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SEINURA, APHELENCHOIDES AND APHELENCHUS FROM BRAZIL (NEMATODA : APHELENCHINA)

by

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ABSTRACT. – Seven species belonging to the genera Seinura, Aphelenchoides and Aphelenchus are reported from Brazil. Three species found for the first time since their descriptions are : Aphelenchoides helicus Heyns, 1964, A. spicomucronatus Shavrov, 1967 and A. parabicaudatus Truskova, 1973. Male of A. parabicaudatus is described for the first time. All species are reported for the first time from Brazil.

INTRODUCTION

Soil samples were collected by the third author during 1974-75 from Brazil. Soil samples were fixed in 5% hot formaldehyde and processed to anhydrous glycerine by a modified Seinhorst's method (De Grisse, 1969). The nematodes were mounted on aluminium slides with double cover slips (Cobb, 1917).

> DESCRIPTION Seinura oxura (PAESLER, 1957) J. B. Goodey, 1960 (Fig. 1 D & E)

Measurements

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Females (n = 3): L = 0.75 (0.69-0.86) mm; body width = 24.5 (23-27) μ m; a = 31.0 (29.0-32.0); pharynx = 93 (91-95); b = 7.6 (7.3-8.0); tail = 66 (62-70) μ m; c = 11.5 (10.3-13.8); V = 75 (74-76); stylet = 17.5 (16-19) μ m; excretory pore = 84-88 μ m; MB = 19 × 13 (18 × 13-20 × 12) μ m.

RASHID, F.; GERAERT, E. & SHARMA, R.D. Seinura, aphelenchoides and aphelenchus from Brazil



FIG. 1. – Seinura hechlerae, Q. A : Female reproductive system ; B : Anterior region ; C : Tail region. Seinura oxura. Q. D : Anterior region ; E : Tail.

160

Discussion. The three females in our material are moderately preserved : female genital structure and lateral fields are difficult to observe. Measurements and general structure correspond with *Seinura oxura*.

Habitat and locality. Light soil around the roots of Nicotiana tabacum L., Muritiba, Sitio Pracinha, BR 101, Highway, Bahia, Brazil.

Seinura hechlerae Chaturvedi, Singh & Khera, 1979 (Fig. 1 A-C)

Measurements

Female (n = 1): L = 0.42 mm; body width = 17 µm; a = 25.0; pharynx = 58 µm; b = 7.2; tail = 68 µm; c = 6.2; c' = 8.0; V = 61; stylet = 11 µm.

Female. Body ventrally arcuate when relaxed, tapering at both ends, more to the posterior. Cuticle finely annulated, inner annulation more prominent. Lateral field not very pronounced, with two lines. Head rounded, distinctly sett off from body contour. Stylet with small basal thickenings. Procorpus tubular, metacorpus $14 \times 9 \mu m$ in diameter, valve located slightly posterior to the middle. Dorsal pharyngeal gland overlapping the intestine, about three body widths long. Excretory pore posterior to nerve ring, 66 μm from anterior extremity. Nerve ring encircling the intestine, just behind metacorpus. Intestinal cells distinct. Ovary single outstretched; oocytes arranged in a single row. Spermatheca empty, heart-shaped. Vulva a transverse slit. Vulval lips slightly protruding. Vagina slightly oblique. Posterior uterine sac 23 μm long, without sperms. Tail conical, elongate, tail tip curved so that actual shape is difficult to observe (it could even be split). Rectum twice anal body width long.

Habitat and locality. Heavy soil around the roots of Theobroma cacao L. cv. Comum, Ilhéus, Cepec, Cacao nursery, Bahia, Brazil.

Discussion. The female found from Brazil, mostly corresponds with the description given by Chaturvedi *el al.* (1979) except for the stylet length (13-14 vs 11 μ m lateral field (absent) and the presence of sperm. It is possible that the authors did not observe the exact stylet length (in our female, it was also difficult to observe the stylet) and did not observe the lateral field (they did not make any cross-section). In our female, no sperms were observed.

Aphelenchoides parabicaudatus Shavrov, 1967 (Fig. 2)

Measurements

Females (n = 4): L = 0.34 (0.32-0.40) mm; body width = 10 (18-13) µm; a = 35 (31-39.6); pharynx = 62 (51.5-74) µm; b = 5.7 (4.3-6.7); tail = 31.5 (29-32.5) µm; c = 11 (10-13.7); c' = 5.6 (4.5-7.1); V = 67 (66-68); stylet = 9 (8.5-9.5) µm.

Male (n = 1): L = 0.34 mm; body width = 9.5 μ m; a = 36.0; pharynx = 77 μ m; b = 4.4; tail = 30.5 μ m; c = 11.2; T = 43; stylet = 8.5 μ m.

Females. Body small, cylindrical, gradually narrowing posterior to the anus, with a slight ventral curvature upon fixation. Cuticle finely striated. Lateral field protruding, probably with one line in the centre, showing three lines in total. Head slightly set off from body contour, with apparently heavy basal framework. Stylet with distinct basal thickenings. Guide ring usually posterior to the conical part. Procorpus cylindrical with a slight constriction at metacorpus : metacorpus usually oval in shape with prominent valve plates, that are variable in position from the middle to posterior to the middle. Dorsal pharyngeal gland overlapping intestine for about three times body width. Excretory pore 42 µm anterior to the median bulb in one female (Fig. 2 F), and posterior in others. Nerve ring about 5 μ m from base of median bulb. In the male, intestinal cells very distinct, paired, elongated and having two nuclei per cell (Fig. 2 B), the intestine beginning 4-6 µm posterior to the median bulb; region between median bulb and intestine resembling an isthmus, in the male, apparently formed by two uninucleated cells. This isthmus-like part interpreted as a part of pharynx. Ovary single, outstretched; oocytes arranged in a single row; spermatheca small, usually empty. Vulva a transverse slit. Vagina extending about 1/2 vulval body width. Post-vulval sac variable in length, 12 (10-17) µm long. Tail slightly curved ventrally, subcylindrical, elongated; tail tip indistinctly bifurcated with a long ventral spicate terminus. Anus distinct, anterior lip slightly protruding.

Male. Similar to female in general appearance, with anterior excretory pore, 37 μ m from head end anterior to metacorpus (Fig. 2 B). Testis single, outstretched. Spicules typical aphelenchoid in shape, 15 μ m long; gubernaculum delicate; papillae indistinct (perhaps halfway along the tail). Tail subcylindrical then conical, with an acute terminus.

Habitats and localities. Heavy and sandy soil around the roots of Hevea brasiliensis Muell.-Arg.; Theobroma cacao L., and Cocos nucifera L. in



FIG. 2. – Aphelenchoides parabicaudatus. A : Male reproductive system ; B : Anterior region male ; C : Spicule ; D-D₂ : Vulva region showing variation in post-uterine sac ; E : Female reproductive system ; F : Anterior region female showing anterior excretory pore ; F_1 - F_2 : Position of nerve ring ; G : Anterior region female ; H-H₁ : Variation of tail tip in female.

Viana, Faz. Tira Teima; Ilhéus Cepec; Ilhéus cepec, Quadra 'G' and Valencia, Road Side, Bahia and Espirito Santo State, Brazil.

Discussion. Although the four females differ in position of excretory pore and median bulb valve, they were interpreted as representatives of the same species. The specimens (one female and one male) with an anterior excretory pore, agree mostly with *A. parabicaudatus* Shavrov, 1967. We found some differences in 'a' value (31-39.6 vs 21-25), vulva position (66-68 vs 61.2-64.7); head shape and structure of lateral field. The female drawn by Shavrov (1967) has a well offset head perhaps due to fixation, while the vulva percentage given by Shavrov is different from the percentage calculated from his drawing (V = 66%) and his drawing of the lateral field shows four lines, although the exact number is not easy to see, as also for *A. bicaudatus* (Imamura, 1931) Filipjev & Schuurmans Stekhoven, 1941.

We consider our populations as *A. parabicaudatus*, which differs from *A. bicaudatus* in having a relatively small body (0.32-0.40 vs 0.41-0.55 μ m); a short post-vulval sac and a tail tip without distinct bifurcation. The male can be differentiated by the anterior position of the excretory pore.

The male is described for the first time, *A. parabicaudatus* has been found for the first time since its description.

Aphelenchoides spicomucronatus Truskova, 1973 (Fig. 3)

Measurements

Females (n = 22) : L = 0.49 \pm 0.06 (0.37-0.61) mm; body width = 18.0 (13-26) μ m; a = 28.3 \pm 4.7 (20.0-37.3); oes. = 69.6 \pm 6.8 (61.5-86) μ m; b = 6.5 \pm 0.6 (6.0-8.2); tail = 33.0 \pm 4.0 (26-41) μ m; c = 15.1 \pm 1.3 (11.2-17.5); c = 3.5 (3.0-4.3); V = 69.5 \pm 1.2 (61-71); stylet = 10.5 \pm 0.6 (9.5-11).

Females. Body slender, tapering at both ends, ventrally curved after fixation. Cuticle marked by fine annules. Lateral field with four incisures, the two inner ones closer together; in cross section, lateral field is elevated (Fig. 3 G). Head rounded, slightly offset, without annulation. Stylet 9.5-11.5 μ m long, with distinct small basal knobs; conical part shorter than shaft. Procorpus cylindrical with a slight constriction at median bulb; median bulb oval to spherical in shape, prominent, with large centrally placed valve plates. Pharyngeal gland overlapping intestine dorsally, about 2 1/2 to 3 body



FIG. 3. – Aphelenchoides spicomucronatus, 9. A : Anterior region ; B-C : vulva, ventral view ; B : Close to surface ; C : Vulva 1-2 μ m below surface ; D-D₃ : Position of excretory pore ; E-E₂ : Variation in post-uterine sac ; F : Female reproductive system ; G : Cross section through mid-body, showing lateral field ; H-H₄ : Tail region showing variation in tail tip.

widths long, with three pharyngeal nuclei. Excretory pore (n = 26) 59 (48-69.5) μ m from anterior extremity, variable in position, from opposite middle of median bulb to about one bulb length posterior to it (Fig. 3 D-D₃). Nerve ring, 2-12 μ m from base of median bulb. Hemizonid not seen.

Ovary single, outstretched or with one flexure at anterior end; oocytes arranged in single row. Spermatheca rather indistinct, empty. Vulval lips slightly protruding. Vulva a transverse slit, about 2 μ m wide in ventral view (Fig. 3 B). Vagina slightly oblique anteriad. Post-vulval sac variable in length (n = 19) 56 (24-63) μ m long i.e. 2.3 (2-3) times vulval body width (Fig. 3 E-E₂). Tail conical, terminus variable in shape, with a mucro, having an approximately central position (Fig. 3 H-H₄). Anus distinct, anterior lip slightly protruding; body gradually narrowing behind anus.

Male. Not found.

Discussion. The populations of *Aphelenchoides* from Brazil were compared to the following species having four incisures.

A. submersis Truskova, 1973, which is different in having a relatively large body, posterior vulva and an anteriorly located excretory pore. A lucknowensis Tandon & Singh, 1973 and A. lanceolatus Tandon & Singh, 1974, which can be differentiated by their body length and longer stylet. A. franklini Singh, 1969, differing by tail tip, more posterior vulva, and by having sperms. A. jadhpurensis Tikyani et al., 1969 differing in the position of excretory pore, the relatively large stylet (13-14 μ m) and the relatively short postvulval sac. A. editocaputis Shavrov, 1967, different by being smaller in size (0.27-0.31 vs 0.40-0.61 mm). A. absari Husain & Khan, 1967, different by having a relatively longer stylet (11-13 μ m) and a longer body (0.39-0.45 mm), and a posterior vulva and by the absence of a post-vulval sac. A. orientalis Eroshenko, 1968, different in having large spermatheca filled with sperms and a different tail shape. A. platycephalus, A. rarus and A. eradicitus Eroshenko, 1968, differing by their body length, and by the position of the excretory pore and the vulva.

Closely related species are A. spasskii Eroshenko, 1968 and A. spicomucronatus Truskova, 1973 the former species differs only in having sperms and the latter in the absence of a lateral field. Because the lateral field is rather obscure and difficult to observe, it is possible that the author (Truskova, 1973) overlooked it (no sections were made); therefore we consider our females as A. spicomucronatus. This species has been found for the first time since it was described.

37

Aphelenchoides dactylocercus Hooper, 1958 (Fig. 4)

Measurements

Females (n = 11); L = 0.35 (0.28-0.42) mm; body width = 17 (11-24) μ m; a = 22.0 (16.0-29.6); pharynx = 57.5 (51-67) μ m; b = 6.2 (5.5-7.0); tail = 25 (18.5-29) μ m; c = 14.2 (13.0-15.2); c' = 3.3 (2.3-4.2); V = 70 (68-72); stylet = 9 (8-11) μ m.

Females. Body cylindrical, slightly ventrally curved when relaxed, tapering at both extremities. Cuticle finely annulated, inner annulation more prominent. Lateral field marked by three incisures (Fig. 4 A). Head slightly offset from body, apex flattened, without annulation. Stylet with distinct basal thickenings; guide ring usually at the junction of conical part and shaft. Procorpus narrow, followed by a muscular median bulb; median bulb variable in shape, spherical to oval with conspicuous valve plates (Fig. 4 B-B₂). Pharyngeal glands lying dorsally along the intestine, about three body widths long. Intestine beginning immediately behind median bulb. Excretory pore variable in position, from opposite the middle of the median bulb till a few μ m posterior to it (Fig. B-B₂). Nerve ring 3-5 μ m behind median bulb, encircling intestine.

Female monodelphic, prodelphic; ovary outstretched, oocytes arranged in tandem. Spermatheca small, rounded without sperms. Vulva a transverse slit about 4 μ m wide in ventral view (Fig. 4 D). Vulval lips generally slightly protruding. Vagina slightly oblique, inwardly directed. Post-vulval sac variable in length; (n = 7) 20.5 (14.5-29.5) μ m long, i.e. 1-2 times vulval body width. Tail gradually tapering towards tip, generally with sharply pointed, ventrally placed mucro; tail usually strongly curved ventrally when relaxed but sometimes straight (Fig. 4 F-F₃). Anus distinct, body narrowing just behind the anus.

Male. Not found.

Habitats and localities. Heavy soil around the roots of *Theobroma cacao* L. cv. Comum, *Hevea brasiliensis* Muell-Arg. in Mucuri, Faz. Vomitorio, Bahia and Viana, Faz. Tira Teima, Espirito Santo State, Brazil.

Discussion. The females found from Brazil are closely related to *Aphelenchoides dactylocercus* Hooper, 1958. However, some differences occur ; the body length of the type population is longer (L= 414-502 μ m) and the 'b' and 'c' values are different (b = 7.3-9.1 ; c = 8.6-11.8). In our females, the length of tail and post-vulval sac is more variable than originally reported.



FIG. 4. – Aphelenchoides dactylocerus, Q. A : Anterior region ; B-B₂ : Position of excretory pore ; C-C₂ : Variation in post-uterine sac ; D : Vulva, ventral view ; E : Female reproductive system ; F-F₃ : Tail region showing variation.

Aphelenchoides helicus Heyns, 1964 (Fig. 5)

Measurements

Females (n = 3): L = 0.40 (0.34-0.51) mm; body width = 14 (13-17) μ m; a = 27.5 (26.2-29.7); pharynx = 61.5 (54-71) μ m; b = 6.4 (5.7-7.2); tail = 24.5 (19.5-29) μ m; c = 16.5 (13.5-18.0); c' = 3.3 (2.8-4.0); V = 71 (70-74); stylet = 9 (8.5-10) μ m.

Females. Body ventrally arcuate upon fixation. Cuticle finely striated, inner striation more prominent. Lateral field marked by three incisures (Fig. 5 A). Head slightly offset, rounded, smooth. Stylet with small basal thickenings, distinct. Pharynx typical with prominent muscular median bulb. Pharyngeal gland overlapping intestine dorsally, about three body widths long. Excretory pore 51.5 (47-59) μ m from anterior end, just posterior to median bulb. Nerve ring 3.5-5.5 μ m from base of median bulb. Intestine begins just behind median bulb. Deirid about one body width posterior to nerve ring. Ovary single, short, outstretched; oocytes arranged in a single row. Spermatheca small, elongate to rounded, empty (Fig. 5 C-C₂). Vulval lips sometimes slightly protruded. Vulva a transverse slit. Vagina straight or slightly obliquely inwardly directed. Posteriot uterine sac variable in length, 25 (13-44) μ m (Fig. 5 C-C₂). Tail finger-shaped, ventrally curved with rounded to truncate terminus (Fig. 5 E-E₁). Rectum twice anal body width. Phasmid not seen.

Male. Not found.

Habitats and localities. Heavy soil around the roots of Piper nigrum L., Itubera, Faz, Kuratani; Theobroma caco L. cv. Catongo, Itabuna, Faz. Boa Esperança Bahia, and Hevea brasiliensis Muell-Arg., Viana, Faz. Tira Teima, Espirito Santo State, Brazil.

Discussion. These females are considered to be A. helicus Heyns, 1964, because of the similar tail shape, the three incisures, the small knobbed stylet and the similar length of the post-vulval uterine sac. They differ, however, in body shape because A. helicus females 'have' a strong spiral body shape and the excretory pore is opposite the middle of the median bulb. Our females extend slightly the measurements given by Heyns (1964). Because of the tail shape, they were also compared with A. limberi Steiner, 1936 and A. jacobi Husain & Khan, 1967, but A. limberi has four lines in lateral field and A. jacobi has a longer stylet (12-14) μ m without knobs.



FIG. 5. – Aphelenchoides helicus, Q. A: Anterior region; B-B₁: Position of excretory pore; C-C₂: Vulval region showing variation in post-vulval sac; D: Female reproductive system; E-E₁: Tail region showing variation.

Aphelenchus (Anaphelenchus) isomerus Anderson & Hooper, 1980 (Fig. 6)

Measurements

Females (n = 60): L = 0.68 ± 0.08 (0.49-0.92) mm; a = 37.8 ± 4.5 (30.0-54.0); oes. = 111 + 11.9 (84-130) µm; b = 6.0 ± 0.90 (4.9-8.4); b = 4.1 (3.2-5.2); tail = 22.5 ± 2.6 (15.0-31.5) µm; c = 30.9 ± 3.0 (24.8-37.8); c' = 1.9 (1.5-2.7); V = 73.2 ± 1.09 (72-78); stylet = 12.5 ± 0.96 (10.5-15.0) µm.

Females. Body slender, linear to slightly arcuate when relaxed. Body width 18 (14-24) μ m; annules very fine, often obscure; interiotr cuticular annulation more prominent. Lateral field marked by 12 to 16 incisures (Fig. 6 C-C₁ & E). Head low, broadly rounded, apex often flattened. Lips continuous with body contour or slightly set off by a shallow constriction.

Procorpus almost cylindrical with a slight constriction at median bulb, median bulb oval with almost centrally placed crescentic valve. Pharyngeal gland overlapping intestine dorsally, with three distinct pharyngeal gland nuclei. Excretory pore 90.5 (74-112) μ m from anterior extremity. Nerve ring surrounding isthmus from, near base of metacorpus to 7 μ m posterior it. Hemizonid distinct with 3 to 4 annules posterior to excretory pore or at the same level. Hemizonion prominent, about 1. 1/2 body width behind hemizonid. Deirid not seen. Female monodelphic, prodelphic, ovary outstretched. Oviduct with distinct cells (Fig. 6 A). Vulva a small transverse slit in ventral view (Fig. 6 B-B₃). Vagina isomorphic (Fig. 6 F-F₃) postuterine sac varying in length from 32 to 85 μ m (Fig. 6 G-G₁). Tail cylindrical to subcylindrical : terminus hemispherical, obliquely flattened to offset. Body gradually decreasing in diameter behind anus. Phasmids not seen. One female having an egg, 55 × 21 μ m, in size.

Habitats and localities. Heavy, light and sandy soil around the roots of *Theobroma cacao* L. (Hybrid, cv. Comum, clone SCA-6), *Piper nigrum* L., *Cocos nucifera* L. and *Ananas sativus* Schult, at Ilhéus, Cepec, Quadra 'H', Quadra 'G', Bloco I & II, Itamaraju, Faz. vigia, Gandu Faz. Asonara Dois, Itapebi, Faz. Lombardia, caravelas, Faz. Dois Luizes, Ituberá, Faz. Kuratani, Barra de Rocha, Faz. Esmeralda, Itabuna, Faz. Boa Esperança, Itacaré, Faz. Canta Cralo, Ubaitaba, Faz. Deus é pai, Bahia state and Estancia, Faz. Crasto, Sergipe State, Brazil.

Discussion. Our females agree well with the description given by Anderson & Hooper (1980); therefore, we consider our populations as Aphelenchus



FIG. 6. – Aphelenchus (Anaphelenchus) isomerus, Q. A.: Female reproductive system : B-B₃: Vulva at different levels, ventral view ; C-C₁: Cross sections through mid-body showing lateral field ; D-D₁: Position of excretory pore ; E : Anterior region ; F-F₃: Vagina and vulva region ; G-G₁: Vulval region with long and short post-vulval sac : H-H₄: Variation of tail tip in females.

(Anaphelenchus) isomerus. However, variations occur among populations in length of postuterine sac and in tail tip. Their drawing (Fig. 1 C) gives only part of the vagina, their photographs (Fig. 2 A-C) show that in their specimens a similar vaginal structure is present as in our specimens (Fig. 6 F- F_3).

This species has been found for the first time in Brazil.

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