

A new species of *Chronogaster* Cobb, 1913 (Nemata : Plectidae) with an amended diagnosis of the genus and discussion of cuticular ornamentation⁽¹⁾

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SUMMARY

Chronogaster spinicarpus n. sp. is described from soil about the roots of coconut palm in Kerala, India. It is distinguished from all other species of *Chronogaster* by its longitudinal rows of spines. The stability of the genus *Chronogaster* is discussed with stress on internal anatomy and distribution of cephalic sensillae as generic characteristics. Most external ornamentation is judged to be diagnostic for species only.

RÉSUMÉ

Description d'une nouvelle espèce de *Chronogaster* Cobb, 1913 (Nemata : Plectidae),
diagnose émendée du genre et considérations sur l'ornementation cuticulaire

Description est donnée de *Chronogaster spinicarpus* n. sp., venant de sol de rhizosphère de cocotier, au Kerala (Inde). Il se distingue de toutes les autres espèces du genre par la présence de rangées longitudinales d'épines sur le corps. La solidité du genre *Chronogaster* est discutée en insistant sur l'anatomie interne et la position des sensilles céphaliques en tant que caractères génériques. La plupart des ornements cuticulaires sont considérées comme caractères de niveau spécifique seulement.

In 1913, Cobb proposed the genus *Chronogaster* to accommodate his newly found freshwater species *C. gracilis*. Andrassy (1958) synonymized Cobb's species with Daday's 1899 *Cephalobus longicollis*. Therefore, the correct contemporary nomenclatorial designation for the type species is : *Chronogaster longicollis* (Daday, 1899) Andrassy 1958, syn. *C. gracilis*, Cobb 1913. Twenty nominal species from marine, freshwater and soil environments are now recognized in the genus. Heyns and Coomans (1980) reviewed the genus and clarified many, heretofore, poorly understood morphologic features. The specimens described and proposed here as a new species were collected in Kerala, India. More impor-

tant than a new species proposal it adds new dimensions to this widespread and varied genus.

Materials and methods

Nematodes, after separation from soil by sieving and decanting, were killed by heating in water. Subsequently, the recovered specimens were preserved in 2 % formalin and stored for several weeks prior to transfer to F.A.A. Dehydration to glycerin followed Cobb's slow method : 2.5 % glycerin in 30 %

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ethanol, minimum 24 h; specimens are then transferred to 5 % glycerin in 30 % ethanol and allowed to evaporate to glycerin under ambient conditions. Final dehydration to anhydrous glycerin was achieved over CaCl_2 in a desiccation chamber. *En face* sections cut in glycerin were mounted in glycerin-jelly.

Specimens for scanning electron microscopy were transferred from F.A.A. into a graded series of ethanol beginning at 30 % ethanol and terminating in absolute ethanol. Specimens were then taken through a graded series of amyl acetate-absolute alcohol, beginning with 30 % amyl acetate and ending with absolute amyl acetate. Other specimens from permanent glycerin slides, whose method of preservation was unknown, were first placed in a mixture of glycerin-alcohol-water, 80:6:14. Through a series of gradual changes the glycerin was removed and the specimens were in 30 % ethanol. These specimens were then transferred to F.A.A. then to 2.5 % formalin where they remained a minimum of 24 h. From this point they were processed into a graded series of ethanol and then amyl acetate as described above for specimens not previously in glycerin. A 15 sec sonication was applied in absolute amyl acetate. After critical point drying with CO_2 , the specimens were mounted on stubs and coated with 200 Å of gold sputtered on in several layers. Examination and photography was done on a Cambridge Mark II scanning electron microscope at 7000-8000 × and 10 KV.

Chronogaster Cobb, 1913
= *Walcherenia* de Man, 1921

DIAGNOSIS EMEDED

Plectidae. Relatively small (less than 2 mm), slender (a = 33-94) nematodes tapering more posteriorly than anteriorly. Body cuticle transversely striated, striations may be broken by longitudinal striae, lateral field incisures or annules may bear hooklike spines that form six to twelve longitudinal rows. Lips fused but oral aperture often hexa- or triradiate, ancestral twelve labial sensillae not seen. Lip capsule non-annulated, low and rounded or high and truncate, bearing four prominent submedian sensilla trichodea. Amphids one to four annules posterior to lip capsule; variable in shape of external aperture: nearly slit-like, semi-crescentic oval, nearly circular or extended stirrup-shape; posterior edge of aperture usually (? always) bearing two protuberances which may be borne on an elongated, anteriorly directed pedicel. Oral opening followed by narrow,

short vestibule leading to stoma. Stoma composed of two parts: anterior cylindrical cheilostome and posterior funnel-shaped esophastome. Radial tubules on each ray of esophageal lumen (characteristic of the suborder Araeolaimina) located one and one-half to two and one-half body diameters posterior to base of stoma. Esophagus often slightly expanded in this area. Esophagus cylindroid anteriorly, expanding posteriorly to an ovoid bulb, followed by a stem-like extension leading to the esophago-intestinal valve. Lumen of subterminal bulb generally strongly cuticularized in anterior half of bulb, forming a denticulate chamber. When visible, excretory pore and hemizonid located just posterior to level of circum-esophageal commissure (nerve ring). Circumesophageal commissure surrounds the slender anterior esophagus near its middle. Tail elongate-conoid to nearly filiform; terminus either minutely rounded or sharply pointed. Tail terminus sometimes with one or more mucros accompanied by one or more spines. Caudal glands, spinneret doubtful; lateral gland cells rarely present. Vulva generally near equatorial. Genital system antepudendal, *i.e.*, with a single anteriorly directed reflexed genital tube. Postuterine branch absent or when present may exceed two vulval body diameters in length. Males with narrow, setaceous, slightly arcuate spicules. Gubernaculum present but reportedly absent in *C. longicollis*. Two opposed testes, anterior outstretched, posterior reflexed. Tuboid pre-anal supplements variable in number.

TYPE SPECIES

C. longicollis (von Daday, 1899) Andrassy, 1958 = *Cephalobus longicollis* von Daday, 1899 = *Chronogaster gracilis* Cobb, 1913.

Chronogaster spinicarpus* n. sp. (Figs 1 A-E; 2 A-G)

DIMENSIONS

Females (n = 10): L = 1.17 (1.01-1.33) mm; a = 60 (49-73); b = 4.9 (4.0-5.2); c = 7.9 (6.4-11.0); V = $11^{(9-13)}51^{(50-52)4.2^{(4-5)}}$; R (body annules) = 299 (269-353).

* From: *spina* = thorn and *corpus* = body.

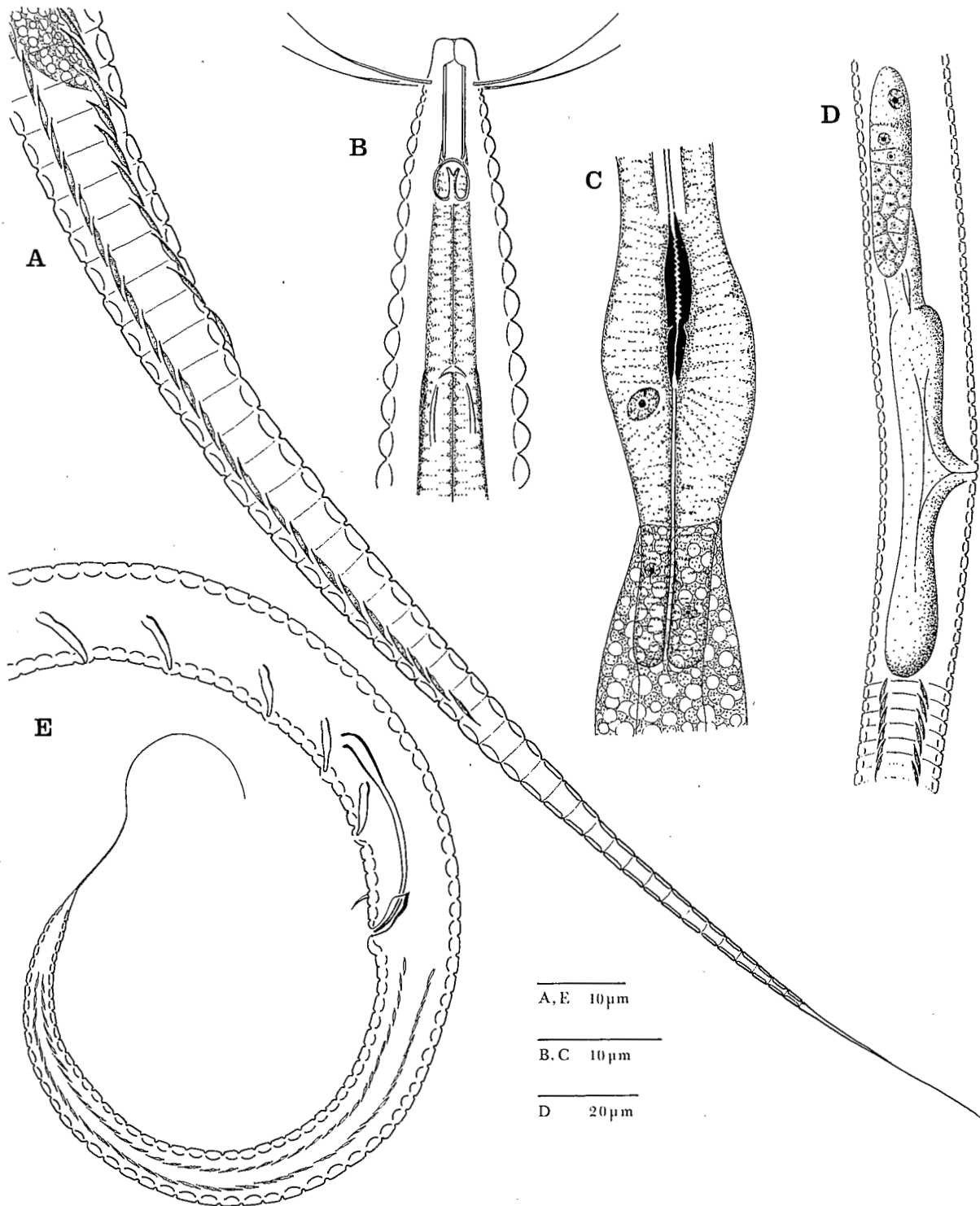


Fig. 1. *Chronogaster spinicarpus* n. sp. Female, A-D. A : Tail region ; B : Cephalic region ; C : Posterior bulbar region of esophagus ; D : Vulvar region, lateral view. Male, E : Tail region, lateral view.

Males ($n = 10$) : $L = 1.22$ (1.0-1.40) mm ; $a = 83$ (74-91) ; $b = 5.5$ (5.2-6.0) ; $c = 8.5$ (8.0-9.3) ; $T = ?$ 37 ; $R = 303$ (255-371).

Juveniles ($n = 8$) : $L = 0.74$ (0.57-0.87) mm ; $a = 55$ (44-64) ; $b = 4.2$ (3.5-4.8) ; $c = 6.4$ (3.3-9.1) ; $R = 331$ (209-366) ; vestibule = 2.6 (1.0-3.5) μm ; stoma = 7.2 (6.5-8.0) μm ; stoma to radial tubules = 25 (21-26.5) μm ; amphid 4-6 annules posterior to lip cap ; amphid aperture = 3.3 (3.0-3.5) \times 3.5 (3.0-4.0) μm .

Holotype ; female : $L = 1.07$ mm ; $a = 49$; $b = 5.0$; $c = 7.9$; $V = 9$ 52⁴ ; $R = 328$.

Allotype ; male : $L = 1.07$ mm ; $a = 77$; $b = 5.4$; $c = 8.0$; $T = 37$; $R = 345$.

DESCRIPTION

Female : Body, when killed by gentle heat, assumes an arcuate posture ; body, for the greater part of its length, cylindrical with pronounced taper from anus to filiform tail tip ; anteriorly tapered but less noticeable. Labial capsule truncate, non-annulated, with four long submedian setae near posterior margin. Anterior edge of amphid three to five annules posterior to lip capsule. Amphid aperture slightly taller than wide, 3.5 \times 4.0 μm (3.2-4.3 \times 3.2-4.8 μm), arched anteriorly and flattened posteriorly ; from posterior edge a tongue-like, apically-forked arm projects anteriorly ; arm length three-quarters height of aperture. First six to seven body annules sequentially increase in width to general body annulation (2.5-5.1 μm) ; first annule width 1.0 μm , annule width at base of esophagus 3.0 μm , at mid-body 3.0 μm , at anus 2.7 μm . Transverse annulation interrupted by up to twelve rows of hook-like spines ; spines attached at middle of annule and overlap preceding and succeeding annules ; spine rows begin immediately posterior to amphid. Near amphids spine-rows 2-3 μm apart, at mid-body rows 5.8-9.6 μm apart. Spines anteriorly and over most of body arranged in twelve rows, decreasing near anus to six rows, at anus to four rows, then decreasing to two lateral rows that extend for two-thirds of tail length. Oral aperture hexaradiate ; leads to short vestibule 2.7-3.2 μm deep, followed by stoma proper. Stoma walls parallel for most part becoming funnel-shaped at base, total length 7.5-10.6 μm . Distance from base of stoma to radial tubules 24.5-32.9 μm . Nerve ring located near mid-esophagus, 100-168 μm from anterior extremity, near annule 35-38. Excretory pore and hemizonid not observed. Basal bulb ovate with denticulated valve, approximately fourteen denticles on each longitudinal row. Valve located in anterior

half of bulb. Basal bulb 21-26 μm long ; post bulbar extension 10.5-13.0 μm in length. Tail approximately thirteen anal body diameters in length, shape conoid-filiform, non-annulated tip extends to hair-like process 17.0-35.1 μm long (difficult to measure because often broken). Caudal glands and spinneret absent. Vulva not prominent, located near mid-body (50-52 %) ; vagina inconspicuous ; anterior gonad 93.6-209.6 μm , reflexed portion of gonad 44.7-191.5 μm (length of gonad and reflexed portion varies according to stage of egg development). Post-uterine branch long, 42.6-63.8 μm .

Male : Body and cephalic shape similar to female ; tail slightly more curved when killed by gentle heat. Amphid aperture similar to that of female ; aperture taller than wide : 3.2-4.0 \times 4.3-5.3 μm . From posterior rim a tongue-like, apically-forked arm projects anteriorly, arm three-fourths the height of aperture. Oral vestibule shallow, 1.6-2.7 μm ; stoma cylindroid, 6.1-8.8 μm long ; base of stoma funnel-shaped. From base of stoma to radial tubules 26.1-32.5 μm . Esophagus length 197.9-242.6 μm ; base of esophagus at level of annule 49-67. Posterior bulb with valve and extension similar to female. Transverse annulation interrupted by twelve rows of hook-like spines, similar to those of females. Tail conoid-filiform, non-annulated tip extends to hair-like process 19.7-37.8 μm in length (accurate measurements difficult because tip often broken). Testis 397 μm long ; occupies 37 % of body length. Cloacal opening 0.95-1.25 mm from anterior extremity, at level of annule 222-323. Spicules equal, 28.2-32.9 μm long ; gubernaculum 7.5-9.6 μm . Six to seven preanal tubular supplements 8 μm long. First supplement at annule 204-278 ; second, 207-298 ; third, 211-301 ; fourth, 215-305 ; fifth, 223-310 ; sixth, 226-315 ; seventh, 298-318. Single medioventral bristle three to four annules anterior to cloacal opening.

TYPE HABITAT AND LOCALITY

Sandy loam soil about roots of coconut, *Cocos nucifera* L., from a depth of 10-75 cm. Palm No. 65, Block No. 1 of Central Plantation Crops Research Institute, Regional Station, Kayangulam, P.O. Krishnapuram, Kerala, India - 690 533 ; located at a latitude of 9° 8' N and longitude of 76° 31' E, height of 3.05 m above mean sea level ; a hot, humid, tropical climate, annual rainfall 2 415 mm in 120 days, mostly between June and November, mean temperature ranges from 30-34°.

TYPE MATERIAL

Holotype : Female, collected 16 June 1979 by V. K. Sosamma, Catalogue Slide Number 1568, Uni-

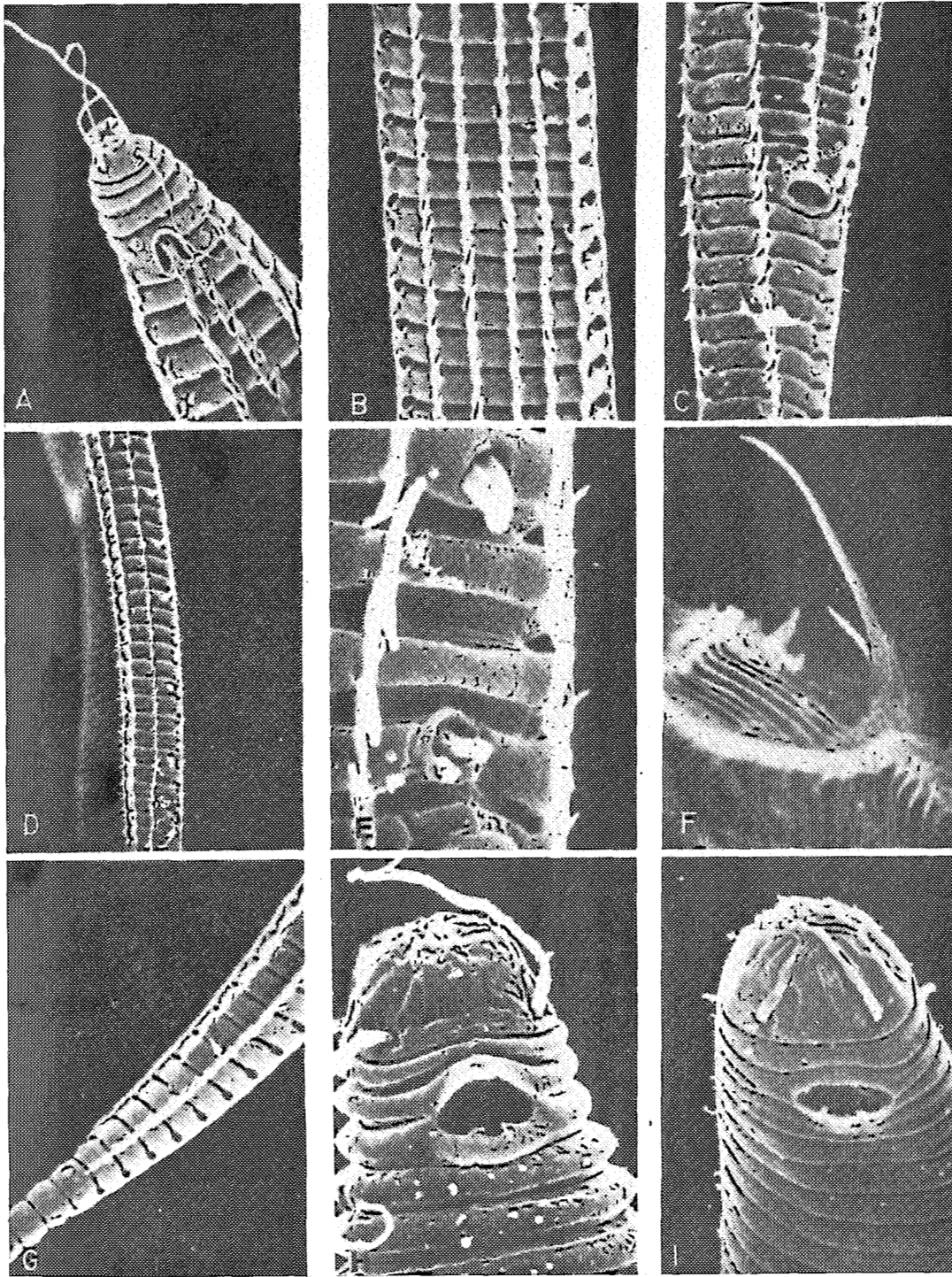


Fig. 2. *Chronogaster spinocorpus* n. sp. Female, A-C, G. A : Cephalic region, 2 000 \times ; B : Lateral view about midbody, 1 650 \times ; C : Anal region, 2 000 \times ; G : Tail at termination of longitudinal rows of spines, 1 600 \times . Male, D-F. D : Ventro-lateral view of supplements, spine and spicules, 800 \times ; E : Supplement (above) and spine (below, anterior to cloaca), 4 400 \times ; F : Spicules protruding from cloaca as viewed posteriorly on ventral surface, 5 050 \times . *Chronogaster* sp. (Florida). Female, H : Cephalic region, 4 550 \times . *Chronogaster* sp. (India). Female, I : Cephalic region, 5 000 \times .

versity of California Nematode Collection (UCNC), Davis, California.

Allotype : Male, same data as holotype, Catalogue Slide Number 1569, UCNC.

Paratypes : 25 females, eleven males, twelve juveniles, same data as holotype, deposited as follows : eight females, five males, twelve juveniles, UCNC ; six females, two males, Nematology Laboratory, CPCRI, Regional Station, Kayangulam, Kerala, India ; one female, one male each ; National Nematode Collection, Indian Agricultural Research Institute, New Delhi, 110012 ; United States Department of Agriculture Nematode Collection, Beltsville, Maryland ; Nematology Department Rothamsted Experimental Station, Harpenden, Herts., England ; Agricultural University, Wageningen, The Netherlands ; Commonwealth Institute of Helminthology, St. Albans, Herts., England.

DIAGNOSIS

Chronogaster spinicarpus n. sp. is distinguished from all other species of *Chronogaster* by the longitudinal rows of spines. The shape of the non-annulated cephalic cap is high and truncate as in *C. typica* (de Man, 1921) De Coninck, 1935. Two other species show departure from typical transverse annulation : *C. alata* Gerlach, 1956 (emended spelling of *alatum*) and *C. magnifica* Andr ssy, 1956. Both of these species display both transverse and longitudinal striae, however, this modification is in no way similar to the cuticular spines of *C. spinicarpus* n. sp.

Discussion

A rather unusual philosophy has been applied to the systematics of the genus *Chronogaster*, one too seldom applied in nematology. In *Chronogaster*, the dictum of Linnaeus (1737) is reiterated : "It is the genus that gives the characters and not the characters that make the genus." In essence, this means the better we understand a genus, the more tolerant we are for wide variability among its characteristics. The taxonomy of *Chronogaster* is not a history of splitting based on lack or gain of one or more characters in the aggregate complex that has come to define this taxon.

The stabilization of the genus *Chronogaster* is a result of accepting that variability of characters does not inherently demand the division of a taxon. Characteristics upon which the genus *Chronogaster*

is based are the form and distribution of the cephalic sensillae and internal anatomy. Most external characteristics are employed to distinguish species. For instance, the non-annulated lip cap may be low and rounded or high and truncate ; body annulation may be fine or coarse, or with longitudinal incisures or rows of spines. The variables important at the species level are inconsequential to those characters that delineate the genus. As a result of accepting that variability does not necessarily destroy stability, we have chosen to emend the generic description rather than propose a new genus whose foundation would represent no more than a "key" character.

In all respects save on this new species is a typical member of the genus *Chronogaster*. It is only by the external ornamentation that it is distinguished from other members of the taxon. If one insists that external ornamentation is sufficient to establish new genera, then *Chronogaster* could be split into several genera by giving recognition to those with fine annulation, those with prominent annulation, those with transverse and longitudinal annulation, etc. Would such recognition add to our knowledge of Plectidae (it certainly does not add to our knowledge of *Chronogaster*) and could we state with reasonable justification that each of the proposed genera has a different phylogeny and represents a unique ecologic unit ? We believe not. The taxonomy of the other Araeolaimida already suffers with 44 % of the included genera being monotypic !

The amphids of four other species of *Chronogaster* as well as other members of the family Plectidae (*Plectus* and *Anaplectus*) were studied with SEM to determine how common is the tongue-like extension of *C. spinicarpus* n. sp. None of the species studied showed a tongue-like extension ; however, three of the four species of *Chronogaster* did show two tubercles on the posterior rim of the amphidial aperture. Two such examples are illustrated in Fig. 2 H, I. These tubercles may be comparable to or precursors of the forked tip of the *C. spinicarpus* n. sp. amphidial tongue. This tongue is not readily resolvable with a light microscope. In all probability, it would not be interpreted properly without prior knowledge from SEM. Therefore, other species of *Chronogaster* may have prominent projections in the amphidial aperture that with the light microscope gives an incorrect impression of being unispiral amphids.

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