DITYLENCHUS ANGUSTUS

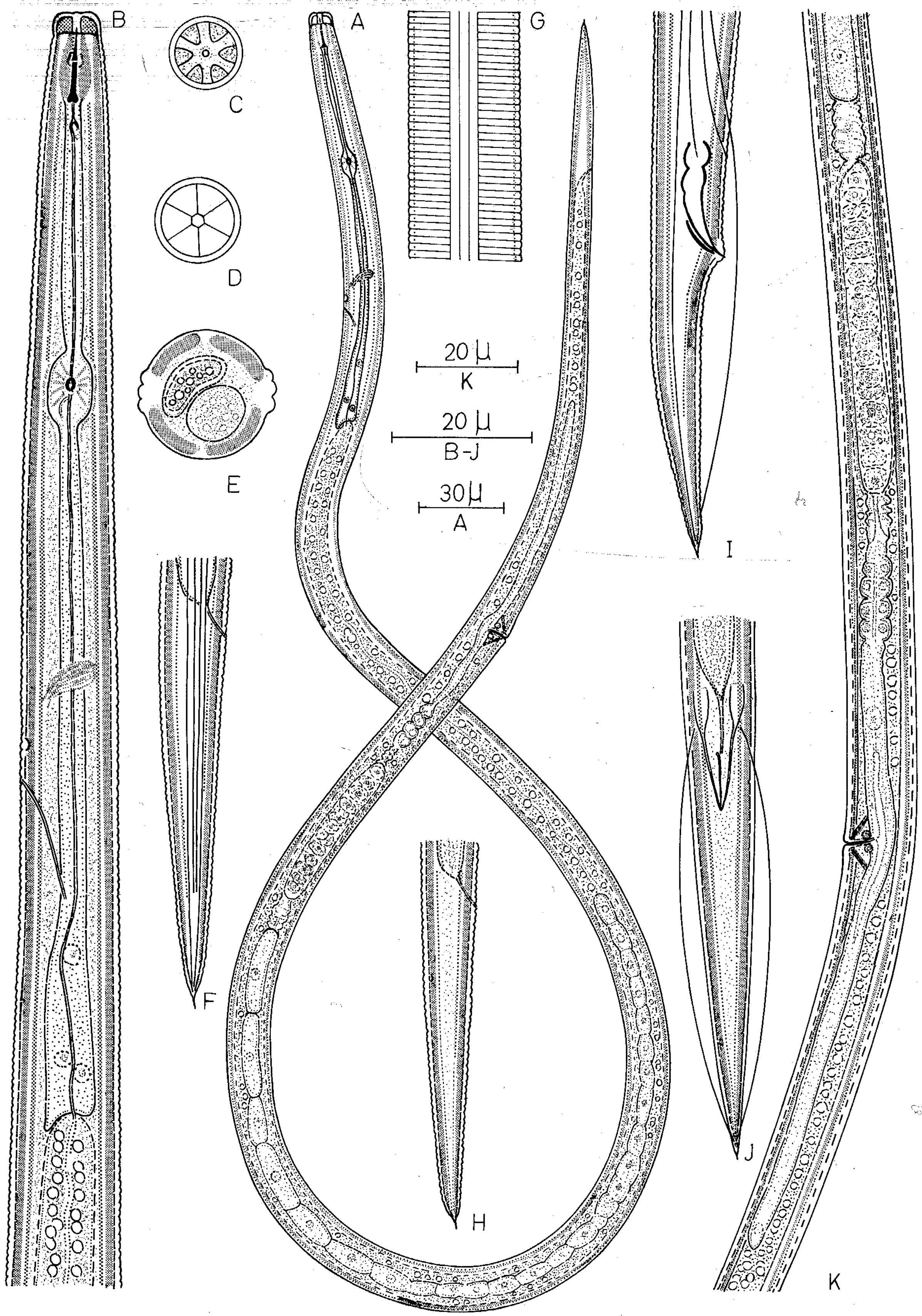


Fig. 1. *Ditylenchus angustus* (Butler, 1913) Filipjev, 1936. (All the illustrations are original, from specimens obtained through courtesy of Dr. R. W. Timm.) A. Female, entire. B. Female oesophageal region. C. *En-face* view. D. Cephalic framework. E. Female, cross section at mid-body. F. Female tail. G. Lateral field at mid-body. H. Larval tail. I. Male tail, lateral view. J. Male tail, ventral view. K. Female, vulval region.

***Ditylenchus angustus* (Butler, 1913) Filipjev, 1936.**

Syn. *Tylenchus angustus* Butler, 1913; *Anguillulina angustus* (Butler, 1913) Goodey, 1932.

MEASUREMENTS (From rice at Joydevpur, Bangla Desh; by courtesy of Dr. R. W. Timm. Authors' measurements.): 15 ♀♀: L = 0.8–1.20 mm; a = 50–62; b = 6–9; c = 18–24; V = 78–80; spear = 10–11 μ.

10 ♂♂: L = 0.7–1.18 mm; a = 40–55; b = 6–8; c = 19–26; T = 60–73; spicules = 16–21 μ; gubernaculum = 6–9 μ; spear = 10 μ.

6 larvae: L = 0.5–0.7 mm; a = 41–60; b = 6–9; c = 14–18; spear = 8–10 μ.

(From type host and locality, after Butler, 1913): ♀♀: L = 0.7–1.1 (0.9) mm; a = 47–58 (50); width = 15–22 (19 μ;) b = 7.0 (?); c = 15–23 (20); V = 70–80; spear = 9 or 10 μ. Eggs = 80–88 μ × 16–20 μ.

♂♂: L = 0.6–1.1 mm; a = 36–47 (44); width = 14–19 μ; b = 7 (?); c = 18–23; spear = 9 or 10 μ.

(After Goodey, 1932): ♀♀: L = 0.7–1.23 mm; a = 36–58; b = 7–8; c = 17–20; V = 80; spear = 10 μ.

♂♂: L = 0.6–1.1 mm; a = 36–47; b = 6–7; c = 18–23; spear = 10 μ.

No types designated.

DESCRIPTION **Female:** Body slender, almost straight to slightly arcuate ventrally when relaxed. Cuticle with fine transverse striations; annules about 1 μ wide at mid-body. Lip region unstriated, not distinctly set off from the body, low, flattened, wider than high at lip base. Cephalic framework lightly sclerotized, hexaradiate, *en-face* view showing six lips of almost equal size. Lateral fields one-fourth of body width or slightly less, with 4 incisures, outer incisures more distinct than inner ones, extending almost to tip of tail. **Deirids** immediately posterior to the level of excretory pore. Phasmids close behind mid-part of tail, pore-like, difficult to see. Spear moderately developed, conus attenuated, about 45% of total spear length; knobs small but distinct, usually with posteriorly sloping anterior surfaces, rather amalgamated with one another, about 2 μ across. Procorpus cylindrical, narrows as it joins median oesophageal bulb, as long as 3–3.6 times body-width in that region. Median oesophageal bulb oval, **with a distinct valvular apparatus anterior to the centre.** Isthmus narrow, cylindrical, 1.5 to 1.9 times as long as procorpus; posterior oesophageal bulb usually clavate; 27–34 μ long, slightly overlapping the intestine mainly on ventral side, with 3 distinct gland nuclei. Cardia absent. Nerve ring conspicuous, 21 to 35 μ behind median oesophageal bulb. Excretory pore 90 to 110 μ from anterior end, slightly anterior to beginning of posterior oesophageal bulb. Hemizonid 3 to 6 μ anterior to excretory pore. Vulva a transverse slit, **vaginal tube somewhat oblique,** reaching more than half-way across body. **Spermatheca very elongated, packed with large rounded sperms.** Anterior ovary outstretched, oocytes in single row, rarely in double rows. Post-uterine sac collapsed, without sperms, 2.0–2.5 times as long as vulval body width, extending about $\frac{1}{2}$ to $\frac{3}{4}$ distance to anus. Tail conoid, 5.2 to 5.4 times the anal body width in length, **tapering to a sharply pointed terminus resembling a mucro.**

Male: As numerous as females. Body almost straight to slightly curved ventrally when fixed. Morphology similar to females. Caudal alae (bursa) present, narrow in some specimens, beginning opposite the proximal end of spicules, **extending almost to tail tip.** Spicules curved ventrally, simple; gubernaculum short, simple.

Larvae: Similar to adults in gross morphology, oesophagus proportionally longer than in adults.

TYPE HOST AND LOCALITY Rice, *Oryza sativa*, in Eastern Bengal (= Bangla Desh)

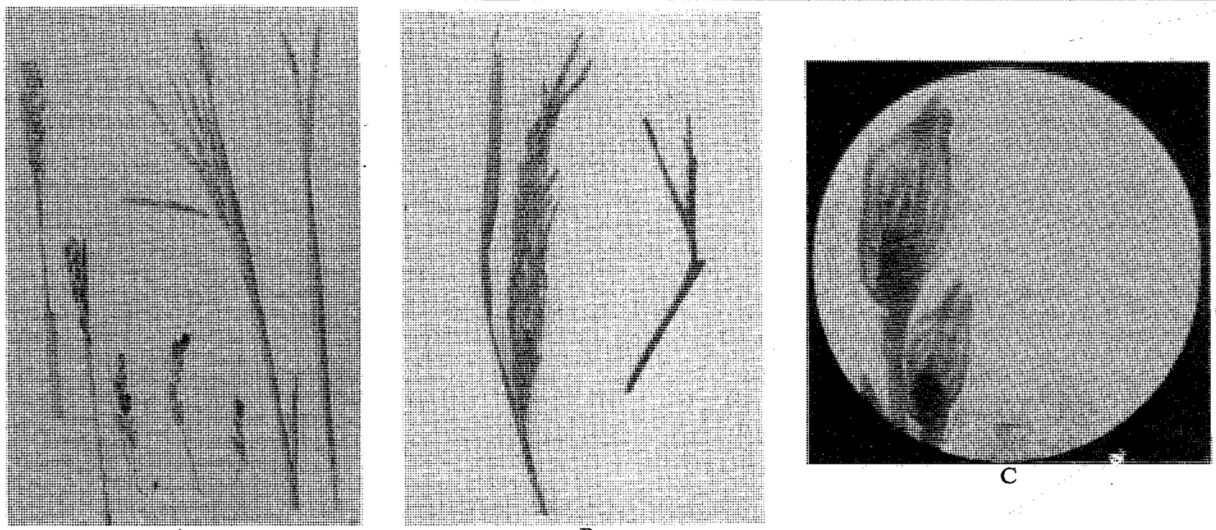
SYSTEMATIC POSITION (After Siddiqi, 1971) Tylenchida: Tylenchoidea: Anguinidae: Anguininae: *Ditylenchus* Filipjev, 1936.

DISTRIBUTION AND HOSTS The rice stem nematode, *Ditylenchus angustus* was first reported by Butler (1913) causing "ufra" disease of rice in the districts of Noakhali, Tippera and part of Dacca in Eastern Bengal (now Bangla Desh). Butler (1913) also gave a detailed account of the infested areas in these three districts. *D. angustus* is known to occur in rice also in Burma (Seth, 1939), Uttar Pradesh in India (Singh, 1953), Gangetic delta in India, Malaya and Burma (Ling, 1951), Philippines (Reyes & Palo, 1956), United Arab Republic (Winslow, 1960), Phatalung in southern Thailand (Hashioka, 1963), and in the high plateau regions of Madagascar (Vuong, 1968a, 1968b, 1970a, 1970b, 1970c). According to the last author (1969a) the whole of Madagascar except the west coast is now infested by *D. angustus*.

The host range of *D. angustus* is usually confined to *Oryza* spp. (Hashioka, 1963) including *O. sativa* var. *fatua*, *O. glaberrima*, *O. minuta*, *O. cubensis*, *O. officinalis*, *O. meyriana*, *O. latifolia*, *O. eichingeri* and *O. alta*. *Leersia hexandra* has been recorded as a host in Madagascar (Vuong, 1969a, 1970; Vuong & Rabarijoela, 1968). Timm & Ameen (1960) reported *D. angustus* in soil around tomato (*Lycopersicon esculentum*) in Eastern Bengal (= Bangla Desh), however there was no indication that this crop served as a host of this nematode.

BIOLOGY AND LIFE-HISTORY Butler (1913) and Vuong (1969a) studied the biology of *D. angustus*. In Eastern Bengal, adults, larvae and eggs of the nematode have been found in all stages of the "ufra" disease (Butler, 1913). A few days after the rice seedlings have been transplanted the nematodes are found in the terminal buds and, with the growth of the plants, they ascend to feed ectoparasitically on the newly formed tissues (Butler, 1913; Vuong, 1969a). During flowering and heading of the rice crop, the nematodes are mainly observed in tender parts of the stem, leaf sheath, stalks, sterile twisted grains and in malformed peduncles (Fig. 2). According to Butler (1913), most of the individuals on aman paddy (= winter rice) in July are larvae with few adults and eggs. In August the adults are numerous. The nematodes remain coiled in a dormant state within the dry glumes and stubble during winter after harvest and resume their activity only with the flooding of the fields. Under Bangla Desh conditions, multiplication of the nematode takes place between May or June and November and apparently there are not less than three generations during this period (Butler, 1913). The spread of the nematode from field to field is through irrigation water and rain. The ratoons, plant debris left in the field after the harvest and contaminated soil are the sources of infection. Seth (1939) observed *D. angustus* on rice grains, however, Vuong (1970c) and Butler (1913) failed to record this, and the chance of transmission of "ufra" through seed is minimal (Vuong, 1970). The nematode can survive desiccation for more than 15 months (Butler, 1913, Hashioka, 1963). The most favourable temperature for infection of rice is from 28 to 30°C indicating the possibility of multiplication of *D. angustus* throughout the year under tropical conditions.

HOST-PARASITE RELATIONSHIPS *D. angustus* is known to be the causal organism of the diseases "Ufra" or "Dak Pora" in Bangla Desh, "Akhet-pet" in Burma and "yad-ngo" in southern Thailand. Rice is the principal host for this nematode and losses due to "ufra" were estimated to be 50% in U.P., India (Singh, 1953) and 20–90% in Thailand (Hashioka, 1963). Butler (1913) estimated the loss of grain to be 200,000 maunds (= 8,000 tonnes) in one area of Noakhali in Eastern Bengal in 1910.



A B C

Fig. 2. A. Rice ears showing symptoms of *D. angustus* infection. Note dark lesions on the grain and flaccid and shrunken stalk. (From Butler, 1913.) B. Rice ear infested with *D. angustus* (right) compared with healthy ear (left). C. Large numbers of *D. angustus* released from rice inflorescence at an early stage of disease. (From Butler, 1913.)

The nematodes feed ectoparasitically causing malformation of host tissues. Infected plants are stunted and the leaves often wilt. The leaf sheath and the limb above the last internode become distorted and crimped. The peduncle coils and pedicels bear distorted sterile spikelets. The stem bears characteristic lesions just above one or more of the upper nodes (Fig. 2, A, B). Butler (1913) describes two types of "ufra" symptoms: in "thor ufra" (= swollen ufra) upper parts of stalks appear to be swollen into a spindle shape and the ears cannot escape; in "pucca ufra" the ears escape from the sheath wholly or in part. "Ufra" has been found on both "aus" (= rainy season crop) and "aman" crops (= winter crops) but not on the "boro" crop. There is no difference in susceptibility to the nematodes between aus and aman crops. Vuong (1970c) could not find any variety completely resistant to *D. angustus.* According to Butler (1913) the transplanted crop is never severely attacked, the damage being mainly to broadcast rice.

ASSOCIATIONS WITH OTHER PATHOGENS No definite associations between *D. angustus* and other pathogens have been observed. Vuong (1969a, 1970c) considers that the spots on the sheath due to nematode attack may also be the sites of secondary invasion by fungi like *Fusarium*, *Cladosporium* and *Sclerotium.*

CONTROL Phytosanitary methods appear to be very important in controlling *D. angustus*. Burning of stubbles, stubble ploughing, and fallowing during the hot season are recommended (Butler, 1919; Vuong, 1969, 1970b, 1970c). Experiments with large numbers of chemicals are in progress in Madagascar (Vuong, 1970b, 1970c; Vuong & Rodriguez, 1970, 1972). Soil application of dazomet appears to be promising; however, more work is necessary before any chemicals can be recommended for controlling this nematode (Vuong, 1970b, 1970c).

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