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Geocenamus angelescresti n. sp., a Diagnostic Key and Compendium to the Species of the Genus *Geocenamus* Thorne & Malek, 1968 (Nematoda: Belonolaimidae)

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Abstract: *Geocenamus angelescresti* n. sp. (Nematoda: Belonolaimidae) was found in rhizosphere of *Pinus ponderosa* and *Arctostaphylos patula* growing along Angeles Crest Highway in the San Gabriel mountains of California. The nematode species is characterized by a round-to-hexagonal labial disc with six bulging sectors, lateral sectors of first labial annule smaller than the submedian sectors, six to eight labial annules, distinct deirids, stylet length (45–57 µm), body length (666–996 µm), lateral field with or without areolation of outer bands on tail, and a rounded, smooth tail terminus. *Geocenamus angelescresti* n. sp. most closely resembles *G. superbus* but differs from it by a shorter stylet (45–57 µm vs. 67 µm), shorter body length (666–996 µm vs. 1,200 µm), bulged sectors and smaller diameter of the labial disc (2.3–2.8 µm vs. 4.0 µm, round, smooth), longer female tail (54–68 µm vs. 41 µm), and a narrower tail terminus. An emended description of the genus and a list of valid species are provided. *Geocenamus arcticus* (Mulvey, 1969) Tarjan 1973 and *G. uralensis* Baydulova 1983 are proposed as junior synonyms of *G. tenuidens* Thorne & Malek 1968. An identification key to 12 species of *Geocenamus* and a compendium of important diagnostic morphological characters used in the identification of species are included.

Key words: Belonolaimidae, compendium, diagnostic key, *Geocenamus, Geocenamus angelescresti,* morphology, new species, taxonomy.

The genus *Geocenamus* was established by Thorne and Malek (1968) in the subfamily Tylenchorhynchinae to include the type and only species, *G. tenuidens,* and was distinguished from other genera within the subfamily by a labial disc from which the slender stylet guide extends back almost one-third the length of the exceedingly slender stylet, and a weakly developed cephalic framework. Since then the number of species has increased and decreased following divisions of the genus *Tylenchorhynchus* sensu lato. Currently, *Geocenamus* contains 14 species. Siddiqi (1979) placed *Geocenamus* under Merliniinae and emended the description to include a lip region offset by deep constriction, spear conus markedly longer than half the spear length, and cuticle marked by longitudinal striae. Fortuner and Luc (1987), however, considered the round labial disc and elongate stylet to be derived characters and placed *Geocenamus* under Belonolaiminae, with *Hexadorus* as a junior synonym, and thereby recognized eight valid species. Later, Fortuner and Luc (1988) modified the description of *Geocenamus* to include species with or without deirids, and did not consider stylet length as a valid diagnostic criterion at the genus level for separating *Pathotylenchus,* created by Eroshenko and Volkova (1987), from *Geocenamus.* Brzeski (1991) considered *Merlinius* and *Scutylenchus* (with *Hexadorus* and *Pathotylenchus*) as morphological variants and junior synonyms of *Geocenamus* and subsequently recognized 67 species. Volkova (1995) rejected Brzeski's synonymy of genera and accepted only five species in *Geocenamus,* three of which were from the Primorje Territory in Russia. Siddiqi (2000) also rejected Brzeski's proposal and recognized 13 valid species in *Geocenamus* within Merliniinae, characterized by a long stylet conus markedly longer than shaft and a bulbous, six-sectored cephalic region with a well-marked, rounded perioral disc. In the present study, we agree with Siddiqi's characterization of *Geocenamus,* however emended.

In September 2003, a new species of *Geocenamus* sp. was found in soil samples collected from western yellow pine and greenleaf manzanita in the San Gabriel Mountains in California, thereby resulting in the current study. The objectives of this study were to (i) review the literature and compile a compendium of the differentiating diagnostic morphological characters of valid species of *Geocenamus* and (ii) describe the new species *Geocenamus angelescresti* n. sp.

Materials and Methods

Soil was collected from the rhizospheres of *Pinus ponderosa* (western yellow pine) and *Arctostaphylos patula* (greenleaf manzanita) along the Islip Saddle, Angeles Crest highway, at N 34° 21′, W 117° 55′, altitude 6,658 feet in the San Gabriel mountains in California. The soil profile at the sample sites comprised sandy soil covered by a thick organic layer at 2,042 m above sea level. Male and female specimens of *G. angelescresti* n. sp. were extracted from the soil samples suspended in water decanted through a 850-µm-pore sieve and collected on a 38-µm-pore sieve. Material caught on the 38-µm-pore sieve was placed on a Baermann funnel for 48 hours to extract the nematodes. For light microscopy, specimens were heat-killed and fixed in double strength FAA (6 ml formalin: 20 ml distilled water) and processed to dehydrated glycerin according to Seinhorst (1959). Measurements (Table 1) and illustrations were made from specimens in glycerin, using a camera lucida attach-

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TABLE 1. Morphometrics of holotype female, allotype male, and female and male paratypes of *Geocenamus angelescresti* n. sp.

	Holotype female	Allotype male	Female paratypes (n = 24)	Male paratypes (n = 11)
			Measurements in µm	
L	861.1	801.1	887.2 ± 58.6 (801–996)	838.3 ± 81.9 (666–915)
Lip region height	6.0	5.8	5.8 ± 0.5 (5–7)	5.6 ± 0.6 (5–7)
Lip region width	11.0	9.8	10.7 ± 0.6 (10–12)	9.7 ± 0.7 (8–10)
Stylet cone	30.0	28.8	30.5 ± 1.2 (28–32)	28.9 ± 1.7 (26–31)
Stylet shaft	19.2	19.8	19.7 ± 1.5 (16–22)	19.2 ± 1.9 (16–23)
Stylet length	52.2	50.6	53.3 ± 1.8 (50–57)	50.7 ± 3.2 (45–56)
Stylet knob height	3.0	2.0	3.0 ± 0.4 (2–4)	2.7 ± 0.3 (2–3)
Stylet knob width	6.0	5.2	5.9 ± 0.5 (5–7)	5.5 ± 0.4 (5–6)
Stylet base to DGO	2.8	4.0	3.0 ± 0.5 (2–4)	3.2 ± 0.7 (2–4)
Body width at stylet base	23.2	18.4	22.6 ± 0.8 (21–24)	18.9 ± 1.0 (17–20)
Body width near mid body[a]	—	22.8	—	23.9 ± 1.9 (20–26)
Body width at vulva	30.4	—	29.0 ± 1.4 (27–32)	— —
Body width at anus	22.4	20.2	22.7 ± 1.6 (19–26)	20.8 ± 1.2 (18–22)
Anterior end to median bulb	93.2	90.6	91.9 ± 4.3 (83–92)	87.5 ± 6.0 (77–98)
Anterior end to median valve	103.0	98.6	100.9 ± 4.7 (90–110)	96.3 ± 6.8 (84–107)
Median bulb width	14.0	10.8	3.2 ± 0.4 (2–4)	11.2 ± 0.8 (10–13)
Median bulb length	18.4	18.0	21.0 ± 1.5 (17–23)	20.8 ± 2.5 (18–25)
Anterior end to nerve ring	124.0	115.4	118.7 ± 6.0 (107–132)	113.6 ± 7.0 (101–121)
Anterior end to excretory pore	144.2	141.4	141.7 ± 8.0 (128–156)	136.1 ± 9.0 (116–148)
Isthmus length	47.2	47.4	41.5 ± 44. (32–48)	45.1 ± 3.1 (41–50)
Basal bulb length	29.6	26.8	31.5 ± 1.9 (28–35)	27.6 ± 2.3 (24–31)
Tail length	54.4	72.0	62.0 ± 4.5 (54–68)	72.4 ± 6.1 (61–79)
Spicule length	—	29.0	—	30.2 ± 2.5 (26–33)
Gubernaculum length	—	10.8	—	12.2 ± 1.0 (11–14)
			Ratios	
a	28.3	35.1	30.6 ± 1.9 (27–34)	34.8 ± 1.8 (31–37)
b	4.5	4.4	4.8 ± 0.3 (4–6)	4.6 ± 0.3 (4–5)
c	15.8	11.1	14.4 ± 1.2 (12–16)	11.6 ± 0.9 (10–13)
c′	2.4	3.6	2.7 ± 0.3 (2–3)	3.5 ± 0.2 (3–4)
			Percentages	
V	57.1	—	57.7 ± 1.4 (56–62)	—
M	57.5	56.9	57.2 ± 1.9 (54–62)	57.0 ± 1.9 (53–60)
MB	48.3	49.6	49.5 ± 1.6 (47–53)	48.4 ± 1.5 (46–52)
O	5.4	7.9	5.7 ± 1.0 (4–8)	6.4 ± 1.2 (5–9)
Phasmid % tail	36.8	37.8	34.6 ± 6.0 (23–49)	37.8 ± 4.1 (28–41)
			Number of annules	
Tail annule (ventral)	31	—	33.8 ± 4.4 (25–40)	—

[a] Body width near mid body measured at vulva for holotype and female paratypes.

ment to obtain 110× and 2,250× magnifications. Number of tail annules in females was measured on the ventral body side, from the anus to the posterior terminus. M stands for the percent length of the anterior stylet cone divided by total stylet length. O is the percent distance from the stylet base to the dorsal esophageal gland orifice divided by total stylet length. MB is the percent distance of the middle of the median bulb from the anterior end divided by total esophageal length. Specimens fixed in FAA were processed for scanning electron microscopy (SEM) as described by Chitambar (1992). Specimens were attached to aluminum foil on stubs and sputtered with 30 nm gold-palladium, then examined at 15 kV.

Diagnostic information for the compendium was compiled from original descriptions and redescriptions. Table 2 contains the compendium with updated morphometric and morphological information of the most useful diagnostic characters of species considered valid. Data absent in the text of published descriptions were extrapolated from published illustrations of species and indicated by a superscripted letter. Different shapes of tail termini found within the genus are designated by codes that are used in the compendium (Fig. 1). Paratype specimens of *G. superbus* (= *Tylenchorhynchus superbus*) were available for examination.

Systematics

Genus *Geocenamus* Thorne & Malek, 1968
= *Hexadorus* (Ivanova & Shagalina, 1983) Fortuner & Luc, 1987
= *Pathotylenchus* (Eroshenko & Volkova, 1988) Fortuner & Luc, 1990

Emended diagnosis: Body small to medium (660–2,150 µm). Labial region bulbous, offset, with six longitudinal incisures (12 in *G. deserticola*), five to nine annules, and a distinct, round-to-hexagonal labial disc, surrounded by well-demarcated sectors of the first labial annule. Lateral sectors smaller and flattened or same size as submedian sectors. Cuticle annulated, with or without additional longitudinal striae outside of lateral field extending throughout body; short, irregular lines may demarcate annules at anterior end. Cephalic framework weakly or strongly developed. Lateral field with six lines, completely or partially areolated throughout body. Deirids absent or present. Stylet 20–132 µm long, slender, cone longer than shaft. Epiptygma present. Female tail conical with broadly or narrowly rounded terminus (digitate in *G. khashanicus*). Spicules slightly arcuate, without velum, notched at tip. Gubernaculum crescent-shaped, not protruding from cloaca.

Type species: Geocenamus tenuidens Thorne & Malek, 1968
= *Tylenchorhynchus polonicus* Szcygiel, 1970
= *G. polonicus* (Szcygiel, 1970) Sturhan, 1981
= *G. arcticus* (Mulvey, 1969) Tarjan, 1973 n. syn.
= *G. uralensis* Baydulova, 1983 n. syn.

Other species:
G. angelescresti n. sp.
G. arealoferus (Razzhivin, 1971) Fortuner & Luc, 1987
= *Morulaimus arealoferus* Razzhivin, 1971
= *Hexadorus arealoferus* (Razzhivin, 1971) Ivanova & Shagalina, 1983
= *Geocenamus arealoferus* (Razzhivin, 1971) Brzeski, 1991

G. deserticola (Ivanova & Shagalina, 1983) Fortuner & Luc, 1987
= *Hexadorus deserticola* Ivanova & Shagalina, 1983

G. khashanicus Volkova, 1995
G. kirjanovae (Sagitov, 1973) Fortuner & Luc, 1987
= *Dolichodorus kirjanovae* Sagitov, 1973
= *Merlinius kirjanovae* (Sagitov, 1973) Loof & Sharma, 1975
= *Nagelus kirjanovae* (Sagitov, 1973) Siddiqi, 1979
= *Hexadorus kirjanovae* (Sagitov, 1973) Siddiqi, 1986
= *Pathotylenchus kirjanovae* (Sagitov, 1973) Eroshenko & Volkova, 1987

G. longus (Wu, 1969) Tarjan, 1973
= *Tylenchorhynchus longus* Wu, 1969
= *Scutylenchus longus* (Wu, 1969) Skwiercz, 1984
= *Merlinius longus* (Wu, 1969) Sturhan, 1981
= *Pathotylenchus longus* (Wu, 1969) Eroshenko & Volkova, 1987
= *Geocenamus longus* (Wu, 1969) Brzeski, 1991

G. nurserus (Eroshenko & Volkova, 1987) Fortuner & Luc, 1990
= *Pathotylenchus nurserus* Eroshenko & Volkova, 1987
= *Merlinius nurserus* (Eroshenko & Volkova, 1987) Fortuner & Luc, 1990 [acc.to Siddiqi, 2000]
= *Geocenamus nurserus* (Eroshenko & Volkova, 1987) Brzeski, 1991

G. patternus Eroshenko & Volkova, 1987

G. squamatus Eroshenko & Volkova, 1988

G. superbus (Allen, 1955) Fortuner & Luc, 1987
= *Tylenchorhynchus superbus* Allen, 1955
= *Merlinius superbus* (Allen, 1955) Siddiqi, 1970
= *Nagelus superbus* (Allen, 1955) Siddiqi, 1979
= *Pathotylenchus superbus* Eroshenko & Volkova, 1987
= *Geocenamus superbus* (Allen, 1955) Brzeski, 1991

G. tokobaevi (Sultanalieva, 1983) Fortuner & Luc, 1987
= *Morulaimus tokobaevi* Sultanalieva, 1983
= *Hexadorus tokobaevi* (Sultanalieva, 1983) Siddiqi, 1986

Discussion

Species within *Geocenamus* can be differentiated from *Merlinius* mainly by the derived characters: bulbous la-

TABLE 2. Diagnostic data on species of *Geocenamus* spp. females

Species	Length (µm)	Stylet (µm)	Lip annules	Cephalic framework[a]	Longl. striae[b]	Deirids[c]	Lateral field areolation[d]	b	c	Tail annules	Tail length (µm)	Tail tip annulations[e]	Tail terminus[f]	References[g]
angelescresti	801–996	50–57	6–8	WEK	ABS	DIST	PAR	4.2–5.5	12.1–16.4	25–40	54–68	SMO	RND	I
areoloferus	1,295–1,489	120–132	7	STR	ABS	NOM	COM	5.3–5.9	20.3–25.2	21–22	57	ANN	BDR	II
deserticola	1,010–1,500	60–70	5–6	WEK	ABS	NOM	COM	6.8–11.8	18.6–25.2	39–45	49–58	SMO	RND	III
khashanicus	820–960	27–29	6	WEK	ABS	ABS	ABS	5.5–6.4	12.0–14.0	42–51	66–75	SMO	DIG	IV
kirjanova	1,531–1,813	95–100	8–10	STR	ABS	NOM	ABS	7.7–9.7	18–19.8	44[h]	84[h]	SMO	BLT	V
longus	860–1,400	53–69	6–8	WEK	IRP	ABS	PAR	4.2–6.4	14.0–22.0	20–57	48–72	ANN	RND	VI
nurserus	1,400	96–107	8–9	WEK	ABS	DIST	COM	4.8–5.6	18.0–24.0	27[h]	62[h]	ANN	BDR	VII
patternus	1,000–1,100	28–29	5–6	WEK	PRS	NOM	PAR	6.0–6.4	13.0–18.0	39[h]	38[h]	ANN	BPT/DIG	VII
squamatus	890–920	26	6	WEK	PRS	ABS	ABS	5.2–5.8	17.1–17.5	26	51[h]	ANN	RND	VIII
superbus	1,120	67	8	WEK	ABS	DIST	ABS	5.6	22.0	29[h]	41	SMO	BDR	IX
tenuidens	660–1,390	21–38	5–7	WEK	ABS	ABS	PAR	5.0–8.8	12.0–26.0	32–80	43–80	SMO/ANN	RND	X
tokobaevi	1,800–2,150	100	7	STR	ABS	NOM	ABS	6.5–7.8	18.6–26.4	?	80	SMO	RND	XI

[a] Cephalic framework: WEK = weakly sclerotized; STR = strongly sclerotized.
[b] Longitudinal striae (body longitudinal striation outside lateral field): ABS = absent; PRS = present; IRP = irregular striae present (forming blocks with transverse striae).
[c] Deirids: DIST = distinct; ABS = absent; NOM = not mentioned in text or illustrated.
[d] Lateral field areolation: PAR = partial (only outer chords or posterior region areolated); COM = complete (all chords areolated throughout body); ABS = absent.
[e] Tail tip annulations: ANN = annulated; SMO = smooth.
[f] Tail terminus shape: RND = round; BDR = broadly round; BLT = blunt; DIG = digitate; BPT = bluntly pointed; BLR = bluntly round.
[g] References: I = n. sp.; II = Razzhivin, 1971; III = Ivanova & Shagalina, 1983; IV = Volkova, 1995; V = Sagitov, 1973; VI = Wu, 1969; Knobloch, 1971; Sturhan, 1981; Skwiercz, 1984; Eroshenko & Volkova, 1988; Powers, 2003; VII = Eroshenko & Volkova, 1987; VIII = Eroshenko & Volkova, 1988; IX = Allen, 1955; X = Thorne & Malek, 1968; Mulvey, 1969; Loof, 1971; Tarjan, 1973; Sturhan, 1981; Baydulova, 1983; Eroshenko & Volkova, 1988; Brzeski, 1991; Powers, 2003; XI = Sultanalieva, 1983.
[h] Measured from original figure.

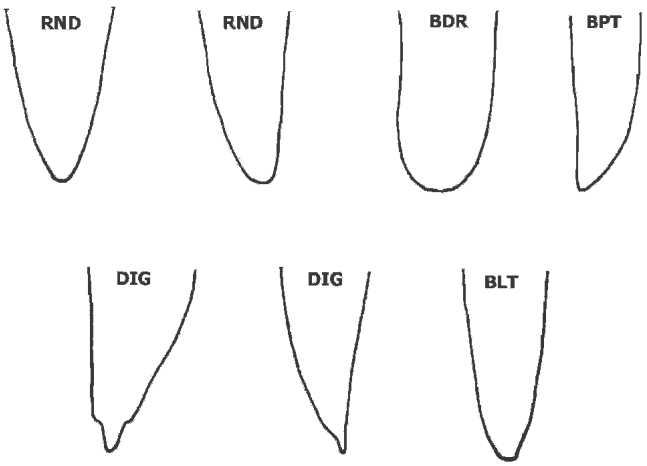

FIG. 1. *Geocenamus* spp. Tail terminus shapes with codes used in the compendium. RND = round; BDR = broadly round; BPT = bluntly pointed; DIG = digitate; BLT = blunt.

bial region, an elongate stylet with a conus distinctly longer than the shaft, and a distinctly round-to-hexagonal labial disc. Although Brzeski (1991) considered *Merlinius* a junior synonym of *Geocenamus* and discussed the morphological variations within a subsequent larger species group, we believe the variations reported in the above-derived characters still separate the species recognized here in *Geocenamus* from those in *Merlinius*.

Sturhan (1981) reported that populations of *Geocenamus arcticus* from Canada (Mulvey, 1969), Spitzbergen (Loof, 1971), and northern Germany (Sturhan, 1981) differed from *G. tenuidens* only by a smooth tail terminus. However, smooth tail termini have been occasionally observed in *G. tenuidens* (Sturhan, 1981). Furthermore, Powers (2003b) reported an Alaskan population of *G. arcticus* with partially and completely annulated tail termini. Brzeski (1998) considered *G. arcticus* a synonym of *G. tenuidens;* however, thereafter the former species has been reported valid (Siddiqi, 2000). We agree with Brzeski (1998) and herein consider *G. arcticus* a junior synonym of *G. tenuidens*.

Geocenamus uralensis was considered morphologically close to *G. tenuidens* and *G. arcticus* and differentiated from these species by a curved gubernaculum, peloderan bursa, shorter stylet, shorter body length, and smaller c value (Baydulova, 1983). However, morphometric values for stylet, body length, and c are no longer valid distinguishing characters as they fall well within the range of values that include all populations of *G. tenuidens* (Baydulova, 1983; Brzeski, 1991; Eroshenko and Volkova, 1988; Loof, 1971; Mulvey, 1969; Powers, 2003a; Sturhan, 1981; Tarjan, 1973; Thorne and Malek, 1968). A curved gubernaculum and peloderan bursa are common to all species of the genus and cannot be used as valid characters to differentiate *Geocenamus* species. Therefore, *G. uralensis* is herein considered a junior synonym of *G. tenuidens*.

Geocenamus angelescresti n. sp.
(Figs. 2–4)

Morphometrics of the holotype female, allotype male, and paratype females and males are given in Table 1.

Description

Female: Body slightly ventrally arcuate when heat-killed, tapered at anterior and posterior ends. Cuticle in two layers; inner layer finely striated, distinct from region near stylet base to posterior end; outer layer more broadly annulated, each annule 1.4–1.8 µm wide. Excluding lateral field, cuticle without longitudinal striae or ridges. [Small irregular longitudinal ridges within annules, and short longitudinal ridges three to four annules long on either side of vulva (Fig. 3F) are likely due to shrinkage during preparation and not considered diagnostic for the species.] Cuticle of dorsal posterior tail end often marked with longitudinal striae extending three to four annules in length and appearing columnar before converging to a smooth tail ter-

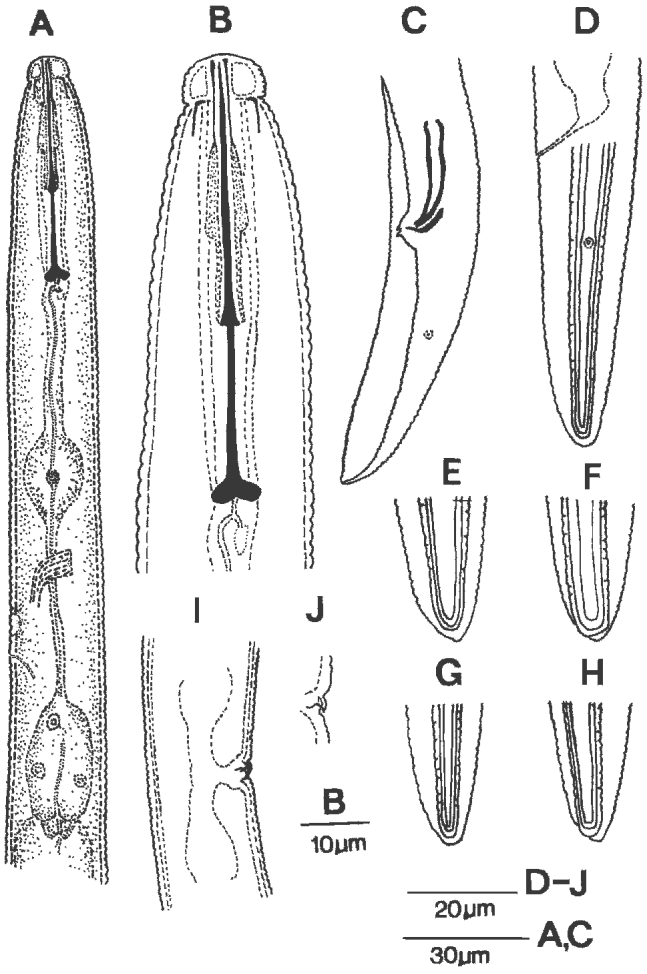

FIG. 2. *Geocenamus angelescresti* n. sp. A, B, D–J: Females. A) Anterior body. B) Anterior end. C) Male, posterior end. D) Posterior body. E–H) Tail termini. I) Vulva region. J) Double epitygma.

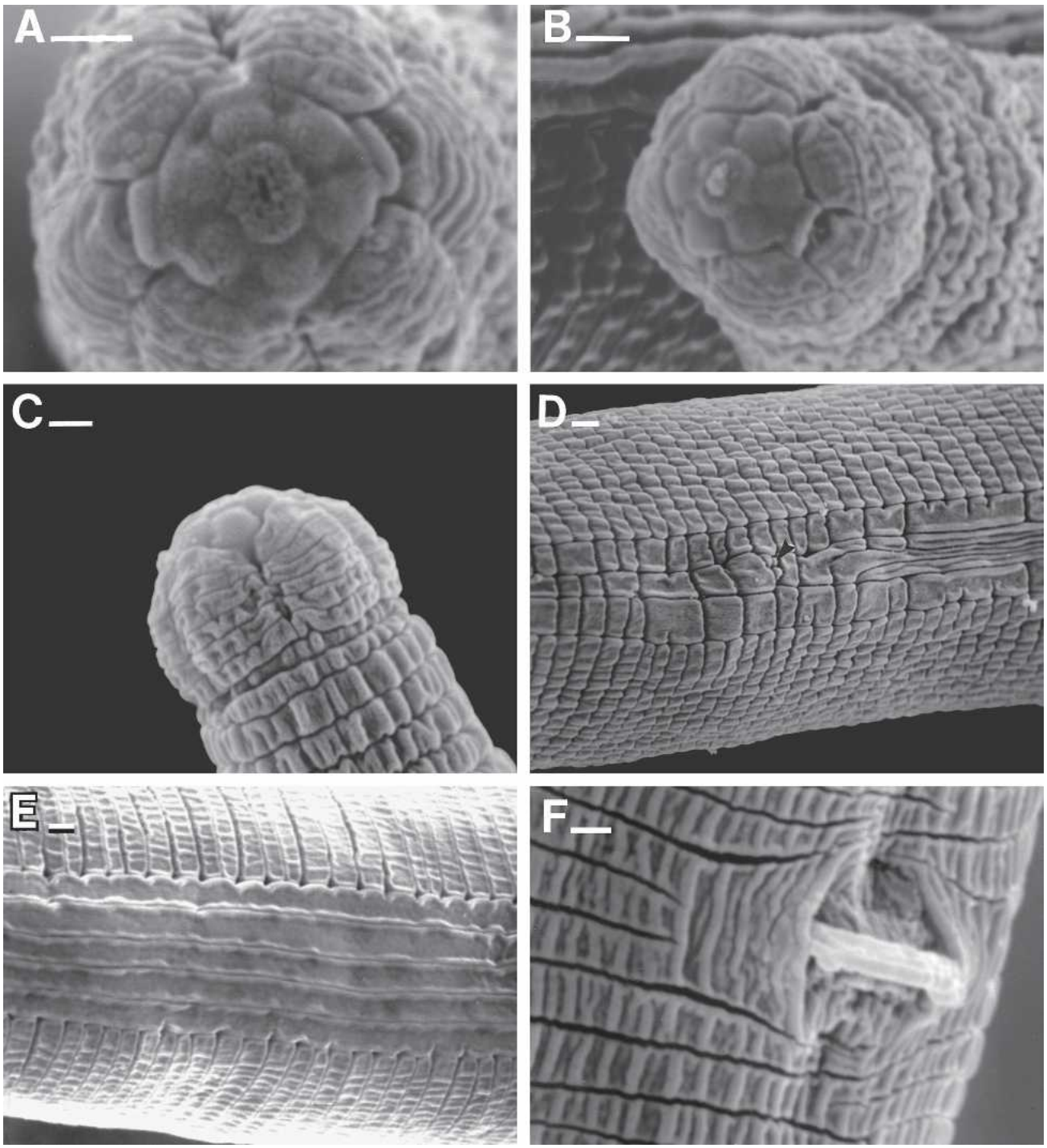

FIG. 3. Scanning electron micrographs of *Geocenamus angelescresti* n. sp. females. A, B) Face views. C) Anterior end, ventral view. D) Lateral field at anterior body, arrowhead indicates deirid. E) Lateral field near mid body. F) Vulval region. (Scale bar: A–F = 1 µm).

minus (Fig. 4G). Near anterior end, lateral field initiates as two longitudinal incisures, expanding to four incisures up to isthmus region and then extending as six incisures from level of posterior region of esophageal bulb to tail terminus where the bands form a square terminus (Figs. 3D–E;4G); innermost incisures may converge just anterior to tail terminus; outer incisures crenate; lateral field bands completely areolated resembling blocks from anterior end to just posterior to deirid (Fig. 3D); thereafter, outer bands areolated throughout entire body but less frequently or sometimes absent on tail. Deirids present at level of esophageal isthmus and specifically just anterior to transition in lateral field from four to six incisures (Figs. 3D;4J). Lip region rounded, bulbous, slightly flattened anteriorly, set off from anterior body by constriction; labial annules six to eight; annules with six longitudinal incisures demarcating into six lobes: two subdorsal, two

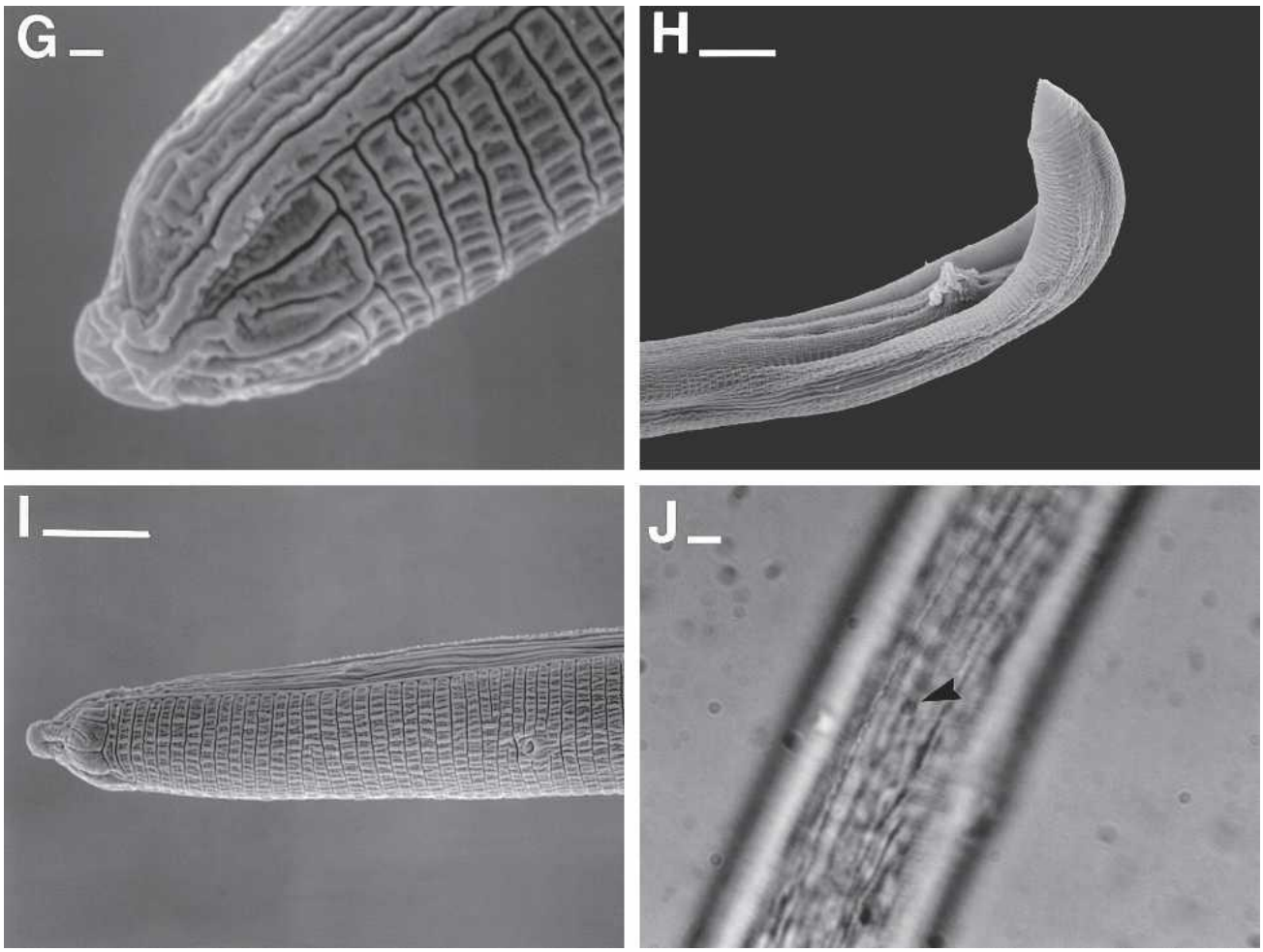

Fig. 4. *Geocenamus angelescresti* n. sp. G–I) Scanning electron micrographs. G) Female tail terminus, sublateral view. H) Male posterior body, subventral view. I) Female posterior body, subventral view. J) Light micrograph of female anterior body cuticular surface indicating (arrowhead) deirid. (Scale bar: G = 1 µm; H, I = 10 µm; J = 2 µm).

subventral, two lateral longitudinal incisures defining lobes may terminate one or two annules anterior to constriction of lip region. Transverse stria forming first body annule at constriction usually with anastomosis. Oral aperture rectangular, the longer axis being dorsoventrally directed, surrounded by wide, rectangular-to-hexagonal bulging rim bearing six labial sensilla; labial disc round to slightly hexagonal, approximately 2.8 µm diam., with six equally bulging labial disc sectors (two subventral, two subdorsal, one ventral, one dorsal) delimited by broad indentations but not striae; labial rim and disc prominently bulged but not demarcated by striae. First labial annule six-sectored (two subdorsal, two subventral, and two lateral); lateral sector slightly flattened and smaller than remaining sectors. Sectors of first labial annule do not correspond with labial disc sectors in position. (Figs. 3A,B;5) Amphid apertures circular to oval, wide, located at lateral edge of labial disc, and separated from it by distinct partial amphidial shields. Cephalic framework mostly inconspicuous, basal plate sclerotized, extending posteriorly three to four annules. Cheilorhabdions distinctly sclerotized, thicker at anterior end, 10–11 µm long (Fig. 2B). Stylet conus slender, elongate, approximately 1.6 times longer than shaft; stylet basal knobs rounded, sloping posteriorly, with or without distinct cavity between knobs. Esophageal isthmus slender, straight, approximately 1.4 times longer than basal bulb. Excretory pore near posterior end of isthmus, anterior to basal bulb, three annules below hemizonid. Hemizonid three annules long. Vulva with double epiptygma, overlapping each other or occasionally outstretched laterally, sunken into vulval cavity. Vagina walls thickened at anterior end. Spermatheca bilobed, spherical, offset, filled with large, round sperm. Ovaries outstretched. Tail gradually tapers to rounded, smooth terminus; dorsal and ventral terminal sides may be offset from lateral sides due to distinct extension of lateral field to posterior terminus. Tail annules 29–41 on ventral side.

Male: Similar to female but more ventrally arcuate. Spicules proximally straight, distal quarter ventrally curved. Gubernaculum crescent-shaped, not protruded, thickened distally, tapered, narrow proximally. Bursa peloderan, finely annulated.

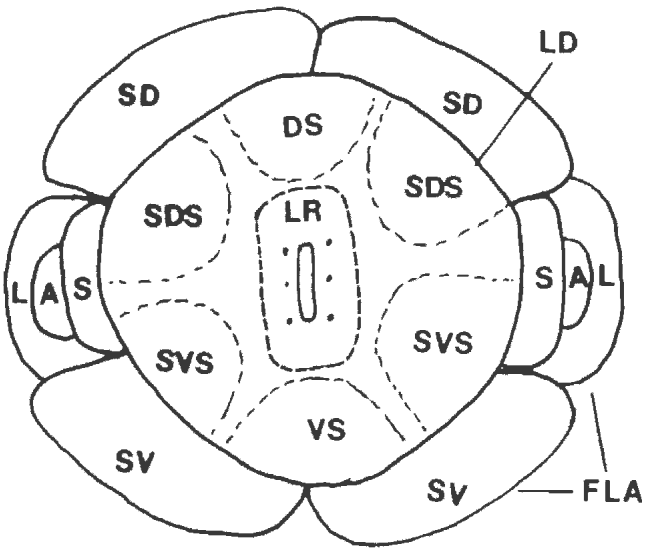

FIG. 5. Illustration showing details of face view of *Geocenamus angelescresti* n. sp. LD = labial disc: LR = labial rim; DS = dorsal sector; VS = ventral sector; SDS = subdorsal sector; SVS = subventral sectors. FLA = first labial annulus: SD = subdorsal sector; SV = subventral sector; L = lateral sector; A = amphid; S = amphid shield.

Type host and locality

Type specimens extracted from rhizosphere soil samples collected in September 2003 from western yellow pine (*Pinus ponderosa*) and greenleaf manzanita (*Arctostaphylos patula*) growing at Islip Saddle, Angeles Crest Highway, at N 34° 21′, W 117° 55′, altitude 6,658 feet, in the San Gabriel mountains in California.

Type designations

Holotype female, allotype male, seven female and three male paratypes deposited in the University of California, Davis Nematode Collection (UCDNC), Department of Nematology, University of California, Davis; three male and seven female paratypes deposited in the University of California, Riverside Nematode Collection (UCDRNC), Department of Nematology, University of California, Riverside; three male and seven female paratypes deposited in the USDA Nematode Collection, Beltsville, Maryland; and additional paratypes deposited in the California Department of Food and Agriculture permanent nematode slide reference collection.

Etymology

The species is named after the geographic location and in celebration of the Angeles Crest 161-km endurance race as samples were collected on the day of the event, just 6.1 meters from the course.

Diagnosis

Geocenamus angelescresti n. sp. is characterized by the structure of the labial disc with six bulging sectors; lateral sectors of the first labial annule smaller than submedian sectors; six to eight labial annules; deirids distinct; stylet length (50–57 µm females, 45–56 µm males); body length (801–996 µm females, 666–915 µm males); lateral field with or without areolation of outer bands on tail, and a rounded smooth tail terminus.

Geocenamus angelescresti n. sp. closely resembles *G. superbus* (Allen, 1955) Fortuner & Luc, 1987. It differs from *G. superbus* by a shorter stylet (50–57 µm vs. 67 µm), shorter body length (801–996 µm vs. 1,200 µm), face view shape of labial disc round to hexagonal with six bulging sectors and rim around oral aperture vs. round, smooth disc without sectors or rim (Powers et al, 1983), longer female tail (54–68 µm vs. 41 µm), and a narrower tail terminus.

Geocenamus angelescresti n. sp. also resembles *G. longus* (Wu, 1969) Tarjan 1973 and *G. deserticola* (Ivanova and Shagalina, 1983) Fortuner & Luc, 1987. It differs from *G. longus* by the absence of longitudinal striae, face view shape of labial disc (round and smooth in *G. longus*), presence of deirids (vs. absent), and a smooth tail terminus (vs. annulated). It differs from *G. deserticola* in body length (801–996 µm vs. 1,010–1,500 µm), number of labial longitudinal incisures (6 vs. 12), lateral sectors of first labial annule smaller than submedian vs. similar size in *G. deserticola,* areolation of lateral field (outer bands areolated vs. all bands areolated), and a shorter stylet (50–57 vs. 60–70).

Remarks

The face view of *G. angelescresti* n. sp., with six bulging sectors in the labial disc not corresponding to position of the sectors of the first labial annule or sensilla, was consistently present in several specimens examined. Similar bulging sectors also have been reported by Choi and Geraert (1994). They separated 13 species of *Geocenamus,* as recognized by Brzeski (1991), into three groups based on differences in face view patterns. Based on face view alone, *G. angelescresti* n. sp. resembles group 1 by the presence of six bulging labial disc sectors, but differs from it by the presence of six distinct sectors of the first labial annule as found in groups 2 and 3. However, as we recognize only 2 of those 13 species (namely, *G. longus* and *G. tenuidens*), the face view of *G. angelescresti* distinguishes it from other species for which SEM micrographs of face views have been reported and are similar: *G. arcticus* in Powers (2003b), *G. longus* in Hooper (1988) and Powers (2003c), *G. superbus* Allen, 1955 in Powers et al. (1983), and *G. tenuidens* (Powers, 2003a).

Key to Species of the Genus *Geocenamus*

1. Stylet length equal to or greater than 90 µm ... 2
   1a. Stylet length 20–49 µm ... 5
   1b. Stylet length 50–69 µm ... 8
2(1). Tail cylindrical, terminus broadly rounded, annulated ... 3
2a. Tail conical, terminus narrowly rounded, smooth ... 4

3(2). Stylet length 120–134 µm; lateral field completely areolated throughout entire body; cephalic framework strongly sclerotized ---------- *G. arealoferus*

3a. Stylet length 96–107 µm; lateral field not areolated throughout entire body; cephalic framework lightly sclerotized ---------- *G. nurserus*

4(2a). Lateral field incisures completely crenate; L = 1,530–1,813 ---------- *G. kirjanovae*

4a. Lateral field incisures not crenate; L = 1,800–2,150 ---------- *G. tokobaevi*

5(1a). Longitudinal striae extend throughout body---------- 6

5a. Longitudinal striae absent except in lateral field---------- 7

6(5). Tail terminus narrowly rounded almost to a point; longitudinal striae 26–28; stylet length 28–29 µm ---------- *G. patternus*

6a. Tail terminus rounded but not narrowly to a point; longitudinal striae 20; stylet length 26 µm ---------- *G. squamatus*

7(5a). Tail terminus broadly or narrowly rounded, smooth or annulated; lateral field areolated on tail, 4 incisures posterior to phasmid ---- *G. tenuidens* = *G. arcticus* = *G. uralensis*

7a. Tail terminus digitate, smooth; lateral field not areolated on tail, 6 incisures posterior to phasmid ---------- *G. khashanicus*

8(1b). Longitudinal striations intersect transverse annules forming series of blocks over entire body ---------- *G. longus*

8a. Longitudinal striations absent outside of lateral field---------- 9

9(8a). Lip region with 12 longitudinal incisures ----------*G. deserticola*

9a. Lip region with 6 longitudinal incisures--------- 10

10(9a). Female stylet 67 µm, L = 1,120 µm ---------- *G. superbus*

10a. Female stylet 50–57 µm, L = 801–996 µm ------ *G. angelescresti*

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