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Mielkiella spinulosa gen.n. sp.n., a new taxon of the Laophontidae (Copepoda, Harpacticoida) from Porvenir (Tierra del Fuego, Chile).

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Abstract

Male and female of *Mielkiella spinulosa* gen.n. sp.n. are described. Specimens were collected in a sandy beach in Porvenir (Tierra del Fuego, Chile). The new species belongs to the family Laophontidae. It exhibits a combination of apomorphies in the A1 (male), A2, the peraeopods and the genital field (female), so that a new genus is erected. The phylogenetic relationship between *Mielkiella spinulosa* gen.n. sp.n. and *Stygolaophonte arenophila* Lang, 1965 is discussed.

Keywords: Taxonomy, Harpacticoida, *Mielkiella spinulosa*, Chile

A. Introduction

In material collected along a sandy beach in Porvenir (Tierra del Fuego, Chile), a few specimens of a peculiar laophontid copepod were found. Subsequent search in the literature revealed, that it closely resembles a male of a new species that MIELKE (1987) had collected in Punta Arenas (Chile). He found only one male specimen, so he did not give a complete description of the species and named his specimen "Laophontidae spec. 1". In spite of some slight differences, the material from Porvenir doubtlessly belongs to the same species of which a detailed description is presented here.

B. Material and methods

Eight males, 25 females and 1 copepodid have been sorted out from material of a sandy beach at Porvenir, Tierra del Fuego, Chile, on 13. 09. 91.

Locality: 53° 17' 50"S, 70° 22' 45"W. Samples were taken at low-tide directly at the waterline.

Three males and 8 females have been dissected, and 6 specimens were utilized for Scanning Electron Microscopy. The holotype has been preserved in 5% buffered formaldehyde and was later dissected and transferred into lactophenol embedding medium. Drawings were made with the aid of a camera lucida on a Leitz-Dialux EB 22 microscope equipped with an interference contrast 100times objective. All specimens are provisionally in the collection of the AG Zoomorphologie of Oldenburg University.

The terminology is adopted from HUYS & BOXSHALL (1991), as well as the numeration of the setae of caudal rami. The terminology related to systematics is used according to AX (1984). Abbreviations used in the text: cphth: cephalothorax, A1: antennule, A2: antenna, md: mandible, mxl: maxillule, mx: maxilla, mxp: maxilliped, enp: endopodite, exp: exopodite, exp1: first segment of exp, CR: caudal ramus, P1-P6: swimming legs 1–6, benp: baseoendopodite.

C. Results

Description of female

Body length (including CR): 380 µm
Cphth length: 110 µm
Cphth width: 160 µm

Rostrum (Figs. 2A, 8A) triangular, as long as wide, fused with cphth, but nevertheless presenting a well defined chitinous reap at ist base, with 2 small setules anteriorly.

Body (Figs. 1A, B) dorsoventrally flattened. Cphth wider than long. Thoracic somites bearing P2-P4 as wide as cphth, the following somites tapering posteriorly. Telson as long as preceding 2 somites. Whole cphth covered with small sensillae. Posterior border of cphth and free somites except the last 2 ones bearing dorsally a row of small sensillae of which the number decreases posteriorly. Posterior border of all thoracic and abdominal somites with a line of small spinules. Ventrally and laterally, abdominal somites with several rows of long spinules (Figs. 1B, 2B). Cphth and thoracic somites laterally covered with fine cuticular "hairs" (Fig. 1B), in thoracic somites accompanied by se-

veral short spinules. Anal somite with spinulose anal operculum flanked by 2 setules arising from small knobs.

CR (Fig. 2B) short, slightly longer than broad. Sizes and positions of setae: I very small, inserting at halflength of outer margin of ramus. II located

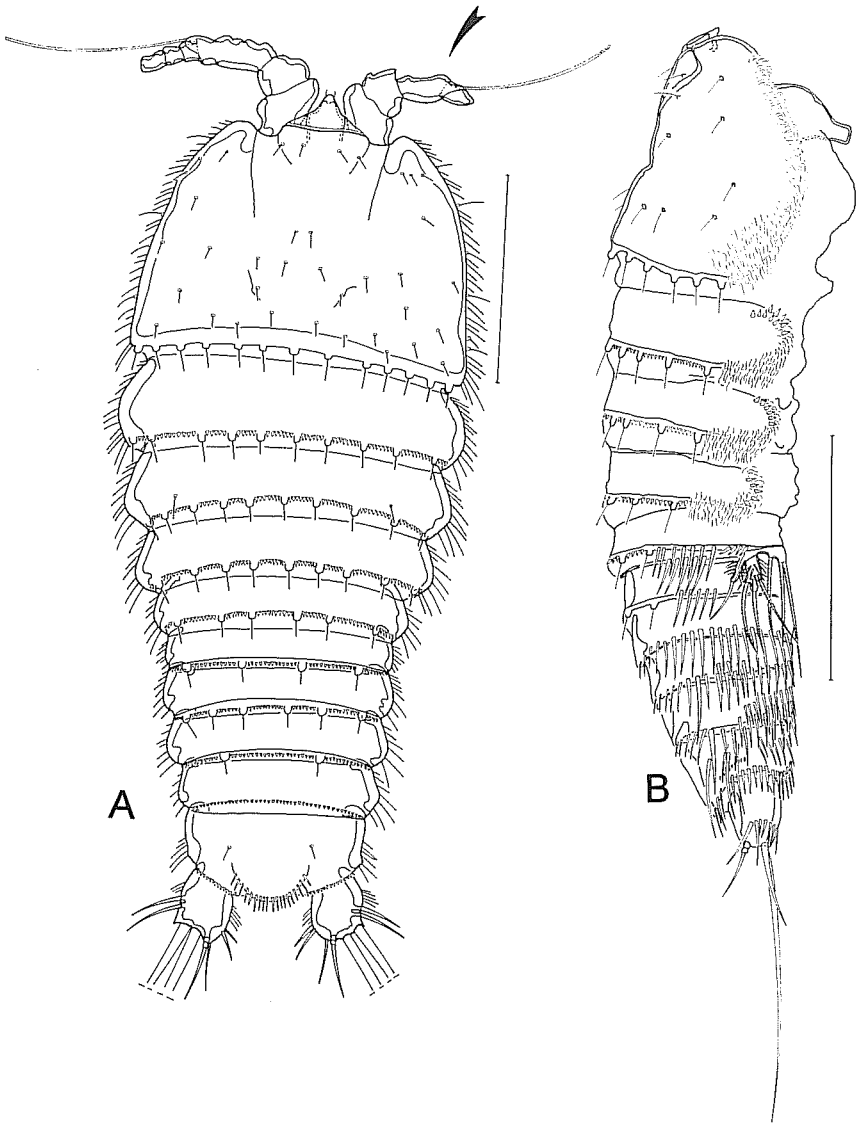

Fig. 1: *Mielkiella spinulosa* gen.n. sp.n., female, A) dorsal view (paratype 1), B) lateral view (Paratype 2). Black arrow indicates deformed A1. Scales: 100 µm.

directly posteriorly of I, nearly five times longer than the first. III directly posteriorly of II, of approximately the same size. IV and V terminal, V approximately 3 times longer than IV and reaching the same length as first 3 thoracic somites. VI short and strong, subterminally on the inner side of CR. VII biarticulated at base, situated in midline of dorsal surface near the posterior end of CR. IV, V and VI accompanied by strong short spinules. At bases of I, II and III with a group of short slender spinules, a further one subterminally at the inner side of CR.

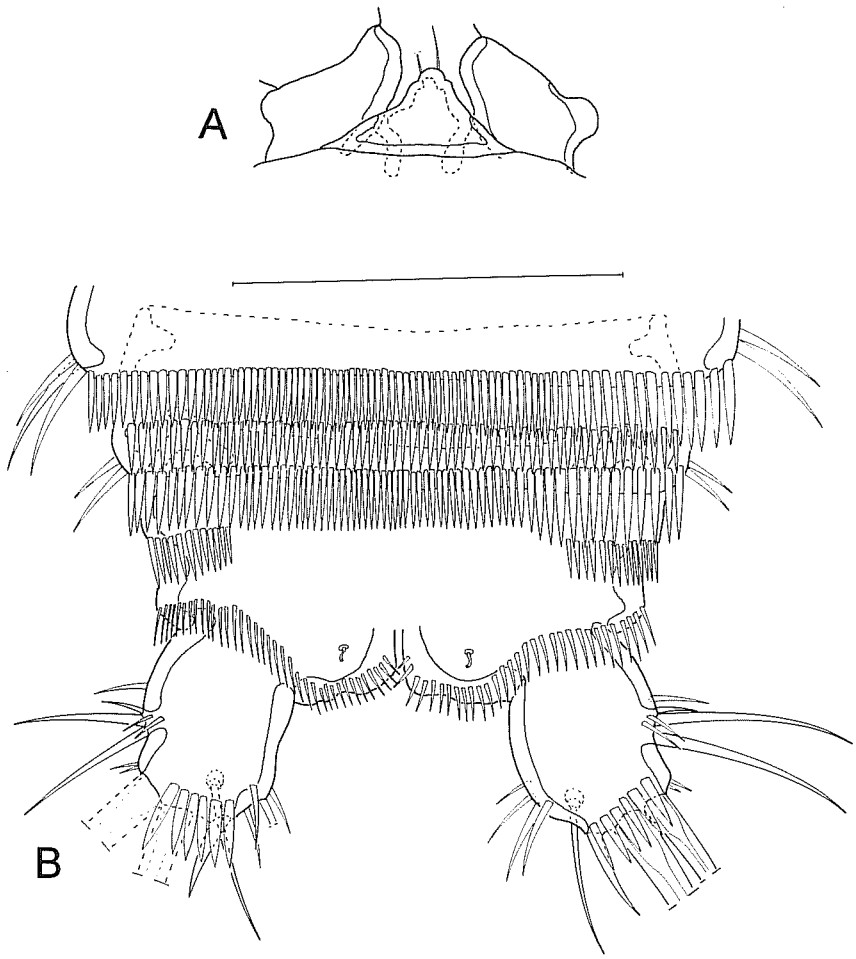

Fig. 2: *Mielkiella spinulosa* gen.n. sp.n., female, A) rostrum (paratype 1), B) furca, ventral view (holotype). Scale: 50 µm.

Genital field (Figs. 3A, 9A, B): last thoracic and first abdominal somites not completely fused to genital double somite. The dorsal view (Fig. 1A) shows clearly the separation between genital and first abdominal somite. Nevertheless, a lateral view reveals that the 2 somites are fused ventrally (Fig. 1B). Copulatory porus located ventrally in middle of somite, showing 2 seminal ducts to seminal receptacles. P6 small, with 2 setae, forming genital operculum which covers the genital apertures. Posteriorly with 2 strong sclerotized tubes,

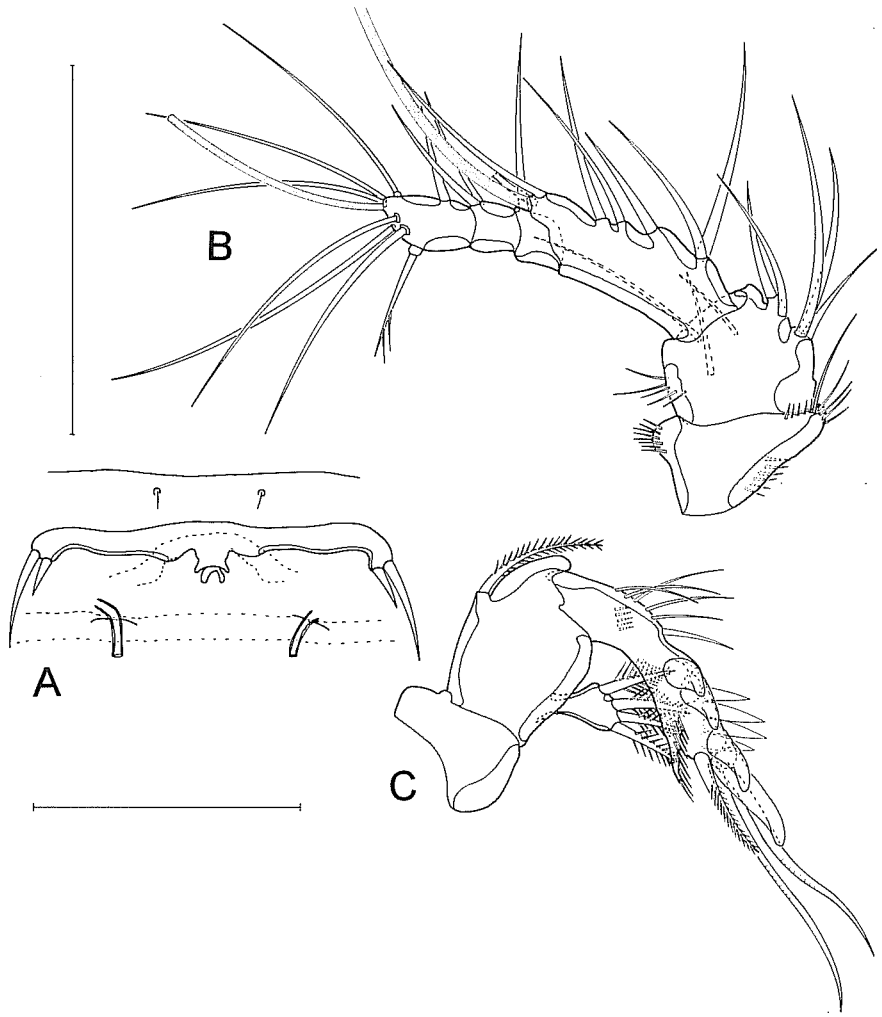

Fig. 3: *Mielkiella spinulosa* gen.n. sp.n., female, A) genital field (paratype 3), B) A1, C) A2 (paratype 4). Scales: 50 µm.

crossing a chitinous reap. Observations by Scanning Electron Microscopy revealed that each tube inserts at the upper part of a hole (Figs. 9A, B). The chitinous reap is passing at the inner side of the somite, being originally the limit of the genital and first abdominal somite.

A1 (Fig. 3B) 6-segmented, short, outwardly directed. First segment with 1 small seta and a row of long spinules on inner side near base of segment, and 1 row on the outer, protruding corner. Second segment with 5 setae on inner side and 2 short setae and 1 long slender seta on ventral surface. Outer border with a group of long spinules. Third segment longest, along inner margin with 5 setae, terminally with 2 setae and 1 aesthetasc (aes.). Fourth segment small, bearing 1 seta at inner corner. Fifth segment as long as fourth, with 2 setae on inner corner. Sixth segment approximately 1,5 times longer than fifth, with 1 seta at inner base and 4 long setae subterminally, all arising from small knobs.

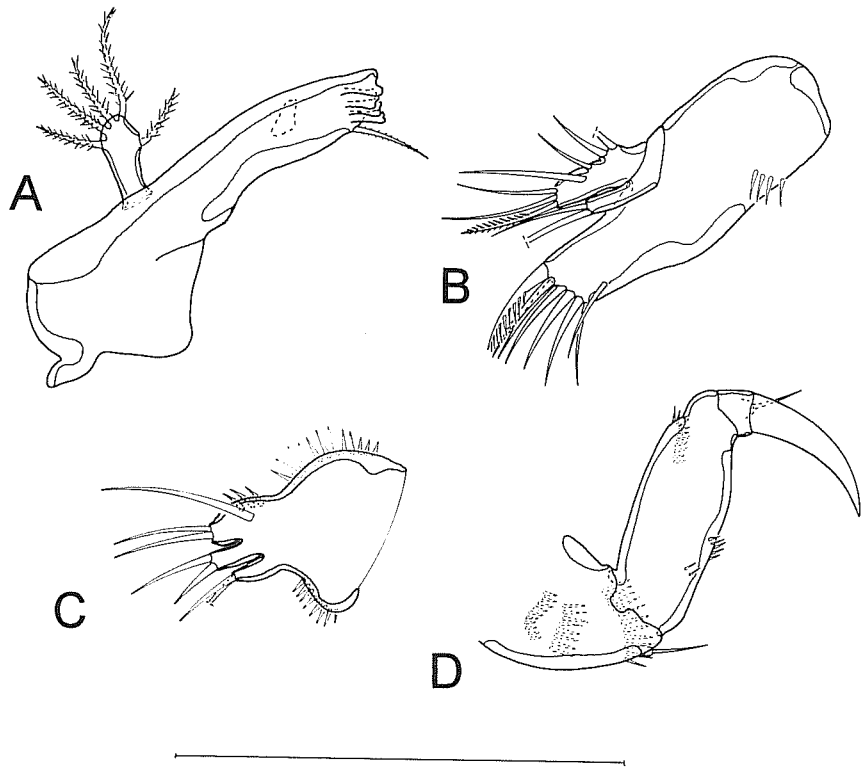

Fig. 4: *Mielkiella spinulosa* gen.n. sp.n., female, A) md (paratype 4); B) mxl, C) mx (paratype 5), D) mxp (paratype 4). Scale: 50 µm.

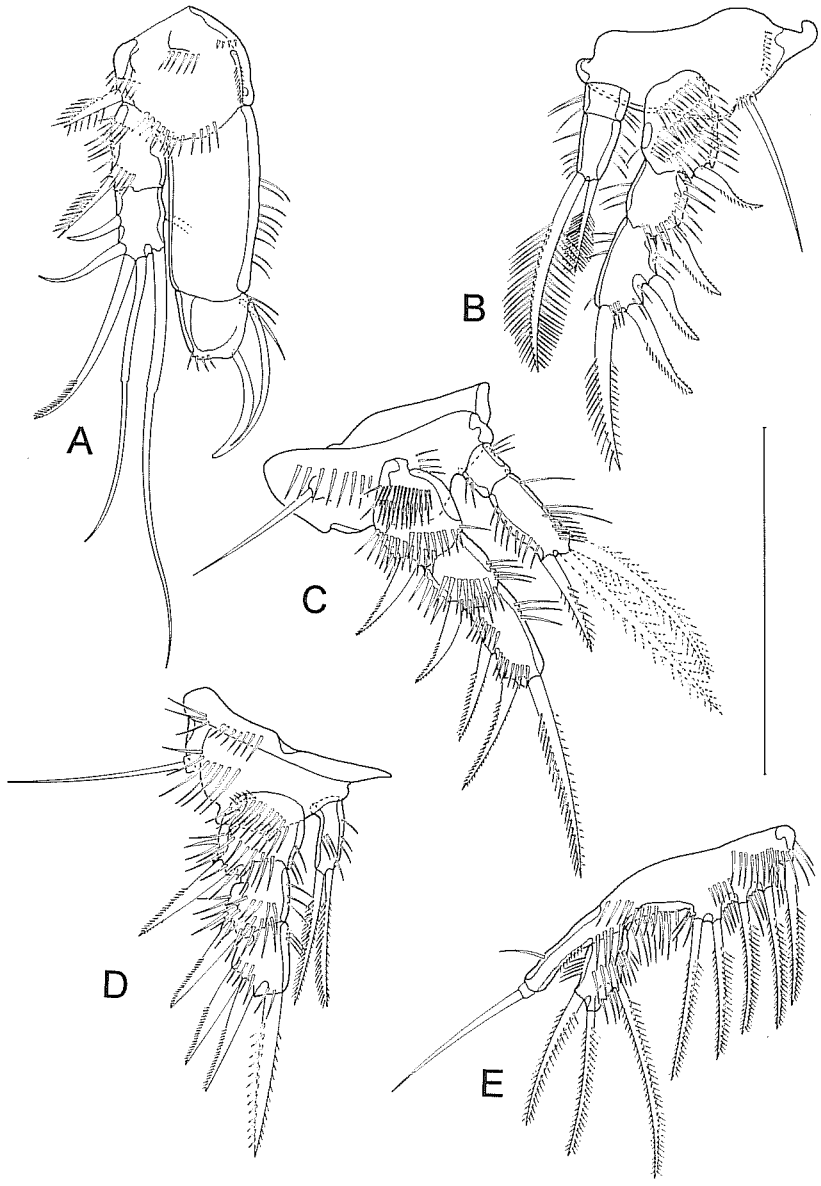

Fig. 5: *Mielkiella spinulosa* gen.n. sp.n., female, A) P1, B) P2, C) P3 (holotype), D) P4 (paratype 6), E) P5 (paratype 4). Scale: 50 µm.

Terminally with 2 long setae and 1 small slender aes. Outside with 1 additional seta arising from a knob.

Setal formula: I-1; II-8; III-7 + aes; IV-1; V-2; VI-8 + aes.

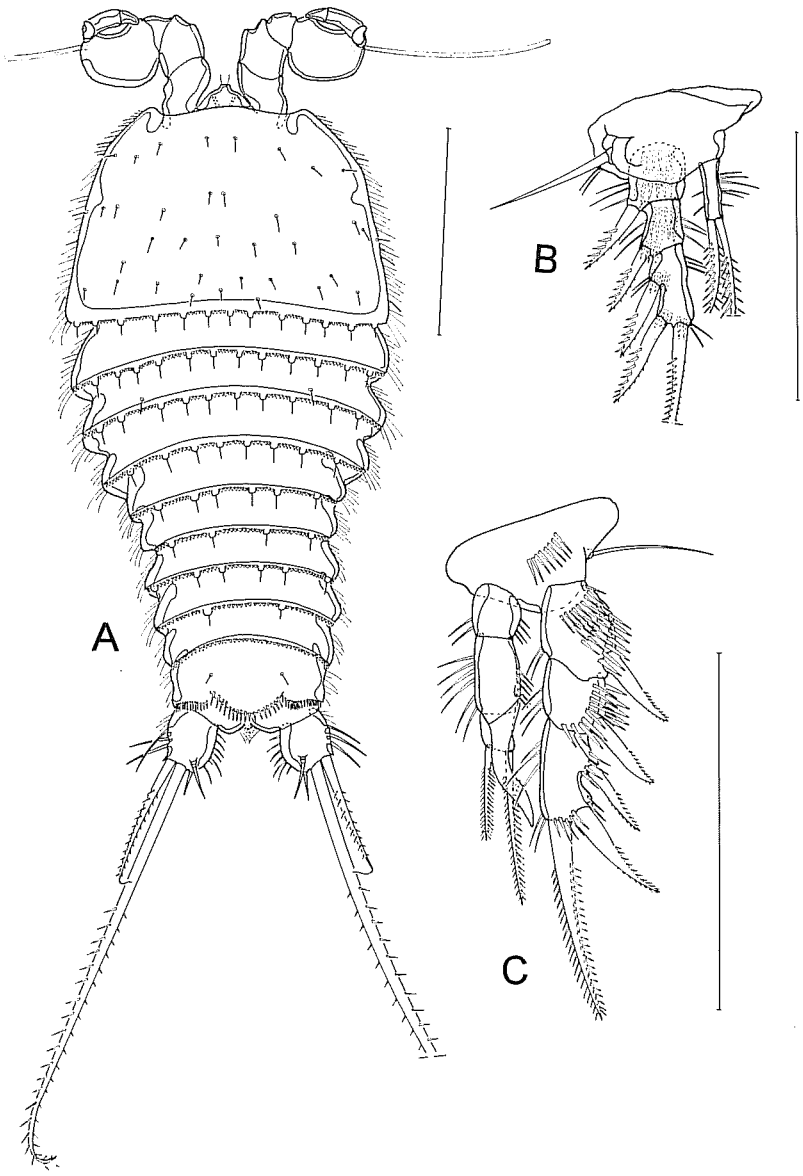

Fig. 6: *Mielkiella spinulosa* gen.n. sp.n., male, A) dorsal view (paratype 11), Scale: 100 µm, B) P2, C) P3 (allotype). Scales: 50 µm.

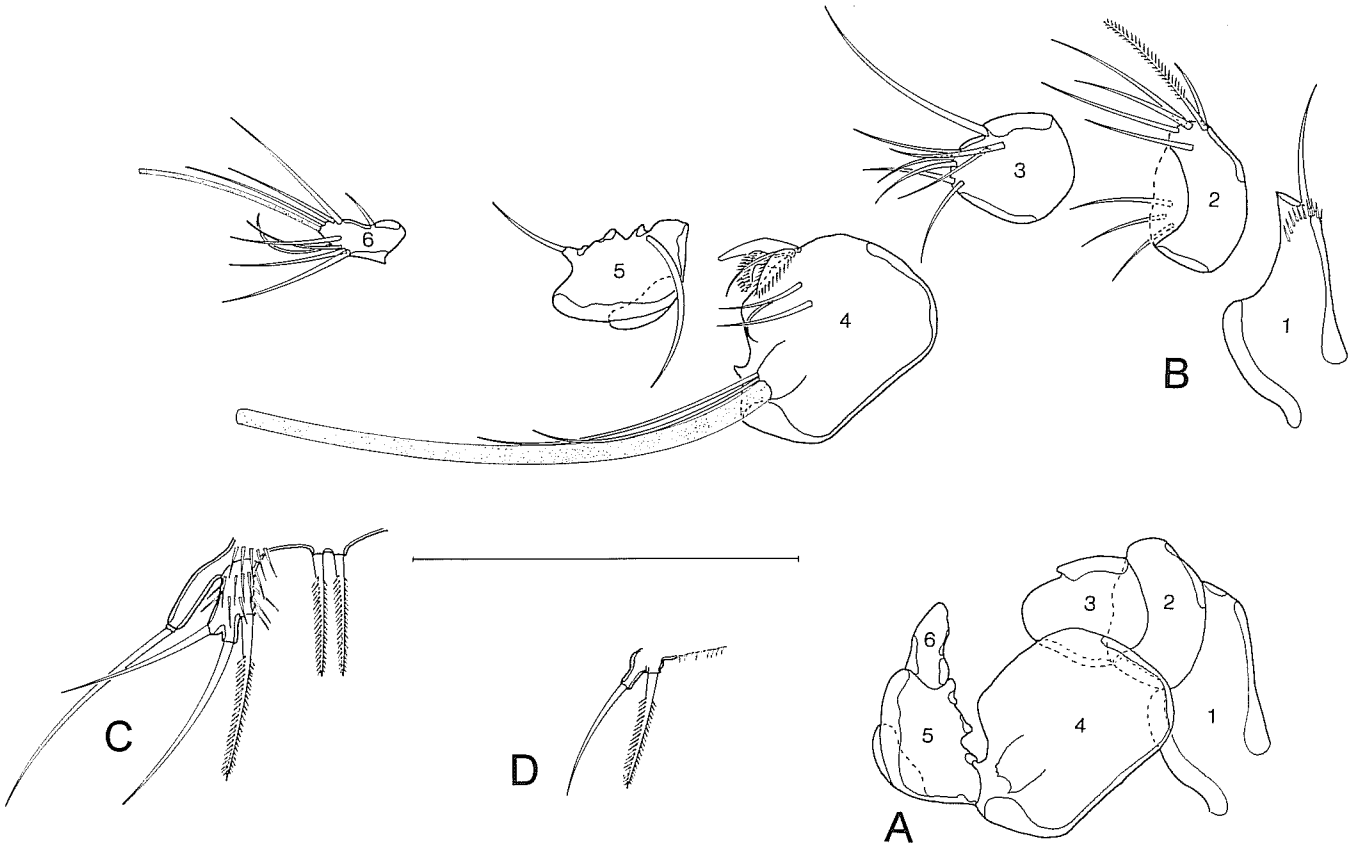

Fig. 7: *Mielkiella spinulosa* gen.n. sp.n., male (paratype 12), A) complete A1, B) segments 1 to 6 with corresponding setation, c) P5, d) P6 (paratype 13). Scale: 50 µm.

A2 (Fig. 3C) with unarmed coxa. Allobasis compressed, with 2 plumose seta. Enp. on inner side with 6 long spinules, ventrally with a row of short spinules. Laterally with 3 claw-like setae, apically with 1 claw-like seta, 2 geniculated setae and 1 plumose seta. Subapically there is a cuticular frill bearing spinules. Exp. 1-segmented, bearing 4 plumose setae.

Md (Fig. 4A) with unarmed coxa, except of 1 pinnate seta at base of cutting edge consisting in 4 teeth. Basis, enp and exp fused to 1-segmented palp carrying 5 plumose setae.

Mxl (Fig. 4B): Arthrite of praecoxa apically with 8 setae, one of them plumose, on inner side with 4 small spinules. Coxal endite bearing 2 setae, basis without exp and enp, terminally with 2 bare setae and 1 plumose seta, along outer margin with 4 setae.

Mx (Fig. 4C) derived. Syncoxa with several spinules, bearing 2 endites and fused with basis. Proximal endite terminally with 2 bare setae, second endite bearing 1 smaller and 1 longer seta. Basis sturdy, terminally without claw-like projection and bearing 2 setae, subterminally with 1 long seta representing the enp.

Mxp (Fig. 4D) prehensile, syncoxa proximally with 2 rows of spinules, subterminally with 1 inner bare seta and an additional row of long spinules. Basis with 2 rows of spinules and a few single ones. Enp bearing 1 small seta, arising from a process, and a big, claw-like seta.

P1 (Fig. 5A) prehensile, segments short and sturdy. Basis with 1 outer plumose seta, accompanied by a row of large spinules at ist base; subterminally with a row of strong spinules, and another row in the middle of the segment. Inner basal seta accompanied by a row of small spinules. Exp 2-segmented, inserting near outer basal seta, first segment with 1 plumose seta and with 2 rows of long, slender spinules on outer margin. Second segment as long as first, not reaching end of enpl. with 5 setae: 3 lateral ones, the distal one plumose, and terminally 2 long setae, of which the proximal half is broader than the distal half. Enp 2-segmented, enp1 longer than exp, with a row of long spinules on inner margin. Enp2 small, medially with 1 slender and 1 massive claw-like seta, terminally with 4 small spinules.

P2-P4 (Figs. 5B-D): bases with 1 long bare outer seta, exp 3-segmented, segments with 1 up to 4 rows of long spinules. Enp P2 and P3 2-segmented, enp P4 1-segmented. Basis P2 with 2 rows of short spinules, bases P3 and P4 with several long spinules. Exp1 and exp2 with 1 strong seta on outer margin, exp3 with 2 plumose outer setae, and terminally with 1 plumose seta. Enp1 P2 and P3 without setae, enp2 P2 with 1 long and 1 small plumose seta. Enp2 P3 with 2 long plumose setae and 1 smaller plumose seta. Enp P4 with 2 slender plumose setae.

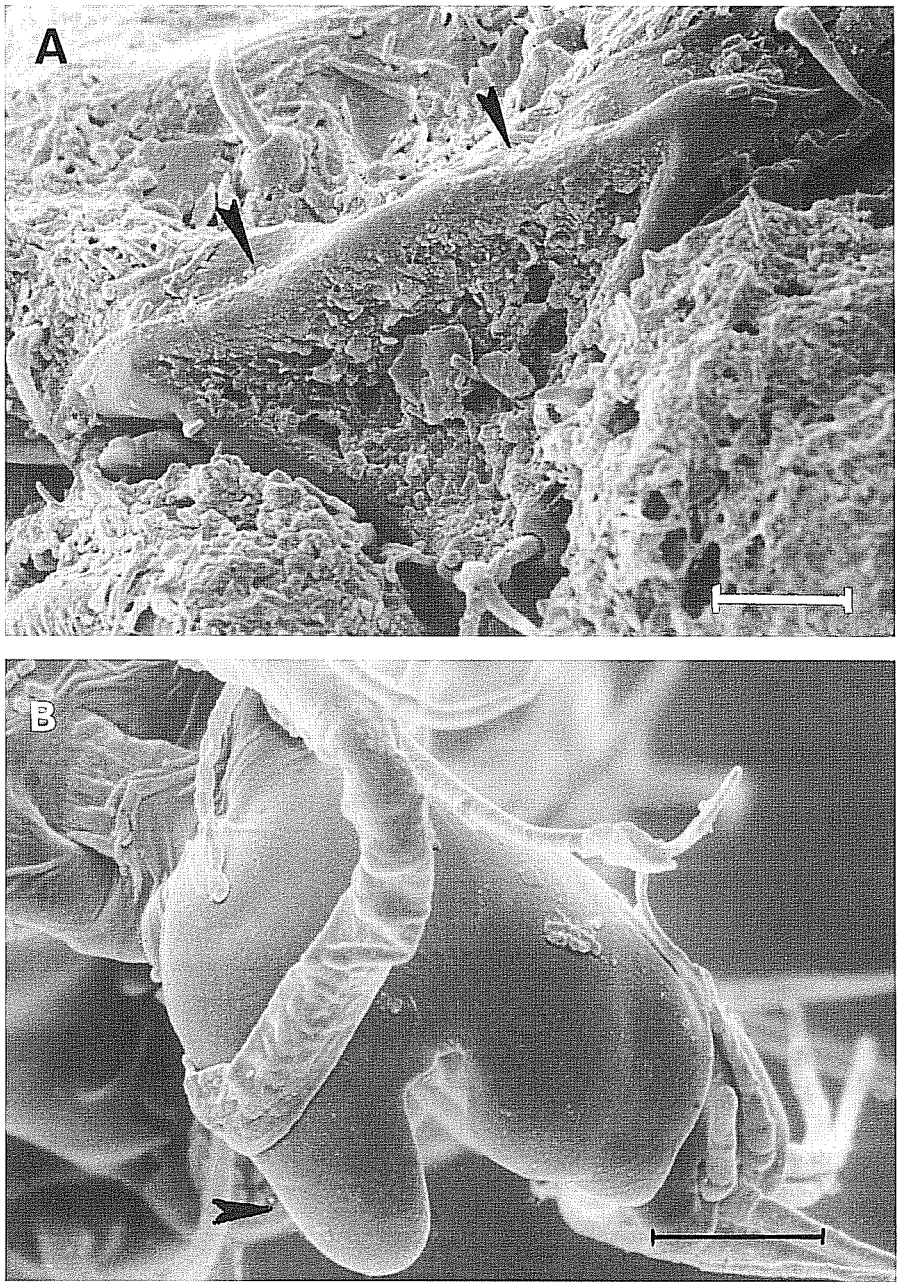

Fig. 8: *Mielkiella spinulosa* gen.n. sp.n., A) female (paratype 14), rostrum. Arrows indicate basal chitinous reap. Scale: 5 µm, B) male (paratype 16), fifth segment of A1 showing cuticular process (arrow). Scale: 5 µm.

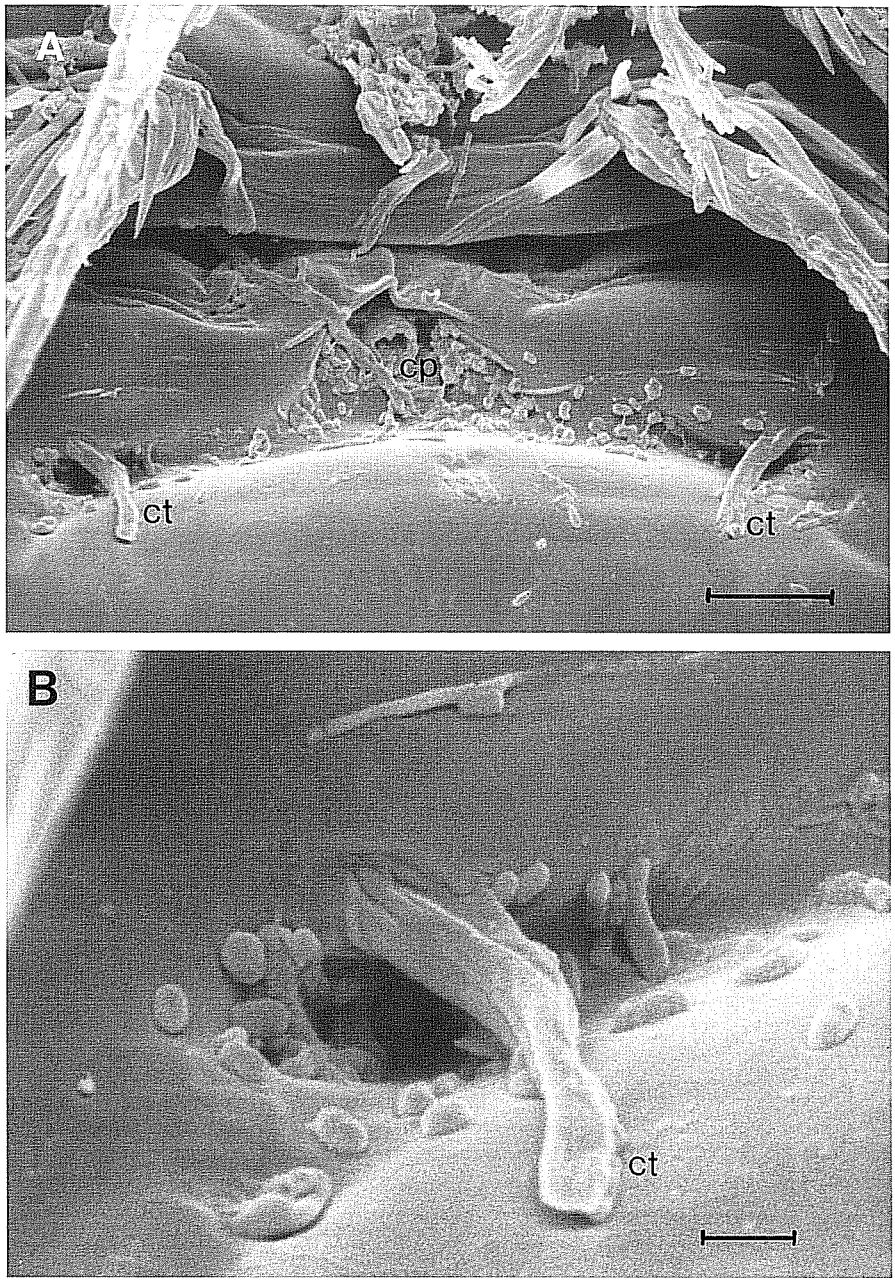

Fig. 9: *Mielkiella spinulosa* gen.n. sp.n., female (paratype 15), ventral view showing A) genital field, scale: 5 µm, B) cuticular tube, scale: 1 µm. Abbreviations: cp: copulatory pore, ct: cuticular tube.

Setal formula:

	Exp1	Exp2	Exp3	Enp1	Enp2
P2	0	0	0; 1; 2	0	0; 2; 0
P3	0	0	0; 1; 2	0	0; 2; 1
P4	0	0	0; 1; 2	0; 2; 0	–

P5 (Fig. 5E): Benp wider than long, covered with several rows of long spinules. Outer margin with 1 bare seta, arising from a process. Distally with 5 long plumose setae. Exp small and sturdy, with 2 rows of long spinules and 3 long plumose setae.

Description of male

Body length:	310 µm
Cphth length:	100 µm
Cphth width:	150 µm

Body (Fig. 6A) smaller than female, presenting the following differences: posterior border of Cphth with a line of small spinules, as well as in the thoracic and abdominal somites; transition from thoracic to abdominal somites is more pronounced than in female; 2 rows of spinules running outwards from anal operculum; seta I of CR as long as setae II and III; V reaching the same length as all free thoracic and abdominal somites.

A1 (Figs. 7A, B, 8B) 6-segmented, sturdy, subchirocer Geniculation between fourth and fifth segment. Fourth segment swollen, with 3 modified flat setae at inner side. Fifth segment dorsally with a strong cuticular process, and with indentated inner margin. Aes on furth and sixth segment.

Setal formula: I-1; II-9; III-8; IV-9 + aes; V-2; VI-9 + aes.

P2 (Fig. 6B) with 1-segmented enp, bearing 2 plumose setae.

P3 (Fig. 6C) with 3-segmented enp, second segment with apophysis, reaching end of exp. Enp3 with 2 plumose setae.

P5 (Fig. 7C) smaller than in female. Benp. with 1 row of long spinules, 1 bare outer seta, distally with 2 plumose setae. Exp with 2 rows of spinules, 2 long bare setae and 1 plumose seta.

P6 (Fig. 7D) very small, with 1 plumose seta at inner side and 1 bare seta at outer side.

D. Discussion

In his fragmentary description of a male of a new species ("Laophontidae spec. 1") found in Punta Arenas (Chile) MIELKE (1987) noticed that this species did not fit into any of the so far known Laophontidae genera. He made il-

lustrations of the A2, of P1-P6 and of one caudal ramus. When comparing these drawings with the specimens found in Porvenir (Tierra del Fuego, Chile) there is no doubt that both refer to the same species. *Mielkiella spinulosa* gen.n. sp.n. belongs to the family Laophontidae as recognized by MIELKE (1987) before. It shows all diagnostic characters that had been interpreted by HUYS (1990) as apomorphies of the family: Rostrum fused with cphth (nevertheless it shows a well defined chitinous reap at ist base, not comparable with the less sclerotized hyaline band of other Laophontidae mentioned by HUYS (1990)), A1 setae and spines without ornamentation, 1-segmented mandibular palp (basis and exp each represented by 1, enp. represented by 3 setae), P1 with displacement of inner basal seta into centre of segment, basis produced into pedestal for insertion of enp, loss of inner seta enp1, posterior seta of enp2 reduced to setule, modification of front seta enp2 into a strong claw. Nevertheless it is not possible to ally the new species to one of the known laophontid genera, even though it shares some characters with some of them:

a) A1 6-segmented, without thorn (*Arenolaophonte* Lang, 1965, *Hemilaophonte* Jakubisiak, 1932, *Klieonychocamptus* Noodt, 1958 (part.), *Phycolaophonte* Pallares, 1975, *Xanthilaophonte trispinosa* (Sewell, 1940));

b) Allobasis A2 strongly tossed (*Stygolaophonte* Lang, 1965);

c) Enp. A2 with 7 apical setae (*Afrolaophonte* Chappuis, 1960, *Coullia* Hamond, 1973, *Harrietella* T. Scott, 1906, *Hemilaophonte, Lobitella* Monard, 1934, *Loureirophonte* Jakobi, 1953, *Platychelipus* Brady, 1880, *Raptolaophonte* Cottarelli & Forniz, 1989, *Stygolaophonte*);

d) Exp P1 2-segmented (exp2 with 4 or 5 setae) (widerspread within Laophontidae, e.g. *Archilaophonte* Willen, 1995, *Arenolaophonte, Esola hirsuta* Thompson & A. Scott, 1903, *Folioquinpes* Fiers & Rutledge, 1990, *Heterolaophonte furcata* Noodt, 1958, *H. serratula* Mielke, 1981, *Hoplolaophonte* Hamond, 1973, *Klieonychocamptus* (part.), *Laophonte* Philippi, 1840 (part.), *Loureirophonte, Microlaophonte* Vervoort, 1964, *Myctyricola* Nicholls, 1957, *Phycolaophonte, Platychelipus, Psammolaophonte* Wells, 1967, *Quinquelaophonte* Wells, Hicks & Coull, 1982 (part.), *Raptolaophonte, Stygolaophonte, Xanthilaophonte carcinicola* Fiers, 1991);

e) P2-P4 exp3 with 3 setae (*Robustunguis* Fiers, 1992, *Stygolaophonte*);

f) P2-P4 short and sturdy (*Stygolaophonte*);

g) Inner setae exp P2-P4 totally reduced (*Stygolaophonte*, except P2 male);

h) P5 small, benp broader than long, with cuticular spines, exp small (*Stygolaophonte*);

i) Ventral side of abdomen and peraeopods with long cuticular spines (*Arenolaophonte, Heterolaophonte furcata, H. serratula, Laophonte* (part.), *Myctyricola, Stygolaophonte*).

On the other hand there is a number of autapomorphic characters which seem to justify the establishment of a new genus:
- 5th segment of A1 (male) with strong cuticular process;
- Basis of Mx obtuse and shortened;
- Mxp short and compact;
- P1 short and sturdy;
- Terminal setae exp P1 with abrupt transition between broad proximal and slender distal half;
- Female with 2 cuticular "tubes" at the genital field.

Looking at the characters a-i it becomes evident that *Mielkiella spinulosa* gen.n. sp.n. shares the gratest number of characters with *Arenolaophonte* Lang, 1965 (characters a, d, i) and *Stygolaophonte* Lang, 1965 (characters b, c, d, e, f, g, h, i). While some of them (a, c, d, i) may be convergent there are two which are interpreted here as synapomorphic for *Mielkiella spinulosa* gen.n. sp.n. and *Stygolaophonte arenophila* Lang, 1965:
- The similarity of P5 female as well as of male (see character h). Within Laophontidae only *Stygolaophonte* and *M. spinulosa* gen.n. sp.n. present such a particular P5. It is not likely that this particular form is the result of convergent evolution due to an adaptation to the same environment.
- The strongly compressed allobasis of A2, which is unique for all Laophontidae.

Despite the synapomorphies there are important differences between both species so that they cannot be united in one genus. *S. arenophila* shows the following autapomorphies in respect to *M. spinulosa* gen.n. sp.n.:

1. Mandibular palp with 3 setae;
2. A2 exp with 2 setae;
3. P1 exp2 with 4 setae;
4. P3 enp3 of male with 1 seta;
5. P4 exp 2-segmented;
6. P5 benp of female with 4 setae.

M. spinulosa gen.n. sp.n. on the other hand shows the following autapomorphies in respect to *S. arenophila*:

1. Body short and sturdy;
2. A1 6-segmented;
3. A1 of male with cuticular pedestal base on fifth segment;
4. Basis of Mx fused with syncoxa, obtuse and shortened;
5. Mxp short and compact;
6. P1 short and sturdy;
7. Terminal setae of P1 exp2 with abrupt transition between broad proximal and slender distal half;

8. P2 exp male without inner setae;
9. P2 male with 1-segmented enp;
10. Female with 2 cuticular "tubes" at the genital field.

As a result of this discussion it can be said that *Mielkiella* gen.n. is distinct from *Stygolaophonte* but that both genera appear to be closely related.

Zusammenfassung

Weibchen und Männchen von *Mielkiella spinulosa* gen.n. sp.n. werden beschrieben. Die Art wurde in Sandproben aus Porvenir (Tierra del Fuego, Chile) gefunden. Sie gehört in die Familie Laophontidae, weist allerdings eine Reihe von Apomorphien an der A1 (Männchen), der A2, den Peraeopoden und dem Genitalfeld (Weibchen) auf, so daß eine neue Gattung errichtet wurde. Die phylogenetische Beziehung zwischen *Mielkiella spinulosa* gen.n. sp.n. und *Stygolaophonte arenophila* Lang, 1965 wird diskutiert.

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Reference

AX, P. (1984): Das Phylogenetische System. Gustav Fischer Verlag, Stuttgart, 349 pp.

FIERS, F. (1990): *Abscondicola humesi* n.gen. n. sp. from the gill chambers of land crabs and the definition of the Cancrincolidae n. fam. (Copepoda, harpacticoida). Bull. Inst. r. Sci. nat. Belg. (Biologie) 60, 69–103.

HUYS, R. (1990): A new family of harpacticoid copepods and an analysis of the phylogenetic relationships within the Laophontoidea T. Scott. Bijdragen tot de Dierkunde 60, 79–120.

HUYS, R. & G. A. BOXSHALL (1991): Copepod Evolution. the Ray Society, London, 468 pp.

LANG, K. (1965): Copepoda Harpacticoidea from the Californian Pacific coast. K. svenska vetensk. Akad. Handl. 10 (2), 1–566.

MIELKE, W. (1987): Interstitielle Copepoda von Nord- und Süd-Chile. Microfauna Marina 3, 309–361.

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