

Brachydorus swarupi sp. n. (Nematoda: Dolichodorinae) from Soil about Roots of Arecanut Palm in Kerala State, India¹

P. K. Koshy,² D. J. Raski,³ and V. K. Sosamma⁴

Abstract: *Brachydorus swarupi* sp. n. is described from soil about roots of arecanut palm in Kerala State, India. It is the second species to be described in *Brachydorus* De Guiran and Germani 1968 and differs from *B. tenuis*, the type species, by its greater length (1.52–2.34 mm for *B. swarupi* vs. 1.03–1.32 mm for *B. tenuis*); longer and more delicate stylet (26–35 μ m for *B. swarupi* vs. 20–23 μ m for *B. tenuis*); head shape with concave protrusion at oral aperture (simple rounded in *B. tenuis*); shorter isthmus and larger posterior bulb in *B. swarupi*; shorter tail (in *B. tenuis* $c = 9.7$ [8.6–11.5] in female, $c = 42.3$ [33–48] in male); larger spicules and gubernaculum (22–39 μ m and 9–12 μ m, respectively, for *B. tenuis*); and phasmids near posterior connection of caudal alae and tail (almost central on caudal alae of *B. tenuis*). The relationship of *Brachydorus* to *Dolichodorus* is discussed. **Key words:** taxonomy, nematodes.

Arecanut palm, *Areca catechu* L., also commonly known as betel nut palm, is extensively cultivated in south India. Recent surveys have found 22 genera of nematodes in association with arecanut palm (2). This report describes a new species of the genus *Brachydorus* De Guiran and Germani 1968 (1) found in soil from around roots of arecanut palm in South India. The description is especially significant because *Brachydorus* has been monotypic until now, and also because it is the first record of this genus from India.

The collection site, Kulathupuzha, is located in the state of Kerala between 8°55' and 8°56'N latitude and 77°3' and 77°4'E longitude at an elevation of 106 m above mean sea level. The region has a hot, humid, tropical climate with an annual rainfall of 2,435 mm in 150 rainy days with most rainfall occurring between May and November. The mean temperature ranges from 19 to 35 C.

The nematodes were first found in a soil sample collected in November 1976 from a depth of 25–50 cm. Additional soil and root samples collected one month later from the original site yielded adults and juvenile

stages. The arecanut root pieces were split into several segments and held in water contained in a petri dish. No nematodes were recovered from the roots. Another collection made in March 1980 at various depths at the same site did not yield any specimens of the nematode. March is part of the drought season in Kerala but this soil had adequate moisture from a stream running nearby. Possibly the high temperatures prevalent that time of year are adverse to this species and could account for their absence. Samples collected on 20 November 1980 yielded large numbers of males, females, and various juvenile stages which supports that conjecture.

MATERIALS AND METHODS

Nematodes were extracted by decanting and sieving soil containing arecanut feeder roots. Specimens were killed by heating in water and preserved in 4% formalin. After storage for about 18 months the specimens were fixed in FAA. The specimens were dehydrated in 2.5% glycerine in 30% alcohol and then transferred to 5% glycerine in 30% alcohol. That solution was allowed to evaporate during storage in a petri dish for several days and the specimens finally dried over CaCl₂ crystals in a desiccator. Specimens were mounted in dehydrated glycerine. *En face* and transverse sections in glycerine were cut by hand and mounted in glycerine jelly.

Brachydorus swarupi sp. n.
(Fig. 1, A-K)

Dimensions: Females (13): L = 2.13 (1.87–2.34) mm; a = 61 (53–67); b = 8.5 (7.8–9.6); c = 13 (10–20); V = 18(16–24)

Received for publication 14 October 1980.

¹Contribution No. 547 of C.P.C.R.I., Regional Station, Kayangulam. This species is named in honor of Dr. Gopal Swarup, Head of the Division of Nematology, Indian Agricultural Research Institute, New Delhi 110012, India, in recognition of his dedicated service to the science of nematology as an outstanding teacher, researcher and administrator.

²Senior Scientist (Nematology) and ⁴Junior Scientist (Nematology), Central Plantation Crops Research Institute, Krishnapuram P. O., Kerala State, India, 690533; and ³Professor of Nematology, University of California, Davis, CA 95616. The authors thank Dr. N. M. Nayar, Director, CPCRI, Kasaragod, Kerala, India, for providing facilities at Kayangulam. We are also indebted to Staff Research Associate N. O. Jones, U. C. Davis, for his valuable assistance in making many permanent slides of specimens in glycerine.

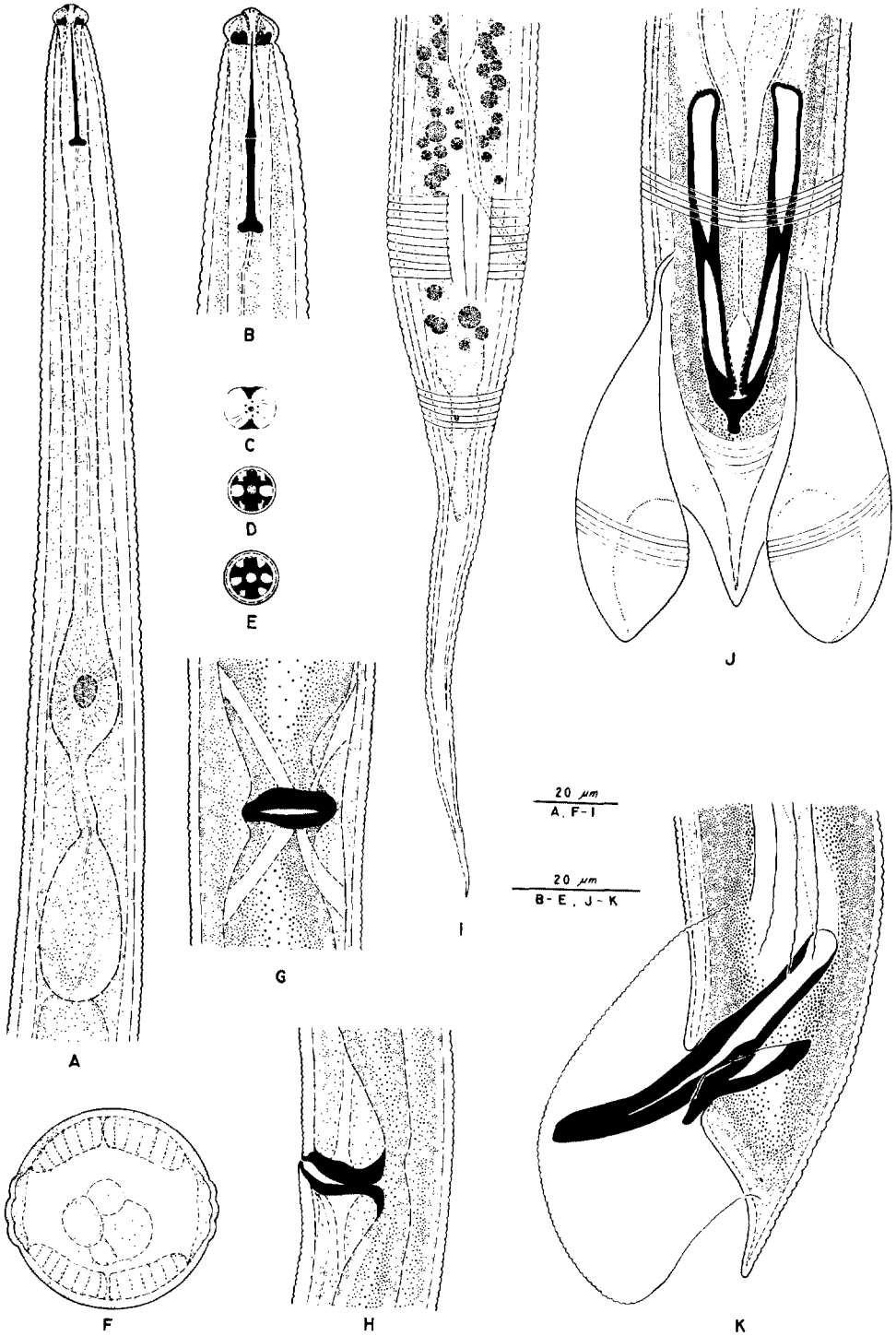


Fig. 1. *Brachydorus swarupi* sp. n. Female, A-I: A) Esophageal region of anterior end; B) anterior end; C-E) successive transverse sections from anterior surface to the posterior; F) transverse section near midbody; G) vulva, ventral view; H) vulva, lateral view; I) tail region. Male, J-K, spicules and caudal alae; J) ventral view; K) lateral view.

50 (48–53)^{18(17–21)}; stylet = 30 (28–32) μm ; cone = 15 (13–17) μm .

Males (13): L = 1.78 (1.52–1.99) mm; a = 58 (50–64); b = 7.3 (6.5–8.0); c = 56 (48–70); T = 42 (28–53); stylet = 30 (26–35) μm ; cone = 15 (13–19) μm ; spicules = 54 (50–57) μm ; gubernaculum = 21 (20–26) μm .

Juveniles 2nd-stage ? (6): L = 1.03 (0.91–1.14) mm; a = 52 (48–57); b = 5.3 (5.0–5.7); c = 10 (9.4–10.7); stylet = 24 (22–24) μm ; cone = 12 (11–12) μm ; length of gonad = 17–20 μm .

Juveniles 3rd or 4th stages ? (10): L = 1.49 (1.32–1.79) mm; a = 58 (49–62); b = 6.6 (5.9–7.8); c = 11 (10–17); stylet = 28 (26–30) μm ; cone = 14 (13–16) μm ; length of gonad = 72–101 μm .

DESCRIPTIONS

Holotype (female): L = 1.99 mm; a = 57; b = 8.2; c = 10; V = ²⁴53²¹; stylet = 30 μm ; cone = 16 μm . Body with anterior half almost straight when killed by gentle heat, slightly curved ventrad from midbody posteriorly (forms open "C" shape in some paratypes), of uniform diameter except at esophageal region and tail. Body strikingly attenuated from esophago-intestinal junction to small head about 8 μm in diameter. Head distinctly set off by constriction, smooth; with low, rounded sclerotizations at base. *En face* sections show head with slight indentations on dorsal and ventral margins at anteriad extremity; oral aperture surrounded by six tiny dark spots probably representing inner labial papillae. Amphidial apertures not evident. Transverse section of labial region slightly posteriad to anterior extremity shows sclerotized cephalic framework with bilobed outline dorsoventrally and large openings laterally. Two innervations evident in each of two subventral and two subdorsal openings in framework. Stylet slender, delicate; cone length about half total length; knobs small, rounded (posteriorly directed in some paratypes). Dorsal gland orifice about 4 μm posterior to knobs of spear (varies up to 6 μm in some paratypes). Procorpus very long and slender, gradually enlarges to muscular metacarpus equipped with large sclerotized valve (7 μm long, 6 μm wide). Distance

from anterior end to posterior margin of metacarpus 181 μm (147–197 μm in paratypes). Isthmus 18 μm long, narrow, distinct (17–40 μm long in paratypes). Posterior bulb 43 μm long, ovate (31–46 μm long in other paratypes). Excretory pore and canal not observed. Hemizonid 5 μm long, distinct near anterior end of posterior bulb (near nerve ring in some paratypes). Hemizonium small, opposite esophago-intestinal junction. "Serpentine duct" reported by De Guiran and Germani (1) as apparently located inside the intestine not observed (in some paratypes similar but incomplete sinuous structures present, appearing to be sclerotization of intestinal lining). Small anterior lip overlapping vulva but only slightly protruding beyond outline of body. Vagina with pronounced sclerotizations; gonads didelphic, outstretched. Tail long, slender; tapers rapidly posterior to anus with fine, almost pointed, terminus. Body annules fine, averaging about 1.5 μm wide. Lateral field with four longitudinal incisures occupying 26–31% of body width, equally spaced about 2 μm apart at midbody; ending irregularly slightly posteriad to anus. Phasmid small, pore-like; about one-fourth tail length posterior to anus.

Allotype (male): L = 1.88 mm; a = 55; b = 6.9; c = 54; T = 46; stylet = 35 μm ; cone = 19 μm ; spicules = 57 μm ; gubernaculum = 25 μm . Resembles female, slightly shorter in total length. Spicules massive, slightly curved. Gubernaculum complex; with notch on underside of proximal end; thin, blade-like projection laterad to each spicule. Tail narrows abruptly behind cloacal opening; terminus rounded. Lateral field with four lines equidistant about 3 μm apart, occupying 26% (25–35% in paratypes) of body width; extends short distance onto caudal alae, ending irregularly. Caudal alae with large lobes projecting beyond tail terminus; bearing fine annulations averaging about 1 μm wide, extending from inner margins laterad onto body. Phasmids about midway on tail near posterior junction of caudal alae and tail proper.

Juveniles: Smaller in size but with general aspect similar to adult female. Small developing gonad at midbody suggests six juveniles are second-stage, ten larger juve-

niles could not be distinguished as to third or fourth stages.

Type host: Around roots of arecanut palm, *Areca catechu* L. in laterite soil.

Type locality: Arecanut planting owned by Mr. M. K. George Muthalali, Valia-vedu, ex-servicemen's colony, Kulathupuzha P. O., Quilon district, Kerala, India, on the eastern side of the Thenmalai-Kulathupuzha road opposite a hair pin curve, 2 km towards Kulathupuzha, on the first terrace, 15 m from the road and 20 m above the paddy field.

Holotype: Female, collected 30 November 1976 by P. K. Koshy, slide number 1599, University of California Nematode Collection (UCNC), Davis, California.

Allotype: Male, same data and slide number as holotype, UCNC, Davis, California.

Paratypes: 31 females, 34 males, 43 juveniles, same data as holotype distributed as follows: 21 females, 22 males, 28 juveniles, UCNC; 5 females, 7 males, 10 juveniles, Nematology Laboratory, CPCRI Regional Station, Kayangulam, Kerala, India; 1 female, 1 male, 1 juvenile each to the following: National Nematode Collection, Division of Nematology, Indian Agricultural Research Institute, New Delhi, India; USDA Nematode Collection, Beltsville, Maryland, USA; Nematology Department, Rothamsted Experimental Station, Harpenden, England; Plantenziektenkundige Dienst, Wageningen, Netherlands; Commonwealth Institute of Helminthology, St. Albans, Herts., England.

DIAGNOSIS

Brachydorus swarupi sp. n. is the second species to be described in that genus and is obviously closely related to the type species, *Brachydorus tenuis*. *B. swarupi* differs from *B. tenuis* in its greater length (1.52–2.34 mm vs. 1.03–1.32 mm for *B. tenuis*); longer and more delicate stylet (26–35 μm vs. 20–23 μm in *B. tenuis*); head shape with convex

protrusion at oral aperture (simple rounded in *B. tenuis*); shorter isthmus and larger posterior bulb in *B. swarupi*; shorter tail (in *B. tenuis* female $c = 9.7$ (8.6–11.5) and $c = 42.3$ (33–48) in male); spicules and gubernaculum larger (22–39 μm and 9–12 μm , respectively, for *B. tenuis*); phasmid near posterior connection of caudal alae and tail (almost central on caudal alae of *B. tenuis*).

De Guiran and Germani (1) proposed *Brachydorus* as a monotypic genus based on their new species, *B. tenuis*. *Brachydorus swarupi* described here supports and reinforces that generic concept. Both species show relationship with *Dolichodorus* by virtue of 1) the trilobed nature of the male caudal alae and tail; 2) the pronounced cephalic sclerotization; and 3) the didelphic female genital system. However, the shorter length of *B. tenuis* cited (1) as a difference from *Dolichodorus* is no longer valid since the length of *B. swarupi* overlaps the range of *Dolichodorus*. The other differences distinguishing *Brachydorus* from *Dolichodorus* are consistent in *B. swarupi*. These differences include 1) shorter stylet, up to 35 μm in *Brachydorus*, whereas the shortest in *Dolichodorus* is 58–82 μm found in *D. minor*; 2) a longer female tail narrowing regularly; 3) a smaller head, smooth or lacking striae. In addition it should be emphasized there is a unique aspect in the esophageal and head region of *Brachydorus* in that the procarpus is strikingly elongated, gradually enlarging to form the metacarpus. Also the body outline tapers sharply anteriorly from the esophago-intestinal junction to the very small head.

LITERATURE CITED

1. De Guiran, G., and G. Germani. 1968. *Brachydorus tenuis* n.g., n.sp. (Nematoda: Dolichodorinae), associé à *Ravenala madagascariensis* sur la côte est Malgache. *Nematologica* 14:447-452.
2. Koshy, P. K., V. K. Sosamma, and P. Sundararaju. 1976. Yellow leaf disease: nematological studies. *Arecanut and Spices Bull.* 8:37-41.