

On the pisionids (Polychaeta: Pisionidae) from Papua New Guinea, with a description of six new species¹

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Abstract

Out of eight species of pisionids sampled in Papua New Guinea, six are new to science: *Pisione helenae* n.sp., *P. parhelenae* n.sp., *P. parva* n.sp., *P. brevicirra* n.sp., *P. ungulata* n.sp. and *P. primitiva* n.sp. Some remarks are given for *P. subulata* YAMANISHI, 1992, new for Papua New Guinea, and for *P. papuensis* GOVAERE & DE WILDE, 1993.

Special attention was paid to some female worms. A key is included for the Pisionidae of Papua New Guinea.

Key words: Polychaeta, Pisionidae, Taxonomy, Papua New Guinea.

Résumé

Parmi huit espèces de pisionides récoltées en Papouasie Nouvelle-Guinée six sont nouvelles pour la science: *Pisione helenae* n.sp., *P. parhelenae* n.sp., *P. parva* n.sp., *P. brevicirra* n.sp., *P. ungulata* n.sp. et *P. primitiva* n.sp. Quelques remarques sont notées sur *P. subulata* YAMANISHI, 1992, espèce nouvelle pour la Papouasie Nouvelle-Guinée, et sur *P. papuensis* GOVAERE & DE WILDE, 1993.

Une attention particulière a été accordée aux formes femelles. Une clef est donnée pour les Pisionidae de Papouasie Nouvelle-Guinée.

Mots-clefs: Polychaeta, Pisionidae, taxonomie, Papouasie Nouvelle-Guinée.

Introduction

Within the polychaete collection sampled at Laing Island in September-November 1985, special attention was given to the pisionids. Eight species of the genus appeared to be present in the material, six new to science (*P. helenae* n.sp., *P. parhelenae* n.sp., *P. parva* n.sp., *P. brevicirra* n.sp., *P. ungulata* n.sp. and *P. primitiva* n.sp.), one new for Papua New Guinea (*P. subulata* YAMANISHI, 1992) and *Pisione papuensis*, already described from the same material in a previous paper (GOVAERE & DE WILDE, 1993).

Material and methods

The material was collected by the first author in 1985 on Laing Island, (Hansa Bay, Madang Province, Papua New Guinea) 4° 10' 20" S; 144° 52' 20" E, at the Belgian biological station King Leopold III.

Samples were collected by hand from the littoral to -30 m. Sediments varied from coarse sand mixed with corral rubble to fine sand.

The animals were anesthetized with the MgCl₂ method and extracted from the sediment by sieving the latter on a 0.125 mm sieve and picking them out under dissecting microscope. They were fixed afterwards in formalin and later transferred into alcohol. Details of the animals (i.e. setae, copulatory organs,...) were obtained by observation under dissecting microscope, light microscope and scanning electron microscope, after critical point drying and coating them with 300 Å of gold (not preserved paratypes).

Pisione helenae n.sp.
(figs. 1a,b; 2a; 3a; 5a,b)

TYPE LOCALITY

Durangit Reef, at -4 m in fine sandy sediment, between ripple marks.

Material deposited in the collections of the KBIN (Koninklijk Belgisch Instituut voor Natuurwetenschappen), Brussels.

TYPE MATERIAL

Holotype (KBINPY2113): Male of 53 setigerous segments, 8.7 mm long and 0.29 mm wide without and 0.63 mm with parapodia at setiger 4; 0.17 mm wide without and 0.4 mm with parapodia at setiger 50. Buccal segment 0.23 mm wide, palps 0.58 mm long and dorsal cirrus of buccal segment 0.17 mm long.

Copulatory organs on setigers 31-32-33; collected on 15-09-1985.

(1) Leopold III Biological Station, Laing Island. Contribution n° 311.

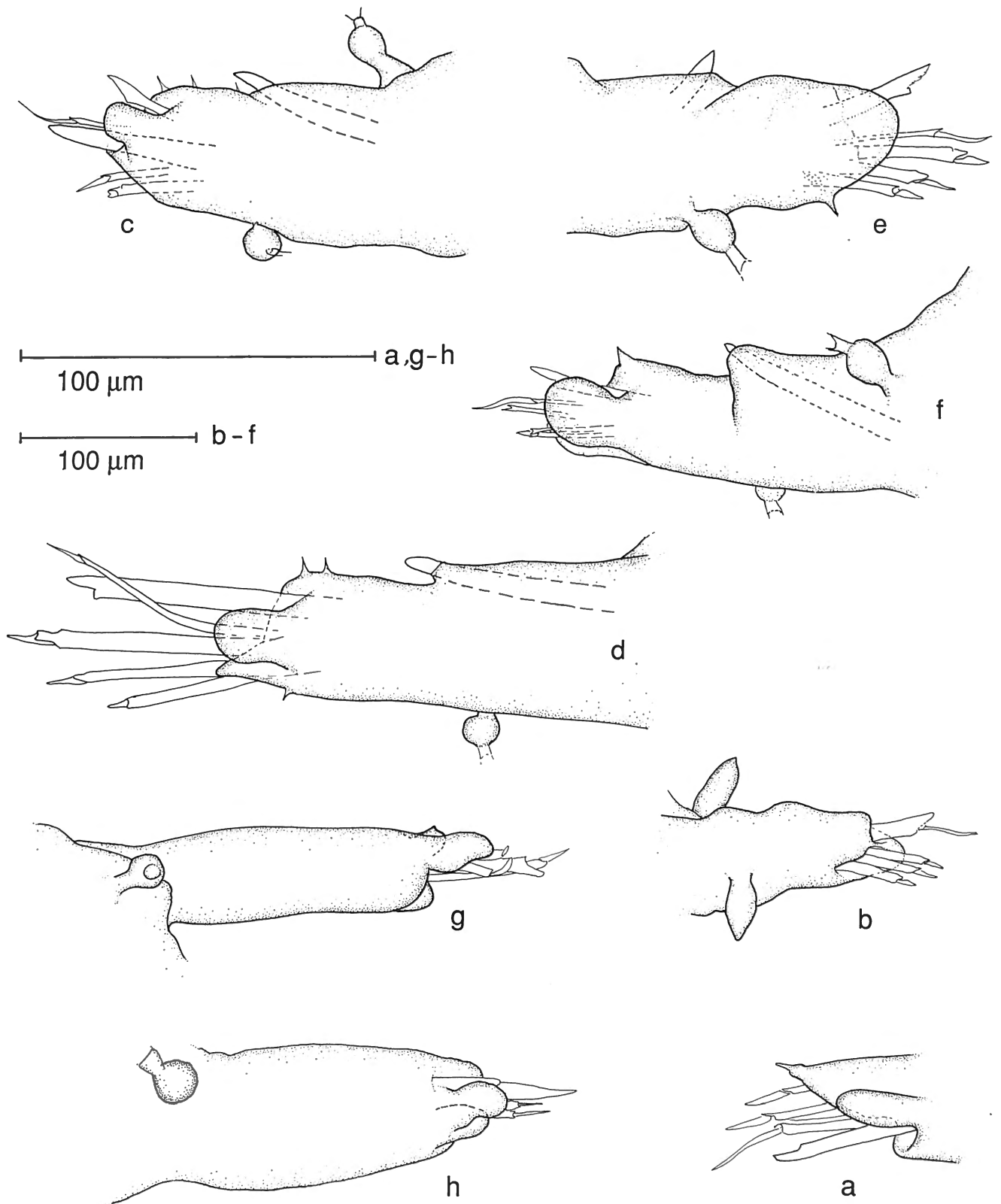


Fig. 1. – Parapodia of *Pisone* species.

- a. *P. helenae* n.sp. left parapodium of setiger 5 postero-lateral (holotype).
- b. *P. helenae* n.sp. right parapodium of setiger 10 ventral (paratype 1).
- c. *P. subulata* YAMANISHI, 1992 right parapodium of setiger 21 anterior view.
- d. *P. ungulata* n.sp. anterior view, middle setiger (holotype).
- e. *P. primitiva* n.sp. dorsal view, setiger 12 (holotype).
- f. *P. primitiva* n.sp. dorso-lateral view, middle setiger (paratype 1).
- g. *P. brevicirra* n.sp. dorsal view, setiger 2 (paratype 2).
- h. *P. brevicirra* n.sp. dorsal view, setiger 21 (paratype 2).

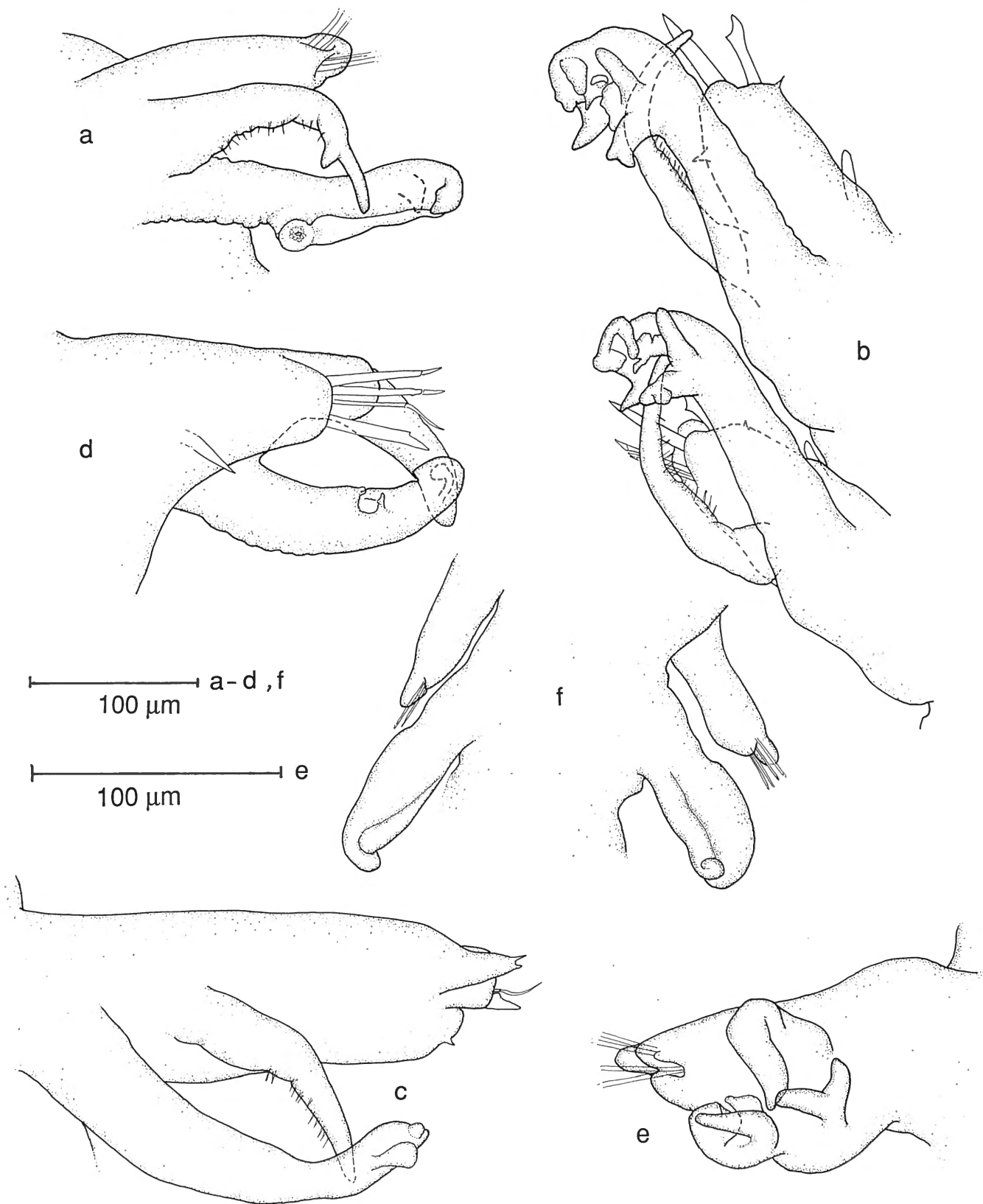


Fig. 2. – Male copulatory organs of *Pisione* species.

- a. *P. helenae* n.sp. ventral view, setiger 31 (holotype).
 b. *P. subulata* YAMANISHI, 1992 ventral view, setiger 16 and setiger 17.
 c. *P. ungulata* n.sp. ventral view, setiger 29 (holotype).
 d. *P. primitiva* n.sp. dorsal view, setiger 23 (holotype).
 e. *P. brevicirra* n.sp. ventral view, setiger 16 (paratype 1).
 f. *P. parhelenae* n.sp. ventral view, setiger 17 (holotype).

Paratype 1 (KBINPY2114): Male of 34 setigerous segments, regenerating, 4.23 mm long and 0.24 mm wide without and 0.5 mm with parapodia at setiger 4; 0.2 mm wide without and 0.57 mm with parapodia at setiger 30. Buccal segment 0.21 mm wide, palps 0.5 mm long and dorsal cirrus of buccal segment 0.14 mm long; copulatory organ on setiger 18. Durangit SE, -35 m; collected on 03-10-1985.

Paratype 2 (KBINPY2115): Female of 43 setigerous segments, receptacula seminis and cirriform process on 10 setigers. Laing N, -15 m; collected on 19-10-1985.

Paratype 3 (KBINPY2116): Male of 45 setigerous segments with copulatory organs on setigers 32, 33, 34, 35 and 36. Durangit NW, -6 m; collected on 15-10-1985. Prepared for SEM.

Additional material deposited in KBIN under number IG.27026 (nrs. KBINPY2117 to KBINPY2161; from Laing Island and Durangit Reef, from littoral to -35 m).

DESCRIPTION

Holotype: Male of 53 setigerous segments.

Prostomium diamond-shaped, well visible, stout buccal acicula, reaching back to the first setigerous segment. Palps smooth, long; dorsal cirri of buccal segment long and tapering, ventral cirri flask-shaped.

Ventral cirri of the first setiger elongated, in form and length resembling the dorsal ones of the buccal segment. Dorsal cirri of second setiger not longer than on other segments.

The dorsal cirri of the 2nd setiger can be cylindrical to slightly elongated in the species but then the dorsal cirri of the following segments are of the same size and the cirri are never longer than the parapodium. In fact, the dorsal cirri of *P. helenae* n.sp. tend to be rather long and conspicuous on the whole body, in comparison with other species of the genus (fig. 5a).

In the anterior segments, the presetal lobe is divided in a round lobe and a triangular one, the latter with a thin thread on top. From setiger 6 to 9 both lobes are round and gradually fused into one round presetal lobe from setiger 10 on (fig. 1a, 1b, 5a).

Setae: *P. helenae* n.sp. fits in the "longbladed compound seta"-group. The parapodia have one simple seta, a longbladed seta with a thin shaft and a small recurved blade, and three (seldom four) subacicular falcigers with short blades. Some parapodia may have a second simple seta or a second longbladed seta (not in the holotype). The body ends in a pygidium with two urites.

Copulatory organs: Some mature males of *P. helenae* n.sp. have one, most have three to four copulatory organs on successive segments. (Of more than 100 specimens controlled, only one had 2 pairs of copulatory organs.) The holotype bears copulatory organs on segments 31 to 33.

Parapodia are not suppressed and dorsal cirri and setae are as in other segments. A few specimens of the additional material had lost the falcigerous setae, or had one simple and two longbladed setae on some, not all copulatory segments. (There even occurred a difference in the same segment between left and right).

The ventral cirri are much enlarged and have an outgrowth or "second tip". The copulatory organ (fig. 2a; 5b) is a stout cylindrical structure with a cirrus on the tip and a papilla in about its middle. The cirrus and the papilla are connected by a well-visible membrane. Sperma is visible in each male segment.

In specimens with only one copulatory organ (e.g. paratype 1), the sperma reaches into three previous segments, and the membrane connecting papilla and cirrus is not developed.

Female: paratype 2 is a female worm of 43 setigerous segments. The body is filled with ripe eggs and the receptacula seminis are well visible and filled with sperma in the setigers 21, 23, 25, 27, 29, 31, 35, 37 and 42.

On the genital segments a simple cirriform process is developed ventrally at the base of the parapodium (fig. 3a), resembling much that of *P. complexa* ALIKUNHI, 1947 (p.118, txt-fig. 9).

DISCUSSION

P. helenae n.sp. is a rather big pisionid. The presetal lobes are divided as in *P. tortuosa* HARTMAN-SCHROEDER & PARKER, 1990, but in the latter the dorsal cirrus on the 2nd setiger is elongated, tapering. This is also true for *P. oerstedii* GRUBE, 1857 (in FAUVEL, 1939).

The longbladed setae in *P. tortuosa* have a bifid tip, while in *P. helenae* n.sp. they have a thin simple top.

In *P. corallicola* HARTMANN-SCHROEDER, 1974, the ventral cirrus on setiger 1 is shorter than the dorsal buccal cirrus (not so in *P. helenae* n.sp.) and the copulatory organs are unknown.

P. papillata YAMANISHI, 1976 has also bifid presetal lobes and three kinds of setae, but the dorsal cirrus on setiger 2 is elongated and the single pair of copulatory organs are on reduced parapodia.

This is also the case in *P. africana* DAY, 1963 where the second setiger has an elongated cirrus and the copulatory organs are of a different pattern.

Juveniles of *Pisone helenae* n.sp. and *P. papuensis* are difficult to distinguish at first sight.

P. papuensis has on the first setiger a rather stout ventral cirrus, especially at the base, while the same on *P. helenae* n.sp. is more slender. The dorsal cirrus on setiger 2 of *P. papuensis* is not very much enlarged in juveniles, but its shape is ovoid while the dorsal cirri on the rest of the body are bottle-shaped.

In *P. helenae* n.sp. the dorsal cirri on setiger 2 can be rather long, but then, as stated above, the dorsal cirri on

the rest of the body are of the same form and size, and they are never bottle-shaped.

The diamond-shaped prostomium of *P. papuensis* is not always conspicuous, in *P. helenae* n.sp. it is always well visible.

However, the best specific character is the form of the presetal lobe, which is round, big, and undivided in *P. papuensis* and divided in a rounded lobe and a conspicuous slender tip in the anterior segments of *P. helenae* n.sp..

ETYMOLOGY

We named the species *helenae* to please our daughter Heleen, on whose birthday the material was collected.

Pisone papuensis GOVAERE & DE WILDE, 1993 (fig. 4, 5c,d)

Remarks: The original description states that the prostomium is not conspicuous. This is so in the holotype, and generally the prostomium is certainly not very well lined off posteriorly, although some worms have a diamond-shaped prostomium, as is usual within the Pisionidae.

A series of male worms (KBINPY2024), developing copulatory organs, was found in material from Durangit N (-5 m) on 04-10-1985.

Figs. 4a to 4e show the different evolutive stadia. In fig. 4a, a process develops on the ventral side of the parapodium, that lost the falciger setae, and where the ventral cirrus is already broad and large. In fig. 4b, the tips of the process and of the ventral cirri are dividing and growing.

In figs. 4c and 4d, the divided process is further splitting and entwining and a spinuous papilla develops. In fig. 4e, the process is completed, with the double ventral cirrus and the spirally wound copulatory organ as described for the holotype (GOVAERE & DE WILDE, 1993).

The same material revealed a female of 85 setigerous segments; with ripe eggs and full receptacula seminis (fig. 4f).

A simple cirriform process, as in *P. helenae* n.sp. and *P. complexa*, is here accompanied by a big lap dorsally to the cirriform outgrowth and covering the process and the opening of the genital funnel (fig. 5c,d).

The genital segments are setigers 50, 53, 56, 59, 65 and 69. The ripe eggs fill the two or three previous segments, so that the worm is full of gonads (eggs and/or sperma) from setiger 48 to setiger 69. This is in contrast to the males, which have only one pair of copulatory organs, and sperma in three segments. It is not known whether the eggs of one female are fertilized by several males, or rather, as described for *P. remota* by STECHER, 1967 (p. 387-392), by one male worm crawling over the female till all her receptacula seminis are filled with sperma.

Pisone parva n.sp. (fig. 5e,f)

TYPE LOCALITY

Laing Island E, in permanent puddles by the low-water mark.

Material deposited in the collections of the KBIN, Brussels.

TYPE MATERIAL

Holotype (KBINPY2082): Male of 28 setigerous segments, 3.02 mm long and 0.15 mm wide without and 0.46 mm with parapodia at setiger 4; 0.11 mm wide without and 0.46 mm with parapodia at setiger 25. Buccal segment 0.15 mm wide, palps 0.37 mm long, dorsal cirri of buccal segment 0.07 mm long. Ventral cirri of first setiger 0.03 mm long. Urites 0.5 mm long. Copulatory organs on setigers 11, 16, 20 and 24; collected on 20-10-1985.

Paratype 1 (KBINPY2083): Male of 17 setigers with copulatory organs on setigers 11 and 16. Locus typicus; collected on 20-10-1985.

Paratype 2 (KBINPY2085): Female of 29 setigers, Laing Island W, subtidal, ripple marks; collected on 23-10-1985.

Paratype 3 (KBINPY2090): Male of 25 setigerous segments, with copulatory organs on setigers 12, 17, and 21; Laing W, subtidal; collected on 23-10-1985; prepared for SEM.

Paratype 4 (KBINPY2090b): Male of 23 setigerous segments, with copulatory organs on setigers 11- 16- 20, Laing W, subtidal; collected on 23-10-1985; prepared for SEM.

Additional material from Laing Island, Durangit Reef and Hansa Bay, deposited in KBIN under number IG.27026 (nrs. KBINPY2087 to KBINPY2112).

DESCRIPTION

Holotype: Male of 28 setigerous segments.

Prostomium diamond-shaped, buccal acicula stout (out of about 50 juveniles of between 7 and 12 setigers, three young specimens (KBINPY2110) showed a second pair of buccal acicula, not yet protruding, but well visible in the buccal segment, alongside of the first, protruding pair). Palps, dorsal and ventral cirri of buccal segment developed as in the other species of the genus, but relatively short.

Ventral cirrus of first setiger elongated but not as long, nor of the same form as the dorsal cirrus of the buccal segment; typically asymmetrical, lobed on one side, straight on the other side; not reaching the base of the palps.

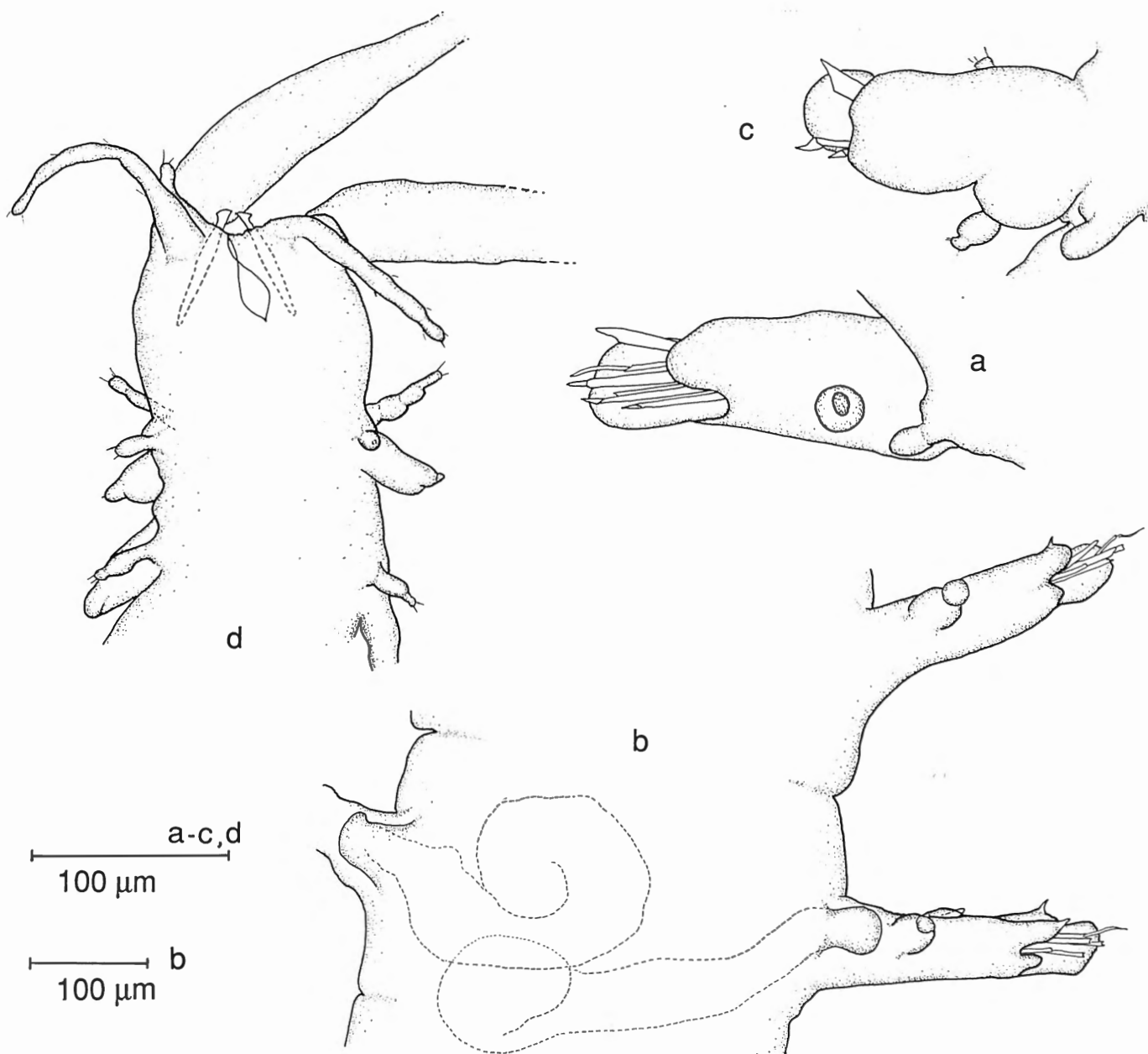


Fig. 3. – Female copulatory organs of *Pisione* species (a,b,c).

a. *P. helenae* n.sp. ventral view, setiger 23 (paratype 2).

b. *P. primitiva* n.sp. ventral view, setigers 34 (genital) and 35 (non genital), parapodia slightly squeezed (paratype 2).

c. *P. parhelenae* n.sp. postero-ventral view, setiger 30 (paratype 2).

d. Anterior segments of *P. parhelenae* n.sp.(holotype) with relatively short ventral cirri of setiger 1.

Dorsal cirrus of second setiger as on other segments, not longer.

In the anterior segments, the presetal lobe is divided in a rounded lobe and a pointed triangular one (fig. 5e). From setiger 13 on, the presetal lobe becomes gradually round and undivided and with the same kind of cartwheel glandular openings as in *P. papuensis* (visible only with SEM), from setiger 15 on.

Setae: *P. parva* n.sp. lacks the longbladed setae. There is only one simple seta and never more than one, with a serration between a subdistal notch and the top. There are three subacicular falcigers, with short stout blades, serrated and with a blunt top.

The body ends in a pygidium with two long urites, longer than the palps.

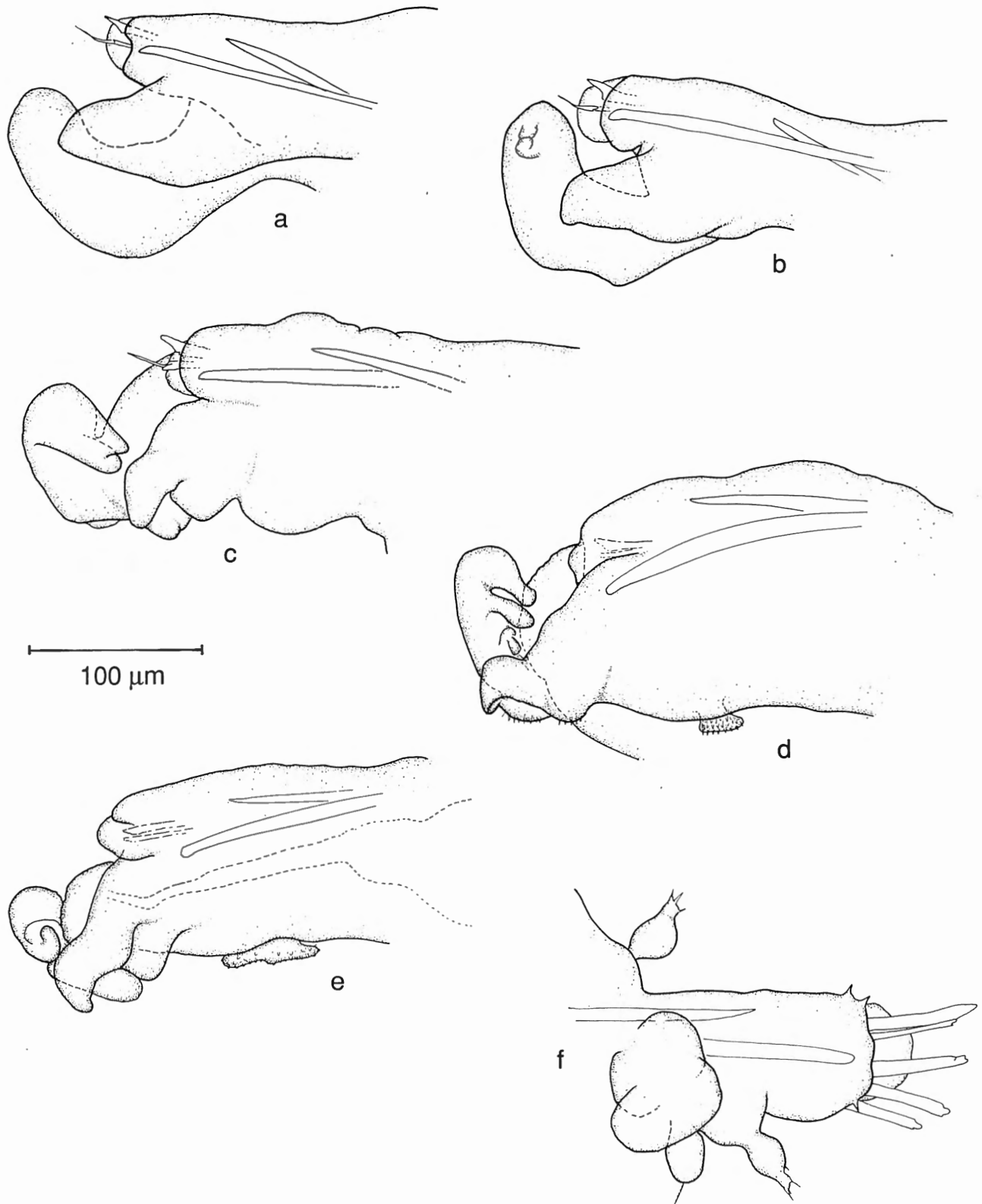


Fig. 4. – Developing stadia of the male copulatory organ of *Pisione papuensis* GOVAERE & DE WILDE, 1993 on 5 different specimens.

- a. enlarged ventral cirrus and growing copulatory organ (setiger 43 of a 53 setigerous *P. papuensis*).
- b. tip of copulatory organ and ventral cirrus dividing (setiger 34 of a 49 setigerous *P. papuensis*).
- c. further splitting and entwining of the ventral cirrus and the copulatory organ (setiger 26 of a posterior fragment of 53 setigers of *P. papuensis*).
- d. spinous papilla forming (setiger 42 of a 66 setigerous *P. papuensis*).
- e. fully developed apparatus on setiger 39 of a 60 setigerous *P. papuensis*.
- f. Female *P. papuensis*: parapodium with cirriform proces and covering lap at the base.

Copulatory organs: mature males have 3 to 5 pairs of copulatory organs, separated by 3 or 4 normal segments; the parapodia are totally suppressed. The ventral cirrus seems to be enlarged but nearly completely fused with the copulatory organ, so that the latter seems to have a bifid tip (fig. 5f). There are no setae.

Sperma in the male segments visible.

In the holotype, the male segments are setigers 11, 16, 20 and 24. Paratype 1 (KBINPY2083) has 17 setigers and male segments on setigers 11 and 16.

Paratype 2 is a female of 29 setigers. There are no cirriform processes or gonadal laps visible, the sperma is dispersed in several segments, as well as the ripe eggs, so that the body is filled with gonads from setiger 12 to setiger 26.

DISCUSSION

P. parva n.sp. is a very small pisionid, completely metamorphosed from 6 setigers on (cfr. BANSE, 1957: *P. remota* is sedentary at 9 setigers, but still without palps.) The specific characters of *P. parva* n.sp. are the relatively short ventral cirri of the first setiger and the not elongated dorsal cirri of the second setiger, this in combination with the simple seta and the three falcigers in all non-genital parapodia.

ETYMOLOGY

The name is derived from the Latin word *parvus*: little.

Pisione subulata YAMANISHI, 1992
(fig. 1c; 2b; 6a,)

MATERIAL

(KBINPY2047): Male of 46 setigerous segments, with copulatory organs on setigers 14, 15, 16, 17 and 18; Laing N at -15 m; collected on 20-09-1985;

(KBINPY2044): Asexual specimen of 54 setigers, Laing N at -15 m; collected on 20-09-1985; (KBINPY2046): Fragment, without anterior part, of 32 setigers, Laing W at -4 m; collected on 23-09-1985; (KBINPY2049): Male of 45 setigers with copulatory organs on setigers 14, 15, 16 and 17; Laing E, -20 m; collected on 13-10-1985; prepared for SEM.

(KBINPY2048): Asexual specimen of 28 setigers, Laing E at -20 m; collected on 13-10-1985;

(KBINPY2043): Fragment from Durangit NW -6 m; collected on 14-10-1985;

(KBINPY2045): Fragment from Durangit N -5 m; collected on 04-10-1985.

The specimens mentioned here are conform to the description given by YAMANISHI, 1992. The copulatory organs are also "fistlike" but we didn't observe the "ribbon". The ventral cirrus seems much larger than mentioned in the original description, the tip bending into the "fist" which has four groups of papillae and where the opening of the genital duct is located (fig. 2b). The parapodia have each a simple seta, an acicular, a very fine longbladed compound seta and two different falciger setae, one being smaller and with a serrated blade, the other twice as stout and without serrations on the short blade. The anterior segments have no acicular setae but three falcigers, two of the stouter type and a thinner one. The notoacacula are stout and protruding through the body wall (fig. 6a, 2b; 1c).

Pisione ungulata n.sp.
(figs. 1d; 2c; 6b,c)

TYPE LOCALITY

Laing Island, North side of Laing, -15 m; soft bottom, fine to very fine sediment.

Material deposited in the collections of the KBIN, Brussels.

TYPE MATERIAL

Holotype (KBINPY2036): Incomplete male of 39 setigerous segments, 8.17 mm long and 0.34 mm wide without and 0.57 mm with parapodia at setiger 1; 0.46 mm without and 0.93 mm with parapodia at setiger 7; 0.5 mm without and 1.17 mm with parapodia at setiger 39. Buccal segment 0.37 mm wide, palps 0.87 mm long, dorsal cirri of buccal segment 0.30 mm long.

Ventral cirrus of 1st setiger 0.26 mm and dorsal cirri of 2nd setiger 0.20 mm long.

Copulatory organs on setigers 29, 30, 31, 32, 33, 34, 35, 36, 37, 38 and 39; collected on 20-09-1985.

Paratype 1 (KBINPY2037): An 11 segments posterior fragment. Locus typicus; collected on 20-10-1985.

Paratype 2 (KBINPY2038): Incomplete asexual specimen of 16 setigerous segments from Durangit Reef N at -5 m; collected on 04-10-1985.

Paratype 3 (KBINPY2039): Incomplete asexual specimen of 67 setigerous segments, Laing N; collected on 20-09-1985 at -15 m. Prepared for SEM.

DESCRIPTION

Holotype: Incomplete male of 39 setigerous segments. Prostomium diamond-shaped and rather large, very stout buccal acicula.

Palps and buccal cirri long and tapering, ventral buccal cirri somewhat leaflike.

Ventral cirri of first setiger in form and length as dorsal cirri of buccal segment; dorsal cirri of second setiger elongated, longer than parapodium. Other cirri on all segments cylindrical to leaf-shaped.

The presetal lobe is divided, on all segments, in a slender fingerlike and a broad round lobe, here also with the cartwheel-like glandular openings (SEM) (figs. 6b,c).

Setae: *P. ungulata* n.sp. has a stout simple seta, a longbladed compound seta with a long slender serrated blade and a fine top, and three subacicular falcigers, with a notch under the articulation, serrated short blades and a falcate top in all setigerous segments. In setiger 45 of paratype 1, a 4th falciger can be seen embedded halfway in one parapodium. There are no acicular setae. The dorsal (notopodial) acicula protrude in all parapodia, save some 15 anterior ones. The posterior part of the body is not known (fig. 1d).

Copulatory organs: the holotype is a mature male with copulatory organs on the setigers 29 to 39 (since the body is broken off at setiger 39, it is not known how many copulatory organs are present). The parapodium is well developed, with setae and protruding notoacacula. The ventral cirrus is enlarged, with sensitive hairs on the inner side, and ends in a fine tip.

The copulatory organ is rather simple, cylindrical, with bifid tip (fig. 2c).

DISCUSSION

P. ungulata n.sp. shares with *P. subulata* YAMANISHI, 1992 the protruding notoacacula. The most relevant difference with *P. subulata* is the long dorsal cirrus on setiger 2. Further differences are the absence of acicular setae in *P. ungulata* n.sp. and the form of the copulatory organs.

ETYMOLOGY

Derived from the Latin word *ungulatus*: with claws.

Pisione primitiva n.sp.
(figs. 1e, 1f; 2d; 3b)

TYPE LOCALITY

Laing Island, North side of Laing, -15 m; soft bottom, fine to very fine sediment.

Material deposited in the collections of the KBIN, Brussels.

TYPE MATERIAL

Holotype (KBINPY2040): Incomplete male, broken off at setiger 25, 8.75 mm long and 0.27 mm wide without and 0.59 mm with parapodia at setiger 3; 0.28 mm without and 0.65 mm with parapodia at setiger 24; 0.46 mm wide without parapodia in setiger 22 which is filled with sperma. Buccal segment 0.24 mm wide, palps 0.79 mm long, dorsal buccal cirri 0.16 mm long. Ventral cirri of 1st setiger 0.16 mm long. Copulatory organ on setiger 23; collected on 20-09-1985.

Paratype 1 (KBINPY2042): Posterior fragment of 24 setigers with pygidium. Collected at the locus typicus on 20-09-1985. Prepared for SEM.

Paratype 2 (KBINPY2041): Incomplete female of 45 setigers and receptacula seminis in setigers 34, 36, 38 and 40; collected N of Durangit Reef at -5 m, on 04-10-1985.

DESCRIPTION

Holotype: Incomplete male of 25 setigerous segments. Prostomium diamond-shaped, palps and buccal cirri as in the other species of the genus. Stout buccal acicula, a second buccal aciculum alongside of the first, not protruding and on the right side only (holotype only).

Ventral cirri of the first setiger as long as the buccal dorsal cirri; all other cirri, including the dorsal ones of setiger 2, short, cylindrical to flask-shaped.

The presetal lobe is divided in the first 11 segments in two fingerlike tips, from setiger 12 on, the presetal lobe is round and undivided, but provided with very small cirriform processes (fig. 1e, 1f).

Setae: *P. primitiva* n.sp. has one simple, one longbladed compound seta and 3 falciger setae. In paratype 2 on setiger 6 and 7 two longbladed setae are found. There are no acicular setae, never more than one simple seta per parapodium. The simple setae have a serrated end and a falcate top, the longbladed setae a fine recurved serrated blade with simple top, and the falcigers have a notch under the articulation and serrated, short, broad blades and falcate top.

The notoacacula protrude from a swelling on the parapodia, reminding of a relict of the notopodium, from setiger 10 on in the holotype (setiger 8 in paratype 2); the notoacacula protrude to setiger 23 in paratype 1.

Copulatory organ: The parapodia of setiger 23 bear copulatory organs of a very simple form, a cylindrical outgrowth, with a group of small papillae near the tip; the ventral cirri are enlarged and of the same size as the copulatory organ. The parapodia are further no different from other parapodia. Sperma can be seen in three previous segments, where the body is swollen; setiger 22 is nearly twice as wide as setiger 3; setiger 24 is as wide as setiger 3. (0.46 mm in setiger 22, 0.35 mm in setiger 23, 0.28 mm in setiger 24 and 0.27 mm in setiger 3, all without parapodia) (fig. 2d).

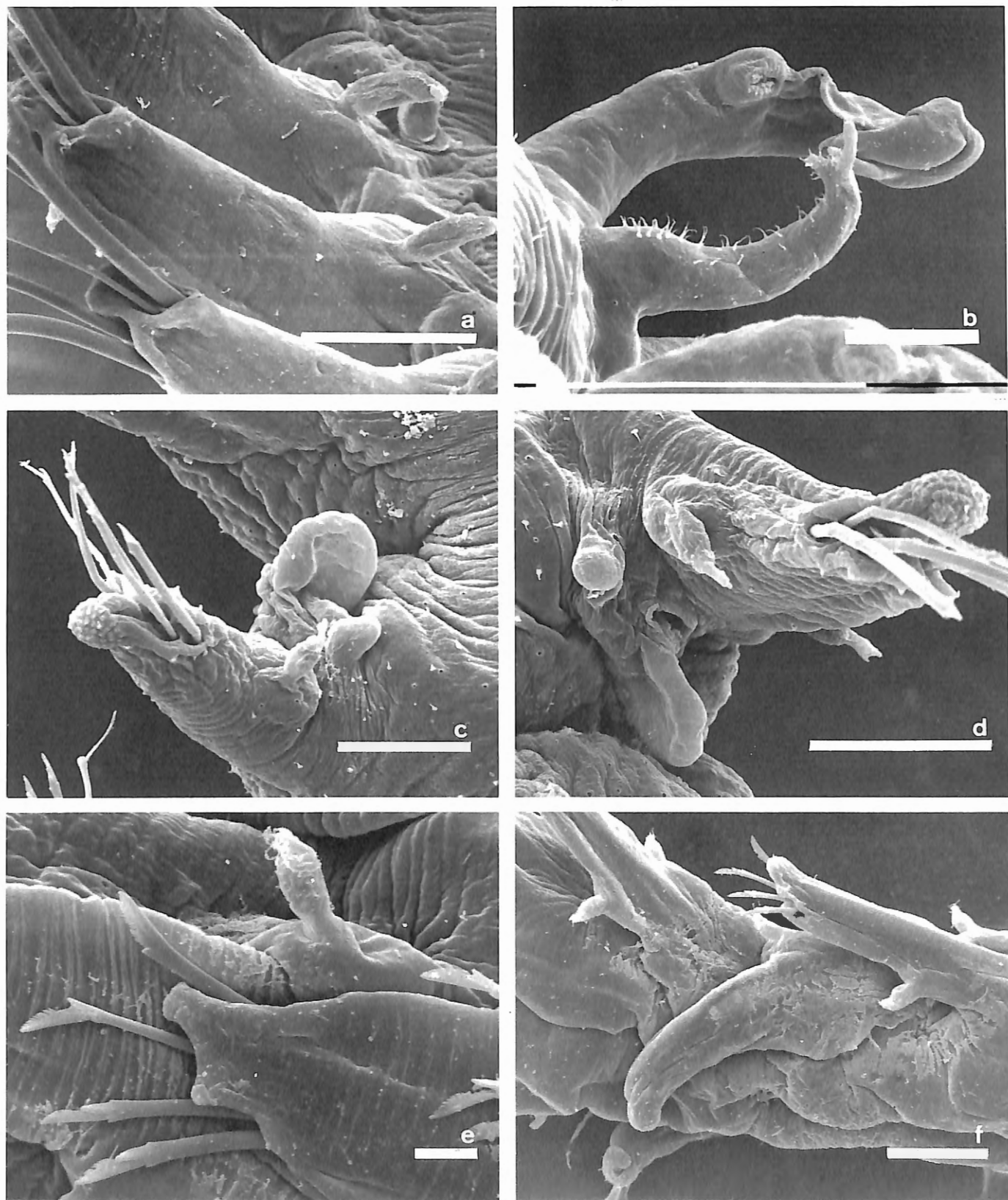


Fig .5. - SEM photographs of Pisionidae.

- a. *Pisione helenae* n.sp.: dorsal cirri and undivided presetal lobe in posterior part of body (paratype 3) (scale = 50 μ m).
 b. *P. helenae* n.sp.: detail of setiger 36 with male copulatory organ (paratype 3) (scale = 50 μ m)
 c. *P. papuensis* GOVAERE & DE WILDE, 1993: cirriform process and covering lap, genital opening on female setiger (scale = 50 μ m).
 d. *P. papuensis*: detail of female copulatory organ (scale = 50 μ m).
 e. *P. parva* n.sp. parapodium of setiger 4: divided presetal lobe and 1 simple and 3 falciger compound setae (scale = 10 μ m).
 f. *P. parva* n.sp. modified setiger 11, with male copulatory organ (scale = 50 μ m).

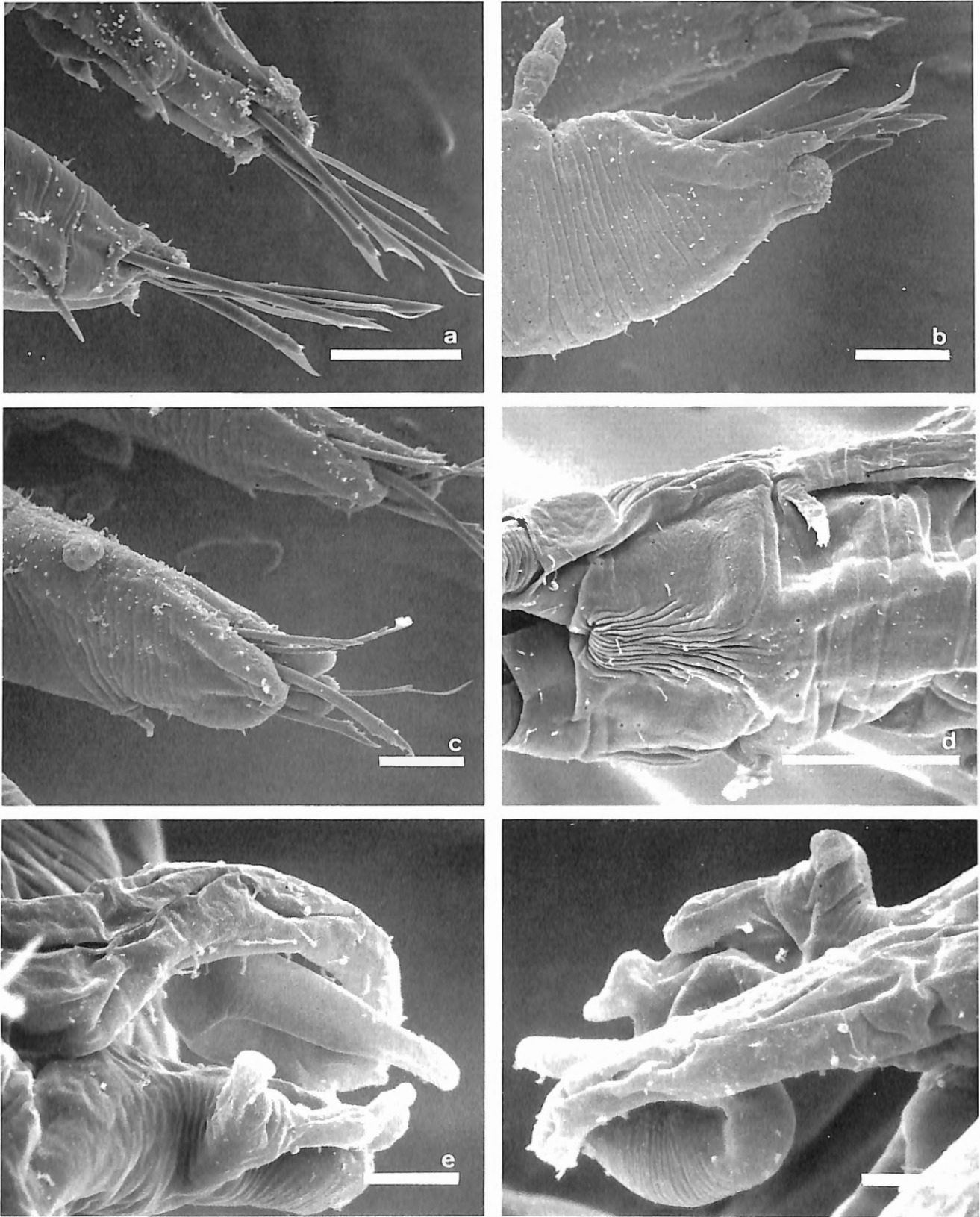


Fig. 6. – SEM photographs of Pisionidae.

- a. *P. subulata* YAMANISHI, 1992: top of parapodium of a posterior setiger, with 1 simple and 3 different compound setae and protruding notoaciculum (scale = 50 μm).
- b. *P. ungulata* n.sp.: anterior setiger without protruding notoacacula and detail of top of parapodium (scale = 50 μm).
- c. *P. ungulata* n.sp.: posterior setiger with protruding notoaciculum and detail of top of parapodium (scale = 50 μm).
- d. *P. brevicirra* n.sp.: ventral view on head and ventral cirri of setiger 1 (scale = 50 μm).
- e. *P. brevicirra* n.sp.: detail of setiger 17 with male copulatory organ, anterior view (scale = 10 μm).
- f. *P. brevicirra* n.sp.: detail of setiger 17 with male copulatory organ, ventral view (scale = 10 μm).

The female paratype 2 has no mature eggs, but has sperma in receptacula seminis of setigers 32, 34, 36, 38 and 40 and simple cirriform processes on the same segments (fig. 3b).

DISCUSSION

P. primitiva n.sp. belongs to the group with protruding notoacacula. It differs from *P. subulata* YAMANISHI, 1992 by the absence of acicular setae, and the form and number of copulatory organs. It differs from *P. ungulata* n.sp. by the length of the dorsal cirri of setiger 2, the undivided presetal lobe in segments posterior to setiger 11 and the form and number of copulatory organs. Moreover, the swellings with the protruding notoacacula are obvious.

ETYMOLOGY

The pseudonotopodia and the very simple copulatory organs suggest a primitive form, hence the name *Pisione primitiva* n.sp.

Pisione brevicirra n.sp.
(figs. 1g, 1h; 2e; 6d, e, f)

TYPE LOCALITY

Durangit Reef SE at -35 m.
Material deposited in the collections of KBIN, Brussels.

TYPE MATERIAL

Holotype (KBINPY2069): Male of 28 setigerous segments, 2.77 mm long and 0.06 mm wide without and 0.13 mm with parapodia at setiger 4; 0.05 mm wide without and 0.15 with parapodia at setiger 24.

Buccal segment 0.14 mm wide, palps 0.15 mm long, buccal dorsal cirri 0.03 mm, ventral cirri of 1st setiger 0.01 mm long. One urite 0.36 mm long, the second is broken off.

Copulatory organ on setiger 17; collected on 03-10-1985.

Paratype 1 (KBINPY2070): Male of 28 setigers, copulatory organ on setiger 16; collected at the locus typicus on 03-10-1985.

Paratype 2 (KBINPY2071): Male of 26 setigerous segments, copulatory organ on setiger 17; collected at the locus typicus on 03-10-1985.

Paratype 3 (KBINPY2072): Young male of 19 setigerous segments, developing copulatory organs on setiger 18; collected at Laing N, at -15 m, on 21-09-1985.

Paratype 4 (KBINPY2081): Immature specimen of 20 setigerous segments; collected at Laing N, at -15 m, on 21-09-1985.

Paratype 5 (KBINPY2068): Male of 22 setigerous segments, with copulatory organ on setiger 17, prepared for SEM; Laing Island W -15 m; collected on 26-09-1985.

Additional material from Laing Island and Durangit Reef deposited in KBIN under number IG.27026 (KBINPY2073 to KBINPY2080).

DESCRIPTION

Holotype: Male of 28 setigerous segments.

Prostomium diamond-shaped, well visible, stout buccal acicula. Palps long, dorsal buccal cirri relatively short. Ventral cirri of first setiger flask-shaped, not much enlarged. Ventral cirri in paratypes lobated, fingerlike (fig. 6d). Dorsal cirri of second setiger not otherwise than on other segments, short and flask-shaped.

Presetal lobes divided in first setiger in a fine lobe with a tip and a smaller lobe; in all other segments presetal lobes divided in two rounded lobes (figs. 1g, 1h).

Setae: Except in some anterior segments, *P. brevicirra* n.sp. has two simple setae, one with a subdistal notch, one acicular seta, and two stout falciger setae with short serrated, falcate blades. In most of the studied specimens, the setae are not protruding very far, and thus seem short. In some anterior parapodia there are three falcigers, but then there is only one simple, not acicular seta.

In the two juveniles, paratypes 3 and 4, the acicular setae are only present from setiger 9 and setiger 7 respectively, and in the holotype from setiger 5 on.

The body ends in a pygidium with two very slender urites, longer than the body with the palps, but easily breaking off.

Copulatory organs: The only pair of copulatory organs is situated on setiger 17.

The parapodia are not suppressed, having normal dorsal cirri, presetal lobes and setae. The ventral cirri are much enlarged. Between the ventral cirri and the body, the copulatory organs (figs. 2e; 6e, f) form a helix with, proximally from the fine top, a bifid cirrus and, distally, a broader cirriform appendix.

In paratype 3, the copulatory organs on setiger 18 are developing: the ventral cirrus is much enlarged and the axis of the copulatory organ is still developing and without appendices.

DISCUSSION

P. brevicirra n.sp. is the only pisionid with only 2 falciger setae per parapodium. The configuration of two simple setae and two falcigers is an easy specific character. The combination and shape of relatively short ventral cirri on setiger 1 (about 1/3 of the buccal cirrus) and short cirri on setiger 2 are as in *P. parva* n.sp., but the latter has never

two simple setae and, as in other pisionids, three falcigers per parapodium.

The copulatory organs are also specific.

ETYMOLOGY

From the Latin words *brevis* and *cirrus* for the short cirri on the first two setiger segments.

Pisone parhelenae n.sp.
(figs. 2f; 3c, 3d)

TYPE LOCALITY

Hansa Bay beach (mainland Hansa Bay, Madang Province, Papua New Guinea) MHW, strong surf.
Material deposited in the collections of the KBIN.

TYPE MATERIAL

Holotype (KBINPY2051): Male of 35 setigerous segments, 3.43 mm long and 0.10 mm wide without parapodia and 0.38 mm with parapodia at setiger 9. 0.15 mm wide without and 0.36 mm with parapodia at setiger 20. Buccal segment 0.12 mm wide, palps 0.27 mm long, dorsal buccal cirri 0.12 long; Ventral cirri of the 1st setiger 0.04 mm long. (dorsal cirri of setiger 2 0.02 mm long). Copulatory organ on setiger 17; collected on 10-09-1985.
Paratype 1 (KBINPY2060): Asexual of 28 setigers, permanent slide. Locus typicus, collected on 10-09-1985.
Paratype 2 (KBINPY2050): Incomplete female of 32 setigers; Durangit NW, -6 m; collected on 15-10-1985.
Paratype 3 (KBINPY2052): Male of 39 setigers with copulatory organs on setiger 17, prepared for SEM; locus typicus; collected on 10-09-1985.

Additional material from Hansa Bay beach and Durangit N, from beach to -6 m, in KBIN under number IG.27026 (KBINPY2053 to KBINPY2059).

DESCRIPTION

Holotype: Male of 36 setigerous segments.
Prostomium triangular, buccal acicula strong, with broad top, not reaching backwards to setiger 1. Palps broad, not very long, buccal cirri slender, about half as long as palps. Ventral cirri of 1st setiger lobed, in length one third of the dorsal buccal cirri (fig. 3d); dorsal cirri of 2nd setiger as on other parapodia, not elongated.

All dorsal cirri short, bottle-shaped, all ventral cirri from setiger 2 on, on a bulge of the parapodium and also bottle-shaped.

The presetal lobes are divided in a fine top with a fine thread and a round lobe to setiger 10, undivided, with

cartwheel glandular openings (SEM), from setiger 11 on in the holotype. In paratype 1 the presetal lobes are divided only in the first 6 setigers.

Setae: *P. parhelenae* n.sp. has 1 simple seta, with a subdistal notch and serration, a longbladed compound seta with a long serrated blade and 3 falcigers with broad short serrated blades, per parapodium.

The shafts of the simple setae are not as stout as in other species, being of the same size as those of the falcigers. The shaft of the longbladed seta is, as in all other species where it occurs, much thinner.

The body ends in a pygidium with urites.

Copulatory organ: *P. parhelenae* n.sp. has only one pair of copulatory organs; the parapodium is suppressed, forming only a cylindrical axis with a simple dorsal cirrus and wherein an aciculum is visible; no setae (fig. 2f). The copulatory organ seems to be fused with this axis, the whole resembling the structure found in *P. parva* n.sp. Sperma is visible in two previous segments. In the holotype the copulatory organs are on setiger 17, sperma in setigers 15 and 16.

The female paratype 2 has a gonadal lap on setiger 30, as in *P. papuensis*, but smaller (fig. 3c).

DISCUSSION

P. parhelenae n.sp. resembles closely *P. helenae* n.sp.. The differences lay mainly in the form of the dorsal cirri (bottle-shaped in *P. parhelenae* n.sp., ovoid in *P. helenae* n.sp.), the very short ventral cirri on setiger 1 and, most of all, the form of the copulatory organs which are on the non-suppressed parapodia and of a more complex form in *P. helenae* n.sp.

The copulatory organs of *P. parhelenae* n.sp. resemble most those of *P. parva* n.sp., but the latter has a series of copulatory organs instead of only one pair, and principally, *P. parva* n.sp. has no longbladed compound setae.

ETYMOLOGY

P. parhelenae from the Latin *par*: resembling *P. helenae* n.sp..

Key to the Pisionids of Papua New Guinea

1. - Notoaciculum protruding in posterior segments 2.
 - Notoaciculum embedded 4.
2. - Dorsal cirrus of 2nd setiger
 - elongated *P. ungulata* n.sp.
 - Dorsal cirrus of 2nd setiger not elongated 3.

3. - 1 simple seta and 3 falciger compound setae per parapodium throughout the body *P. primitiva* n.sp.
 - 1 simple seta, 1 acicular seta and 3 falciger compound setae in posterior segments *P. subulata*
4. - Dorsal cirrus 2nd setiger elongated, presetal lobe round, 3 kinds of setae per parapodium (1 simple, 1 longbladed compound, and 3 falcigers) *P. papuensis*
 - Dorsal cirrus 2nd setiger not longer than on following parapodia, presetal lobe divided, in anterior segments at least 5.
5. - 3 kinds of setae per parapodium (1 simple, 1 longbladed compound and 3 falcigers) 6.
 - 2 kinds of setae per parapodium (no longbladed compound) 7.
6. - Ventral cirrus of 1st setiger about as long as dorsal buccal cirri *P. helenae* n.sp.
 - Ventral cirrus of 1st setiger clearly shorter than dorsal buccal cirri *P. parhelenae* n.sp.
7. - 1 simple seta and 3 falciger setae per parapodium, presetal lobe undivided in posterior segments *P. parva* n.sp.
 - 2 simple and 2 falciger setae in posterior parapodia, all presetal lobes divided *P. brevicirra* n.sp.

Table I attempts to summarize the most important taxonomic characters of the members of the genus *Pisione*, as described in literature.

The main specific characters are the length of the ventral cirri on setiger 1 and the dorsal cirri on setiger 2, together with the setal configuration. A useful character is the presetal lobe: there can, however, be some confusion between "bifid tip of parapodium" and "bifid presetal lobe"; where this is not clearly described, we refer to the original drawings.

The determination of mature males can be no problem, since no two species have the same form of copulatory organs. Where they are somewhat similar in form, other characters (i.e. setae,...) make the differences clear. It is important to describe and, if possible, to make SEM photographs of mature males. The structures are so complicated that a description and a good drawing alone are not always sufficient to give a three-dimensional rendering.

The number of copulatory organs is mostly constant within a species.

For *Pisione oerstedii* GRUBE, 1857, there is some confusion, as descriptions may vary with the authors. HARTMAN, 1941 and CASTRO, 1958 give only the simple and falciger setae with short blades. FAUVEL, 1939 describes female worms from Indochina with 1 simple, 3 to 4 compound setae with short falciger blades and 3 very slender, longbladed compound "epitoke" (sic) setae (i.e. 7 to 8 setae per parapodium). The male worms have 1 simple, 1 to 2 compound longbladed and 3 to 4 shortbladed compound setae per parapodium and only 1 or 2 copulatory organs. In *P. oerstedii pulla* WESTHEIDE, 1974 (Galapagos), there are no buccal acicula present. It concerns a female specimen with 1 simple, 4 to 5 longbladed compound setae and 3 to 4 falciger setae with short blades, i.e. 8 to 10 setae per parapodium, where all other *Pisione* have at the most 5 to 6 setae per parapodium. We suggest that the 3 female worms of FAUVEL, 1939 and the specimen of WESTHEIDE, 1974 are no female *P. oerstedii*, but new species, with more longbladed setae than the presently known species.

AUGENER, 1923 mentions 2 to 4 "komplexe Sichelborsten" without further describing them and AUGENER, 1925 mentions "keines Unterschied von *P. oerstedii*".

To our regret, we couldn't consult the publication of GRUBE, 1857 with the original description, nor that of EHLERS, 1901 with a redescription of the species.

It is interesting to note that female copulatory organs somehow escaped attention in literature. Only FAUVEL, 1939 gives a description of a female "*P. oerstedii*", without drawings, however.

Remarks

The setae are not described nor drawn, as for all the species mentioned the form and structure are the same as in *Pisione papuensis* GOVAERE & DE WILDE, 1993; only the configuration differs per species, as noted in the descriptions.

The great number of Pisionidae-species in a restricted area seems odd. Normally, not more than two species were found in one sampling campaign, e.g. HARTMANN-SCHROEDER & PARKER, 1990: 2 species, 342 specimens in different stations; YAMANISHI, 1976: 2 species, 25 specimens on two beaches; WESTHEIDE, 1976: 2 species, about 30 specimens; YAMANISHI, 1992: 1 species, 8 specimens, 1 sampling station.

In this article 8 species are mentioned in a total of about 400 specimens out of 155 samples, 52 sampling stations. It must be said here that the samples of this study were chosen in function of the interstitial fauna. Most of them were taken in coarse to medium sandy sediments, intertidally or subtidally in places where a strong surf prevails, so that a lot of pisionids and other interstitial benthic animals could be expected and were indeed found.

Table 1.

	buccal acicula	protruding notoacicula	all dorsal and ventral cirri similar	dorsal cirri setiger 2 elongated	longbladed compound seta	presetal lobe divided	male copulatory organ		
<i>P. oerstedii</i> GRUBE, 1857	+	(a) -	-	+	+	(b) -	many successive (c)		
<i>P. remota</i> (SOUTHERN, 1914)	+	-	-	-	-	+	(?)	4-18 successive	
<i>P. gopalai</i> ALIKUNHI, 1941	+	-	-	-	+	-	-	1 (rarely 2)	
<i>P. complexa</i> ALIKUNHI, 1947	+	-	-	-	+	(d)	-	1-6; >6	
<i>P. puzae</i> SIEWING, 1953	+	-	-	-	-	-	-	2-4 successive	
<i>P. koepkei</i> SIEWING, 1954	-	-	-	-	+	-	-	2 successive	
<i>P. longipalpa</i> USHAKOV, 1956	+	-	-	-	-	-	(?)	(e)	?
<i>P. africana</i> DAY, 1963	+	-	-	+	+	+	+	many successive (8?)	
<i>P. alikunhii</i> TENERELLI, 1965	+	-	-	-	+	-	-	1	
<i>P. reducta</i> STORCH, 1967	+	-	+	-	-	-	?	?	
<i>P. laubieri</i>									
HARTMANN-SCHROEDER, 1970	+	-	-	-	+	-	-	1-3	
<i>P. galapagoensis</i> WESTHEIDE, 1974	+	-	-	-	+	-	-	3-6	
<i>P. corallicola</i>									
HARTMANN-SCHROEDER, 1974	+	-	-	-	+	+	+	?	
<i>P. martinsi</i>									
HARTMANN-SCHROEDER, 1974	+	-	-	-	-	-	-	2 (also 1)	
<i>P. papillata</i> YAMANISHI, 1976	+	-	-	+	+	+	+	1	
<i>P. crassa</i> YAMANISHI, 1976	+	-	-	+	-	-	-	many successive	
<i>sp. A</i> WOLF, 1984	+	-	-	-	+	-	-	2	
<i>P. tortuosa</i> HARTMANN-									
SCHROEDER & PARKER, 1990	+	-	-	+	+	+	+	?	
<i>P. subulata</i> YAMANISHI, 1992	+	+	-	-	+	-	-	3-5 successive	
<i>P. papuensis</i>									
GOVAERE & DE WILDE, 1993	+	-	-	+	+	-	-	1	
<i>P. parva</i> n.sp.	+	-	-	-	-	+	+	3-5 not successive	
<i>P. brevicirra</i> n.sp.	+	-	-	-	-	+	+	1	
<i>P. ungulata</i> n.sp.	+	+	-	+	+	+	+	11(or >?) successive	
<i>P. primitiva</i> n.sp.	+	+	-	-	+	+	+	1	
<i>P. parhelenae</i> n.sp.	+	-	-	-	+	+	+	1	
<i>P. helenae</i> n.sp.	+	-	-	-	+	+	+	1 or 3-4 successive	

(a) not in *P. oerstedii pulla* WESTHEIDE, 1974(b) not in *P. oerstedii* of HARTMAN, 1941 nor of CASTRO, 1958(c) 1 or 2 in *P. oerstedii* of FAUVEL, 1939(d) "as in *P. gopalai*" ALKUNHI, 1947

(e) from figures, not mentioned in text (USHAKOV, 1956).

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