

# *Interkletodes interita* n.gen., n.sp. and *Orthopsyllus coralliophilus* n.sp., two new copepods from the northern coast of Papua New Guinea (Copepoda, Harpacticoida)\*

by Frank FIERS

## Abstract

In the present paper two new harpacticoid copepods, including a new genus, are described. Both species: *Interkletodes interita* n.gen., n.sp. and *Orthopsyllus coralliophilus* n.sp. were found in the cavity formed and inhabited by a gastropod, *Leptoconchus* sp., living in a massive coral of the genus *Favia*.

Key-words: Copepods, new species, *Leptoconchus*, Papua New Guinea.

## Résumé

Dans cet article, deux nouvelles espèces, dont une représentant un nouveau genre, sont décrites. Ces deux espèces, *Interkletodes interita* n.gen., n.sp. et *Orthopsyllus coralliophilus* n.sp. ont été trouvées dans la cavité creusée et occupée par un gastéropode, *Leptoconchus* sp., vivant dans un corail massif du genre *Favia*.

Mots-clés: Copépodes, nouvelles espèces, *Leptoconchus*, Papouasie Nouvelle Guinée.

## Introduction

During an intensive survey on parasitic gastropods of the family Coralliophilidae HOYLE, 1888, along the northern coast of Papua New Guinea, Dr. Cl. MASSIN (Brussels) collected some interesting copepods occurring in the burrow of a *Leptoconchus*, living in a large massive coral. In the present paper two new species found in this peculiar habitat are described.

Species of the gastropod genus *Leptoconchus* live in hard corals where they form, strictly speaking, a vertical irregular gallery. The gastropod occurs almost directly under the upper surface of the coral and stays in contact with the environment through a small opening. In the case of massive corals, the gastropod is moving to a small distance from the surface, following in this way the growth of the coral. As a result of this behaviour a tubular canal is developed which can be filled up with sand.

Sand filled *Leptoconchus*-tubes are rather rare and it is surprising to find copepods living in this difficultly

accessible environment. Since this report is the first dealing with copepods living in such a peculiar habitat, other records are needed before this observation can be generalised and these animals can be considered as real associates of *Leptoconchus*.

## Material and methods

The host-coral was dived up from Duangit Reef, situated north of Laing Island, Hansa Bay (Madang Province, Papua New Guinea) by Dr. Cl. MASSIN on 18 november 1983. The coral, *Favia* cf. *F. rotumana* (GARDINER, 1899) (fam. Faviidae) was found in 5 m deep water and had a 9.5 cm deep and 2.5 cm wide canal partially filled up with sand and containing a living *Leptoconchus* (Gastropoda, Coralliphilidae). The gastropod and the sand were fixed in 4% buffered formalin. After picking out, the copepods were stored in a 75% alcohol solution. Besides the two species described below, one female of *Stenocopia longiseta* BOZIC, 1964 and four females of *Euryte* spec. were found and stored in the collections under number COP 1979 and COP 1980, respectively. The animals are preserved and deposited in the collections of the "Koninklijk Belgisch Instituut voor Natuurwetenschappen" at Brussels, I.G. nr. 26.700.

## *Orthopsyllus coralliophilus* n.sp.

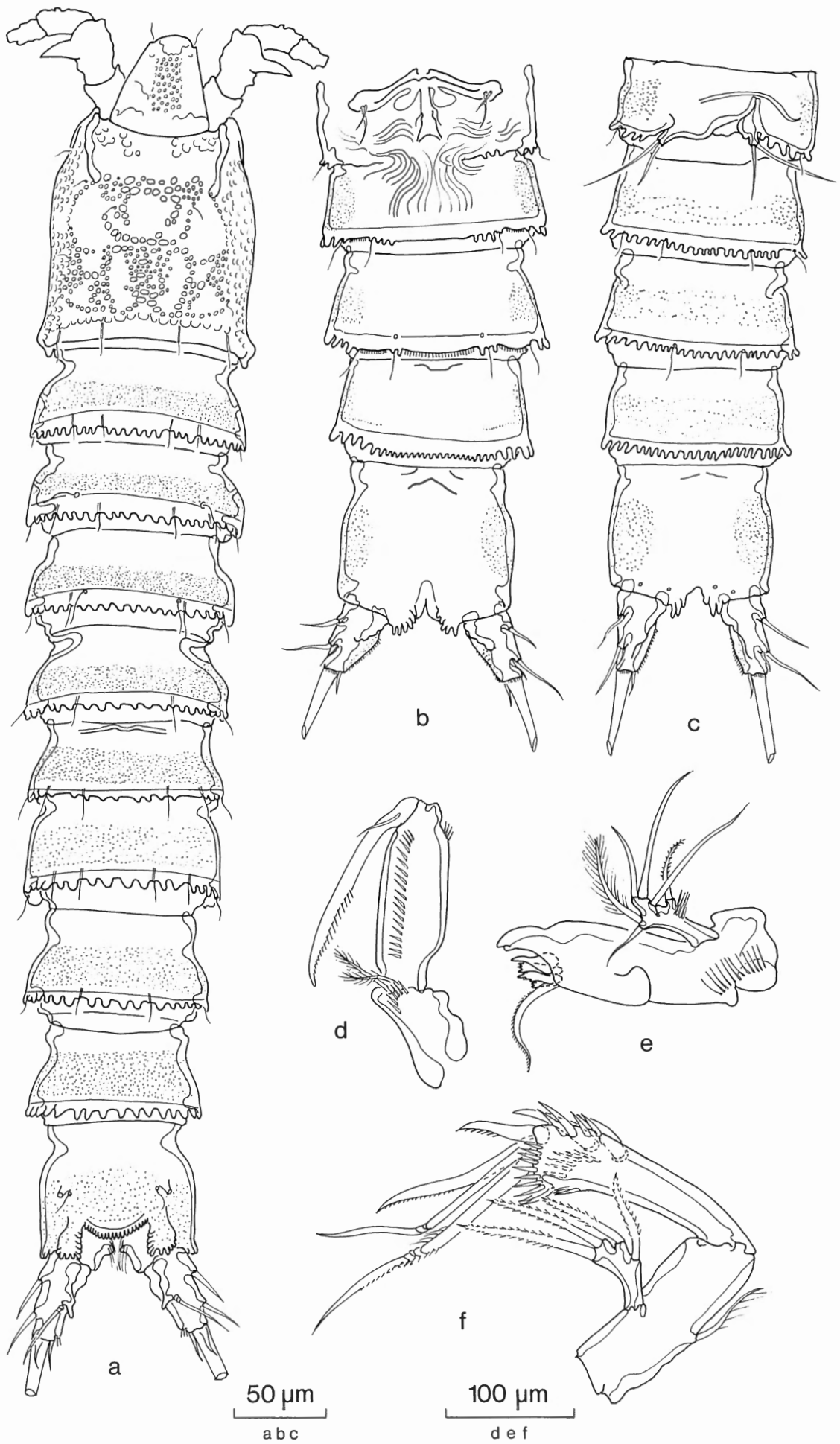
### Type-material:

The holotype is a dissected female, mounted on one slide and labeled COP 1959, the allotype is a dissected male, labeled COP 1960. The remaining specimens (paratypes), i.e. 5 females, 1 male and 1 copepodid C IV, are preserved in alcohol under number COP 1961.

### Etymology:

The specific name is a conjunction of the Greek words *korallion* (= coral) and *philos* (= friend) and refers to the peculiar habitat in which this species was found.

\* Leopold III Biological Station, Laing Island, Contribution Nr. 138.



*Figures:*

Holotype: Fig. 1a, b, d, e, f; 2a, b, d, e, f; 3a;  
allotype: Fig. 1c; 2c, g; 3b, c.

## DESCRIPTION

Female (holotype): body (Fig. 1a, b) typical fusiform; length 715  $\mu\text{m}$ ; cephalothorax with parallel lateral margins, slightly concave in the posterior half and tapering towards the anterior edge in the anterior third; thoracic and abdominal segments clearly constricted in the anterior half; posterior width almost identical in each somite; genital segments fused with a distinct medio-dorsal transversal hyaline band comparable with the posterior margins of the other segments; anal segment with parallel lateral margins; anal area deep; furcal rami tapering towards the posterior edge and about twice as long as wide; dorsal surface of each ramus with a blunt thorn in front of the implantation of the dorsal seta; one lateral seta implanted in the proximal third and one implanted in the distal third; outer apical seta short and fused with the principal one; inner apical seta as long as the outer one.

Rostrum articulating with the cephalothorax; lateral margins almost straight; rostral tip slightly prominent and rounded without a bifid tip.

Integumental structures: rostrum and cephalothorax with a pitted integument; pitted on the cephalothorax arranged into a typical pattern; posterior margin of the cephalothorax smooth; thoracic and abdominal somites furnished with an irregular pattern of minute spinules; posterior margins of the thoracic and abdominal segments incised forming irregular lip-shaped processes; ventral surface of the genital segment covered with a pattern of curved lines; surface of the abdominal segments smooth except for a small lateral area; anal segment with strong and blunt spinules along the margin, limiting the anal area; anal operculum concave and set with the same strong blunt spinules; postero-ventral margin having three strong spinules; surface of the anal segment covered with somewhat coarser spinules; integument of the furcal rami smooth except for a small row of minute teeth along the distal inner margin and near the implantation of the principal seta.

Antennule (Fig. 2a): four-segmented; first segment with a comb of long spinules along the anterior margin and with two blunt thorns on the dorsal surface; second segment with a strong, curved posterior hook; third and fourth segments without special processes; first segment bearing one seta, second segment having nine setae and third segment with the aesthetasc and nine setae of which the apicalmost articulating on a

basal part; ultimate segment with nine setae (some articulating and one armed) and three fused apical ones.

Antenna (Fig. 1f) with allobasis having a seta, along the outer margin; exopodite oblong, somewhat curved, bearing four armed setae; endopodal segment with spinules subdistally and distally implanted around the most apical part of the segment; two sub-distal spines; two apical ones and two apical and geniculating setae.

Mandible (Fig. 1e): arthrite with five teeth and one sensorial seta; palp with two setae representing the basis; one seta representing the exopodite and three setae representing the endopodite.

Maxillule and maxille as figured by LANG (1965, p. 427).

Maxilliped (Fig. 1d): basis with a curved row of teeth and two setae; first endopodal segment with a longitudinal row of teeth; endopodal claw longer than the supporting segment and armed in the distal half.

Table 1

*Chaetotaxy of Orthopsyllus coralliophilus n.sp.*

	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>
exo	0-0-022	0-0-022	0-0-022
end	0-110	0-121	0-021

P<sub>1</sub> (Fig. 2b): coxa sub-square having strong spinules on the outer distal edge; basis with curved margins and hairy along the inner margin; exopodite three-segmented; first exopodal segment with a smooth outer spine; second segment without spine or setae; third segment with two long setae and two geniculating spines; first endopodal segment as long as the interne exopodite; second endopodal segment with spinules on the inner margin, one long seta and one armed spine.

P<sub>2</sub>-P<sub>4</sub> (Fig. 2D, e, f): coxae well developed, overlapping the implantation of the seta on the basis; inner margin of the coxae indistinctly separated from the intercoxal plates; basis rather small having a row of strong spinules between both rami and near the articulation of the endopodite; exopodites three-segmented and endopodites two-segmented, setal formula: see table 1; second endopodal segments in leg 3 and 4 with a very small smooth seta near the implantation of the apicalmost seta.

P<sub>5</sub> (Fig. 3a): typical for the genus; baseoendopodite with five setae, all smooth, and exopodite with six setae; lateral setae of the exopodite very strong and

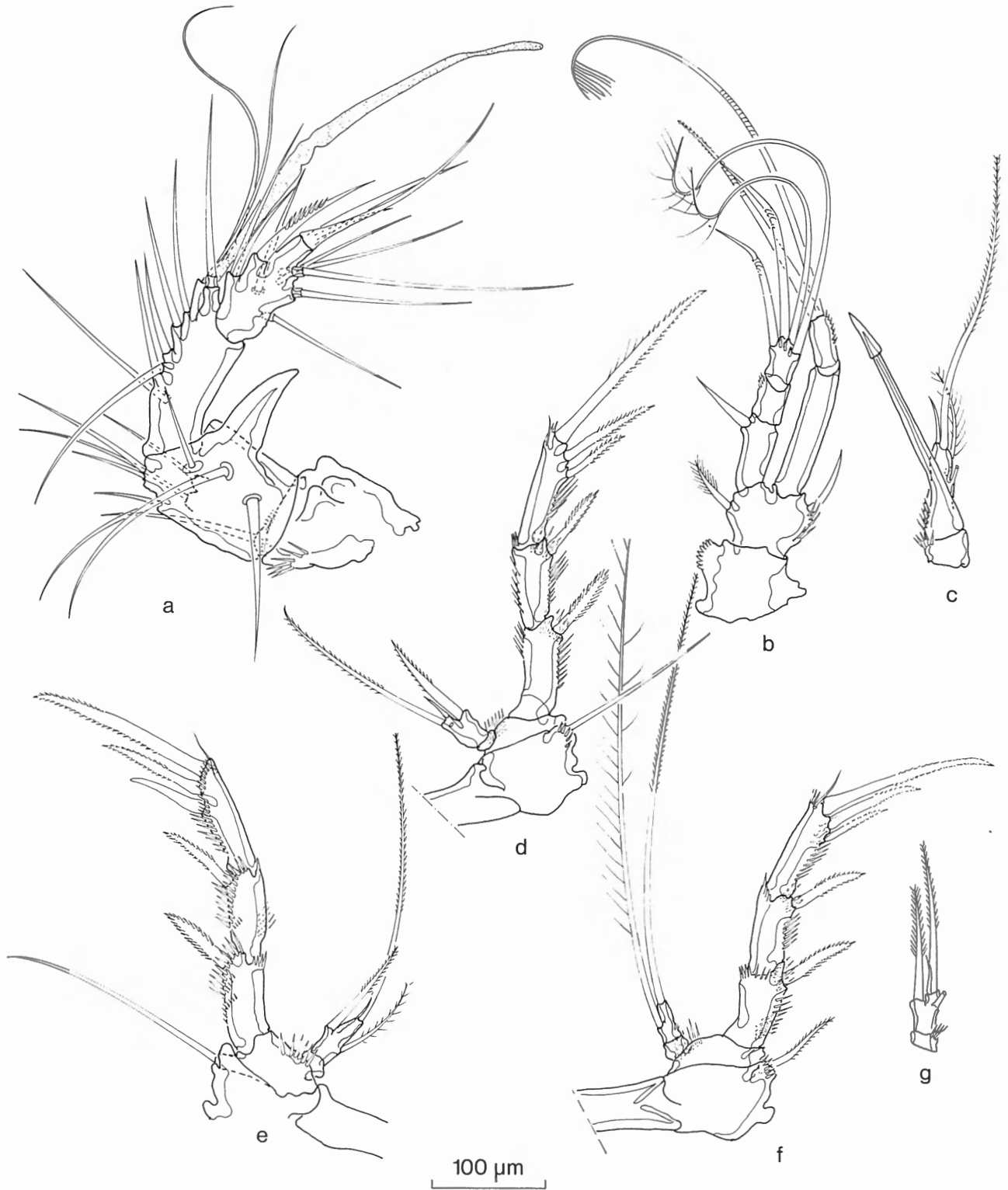


Fig. 2. *Orthopsyllus coralliophilus* n.sp.: a, antennule of the female; b, P<sub>1</sub>; c, endopodite P<sub>3</sub> of the male; d, P<sub>3</sub>; e, P<sub>4</sub>; f, P<sub>2</sub>; g, endopodite P<sub>4</sub> of the male.

the subapical inner and outer one small; apicalmost exopodal seta smooth; baseoendopodal inner and outer margin and exopodal outer margin provided with hairs; surface of both rami smooth. Male: habitus and length as in the female except for the free genital segments; integumental structures as in the female but with a spinulose integument on the ventral surface of the abdominal segments.

Antennule (Fig. 3b) six-segmented; first and second segment as in the female but with a smaller hook; fourth segment with rows of minute spinules; sixth segment prolonged and curved. P<sub>3</sub> (Fig. 2c): endopodite two-segmented; second segment prolonged into a typical apophysis and having two apical and one sub-apical seta; a fragile pore near the implantation of the apophysis.

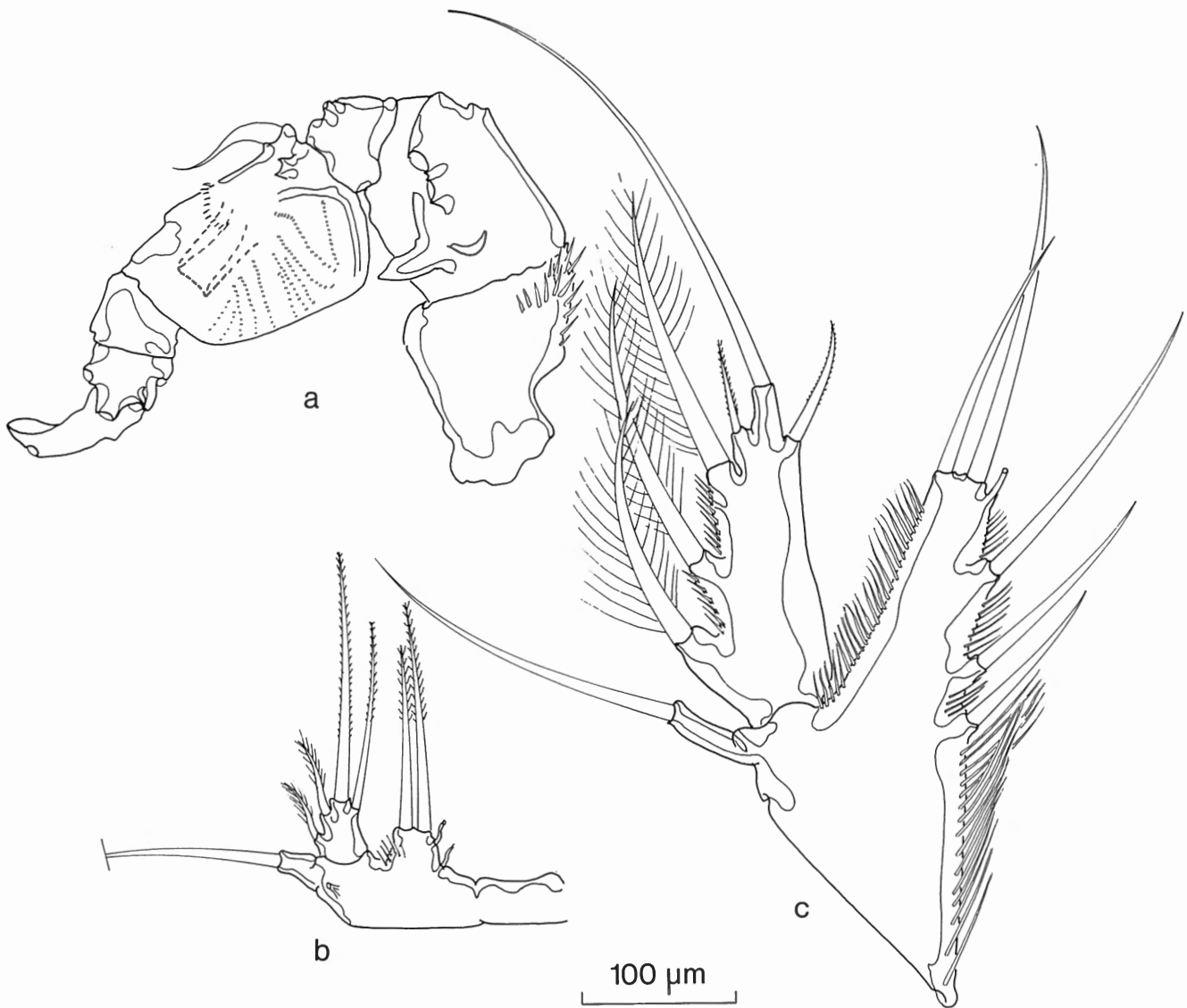


Fig. 3. *Orthopsyllus coralliophilus* n.sp.: a, antennule of the male; b,  $P_5$  of the male; c,  $P_5$  of the female.

$P_4$  (Fig. 2g): endopodite with two apical and one sub-apical seta, all of them much shorter than in the female; second segment with a fragile pore on the inner margin.

$P_5$  (Fig. 3c) baseoendopodites fused and distinctly separated from the supporting segment; baseoendopodal process with two pores and two setae; exopodite sub-square and bearing four setae set with small spinules.

$P_6$  (Fig. 1c) situated closely together in the middle of the ventral side of the segment; each with two smooth setae implanted on a distinct socle.

#### Variability:

No variability was observed within the paratypes except for a slightly longer first endopodal segment in the  $P_1$  which in some specimens is reaching beyond the exopodite.

#### DISCUSSION

Actually, two species of the genus *Orthopsyllus* are known, having two outer spines on the ultimate segments of  $P_2$ - $P_4$ : *O. wallini* LANG, 1934 from Tasmania and *O. littoralis* NICHOLLS, 1943 from Rottneest Island, Australia. The here described species, *O. coralliophilus* n.sp. is undoubtedly closely related to both species, *O. coralliophilus* n.sp., however, is easily distinguishable from both congeners through the chaetotaxy of the legs and the proportional lengths of the  $P_1$ . As mentioned in the description, the second exopodal segment lacks an outer spine. This peculiar feature is unique within the whole genus *Orthopsyllus* and very rare among all other known harpacticoids. Besides the exopodal characteristics, the endopodite of  $P_1$ , reaching to the tip of the exopodite and sometimes even beyond it, clearly discriminates *O. corallio-*

*philus* from both other species. This feature is also known in *O. sarsi* KLIE, 1941 which belongs to the major-group (BOER, 1975). This species however is not directly related to *O. littoralis* and congeners.

Furthermore, *O. coralliophilus* n.sp. differs from *O. wallini* and *O. littoralis* in the chaetotaxy of the endopodites of P<sub>2</sub>-P<sub>4</sub>. The latter have three setae on the endopodite of the P<sub>2</sub> while *O. coralliophilus* bears only two setae on this ramus. The endopodite of the P<sub>3</sub> of *O. coralliophilus* n.sp. bears one apical setae more than in *O. wallini* and two more than in *O. littoralis*. Finally, the endopodite of the P<sub>4</sub> of *O. coralliophilus* n.sp. differs significantly in proportional lengths from those of *O. wallini* and in the chaetotaxy from *O. littoralis*.

Besides these obvious discriminating features, *O. coralliophilus* n.sp. shows remarkable setae on the P<sub>5</sub>. The three lateral setae implanted on the exopodite, are distinctly stronger than the other exopodal setae. No actually known *Orthopsyllus*-species has such strong setae. In *O. coralliophilus* n.sp. all baseoendopodal setae on the P<sub>5</sub> are smooth. As far as can be judged from the drawings of other species of the genus, only *O. similis* NICHOLLS, 1943 has entirely smooth baseoendopodal setae.

In his evaluation of the genus *Orthopsyllus*, BOER (1975) questioned the status of *O. littoralis* and supposed that this species was conspecific with *O. wallini*. As pointed out by NICHOLLS (1943) in the original description, *O. littoralis* differs from *O. wallini* in the chaetotaxy of the P<sub>1</sub>-P<sub>4</sub> and in the shape of the P<sub>5</sub>. NICHOLLS' figures illustrate that the proportional lengths of the endopodal segments of P<sub>2</sub>-P<sub>4</sub> are distinctly different from those of *O. wallini*. The detailed analysis of the characteristics of *O. coralliophilus* n.sp. and the comparison with other species indicate that *O. littoralis* has to be considered as a distinct species which can unequivocally be differentiated from *O. wallini*.

#### **Interkletodes** n.gen.

##### *Diagnosis:*

A genus of the family Cletodidae SARS sensu POR; body fusiform: posterior margins of the thoracic and abdominal segments with socles bearing the posterior sensillae; furcal rami cylindrical and about four times as long as wide; antennule four-segmented and bearing strongly armed setae; P<sub>1</sub> with a three-segmented exopodite and a two-segmented endopodite; second exopodal segment without an inner seta; exopodites of P<sub>2</sub>-P<sub>4</sub> three-segmented and endopodites absent; basis of P<sub>2</sub>-P<sub>4</sub> transversally prolonged; third exopodal segments of P<sub>2</sub>-P<sub>4</sub> with two outer and two apical

spines; P<sub>5</sub> with a less prominent endopodal process, bearing three setae and a oblong exopodite with five setae.

Sexual dimorphism: genital segments free; antennule of the male sub-chirocer; mouthparts and legs as in the female; P<sub>5</sub> with a oblong exopodite having two apical setae and a tubular pore on the outer margin; baseoendopodite represented as a small sclerified strip bearing no setae; right P<sub>6</sub> represented as an ovate plate, without setae.

##### *Type-species:*

*Interkletodes interita* n.sp., here designated.

##### *Etymology:*

The generic name is a conjunction of the prefix *inter* (Latin, meaning between) and *Cletodes*, referring to the intermediate systematical position. Gender: feminine.

#### **Interkletodes interita** n.sp.

##### *Type-material:*

The holotype is a dissected female mounted on one slide and labeled COP 1981. The allotype is preserved in alcohol, nr. COP 1982. Paratypes: 3 females, 1 male, 1 CII, 2 CIII, 4 CIV and 1 CV, are preserved in alcohol and stored under number COP 1983.

##### *Etymologie:*

The specific name *interita* (Latin, meaning lost) refers to the absence of the endopodites of P<sub>2</sub>-P<sub>4</sub> and to the absence of sexual dimorphism in those legs.

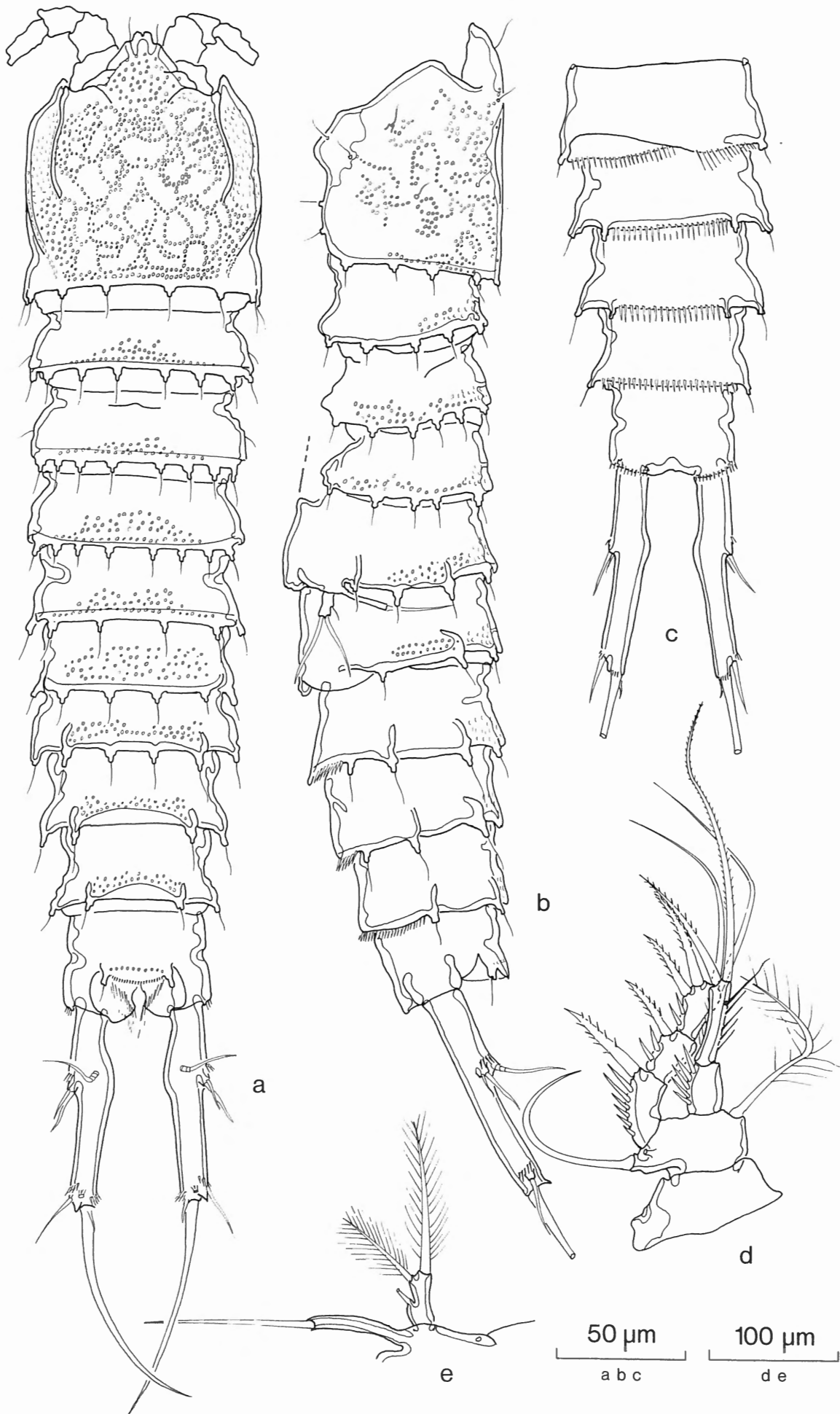
##### *Figures:*

Holotypes: Fig. 4a, d; 5a, b, c, d, e, f; Allotype: Fig. 4b, c, e; 2e.

#### DESCRIPTION

Female (holotype): habitus: (Fig. 4a) length, including rostrum and furcal rami, 450 μm; body cylindrical in dorsal view; largest width at the height of the posterior margin of the caphalothorax; all pleurotergites of the thoracic and abdominal segments clearly constricted in the anterior part; diameter of the abdomen slightly decreasing in posterior direction; posterior margin of the genital segments and the following abdominal segments somewhat elevated forming a strong posterior ridge; anal segment longer than the preceding one and constricted in the middle. Integumental structures: caphalothorax pitted but with a symmetrical pattern of smooth areas; density of pits decreasing towards the lateral sides; thoracic

Fig. 4. *Interkletodes interita* n.gen., n.sp.: a, habitus of the female; b, habitus of the male in lateral view; c, abdomen of the male in ventral view; d, P<sub>1</sub>; e, P<sub>5</sub> of the male. ▷





and abdominal sclerites with a small irregular pattern of pits situated at the height of the postero-median margin; major part of the integument smooth.

Integumental organs: sensillae on the posterior margin of all the somites implanted on a strongly developed conical socle.

Furcal rami long and almost cylindrical; inner margin somewhat convex in the anterior third; three lateral setae and the dorsal seta implanted in the anterior half; apical outer seta sub-apically implanted; inner apical one small and somewhat dorsally implanted; principal furcal seta as long as the supporting ramus and smooth; integument smooth.

Rostrum fused with the cephalothorax; lateral margins tapering strongly in anterior direction; rostral tip slightly prominent and bifid; integument pitted.

Antennule (Fig. 5f) four-segmented; first segment with a transversal row of strong spinules; several setae on the second, third and fourth segment strongly armed, having a spiniform appearance; aesthetasc implanted on the third segment and accompanied with two setae.

Antenna, maxillule and maxilla as in *Cletodes hartmannae* LANG, 1965.

Mandible (Fig. 5d); gnathobasis with two lateral setae and five teeth; coxa-basis with one apical seta and a median one; endopodite represented as three setae and exopodite as one seta.

Maxilliped (Fig. 5b): coxa twice as long as wide, bearing one slender seta; basis almost cylindrical and furnished with long spinules along the entire inner margin; endopodal claw armed along the apical third.

P<sub>1</sub> (Fig. 4d): coxa and basis devoid of integumental structures; inner seta of the basis feathered and reaching beyond the rami; exopodite three-segmented having strong spinules and spines on the outer margins of each segment; ultimate exopodal segment with two spines and two setae; endopodite two-segmented reaching towards the apical margin of the exopodite; first endopodal segment set with spinules along the outer margin; second segment almost twice as long as the first one, set with slender setules along the margins and bearing a sub-apical seta, an apical seta and an apical spine. P<sub>2</sub>-P<sub>4</sub> (Fig. 5a = P<sub>2</sub>): coxae furnished with rows of spinules: two parallel ones near the outer margin and a transversal one near the inner margin; basis with spinules near the implantation of the outer seta and along the inner margin; exopodite three-segmented; outer margin of the exopodal segments spinulose and inner margin of the first and second segment hairy; inner margin of the third segment smooth; endopodites in P<sub>2</sub>-P<sub>4</sub> absent; setal formula of all the legs: 0 - 0 - 022.

P<sub>5</sub> (Fig. 5c): baseoendopodite slightly prominent bearing three setae; surface of the baseoendopodite smooth; margins set with long setules; outer baseoendopodal seta implanted on a long cylindrical structure (probably) articulating with the supporting segment; oblong exopodite having a smooth surface,

setulose margins and bearing two outer setae, two apical ones and an inner seta.

Male: habitus (Fig. 4b and c) as in the female except for the free genital segments; integumental structures on the dorsal and lateral sides of the somites as in the female; ventral surface of the abdominal segments smooth; posterior margins of the abdominal segments furnished with long strong setules.

Antennule (Fig. 5e) seven-segmented and sub-chirocer; first and second segment as in the female; fourth segment distinctly larger than the other segments and bearing the aesthetasc; ultimate segment prolonged into a blunt innerwards directed structure.

Mouthparts and legs as in the female.

P<sub>5</sub> (Fig. 4e): baseoendopodite fused with the supporting segment bearing no inner seta; outer baseoendopodal seta implanted on a cylindrical structure which seems to be entirely fused with the ramus; exopodite small bearing two apical setae and a pore-like structure along the outer margin.

P<sub>6</sub> (Fig. 4c): asymmetrical, bearing no setae; left P<sub>6</sub> entirely fused with the somite, right P<sub>6</sub> forming a triangular plate set with strong setules along the posterior margin.

#### Variability:

Length ranging from 450 to 490 µm in the female as well as in the male. Variability was also observed in the shape of the outer exopodal structure of the male P<sub>5</sub>. As seen in the description of the allotype, this structure resembles most to a small tubular pore. In an other male, however, this structure is replaced by a small smooth seta of only a few µm longer than the tubular structure.

#### DISCUSSION

*Interkletodes* n.gen. belongs undoubtedly to the family Cletodidae as redefined by POR (1986) in his recent evaluation of the Cletodidae sensu SARS, LANG. Within this family, *Interkletodes* n.gen. is most related to the genera *Cletodes* BRADY, 1872 and *Monocletodes* LANG, 1936. *Interkletodes* n.gen. has many characteristics in common with both genera in the body-shape, antennule, mouthparts and legs, but shows a remarkable reduction in the endopodites of the legs. All known species of the genus *Cletodes* still have fully developed legs (three-segmented exopodites and two-segmented endopodites) while the genus *Monocletodes* has entirely reduced endopodites. *Interkletodes* n.gen. is intermediate between both genera by the presence of a two-segmented endopodite in the P<sub>1</sub> and the total reduction of the endopodites of the P<sub>2</sub>-P<sub>4</sub>. Among the Cletodidae sensu POR, comparable reductions in the endopodital segments are known in the genera *Scintis* POR (missing the P<sub>1</sub>-endopodite) and *Australonannopus* HAMOND (missing the P<sub>4</sub>-endopo-



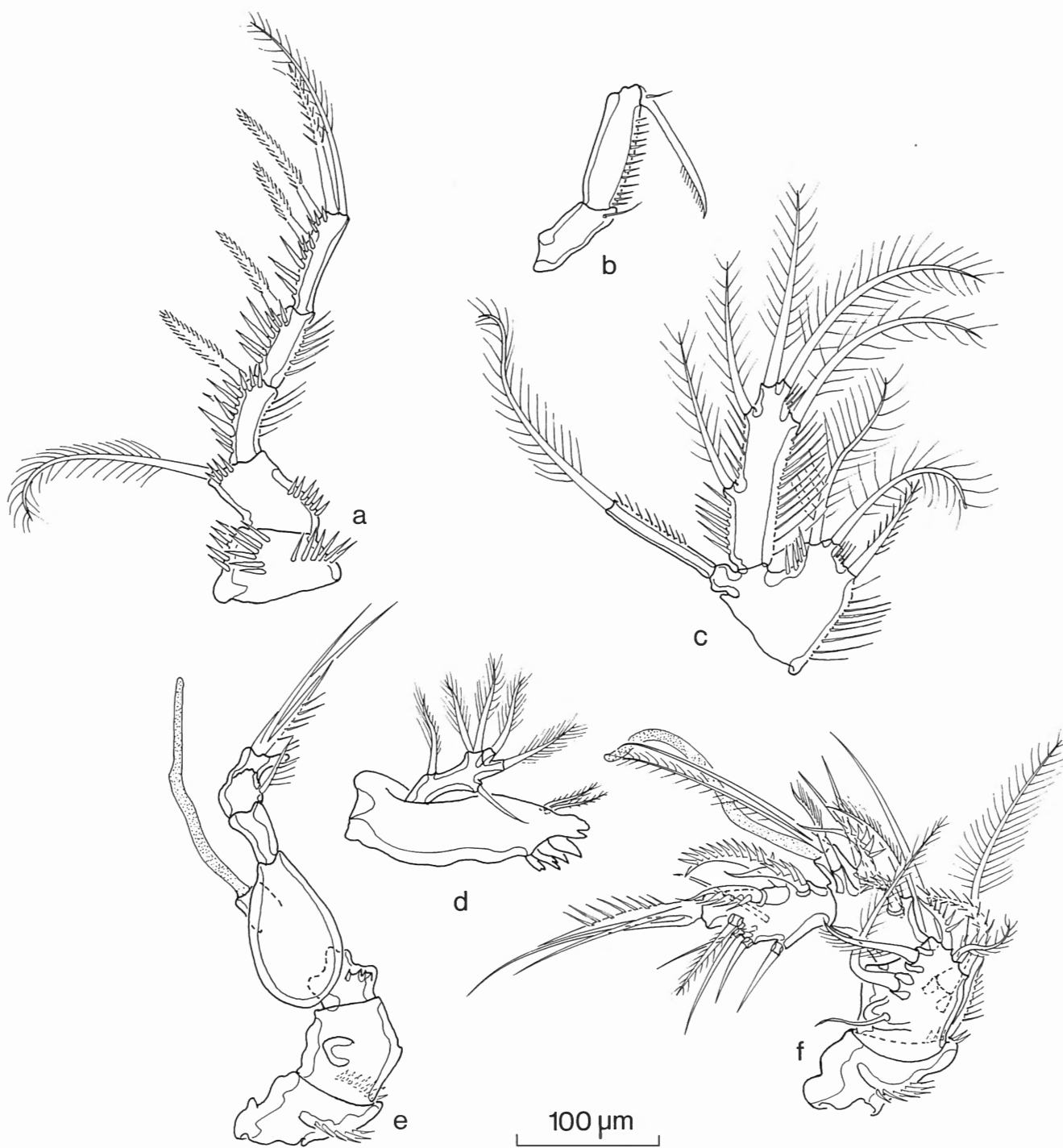


Fig. 5. *Interclctodes interita* n.gen., n.sp.: a, P<sub>2</sub> of the female; b, maxilliped; c, P<sub>5</sub> of the female; d, mandible; e, antennule of the male; f, antennule of the female.

dite). These genera, however, are not directly related to the genera *Cletodes*, *Monocletodes* and *Interclctodes* n.gen.

One other genus, *Austroclctodes* PALLARES, 1979, at first sight shows remarkable resemblances with the genus *Interclctodes* n.gen. By the absence of endopodites in P<sub>2</sub>-P<sub>4</sub> one could consider *Interclctodes* n.gen. as congeneric with *Austroclctodes*. In his revision, POR (1986), who had no access to the description of this genus at that time, could not assign the genus to a

certain family. As far as I can see, the antennule of both sexes and the morphology of the P<sub>5</sub> indicate relationships with the family Argestidae POR. Within this family, the monotypic genus *Austroclctodes* represents one of the most advanced genera with strong affinities with certain species of the genus *Euryclctodes*.

As mentioned above, the genus *Monocletodes* LANG, 1936 is assigned here to the family Cletodidae Sars sensu POR. POR (1986), in his re-evaluation of the

former heterogeneous family Cletodidae SARS, LANG, correctly removed *Monocletodes spinosus* KLIE, 1939 to the genus *Metahuntemannia* (family Huntemannidae), but omitted to assign *Monocletodes* LANG to a family. As a result of the outstanding redescription of *Monocletes varians* T. SCOTT, 1903 by SCHRIEVER (1982, 1984, 1986) it seems to be beyond any doubt that the monotypic genus *Monocletodes* T. SCOTT, 1903 is a valid genus, belonging to the family Cletodidae SARS sensu POR.

## References

- BOER, P., 1971. Harpacticoid copepods (Crustacea) living in wood infested by *Limnoria* from northwestern France. *Bulletin Zoologisch Museum Amsterdam*, 2 (8): 63-72.
- LANG, K., 1948, *Monographie der Harpacticoiden*, 1 & 2: 1-1682 (Hakan Ohlsson, Lund).
- LANG, K., 1965. Copepoda Harpacticoida from the Californian Pacific Coast. *Kungliga Svenska Vetenskapsakademiens Handlingar*, 10 (2): 5-566.
- POR, F.D., 1986. A re-evaluation of the family Cletodidae SARS, LANG (Copepoda, Harpacticoida). *Syllogeus*, 58: 420-425.
- NICHOLLS, A.G., 1943. Marine Copepoda from Western Australia. 1. Littoral Harpacticoids from Rottneest Island. *Journal of the royal Society of Western Australia*, 27: 135-142.
- SCHRIEVER, G., 1982. Neue Harpacticoida (Crustacea, Copepoda) aus dem Nordatlantik, I. Die Gattung *Thieliella* nov. gen. (Familie Ancorabolidae). "*Meteor*" *Forschungsergebnisse*, D 35: 21-26.
- SCHRIEVER, G., 1984. New Harpacticoida (Copepoda) from the North Atlantic Ocean, IV. Four new species of the families Diosaccidae, Ameiridae and Ancorabolidae. *Crustaceana* 47: 52-71.
- SCHRIEVER, G., 1986. The status of the genus *Thieliella* (Copepoda Ancorabolidae) including the description of the male of *Cletodes endopodita* (SCHRIEVER, 1984). *Crustaceana* 51: 102-104.

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