

THE UNUSUAL POSITION OF THE PHASMIDS IN *COSLENCHUS*
COSTATUS (DE MAN, 1921) GEN. N., COMB. N. AND OTHER
 TYLENCHIDAE (NEMATODA: TYLENCHIDA)

BY

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Phasmids are reported in *Aglenchus*, *Campbellenchus*, *Coslenchus* gen. n., *Filenchus*, *Irantylenchus*, *Malenchus*, *Ottolenchus* and *Tylenchus* as occurring just dorsal to the lateral fields in the post-median region of the body of males, females and juveniles; in the female their position being at or near the vulva. This unusual position of the phasmids is a unique feature of the Tylenchidae. In *Coslenchus costatus* (de Man, 1921) gen. n., comb. n. the phasmids generally occur on the first dorsal ridge next to the lateral field. *Coslenchus* gen. n. is proposed for those species of *Aglenchus*, *sensu lato*, that have longitudinal cuticular ridges around the body. The type-species *C. costatus* (de Man, 1921) comb. n. and *C. areolatus* (Egunjobi, 1967) comb. n., *C. indicus* (Khan, Chawla & Prasad, 1969) comb. n. and *C. lycopersicus* (Husain & Khan, 1976) comb. n. are included in the new genus.

The order Tylenchida belongs to the subclass Secernentea (= Phasmidia) containing nematodes that, theoretically, possess phasmids. Whereas phasmids are clearly visible in some groups e.g. Dolichodoridae, Hoplolaimidae, Pratylenchidae, they are indistinct or have not been seen and reported in others. Typically, the phasmids in Tylenchida are small with pore-like apertures located centrally in the lateral fields on either side of the tail. They may be pre-anal (e.g. *Helicotylenchus*, *Rotylenchus*, *Neodolichodorus*) or greatly enlarged when they are called scutella (singular: scutellum) as in several genera of Hoplolaiminae. Scutella vary in position but are always in the middle of the lateral fields. They are caudal in *Scutellonema*, pre-anal in *Scutellonema* and *Peltamigratus* and aberrantly placed along the body in *Aorolaimus* and *Hoplolaimus*.

In the males of the Tylenchida, phasmids may or may not extend into the bursa to form a pair of rod-like false ribs. This characteristic was used by Andr assy (1976) to differentiate between the Tylenchorhynchidae and Belonolaimidae and the Hoplolaimidae. Andr assy's contention that male Dolichodoridae have small phasmids which are not rod-like is rejected because in Dolichodorinae the phasmids are rod-like and extend into the bursa (see Siddiqi, 1976).

In the Aphelenchina, the phasmids are obscure and have rarely been reported. Thorne & Malek (1968), however, illustrate phasmids located terminally or sub-terminally on the tails of *Aphelenchus*, *Aphelenchoides*, *Anomyctus*, *Megadorus* and *Paraphelenchus*. Saltukoglu *et al.* (1976) reported the occurrence of sub-terminal phasmids in *Aprutides*.

In the Tylenchida, the phasmids are undescribed for most Criconematoidea,

Neotylenchoidea, Tylenchidae (excluding Psilenchinae) and Anguinidae; in Aphasmatylenchinae they are said to be absent. In *Tylenchus*, *Ditylenchus* and the related genera, phasmids are indistinct or absent. In *Tylenchus*, Thorne (1949, 1961) reported that phasmids had not been observed, and in *Ditylenchus*, although Thorne (1949) illustrated phasmids on the tail of *Ditylenchus dipsaci*, he (1961) stated, "Phasmids rarely visible even from a dorsoventral view".

In his generic diagnoses Golden (1971) reported that phasmids were usually invisible in *Tylenchus*, indistinct, often invisible in *Ditylenchus* and invisible in *Aglenchus* and *Cephalenchus*. Phasmids were not mentioned in *Anguina*, *Paranguina* and *Subanguina*. However, Siddiqi (1971) wrote that phasmids were indistinct in the Anguinidae, contrasting with the distinct phasmids of Hoplolaimidae, Merliniinae and Tylenchorhynchinae.

Andrássy (1976) used phasmids in a key to differentiate the Psilenchidae (phasmids usually visible) from the Tylenchidae (phasmids invisible).

Whatever their form, the phasmids of Tylenchina are described as situated in the middle of the lateral fields (occasionally not exactly in the middle as in some species of *Helicotylenchus*, *Tylenchorhynchus*, etc.). As no one appears to have searched for phasmids outside the lateral fields in those genera in which the phasmids were reported as obscure or absent I decided to look for them and was successful in finding them just dorsal to the lateral fields in the post-median region of the body of males, females and juveniles of several species of *Aglenchus*, *Campbellenchus*, Wouts, 1978, *Coslenchus* gen. n., *Filenchus*, *Irantylenchus*, *Malenchus*, *Ottolenchus* and *Tylenchus* of the family Tylenchidae (Fig. 2). This newly recorded dorso-sublateral position of the phasmids outside the lateral fields in the Tylenchidae is a unique feature of this family within the order Tylenchida. In these genera all previous records of phasmids occurring on the tail are almost certainly incorrect.

The phasmids are easily seen in species of *Coslenchus* gen. n. and *Campbellenchus* Wouts, 1978, which have longitudinal cuticular ridges on the body, but they are rather difficult to see in *Aglenchus agricola* and *Ottolenchus* spp. The phasmids of *Coslenchus costatus* (de Man, 1921) gen. n., comb. n. collected in St. Albans and Luton, England, in Cyprus, Fiji, Iran, Minneapolis (USA), Moscow (USSR) and New Zealand were studied in detail. Several other species of *Coslenchus* (to be described later as new species) were also studied from Australia, England, Ghana, Portugal, Syria, Trinidad and Turkey. It was found that the phasmids in *C. costatus* may be either opposite each other or a small distance apart. In females they are always at or close to the vulva; they may be pre-vulval, ad-vulval, post-vulval or one pre- and the other post-vulval.

Generally they are located on the first dorsal ridge next to the lateral field but their position varies from just in the lateral field (as seen in one of the females and a IV-stage female juvenile of *C. costatus*) to the dorsal edge of the first dorsal ridge, i.e. they may be in the lateral field (Fig. 1, A & B), just below the dorsal edge of the lateral field (Fig. 1, C & F), in the groove just dorsal to the lateral

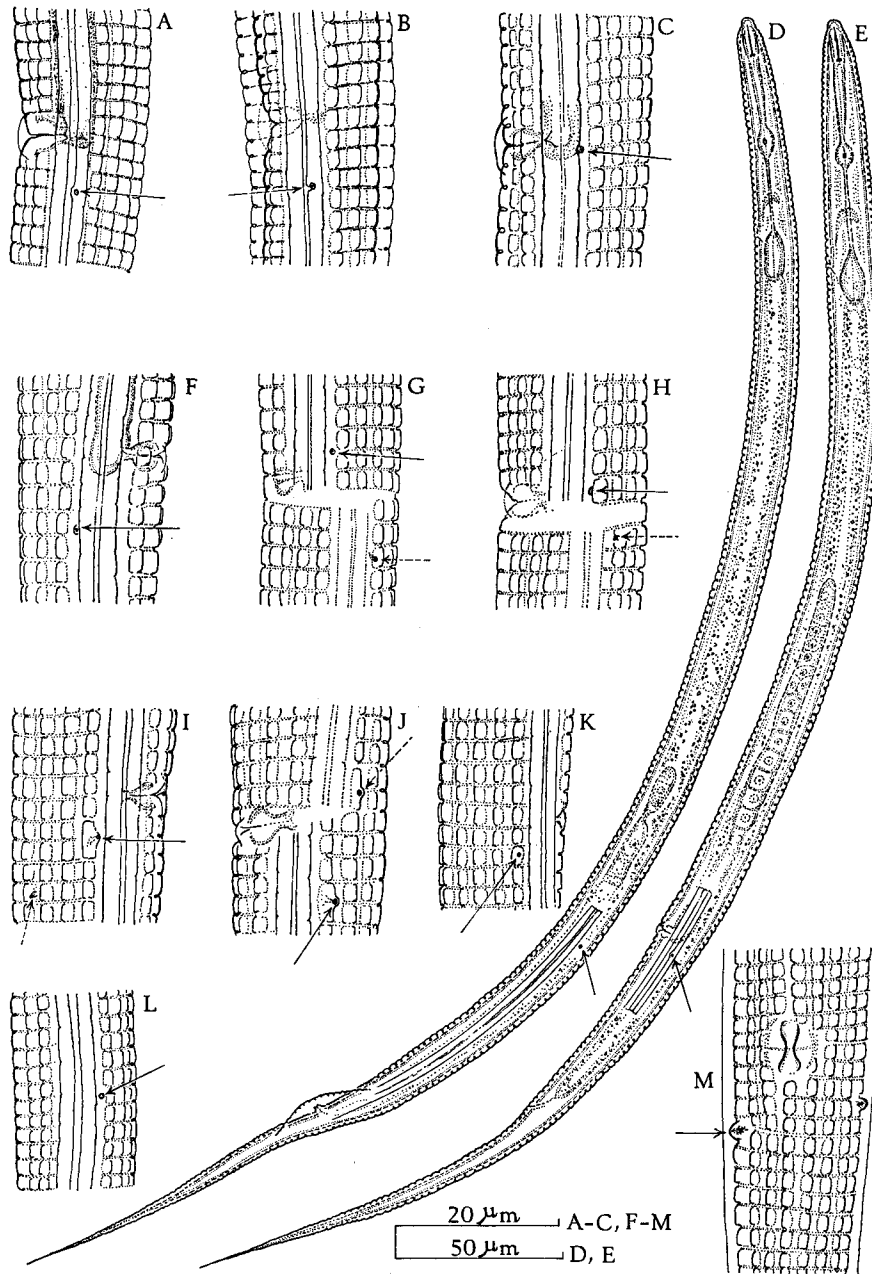


Fig. 1. Phasmid in species of *Coslenchus* gen. n. A, C, F-K and M. Vulval regions. B. Pre-adult female juvenile. D and L. Male. E. Female. A and E. *Coslenchus costatus* from apple soil in Luton, England. B, C, I and M. *C. costatus* from tree soil in Minneapolis, USA. D, K and L. *C. costatus* from tea soil in Lahidjan, Iran. F-H *Coslenchus* sp. from maize soil in Taipadas, Portugal. J. *Coslenchus* sp. from grapevine soil in de Burgh, upper Swan, Australia. (Arrows point to phasmid apertures; broken arrows point to phasmid apertures on lower side).

field, (Fig. 1, G) at the ventral edge of the first dorsal ridge next to the lateral field (Fig. 1, H & J), in the centre of the dorsal ridge (Fig. 1, K) or on the dorsal edge of the first dorsal ridge next to the lateral field (Fig. 1, J). They may be located on the transverse stria but more often they lie between striae. A similar variation in the location of the phasmids was seen in *Filenchus* spp. from Louisiana (USA), Moscow (USSR) and UK (Fig. 2, A, B & F). In a bisexual population

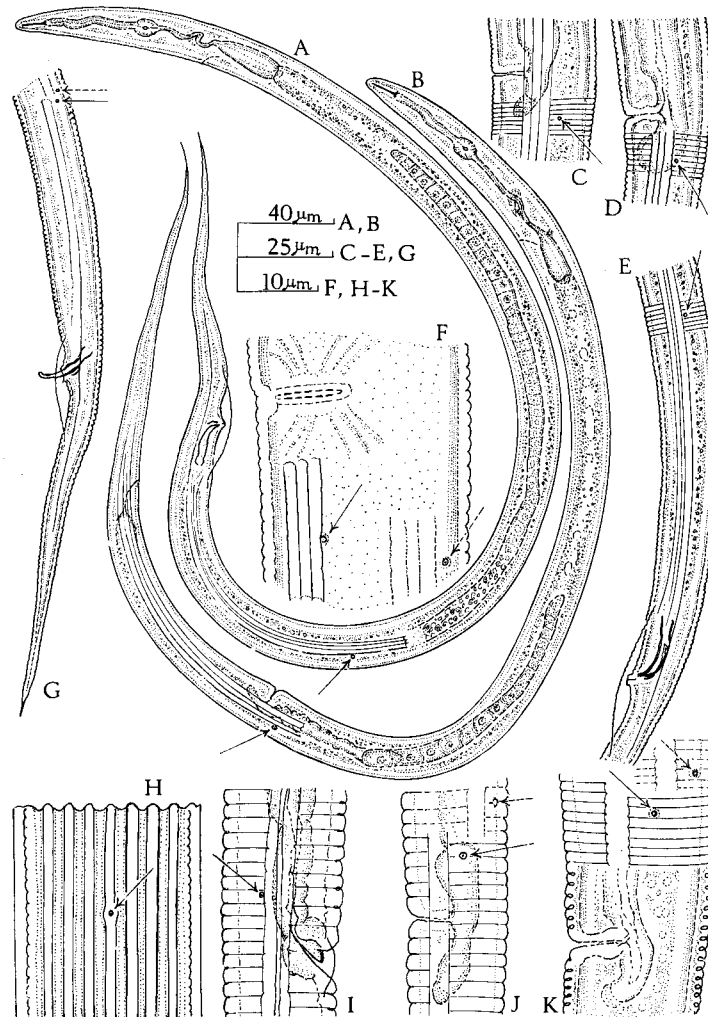


Fig. 2. Phasmid in Tylenchidae. A, E, G and H. Males, remainder females. A and B. *Filenchus* sp. from wheat soil near Moscow, USSR. C. *Iranitylenchus* sp. from soil of *Cannabis sativa* in Castamonu, Turkey. D and E. *Tylenchus davainei* from oak soil in Scotland. F. *Filenchus* sp. from rice soil in Louisiana, USA. G. *Malenchus* sp. from grass soil in Luton, England. H. *Campbellenchus poae* from soil in Campbell Island, New Zealand. I. *Aglenchus* cf. *agricola* from banana soil in Fiji. J. *Ottolenchus* sp. from sweet pepper soil in Brunei. K. *Malenchus* sp. from tomato soil in Brunei. (Arrows point to phasmid apertures; broken arrows point to phasmid apertures on lower side).

of *Coslenchus costatus* from Iran supplied by Dr. Geraert, the phasmids in female and male occur at 63 and 60% of the body length from the front end respectively.

The phasmid apertures are seen as minute pores usually on a papilla-like elevation of the cuticle. The pores lead into a short pouch, the phasmid proper, from which a duct or nerve leads deep into the lateral chord tissues.

The relative position of the phasmids on the body may be useful in differentiating between the species and higher categories and in deciding the systematic position of the genera. For example, in *Campbellenchus poae* Wouts, 1978, the females have phasmids 27 μm and 115 μm in front of the vulva and anus, respectively, and the males 104-106 μm in front of the cloaca. In the other species, *C. filicauda* Wouts, 1978, the phasmids of females are 21-23 μm and 127-129 μm in front of the vulva and anus, respectively, and of males 126-128 μm in front of the cloaca. Among higher categories, the finding of dorso-sublateral post-median phasmids should help to distinguish the Tylenchidae from the Psilenchidae and Tylodoridae which have lateral caudal phasmids. The strongly developed spear of *Campbellenchus* suggests it should be placed in the Tylodoridae (see Wouts, 1978), but the dorso-sublateral post-median phasmids would justify a position in the Tylenchidae.

Now it is known that phasmids can be found in unexpected places, it is hoped that these chemo-receptors will be studied in greater detail to ascertain their function.

What evidence is there that these post-median, pore-like structures of Tylenchidae are phasmids? And, if they are phasmids, why are they placed so far forward on the body? In answer to the first question, it may be said that under the light microscope these structures resemble phasmids that occur on the tails of the other Tylenchida. Furthermore these structures are seen in those genera in which the phasmids are absent from the usual position and are not seen in those that have well recognized phasmids.

In answer to the second question, one can only speculate that phasmids situated in the vulval region are an adaptation to assist during copulation. Why the phasmids have come to lie outside the lateral fields, is unknown. However, as mentioned above, the primary position of the phasmids in the middle of the lateral fields was occasionally observed in *Coslenchus costatus*.

Coslenchus gen. n.

Diagnosis. Tylenchidae. Small-sized (under 1 mm), straight to arcuate upon relaxation. Body cuticle coarsely annulated, modified into longitudinal ridges (12-22 in number excluding the ridges of the lateral fields) which in surface view show minute squares or rectangles due to intersections by the transverse striae. Lateral fields with two or three longitudinal ridges well marked from other body ridges by being larger and not divided into minute squares or rectangles; with 4, occasionally 3 incisures. Lip region striated. Spear under 15 μm long, with conus less than half its length; basal knobs rounded. Deirids present. Median oesophageal bulb strongly muscular. Basal oesophageal bulb offset from intestine, with

a valve at base. Vulva transverse, depressed, with lateral flaps which are sometimes rudimentary; no overhanging anterior lip flap. Vagina at right angles to body axis. Post-vulval uterine sac usually rudimentary. Phasmids dorso-sublateral post-median, near vulva in females. Tail very elongate-conoid to filiform. Male similar to female in gross morphology, with ad-anal bursa, small fixed gubernaculum and cloacal lips forming a short tube.

Type-species: Coslenchus costatus (de Man, 1921) comb. n.

Syn. *Tylenchus costatus* de Man, 1921
Tylenchus (Aglenchus) costatus (de Man, 1921)
 Andrassy, 1954
Aglenchus costatus (de Man, 1921) Meyl, 1961
Tylenchus cancellatus Cobb, 1925
Tylenchus buffalorae Altherr, 1950
Tylenchus (Aglenchus) neozelandicus Egunjobi, 1967

Other species: Coslenchus areolatus (Egunjobi, 1967) comb. n.

Syn. *Aglenchus areolatus* Egunjobi, 1967

Coslenchus indicus (Khan, Chawla & Prasad, 1969) comb. n.

Syn. *Tylenchus (Aglenchus) indicus* Khan, Chawla & Prasad, 1969

Coslenchus lycopersicus (Husain & Khan, 1976) comb. n.

Syn. *Aglenchus lycopersicus* Husain & Khan, 1976

Relationship. In having longitudinal cuticular ridges around the body, *Coslenchus* gen. n. resembles *Pleurotylenchus* Szczygieł, 1969 and *Campbellenchus* Wouts, 1978. *Pleurotylenchus* lacks lateral fields, has a single ridge laterally which is similar to other ridges, only 10 longitudinal ridges around the body, vulva covered by an anterior lip flap, lateral flaps absent. *Campbellenchus* lacks transverse annulations except in the most anterior region of the body, and has a robust spear.

Coslenchus gen. n. shows affinities to *Aglenchus* Andrassy, 1954 but differs in having longitudinal cuticular ridges around the body and vagina being at right angles to body axis (vagina is oblique to body axis in *Aglenchus* s. str. (see Fig. 2, I)).

ZUSAMMENFASSUNG

Die ungewöhnliche Lage der Phasmiden bei Coslenchus costatus (de Man, 1921) gen. n., comb. n. und anderen Tylenchiden (Nematoda: Tylenchida)

Für *Coslenchus costatus* (de Man, 1921) gen. n., comb. n. und *Aglenchus*, *Campbellenchus*, *Filenchus*, *Iranitylenchus*, *Malenchus*, *Ottolenchus* und *Tylenchus* werden die Phasmiden als gerade dorsal zu den Seitenfeldern im postmedianen Körperbereich von Männchen, Weibchen und Larven liegend beschrieben, bei den Weibchen also an oder nahe der Vulva. Bei *C. costatus* befinden sich die Phasmiden meist auf der ersten dorsalen Leiste neben dem Seitenfeld, doch werden sie manchmal auch im Bereich des Seitenfeldes und in dem Raum zwischen Seitenfeld und erster dorsaler Leiste gefunden. Die latero-subdorsale Lage der Phasmiden außerhalb des Seitenfeldes ist ein einmaliges Kennzeichen der Tylenchidae. Es wird angenommen, daß die relative Lage der Phasmiden am Nematodenkörper ein brauchbares Merkmal für die Unterscheidung von Arten und von höheren Kategorien sowie für die Beurteilung der systematischen Stellung der Gattungen sein kann.

Coslenchus gen. n. (Typenart *C. costatus* (de Man, 1921) comb. n.) wird für die Arten von *Aglenchus* s.l. vorgeschlagen, die rings um den Körper Cuticularlängsleisten besitzen. Andere zu dieser Gattung gehörende Arten sind *Coslenchus areolatus* (Egunjobi, 1967) comb. n., *C. indicus* (Khan, Chawla & Prasad, 1969) comb. n. und *C. lycopersicus* (Husain & Khan 1976) comb. n.

REFERENCES

- ANDRÁSSY, I. (1976). *Evolution as a basis for the systematization of nematodes*. London: Pitman Publishing, 288 pp.
- GOLDEN, A. M. (1971). Classification of the genera and higher categories of the order Tylenchida (Nematoda). In: *Plant parasitic nematodes*, Vol. 1, edited by Zuckerman, B. M., Mai, W. F. & Rohde, R. A., New York: Academic Press, Inc., 191-232.
- SALTUKOGLU, M. E., GERAERT, E. & COOMANS, A. (1976). Some Tylenchida from the Istanbul-area (Turkey). *Nemat. medit.* **4**, 139-153.
- SIDDIQI, M. R. (1971). Structure of the oesophagus in the classification of the superfamily Tylenchoidea (Nematoda). *Indian J. Nematol.* **1**, 25-43.
- (1976). New plant nematode genera *Plesiodoros* (Dolichodorinae), *Meiodorus* (Meiodorinae subfam. n.), *Amplimerlinius* (Merliniinae) and *Gracilancea* (Tylogoridae grad. n.). *Nematologica* **22**, 390-416.
- THORNE, G. (1949). On the classification of the Tylenchida, new order (Nematoda: Phasmidia). *Proc. helminth. Soc. Wash.* **16**, 37-73.
- (1961). *Principles of Nematology*. New York: McGraw-Hill Book Co., Inc., 553 pp.
- THORNE, G. & MALEK, R. B. (1968). Nematodes of the Northern Great Plains. Part I. Tylenchida Nematoda: Secernentea. Techn. Bull. 31, S. Dak. St. Univ., 111 pp.
- WOUTS, W. M. (1978). Campbellenchinae (Nematoda: Tylenchidae) a new subfamily from Campbell Island with a description of two new species. *N. Z. J. Zool.* (1977) **4**, 216-219.