Journal of Nematology 21(2):189–201. 1989.

Taxonomy and Postembryonic Stages of the Nematode Predator *Odontopharynx longicaudata* de Man, 1912 (Diplogasterida)[1]

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Abstract: Odontopharynx longicaudata (Diplogasterida: Odontopharyngidae) was found in soil around roots of *Poa annua* L. growing on a golf course in San Francisco, California. This is the first record of this species in the United States. Populations of *O. longicaudata* were increased in the laboratory on the free-living nematode UCD *Acrobeloides* No. 1 (Rhabditida: Cephalobidae). Light microscopy was used to compare the morphology of fixed specimens from California and The Netherlands. California specimens were studied in greater detail by scanning electron microscopy. Emended descriptions are given for the genus and species, as well as the diagnostic morphological characters of the juvenile stages. The species is distinguished by the number and position of stomatal teeth (seven anterior, six posterior); vulva position (41–65%), length of the paired postuterine sacs (left 35–78 μm, right 29–73 μm); size and shape of the spicules and gubernaculum, and by number and position of the preanal papillae (two subventral pairs, one ventral papilla), anal papillae (one lateral pair), and caudal papillae (one pair anterior to phasmid, four posterior pairs). A neotype is designated from The Netherland collection.

Key words: Acrobeloides, California, culturing, Diplogasterida, morphology, neotype designation, The Netherlands, Odontopharyngidae, *Odontopharynx longicaudata,* postembryonic stage, predator, redescription, taxonomy.

In 1912, de Man described a new genus and species, *Odontopharynx longicaudata,* from a rotting hyacinth bulb sent to him by J. Ritzema Bos, Director, Plant Pathology Institute, Wageningen, Holland (The Netherlands). Until 1986, when it was first reported from the United States (3), the genus *Odontopharynx* had been reported only from Europe. In Europe, *O. longicaudata* has been found in coastal saline soils and ground water and in soil around the roots of *Potentilla anserina* L., *Glaux maritima* L., and various salt plants (5,9,12,16). The California population occurred in nonsaline sandy soil around roots of *Poa annua* L. (annual bluegrass) growing on a golf course in San Francisco. Comparison of the California population with specimens of *O. longicaudata* from The Netherlands has convinced us that both are the same species.

Due to the poor condition of the specimens, de Man was unable to describe the complete reproductive system of the male and female *O. longicaudata.* Additional studies (1,6,12,16) provided conflicting information on the morphology of this species, especially on the numbers of stomatal teeth, male caudal papillae, and spicules. Successful culturing of *O. longicaudata* on a bacterivorous nematode, UCD *Acrobeloides* No. 1 (Rhabditida: Cephaloboidae), enabled us to study in detail the morphology and development of its postembryonic stages.

Morphological studies of the adults and juveniles have indicated that an emended description was needed to accurately define the morphological characters of *O. longicaudata.* Through personal communication with P. A. A. Loof (Agricultural University, Wageningen, The Netherlands) and S. van der Spoel (Zoology Museum, Amsterdam, The Netherlands), we

Received for publication 8 April 1988.

[1] This study was supported in part by National Science Foundation Grant No. BSR 8213566. Mention of a trade name does not indicate an endorsement of that product.

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The authors thank P. A. A. Loof, Agricultural University, Wageningen, The Netherlands, for furnishing specimens from The Netherlands, and S. van der Spoel, Zoologisch Museum, Amsterdam, The Netherlands, for searching the de Man collection for specimens; L. R. Costello, Farm Advisor, University of California Cooperative Extension, San Mateo–San Francisco counties, for assistance with the field collections; Alma P. Elliott and S. T. Miyagawa for collecting the first specimens; A. R. Maggenti and D. J. Raski for reviewing the manuscript; and H. Ferris for encouragement and support.

have determined that de Man's specimens of *O. longicaudata* are no longer available. After consultation with other taxonomists and in accordance to the guidelines established by the International Code of Zoological Nomenclature, we have designated one of The Netherland specimens as a neotype in order to stabilize this genus and species.

Materials and Methods

Specimens of *O. longicaudata* were originally collected in April 1985 by Alma P. Elliott and Starr T. Miyagawa (Department of Nematology, University of California, Davis) and Larry R. Costello (Farm Advisor, University of California Cooperative Extension, San Mateo–San Francisco counties) from soil around roots of *Poa annua* L. (annual bluegrass) growing at the edge of greens on the Olympic Golf Course in San Francisco, California. Physical properties of the soil were analytically determined as sandy (91% sand, 5% silt, 4% clay), slightly acidic (pH 6.4), and low in salt content (electrical conductivity 0.67 mmhos/cm). Nematodes were extracted from the soil by the sieving and Baermann funnel technique (15). Specimens of *O. longicaudata* and other species of nematodes contained in the sample were handpicked from the suspension, rinsed several times in sterile distilled water, and transferred to a water agar plate.

Odontopharynx longicaudata obtained from the original culture was increased and maintained on UCD *Acrobeloides* No. 1 in 1.5% water agar plates incubated at 25 C. The *Acrobeloides* culture was obtained from D. W. Freckman (Department of Nematology, University of California, Riverside) and increased on bacteria growing on oatmeal agar. Bacteria were not added separately to the medium because sufficient amounts are carried by the nematodes. Specimens of *O. longicaudata* were extracted from the water agar, which was cut in approximately 5-cm cubes, and placed on modified Baermann funnels in a mist chamber for 2 days. The nematodes were gently heat killed, fixed in FAA, processed to glycerin (13), and permanently mounted in anhydrous glycerin.

Measurements and illustrations were made using a light microscope and camera lucida. Photomicrographs were taken with a 35 mm camera attached to a compound microscope with interference contrast system. For scanning electron microscope (SEM) observations, specimens were heat killed and fixed in 2½% formalin for 1 or 2 days, then suspended in 30% ethanol (ETOH) for 30 minutes, sonicated in three changes of 30% ETOH for 1 minute each, dehydrated in an ETOH series, and subsequently critical point dried. Specimens then were attached to aluminum foil on stubs with a toulene-tape (Scotch) adhesive mixture, sputtered with approximately 300 Å gold, and examined with a SEM at 10 kV.

Juvenile stages of *O. longicaudata* were obtained for morphological study by transferring freshly hatched juveniles (J2) to 35-mm water agar plates, five nematodes per plate. Approximately 100 UCD *Acrobeloides* No. 1 were transferred in a small wedge of oatmeal agar to the plates which were sealed with Parafilm and incubated at 25 C. Extractions were done three times daily, at intervals of 4 and 12 hours by blending quartered agar pieces for 5–8 seconds, and all stages of *Odontopharynx* were handpicked from the suspension and processed to permanent mounts for examination (4).

Voucher specimens of *O. longicaudata* are on deposit in the University of California, Davis Nematode Collection (UCDNC).

Systematics

Genus *Odontopharynx* de Man, 1912

Diagnosis emended: Order Diplogasterida Maggenti, 1981; superfamily Odontopharyngoidea Micoletzky, 1922; family Odontopharyngidae Micoletzky, 1922 (1,7). Adults and juveniles similar, no sexual dimorphism. Body elongate, cylindrical; tail long, filiform. Anterior terminus broadly flattened; without distinct lips. Cuticle with fine transverse striae, longitudinal striae

absent. Twelve cephalic sensory papillae arranged in a single whorl, inner and second circlets joined; sensilla basiconica (externally peg or cone shaped). Amphid openings distinct, transversally elongate oval; posterior to lip region, upper third of stoma. Stoma large; anterior globose, narrowing posteriorly, telostome not elongated; armed with teeth. One large dorsal tooth, anterior half of stoma, movable; numerous smaller teeth, at level of dorsal tooth, not movable. Posterior fourth of stoma armed; small teeth in separate sets, several teeth per set, teeth in each set fused at base. Dorsal esophageal gland opens through dorsal tooth. Three part esophagus: corpus cylindrical, heavily muscled, without swelling or valve; isthmus short; posterior bulb glandular, swollen, not valved. Excretory system diplogasteria type (a single canal extending anteriorly and posteriorly to the ventral gland and excretory duct), excretory cell distinct. Females amphidelphic, monovarial, ovary reflexed, two postuterine sacs, spermatheca absent. Males monorchic, testis reflexed. Two spicules, unequal size; left spicule normal; right spicule reduced, minute, triangular. Gubernaculum complex, without dorsal apophysis. Bursa absent. Male posterior papillae present; preanal, anal, and postanal; usually paired, pairs numerous, some may be single. Tail long, filiform, terminus minute.

Diagnosis: Odontopharynx differs from the other genus in the family, *Zullinius* Andrássy, 1984, by the large globose stoma and absence of the elongated telostome. Males differ by the size and shape of the small right spicule and absence of a dorsal apophysis on gubernaculum.

Type and only species: Odontopharynx longicaudata de Man, 1912.

Odontopharynx longicaudata de Man, 1912
(Figs. 1–4)

Males (emended): Measurements (n = 49) of the neotype and other males, in glycerin, are given in Table 1.

Neotype (male): Measurements in parentheses indicate range of total males. Fixed specimen ventrally arcuate, posteriorly very arcuate. Body cylindrical, elongate; tail long, filiform, terminus obscure. Cuticle with fine transverse striae, longitudinal striae and lateral fields absent. Anterior terminus broadly flattened, without distinct lips. Twelve cephalic sensory papillae arranged in single whorl, inner and second circlets joined; sensilla basiconica (peg or cone shaped). Amphids distinct, 4 μm posterior to lips; opening transversally elongate oval, slit length 3 μm. Stoma large, length 2½ times midstoma width; armed with teeth; anterior globose narrowing posteriorly, telostome not elongated; walls heavily cuticularized. Anterior half of stoma armed: one large dorsal tooth; six small teeth (two subventrals, two laterals, two ventrolaterals), near dorsal tooth level. Posterior fourth of stoma armed: two separate multi-teeth sets (one subventral, one ventrolateral); three teeth each set, teeth fused at base. Large dorsal tooth solid, movable; dorsal esophageal gland duct opens through tooth, opening ventral, subterminal. Small teeth solid, not movable, tips heavily cuticularized. Esophagus three-part: corpus cylindrical, heavily muscled, lumen thickened, metacorpus without swelling or valve; isthmus short; posterior bulb swollen, glandular, three distinct gland cell nuclei; without valve. Nerve ring near posterior bulb, 28 μm posterior to corpus base (5–32 μm). Hemizonid 7 μm (3–7 μm) anterior to excretory pore. Excretory pore 41 μm (29–58 μm) posterior to corpus, duct cuticularized. Excretory cell distinct. Esophageal-intestinal valve indistinct. Reproductive system monorchic, testis reflexed. Two spicules, unequal size; left spicule well developed, arcuate; right spicule reduced, one-sixth length of left, narrowly triangular (Fig. 1N). Gubernaculum well developed. Three distinct anal glands. Five preanal papillae: one ventral papilla, 2 μm (2–4 μm) anterior to anus; two subventral pairs, one pair 11 μm (6–15 μm) anterior to anus, one pair 24 μm (17–32 μm) anterior to anus. One anal pair of papillae, lateral to subdorsal, adjacent to or slightly posterior to anus. Five pairs caudal pa-

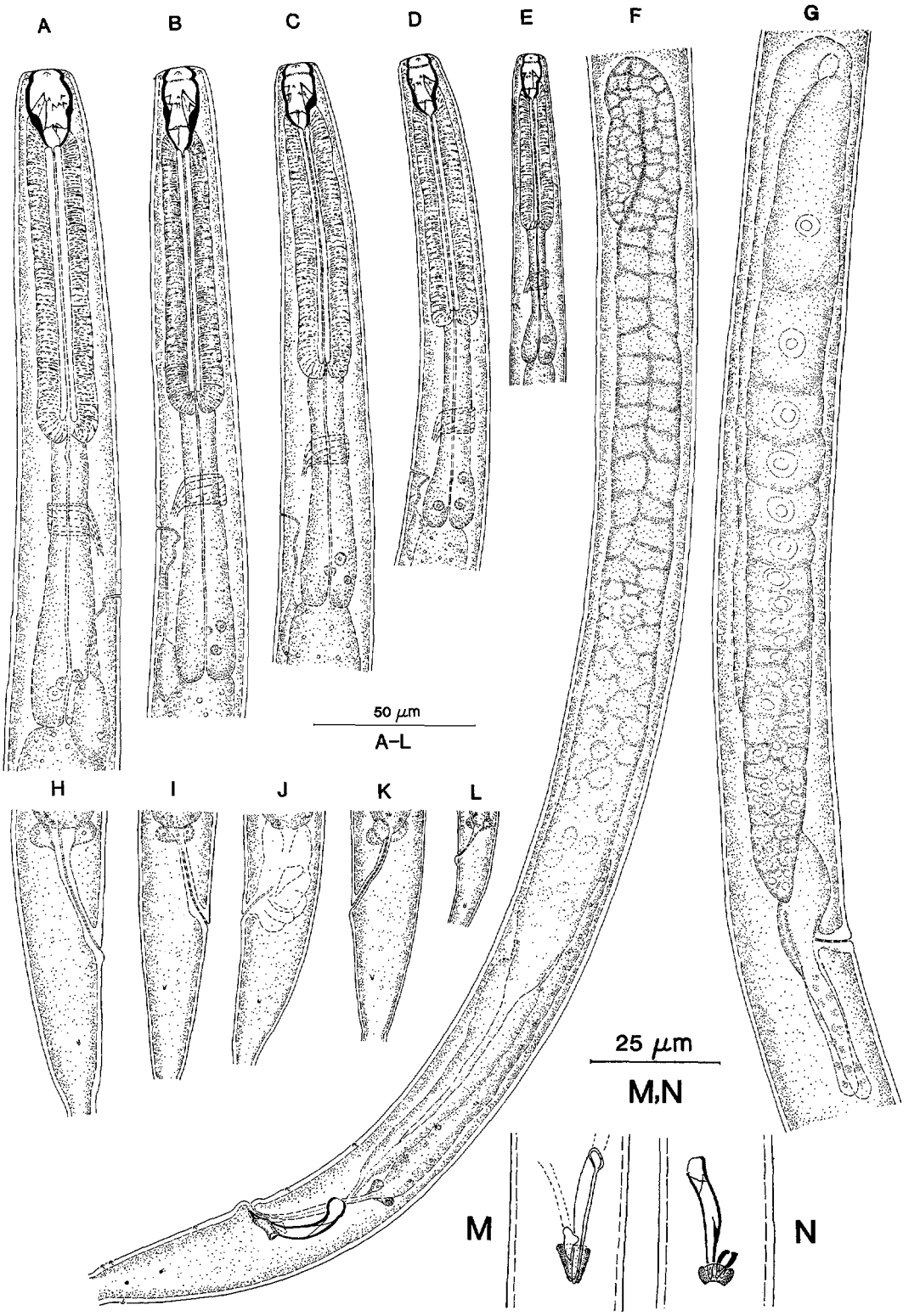

FIG. 1. Postembryonic stages of *Odontopharynx longicaudata*. A–E) Anterior body regions. A) Female. B) Male. C) J4 male. D) J3. E) J2. F, G) Adult gonad regions. F) Male, gonad and cloacal region. G) Female. H–L) Anal regions. H) Female. I) J4 female. J) J4 male. K) J3. L) J2. M, N) Spicules. M) Ventral view. N) Dorsal view.

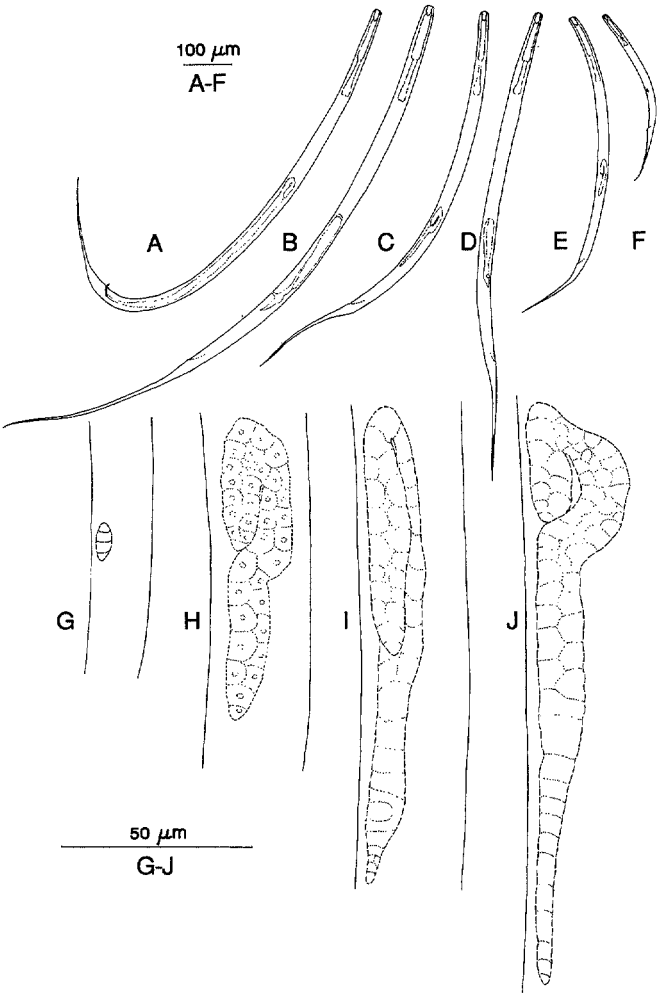

FIG. 2. Gonad development in postembryonic stages of *O. longicaudata*. A–F) Total body. A) Male. B) Female. C) J4 male. D) J4 female. E) J3. F) J2. G–J) Developing gonad. G) J2. H) J3. I) J4 female. J) J4 male.

pillae. One pair anterior to phasmid, subventral, 22 μm (16–23 μm) posterior to anus. Four pairs posterior to phasmid: one subventral pair, 47 μm (41–50 μm) posterior to anus; one lateral pair, 50 μm (41–51 μm) posterior to anus; one subventral pair, 51 μm (45–54 μm) posterior to anus; one subdorsal pair, 56 μm (46–56 μm) posterior to anus. Phasmid distinct, 39 μm (32–42 μm) posterior to anus. Tail first conical, then filiform; 14 (7–15) times anal body width; terminus minute, obscure.

Females (emended): Measurements (n = 48) of females, in glycerin, are given in Table 2.

Similar to males, usually larger. Fixed specimens slightly ventrally arcuate. Cuticle with fine transverse striae, some anastomose near vulva. Nerve ring 4–31 μm posterior to corpus. Excretory pore 25–63 μm posterior to corpus base. Reproductive system amphidelphic, antepudendal; monovarial, ovary reflexed, sometimes reflex extends posterior to vulva. Vulva lips may protrude. Spermatheca absent. Two postuterine sacs, left sac usually longest, both filled with sperm. Anus crescent shaped; posterior lip with one punctation, obscure. Tail filiform, 10–17 times anal body width. Preanal and caudal papillae absent. Phasmid 23–38 μm posterior to anus.

Juveniles (Figs. 1, 2): Measurements of

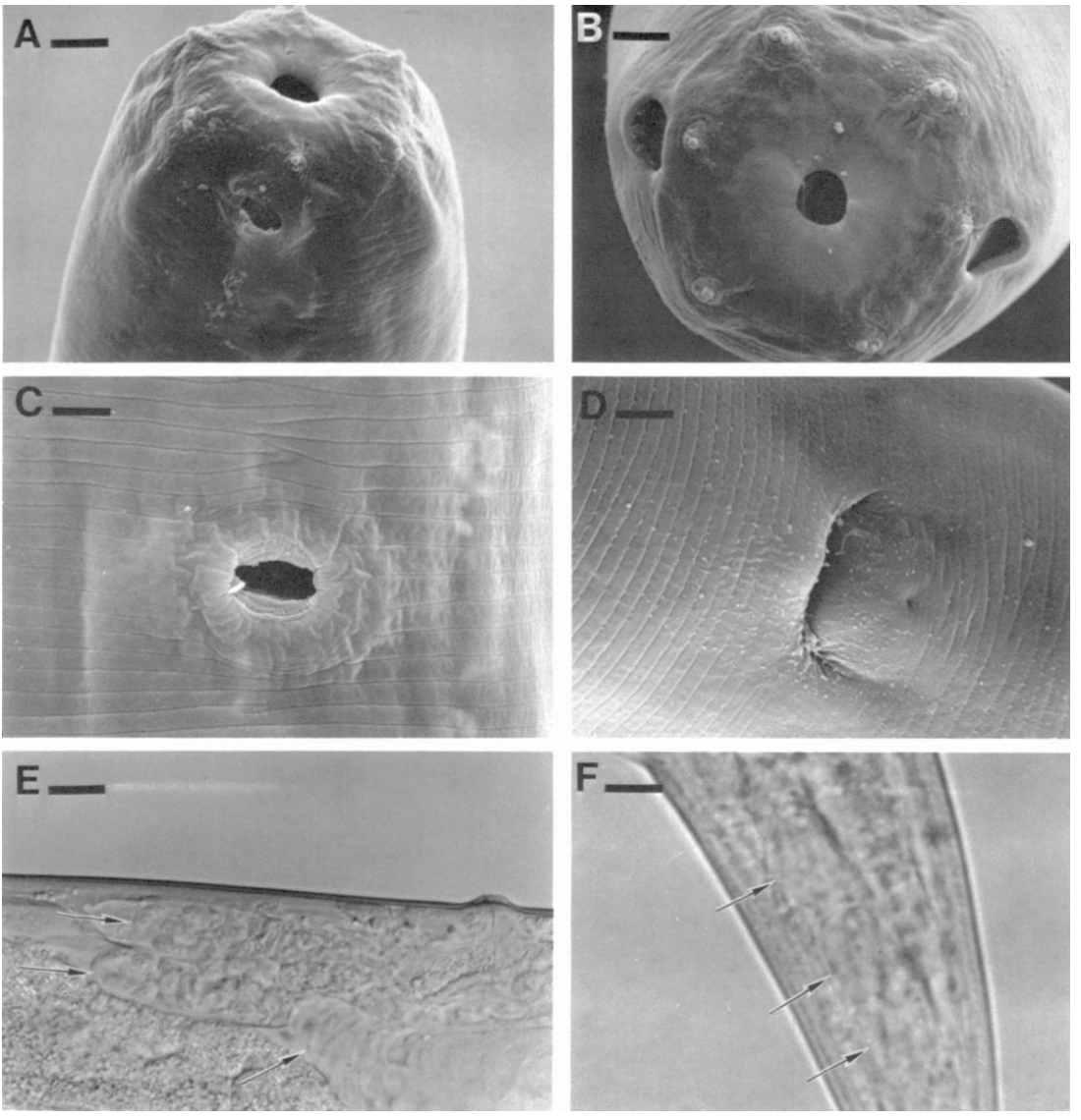

FIG. 3. A–D) Morphology of *O. longicaudata*. SEM; scale bar = 2 μm. A) Female, anterior end. B) Male, face view. C) Female vulva. D) Female anus. E) Female vulva region. Left arrows indicate postuterine sacs; lower right arrow indicates terminus of reflexed ovary. LM, scale bar = 8 μm. F) Female caudal region. Arrows indicate glandular appearing cells. LM, scale bar = 4 μm.

postembryonic juvenile stages of the Californian population, in glycerin, are in Table 3.

J2 (n = 20): Similar to adults. Esophagus length from anterior terminus, 95–136 μm, posterior bulb distinctly swollen. Developing reproductive system: fresh-hatch J2, four cells, length ca. 11 μm; 1-day-old J2, reflexed, reflex length 10–20 μm, total gonad length 9–43 μm, increase 4.8 times that of fresh-hatch J2. Posterior anal lip protruded.

J3 (n = 20): Similar to adults. Esophagus length from anterior terminus, 138–178 μm. Developing reproductive system: reflexed, reflex length 21–39 μm, total gonad length 73–114 μm; increase 1.5 times that of fresh-molt J2. Posterior anal lip not protruded.

J4 males (n = 13): Similar to adults.

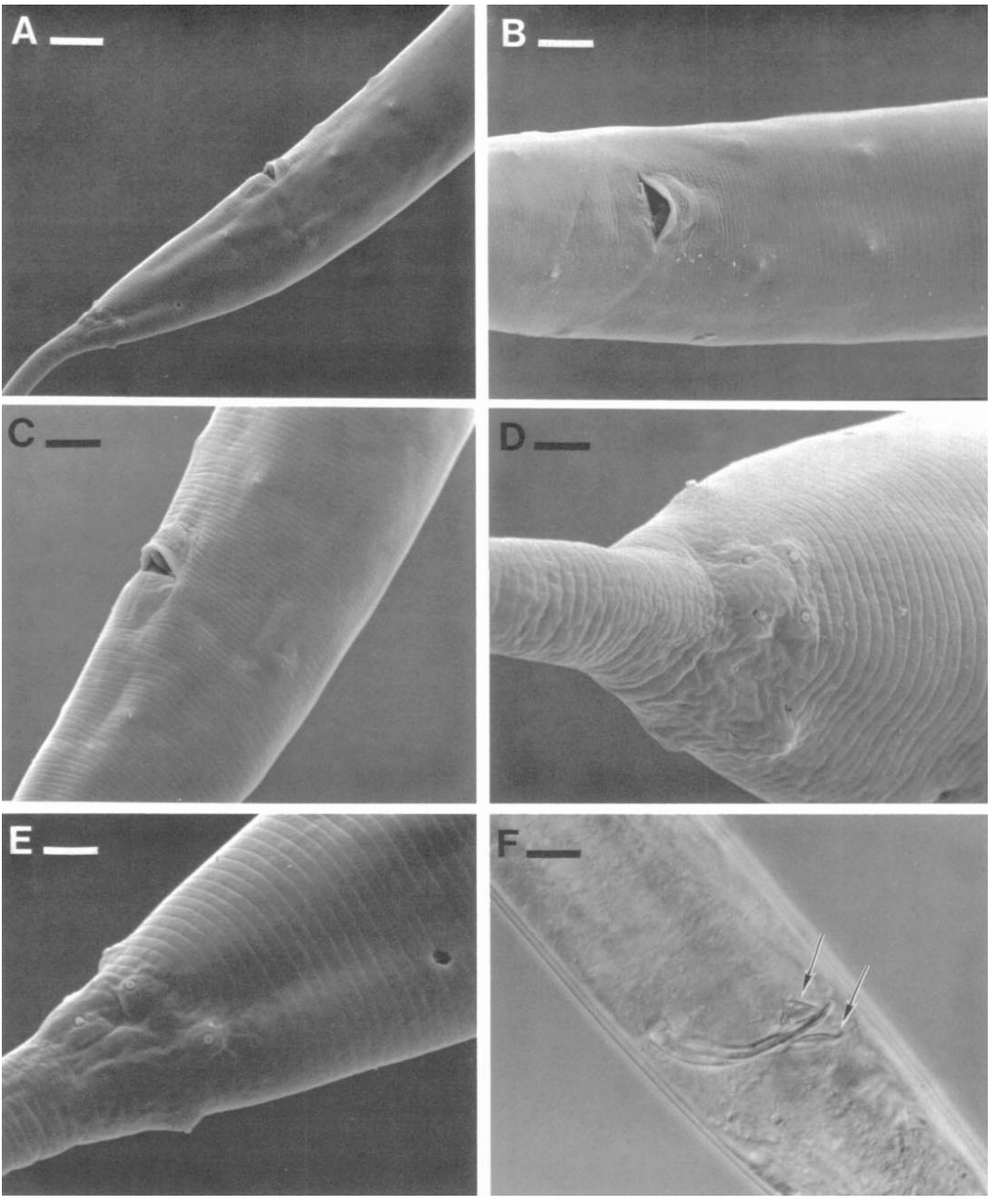

FIG. 4. A–E) Secondary sex organs and anal region of the male *O. longicaudata*. SEM. A) Posterior region, lateral, showing papillae, phasmid, and anus. Scale bar = 9 μm. B) Anal region, ventral, showing papillae and anus. Scale bar = 5 μm. C) Anal region, ventrolateral, showing papillae and anus. Scale bar = 5 μm. D, E) Posterior end of conical tail region. Scale bar = 2 μm. D) Ventral, showing papillae and edge of phasmid. E) Lateral, showing papillae and phasmid. F) Spicules. LM, scale bar = 8 μm. Upper arrow indicates right spicule. Lower arrow indicates gubernaculum.

Esophagus length from anterior terminus, 162–192 μm. Developing reproductive system: reflexed, reflex length 27–42 μm, total gonad length 121–249 μm; increase 2.0 times that of fresh-molt J3. Spicular pouch distinct. Posterior anal lip not protruded.

J4 females (n = 20): Similar to adults. Esophagus length from anterior terminus,

TABLE 1. Population morphometrics of *Odontopharynx longicaudata* males.

Character	California					
	Culture (n = 20)			Soil (n = 14)		
	Mean	Range	SD	Mean	Range	SD
Length (mm)	1.07	0.94–1.22	0.07	1.04	0.97–1.11	0.03
a	36.55	32–42	2.76	33.28	30–37	1.77
b	5.53	4.7–6.1	0.36	5.18	4.8–5.6	0.22
c	4.38	3.7–5.2	0.48	4.70	4.0–5.4	0.42
c′	9.80	7.3–12.8	1.54	8.48	7.2–10.4	0.90
T%	38.85	30–46	3.74	46.42	39–61	6.59
Stoma length	24.95	23–26	0.80	23.78	21–25	1.18
Greatest body width	29.50	26–33	1.90	31.50	28–33	1.28
Corpus to total esophagus (%)‡	56.90	55–61	1.97	56.42	55–58	1.01
Length of gonad reflex	48.55	33–62	6.27	40.07	32–47	4.37
Left spicule	35.10	31–40	2.40	35.92	33–37	1.26
Right spicule	5.80	5–7	0.60	6.00	5–7	0.67
Anal body width	24.90	22–29	1.71	26.00	24–28	1.10
Tail length	246.10	180–308	37.08	221.71	188–264	25.49
Distance from anterior terminus to:						
Nerve ring	124.26	112–139	7.43	149.78	140–159	5.42
Excretory pore	153.88	139–171	7.25	125.14	120–131	3.34
Esophageal–intestinal junction	192.70	176–210	9.29	200.21	189–210	7.67
Anus	819.60	756–924	44.55	824.71	780–856	21.42
Distance from anus to phasmid	36.40	32–40	2.50	38.00	34–42	2.76

Linear measurements are in μm unless otherwise indicated. SD = standard deviation.
† Measurements taken from literature.
‡ Measured from anterior body terminus.

174–205 μm. Developing reproductive system: reflexed, reflex length 44–86 μm, total gonad length 132–261 μm; increase 2.0 times that of fresh-molt J3. Vulva primordium distinct; right postuterine sac distinct, left postuterine sac obscure. Posterior anal lip protruded.

Diagnosis: Adults and juveniles can be distinguished from all other species by the number and position of teeth in the stoma. Males are distinguished by length of the left spicule, size and shape of the right spicule, and number and position of the preanal, anal, and caudal papillae. Females are distinguished by position of the vulva and length of two postuterine sacs.

Juvenile stages can be distinguished from each other by differences in development of the reproductive system and length of reflex, total body and esophagus lengths, and distance of nerve ring and excretory pore from anterior terminus. Distinguishing characters of the J2 are body length, prominent swelling of posterior esophageal bulb, length of gonad reflex, and protrusion of the posterior anal lip. Body length and length of gonad reflex are characteristic of the J3. Sexes are distinguishable in the J4 by development of the reproductive system and length of reflex. Fourth-stage males are distinguished by length of reflex (27–42 μm) and development of the spicular pouch, whereas the length of reflex (44–86 μm) and presence of a vulva primordium are diagnostic for J4 females.

Type host and locality: Collected from soil around roots of grass at Kats, The Netherlands, in October 1966.

Type designation (neotype male): Type slide no. WT2581 contains the neotype, four other males, and two females of *O. longicaudata*. The neotype is the uppermost specimen on the slide; there are no other specimens in close proximity. Position of the neotype is indicated in a specimen map on the slide label. The neotype slide is deposited in the Nematode Collection of the Landbouwhogeschool, Wageningen, The Netherlands.

TABLE 1. Extended.

The Netherlands			
Grass (n = 14)		De Man†	
Mean	Range	(n = 1)	Neotype
1.04	0.98–1.14	1.25	1.08
43.21	37–47	35.00	47.00
5.84	5.2–6.4	5.30	5.80
3.94	3.2–4.7	4.10	3.60
13.05	10.9–15.4		14.20
41.07	37–50		37.00
23.57	23–25	28.0	24.00
24.50	21–31		23.00
58.14	56–63		57.00
38.78	31–46		41.00
35.21	32–39		39.00
5.70	5–7		6.00
20.28	19–23		21.00
265.42	280–324		300.00
148.25	142–154		147.00
120.35	106–134		134.00
179.10	165–188		178.00
784.00	740–852		788.00
35.30	33–39		39.00

Distribution: Odontopharynx longicaudata has been reported from San Francisco, California; Kats, Island of Terschelling, and Voorschoten in The Netherlands; coastal areas of the Bay of Kiel, West Germany; Aseleben and Halle, East Germany; and Litauen, Soviet Socialist Republic (1,3–5,9,10,12,16). The Californian population was found in nonsaline, sandy soil around the roots of *Poa annua* L. growing on a coastal golf course. In Europe, it has been found inhabiting saline soil or coastal ground water, either along sea coasts or in salt marshes. These European populations were found in soil surrounding the roots of the following plants: *Aster tripolium* L., *Anemone* L., *Centaurium pulchellum* (SW.) Druce, *Daucus carota* L., *Glaux maritima* L., *Juncus bufonius* L., *J. gerardii* Loisel., *Melilotus dentatus* (W. et K.) Pers., *Phragmites communis* L., *Plantago maritima* L., *Potentilla anserina* L., *Puccinellia distans* (Jacquin) Parl., *Scirpus maritimus* L., *Spergularia salina* L., *Tetragonolobus maritimus* (L.) Roth., *Trifolium fragiferum* L., and *Triglochin maritima* L.

DISCUSSION

California specimens of *O. longicaudata* from field soil and laboratory cultures are morphologically similar to the original description and to the specimens we examined from The Netherlands. Since its description in 1912, there has been conflicting information on some of the adult diagnostic morphological characters (1,6,12,16), and the postembryonic juvenile stages had not been described. Culturing of the California population of *O. longicaudata* in the laboratory enabled us to study the biology (4) and to examine critically the morphology of the adults and postembryonic juvenile stages. From our study of the adult morphology with light and scanning electron microscopes and the conflicting reports in the literature, we concluded that emended descriptions of the male and female were in order.

New information on the morphology includes the presence of 12 cephalic sensory papillae (Fig. 3A, B) instead of six as previously reported (1,6,8,9,16). By using the amphid as an orientation point and comparing positions of the cephalic sensory papillae as illustrated by Maggenti (7) to the SEM face view (Fig. 3B), we concluded that the inner circlet of six papillae and second circlet of six joined, forming a single whorl of 12. Although we found no external evidence of the third circlet of four papillae, it is possible that they exist as sensilla insiticius (7), in which case they would be visible only in longitudinal and (or) transverse sections. Occasionally artifacts are present in SEM face views that could be mistaken for the inner circlet.

Andrássy and Paetzold reported the presence of both transverse and longitudinal striae on the outer cuticle (1,9). We observed only transverse striae by light microscopy, and SEM examination confirmed this observation (Figs. 3A–D, 4A–E).

Six small teeth (Fig. 1A–E), instead of five, at the level of the large dorsal tooth, agree with the reports of de Man (8) and Zullini and Loof (16). Six small teeth in the posterior fourth of the stoma are in two sets; each set is composed of three teeth

TABLE 2. Population morphometrics of *Odontopharynx longicaudata* females.

Character	California					
	Culture (n = 20)			Soil (n = 14)		
	Mean	Range	SD	Mean	Range	SD
Length (mm)	1.27	1.12–1.57	0.1	1.27	1.07–1.44	0.1
a	36.08	29–54	5.2	33.40	27–40	3.0
b	6.05	5.4–7.5	0.5	5.65	4.9–6.5	0.5
c	4.14	3.2–6.1	0.6	4.38	3.7–5.4	0.5
c′	12.93	9.5–16.7	2.1	11.83	9.0–14.7	2.1
V%	57.30	41–65	4.6	58.93	56–63	2.2
G_1	39.22	21–56	8.9	38.93	24–75	12.0
Stoma length	27.00	25–29	1.0	27.00	25–28	1.1
Greatest body width	35.73	29–46	4.5	38.40	34–47	3.4
Corpus to total esophagus (%)‡	57.52	55–64	2.1	56.46	54–60	1.5
Ovary length	226.91	130–314	55.5	222.00	101–447	78.7
Left PUS§	51.50	35–61	7.1	55.40	39–63	6.3
Right PUS§	46.04	29–59	6.9	53.60	45–65	6.0
Rectum length	33.85	28–42	3.4	34.73	25–43	4.4
Anal body width	23.69	21–26	1.2	24.73	23–26	1.1
Tail length	306.56	233–418	48.2	294.13	216–372	55.4
Distance from anterior terminus to:						
Nerve ring	136.52	122–150	6.9	141.93	128–156	7.0
Excretory pore	164.21	143–180	9.0	167.60	155–177	7.5
Esophageal–intestinal junction	208.43	192–221	7.6	224.60	212–243	8.5
Anus	963.39	830–1,320	109.2	982.00	858–1,076	62.8
Distance from anus to phasmid	29.08	25–35	2.4	28.23	23–35	3.2

Linear measurements are in μm unless otherwise idicated. SD = standard deviation.
G_1 = anterior gonad.
† Measurements taken from literature.
‡ Measured from anterior body termius.
§ Length of postuterine sacs from vulva.

fused together at the base. Each set is cleft anteriorly, thus distinguishing separate teeth and not just tips of a ridge as reported (16).

The presence of two postuterine sacs, somewhat rare in the phylum, had not been reported for *O. longicaudata* (Figs. 1G, 3F). A detailed study of the ultrastructure of these two sacs would be necessary to determine if the origin is uterine or vaginal or both. De Man was correct in suggesting that the postuterine sac functions as a seminal vesicle (8); we observed both sacs filled with sperm in the same female. It is possible that the female mates only once in her lifetime, thereby requiring extra sperm storage; however, this needs to be confirmed experimentally.

The presence of two unequal sized spicules was first suggested by Schulz (12) and illustrated by Zullini and Loof (16). Controversy regarding the number of spicules is understandable, since a ventral view, and sometimes a dorsal, is almost always necessary to distinguish the very small right spicule from the gubernaculum (Figs. 1M, N; 4F).

In males, the numbers and arrangement of the posterior papillae are important diagnostic characters (Fig. 4A–E). The two pairs of preanal papillae have been described (8); however, presence of a single preanal ventromedian papilla just anterior to the anus (Fig. 4B) has not been reported. Paired papillae at the cloacal level, illustrated and labelled by de Man (8) as IIIa and occasionally observed by Paetzold (9), may be lateral or subdorsal in position and less prominent than the other papillae. Five pairs of caudal papillae are present instead of the six pairs reported (6,8,16). It is probable that the phasmids were mistaken for papillae, such as IIIb on de Man's illustration (8). Zullini and Loof's report (16) of

TABLE 2. Extended.

The Netherlands		
Grass (n = 14)		De Man† (n = 1)
Mean	Range	
1.17	1.11–1.35	1.4
44.40	35–52	40.0
6.67	5.6–10.6	5.8
3.66	3.1–4.3	3.7
18.23	14.1–22.4	
55.26	50–59	
32.93	23–43	
26.00	25–28	28.0
28.60	24–38	
60.80	55–69	
179.06	86–254	
66.40	50–78	
64.20	46–73	
32.80	26–37	36.0
18.80	17–21	
342.13	254–404	
130.91	122–148	
166.50	162–173	
189.80	127–223	
912.66	856–982	
32.20	29–38	

a lateral pair of papillae may also have been the phasmids, which we observed in The Netherlands specimens to be posterior to, and not at, the level of de Man's Ic. Presence of two pairs of subventral papillae posterior to the phasmid and at the base of the conical part of the tail comply with de Man's IIa and IIb (8) and with Zullini and Loof's description (16); however, there is no evidence of a third subventral pair, de Man's IIc. Zullini and Loof identified the anterior pair of subventral papillae as de Man's IIc; however, their illustration indicated that it is, in fact, at the level of de Man's IIb pair.

A ventral view under SEM of the female anal region revealed a single ventromedian punctation just anterior to the anus (Fig. 3D). The punctation is obscure, but visible under a light microscope. This is the first report of this punctation.

Obscure, glandular appearing cells were observed in the conical tail region of all the postembryonic stages (Figs. 1F, H–K; 3F). We were unable to determine the structure or function of these cells. We have observed, however, individuals of *O. longicaudata* in suspension, adhering by their tail ends either to each other or to the base of the container, thereby suggesting the presence of caudal secretions. A detailed ultrastructure study of this tail region is needed to correctly understand these cells.

Odontopharynx longicaudata is the only known species in the genus *Odontopharynx*. Two other species were described in *Odontopharynx*, but both have since been removed and placed in other genera. *Odontopharynx piracicabensis* Rahm, 1928 was removed from the genus by Goodey (6) and placed in *Mononchoides* Rahm, 1928 (Diplogasterida: Diplogasteridae). The species *O. vanbezooijeni* Zullini and Loof, 1980 was removed from the genus by Andrássy (1) and placed in a new genus *Zullinius* (Odontopharyngidae). We accept these taxonomic decisions.

Tarjan and Hopper (2) and Baker (14) listed *O. longicaudata* as a valid genus and species in their taxonomic checklists. Both checklists state that in 1950 Sachs (11) regarded *O. longicaudata* as a synonym of *Diplogastrellus monhysteroides* (Bütschli, 1874) Paramonov, 1952 (2) and *Diplogaster monhysteroides* Bütschli, 1874 (14). On examining the reference given in both checklists, we found no evidence that Sachs (11) had made *O. longicaudata* a synonym of any species, nor is the species mentioned in his publication. In addition, we have found no mention of such a synonymy in other reports on *O. longicaudata*. Therefore, we consider this synonymy listing as inaccurate.

Since de Man's description of the species in 1912, *O. longicaudata* has been redescribed by Zullini and Loof (16), Schulz (12), and Paetzold (9,10). These authors disagree on the exact morphology of some of the major adult diagnostic characters, thus making this species unstable. After consultations with numerous international and U.S. taxonomists, and to stabilize diagnosis of this genus and species, we have designated a neotype from The Netherland specimens. In accordance with Article

TABLE 3. Measurements of postembryonic juvenile stages of *Odontopharynx longicaudata* from California.

Character	J2 (n = 20)			J3 (n = 20)		
	Mean	Range	SD	Mean	Range	SD
Length	468.0	339–610	9.3	709.0	634–848	5.1
a	25.0	20–29	2.3	29.5	26–32	1.4
b	4.0	3.2–5.0	0.4	4.5	4.2–4.9	0.2
c	3.3	2.6–5.2	0.4	3.5	3.1–4.4	0.3
c′	11.1	6.1–14.0	1.5	11.7	8.3–14.5	1.3
Stoma length	14.6	13–17	1.5	19.8	18–22	0.9
Greatest body width	19.2	14–26	3.3	24.1	22–28	1.5
Corpus to total esophagus (%)†	56.0	53–62	1.9	56.9	55–58	1.0
Length of gonad reflex	16.1	10–20	3.3	30.3	21–39	5.2
Total gonad length	23.2	9–43	13.3	91.6	73–114	11.7
Anal body width	12.7	10–16	2.2	16.9	15–20	1.1
Rectum length	14.8	11–20	2.6	22.1	17–29	3.0
Tail length	140.3	92–190	28.2	198.5	142–232	22.2
Distance from anterior terminus to:						
Nerve ring	78.3	63–96	11.4	102.1	95–113	4.3
Excretory pore	92.6	72–115	13.2	121.2	115–136	5.6
Esophageal–intestinal junction	113.7	95–136	14.2	152.7	138–178	8.3
Anus	327.8	212–442	70.6	510.3	472–636	40.0

Linear measurements are in μm unless otherwise indicated. SD = standard deviation.
† Measured from anterior body terminus.

75 of the "International Code of Zoological Nomenclature," a neotype was selected for the following reasons: 1) The syntype series is no longer available from either the de Man Collection at Amsterdam, Institute voor Taxonomische Zoologie, or the Wageningen Nematode Collection of the Landbouwhoogeschool. Concensus of both curators is that "the specimens no longer exist." 2) Controversy still exists over some of the major adult morphological diagnostic characters. We consider our study to be a "revisory work" in that it is a critical study of the nominal species-group, even though it consists of only one species, and a detailed study of the critical morphological diagnostic characters of the adults (male and female) and the postembryonic stages. Since the geographical distribution of this species is widely separated (Europe and California), if another species in this genus is found the diagnostic characters for *O. longicaudata* will be clearly defined. 3) De Man's specimens were collected from a decaying hyacinth bulb, sent to him by Dr. J. Ritzema Bos, Director, Plant Pathology Institute, Wageningen, Holland (The Netherlands). No type locality is given in the original description, and the hyacinth bulb could have originated from any place in The Netherlands. A very large population was found at Kats, The Netherlands (16), and we have selected Kats as the type locality. From all published reports, personal communication with Loof, and from our own biological experiments (4), we determined that the hyacinth bulb is a nontypical habitat for *O. longicaudata*. Because of its predaceous feeding behavior, the original specimens were probably in the decaying bulb feeding on other nematodes. 4) The male specimen selected as the neotype conforms with both the text and illustration of the original description and, in part, to the other published descriptions of this species. This designated specimen can be differentiated morphologically from all other known nematode species. 5) The neotype is the property of the curated Nematode Collection of the Landbouwhoogeschool, Wageningen, The Netherlands. Collection data is clearly indicated on the slide, the specimen is in good condition, well preserved, on a permanent

TABLE 3. Extended.

J4 females (n = 20)			J4 males (n = 13)		
Mean	Range	SD	Mean	Range	SD
974.0	882–1,100	6.4	871.0	772–1,000	7.8
33.0	30–36	1.8	32.3	29–37	2.6
5.1	4.7–5.7	0.2	4.8	4.3–5.4	0.3
3.6	3.1–4.3	0.2	3.9	3.5–4.3	0.2
12.9	10.2–15.1	1.2	10.7	9.4–12.7	1.0
23.6	22–25	0.9	21.7	21–24	0.9
29.2	26–34	2.0	27.0	24–31	2.0
56.8	54–59	1.2	56.2	54–59	1.3
60.9	44–86	12.4	33.1	27–42	4.6
173.7	132–261	30.7	179.4	121–249	32.4
20.5	18–22	1.1	20.1	17–23	1.7
27.4	20–33	4.4	26.7	21–32	3.7
264.5	215–302	22.6	220.3	196–260	18.6
121.6	112–128	4.7	113.5	109–122	3.3
145.3	137–155	5.4	134.8	126–149	6.9
187.7	174–205	9.2	176.7	162–192	9.2
707.0	624–806	55.6	650.6	556–748	65.0

mount, and is distinctly indicated from the other specimens on the slide.

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