

# *Calomicrolaimus compridus* (Gerlach, 1956) n. comb., a marine nematode with a female producing a copulatory plug

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## SUMMARY

*Microlaimus compridus* Gerlach, 1956 is redescribed and transferred to the genus *Calomicrolaimus*; females and juveniles are described for the first time. In the impregnated female, a copulatory plug is present and produced by her own perivulvar glands.

## RÉSUMÉ

*Calomicrolaimus compridus* (Gerlach, 1956) n. comb., nématode marin dont la femelle sécrète un bouchon copulatoire.

*Microlaimus compridus* Gerlach, 1956, dont seul un mâle était connu, est redécrit sur un matériel comprenant mâles, femelles et juvéniles. Cette espèce est attribuée au genre *Calomicrolaimus*. Il est observé chez la femelle fécondée la présence d'un bouchon copulatoire sécrété par ses propres glandes périvulvaires.

In this paper, a species of the Microlaimidae which shows the interesting feature that the impregnated females possess a copulatory plug in the vulvar region, is described.

*Calomicrolaimus compridus* (Gerlach, 1956) n. comb. is up to now only known from one male collected in muddy sand of the Kiel Bight (Gerlach, 1956, 1958). We found the species in sands (with a low amount of silt) in the Bay of Morlaix (Gourbault, 1981), mainly in the summer period. The species is also found by Jensen (pers. comm.) in some biotopes of *Karkinochromadora lorenzeni* (Jensen, 1981) in the north-east of Denmark.

Females and juveniles are described for the first time, together with some additional information on the males. The information presented justifies the transfer of this species to the genus *Calomicrolaimus* Lorenzen, 1976, revised by Jensen (1978).

### *Calomicrolaimus compridus*

(Gerlach, 1956) n. comb.

= *Microlaimus compridus* Gerlach, 1956

(Figs 1, 2)

## MEASUREMENTS

Males (n = 7) : L = 980 ± 40 (925-1040 µm); a = 60.9 ± 3.4 (57.8-65.3); b = 11.1 ± 0.6 (10.2-11.8); c = 14.7 ± 0.6 (14.1-15.6).

Male 1  $\frac{5\ 53\ 88\ M\ 970}{8\ 16\ 17\ 18\ 15}$  1 040 µm; a = 57.8; b = 11.8; c = 14.8.

Females (n = 7) : L = 1 060 ± 70 (1 000-1 205 µm); a = 55.9 ± 2.4 (52.5-57.5); b = 11.5 ± 0.5 (10.5-12); c = 11.5 ± 0.6 (10.7-12.3); V = 55.6 ± 1.5 (53.6-56.6).

Female 1  $\frac{5\ 56\ 102\ 665\ 1107}{9\ 16\ 17\ 22\ (15)\ 14}$  1 205 µm; a = 54.8; b = 11.8; c = 12.3; V = 55.2.

## DESCRIPTION

*Male* : Body cylindrical, attenuating at both sides. Cuticle obviously annulated, annules 1-1.5 µm broad; cuticle of head end smooth. Six very minute internal labial papillae, six papilliform external labial setae (about 1 µm long) and four cephalic setae, 5 µm long (Fig. 1 B), situated at the posterior border of the non-annulated head. Somatic setae very scarce, except on the tail. Amphideal fovea circular, with a double contour, 5-6 µm diameter or 45 % of the c.b.d. and anterior margin situated at 16-18 µm from the front end. The spiral origin of the amphideal fovea is obvious by the spiralized *corpus gelatum*. Buccal cavity very narrow with weakly sclerotized walls. One small dorsal tooth and two subventral teeth hardly visible. Pharynx slender with terminal bulb (18 µm long). Numerous cells present in the pharyngeal region. Ventral gland weakly developed; ventral pore not found. The nerve ring is situated at 60 % of the pharyngeal length. Cardia well developed, 4 µm long. The first cells of the intestine have a granular

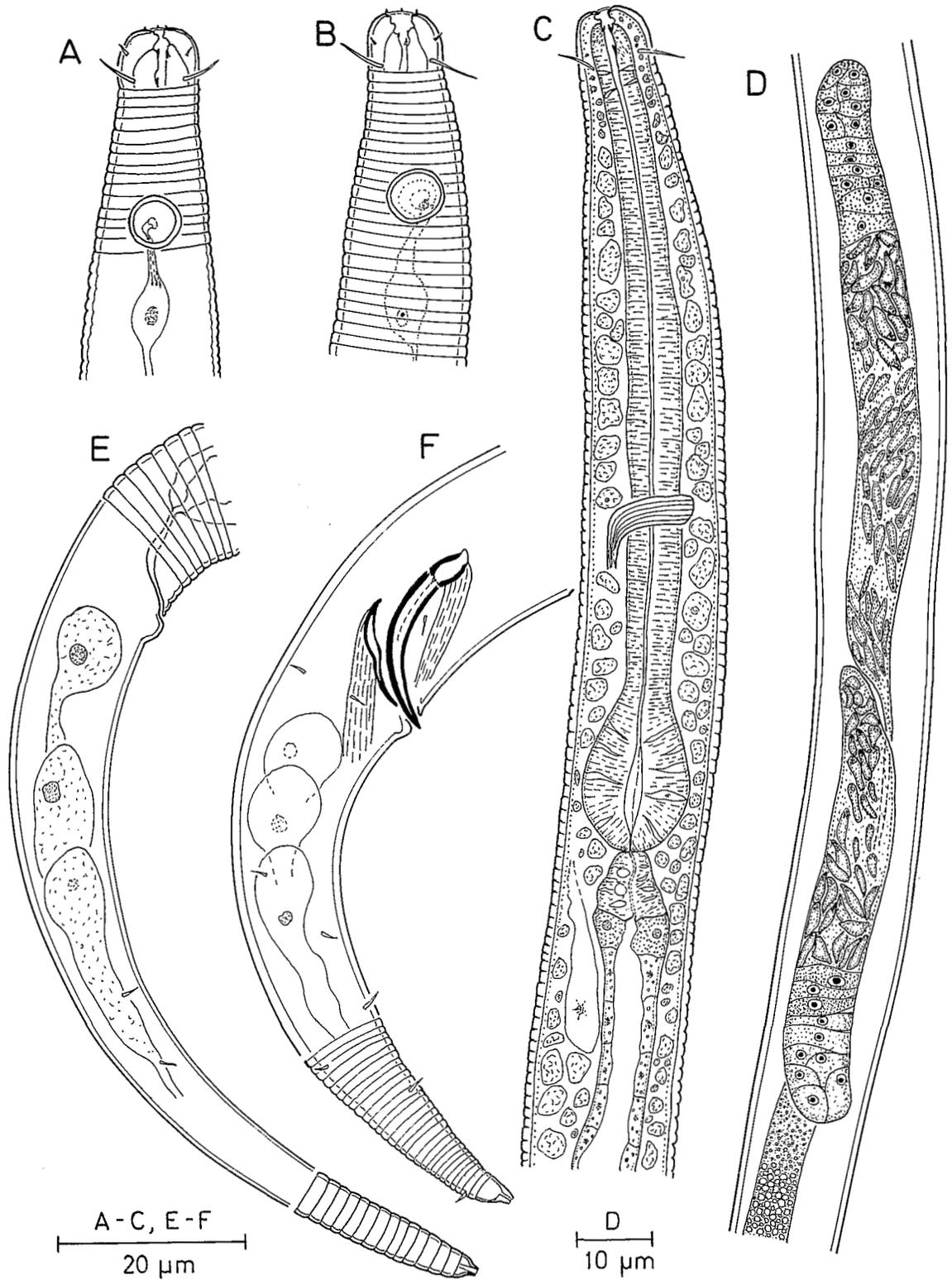


Fig. 1. *Calomicrolaimus compridus*. A : Head end female 1; B : Head end male 1; C : Pharyngeal region male 1; D : Genital system male 1; E : Tail region female 5; F : Tail region male 1.

appearance; the remainder of the intestinal cells are rather flat. Genital system extending till 440  $\mu\text{m}$  from the anterior end; the whole system is about 500  $\mu\text{m}$  long (or 48 % of the total body length). Dioorchic with opposed and short testes; anterior testis situated at the right, posterior testis situated at the left of the intestine. Numerous elongated sperm cells (4-5  $\mu\text{m}$  long) in the distal part of the testes. The sperm cells have a dense cell content (condensed chromatine) directed to the junction with the *vas deferens*. The *vas deferens* contains fine granules in its anterior part, then followed by a region with much bigger granules; at the end, there is a clear patch because of the presence of only very fine granules in that region (cf. some Ethmolaimidae, Platt, 1982). Spicules equal, 22  $\mu\text{m}$  long with a distinct capitulum. Gubernaculum plate-shaped (15  $\mu\text{m}$  long). Tail obviously annulated till the tip; its length is 4.5 times the anal body diameter; only a short spinneret is present. Three caudal glands.

*Female*: Body shape similar to the male except for the longer tail ( $c' = 6.5-7.0$ ). The genital system occupies 20-25 % of the total body length. Didelphic, amphidelphic with outstretched ovaries. Anterior ovary at the left, posterior ovary at the right of the intestine. Ovaries short with ripest oocyte 35-65  $\times$  12-16  $\mu\text{m}$  large. Difference between oviduct and uterus indistinct. Numerous sperm cells are present in the proximal part of the uterus of one female. Vagina weakly sclerotized, provided with well developed dilatory muscles. Sphincter not observed. In non-fertilized females, the vulva is situated on a small elevation; but, in fertilized females, the vulva is invaginated and covered by a copulatory plug which is surrounded by a granular secretion product; this invagination is probably caused by the contraction of the dilators. The vulva is a slit-like opening, following the longitudinal axis of the body; it is surrounded by a circular cuticular border. At both sides of the vagina, two different types of gland cells are present. These glands are especially obvious in non-impregnated females; in lateral view, one pair is situated close to the vulva ("ventral glands") and a second pair (sometimes consisting of two lobes) is situated at the level of the proximal part of the vagina ("dorsal glands"). The openings of the latter gland cells are close to the vulva but the outlets of the perivulvar gland cells are not clear in the non-impregnated females. In fecundated females, the openings of both types of gland cells are clearly visible close to the perivulvar cuticle, because of the invagination of this region. An hyaline plug is produced by the "dorsal glands"; the plug is supported by two tubes which consist probably of the same secretions; the "ventral glands" produce a granular substance which surrounds the dense plug.

*Juvenile*: The juveniles are similar to the adults except for the smaller amphids (only 37 % of the c.b.d.) and the reproductive system.

#### LOCALITIES

Bay of Morlaix, station 1, 1 male Oct. 1978 and 4 males, 1 fem. and 1 juv. Aug. 1981; station 2 : 1 male, 6 fem., 1 juv. Feb. 1980; station 4 : 1 male Aug. 1980 and 1 male, 1 juv. Aug. 1983; station 5 : 1 male Aug. 1980; station 6 : 1 fem. Nov. 1984. Rance maritime, St-Suliac : 1 juv. fem. May 1983.

Data on these stations are given by Goubault (1981) and by Goubault and Renaud-Mornant (1986).

#### TAXONOMIC POSITION

*Microilaimus compridus* Gerlach, 1956 is transferred to the genus *Calomicrolaimus* (as redefined by Jensen, 1978) because of the presence of following characteristics : annulated cuticle, elongated cervical region with amphids in posterior position, papilliform somatic sensilla (setiform on the tail), no cervical setae and female reproductive system with outstretched ovaries.

Sexual dimorphism is present in the shape of the tail (longer in the females). No sexual dimorphism in the structure of the amphid; the amphid resembles that of species of *Molgolaimus* Ditlevsen, 1921.

#### VOUCHER SPECIMENS

Material deposited in the nematode collection of Muséum national d'Histoire naturelle, Paris (MNHN) and Instituut voor Dierkunde, Gent, Belgium (RUG). Slides AN 549 to 558 (MNHN) and slide 10240, RUG.

#### OBSERVATIONS ON THE COPULATORY PLUG

*Calomicrolaimus compridus* is the only species of the genus with a copulatory plug. The vaginal region of impregnated females is invaginated, a feature which is not known in other nematodes.

The presence of a copulatory plug is mentioned in some other nematode species and also in other invertebrates (for a review, cf. Eberhard, 1985).

Recently, Sarr, Coomans and Luc (1987) reported copulatory plugs and ejaculatory glands in five soil or phytoparasitic nematode species and also in the females of *Neodolichodorus rostrulatus* (Siddiqi, 1976). In the mean time, they gave the only few literature data available since the first description of such a plug had been given by Chitwood (1929). But in those cases, as in general for all the other invertebrates, it is always the male who produces the copulatory plug, by means of its ejaculatory glands.

This unique case main originality is that no such glands have ever been found in the males of *Calomicrolaimus compridus*. In this species, the copulatory plug is produced by the female, namely by two different types of gland cells herewith described. The "dorsal glands" produce the hyaline plug, the "ventral glands" producing a granular secretion which adheres the plug to the invaginated region of the cuticle. Especially this last

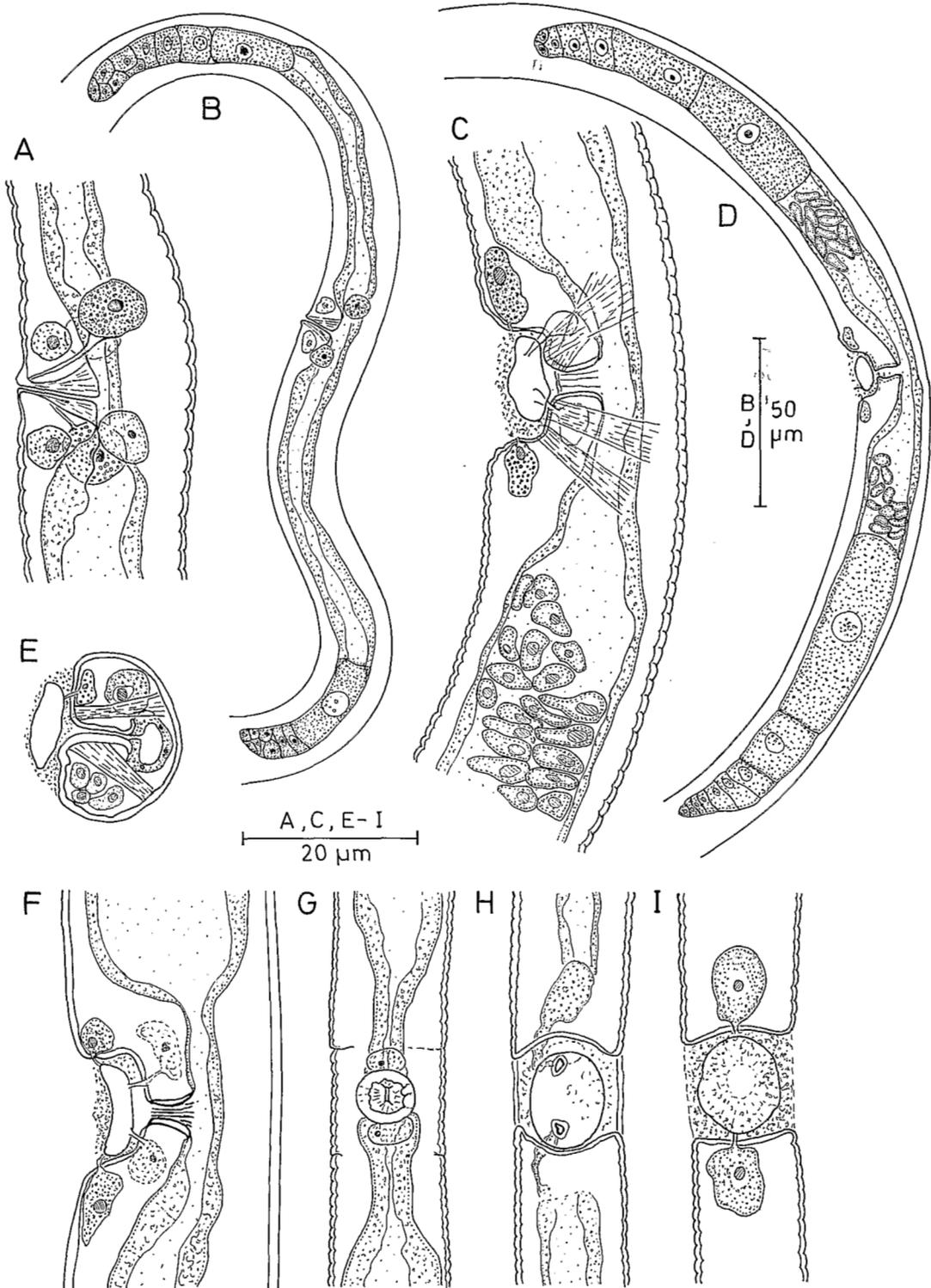


Fig. 2. *Calomicrolaimus compridus*. A-B : Vulvar region and reproductive system, non fertilized female 4; C-D : Vulvar region and reproductive system female 1; E : Transversal section at vulvar level; F : Lateral view of the vulvar region; G-H-I : Ventral views of the vulvar region at three different optical levels.

phenomenon is also mentioned for *Pelodera strongyloides* by Wagner and Seitz (1984) who compare this cement-like substance with a two component glue. However, in *Pelodera strongyloides*, the plug is produced by the male and adheres to the female cuticle after copulation because the females produce a secretion by epidermal glands, which holds the plug to the cuticle.

In the case of *Calomicrolaimus compridus*, we could hypothesize that the females may produce the copulatory plug to grip the male during copulation. This plug might be able to protect also the vulvar region against external infection, or even against repetitive copulations; however this last protection has been demonstrated as ineffective in some Insects (Eberhard, 1985).

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#### REFERENCES

- CHITWOOD, B. G. (1929). Note on the copulatory sac of *Rhabditis strongyloides* Schneider. *J. Parasitol.*, 15 : 282-283.
- EBERHARD, W. G. (1985). *Sexual selection and animal genitalia*. Cambridge & London, Harvard University Press, 244 p.
- GERLACH, S. A. (1956). Diagnosen neuer Nematoden aus der Kieler Bucht. *Kieler Meeresforsch.*, 12 : 85-109.
- GERLACH, S. A. (1958). Die Nematodenfauna der sublitoralen Region in der Kieler Bucht. *Kieler Meeresforsch.*, 14 : 64-90.
- GOURBAULT, N. (1981). Les peuplements de Nématodes du chenal de la Baie de Morlaix (Premières données). *Cah. Biol. mar.*, 22 : 65-82.
- GOURBAULT, N. & RENAUD-MORNANT, J. (1986). Le méiobenthos de la Rance maritime et la structure des peuplements de Nématodes. *Cah. Biol. mar.*, 26 : 409-430.
- JENSEN, P. (1978). Revision of Microlaimidae, erection of Molgolaimidae fam. n. and remarks on the systematic position of *Paramicrolaimus* (Nematoda, Desmodorida). *Zool. Scripta*, 7 : 159-173.
- JENSEN, P. (1981). Description of the marine free-living nematode *Chromadora lorenzeni* n. sp. with notes on its microhabitats. *Zoll. Anz.*, 205 (1980) : 213-218.
- SARR, E., COOMANS, A. & LUC, M. (1987). Development and life cycle of *Neodolichodorus rostrulatus* (Siddiqi, 1976), with observations on the copulatory plug (Nematoda Tylenchina). *Revue Nématol.*, 10 : 87-92.
- WAGNER, G. & SEITZ, K. A. (1984). Funktionsmorphologische Untersuchungen an Vagina, Vulva, Vulvapropf und vulva-assoziiierter Hypodermis bei *Pelodera strongyloides* (Nematoda : Rhabditidae). *Nematologica*, 29 (1983) : 190-202.

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