

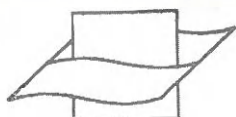
HYDROBIOLOGY

A PRELIMINARY REVISION OF THE PROXENETES GROUP
(TRIGONOSTOMIDAE, TURBELLARIA)

SUPPLEMENT

BY

C. DEN HARTOG



Vlaams Instituut voor de Zee
Flanders Marine Institute

(Communicated by Dr. J. VERWEY at the meeting of April 30, 1966)

Since the publication of the first parts of my revision of the *Proxenetes* group I have received from Dr. M. Bilio some drawings of a new species of the genus *Ptychopera*, which had been found by him in Finland in 1963. During his visit to the Netherlands in 1964 he was fortunate and found it also in the Deltaic area. It was found together with another remarkable species, which appeared to represent a new genus in the *Proxenetes* group. I would like to thank Dr. Bilio for his permission to describe these taxa in a supplement to this revision.

Further I have added some new data of *Proxenetes* species, which concern records from areas where these species have not been found before. Additional data on the local distribution of species in the south-western part of the Netherlands will be published later.

LUTHERIELLA nov. gen.

Pharynx anterior, at $\frac{1}{4}$ of the body length. Efferent tract of the female genital apparatus differentiated into a large bursa copulatrix and a small receptaculum seminis connected by a long narrow ductus spermaticus. Bursal appendage consisting of a short, delicate, hardly cuticularized duct. Wall of the bursa copulatrix unpleated. Male cuticular copulatory organ consisting of a proximally curved stylet and a completely separate additional cuticular duct.

Type: *Lutheriella diplostyla* nov.sp.

Lutheriella is closely related to *Ptychopera* as in both genera the structure of the efferent tract of the female genital apparatus is very similar and the pharynx is anteriorly placed. They differ, however, in the structure of the cuticular copulatory organ and in the differentiation of the wall of the bursa copulatrix.

***Lutheriella diplostyla* nov. sp.**

Fig. 53-54; Pl. XIV, fig. A.

The animals are oblong, 250-300 μ long, and white in colour. The anterior part of the body is obtusely rounded. The two eyes are relatively large and frontally placed. Some inconspicuous rhabdite tracks pass between the eyes. The pharynx lies at $\frac{1}{4}$ of the body length. The testes are elongate sacs extending from the middle of the body in caudal direction. The vasa deferentia are rather long ducts which widen into large spermaducal vesicles before entering the muscular bulbus. The latter is subspherical and discharges its secretory products through two cuticular ducts. The stylet is 44 μ long and consists of a wide proximal funnel, which bends sharply and then proceeds as a gradually narrowing, straight duct, twisted once near its distal tip. The proximal margin of the stylet is irregular

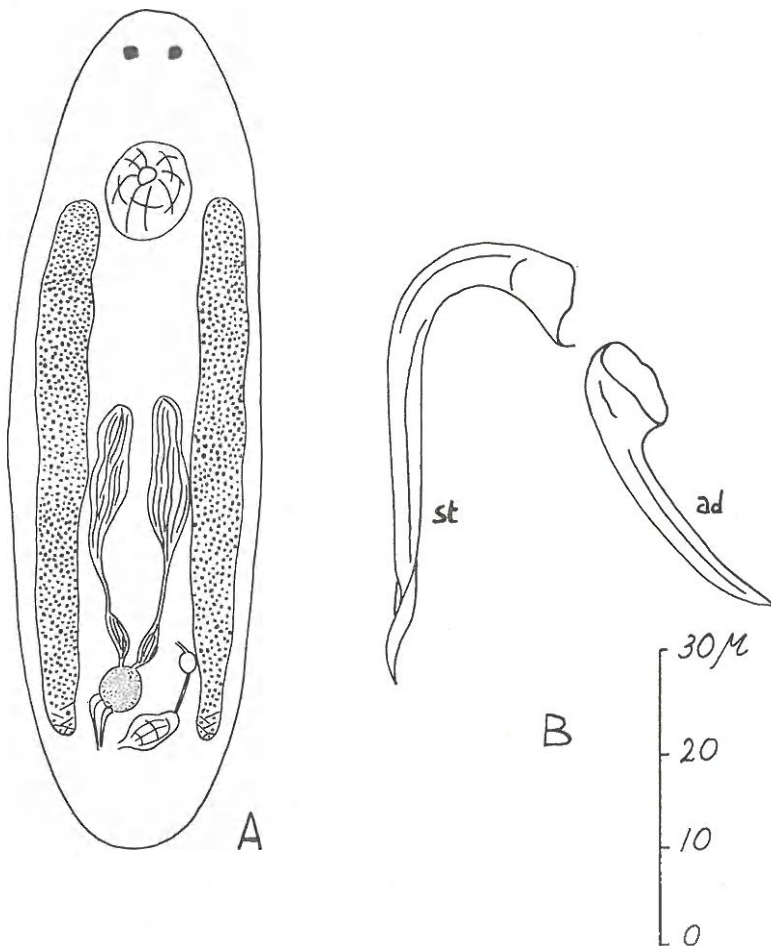


Fig. 53. *Lutheriella diplostyla* nov. sp.: A. General view; B. cuticular copulatory organ, stylet (st) and additional duct (ad) brought out of position by strong pressure (after a specimen from Ossendrecht, Noord-Brabant).

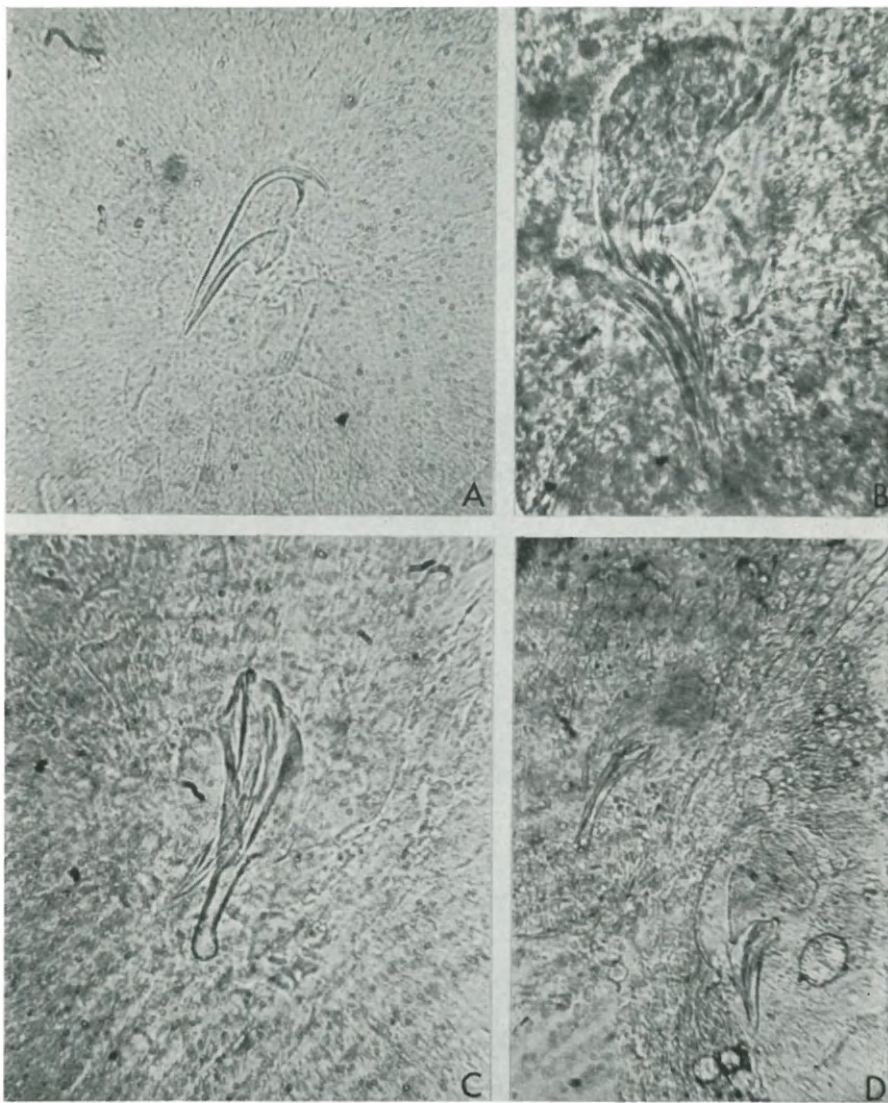


PLATE XIV. *Lutheriella diplostyla* nov. sp.

A. Cuticular copulatory organ, consisting of stylet and additional duct; to the right the bursa copulatrix is visible.

Ptychopera spinifera nov. sp.

B. Cuticular copulatory organ and muscular bulbus. C. Cuticular copulatory organ, the lateral spines brought out of position by strong pressure. D. Cuticular copulatory organs of two specimens; the shapes appear different but this is only a result of the difference in position in the plane of focus. (A after a specimen from Ossendrecht, Noord-Brabant, B-D after specimens from Oudenhorn, Voorne-Putten).

at acute angles; their distal tips are very proximate. The vitellaria are elongate and extend from the pharynx in caudal direction. They join the germaria, which lie lateral to the copulatory organ. The bursa copulatrix is an elongate sac, $60\ \mu$ long and $20\ \mu$ wide. Its distal opening is rather narrow but indistinct. The wall of the bursa is smooth and unpleated, without any cuticularization. The ductus spermaticus is very narrow and $45\ \mu$ long. The ellipsoid receptaculum seminis is $14\ \mu$ long and $7\frac{1}{2}\ \mu$ wide. The ductus spermaticus and the bursal appendage are inserted diametrically opposite on the receptaculum seminis. The bursal appendage is short but relatively wide. Its wall is slightly cuticularized, showing an annular striation. The length is $8\ \mu$. The bursal appendage discharges into the very thin-walled fecundatorium.

Geographical distribution:

The species is known so far from only two localities in the south-western part of the Netherlands.

Localities in the Netherlands:

Province of Noord-Brabant:

1. Ossendrecht, salt-marsh along the Scheldt estuary, October 1964 (Type, collected by Dr. M. Bilio).

Province of Zeeland:

- Zuid-Beveland: 2. Krabbendijke, salt-marsh of Strodorper Polder, May 1965 (collected by Dr. M. Bilio); August 1965 (collected by A. J. J. Sandee).

Ecology:

Lutheriella diplostyla has been found so far only on salt-marshes and particularly in those vegetations which are reached daily by the flood water. On the salt-marsh of Ossendrecht 3 specimens were collected; they were accompanied by several species of which *Proxinetes minimus* Den Hartog and *Ptychopera spinifera* nov. sp. were the most interesting ones. On the salt-marsh of Strodorper Polder *L. diplostyla* was obtained twice from samples taken in the *Spartina maritima* association, viz. 5 specimens in May 1965 and 2 in August 1965.

From these data it seems that *L. diplostyla* is an other characteristic species of the Turbellarian coenosis of the salt-marshes. From the known salinity data for the two localities it may be concluded that the species inhabits at least the euhalinicum and the polyhalinicum of the estuaries.

Ptychopera spinifera nov. sp.

Fig. 55-59; Pl. XIV, fig. B-D, XV.

The animals are oblong, $200-500\ \mu$ long, and yellowish brown in colour. The anterior part of the body is more or less truncate and provided with a small number of papillae. The eyes lie at $1/5-1/10$ of the body length. The pharynx is small and is situated at $1/4-2/5$ of the body length. The

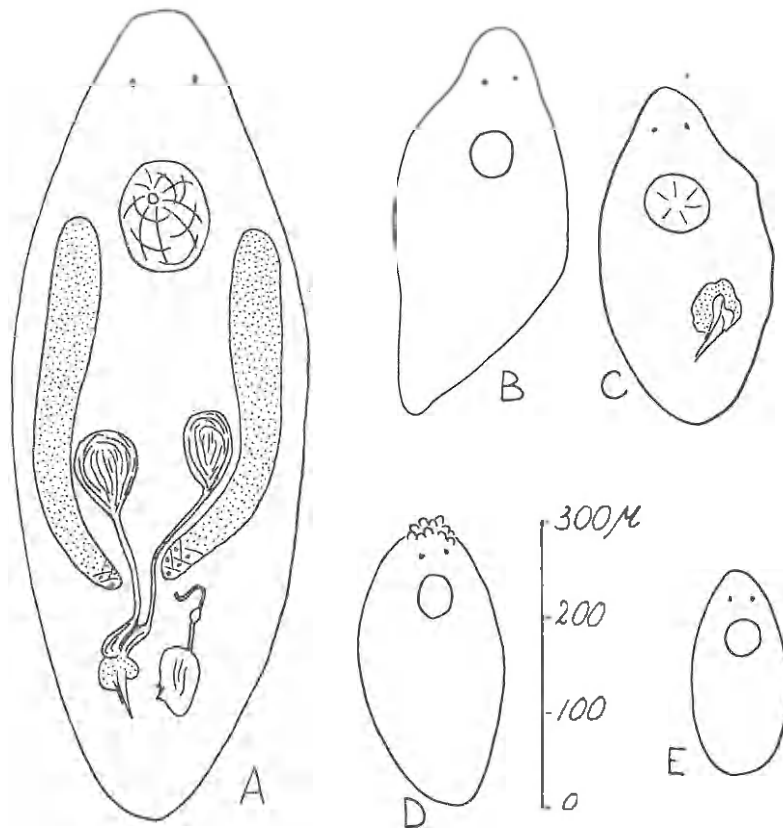


Fig. 55. *Ptychopera spinifera* nov. sp.: A. General view; B-E. shape of some specimens from Oudenhorn, Voorne-Putten.

small testes are subspherical to ovoid in shape and are situated in the posterior part of the body. The narrow vasa deferentia swell at their distal ends into large, curved, spermaducal vesicles, which discharge into the muscular bulbus. The cuticular copulatory organ is $56-63\ \mu$ long and of very complex structure. It consists of a wide cuticular funnel, which is divided into 3 compartments by 2 sagittal cuticular lamellae. The proximal openings of these compartments are very different in size. Within the compartment having the smallest proximal opening 2 or 3 smaller lamellae occur. These lamellae are drawn out distally into spines, projecting on one side of the copulatory organ. On the other side the cuticular funnel continues distally in a linear, somewhat club-shaped process, which is longer than the distal spines of the lamellae. According to observations of Dr. M. Bilio this process has a distal pore. There seems to occur a ciliate velum between this process and the outermost spine, which protects the group of lamellar spines.

The vitellaria are elongate and extend from behind the pharynx in caudal direction. They join the germaria, which lie proximal to the copulatory organ.

The bursa copulatrix is a slightly twisted, obliquely placed, oblong sac. Its length is $70-75\ \mu$ and its width $30-40\ \mu$. The margin of its distal opening is at least partly cuticularized and shows often two more or less spiny extensions. The wall of the bursa is not pleated. The ductus spermaticus is $35-45\ \mu$ long and sharply curved. The receptaculum seminis is ovoid, $20\ \mu$ long and $15\ \mu$ wide. The bursal appendage is $80\ \mu$ long and strongly coiled. I have not seen a small cuticular ridge in the proximal part of the bursal appendage. The ductus spermaticus and the bursal appendage are inserted diametrically opposite on the receptaculum seminis.

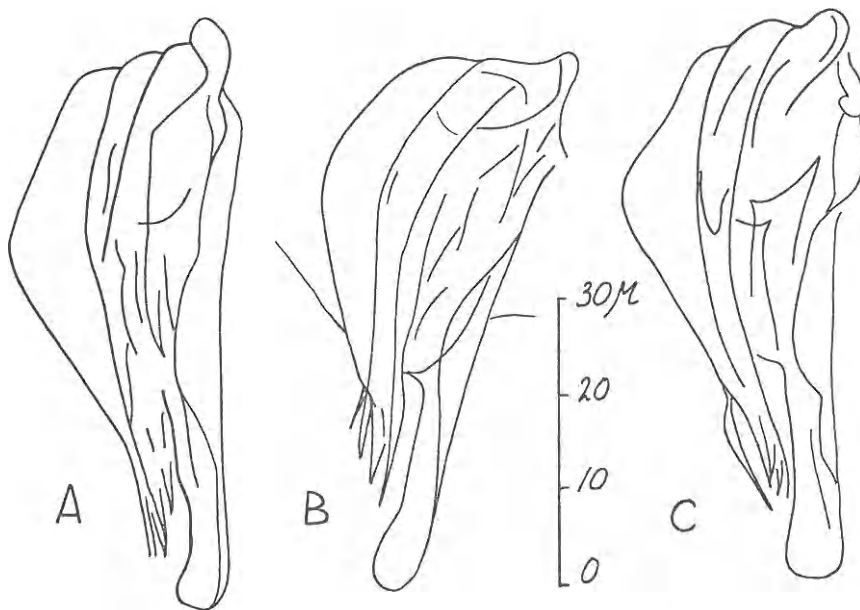


Fig. 56. *Ptychopera spinifera* nov. sp.: A-C. Cuticular copulatory organs (after specimens from Oudenhorn, Voorne-Putten).

Geographical distribution:

Ptychopera spinifera is known so far from the Deltaic area of the rivers Rhine, Meuse and Scheldt and from the south-western coast of Finland.

Localities in the Netherlands:

Province of Zuid-Holland:

Voorne-Putten: 1. Salt-marsh south of Oudenhorn, November 1964 (Type, collected by A. J. J. Sandee).

Beyerland: 2. Zuid-Schuring, a marshy area along the Hollandsch Diep, east of Numansdorp, May 1965 (BILIO, personal communication).

Goeree-Overflakkee: 3. Ventjagerplaat, along the Haringvliet, north of Ooltgensplaat, May 1965 (BILIO, personal communication); 4. Ooltgensplaat, salt-marsh along the Volkerak, May 1965 (BILIO, personal communication), August 1965 (collected by A. J. J. Sandee).



Fig. 57. *Ptychopera spinifera* nov. sp.: A. Cuticular copulatory organ; B. distal tip of the cuticular copulatory organ; C. distal part of the cuticular copulatory organ, showing the velum (after unpublished sketches by BILIO of specimens from Oesterfaerden, Finland).

Province of Noord-Brabant:

5. Ossendrecht, salt-marsh along the estuary of the river Scheldt, October 1964 (collected by Dr. M. Bilio).

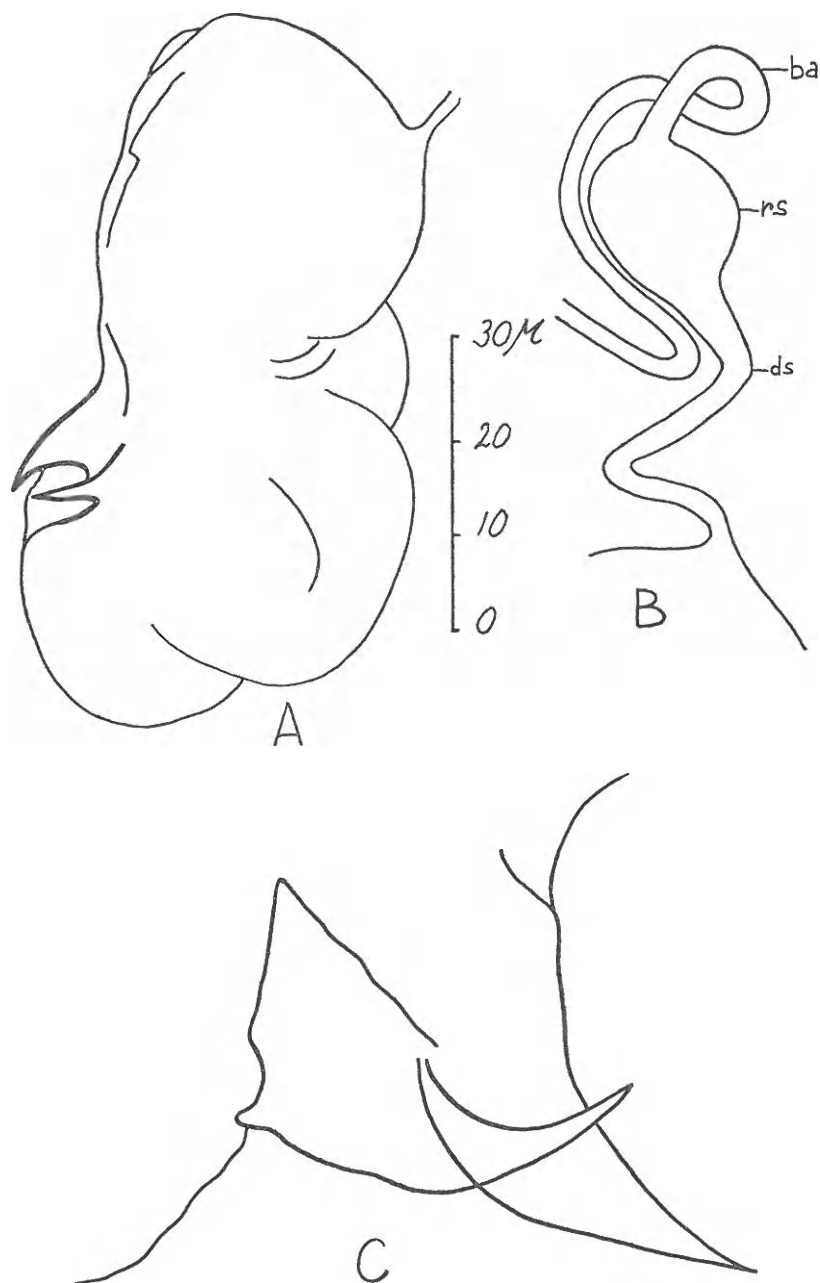


Fig. 58. *Ptychopera spinifera* nov. sp.: A. Bursa copulatrix, showing the cuticular stiffenings around the distal opening; B. receptaculum seminis (rs) with ductus spermaticus (ds) and bursal appendage (ba); C. cuticular stiffenings around the distal opening of the bursa copulatrix (A-B after specimens from Oudenhorn, Voorne-Putten, C after an unpublished sketch by BILIO of a specimen from Oosterfjaerden, Finland; the scale refers to A-B only).

Locality in Belgium:

Province of Antwerpen:

6. Lilloo, salt-marsh along the river Scheldt, May 1965 (BILIO, personal communication).

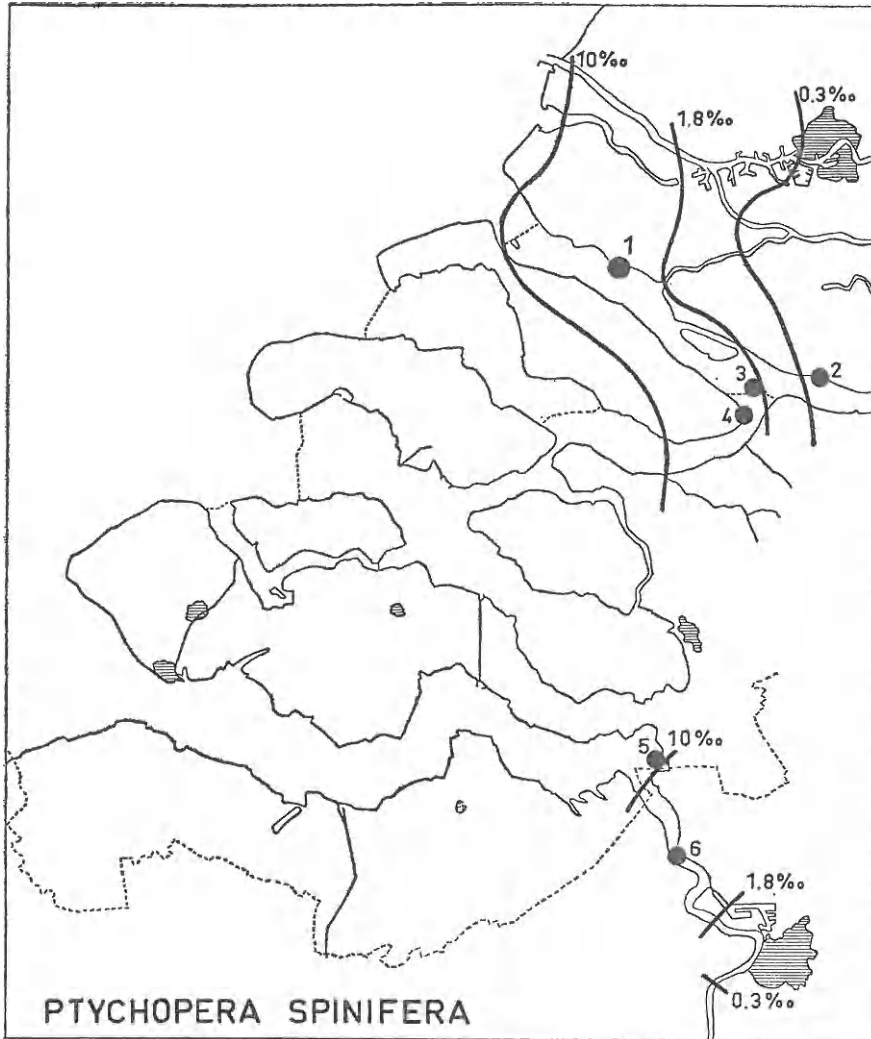


Fig. 59. Distribution of *Ptychopera spinifera* nov. sp. in the Deltaic area of the rivers Rhine, Meuse and Scheldt. The average annual isochalines at high tide of 0.3 ‰, 1.8 ‰ and 10 ‰ Cl' are given.

Locality in Finland:

Hangö Peninsula:

Lagoon Oesterfaerden, which is connected with the Gulf of Finland, in low meadows along the banks. July-August 1963 (BILIO, personal communication).

Ecology:

Ptychopera spinifera is a true brackish-water species. Its localities in the Deltaic area are concentrated in the mesohaliniticum, where it probably is very common. Its most saline locality is the salt-marsh of Ossendrecht along the Scheldt estuary. There the annual average salinity at high tide amounts to ca. 10 ‰ Cl'. In this transition area between mesohaliniticum and polyhaliniticum only 1 specimen of *P. spinifera* has been collected and that together with *Proxenetes minimus* and *Luthericlla diplostyla*. In the other localities *Ptychopera spinifera* was quite abundant, and in the sample from the salt-marsh near Oudenhorn it was even the dominant species. In the Hollandsch Diep, where the average annual salinity at high tide is between 0.1 and 0.3 ‰ Cl', the species appeared to be rather abundant in the vegetation along the banks near Zuid-Schuring. It is thus able to live under fresh-water conditions. It has to be mentioned, however, that under extreme circumstances, e.g. during a protracted period of low fresh-water discharge or during stormy weather, salt water can penetrate into this area. How far *P. spinifera* enters into the fresh-water tidal region is not yet known. In Finland the species occurs at salinities of about 3 ‰ Cl'.

P. spinifera occurs in grassy vegetations near high-water-mark and especially when there is no grazing by cattle. In Ossendrecht, Oudenhorn and Ooltgensplaat it inhabits ungrazed vegetations of the *Puccinellietum maritimae*. The absence of grazing can easily be ascertained by the profuse flowering of *Aster tripolium* in such spots; elsewhere it is eaten by the cattle. In the fresh-water locality near Zuid-Schuring *P. spinifera* inhabits wet marshlands, which are not grazed.

In Oudenhorn a sample was taken in the *Puccinellietum maritimae*, in which beside the dominant sea-speargrass, *Puccinellia maritima*, much *Aster tripolium* and a few plants of *Festuca rubra* were present. The bottom fauna appeared to be very rich, and consisted of many insect larvae,

TABLE 4

Turbellarian fauna of the *Puccinellietum maritimae* on the salt-marsh of Oudenhorn (Voorne-Putten).

Salt-marsh species:	
<i>Ptychopera spinifera</i> nov. sp.	99
<i>Ptychopera tuberculata</i> (Von Graff)	9
<i>Proxenetes minimus</i> Den Hartog	6
Still-water species:	
<i>Provortex karlingi</i> Ax	4
<i>Provortex pallidus</i> Luther	1
<i>Proxenetes karlingi</i> Luther	1
<i>Mecynostomum auritum</i> (Schultze)	1

Surveyed on November 23, 1964.

oligochaetes, nematodes, turbellarians, ciliates, and a few specimens of the amphipod *Orchestia gammarella* (Pallas) and the snail *Assiminea grayana* Fleming.

The composition of the Turbellarian fauna is given in Table 4.

Ptychopera spinifera feeds on diatoms. Many of the investigated specimens had several pennate diatoms in their intestinal tract.

Proxenetes deltoides Den Hartog, 1965

DEN HARTOG, Proc. Kon. Ned. Akad. Wetensch. C. 68, 105-111, f. 12B, 15-17, Pl. 3 (1965).

Locality in France:

Department of Calvados:

Salenelles, north of Caen, salt-marsh along the estuary of the river Orne.
August 1965.

Locality in the Netherlands:

Province of Noord-Holland:

Balgzand, south of Den Helder, salt-marsh, August and October 1965.

Ecology:

The new records have given hardly any new information on the ecology of the species. On the salt-marsh of Salenelles the *Puccinellietum maritimae* is completely absent. The pioneer vegetation of phanerogams consists exclusively of *Salicornia europaea* and *Suaeda maritima*. At a somewhat higher level this vegetation is replaced by an almost pure growth of *Halimione portulacoidis*, which is bordered on the land side by the flotsam deposits of high-water-mark. In these three biotopes samples were taken and they all contained one or a few specimens of *Proxenetes deltoides*. Two specimens were obtained from a vegetation of *Limonium vulgare*, which could be reached only by the flood water at very high spring tides and during stormy weather, remaining inundated for a considerable time after flooding owing to insufficient possibilities for discharge. On the Balgzand the species has been found in the *Puccinellietum maritimae*.

In the guts of these specimens I found oligochaetes and nematodes.

Proxenetes minimus Den Hartog, 1966

DEN HARTOG, Proc. Kon. Ned. Akad. Wetensch. C 69, 109-112, f. 24B, 29-30, Pl. 7 A-B (1966).

Locality in the Netherlands:

Province of Noord-Holland:

Balgzand, south of Den Helder, salt-marsh, October 1965.

Ecology:

Two specimens of this species have been found in a highly situated *Puccinellietum maritimae* on the Balgzand.

Proxenetes britannicus Den Hartog, 1966

DEN HARTOG, Proc. Kon. Ned. Akad. Wetensch. C 69, 120-123, f. 34B, 36 (1966).

Locality in France:

Department of Manche:

Mont St. Michel, west of Avranches, salt-marsh, July 1965.

Locality in the Netherlands:

Province of Noord-Holland:

Balgzand, south of Den Helder, salt-marsh, October 1965.

Ecology:

In both new localities *P. britannicus* has been found in the *Puccinellietum maritimae*. On the salt-marsh of Mont St. Michel, which although flooded for a short period during the highest tides, is nevertheless more or less fully drained owing to the enormous daily tidal oscillations (average tidal difference 13-15 m), the species was accompanied by *Vejdovskya halileimonia*, *Proxenetes cisorius* and an unidentified turbellarian species.¹⁾

On the Balgzand it was found also together with *Vejdovskya halileimonia*, *Proxenetes cisorius*, and several other species, in a rather highly situated, well-drained *Puccinellietum*.

In the body of *Proxenetes britannicus* I have observed parasitic gregarines.

Proxenetes puccinellicola Ax, 1960.

AX, Z. wiss. Zool. 163, 222-223, f. 9-12 (1960).

Locality in France:

Department of Calvados:

Salenelles, north of Caen, salt-marsh along the estuary of the river Orne, August 1965.

Locality in the Netherlands:

Province of Noord-Holland:

Balgzand, south of Den Helder, salt-marsh, October 1965.

¹⁾ This unidentified species is the same as the one found in the Verdrongen Zwarte Polder near Cadzand in November 1964 (see part VIII, p. 137 of this work).

Ecology:

The salt-marsh of Salenelles, situated along the polyhaline section of the river Orne, appeared to be a very rich locality for this species, as no less than 90 mature specimens were obtained from only three samples. In the lowest situated vegetation belt, consisting of *Salicornia europaea* and *Suaeda maritima*, only 5 specimens of *P. puccinellicola* were found. Here *Macrostomum balticum* appeared to be the most numerous species. In the higher situated *Halimionetum portulacoidis*, the bottom of which has a somewhat higher content of fine sand than that of the first-mentioned vegetation, *P. puccinellicola* was with 65 specimens the dominating species. Here *Macrostomum balticum* was the second most numerous species. In the flotsam line, the clayey humose bottom of which has a crumbly texture, *P. puccinellicola* was represented by 20 specimens and highly outnumbered by *Macrostomum spirale*. In the *Limonium* vegetation, which is irregularly flooded and then becomes covered with stagnant water for a longer or shorter period, not a single specimen of *P. puccinellicola* could be found.

On the Balgzand salt-marsh the species has been found in the *Puccinellietum maritimae* only.

In the intestinal tracts of the animals I found almost exclusively nematodes. In a few specimens from Salenelles parasitic gregarines have been observed. I have also seen two specimens in copulation.

Proxenetes cisorius Den Hartog, 1966

DEN HARTOG, Proc. Kon. Ned. Akad. Wetensch. C 69, 132-138, f. 42-44, Pl. 11 (1966).

Localities in France:

Department of Manche:

Mont St Michel, west of Avranches, salt-marsh, July 1965.

Department of Calvados:

Salenelles, north of Caen, salt-marsh along the estuary of the river Orne, August 1965.

Locality in the Netherlands:

Province of Noord-Holland:

Balgzand, south of Den Helder, salt-marsh, October 1965.

Ecology:

Proxenetes cisorius is ecologically one of the most interesting species of the genus. It was found on the salt-marsh of Mont St. Michel in the highest part of the *Puccinellietum maritimae*, which is flooded for only a short period during the highest tides. As a consequence of the large tidal difference the drainage at the higher levels is considerable, and

because of this in summer the clay can be crumbled between the fingers. Besides *Vejdovskya halileimonia*, *Proxenetes britannicus* and an unidentified turbellarian a specimen of *P. cisorius* was also obtained from a soil sample. In the slightly higher situated *Halimionetum portulacoidis* only *Vejdovskya halileimonia* could be found.

On the Balgzand salt-marsh the species combination *Proxenetes cisorius* – *Vejdovskya halileimonia* was found again in the highest situated parts of the *Puccinellietum maritimae*, which are not reached by every tide. In this locality *Proxenetes deltoides* joins the combination, while in one of the two studied samples *P. britannicus*, *P. minimus*, *P. puccinellicola*, *Baicalellia brevituba* and *Macrostomum balticum* were found.

The habitats of *P. cisorius* on the Mont St. Michel and Balgzand salt-marshes are both directly dependent on the tidal cycle and agree in the alternation of short periods of flooding with long periods of desiccation.

On the salt-marsh of Salenelles *P. cisorius* has been found in two different habitats, viz. in the humose clayey soil of the flotsam line and in a depression with *Limonium vulgare*. The first mentioned habitat has a much more constant moisture content than the habitats described above, and I wonder whether the 2 collected specimens perhaps may represent invaders from a higher level not sampled by me.

The *Limonium* depression is reached by the floodwater only at very high tides and during stormy weather. After flooding the water stagnates for considerable time as the discharge is blocked and the soil badly permeable. The vegetation can also be inundated by long-lasting or heavy rain fall. *Proxenetes cisorius* was with 12 mature specimens the second most numerous species beside the dominant *Macrostomum spirale*. Other companion species were *Monocelis lineata*, *Proxenetes deltoides*, *Uteriporus vulgaris* and *Coelogyropora schulzii*. A similar species combination has also been recorded from the Verdrongen Zwarte Polder near Cadzand (see part VIII, p. 137 of this work). In that combination *P. cisorius* was thought to be an infrequent invader from higher levels. At Salenelles the same may be true, but as no samples from higher levels have been taken no certainty exists on this point. The high number of specimens is, however, an indication that *P. cisorius* is probably a regular resident of the *Limonium* vegetation.

In the intestinal tract of *P. cisorius* I found nematodes, which were in some cases still alive. Some specimens from the Balgzand were infected by parasitic gregarines.

In contrast to what has been found in other *Proxenetes* species *P. cisorius* appears to be proterandric. In several specimens from Salenelles I found well-developed testes and an already stiffening cuticular copulatory organ, while the germovitellaria were only faintly developed. No traces of hardening could be detected in the yet little developed female genital tract, and the otherwise so conspicuous bursal appendage was apparently still absent.

