

Section of Nematology, Department of Zoology, Aligarh Muslim University, Aligarh 202002, India

THREE NEW SPECIES IN THE SUPERFAMILY BUNONEMATOIDEA (RHABDITIDA) FROM INDIA

by

T. A. HUSENI, I. AHMAD and N. S. FIRDAUSI

Summary. Three new species in the superfamily Bunonematoidea are described and illustrated. *Bunonema irregularis* sp.n. has L = 0.21-0.28 mm; a = 15.0-19.5; b = 3.1-4.0; c = 11.5-17.4; V = 55-59 and resembles *B. reticulatum* Richters, 1905, *B. multipapillatum* Stefanski, 1914, *B. steineri* Stefanski, 1924 and *B. pustulatum* Andrassy, 1986. *B. minutum* sp.n. has L = 0.19-0.23 mm; a = 11.9-15.3; b = 3.2-3.6; c = 12.0-13.9; V = 56-58 and resembles *B. hessi* Steiner, 1914, *B. teurkorum* Sachs, 1949 and *B. penardi* Stefanski, 1914. *Pterygorhabditis superbus* sp.n. has L = 0.37-0.54 mm; a = 11.0-15.8; b = 3.5-4.6; c = 9.8-15.0; V = 57-60 and resembles *P. panopla* Bernard, 1979 and *P. hungarica* Andrassy, 1982.

In a survey of rhabditid nematodes occurring in organic debris and farmyard manure, three new species belonging to the superfamily Bunonematoidea were discovered. The new species are *Bunonema irregularis* sp.n. and *B. minutum* sp.n. in the subfamily Bunonematinae and *Pterygorhabditis superbus* sp.n. in Pterygorhabditinae.

Materials and methods

The nematodes were extracted by a combination of sieving and decantation and the centrifugal flotation techniques. Debris and nematodes caught on a 300 mesh sieve (pore size 53 μm) were transferred to centrifuge tubes and centrifuged at 1800 g for 4-6 min. The supernatant was discarded and sugar solution (sp. gr. 1.18, prepared by dissolving 484 g of sucrose in 1 l water) added to the tubes which were again centrifuged at the same speed for the same du-

ration. The supernatant was then poured into a large test tube containing water and the nematodes allowed to settle for several hours. Excess water was then decanted and the nematodes isolated were fixed in 4% formaldehyde, dehydrated in a desiccator and mounted in anhydrous glycerine. Measurements were made with an ocular micrometer and drawing by means of a drawing tube on a Nikon Optophot II microscope. Measurements are given in a range with mean and standard deviation in parenthesis.

Descriptions

***BUNONEMA IRREGULARIS* SP. N.**

(Fig. 1)

Holotype (female): L = 0.25 mm; a = 17; b = 3.7; c = 17; c' = 3.3; V = 56.5; stoma = 15 μm ; oesophagus = 68 μm ; rectum = 20 μm ; tail = 15 μm ; ABD = 4.5 μm .

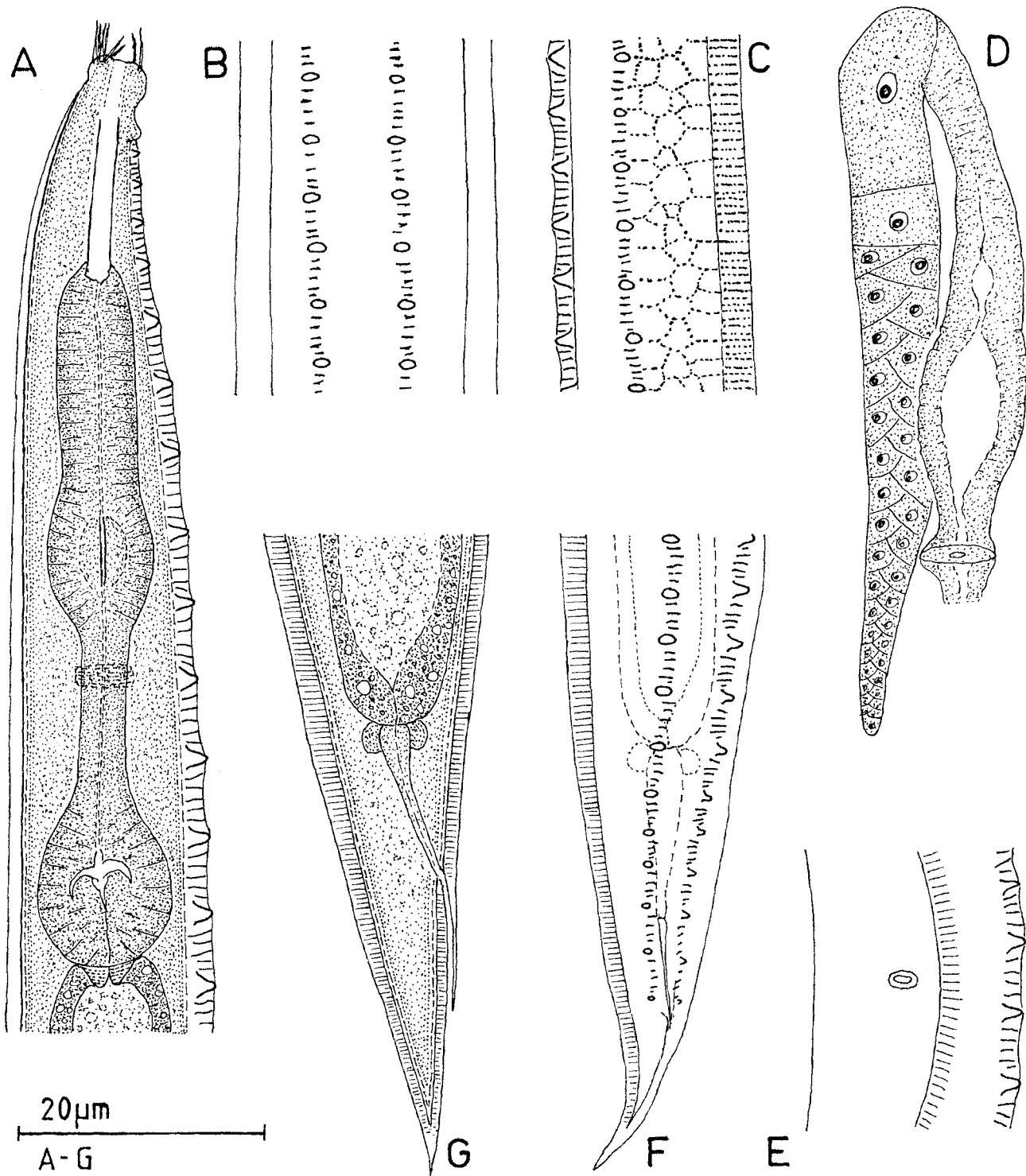


Fig. 1 - *Bunonema irregularis* sp.n.: A, oesophageal region; B and C, midbody region showing tubercles and network; D, female gonad (anterior); E, vulval area; F and G, female posterior ends.

Paratype females (n = 11): L = 0.21-0.28 (0.26 ± 0.02) mm; a = 15.0-19.5 (17.3 ± 1.2); b = 3.1-4.0 (3.6 ± 0.2); c = 11.5-17.4 (13.9 ± 2.0); c' = 2.0-4.0 (2.9 ± 0.6); V = 55-59 (56 ± 1.3); stoma = 15-18 (17 ± 1.1) µm; oesophagus = 68-74 (70 ± 1.9) µm; rectum = 13.0-22.5 (20 ± 2.6) µm; tail = 15-24 (18.9 ± 3.6) µm; ABD = 4.5-9.0 (6.7 ± 1.3) µm.

Female body small, straight upon fixation. Right side ornamented with tubercles and a network pattern composed of rows of small dots. Total number of tubercles ranging from 36-54 pairs over the entire body. Tubercles 3.0-4.5 µm high, without internal rods or thickenings, regularly spaced from one another at a distance of 3.0-4.5 µm. The first pair located in the region of the promesostom and the last pair in the mid-tail region. The tubercles are distributed as follows: 9-15 pairs in the pharyngeal region, 11-17 pairs in the pre-vulval region and 16-22 pairs in the post-vulval region. Two or three unpaired tubercles posterior to the middle of tail. Between the tubercles lies a fine network of small uneven sized dots. Left side of body with five weak ridges. Lip region narrow, set off, 4.5-6.0 µm wide. Lips with four pairs of prominent setae. Amphids inconspicuous. Adam's apple-like collar present in the neck region. Stoma rhabditoid, 3-4 lip-widths long. Cheilostom inconspicuous, prometastom with parallel walls. Metarhabdions thickened, without denticles. Stoma 1/4 of oesophagus length. Corpus 60-65% of oesophagus length. Procorpus muscular. Median bulb cylindrical, well developed. Nerve ring encircling isthmus 51-57 µm from anterior end. Excretory pore opposite the beginning of terminal bulb. Terminal bulb valvate, strong, 1.5-2.7 times wider than lip width. Anterior oesophagus 1.5-1.9 times longer than posterior oesophagus. Intestine with a wide lumen. Gonads amphidelphic. Ovaries reflexed, oocytes arranged in two rows. Uterus muscular, not clearly differentiated. Vagina muscular. Vulva oval, transverse, with prominent swollen lips. Rectum 2-4.7 anal body widths long. Anal appendage 8-12 µm

long. Tail conoid with fine tip. Vulva-anus distance 4-7 times tail length.

Male not found.

Type habitat and locality

Farmyard manure collected at Kamrej village, District Surat, Gujrat, India.

Diagnosis and relationships

Bunonema irregularis sp.n. is characterized by a small body, tubercles without internal rods, a fine network and a transversely oval vulva.

The new species resembles *B. reticulatum* Richters 1905, *B. multipapillatum* Stefanski, 1914 and *B. steineri* Stefanski, 1924 in the total number of tubercles and *B. pustulatum* Andrassy, 1986 in having tubercles without internal rods. However, it differs from *B. reticulatum* in having tubercles without internal rods, a fine network and a more slender body (tubercles with three cuticularized rods, network large and a = 11-14 in *B. reticulatum*). It differs from *B. multipapillatum* in having a smaller body and tubercles without internal rods (L = 0.30-0.38 mm and tubercles with 5-6 cuticularized rods). From *B. steineri* it differs in having a smaller body, and unpaired tubercles in the caudal region (L = 0.37-0.40 mm and tubercles arranged in pairs in *B. steineri*). The new species differs from *B. pustulatum* in having a greater number of tubercles on the body (only 14-16 pairs of tubercles present in *B. pustulatum*).

Type material

Holotype female on slide *Bunonema irregularis* sp.n./1 and paratype females on slides *Bunonema irregularis* sp.n./2-5 deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh. One

paratype female on slide *Bunonema irregularis* sp.n./6 deposited at Istituto di Nematologia Agraria, CNR Bari, Italy.

BUNONEMA MINUTUM SP.N.

(Fig. 2)

Holotype (female): L = 0.21 mm; a = 14.5; b = 3.4; c = 12; c' = 2.5; V = 57; stoma = 19.5 μ m; oesophagus = 65 μ m; rectum = 24 μ m; tail = 18 μ m; ABD = 6 μ m.

Paratype females (n = 4): L = 0.19-0.23 (0.21 \pm 0.02) mm; a = 11.9-15.3 (13.9 \pm 1.2); b = 3.2-3.6 (3.4 \pm 1.2); c = 12.0-13.9 (13.0 \pm 0.6); c' = 2.5-3.0 (2.6 \pm 0.2); V = 56-58 (56.9 \pm 0.8); stoma = 16.5-19.5 (18.0 \pm 1.5) μ m; oesophagus = 57-65 (61.5 \pm 3.2) μ m; rectum = 23-26 (24.0 \pm 1.5); tail = 15-18 (16.1 \pm 1.4) μ m; ABD = 6 (6.0 \pm 0) μ m.

Female body small, almost straight upon fixation. Right side of body with tubercles beginning at base of stoma and continuing up to anus. Tubercles reduced, rudimentary; network distinct, forming a dotted pentagonal pattern. Left side of body with five longitudinal ridges. Lip region narrow, set off, 4.5-7.5 μ m wide. Lips on right side of body with three pairs of large forward directed setae and on the left side of body with three pairs of smaller, inwardly directed setae. Amphids indistinct. A prominent Adam's apple-like collar present in the neck region. Stoma rhabditoid, tubular, 2.2-4.3 lip widths long. Cheilostom inconspicuous, promesostom with parallel walls, metastom without denticles. Stoma 1/4-1/3 of oesophagus length. Corpus 65-69% of oesophagus length. Median bulb cylindrical, muscular. Nerve ring encircling isthmus 42-45 μ m from anterior end. Excretory pore faint, at beginning of terminal bulb. Terminal bulb prominent, 1.4-2.7 times wider than lip width. Anterior oesophagus 1.9-2.2 times posterior oesophagus. Gonads amphidelphic. Ovaries reflexed, oocytes usually in two rows. Vagina small, lightly cuticularized. Vulva a transverse slit, with slightly raised vulval lips. Rectum long,

4-4.3 times anal body width. Anal appendage 7.5-19.5 μ m long. Tail conical, terminus pointed. Vulva-anus distance 4-5 times tail length.

Male not found.

Type locality

Collected from wood frass and bat droppings from the hollow of the trunk of an avenue palm, *Oreodoxa regia* (H, B et K) Cook, from the Department of Zoology, Aligarh Muslim University, Aligarh.

Diagnosis and relationships

Bunonema minutum sp.n. is characterized by a small body, rudimentary tubercles, a dotted pentagonal network pattern and a transverse vulva.

The new species resembles *B. hessi* Steiner, 1914, *B. teurkorum* Sachs, 1949 and *B. penardi* Stefanski, 1914 in having rudimentary tubercles and in the absence of males. It differs from *B. hessi* in having a smaller tail and in the structure of the network pattern (c = 10-11 and network of large quadrangles arranged in 2-3 rows in *B. hessi*). It differs from *B. teurkorum* in having a smaller body (vs L = 0.3-0.35 mm), by the pentagonal network pattern (vs punctated oval spots), a longer oesophagus and smaller ratio of rectum to ABD (b = 4-4.4 and rectum six times ABD in *B. teurkorum*). The new species can be differentiated from *B. penardi* in having a smaller body (vs L = 0.30-0.37 mm), a pentagonal network pattern (vs a fine network without punctated oval spots), a longer tail and greater ratio of rectum to ABD (c = 14-19 and rectum 5-7 times ABD in *B. penardi*).

Type material

Holotype female on slide *Bunonema minutum* sp.n./1 and paratype females on slides *Bu-*

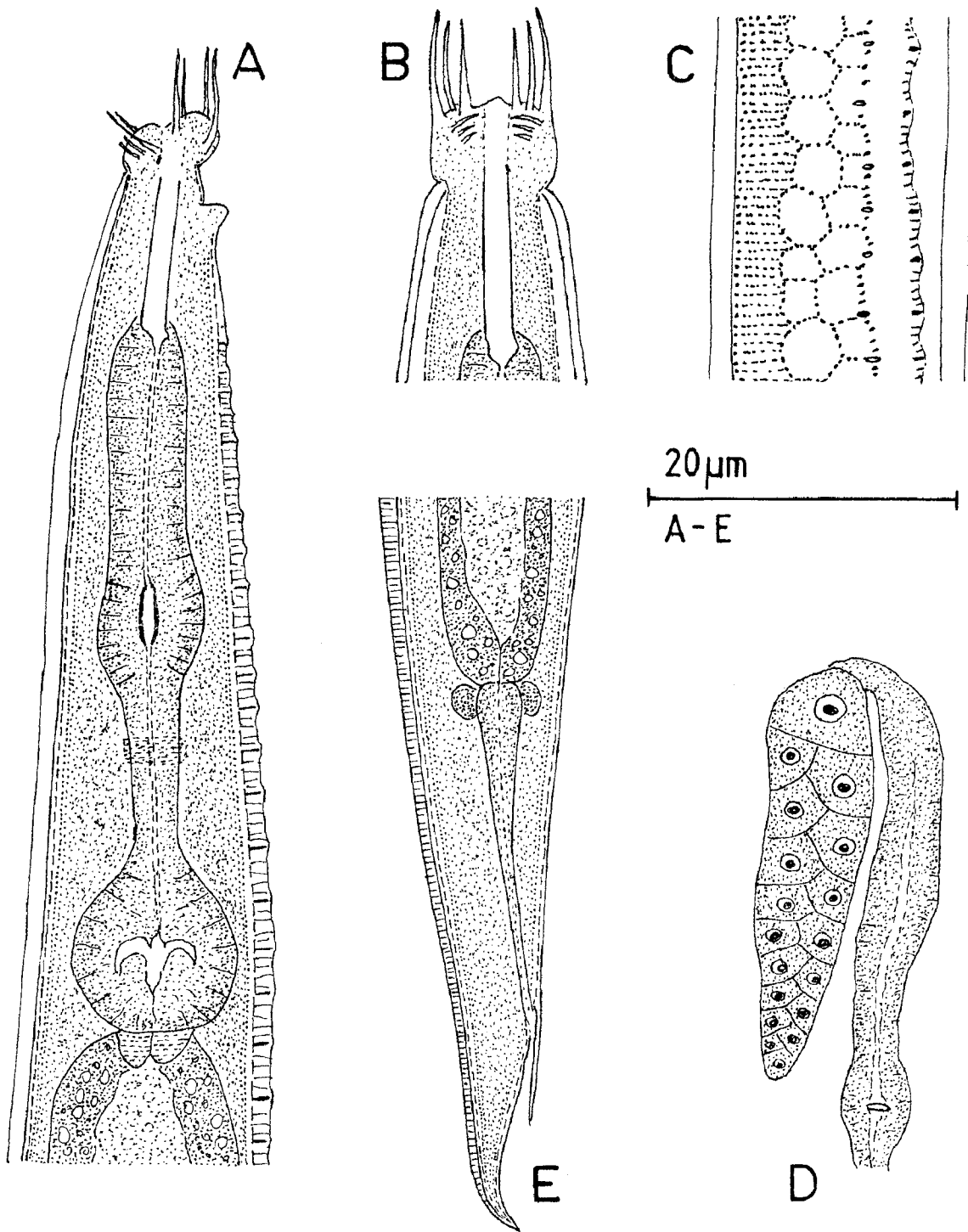


Fig. 2 - *Bunonema minutum* sp.n.: A, oesophageal region; B, anterior end; C, midbody region showing ornamentation; D, female gonad (anterior); E, female posterior end.

nonema minutum sp.n./2-3 deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh. One paratype female on slide *Bunonema minutum* sp.n./4 at Istituto di Nematologia Agraria, CNR, Bari, Italy.

***PTERYGORHABDITIS SUPERBUS* SP.N.**

(Fig. 3)

Holotype (female): L = 0.54 mm; a = 15.8; b = 4.6; c = 15; c' = 3.4; V = 57.6; stoma = 22.5 μ m; oesophagus = 119 μ m; rectum = 39 μ m; tail = 36 μ m; ABD = 10.5 μ m.

Paratype females (n = 5): L = 0.37-0.54 (0.46 \pm 0.08) mm; a = 11.0-15.8 (13.7 \pm 1.8); b = 3.5-4.6 (4.3 \pm 0.5); c = 9.8-15.0 (12.7 \pm 1.9); c' = 3.0-4.2 (3.6 \pm 0.4); V = 57-60 (58.8 \pm 1.6); stoma = 19-24 (21.6 \pm 1.8) μ m; oesophagus = 96-120 (108.6 \pm 9.3) μ m; rectum = 32-45 (40 \pm 5.4) μ m; tail = 31.5-45.0 (36.6 \pm 5.3) μ m; ABD = 9-12 (10.2 \pm 1.3) μ m.

Paratype males (n = 5): L = 0.38-0.48 (0.43 \pm 0.03) mm; a = 12.2-16.0 (14.6 \pm 1.4); b = 3.3-4.7 (4.1 \pm 0.5); c = 28.5-36 (32.2 \pm 2.6); c' = 0.9-1.7 (1.2 \pm 0.3); stoma = 18.0-22.5 (21 \pm 1.9) μ m; oesophagus = 101-125 (106.2 \pm 9.2) μ m; spicules = 51-60 (57 \pm 3.4) μ m; gubernaculum = 13.5-15.0 (14.3 \pm 0.8) μ m; tail = 12-18 (14 \pm 2.5) μ m; ABD = 7.5-12.0 (10.2 \pm 2.4) μ m.

Female body stout, almost straight upon fixation. Cuticle prominently annulated on the right side of body, annulations 1.5-2 μ m wide; left side weakly annulated. Entire body, except lip region, enveloped in a sheath which is interrupted at the anal region to form a tube. Right side of body heavily ornamented into a block-like pattern arranged in six longitudinal rows. The central block wider than the others. Left side of body with four longitudinal lines. Lip region narrow, set off, 7-9 μ m wide. Lips unequal, larger on the right side of body. Four large and eight small labial setae present. Amphids indistinct. Stoma rhabditoid, 2.5-3 times lip-widths

long. Cheilostom prominent, promesostom with parallel walls. Metastom isomorphic, metarhabdions with small denticles. Oesophageal collar absent. Corpus 57-64% of oesophagus length. Median bulb cylindrical, 1.4-2 lip-widths wide. Nerve ring encircling isthmus 72-88 μ m from anterior end. Excretory pore at base of pharynx. Terminal bulb well developed, 2.4-2.7 times lip-widths wide. Anterior oesophagus 1.3-1.8 times posterior oesophagus. Gonad amphidelphic. Ovaries reflexed, oocytes arranged in two rows in germinal zone. Spermatheca not demarcated. Uterus with glandular and muscular parts. Vulva a transverse slit, vagina thick-walled, muscular. Rectum 3.6-5 anal body widths long terminating into a long sleeve which continues into a tube formed by the external sheath. Tail long, conoid, terminus pointed. Phasmids indistinct.

Male body almost straight upon fixation. Anterior end similar to females. Testis single, reflexed. Spicules long, slender, 4-7 times anal body-widths, fused posteriorly. Gubernaculum small, thin, 23-27% of spicule length. Caudal papillae eight pairs of which four pairs are pre-cloacal and four pairs post-cloacal. Tail conoid, phasmids indistinct.

Type locality

Farmyard manure collected from Kamrej village, Surat District, Gujarat, India.

Diagnosis and relationships

Pterygorhabditis superbis sp.n. is characterized by a medium-sized body, lips with four large and eight small setae, right side of body with block-like ornamentations, a long rectum, long and slender spicules and eight pairs of caudal papillae.

The new species resembles *P. panopla* Bernard, 1979 and *P. hungarica* Andrassy, 1982 in body length, and a, b and c values of females.

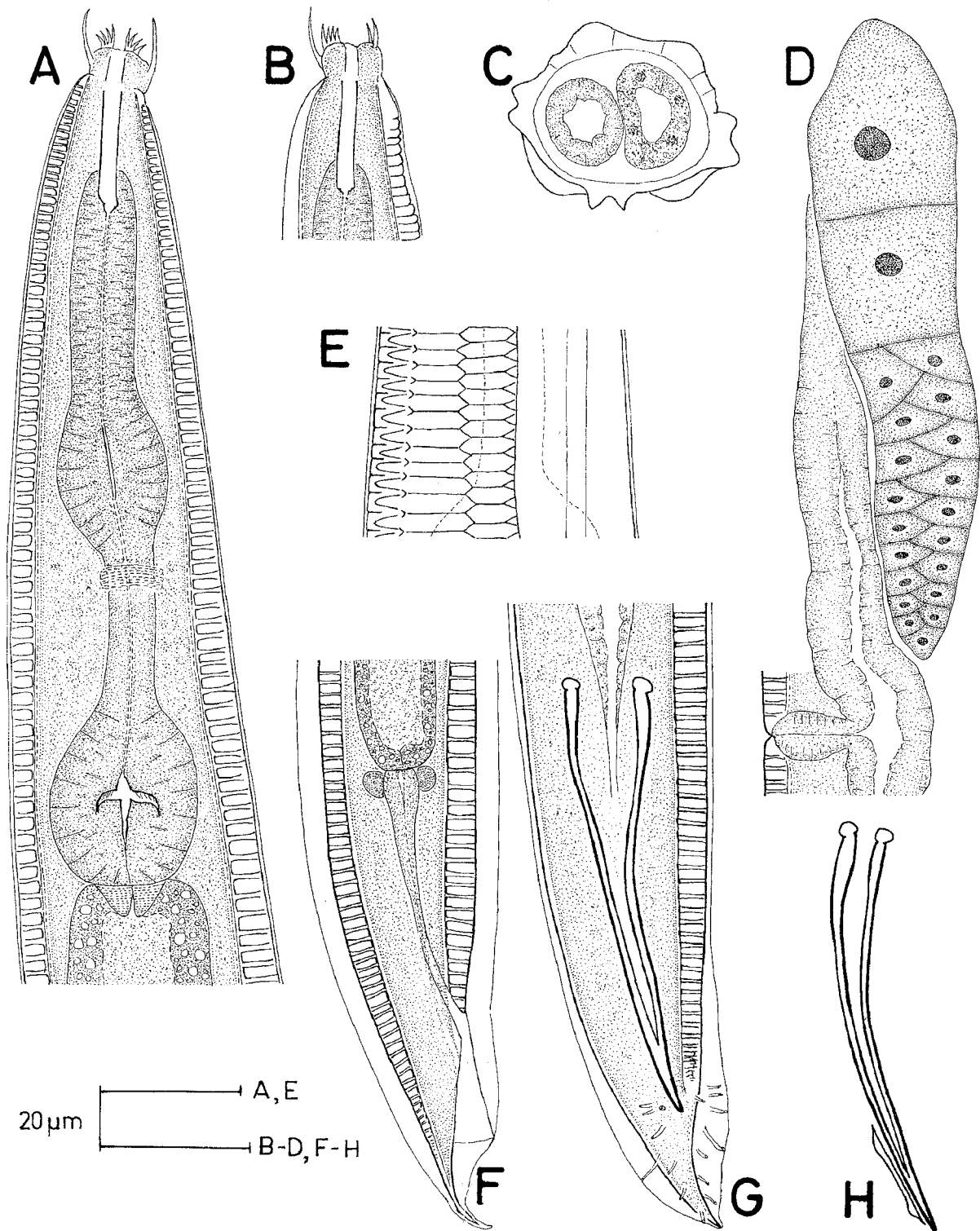


Fig. 3 - *Pterygorhabditis superbis* sp.n.: A, oesophageal region; B, anterior end; C, transverse section through intestine and gonad; D, female gonad (anterior); E, cuticular pattern; F, female posterior end; G, male posterior end; H, spicules and gubernaculum.

However, it can be differentiated from both the species in the absence of an oval shield in the neck region, in the ornamentation of the right side of body and in the shorter tail in males (one oval shield present, right side of body with longitudinal ridges and dumb bell-like structures and $c = 15-20$ in *P. panopla*; three oval shields present, right side of body with rhomboidal structures and $c = 21$ in *P. hungarica*). Further, it differs from *P. panopla* in the arrangement of caudal papillae (caudal papillae all post-cloacal in *P. panopla*) and from *P. hungarica* in the posteriorly located vulva, smaller body size of males and lesser number of caudal papillae ($V = 53-54$, $L = 0.49$ mm in males and caudal papillae eleven pairs in *P. hungarica*).

Type material

Holotype female on slide *Pterygorhabditis superbis* sp.n./1 and paratype females and males on slides *Pterygorhabditis superbis* sp.n./2-5 deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh. One paratype female and two paratype

males on slide *Pterygorhabditis superbis* sp.n./6 at Istituto di Nematologia Agraria, CNR, Bari, Italy.

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Literature cited

- ANDRÁSSY I., 1982. Six new species of the suborder Rhabditina (Nematoda). *Revue Nematol.*, 5: 39-50.
- ANDRÁSSY I., 1986. Fifteen new nematode species from the southern hemisphere. *Acta Zoologica Hungarica*, 32: 1-33.
- BERNARD E. C., 1979. New species of Bunonematoidea (Rhabditida) from Georgia and Tennessee. *J. Nematol.*, 11: 344-358.
- RICHTERS F., 1905. *Bunonema reticulatum* n. sp. *Verh. dt. zool. Ges. 15. Jahresversamml. Breslau.*, 46-47.
- SACHS H., 1949. Revision der Bunonematinae (Anguillulidae, Nematodes). *Zool. Jb. Syst.*, 78: 323-366.
- STEFANSKI W., 1924. Nouvelle contribution à la connaissance de la faune des nematodes libres des environs de Zakopane (Massif du Tatra polonais). *Bull. Intern. Acad. Polon. Sci. Lett. Cracovia*, 539-553.
- STEINER G., 1914. Freilebende Nematoden aus der Schweiz. 1. Teil einer vorläufigen Mitteilung. *Arch. Hydrobiol. Planktonk.*, 9: 259-276.