

# Redescription and Lectotype Designation of *Tylenchorhynchus cylindricus* Cobb, 1913<sup>1</sup>

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**Abstract:** *Tylenchorhynchus cylindricus* is redescribed and illustrated from N. A. Cobb's original specimens collected in 1910. In 1955 M. W. Allen established a neotype from specimens collected near Cathedral City, California. Recently Cobb's original sketches, line drawings, and balsam slides were rediscovered and examined. The specimens collected by Cobb were compared with the neotype established by Allen and with other collections of nominal *T. cylindricus*. Differences in morphology of the Cathedral City (Allen) and Los Patos (Cobb) populations were observed. Collections of males and females from Cathedral City, California; Mosida, Utah; and Kings County, California; were similar to each other except for some variation in female tail shape. Females in Cobb's collection and in a collection from a beach near Ensenada, Mexico, were similar to each other but differed morphologically from other collections. We consider all collections to represent a range of variation within the species. A lectotype and an allolectotype were selected to establish the taxonomic base for the genus. A ruling has been requested from the International Commission of Zoological Nomenclature on the disposition of the neotype. **Key words:** taxonomy, morphology, grass.

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In 1913 Dr. Nathan A. Cobb erected the genus *Tylenchorhynchus* when he described *T. cylindricus* found in soil from reclaimed coastal swamp lands in southern California

(3). Since this material was evidently thought by Allen to have been lost, he established a neotype from a population found in soil near the base of *Prunus* sp. in Cathedral City, California (1). Specimens of *T. cylindricus* from Arvin, Victorville, Yuma Mesa, Modesto, and Stockton, California; and from Mosida and Duchesne, Utah; also were studied by Allen. Cobb's measurements, sketches, and ink drawings of *T. cylindricus* were on file, but the original specimens recently were found at the U. S. Department of Agriculture, Beltsville, Maryland. Examination of this material and the Cathedral City specimens of Allen revealed differences in both males and females.

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Received for publication 3 March 1981.

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## MATERIALS AND METHODS

Specimens of *T. cylindricus* examined included collections from Ensenada, Mexico, from four sites in California, and from Mosida and Duchesne, Utah. Nematodes from these sites were dehydrated and mounted in glycerin by the collectors. Cobb's specimens, including many non-phytophagous forms, were stained red (probably with carmine) and heat sublimated to balsam in 1910. They were found to be in excellent condition. Following the procedure used for many years by Golden, slides containing specimens not drawn or measured for the 1913 publication were placed in a covered petri dish containing 1:1 balsam to xylene at 43 C. After the cover glass floated free, nematodes were remounted individually in balsam on glass slides to facilitate examination and study. Photomicrographs were made with an interference contrast microscope, automatic 35 mm camera, and Kodak Tri-X-film. The procedures used in measuring and drawing specimens were essentially those described by Golden and Birchfield (6).

## SYSTEMATICS

*Tylenchorhynchus cylindricus*  
(redescription)

**FEMALES** (29 paralectotypes): Length 721.3–1,179.9  $\mu\text{m}$  (mean 1,009.6  $\mu\text{m}$ , standard deviation [SD] 110.3  $\mu\text{m}$ ); a = 30.6–40.8 (36.3, SD 2.76); b = 4.5–6.9 (6.1, SD 0.52); c = 15.3–26.7 (22.4, SD 2.28); V = 51–61 (34.5–56.9<sup>34.0</sup>, SD 5.6<sup>2.015.2</sup>); stylet 25.1–29.5  $\mu\text{m}$  (27.4  $\mu\text{m}$ , SD 1.34); dorsal esophageal gland orifice (DGO) 1.6–2.2  $\mu\text{m}$  (1.8  $\mu\text{m}$ , SD 0.24) from base of stylet; center of

median bulb 73.9–91.8  $\mu\text{m}$  (84.7  $\mu\text{m}$ , SD 5.87) from anterior end; excretory pore 126.7–165.8  $\mu\text{m}$  (138.9  $\mu\text{m}$ , SD 14.2) from anterior end; tail length 37.4–51.5  $\mu\text{m}$  (45.1  $\mu\text{m}$ , SD 4.66); tail length/anal body width (c') 1.64–2.35 (2.1, SD 0.26); phasmids 26.6–39.2  $\mu\text{m}$  (32.3  $\mu\text{m}$ , SD 3.79) from tail terminus; number of tail annules 15–22 (19.3, SD 2.3); tail annule width 1.9–2.9  $\mu\text{m}$  (2.2  $\mu\text{m}$ , SD 0.32); annule width at midbody 2.2–2.9  $\mu\text{m}$  (2.5  $\mu\text{m}$ , SD 0.32).

**Lectotype** (female): Length 1,029  $\mu\text{m}$ ; a = 39.3; b = 6; c = 21.2; V = 57; stylet 27.5  $\mu\text{m}$ ; DGO 1.7  $\mu\text{m}$  from base of stylet; center of median bulb 85.1  $\mu\text{m}$  from anterior end; excretory pore 127.3  $\mu\text{m}$  from anterior end; tail length 48.6  $\mu\text{m}$ ; c' = 2.35; phasmids 34.4  $\mu\text{m}$  from tail terminus; number of tail annules 20; tail annule width 2.2  $\mu\text{m}$ ; annule width at midbody 2.6  $\mu\text{m}$ .

**Description. Females:** (The following is from unpublished laboratory notes of N. A. Cobb and from the authors' examination of Cobb's preserved specimens.)

Body cylindrical, tapering toward both ends and slightly arcuate ventrally. Body wall rather thick, traversed by fine striae. Lateral fields with four incisures occupying about one-fourth of the body width; outer incisures crenate. Cephalic region tapering and ending in a subspherical knob-shaped labial region setoff by slight constriction formed by small annule; labial annules five. Labial sclerotization delicate with labial ribs arcuate, slightly enlarged at basal plate becoming narrow near oral aperture. Basal plate not of uniform thickness. Stylet well developed, with rounded knobs sloping posteriorly. Nerve ring near middle of

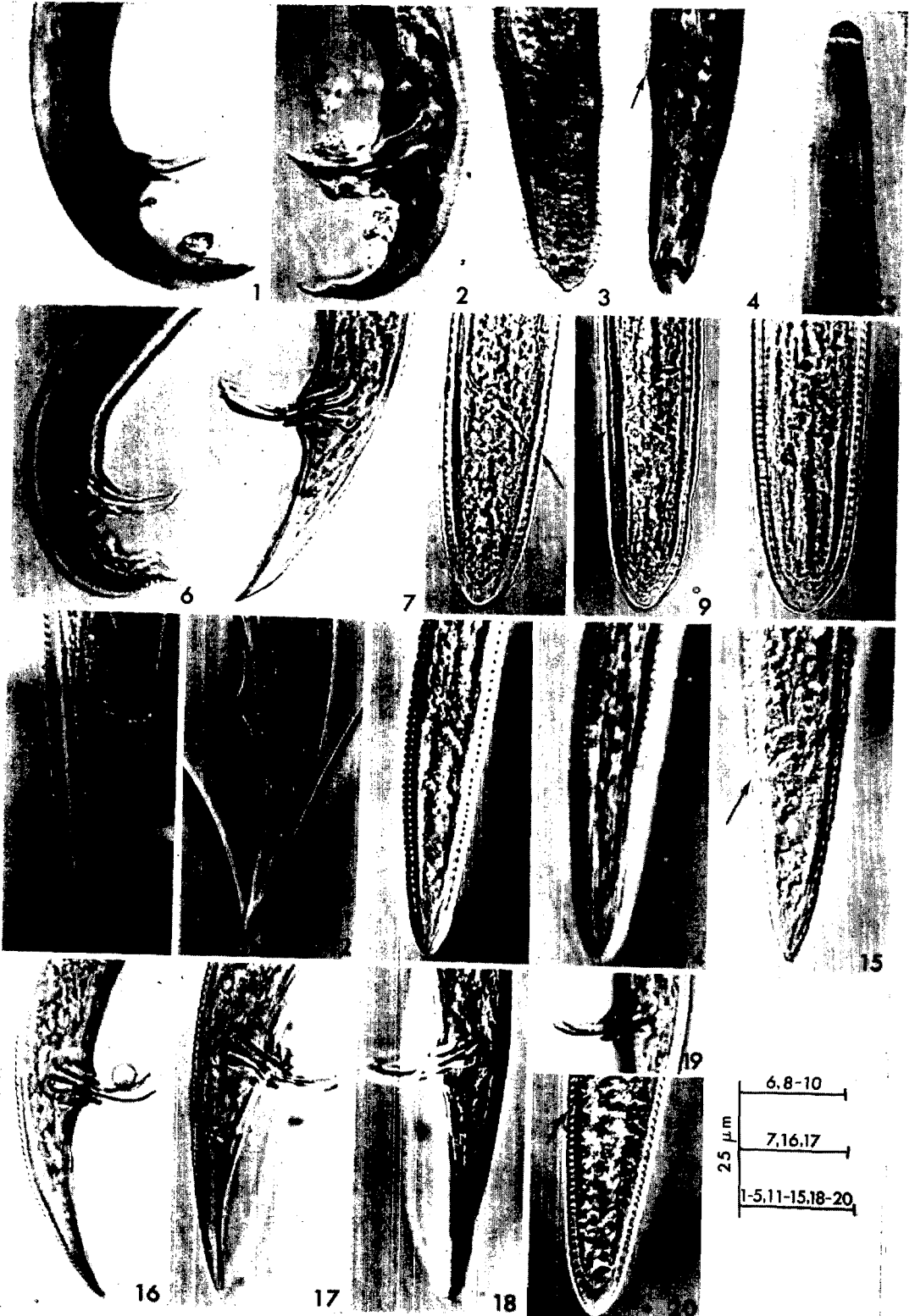


Figs. 1–6. Photomicrographs of *Tylenchorhynchus cylindricus* collected and preserved in balsam by N. A. Cobb in 1910. 1, 2, 6) Male caudal region showing gubernaculum shape (Fig. 1), notched distal end of spicules (Fig. 2) and tail shape. 3, 4) Female tails. Note hemispherical-conoid tail with hyaline cuticle at terminus with arrow pointing to anus. 5) Male cephalic region with stylet knobs.

Figs. 7–10. Photomicrographs of *T. cylindricus* from Ensenada, Mexico. 7) Male caudal region. Note gubernaculum and shape of tail. 8–10) Female caudal region. Note tail shape, arrows indicating anus, and hyaline cuticle at terminus.

Figs. 11–15. Photomicrographs of Allen's *T. cylindricus* from Cathedral City, California. 11, 12) Male caudal region. 13, 14) Female caudal region. Note conoid tail with bluntly pointed tail tip (Fig. 13); and phasmid, lateral field and tail shape (Fig. 14). 15) Tail of female collected in 1963. Note conoid tail with nearly acute terminus.

Figs. 16–20. Photomicrographs of *T. cylindricus* collected in Mosida, Utah by Dr. Gerald Thorne in 1936. 16–18) Male caudal region. Note tail and variation in gubernaculum shape with characteristic shape in Fig. 18; shape is only partly determined by orientation. 19) Notched distal end of spiculum with velum. 20) Caudal region of female. Note shape of tail and terminus (arrow is pointed toward anus).



isthmus. Excretory pore at level of the base of the isthmus. Basal esophageal gland elongate-pyriform; cardia rounded. Vulva transverse, about one-sixth body diameter in length, depressed. Vagina leading inward at right angles to ventral surface, joining two symmetrically placed uteri. Ovaries amphidelphic, germinal zone of ovary twice as far behind terminal portion of basal esophageal bulb as nerve ring is in front of it. The germinal zone of the posterior ovary is about three times as far in front of the anus as the anus is in front of the tail terminus. Ovaries one-third as wide as the body, containing 10 or more developing ova arranged single file. Tail subcylindrical to the hemispherical conoid smooth tail tip which is slightly apiculate and possesses hyaline cuticle at the terminus.

*Males* (15 paralectotypes): Length 627.2–1,140.7 (937.8  $\mu\text{m}$ , SD 135.5); a = 34.7–43.7 (38.2, SD 3.64); b = 5.0–7.0 (5.97, SD 0.70); c = 20.5–27.3 (22.2, SD 2.46); stylet 25.1–28.2  $\mu\text{m}$  (26.3  $\mu\text{m}$ , SD 1.25); DGO 1.3–2.0  $\mu\text{m}$  (1.69  $\mu\text{m}$ , SD 0.19) from base of stylet; center of median bulb 68.5–90.2  $\mu\text{m}$  (83.3  $\mu\text{m}$ , SD 6.5) from anterior end; excretory pore 119.2–161.7  $\mu\text{m}$  (133.1  $\mu\text{m}$ , SD 15.21) from anterior end; spicules 27.7–32.7  $\mu\text{m}$  (29.8  $\mu\text{m}$ , SD 1.64); gubernaculum 16.7–18.0  $\mu\text{m}$  (17.1  $\mu\text{m}$ , SD 0.72); inside diameter of gubernaculum crescent at proximal end 2.64–3.08  $\mu\text{m}$  (2.7  $\mu\text{m}$ , SD 0.29); tail length 37.8–47.5  $\mu\text{m}$  (42.8  $\mu\text{m}$ , SD 4.46);  $c'$  = 1.7–2.3 (2.0, SD 0.18).

*Allolectotype* (male): Length 975  $\mu\text{m}$ ; a = 43.5; b = 5.8; c = 22.7; stylet 26.7  $\mu\text{m}$ ; DGO 1.7  $\mu\text{m}$  from base of stylet; center of median bulb 86  $\mu\text{m}$  from anterior end; excretory pore 131  $\mu\text{m}$  from anterior end; spicules 32.7  $\mu\text{m}$ ; gubernaculum 17.2  $\mu\text{m}$ ; inside diameter of gubernaculum crescent at proximal end 3.0  $\mu\text{m}$ ; tail length 43  $\mu\text{m}$ ;  $c'$  = 2.2.

*Description. Males:* Body similar to female, but slightly smaller. Lateral field about one-third body width; with four lines extending, nonareolated, to posterior portion of body. Bursa tylenchoid, enveloping tail. Tail reflexed ventrally, ending in a point, sometimes hook-shaped (Figs. 2, 6, 21, 22). Spicules ventrally arcuate, cephalated proximally, each possessing a velum, and distally notched (Figs. 19, 21). Proximal

gubernaculum crescent-shaped, middle portion wide with periphery reinforced; distal gubernaculum blunt and wider than immediately preceding portion. Phasmids located about one-half length of tail from terminus.

*Lectotype* (female): Collected in 1910 from reclaimed coastal swamp lands by N. A. Cobb at Los Patos, California. Slide T-340t USDA Nematode Collection (USDANC), Beltsville, Maryland.

*Allolectotype* (male): Slide T-341t. Same data as lectotype. USDANC, Beltsville, Maryland.

*Paralectotypes* (males, females, and juveniles): USDANC, Beltsville, Maryland; Clemson University, Clemson, South Carolina; and University of California, Davis, California.

*Type host and locality:* Brackish soil near a marine estuary, Los Patos, California. No host given. Los Patos (N 33° 42'8", W 118° 4') apparently was a transit stop for the old Los Angeles Electric Railroad. The name remains on a street at the south edge of La Bolsa Chica, a town between Long Beach and Huntington Beach in Orange County. Los Patos was at the western end of the present avenue of the same name.

*Diagnosis* (emended): *Tylenchorhynchus cylindricus* is distinguished by the high rounded lip region, setoff by a constriction; lateral field with four incisures; subcylindrical tail with subhemispherical-conoid, smooth tail tip having a slightly pointed terminus bearing hyaline cuticle; and crescent-shaped proximal gubernaculum.

*T. cylindricus* is similar to *T. dubius* (Bütschli, 1873) Filipjev, 1936; *T. tarjani* Andrassy, 1969; *T. hordei* Khan, 1972; and *T. silvaticus* Ferris, 1963.

It differs from *T. dubius* in shape of the gubernaculum (1). It differs from *T. tarjani* in its greater length, position of vulva, and tail shape (2). The lip region of *T. cylindricus* is setoff and has five annules while the lip region of *T. silvaticus* is continuous and has three annules (4). *T. hordei* [as noted in an abstract (8)] is slightly shorter but otherwise conforms to *T. cylindricus* and is considered very similar to *T. cylindricus* by Hooper (7).

DISCUSSION

For many years *T. cylindricus* was a synonym of *T. dubius* (5). Allen (1) re-established *T. cylindricus* as the type species on the basis of difference in gubernaculum shape.

Examination of *T. cylindricus* from eight sites in the United States and Mexico revealed some differences among collections of this species. We noted two main groups: the Ensenada, Mexico, and Los Patos, California, specimens representing one group;

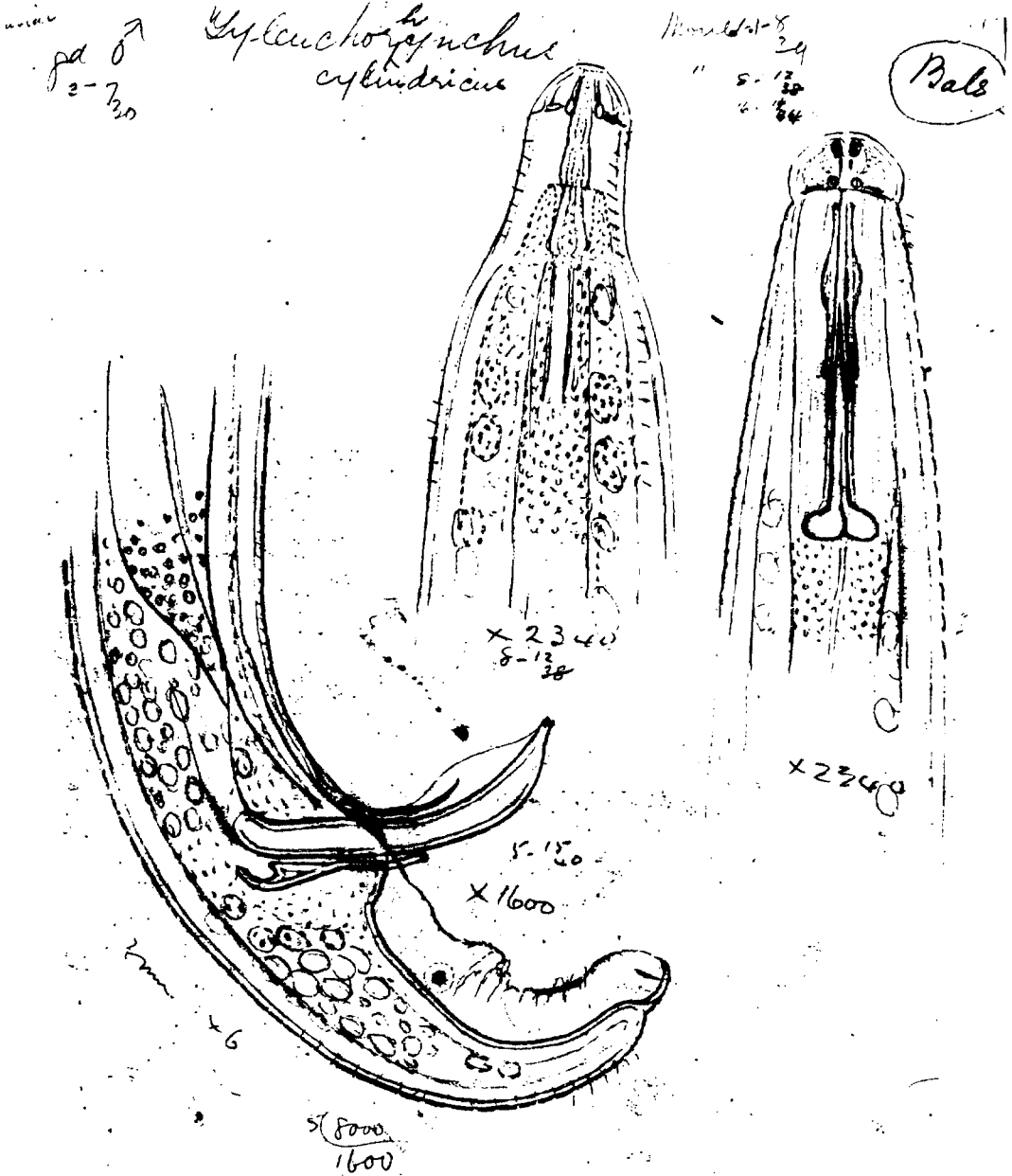


Fig. 21. Photograph of original pencil sketch (actual size) by N. A. Cobb. Male caudal region with spicula, gubernaculum, and tail shape on left, cephalic region of molting specimen in center, and cephalic region with stylet on the right.

Table 1. Selected morphometrics of three *Tylenchorhynchus cylindricus* collections.\*

Collections	Length	Stylet	DGO	a	b	c	Tail	c'	Mid-body annule	- V -	Tail annules/ annule width	Gubernaculum	Spicules
Los Patos, CA													
29 ♀♀	$\frac{1009.6\dagger}{110.3}$	$\frac{27.4}{1.34}$	$\frac{1.85}{0.24}$	$\frac{36.3}{2.76}$	$\frac{6.07}{0.52}$	$\frac{22.4}{2.28}$	$\frac{45.05}{4.66}$	$\frac{2.08}{0.26}$	$\frac{2.48}{0.32}$	$\frac{84.5 \ 56.9 \ 34.0}{5.55 \ 2.01 \ 5.18}$	$\frac{19.3}{2.17}$ / $\frac{2.2}{0.32}$	-	-
15 ♂♂	$\frac{937.8}{135.5}$	$\frac{26.3}{1.25}$	$\frac{1.69}{0.19}$	$\frac{38.2}{3.64}$	$\frac{5.97}{0.70}$	$\frac{22.2}{2.46}$	$\frac{42.84}{4.46}$	$\frac{2.00}{0.18}$	-	-	-	$\frac{17.07}{0.72}$	$\frac{29.8}{1.64}$
Cathedral City, CA													
7 ♀♀	$\frac{853.9}{95.4}$	$\frac{26.4}{0.83}$	$\frac{1.76}{0.62}$	$\frac{31.45}{3.76}$	$\frac{5.42}{0.45}$	$\frac{19.31}{2.09}$	$\frac{44.5}{5.69}$	$\frac{2.43}{0.27}$	$\frac{2.05}{0.22}$	$\frac{26.1 \ 55.8 \ 28.6}{- \ 1.46 \ -}$	$\frac{17.9}{4.26}$ / $\frac{1.76}{0.17}$	-	-
4 ♂♂	$\frac{931.0}{76.3}$	$\frac{26.5}{1.55}$	$\frac{1.98}{0.31}$	$\frac{38.44}{3.06}$	$\frac{5.91}{0.46}$	$\frac{18.19}{1.75}$	$\frac{54.3}{8.07}$	$\frac{2.59}{0.58}$	-	-	-	$\frac{15.13}{1.66}$	$\frac{26.4}{3.22}$
Ensenada, Mexico													
4 ♀♀	$\frac{918.3}{68.4}$	$\frac{28.4}{0.83}$	$\frac{1.17}{0.25}$	$\frac{33.07}{2.53}$	$\frac{5.46}{0.25}$	$\frac{19.98}{0.52}$	$\frac{45.98}{3.78}$	$\frac{1.99}{0.15}$	$\frac{2.11}{0.22}$	$\frac{25.0 \ 55.8 \ 27.0}{- \ 3.2 \ -}$	$\frac{18.3}{0.50}$ / $\frac{2.03}{0.26}$	-	-

\*Values are in  $\mu\text{m}$  except a, b, c, c'; V expressed as percent.†Numbers expressed as  $\frac{\text{average of measurements}}{\text{standard deviation}}$

and the Utah, Cathedral City, and Kings County, California, (from A. C. Weiner) populations representing another group.

All of the populations are similar in number of lip annules, presence of a setoff lip region, stylet length, DGO distance behind stylet knobs, tail length, number of tail annules, V, and distance of phasmids from the tail terminus (Table 1). These constitute the main characters used in separating *Tylenchorhynchus* species. In addition, *c'* and tail shape are often used.

The Los Patos (Cobb) females have a subcylindrical tail with subhemispherical-conoid tail tip possessing hyaline cuticle at the terminus (Figs. 3, 4, 8, 9). Females from Ensenada, Mexico, have tail shapes and *c'* values similar to the Los Patos specimens.

The males of the Los Patos and Mexico populations are similar in gubernaculum configuration and length. Males of the Mexico collection have nearly straight tails progressing evenly to a fine point (Fig. 7), whereas males from Los Patos have reflexed tails which taper abruptly to a straight or hooked point (Figs. 1, 2, 6, 21, 22). The shape of the male tail may have been altered by the fixation method used by Cobb, but other genera on the same slides appeared normal. We were not able to obtain specimens from the type locality to study this question.

Allen's neotype (♀) and the other female specimens from Cathedral City, California, have conoid tails with bluntly (Figs. 13, 14) to acutely (Fig. 15) pointed tail tips. Females from the two sites in Utah (Fig. 20) and Kings County, California, are similar to the Cathedral City populations in this respect.

Males from Cathedral City, Kings County, and Utah are inseparable (Figs. 11, 12, 16-19). Males from Ensenada have a longer gubernaculum (17.3  $\mu\text{m}$  vs. 15.1  $\mu\text{m}$ ) and longer spicules (31.0  $\mu\text{m}$  vs. 26.4  $\mu\text{m}$ ) than the Cathedral City specimens but are otherwise similar.

The principal objective of this study was to determine whether the Cathedral City (neotype location) and Los Patos populations are essentially the same morphologically. Cobb's Los Patos population, which was the basis for the original description of the genus, differs from Allen's Cathedral

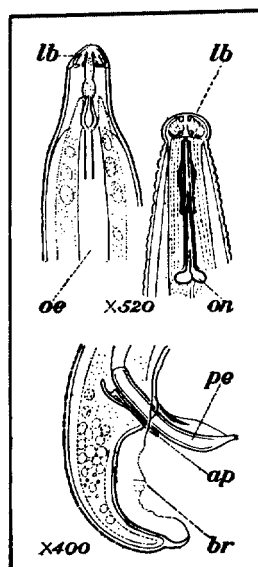


Fig. 22. Photograph of original ink drawing (actual size) submitted for publication by N. A. Cobb. Key to abbreviations: lb = labial region, oe = esophagus, on = stylet, pe = spicula, ap = accessory piece (gubernaculum), br = bursal rib. Note: This ink drawing was made exactly 1/4 size of the original pencil sketch (Fig. 21). Magnifications were also reduced by 1/4. When published, the drawing was reduced about 30% further. However, the listed magnifications remained the same and are therefore about 30% in error.

City population in female and male tail shape, *c'* value, ovary length as a percentage of body length, and gubernaculum and spicule length.

Each of these populations is a geographically isolated unit which reproduces independently of the others. We believe the collections represent a range of variation within one species. Evidence exists for possible erection of subspecies after fresh specimens from Los Patos are observed and found to be similar to the material hot sublimated to balsam. However, in view of the morphological differences stated above, discovery of Cobb's original specimens, and because Allen's neotype was collected about 120 Km inland from the coast in an arid area, we believe it is appropriate and justifiable to designate a lectotype and paralectotypes. In accordance with the rules of the International Code of Zoological Nomenclature we are presenting this case to the International Commission of Zoological Nomenclature for their review.

Diagnoses of the subfamily Tylen-

chorhynchinae (7,9) and of the genus *Tylenchorhynchus* (10) describe spicules as being characteristically pointed distally. *T. cylindricus* does not conform to this portion of the diagnoses.

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