Journal of Nematology 32(4):403–410. 2000.

Redescription of Three *Ektaphelenchus* Species (Nematoda: Aphelenchina)

T. R. Kaisa

Abstract: Three *Ektaphelenchus* species with unusual spicules are redescribed. *Ektaphelenchus obtusus* and *E. riograndensis* are redescribed from newly discovered material in the collection of the USDA Forest Service RMRS. Lectotype slides are designated for both species. *Ektaphelenchus obtusus* is characterized by a set-off head, lips of unequal size, double rows of oocytes and spermatocytes, and a hooked spicule terminus. *Ektaphelenchus riograndensis* is distinguished by a rounded head with six equal lips, and spicules with a large, rounded apex, and recurved terminus. A bursa and gubernaculum are absent in both species. *Ektaphelenchus scolyti* is redescribed from type material deposited in the collection of Rothamsted Experimental Station. It is characterized by a well set-off head, double rows of oocytes and spermatocytes, and spicules with a hooked terminus. A bursa and gubernaculum are absent.

Key words: Aphelenchina, *Cryptaphelenchoides scolyti, Ektaphelenchus macrostylus, Ektaphelenchus obtusus, Ektaphelenchus riograndensis, Ektaphelenchus scolyti,* lectotype, nematode, taxonomy.

In his analysis of the genus *Ektaphelenchus,* Baujard (1984) identified four species with unusual spicules: *E. goffarti* Rühm, 1956; *E. macrobulbosus* (Rühm, 1956) Massey, 1974; *E. obtusus* Massey, 1956; and *E. scolyti* Rühm, 1956. In these species, the spicule terminus is hooked. Of these, *E. macrobulbosus* and *E. obtusus* were illustrated and redescribed. Because of the poor condition of the type material, Baujard could provide only a partial redescription of *E. obtusus.* Another species with oddly shaped spicules, *E. riograndensis* Massey, 1964, was not redescribed because type material could not be found in the U.S. Department of Agriculture (USDA) Forest Service Collection.

In the original descriptions of *E. obtusus* and *E. riograndensis,* Massey (1956, 1964) cited several localities from which these species were collected. The possibility that there might be non-type slides of these species in the USDA Forest Service Collection prompted the author to initiate a search for them. Richard C. Carman, USDA Forest Service RMRS, searched Massey's collection and found 13 slides of *E. obtusus.* Slides of *E. riograndensis* were not found. A search of the card file containing all *Ektaphelenchus* species described by Massey resulted in a startling discovery—the original name *E. riograndensis* had been changed to *E. obtusus.* On each of the cards the specific epithet ''riograndensis'' had been crossed out and replaced with the specific epithet ''obtusus.'' Subsequent examination of three of the eight ''obtusus'' slides revealed that they contained specimens of *E. riograndensis.*

This study redescribes *E. obtusus* and *E. riograndensis* from newly discovered material in Massey's collection, and designates lectotype slides for both species. It also redescribes *E. scolyti* and illustrates for the first time the hooked spicule terminus of this species.

Materials and Methods

Permanent slides of *Ektaphelenchus obtusus* and *E. riograndensis* mounted in glycerin were obtained from the USDA Forest Service RMRS, Lincoln, Nebraska. Measurements of *E. obtusus* were taken from specimens collected from Santa Fe, New Mexico, and Prescott, Arizona. Measurements of *E. riograndensis* were taken from specimens collected from Prescott, Arizona, and Bandelier National Monument, New Mexico. Permanent slides of *E. scolyti* mounted in glycerin were obtained from Rothamsted Experimental Station Nematode Collection,

Received for publication 30 March 2000.

Visiting Lecturer, Department of Biology Instruction and Agricultural Education, 330 Long Hall, Clemson University, Clemson, SC 29634.

The author thanks R. C. Carman, USDA Forest Service RMRS, and L. C. Hingston, IACR-Rothamsted, for providing type specimens and A. L. Harman (Frostburg State University) and D. M. Harman (Appalachian Laboratory, University of Maryland Center for Environmental Science) for their critical review of the manuscript.

E-mail: tkaisa@clemson.edu

This manuscript was edited by R. T. Robbins.

Harpenden, Herts., England. All measurements are in µm unless otherwise specified.

Systematics

Ektaphelenchus obtusus Massey, 1956
syn. *Ektaphelenchus macrostylus* Khan, 1960
syn. *Cryptaphelenchoides macrostylus* (Khan, 1960) Nickle, 1970
(Figs. 1–4)

Description

Lectotype females (n = 7): Length 640–790; (730; SD 48.1); stylet 21–24 (22.5; SD 1.1); ratios—a 22–32; (26.4; SD 3.6), b 6.8–9.5 (8.3; SD 0.9), V 73–86 (80.1; SD 4.1).

Body long (640–790), ventrally curved, at times C-shaped. Tail bluntly rounded. Cuticle with coarse transverse striae. Incisures not observed. Head set off, lips of unequal size. Excretory pore less than two body widths below nerve ring. Stylet long (21–24), without knobs; tip slanted ventrally. Median bulb oblong, valves posteriorly situated. Esophageal gland lobes five to seven body widths long. Rectum and anus absent; intestine terminating in blind sac. Ovary single, outstretched, at times reaching esophageal gland lobes. Oocytes arranged in two to three rows. Vulva posteriorly situated (V 73–86), lips not protuberant. Vulva flap absent. Vagina oblique. Postuterine sac short, less than one body width long.

Lectotype males (n = 2): Length 620–690 (655; SD 35); stylet 23–24 (23.5; SD 0.5); spicules 20 (20; SD 0); ratios—a 31–35 (32.8; SD 1.8), b 6–6.7 (6.4; SD 0.4), c 20.7–23 (21.9; SD 1.2), c′ 1.7–2 (1.9; SD 0.2).

Male shorter than female (620–690), body ventrally curved. Cuticle, head, median bulb, and stylet same as female. Tail sharply curved through 180° to blunt terminus. Testis single, outstretched; spermatocytes arranged in two rows. Two pairs of caudal papillae present: first pair post-anal, ventral; second pair preanal, subventral. Spicules with prominent apex and rostrum; terminus with apophysis (Fig. 4). Bursa and gubernaculum absent.

Type host and locality

Associated with *Dendroctonus pseudotsugae* Hopkins, Santa Fe, New Mexico, and *Ips integer* Eichoff in *Pinus ponderosa* Laws., Prescott, Arizona.

Type specimens

Lectotypes (females & males): Two females and two males on Slide no. 28-F, and five females on Slide no. 56-F-1 in the USDA Forest Service RMRS Collection, National Agroforestry Center, Lincoln, Nebraska.

Remarks

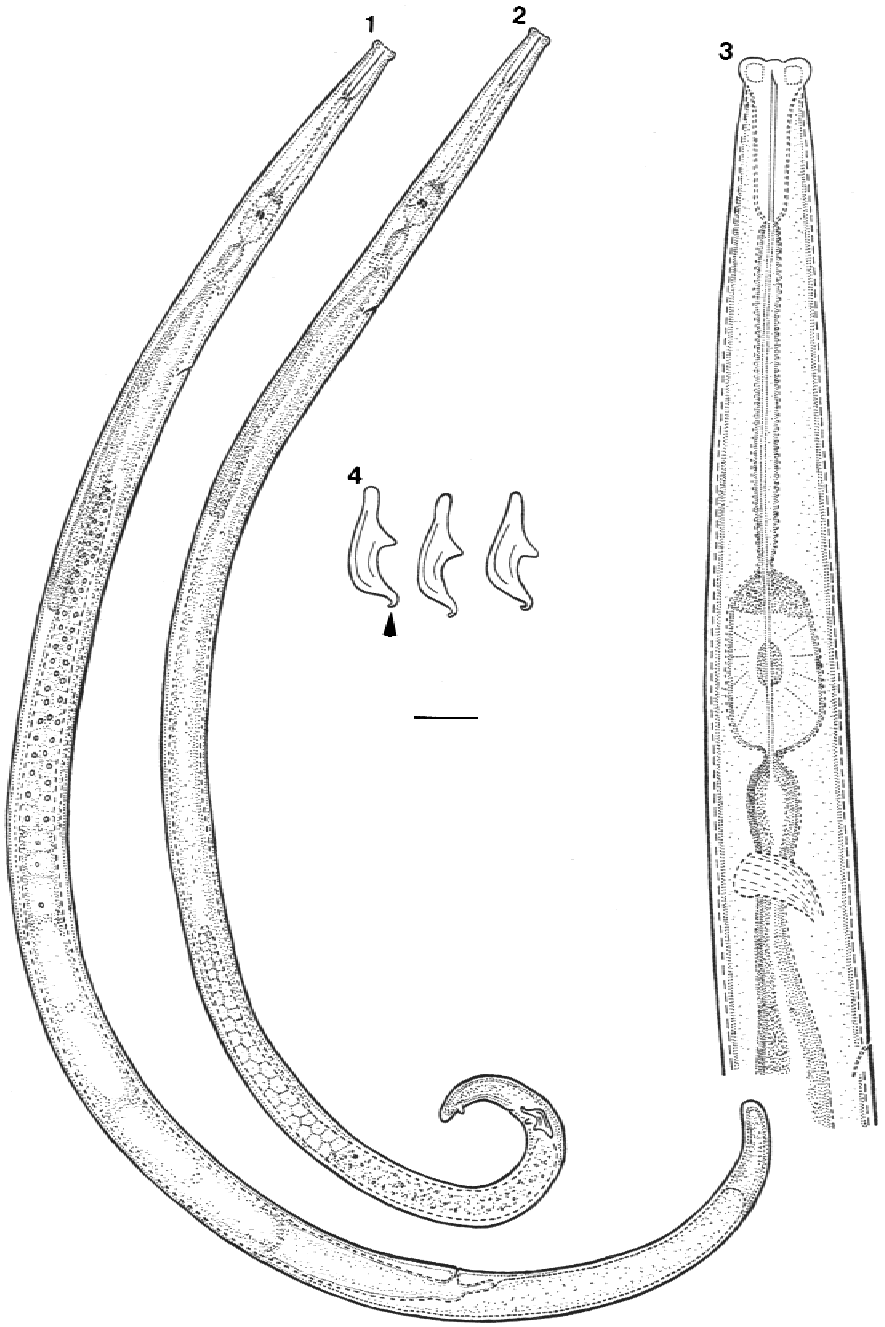
In the present study two pairs of papillae were observed on the male tail of *E. obtusus*. The same number of pairs was also reported by Baujard (1984). Massey (1956) observed three pairs, and Khan (1960) observed a single pair for the synonymous species *E. macrostylus*. Lectotype morphometrics were within ranges reported in the original description. A comparison of *E. obtusus* morphometrics from various authors appears in Table 1.

Ektaphelenchus riograndensis Massey, 1964
syn. *Cryptaphelenchoides riograndensis* (Massey, 1964) Hunt & Hague, 1976
(Figs. 5–8)

Description

Lectotype females (n = 4): Length 630–780 (673; SD 62.6); stylet 22–23 (22.5; SD 0.5); ratios—a 25.2–31.5 (28.5; SD 2.2), b 6.8–9.5 (7.8; SD 1.1), V 79–81.5 (80.6; SD 1.1).

Body 630 to 780 long, ventrally curved posteriorly to blunt terminus. Cuticle with fine transverse striae. Lateral field with two incisures. Head slightly set off, lips of equal size. Stylet long (22–23), without basal knobs. Median bulb oblong, valves posteriorly located. Excretory pore about one body width below nerve ring. Nerve ring less than one body width below median bulb. Esophageal gland lobes five to seven body widths long. Rectum and anus absent; intestine terminating in blind sac. Ovary single, outstretched, oocytes arranged in two rows. Postuterine sac 20 to 23 long. Vulva posteriorly placed (V 79–81.5), lips slightly protuberant. Vulva flap absent. Vagina oblique.



Figs. 1–4. *Ektaphelenchus obtusus* Massey, 1956. 1) Full view of female. 2) Full view of male. 3) Head and neck of female. 4) Spicules showing apophysis (arrow head). Scale = 24 μm in Figs. 1, 2; 10 μm in Figs. 3, 4.

Lectotype males (n = 4): Length 620–650 (640; SD 12.5); stylet 21–22 (21.5; SD 0.5); spicules 20–22.5 (21.3; SD 1.3); ratios—a 26–31 (28.5; SD 1.8), b 7.1–8.1 (7.4; SD 0.4), c 22.5–26 (23.9; SD 1.3), c′ 1.4 (1.4; SD 0).

Body ventrally curved posteriorly to conoid terminus. Tail sharply curved through 180°. Cuticle, head, excretory pore, median bulb, and stylet same as female. Testis 268 to 353 long, spermatocytes arranged in two rows. Two pairs of subventral, caudal papillae present: first pair preanal; second pair

TABLE 1. Comparison of morphometrics of *Ektaphelenchus obtusus* Massey, 1956 from various authors and the present study.

	E. obtusus		syn. *E. macrostylus*		*E. obtusus*
	Massey (1956)	Baujard (1984)	Khan (1960)	Baujard (1984)	Lectotypes (Present study)
Females					
n	1	1	1	6	7
Length (µm)	800	960	700	610–700	640–790
a	30	?	35	?	22–32
b	8	?	4	?	6.8–9.5
V	78	77.5	79	77–79	73–86
Stylet (µm)	24	25	16[a]	25–29	21–24
Males					
n	1	1	1	2	2
Length (µm)	700	920	700	620–710	620–690
a	23	?	34	?	31–35
b	7	?	3.7	?	6–6.7
c	14.4	19.5	18	18–20	20.7–23
Stylet (µm)	?	23	16[a]	?	23–24
Spicules (µm)	17[a]	21.5	24[a]	23	20

[a] Calculated from figures.

post-anal, about one-half body width anterior to tail tip. Spicules 20 to 22.5 long, apex large, rounded. Spicule terminus with apophysis (Fig. 8). Bursa and gubernaculum absent.

Type host and locality

Associated with *Ips lecontei* Swaine in *Pinus ponderosa* Laws., Prescott, Arizona, and also with *Ips pini* Say in *Pinus ponderosa* Laws., Bandelier National Monument, New Mexico.

Type specimens

Lectotypes (females & males): Two females and two males on Slide no. 20-A, and two females and two males on Slide no. 8-Q in the USDA Forest Service RMRS Collection, National Agroforestry Center, Lincoln, Nebraska.

Remarks

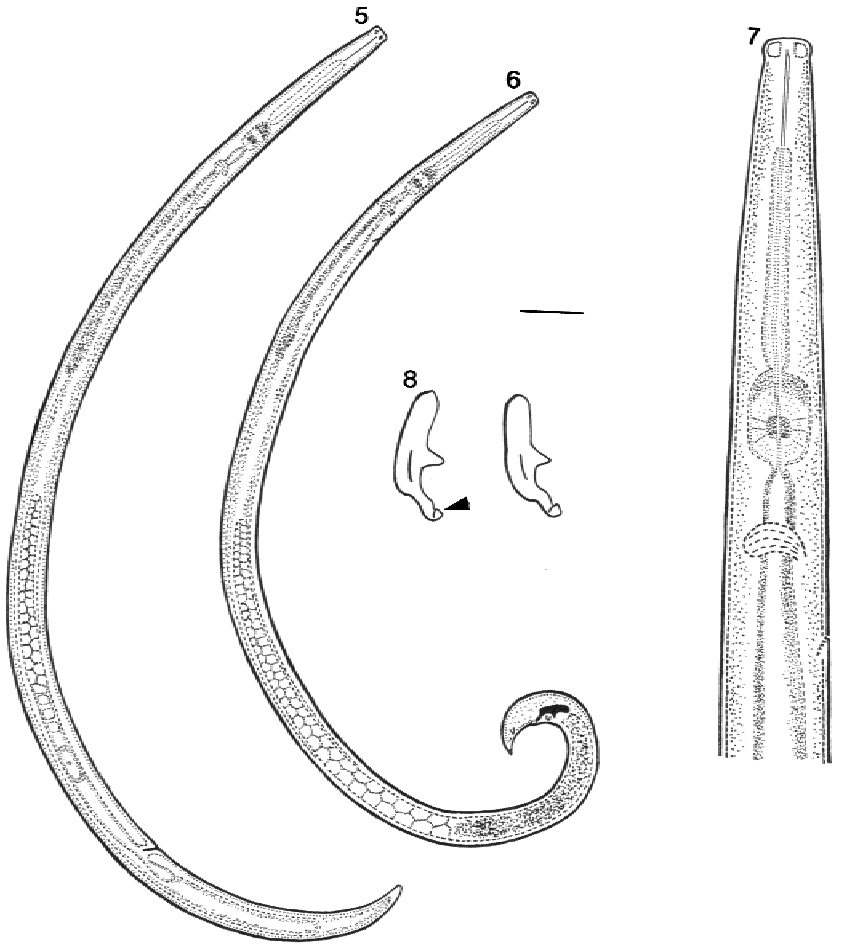
Morphometrics of *E. riograndensis* lectotypes were generally consistent with those reported by Massey (1964) in the original description. In this study males were shorter than originally described (620–650 µm vs. 670–810 µm), and spicules were smaller (20–22.5 µm vs. 24 µm). Lectotype morphometrics and those from the original description appear in Table 2.

Ektaphelenchus scolyti Rühm, 1956
syn. *Cryptaphelenchoides scolyti* (Rühm, 1956) Hunt & Hague, 1976
(Figs. 9–12)

Description

Females (n = 2): (Slide no. 86a/1/1). Length 810–820 (815; SD 5); stylet 15 (15; SD 0); ratios—a 41 (41; SD 0), b 8–9 (8.5; SD 0.5), V 75–78 (76.5; SD 1.5).

Body long (810–820), slender, ventrally curved, at times C-shaped. Tail conoid to amucronate, pointed terminus. Cuticle with fine transverse striae. Incisures not observed. Head well set off, lips of equal size. Excretory pore below nerve ring. Nerve ring one-half body width below median bulb. Median bulb oblong, valves centrally placed. Esophageal gland lobes eight to ten body widths long. Stylet 15 long, without basal knobs. Rectum and anus absent; intestine terminating in blind sac. Ovary single, outstretched, oogonia-oocytes arranged in one to two rows. Postuterine sac less than one body width long. Vulva posteriorly situated



FIGS. 5–8. *Ektaphelenchus riograndensis* Massey, 1964. 5) Full view of female. 6) Full view of male. 7) Head and neck of female. 8) Spicules showing apophysis (arrow head). Scale = 35 µm in Figs. 5, 6; 15 µm in Fig. 7; 10 µm in Fig. 8.

(V 75–78), lips not protuberant. Vulva flap absent. Vagina transverse.

Males (n = 2): (Slide no. 86a/1/5). Length 628–700 (664; SD 36); stylet 15 (15; SD 0); spicules 15–18 (16.5; SD 1.5); ratios—a 35–36 (35.5; SD 0.5), b 8–9 (8.5; SD 0.5), c 23 (23; SD 0), c′ 2 (2; SD 0).

Body long and slender, sharply ventrally curved posteriorly. Cuticle, head, median bulb, and stylet same as female. Testis single, outstretched, spermatocytes arranged in two rows. Three pairs of caudal papillae present: first pair preanal, second and third pairs post-anal, subventral. Spicules 15 to 18 long, terminus with apophysis (Fig. 12); apex prominent, rostrum small, pointed. Bursa and gubernaculum absent.

Remarks

In this study the female stylet of *E. scolyti* was slightly shorter (15 µm) than previously reported by Rühm (1956) and Hunt and Hague (1976). In Rühm's study the stylet was 21 µm long, and in Hunt and Hague's study it was 16 to 20 µm long. Males in Rühm's study had a larger c value than in Hunt and Hague's study or the present study (25.5–27.1 vs. 16–23). Three pairs of papillae were observed on the male tail in Hunt and Hague's study as well as in the present study; in Rühm's study, two pairs were observed. A comparison of morphometrics of *E. scolyti* from earlier studies and the present study appears in Table 3.

TABLE 2. Comparison of morphometrics of *Ektaphelenchus riograndensis* Massey, 1964 from the original description and the present study.

	E. riograndensis Massey (1964)	*E. riograndensis* Lectotypes (Present study)
Females		
n	5	4
Length (µm)	750–910	630–780
a	25–34	25.2–31.5
b	6.4–8.5	6.8–9.5
V	80	79–81.5
Stylet (µm)	22[a]	22–23
Males		
n	5	4
Length (µm)	670–810	620–650
a	24–34	26–31
b	6.3–8	7.1–8.1
c	16–18	22.5–26
Stylet (µm)	21[a]	21–22
Spicules (µm)	24[a]	20–22.5

[a] Calculated from figures.

DISCUSSION

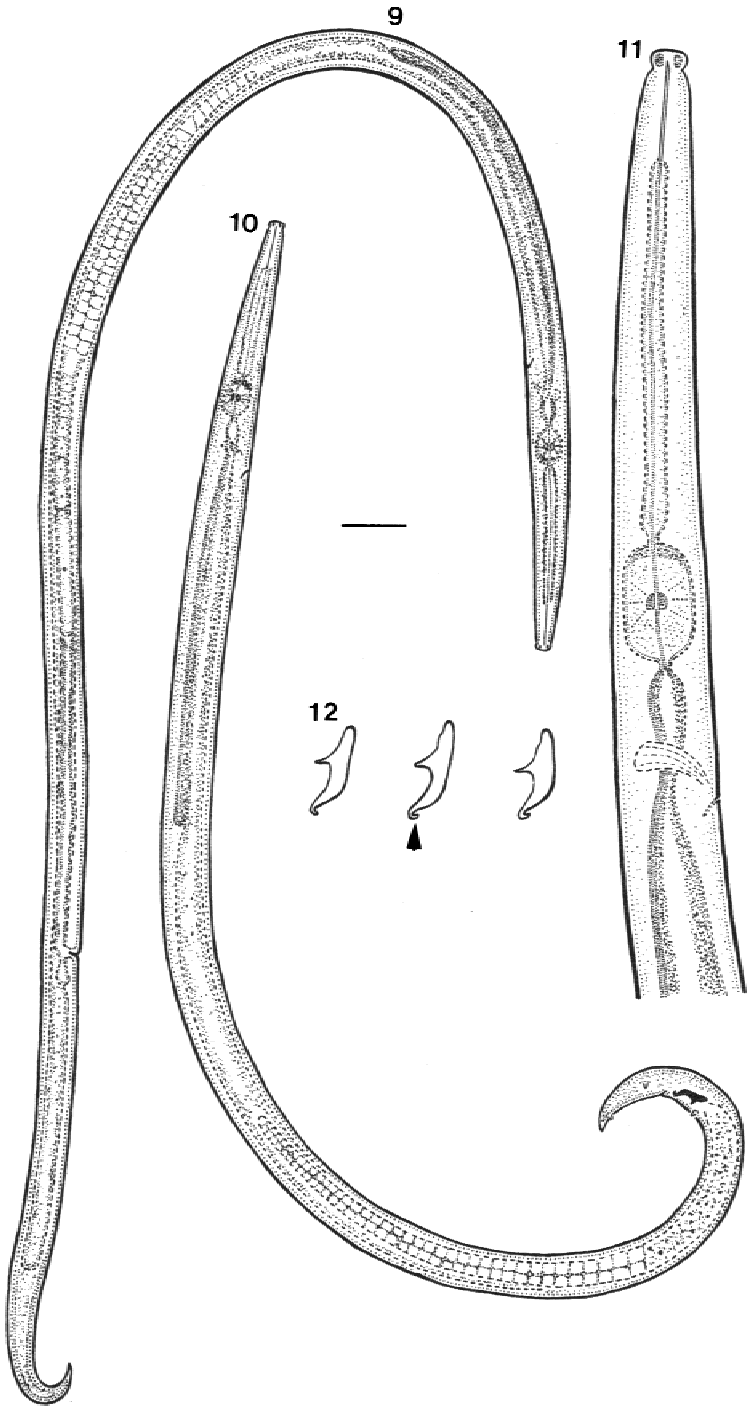
Recent *Ektaphelenchus* species lists by Ebsary (1991) and Hunt (1993) differ significantly regarding the taxonomic status of *E. obtusus, E. riograndensis,* and *E. scolyti*. Ebsary's list follows that of Baujard (1984), which synonymized *E. macrostylus* Khan, 1960 with *E. obtusus* and reestablished *E. riograndensis* and *E. scolyti* as valid species in the genus. Conversely, Hunt considered *E. obtusus* and *E. macrostylus* as separate species and listed *E. riograndensis* and *E. scolyti* as *Cryptaphelenchoides* species.

Hunt rejected the synonymy of *E. macrostylus* with *E. obtusus* based on body-length measurements reported by Baujard. In Baujard's study, *E. obtusus* was significantly longer than *E. macrostylus* (females = 960 µm vs. 610–700 µm; males = 920 µm vs. 620–710 µm). In the present study, measurements of *E. obtusus* (females = 640–790 µm; males = 620–690 µm) were within ranges reported for *E. macrostylus* by Khan and Baujard. Because these two nematodes are similar morphologically and morphometrically and share a common host, *Dendroctonus pseudotsugae* Hopkins, it seems likely that they represent a single species.

Goodey (1960) transferred *E. macrobulbosus* to the genus *Cryptaphelenchoides* Goodey, 1960 based on the presence of an apophysis at the distal end of the spicules. Hunt and Hague (1976) used the same character to transfer *E. riograndensis* and *E. scolyti* to the same genus. Because an apophysis is also found in *E. obtusus,* it appears that *E. macrobulbosus, E. riograndensis,* and *E. scolyti* should be retained in the genus *Ektaphelenchus*. Another character that defines *Cryptaphelenchoides* is the presence of six lips of equal size. The same character is also found in *E. skrjabini* Lazarevskaya, 1961; *E. sandiaensis* Massey, 1964; *E. olitorius* (Chaturvedi & Khera, 1977) Baujard, 1984; and *E. joyceae* Kaisa, Harman & Harman, 1995. The presence of the same characters within *Ektaphelenchus* and *Cryptaphelenchoides* suggests that the two genera might be synonymous and that *Cryptaphelenchoides* should be considered a synonym of *Ektaphelenchus* as proposed by Massey (1974), Andrássy (1976), Baujard (1984), and Ebsary (1991). A rediagnosis of the genus *Ektaphelenchus* is herein considered.

Genus Ektaphelenchus (Fuchs, 1937)
Skrjabin et al., 1954
syn. *Parasitaphelenchus* (*Ektaphelenchus*)
Fuchs, 1937
syn. *Cryptaphelenchoides* Goodey, 1960
syn. *Caballeroides* Chaturvedi & Khera, 1977

Female 466 to 1,320 µm long, body ventrally curved. Tail short, conical to pointed or rounded terminus. Head set off, rounded or flat. Lips of equal or unequal size. Stylet long (≥15 µm), knobs present or absent. Median bulb oblong, valves median or postmedian. Esophageal gland lobes long (five to ten body widths). Intestine terminating in blind sac; rectum and anus absent or vestigial. Ovary single, oocytes in single or multiple rows. Postuterine sac present, length variable. Vulva posteriorly located (V 65–91), flap absent. Males unknown in some species. Body 370 to 1,056 µm long, ventrally curved. Testis single, spermatocytes in single



Figs. 9–12. *Ektaphelenchus scolyti* Rühm, 1956. 9) Full view of female. 10) Full view of male. 11) Head and neck of female. 12) Spicules showing apophysis (arrow head). Scale = 27 µm in Figs. 9, 10; 10 µm in Figs. 11, 12.

or multiple rows. Spicules paired, apex and rostrum well developed. Apophysis present or absent at distal end of spicules. Tail sharply curved; two to three pairs of caudal papillae present. Bursa and gubernaculum absent.

TABLE 3. Comparison of morphometrics of *Ektaphelenchus scolyti* Rühm, 1956 from various authors and the present study.

	E. scolyti *Rühm (1956)*	*E. scolyti* Hunt and Hague (1976)	*E. scolyti* present study
Females			
n	?	20	2
Length (μm)	900–1,185	780–1,004	810–820
a	32.1–48.4	42–53	41
b	8–17.8	7.1–9.7	8–9
V	65–75.5	76–79	75–78
Stylet (μm)	21	16–20	15
Males			
n	?	20	2
Length (μm)	690–765	630–823	628–700
a	32.9–36.4	35–48	35–36
b	6.8–8.4	7.2–9.6	8–9
c	25.5–27.1	16–20	23
Stylet (μm)	15–17	14–18	15
Spicules (μm)	14–15	14–17	15–18

LITERATURE CITED

Andrássy, I. 1976. Evolution as the basis for the systematization of nematodes. London, UK: Pitman Publishing.

Baujard, P. 1984. Remarques sur la sous-famille des Ektaphelenchinae Paramonov 1964 et proposition d'*Ektaphelenchoides* n. gen. (Nematoda: Aphelenchoididae). Revue de Nématologie 7:147–171.

Ebsary, B. A. 1991. Catalog of the Order Tylenchida (Nematoda). Ottawa, Canada: Agriculture Canada.

Goodey, J. B. 1960. The classification of the Aphelenchoidea Fuchs, 1937. Nematologica 5:111–126.

Hunt, D. J. 1993. Aphelenchida, Longidoridae, Trichodoridae: Their systematics and bionomics. Wallingford, UK: CAB International.

Hunt, D. J., and N. G. M. Hague. 1976. The bionomics of *Cryptaphelenchoides scolyti* n. comb., syn. *Ektaphelenchus scolyti* Rühm, 1956 (Nematoda: Aphelenchoididae), a nematode associate of *Scolytus scolytus* (Coleoptera: Scolytidae). Nematologica 22:212–216.

Khan, M. A. 1960. Description of two nematodes *Ektaphelenchus macrostylus* n. sp. and *Laimaphelenchus ulmi* n. sp., with a key to the species of *Laimaphelenchus*. Canadian Journal of Zoology 138:91–97.

Massey, C. L. 1956. Nematode parasites and associates of the Engelmann spruce beetle (*Dendroctonus adjunctus* Hopk.). Proceedings of the Helminthological Society of Washington 23:14–24.

Massey, C. L. 1964. Two new species of the nematode genus *Ektaphelenchus* (Nematoda: Aphelenchoididae) parasites of bark beetles in the Southwestern United States. Proceedings of the Helminthological Society of Washington 31:37–40.

Massey, C. L. 1974. Biology and taxonomy of nematode parasites and associates of bark beetles in the United States. Agricultural Handbook no. 446. USDA Forest Service, Washington, DC: US Government Printing Office.

Rühm, W. 1956. Die Nematoden der Ipiden. Parasitologische Schriftenreihe no. 6. Jena.