditidae). Nematology 9:43–47.

Baermann, G. 1917. Eine einfache Method zur Auffindung yon *Ankylostomum* (Nematoden) Larven in Erdproben. Geneskunding Tijdschrift voor Nederlandsch-Indi 57:131–137.

Cobb, N. A. 1913. New nematode genera found inhabiting freshwater and non-brackish soils. Journal of Washington Academy of Sciences 3:432–444.

Cobb, N. A. 1918. Estimating the nema population of the soil. United States Department of Agriculture, Bureau of Plant Industry, Agricultural Technology. Circular 1:1–48.

Esquivel, A., Abolafia, J., Hanson, P., and Pinto, A. 2012. A new species of Nematode, *Sclerorhabditis neotropicalis* sp. n. (Rhabditida), associated with Azteca ants in *Cecropia obtusifolia*. Nematropica 42:163–169.

Seinhorst, W. 1959. A rapid method for the transfer of nematodes from fixative to anhydrous glycerine. Nematologica 4:67–69.