INTERSTITIAL TYPHLOPLANOIDA (TURBELLARIA) FROM THE AREA OF ROSCOFF

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Résumé

Le travail qui suit donne la description de deux espèces nouvelles, d'une sous-espèce nouvelle et d'une espèce peu connue appartenant au sous-ordre des Typhloplanoida (Turbellaria, Rhabdocoela) : *Trisaccopharynx roscoffensis* n. sp., *Promesostoma meixneri roscoffense* n. subsp., *Ptychopera purasjokii* Ax et *Messoplana roscoffensis* n. sp.

Une première liste des Turbellariés récoltés dans un sable littoral de la région de Roscoff est donnée ainsi que quelques remarques zoogéographiques et phylogénétiques sur les Turbellariés Typhloplaniens et Dalyelliens de la région de Roscoff.

Introduction

Until recently, special investigations on the marine interstitial Turbellaria Rhabdocoela from the area of Roscoff were made only on the Kalyptorhynchia (L'Hardy, 1963 a, b, 1964, 1965, 1966 a, b).

Little information is available on the marine free-living Typhloplanoida and Dalyellioida. The oldest reports by Graff (1913) on the occurrence of the typhloplanoid species *Proxenetes flabellifer* Jensen, *Proxenetes cochlear cochlear* Graff and *Promesostoma marmoratum* (M. Schultze) are doubtful, because these reports may also refer to the numerous *Proxenetes*- and Promesostoma-species which have been described in the last 30 years. The only known free-living Dalyellioida from the area of Roscoff are *Beauchampiola oculifera* (Beauchamp) and *Prorhynchopsis minuta* Beauchamp. The first mentioned species being described as *Jensenia o.* by Beauchamp (1927) was found on the Atlantic coast near Concarneau. Concerning this species, being later placed in the new genus *Beauchampiola* by Luther (1955, 1957), Beauchamp wrote in a letter: « J'ai retrouvé la bête à Roscoff en 1951 dans les algues de la zone des marées, mais en très petit nombre. » The other dalyellioid species, *Prorhynchopsis minuta*, was found in the aquarium of the biological Station of Roscoff (Beauchamp, 1913, 1961).

The material used for this study was obtained from samples taken from the eulittoral on the west side of the Ile Callot about

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200 m to the left of the church. Together with species known from other localities, several new or little known Turbellaria have been found of which four are described in this paper. In addition, some Zoogeographic and phylogenetic comments are given on the interstitial Typhloplanoida and Dalyellioida now known from the area of Roscoff. On the new Turbellaria Macrostomida and Proseriata from this area see Sopott-Ehlers (1976).

The type material of all new species is deposited in the Zoological Museum of the University of Goettingen.

Abbreviations

ba: bursal appendage
cb: copulatory bursa
cg: caudal glands
ch: cirrus hooks
ci: cirrus
cop: copulatory organ
ds: ductus spermaticus
fg: frontal glands
gp: gonopore
i: insemination apparatus
m: mouth
mg: male genital canal
pg: prostatic glands
ph: pharynx
ps: prostatic vesicle
sph: sphincter
sr: seminal receptacle
st: stylet
sta: stylet appendage
sv: seminal vesicle
te: testis
ut: uterus
vi: vitellarium

SPECIES DESCRIPTIONS

TRISACCOPHARYNX ROSCOFFENSIS (nov. spec.)
(Fig. 1 and Plate 1)

Locality

Roscoff, west side of the Ile de Callot (= type locality), fine muddy sand, near the low tide-level. Sept. 19th, 1973.

Material

Living specimens, one whole mount = holotype No. P 771.

Description

The following diagnosis is based on animals in male maturity. Live specimens about 0.5—0.6mm long, without pigmented eyespots. Provided with frontal glands cranially and with caudal glands in the hind part of the body. The pharynx lies in the caudal half of the body; the opening of the pharynx is directed posteriorly.

The paired testes are fused anteriorly, the vasa deferentia are enlarged to small seminal vesicles. A description of the atrial organs is presented provisionally because of the rather deficient material. The large copulatory organ (in squeezed specimens, 140 µm long) includes an inner seminal vesicle lying anteriorly, a prostatic vesicle enclosing the seminal vesicle and building up several granular bulbs

with a diameter of about 7-8 µm in the middle of the organ, and a wide, spiny cirrus lying distally. At the level of the granular bulbs,

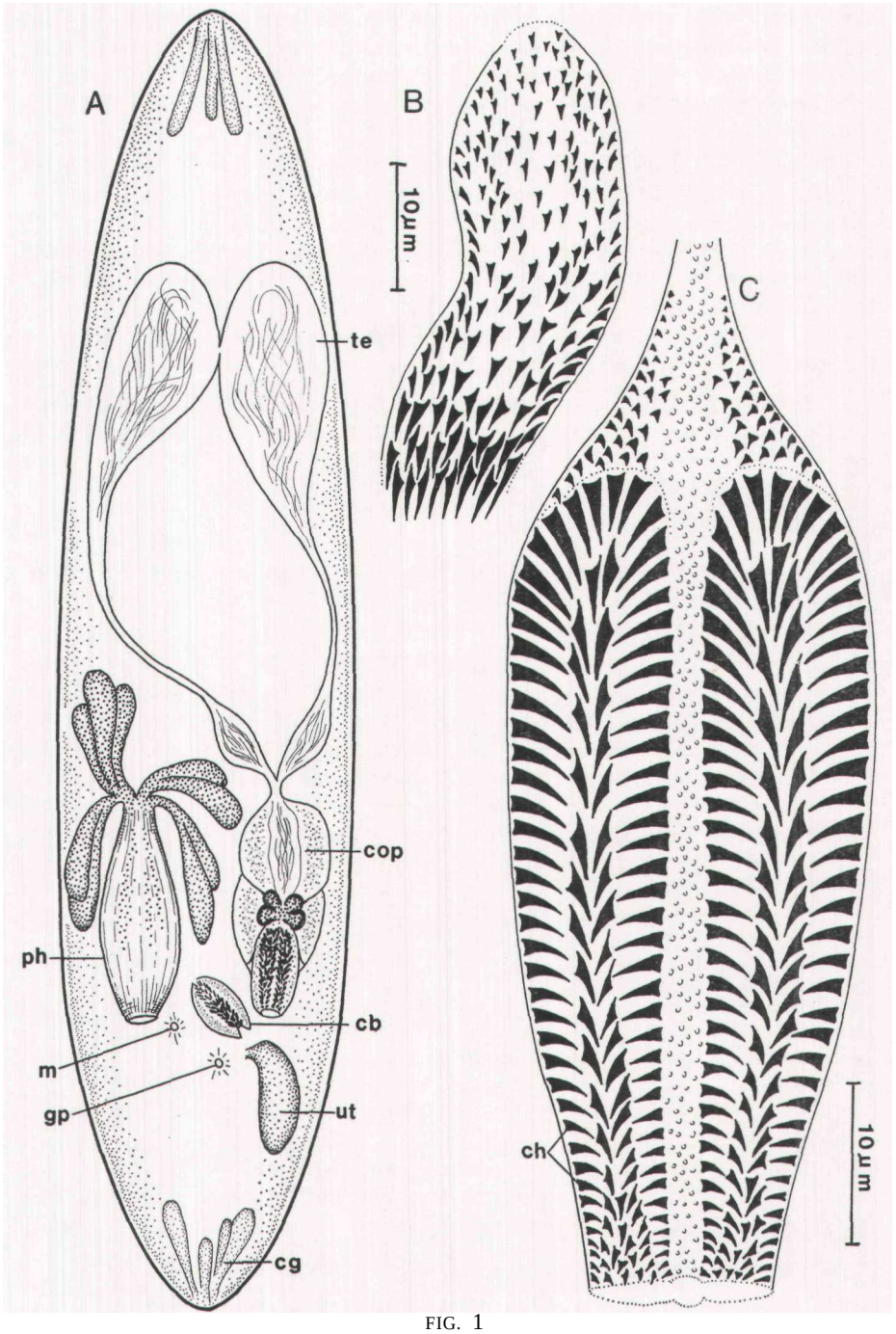

FIG. 1
Trisaccopharynx roscoffensis.
A: organization (dorsal view). B: copulatory bursa. C: cirrus. A - C from squeezed living specimens.

a muscular diaphragm extends to the outer muscular layer of the copulatory organ. The cirrus penetrates about 50-60 µm deep into the copulatory bulb and appears to be compressed in the longitudinal direction. The cirrus is provided with many spines, the larger ones (about 4-5 µm long) lying more proximally (Fig. 1 C). Progessively, more shorter spines are found as one proceeds posteriorly. The most proximal part of the cirrus consists of very small knob-like differentiations.

The copulatory bursa, lying near the male copulatory organ, measures about 40 µm in longitudinal direction and is 15 µm across. The wall of the bursa is provided with many spines (Fig. 1 B). The larger ones (4-5 µm long) are located distally; the spines decrease in size towards the middle part of the bursa. Proximally, only knob-like differentiations are present. The proximal part of the bursa wall exhibits no clear epithelial closure; presumably, a rupture of the wall occurs when the bursa is filled with extrinsic sperm masses.

In the region of the atrium genitale no "cuticular" differentiations exist. A sac-like, glandulous uterus extends behind the common gonopore.

Discussion

The Solenopharyngidae belonging to the genus *Trisaccopharynx* are characterized by a cirrus provided with spines of different lengths and by a spiny copulatory bursa (Ehlers, 1972).

T. roscoffensis differs from the known species by the special arrangement and the length of the spines in the copulatory bursa: *T. spiculatus* Ehlers only possesses two spines in the bursa (Ehlers, 1972), *T. pusa* (Marcus) shows one ring of 25 µm long spines (Marcus, 1952) and, in the third species, *T. westbladi* Karling, the bursa is provided with many spines, the largest of them lying distally, but being twice as long as in *T. roscoffensis* (Karling, 1940). *T. pusa* and *T. westbladi* also differ from the new species by the existence of pigmented eyespots.

PROMESOSTOMA MEIXNERI ROSCOFFENSE nov. subspec.
(Fig. 2 and Plate 2)

Locality

Roscoff, West side of the Ile Callot (= type locality), fine muddy sand, near the low tide-level, Sept. 19th, 1973.

Material

Living specimens, four whole mounts, one of them holotype No. P 781.

Description

The specimens of the Roscoff population conform in most respects with those of the North Sea population as described by Ax (1951) and

Ehlers (1974). In the new material, there also exists a glandular organ at the atrium genitale and a specific arrangement of the secreta in the prostatic vesicle (Fig. 2 A ; see also Ax, 1951, fig. 27 b).

Contrary to the description of *P. m. meixneri*, the new subspecies possesses an unpaired seminal vesicle. There are also small but constant differences in structure and size of the stylet and the annexed copulatory bursal organ between the two subspecies.

In P.m. *roscoffense*, the stylet is about 600 µm long; its proximal part consists of a 10 µm long and 5-6 µm broad bottle-like element (Fig. 2 B). Distally to the muscular sphincter, the stylet enters the male genital canal forming several twistings. The distal end of the stylet is provided with a fine hook being 5-6 µm long (Fig. 2 C).

At the proximal end of the enlarged, muscular male genital canal, there exists a 17-25 µm long copulatory bursa. The "cuticular"

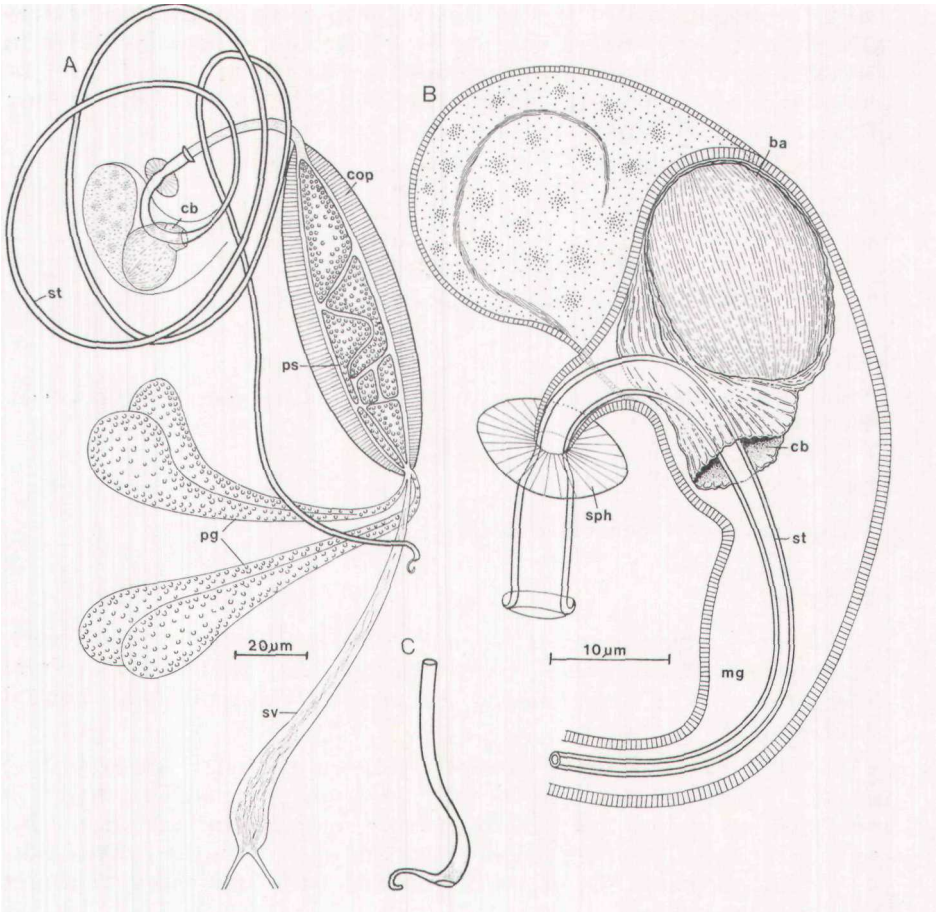

FIG. 2
Promesostoma meixneri roscoffense.
A: male copulatory organ with penis stylet. B: proximal part of penis stylet and of the male genital canal with the copulatory bursa. C: distal part of the penis stylet.
A - C from squeezed living specimens.
C: x 1 000.

basal part of the bursa being funnel-like is annexed to the stylet (Fig. 2 B). More proximally, the bursa consists of a strong, oval-shaped, muscular support surrounded by a "cuticular" sheet. A bursa-flap divided into two parts as being described for *P. meixneri meixneri* (see Ehlers, 1974), does not exist. Proximally to the copulatory bursa, a spacious cavity which is filled with granular secretions as in *P. rostratum* (Ehlers l.c., fig. 19 A), is found. Although no sperm was present in this cavity, it is assumed that it may function as an seminal receptacle. In animals which have been strongly squeezed, a helical differentiation (? strengthened basal lamina) can be isolated from the muscular sheet of the cavity (Fig. 2 B).

Discussion

The most valuable taxonomic attribute on the species level in the genus *Promesostoma* is the specific construction of the stylet, especially the distal part of it. In this respect, the new material agrees with that of the nominal subspecies. But both subspecies differ in the existence of an unpaired seminal vesicle (P. *m. roscoffense)* or paired seminal vesicles (P. *m. meixneri)* and in the special structure of the copulatory bursa.

PTYCHOPERA PURASJOKII Ax, 1971
(Fig. 3 and Plate 3)

Locality

Roseoff, west side of the Ile de Callot, fine muddy sand, near the low tide-level, Sept. 19th, 1973.

Material

Living specimens, four whole mounts.

Description

The new material agrees in many respects with that of the French population from the area of Arcachon (see Ax, 1971). But several differences exist in structure and size of the stylet and female genital canal.

The size of the stylet is smaller (40-45 µm against 55 µm according to Ax). Proximally, it consists of a wide opening and, distally, of a tube splitting up into fine lamella in more squeezed animals (Fig. 3 B). On the concave side of the stylet exists one spine ; on the convex side, the distal boarder of the organ is provided with four spiny processes (by Ax: three spines).

The size of the copulatory bursa varies from 35 µm in slightly squeezed animals up to 70 um in strongly squeezed specimens. In Fig. 3 C, the organ seems to be more compressed than in the pictures of Ax (1971, figs. 4, 5). This has resulted in a broad distal part of the bursa; the unpaired, yellowish-brown tooth as decribed by Ax was

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PLATE 1

Trisaccopharynx roscoffensis.

A: atrial organs. B: cirrus. C: copulatory bursa.
A - C from squeezed living specimens
A: x 1 200. B: x 800. C: x 1 500.

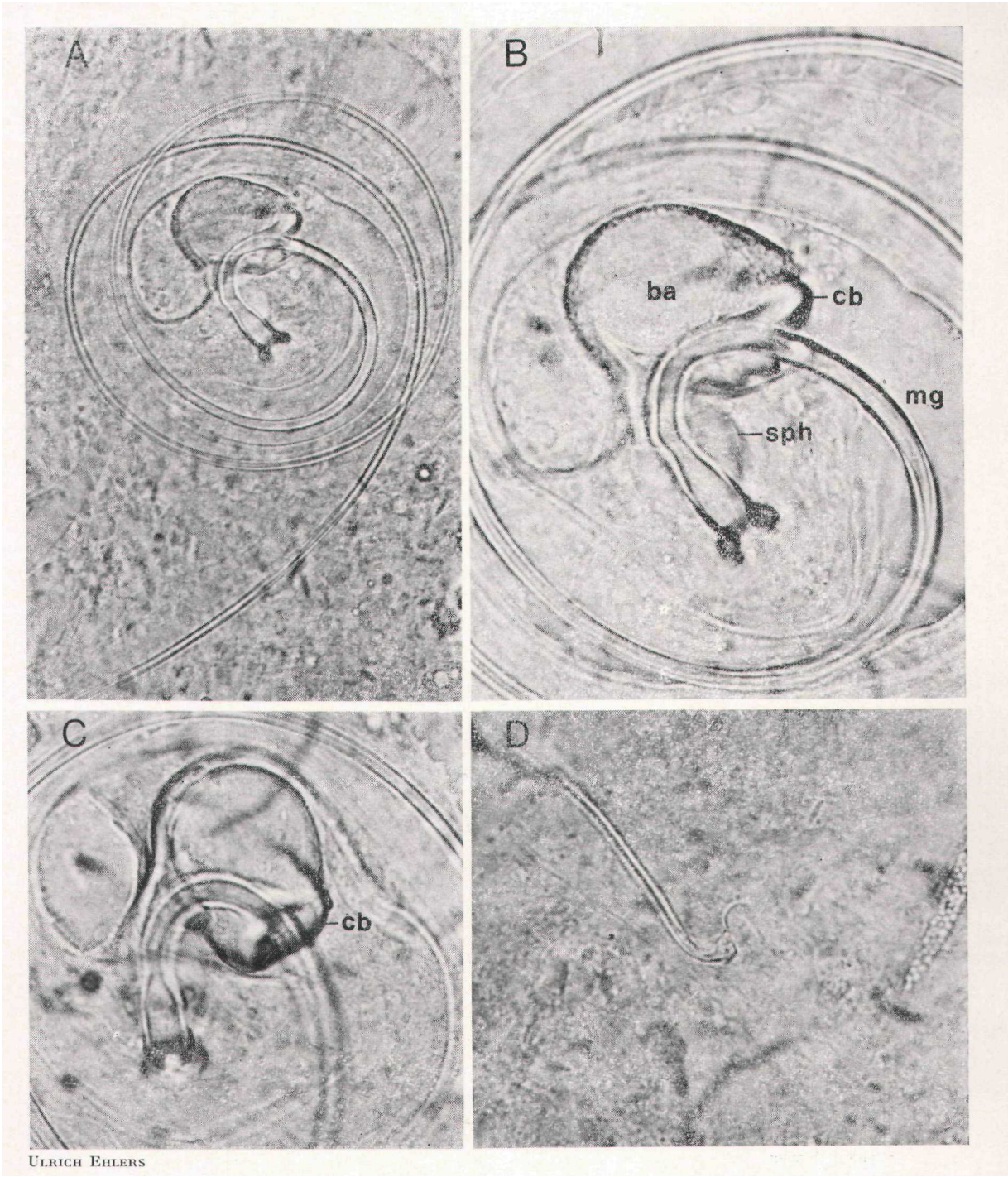

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PLATE 2

Promesostoma meixneri roscoffense.

A: penis stylet. B + C: proximal part of the penis stylet and of the male genital eanal with the copulatory **bursa** (different specimens). **D:** distal part **of** the penis stylet.

A - D from squeezed living specimens.

A: 800. B+C: **x 1 400. C: x 1** 000.

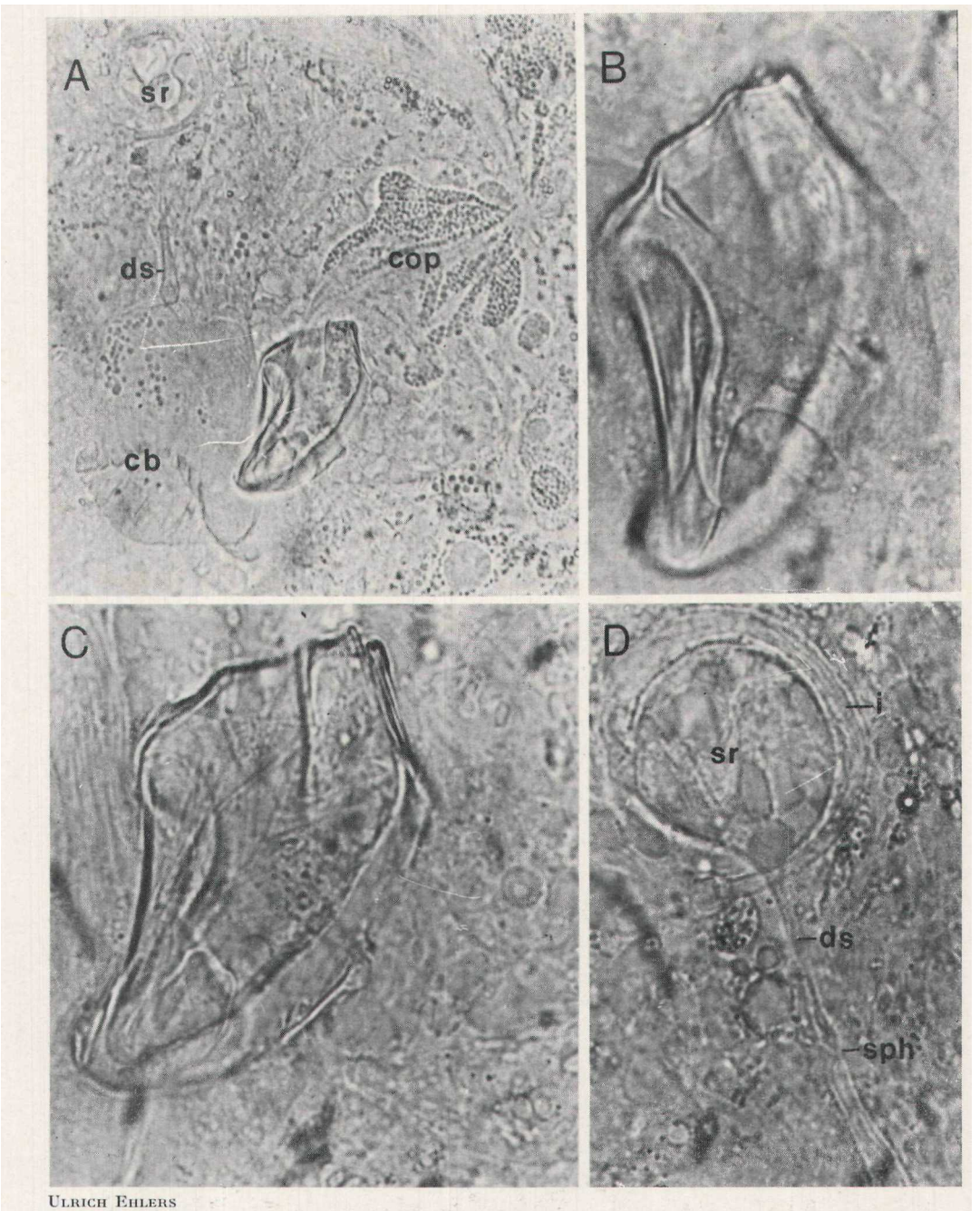

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PLATE 3

Ptychopera purasjokii.

A: atrial organs (dorsal view) with male copulatory organ, copulatory bursa and seminal receptacle. B + C: penis stylet and mantle of the male genital canal (different specimens). D: seminal receptacle.
A - D from squeezed living specimens.
A: x 600. B+C: x 1 600. D: x 1 000.

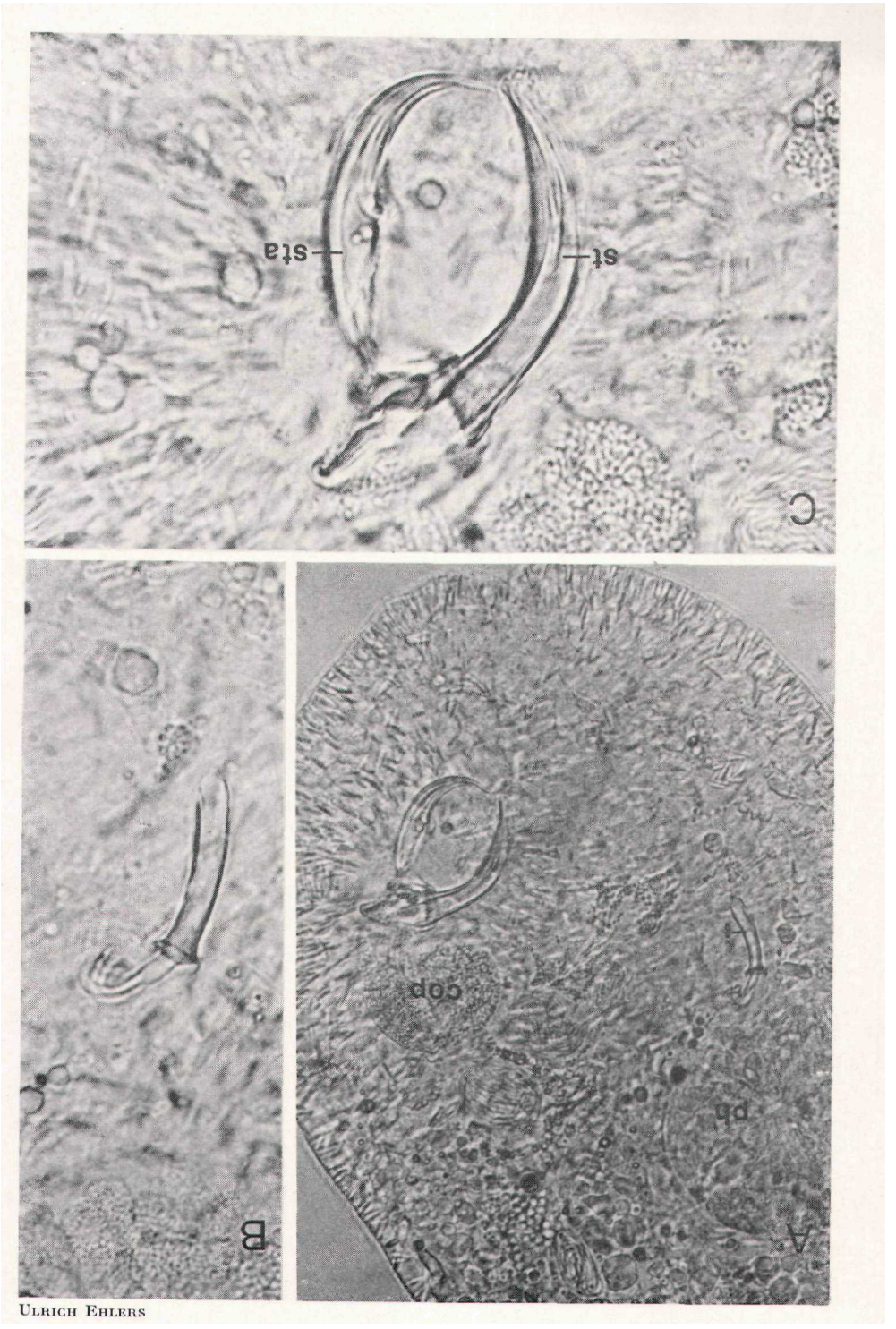

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PLATE 4

Messoplana roscoffensis.

A: anterior part of the body with pharynx and genital organs. B: insemination apparatus. C: penis stylet and stylet appendage.
A - C from squeezed living specimens.
A: x 600. B+C: 1 600.

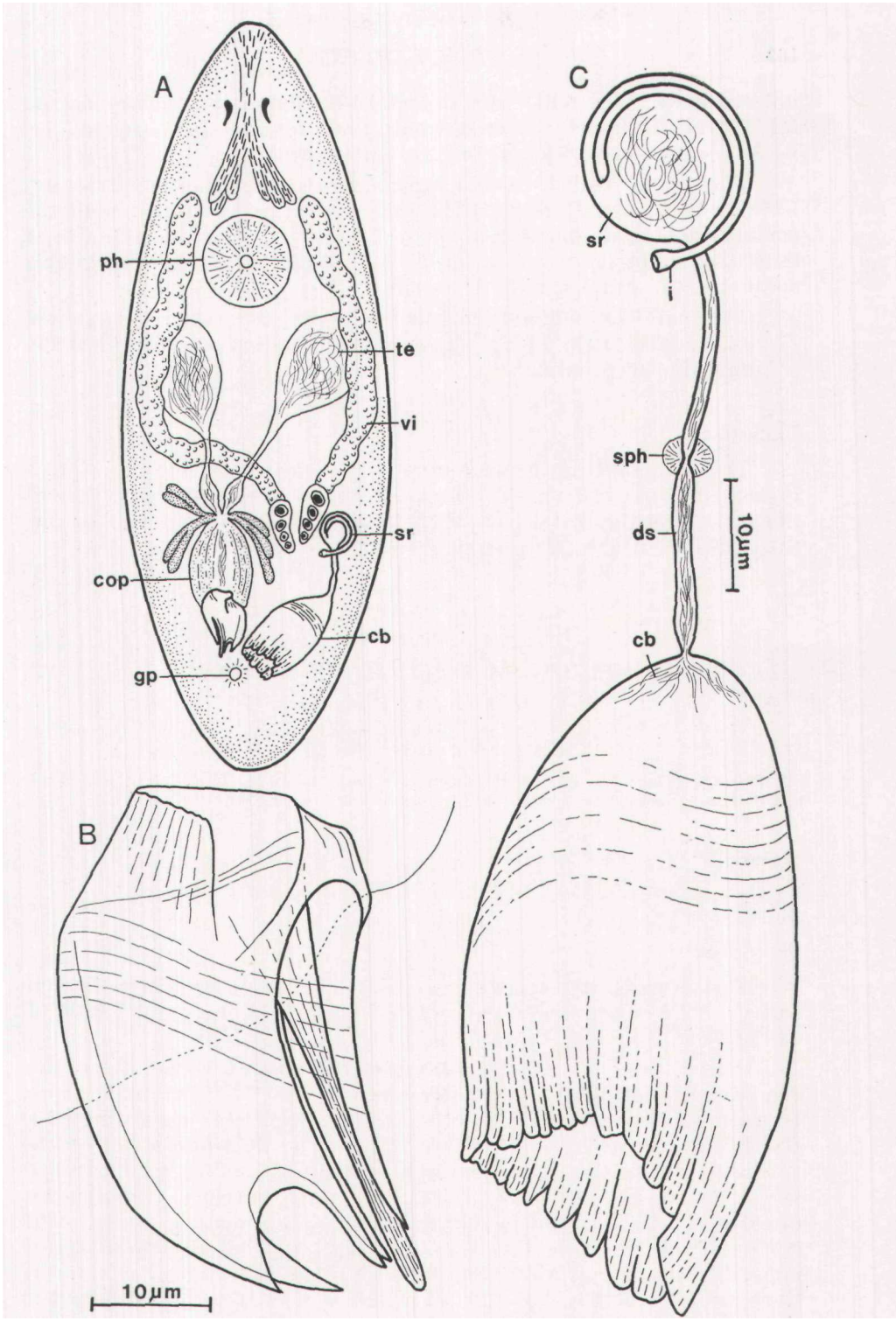

FIG. 3

Ptychopera purasjokii.

A: organization (dorsal view). B: penis stylet and mantle of the male genital canal. C: female atrial organs with the copulatory bursa and the seminal receptacle.

A - C from squeezed living specimens.

not observed. The whole distal part of the copulatory bursa (named bc_1 by Ax) is heavily strengthened; the proximal part (named bc_2 by Ax) is provided with a strong muscular sheath.

The canal called ductus spermaticus in earlier papers (e.g. Luther, 1943; den Hartog, 1964) and connecting the bursa with the seminal receptacle measures about 35 µm (by Ax: 40-44 µm). A muscular sphincter narrows the lumen of the canal; distally to this sphincter, the canal is slightly swollen.

The ball-like seminal receptacle having a diameter of about 17-20 µm continues in a long, unpaired insemination apparatus bearing a funnel-shaped proximal tip.

Discussion

The animals from Roscoff are easily identified by the description presented by Ax (1971). The few differences in size and structure of the stylet and the distal part of the copulatory bursa seem to be due to a different degree of squeezing.

MESSOPLANA ROSCOFFENSIS nov. spec.
(Fig. 4 and Plate 4)

Locality

Roscoff, West side of the Ile Callot (= type locality), at different places of the eulittoral beach slope with rather coarse sand, Sept. 19th, 1973.

Material

Living specimens, two whole mounts, one of them holotype No. P 811.

Description

The animals are slender and about 0.6-0.7mm long in male maturity. Paired pigmented eyespots. Pharynx in the caudal half of the body.

Paired testes lying in the middle of the body; the vasa deferentia are enlarged distally to two outer seminal vesicles. The male copulatory organ is provided with a "cuticular" apparatus consisting of a stylet and a stylet appendage (Fig. 4 B). The duct-like stylet—measuring 41-43 µm—is semicircularly curved. At its proximal end it shows a 14-15 µm wide opening; the duct narrows towards the distal part which is widened in more strongly squeezed animals and composed of more or less fibrous strands. The sickle-like stylet appendage measures 26-28 µm. Distally to the fine lamellar connections with the stylet, the appendage shows a 11-12 µm wide opening.

The insemination apparatus consists of a 30-32 µm long tube (Fig. 4 C); the distal unpaired part of it measures 16-18 µm. The tube is surrounded by a ring-like collar bearing a single spine. More proximally, the tube splits up into two smaller ducts, each provided with a short funnel-like opening.

Discussion

M. roscoffensis is closely related to *M. falcata* (Ax). This species possesses a stylet and a stylet appendage quite similar in shape, but twice as long as in *M. roscoffensis* (cf. Ax, 1953; Ehlers and Ax,

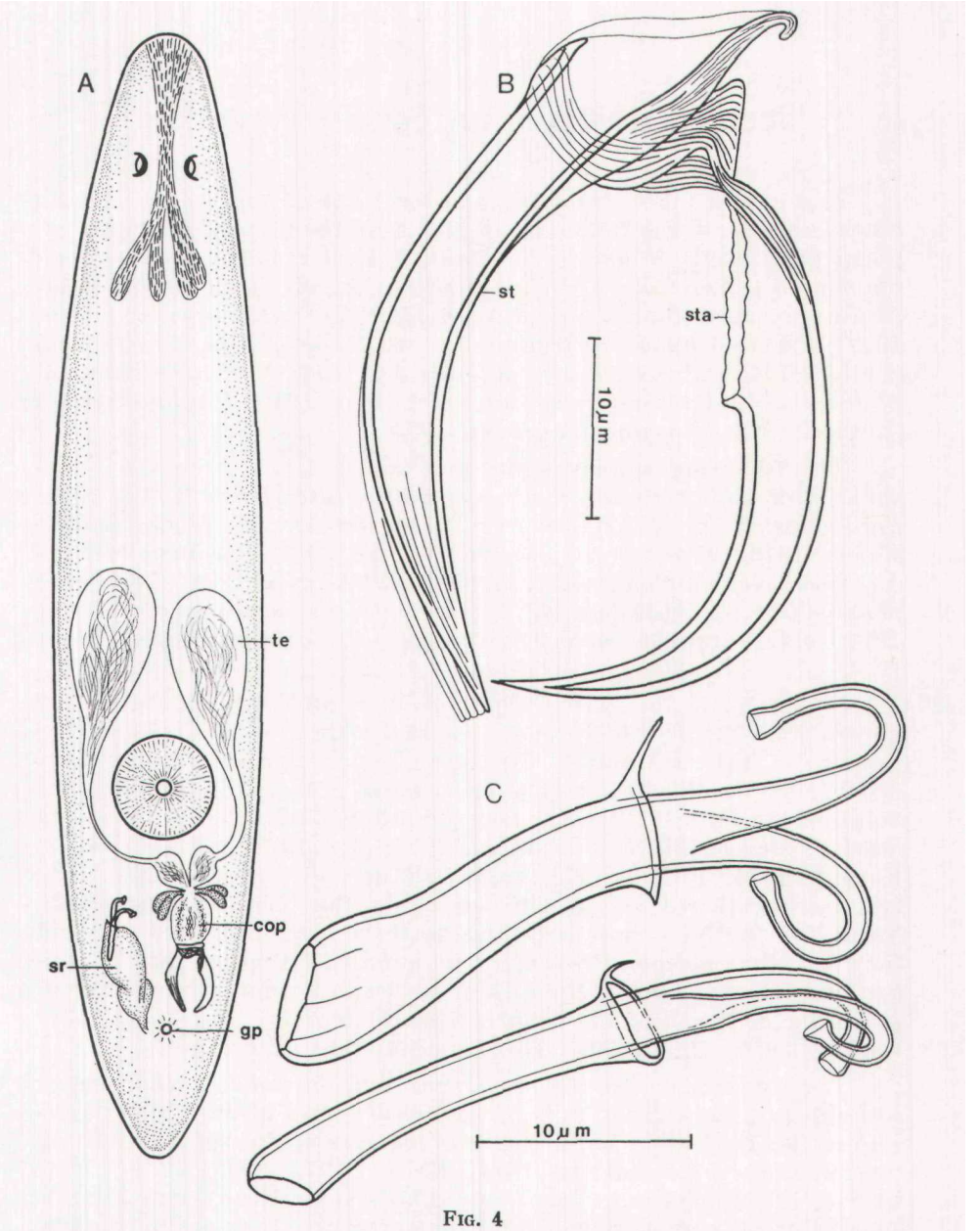

FIG. 4
Messoplana roscoffensis.
A: organization (dorsal view). B: penis stylet and stylet appendage. C: insemination apparatus of two specimens.
A - C from squeezed living specimens.

1974; Rieger, 1977). It seems as if, in the new species, only the distal part of the stylet apparatus of *M. falcata* is realized.

In contrast to the stylet apparatus, the structure of the insemination one is very different in the two species.

The other known species of the genus *Messoplana* do not show closer relationships to the new species (see also p. 165).

ZOOGEOGRAPHIC AND PHYLOGENETIC COMMENTS

In samples taken from the eulittoral flat of the Ile Callot with fine muddy sand, the following species were found: *Convoluta roscoffensis* Graff, 1891; *Monocelis lineata* (O.F. Müller, 1774); *Monocelopsis otoplanoides* Ax, 1951; *Cirrifera cirrifera* Sopott, 1972 (the animals measured more than 1mm); *Adenopharynx mitrabursalis* Ehlers, 1972; *Promesostoma rostratum* Ax, 1951; *Ptychopera westbladi* (Luther, 1943); *Proxenetes ampullatus* Ax, 1971; *Provortex psammophilus* Ax, 1951; *Provortex tnbiferus* Luther, 1948; *Pogaina succica* (Luther, 1948); *Pogaina kinnei* Ax, 1970.

The following species occur in samples taken from the beach slope with rather coarse sand: *Convoluta roscoffensis* Graff, 1891; *Paromalostomum fusculum* Ax, 1952; *Myozonaria falcis* Sopott-Ehlers, 1976; *Monocelopsis otoplanoides* Ax, 1951; *Parotoplana papii* Ax, 1956; *Nematoplana coelogynoporoides* Meixner, 1938; *Coelogynopora gallica* Sopott-Ehlers, 1976; *Anthopharynx sacculipenis* Ehlers, 1972 (mature animals were 0.5mm long); *Pratoplana goleata* Ehlers, 1974.

Several of the interstitial Typhloplanoida and Dalyellioida already known from the area of Roscoff possess a wide geographical distribution in the eastern Atlantic. Three species, *Promesostoma rostratum. Ptychopera westbladi* and *Pogaina suecica,* are distributed from the South of the French Atlantic coast (Arcachon, 45°N) to the Norwegian coast (Tromsoe, 70°N) (see Riedl, 1956; Ax, 1970; Schmidt, 1972; Karling, 1974; Ehlers, 1973, 1974, and unpublished findings). The two last-mentioned species also occur in the Mediterranean. The North Sea (60°N) seems to be the northern boundary of settlement for *Pratoplana goleata, Proxenetes ampullatus, Provortex psammophilus,* and *Pogaina kinnei;* these four species are known from different places to the South of the French Atlantic coast (see Ax, 1951, 1970; Karling, 1974; Ehlers, 1973, 1974, and unpublished findings).

Three more species, *Adenopharynx mitrabursalis, Anthopharynx sacculipenis,* and *Provortex tubiferus,* were found till now along several beaches from 60”N in the North to the area of Roscoff in the South (see Luther, 1962; Karling, 1974; Ehlers, 1972, 1973, 1974). One species, *Ptychopera purasjokii,* only occurs along the French Atlantic coast (Roscoff and Arcachon) and the three new taxa are yet known only from the Roscoff area.

With regard to the habitats, few species are typical inhabitants of beaches or flats with rather clean sand: *Anthopharynx sacculipenis,*

Pratoplana goleata, Proxenetes ampullatus and perhaps also, *Messoplana roscoffensis* and *Promesostoma meixneri roscoffense.* Most of the species are obligates in more or less mud bottoms with fine sands: *Adenopharynx mitrabursalis, Promesostoma rostratum, Ptychopera westbladi, Ptychopera purasjokii, Provortex psammophilus, Provortex tubiferus, Pogaina suecica, Pogaina kinnei* and *Trisaccopharynx roscoffensis.* None of the species hitherto known from the Roscoff area occurs at high energy beaches.

The species *Promestoma meixneri* is now represented by two subspecies, P. *m. meixneri* and *P. m. roscoffense.* Animals occurring along the Norwegian and Swedish coasts (see Schmidt, 1972, *"Promesostoma* cf. *meixneri"* and Karling, 1967, *"P. neglectum"*) may represent other subspecies. But the yet known distribution of the different subspecies does not indicate clear geographical allopatric speciation: whereas *P. m. roscoffense* lives in the area of Roscoff, the nominal subspecies is distributed along beaches of Germany and Denmark (see Ehlers, 1974) and of the Charente (Ile de Ré, own unpublished observations on animals with and without a bursa-flap).

The genus *Messoplana* contains now six known species. In regard to the size and structure of the male copulatory organ, the species can be separated into two groups. The species of the first group, *M. falcata* and *M. roscoffensis,* are characterized by a relatively short stylet, the distal part of it being composed of fibrous strands. To this group one would add *"Messoplana geminata",* described by den Hartog (1966, p. 135). However, the "cuticular copulatory apparatus" of *"M. geminata"* does not represent a stylet, but the spicular apparatus of a digested nematode (M. Bilio, personal communication); thus the specific status of *"M. geminata"* can not be accepted. The species of the second group, *M. elegans, M. helgolandica, M. floralis* and *M. rugata,* possess a very long, threadlike stylet.

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Summary

The Turbellaria Typhloplanoida *Trisaccopharynx roscoffensis* n. sp., *Promesostoma meixneri roscoffense* n. subsp., *Pti/chopera purasjokii* Ax, and *Messoplana roscoffensis* n. sp. being found in the area of Roscoff (North-Finistère, France) are described.

Other known interstitial Turbellaria being found in the same area are listed and several Zoogeographic and phylogenetic comments are given on the interstitial Turbellaria Tvphloplanoida and **Dalyellioida** yet known from the area of Roscoff.

Zusammenfassung

Aus dem marinen Sandlückensystem von Stränden bei Roseoff (Nord-Finistère, Frankreich) werden die Turbellarien *Trisaccopharynx roscoffensis* n. sp.,

Promesostoma meixneri roscoffense n. subsp., *Ptychopera purasjokii* Ax und *Messoplana roscoffensis* n. sp. beschrieben.

Daneben werden die weiteren in diesen Stränden aufgefundenen, aber bereits von anderen Küsten bekannten Turbellarien aufgeführt. Über die interstitiellen Typhloplanoida und Dalyellioida der Region von Roscoff erfolgen einige zoogeographische und phylogenetische Bemerkungen.

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