New benthopelagic aetideids (Crustacea: Copepoda: Calanoida) from deep Antarctic waters

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ABSTRACT: Three new and one rare benthopelagic aetideid species of *Bradyetes* and *Pseudeuchaeta* are described from female specimens collected during the German expeditions ANDEEP I–III in 2002 and 2005 from bathy- and abyssopelagic depths above the sea bed. *Pseudeuchaeta acuticornis* sp.n. is distinguished from congeners by 5 setae on the second endopodal segment of mandible, presence of lateral spine on the first exopodal segment of P1 and 3 setae on the maxillule coxal endite. *P. acuticornis* is the second representative of the genus found in high Antarctic waters. *Bradyetes weddellanus* sp.n. differs from the other species of the genus by, among other states, a very small sensory appendage on the syncoxa of maxilliped, a short lateral spine of P1 exopod segment 2, one additional seta on the distal segment of antennule. *Bradyetes curvicornis* sp.n. is distinguished from congeners by the number of setae on the second endopodal segment of mandible and maxillulary endopod and a very long sensory appendage on the syncoxa of maxilliped. Within *Bradyetes* both new species are distinctly larger than their congeners. Furthermore, present collections yielded female specimens of *Bradyetes* cf. *inermis* from the South Atlantic and in the Southern Ocean; these are the first records for *Bradyetes* from the southern hemisphere.

KEYWORDS: copepods, Aetideidae, *Bradyetes*, *Pseudeuchaeta*, benthopelagic, Weddell Sea.

Новые глубоководные бентопелагические Aetideidae (Crustacea: Copepoda: Calanoida) из Антарктики

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РЕЗЮМЕ: Представлены описания самок трех новых и одного редкого вида бентопелагических Aetideidae *Bradyetes* и *Pseudeuchaeta*. Экземпляры собраны Германскими экспедициями ANDEEP I–III в 2002 и 2005 годах над поверхностью дна с бати- и абиссопелагических глубин. *Pseudeuchaeta acuticornis* sp.n. отличается от других

видов рода наличием 5 щетинок на втором сегменте эндоподита мандибулы, присутствием наружного шипа на первом сегменте P1 и 3 щетинками на коксальном эндите максиллулы. *P. acuticornis,* второй вид *Pseudeuchaeta*, найденный в высоких широтах Антарктики.*Bradyetes weddellanus*sp.n. отличается от остальных видов рода очень малым размером сенсорного придатка на коксальном эндите синкоксы максиллипеды, коротким наружным шипом второго сегмента экзоподита P1, одной дополнительной щетинкой на дистальном сегменте антеннулы и некоторыми другими чертами строения. *Bradyetes curvicornis* sp.n. характеризуется числом щетинок на втором сегменте эндоподита мандибулы и эндоподите максиллулы и наличием очень длинного сенсорного придатка на синкоксе максиллипеды. Оба вида больше по размерам, чем остальные виды рода. Кроме того, в изученном материале найдены четыре самки *Bradyetes* cf. *inermis* из Южной Атлантики и Южного Океана. Род *Bradyetes* впервые отмечен в Южном полушарии.

КЛЮЧЕВЫЕ СЛОВА: копеподы, Aetideidae, *Bradyetes*, *Pseudeuchaeta*, бентопелагические, море Уэдделла.

Introduction

Recent studies of benthopelagic/hyperbenthic calanoid copepods from the Southern Ocean show that the near-bottom calanoid fauna includes many new genera and species (Bradford, Wells, 1983; Ohtsuka et al., 1998; Schulz, 1996, 1998, 2002, 2005; Schulz, Markhaseva, 2000; Markhaseva, Dahms, 2004). Three new and one rare benthopelagic species of two aetideid genera were found in the samples collected during the German expeditions ANDEEP I–III in 2002 and 2005 in the Scotia and Weddell Sea of the Southern Ocean, where an intensive benthopelagic sampling programme by an epibenthic sledge was undertaken (Brandt et al., 2004). Representatives of the genera *Bradyetes* and *Pseudeuchaeta* are mainly benthopelagic, and up to now only *P. brevicauda* Sars, 1905 was recorded from the southern hemisphere (to about 60°S) (Markhaseva, 1996). Present collections of *P. acuticornis* are considered the second and, moreover, the southernmost record of the genus in the Southern Ocean. The genus *Bradyetes* is reported for the first time in the Southern Ocean.

In addition to the above mentioned genera, two other exclusively benthopelagic aetideid genera recently have been recorded from the Antarctic near-bottom fauna: *Parabradyidius* (Schulz, Markhaseva, 2000) and *Comantenna* (Schulz, 2002). Three more aetideid species are described below, bringing to five the number of species in the genus *Bradyetes* and to seven the species in *Pseudeuchaeta.*

Methods and Terminology

Four aetideid species of two genera were collected during R/V *Polarstern* expeditions ANDEEP I–II in 2002 and ANDEEP III in 2005. Sampling was done close to the sea bed at bathypelagic and abyssal depths between 1030 and 4725 m in the Scotia and the Weddell Sea of the Southern Ocean by a closing epibenthic sledge (Brandt, Barthel, 1995) with both supranet (sampling layer ca. 1.00–1.30 m above the bottom; mesh size 0.3 mm) and epinet subsamples (0.27–0.60 m above the bottom; mesh size 0.5 mm). Specimens were fixed in 96% ethanol and later stained by adding a solution of chlorazol black E dissolved in 70% ethanol / 30% water. Oral parts and swimming legs were dissected and figures were done in glycerin using a *camera lucida.*

The following abbreviations are used in the descriptions: P1–P4, swimming legs 1–4. Free segments of antennule are designated by Arabic numerals, ancestral segments by Roman nume-

rals. One seta and one aesthetasc on a segment of the antennule are designated: 1s + 1ae; "1?" indicates that a setal element was broken so that its identity on antennule could not be determined and only the scar at the location of its attachment was counted. Segmentation of antenna is assumed as having an 11-segmented exopod (Schulz, 2005); the maxilliped syncoxa is considered having 3 praecoxal endites and 1 coxal endite (Ferrari, Markhaseva, 2000a,b; Ferrari, Ivanenko, 2001).

Taxonomy

Bradyetes weddellanus **sp.n.**
Figs 1–3.

Material. Holotype, adult female, undissected, body length 5.10 mm (ZMH K–41163). Weddell Sea, 71°18' S, 13°58' W, station 074–6, epinet, 20.02.2005, above the sea bed at depths 1053–1030 m.

Paratypes: 9 females, body length 4.75–5.50 mm. 6 females, (ZMH K–41164) and 3 females, (ZIN 91065), collection data as for holotype.

The holotype and 6 paratypes are deposited at the Zoological Museum Hamburg, University of Hamburg, 3 paratypes are deposited at the Zoological Institute, Russian Academy of Sciences, St. Petersburg (ZIN).

Additional material. One female, collected at station 132–2, epinet, 06.03.2002, above the sea bed at depth 2084 m, Weddell Sea, 65°17' S, 53°22' W; one female collected at station 141–10, supranet, 23.03.2002, above the sea bed at depth 2281–2258m, Scotia Sea, 58°24' S, 25°01' W.

Description. Adult female, total length 4.75–5.50 mm; prosome 2.6–2.9 times longer than urosome. Rostrum as a blunt plate without filaments (Fig. 1B–C). Cephalosome and pediger 1 fused and pedigers 4 and 5 fused; posterior corners as short rounded lobes (Fig. 1A–B, D). Spermathecae narrow ventrally, widening dorsally to varying degree in different specimens (Fig. 1D). Caudal rami with 4 terminal setae, 1 ventral seta (Fig. 1E) and a small subterminal seta (Fig.1B, E).

Antennule as long as prosome or exceeding prosome by distal segment. Antennule (Fig. 1F-I), of 24 free segments, armature as follows: I — 1s, II–IV — 2s+[2s+1ae]+2s, V to IX — 2s each, X–XI — 4s, XII to XX — 2s each, XXI — 2s + 1ae, XXII to XXIII — 1s each, XXIV to XXVI — 2s each, XXVII–XXVIII — 4s + 1ae + 1 small spine-like seta situated near base of aesthetasc (Fig. 1I).

Antenna (Fig. 3A, B), coxa with 1 seta, basis with 2 setae, exopod 8-segmented with 2, 2, 1, 1, 1, 1, 1 (vestigial) and 3 setae; exopod slightly longer (about 1.1 times) than endopod; first endopodal segment with 2 setae, second with 8 and 7 or 8 setae as intrespecific variation.

Mandible (Fig. 1J–M), gnathobase with 5 large and 2 small teeth plus dorsal seta; basis with 1 seta, exopod of 5 segments with 1, 1, 1, 1 and 2 setae; endopod segment 1 with 1 seta, segment 2 with 4 setae.

Maxillule (Fig. 2B–E), praecoxal endite with 9 long and 2 small setae, length of smaller setae varies, sometimes one much smaller (Fig. 2D-E), coxal endite with 4 setae; proximal basal endite with 2 long and 1 short setae; distal basal endite with 4 setae, 1 of them longer and thicker than others; endopod with 12 setae; exopod with 11 setae; coxal epipodite with 9 setae.

Maxilla (Fig. 2A), praecoxal and proximal coxal endites with 3 setae each; proximal basal endite with 3 setae, of these 1 thicker and more sclerotized, spine-like; distal basal endite plus ramus with 8 setae: 6 long and 2 small setae. Praecoxal and coxal endites with short surface spinules.

Maxilliped (Fig. 2F–H), syncoxa with 1 seta on proximal praecoxal endite, 2 setae on middle endite, 3 setae and rows of surface spinules on distal praecoxal endite; coxal endite with 3 setae and small sensory appendage. Basis with 3 medial and 2 distal setae. Endopod of five segments with 4, 4, 3, 3+1 and 4 setae.

P1 (Fig. 3C–E), coxa without seta, basis with small distolateral seta, medial distal seta curved; endopod 1-segmented with poorly developed lateral lobe ornamented with denticles, and patch of denticles on anterior surface. Size of denticles on lateral lobe varies in different specimens (Fig. 3C, E). Exopod segments 1, 2 and 3 with 1 lateral spine each; spine of exopod segment 1 reaching close to midlength of following spine, spine of exopod segment 2 not reaching base of following spine. Spines of exopod segments 1 and 2 densely pubescent on internal surface.

P2 (Fig. 2F), coxa with medial seta; basis without seta; endopod of 2 segments; exopod of 3 segments, lengths of outer spines as figured.

P3–P4 (Fig. 2G–H), coxa with medial seta, basis without seta; endopod and exopod of 3 segments.

Male unknown.

Etymology. The species epithet is given for the type locality in the Weddell Sea. Gender masculine.

Remarks. *Bradyetes* includes 3 species: *B. inermis* Farran, 1905, *B. pacificus* Ohtsuka, Boxshall et Shimomura, 2005 and deviating in the setation of mandibular palp, maxillule and maxilla (see Table 1) species *B. matthei* Johannessen, 1976. The new species *B. weddellanus* fits well the generic definition, but differs from congeners by i) larger size (less than 4.15 mm for remaining species); ii) a very small sensory appendage on coxal endite of maxilliped syncoxa (shares with *B. matthei*, Table 1); iii) a short

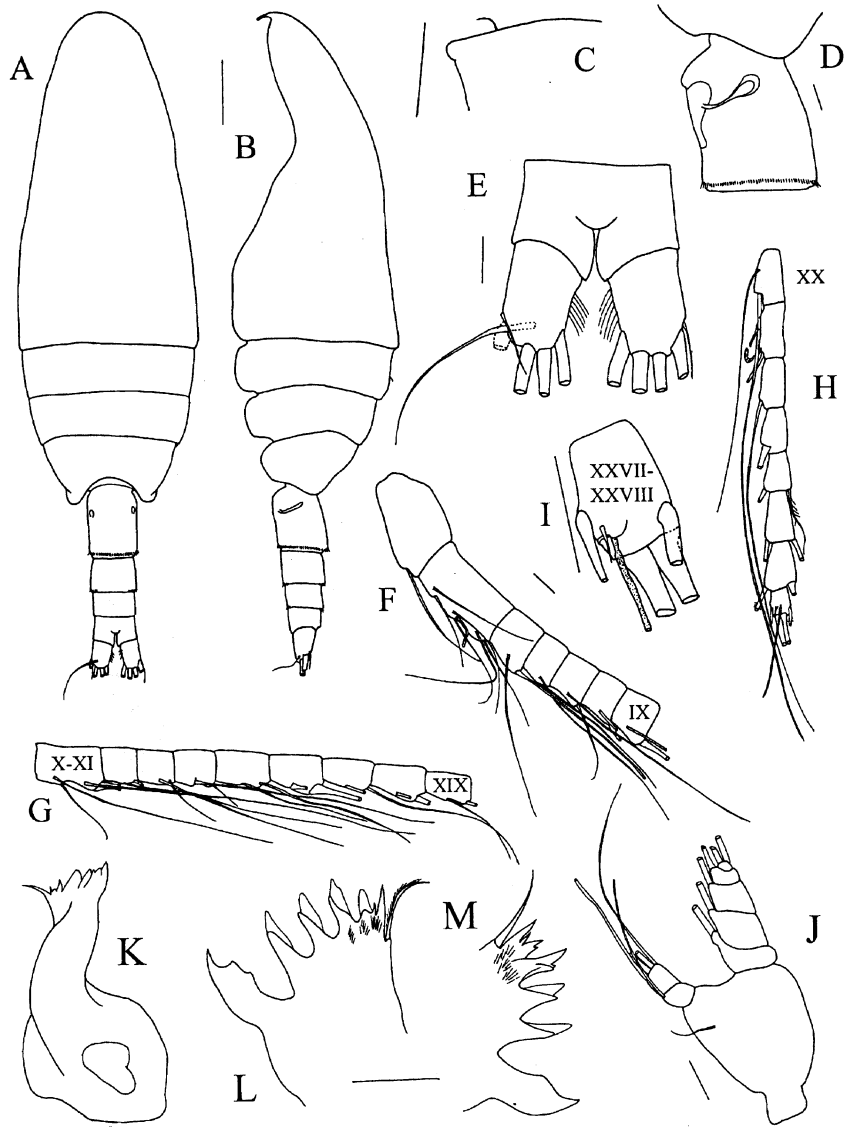

Fig. 1. *Bradyetes weddellanus* **sp.n.** Female, paratype.
A — habitus, dorsal; B — habitus, left lateral view; C — rostrum, left lateral view; D — posterior prosome and genital double-somite, left lateral view; E — anal segment and caudal rami, dorsal view (right ventral seta broken). F — antennule, segments I (1st) to IX (7th), segment 2 is a complex of ancestral segments II–IV; G — antennule, segments X (8th) – XIX (16th); H — antennule, segments XX (17th) to XXVIII (24th), segment 24 is a complex of ancestral segments XXVII–XXVIII; I — antennule, distal segment XXVII – XXVIII (24th); J — mandibular palp; K — mandibular gnathobase; L, M — cutting edge of mandibular gnathobase (different limbs). Scales: A, B — 0.5 mm, remaining figures 0.1 mm.

Рис. 1. *Bradyetes weddellanus* **sp.n.** Самка, паратип.
A — общий вид, вид со спины; B — общий вид, слева; C — рострум, слева; D — задняя часть просомы и генитальный сомит, слева; E — анальный сомит и каудальные ветви, вид со спины (правая вентральная щетинка сломана). F — антеннула, сегменты с I (1-го) по IX (7-й), сегмент 2 — комплекс анцестральных сегментов II–IV; G — антеннула, сегменты X (8-й) – XIX (16-й); H — антеннула, сегменты XX (17-й) – XXVIII (24-й), сегмент 24 — комплекс анцестральных сегментов XXVII–XXVIII; I — антеннула, дистальный сегмент XXVII – XXVIII (24-й); J — щупик мандибулы; K — гнатобаза мандибулы; L, M — жующий край мандибулы (разные конечности). Масштаб: A, B — 0,5 мм, остальные рисунки — 0,1 мм.

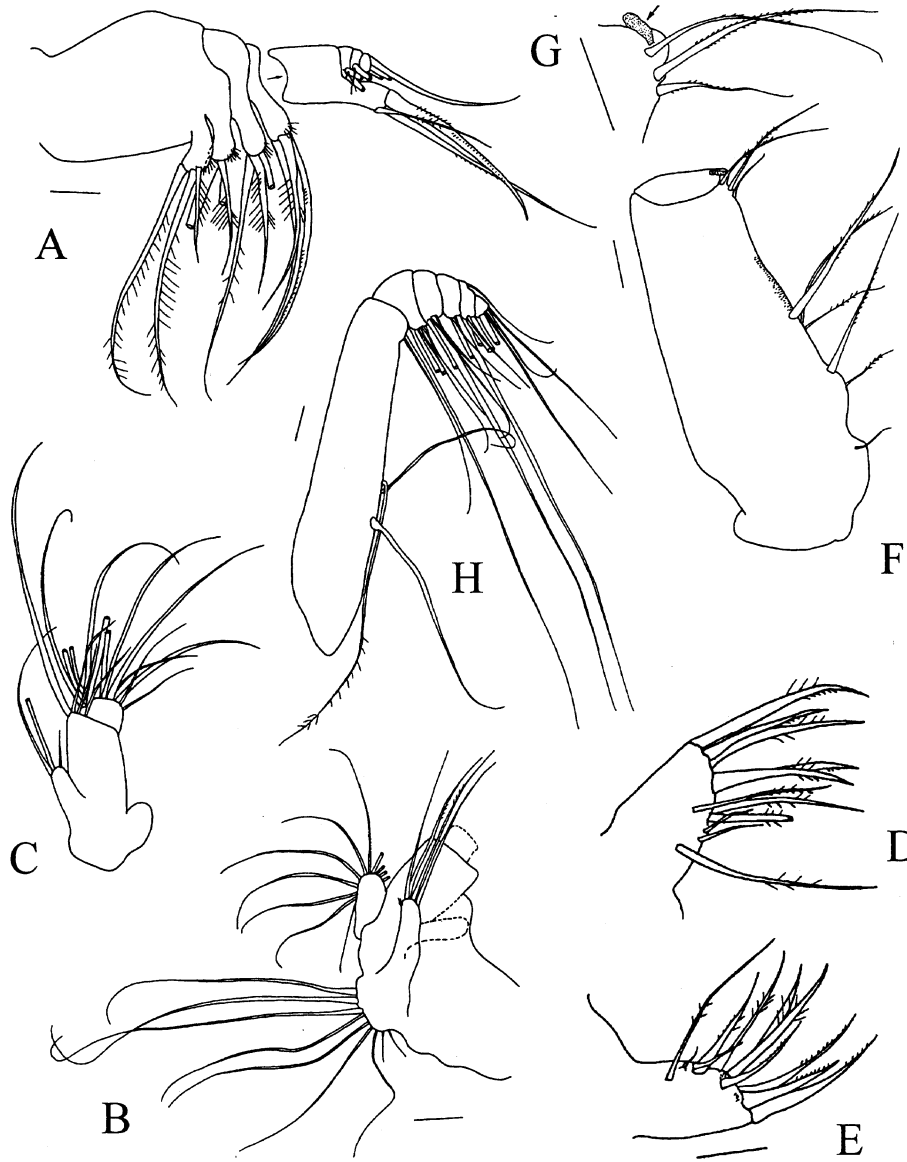

Fig. 2. *Bradyetes weddellanus* **sp.n.** Female.
A — maxilla; B — maxillule, setation figured for coxal epipodite, coxal endite and exopod ; C — maxillule, basal endites and endopodite; D, E — maxillule, praecoxal endite (different specimens); F — syncoxa of maxilliped; G — coxal endite of syncoxa of maxilliped (arrow indicates sensory appendage); H — maxilliped, basis and endopod. [D, female of station 141–10, remaining details: paratype]. Scales: 0.1 mm.

Рис. 2. *Bradyetes weddellanus* **sp.n.** Самка.
A — максилла; B — максиллула, вооружение изображено для коксального эпиподита, коксального эндита и экзоподита ; C — максиллула, базальные эндиты и эндоподит; D, E — максиллула, прекоксальный эндит (разные экземпляры); F — синкокса максиллипеды; G — коксальный эндит синкоксы максиллипеды (стрелка указывает на сенсорный придаток); H — максиллипеда, базис и эндоподит. [D, самка со станции 141–10, остальные детали: паратип]. Масштаб 0,1 мм.

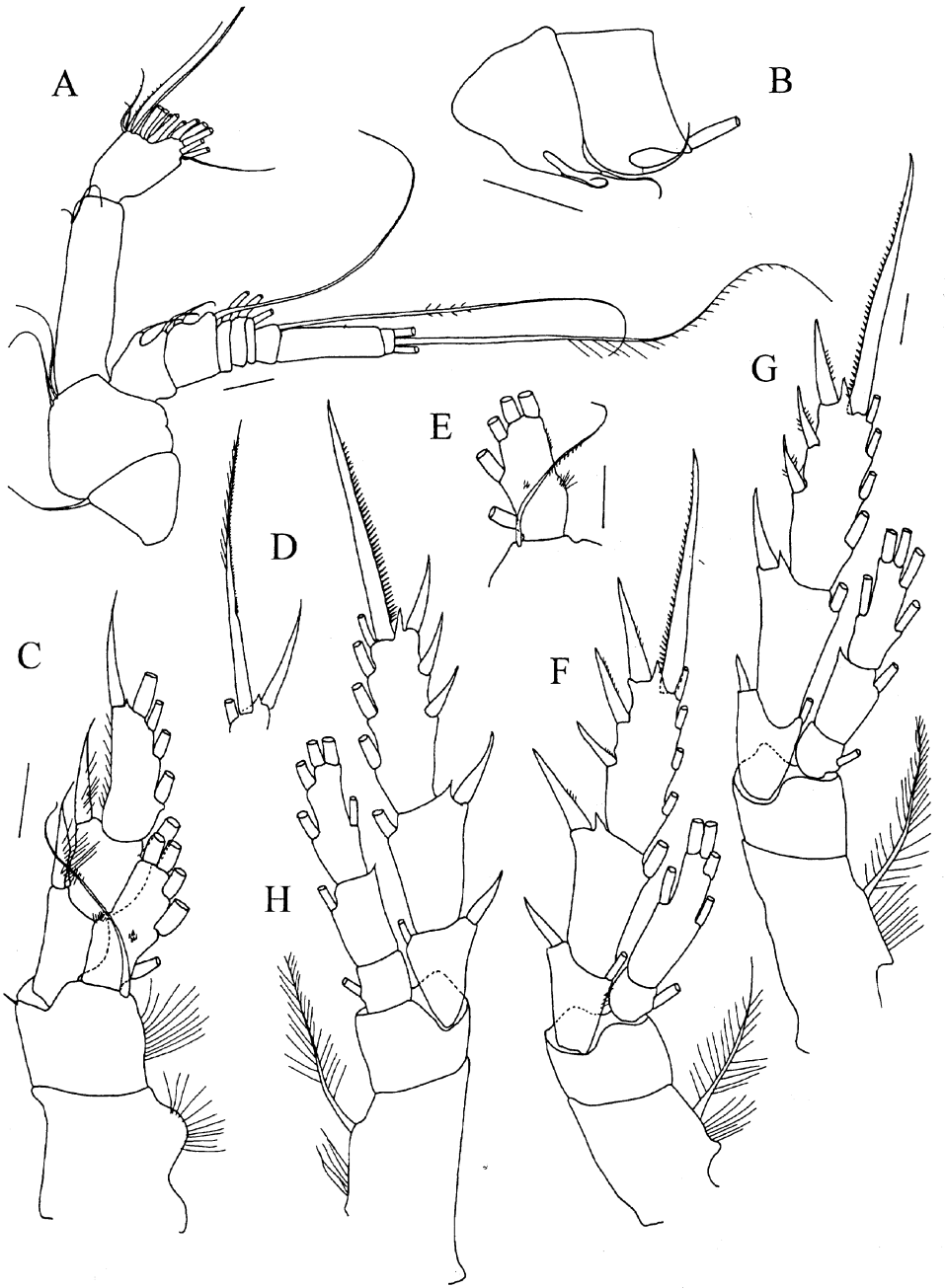

Fig. 3. *Bradyetes weddellanus* **sp.n.** Female.
A — antenna; B — proximal segments of antenna exopod; C — P1, anterior; D — P1, distal part of exopod segment 3; E — P1, anterior, distal part of basis and endopod; F — P2, anterior; G — P3, anterior; H — P4, anterior. E, of female from station 141—10, remaining details of paratype. Scales: 0.1 mm.

Рис. 3. *Bradyetes weddellanus* **sp.n.** Самка.
A — антенна; B — проксимальные сегменты экзоподита антенны; C — P1, вид спереди; D — P1, дистальная часть третьего сегмента экзоподита; E — P1, вид спереди, дистальная часть базального членика и эндоподит; F — P2, вид спереди; G — P3, вид спереди; H — P4, вид спереди. [E, самка со станции 141—10, остальные детали: паратип]. Масштаб 0,1 мм.

lateral spine on P1 exopodal segment 2 (this spine longer in remaining species, Table 1); iv) presence of a small fifth spine-like seta on the distal segment of antennule (absent in other species of the genus); v) presence of a short lateral spine on P3 exopodal segment 1 (shared with *B. curvicornis,* Table 1); vi) rounded posterior corners of prosome (shares with *B. inermis* s.l.); vii) a poorly developed lateral endite of P1 endopod (shared with *B. inermis* sensu Farran (1905) and *B.* cf. *inermis* (Fig. 5A-D, I and Table 1).

Bradyetes curvicornis **sp.n.**
Fig. 4.

Material. Holotype, adult female, dissected, body length 4.14 mm (ZMH K–41167).

Scotia Sea, 59°52' S, 59°59' W, station 129–2, epinet, 23.02.2002, above the sea bed at depths 3643–3622 m. The holotype is deposited at the Zoological Museum Hamburg, University of Hamburg.

Description. Adult female, total length 4.15 mm; prosome 3.35 times longer than urosome. Rostrum as a blunt plate without filaments. Cephalosome and pediger 1 separate, pedigers 4 and 5 separate dorsally and fused laterally; posterior corner ending in short point directed dorsodistally (Fig. 4A–D). Spermathecae narrow, slightly wider in dorsal part (Fig. 4D). Caudal rami with 4 terminal setae, 1 ventral seta (Fig. 4C) and a small lateral subterminal seta; two terminal setae not shown in figure.

Antennule reaching to posterior end of genital double-somite, of 24 free segments, armature differs from *B. weddellanus* in setation of distal segment (XXVII–XXVIII) as 4s + 1ae, small spine-like seta absent.

Antenna (Fig. 4E), coxa with 1 seta, basis with two setae, exopod of 8 free segments with 2, 2, 1, 1, 1, 1, 1 (vestigial) and 3 setae, exopod nearly as long as endopod; first endopodal segment with 2 setae, second with 8 and 7 setae.

Mandible similar to that of *B. weddellanus*, but with 5 setae (instead of 4) on endopod segment 2 (Table 1).

Maxillule endopod with 14 setae, 8 of these thick, long and strongly sclerotized; in other characters as in *B. weddellanus* (Table 1).

Maxilla similar to that of *B. weddellanus*.

Maxilliped (Fig. 4F) coxal endite of syncoxa with very long sensory appendage; in other features as in *B. weddellanus* (Table 1).

P1 (Fig. 4G), endopod with group of denticles on anterior surface near base of second medial seta; lateral lobe well developed, ornamented with denticles; lateral spines of exopod segments 1 and 2 curved distally; lateral spine of segment 3 thinner and longer than spines of segments 1 and 2; spines of exopod segments 1 and 2 pubescent on inner surface.

P2–P4 similar to those of *B. weddellanus*.

Male unknown.

Etymology. The species epithet is given for the posterior horn-like corners of prosome curved posteriodorsally. Gender masculine.

Remarks. The new species is a large-sized species like *B. weddellanus* (all remaining congeners are smaller, Table 1). *B. curvicornis* is distinguished from other species of the genus by: i) 5 setae on the second endopodal segment of mandible (3, 4 or 9 setae in congeners, Table 1); ii) 14 setae on maxillule endopod (12 or 15 setae in other species of *Bradyetes*, Table 1); iii) a very long sensory appendage of coxal endite on the syncoxa of maxilliped (Fig. 4F, Table 1).

Bradyetes cf. *inermis*
Fig. 5.

Material. 1 female, South Atlantic, 41°08'S, 09°56'E, station 016–10, supranet, 26.01.2005, above the sea bed at depths 4725–4469 m; 3 females from stations 046–7, supranet, and 140–9, supranet, Southern Ocean (60°38' S 53°57' W and 58°16' S, 24°54' W, respectively), 30.01 and 22.03.2002 above the sea bed at depths between 2889 and 3005 m.

Description. Adult female, total length 2.95 mm; prosome 3.20 times longer than urosome.

Rostrum as a blunt plate without filaments (Fig. 5E). Cephalosome and pediger 1 fused to the cephalosome, pedigers 4 and 5 separate; posterior corners of prosome rounded (Fig. 5A–D). Caudal rami with 4 terminal setae, 1 ventral seta and a small lateral subterminal seta; some setae broken and not shown in Fig. 5C.

Antennule slightly exceeding posterior border of genital double-somite.

Antenna (Fig. 5F), basis with 2 setae, exopod of 8 free segments with 2, 2, 1, 1, 1, 1, 0 and 3 setae, exopod about 1.1 times longer than endopod; first endopodal segment with 2 setae, second with 8 and 7 setae.

Mandible similar to *B. weddellanus* (Table 1).

Maxillule praecoxal arthrite with 10 setae, proximal basal endite with 1 very long seta: epipodite with only 7 intact setae; other characters as in *B. weddellanus* (Table 1).

Maxilla similar to *B. weddellanus*.

Maxilliped (Fig. 5H) coxal endite of syncoxa with sensory appendage nearly 1.5 times longer than longest distal seta (Fig. 5H, Table 1); basis and endopod similar to *B. weddellanus*.

P1 (Fig. 5I), medial seta of basis not curved or recurved; lateral lobe of endopod poorly developed, lacking denticles; anterior surface of endopod without denticles; lateral spine of exopod segment 1 extending to distal third of lateral spine 2; lateral spine of segment 2 extending beyond base of lateral spine 3. Spines of exopod segments 1 and 2 pubescent on inner surface.

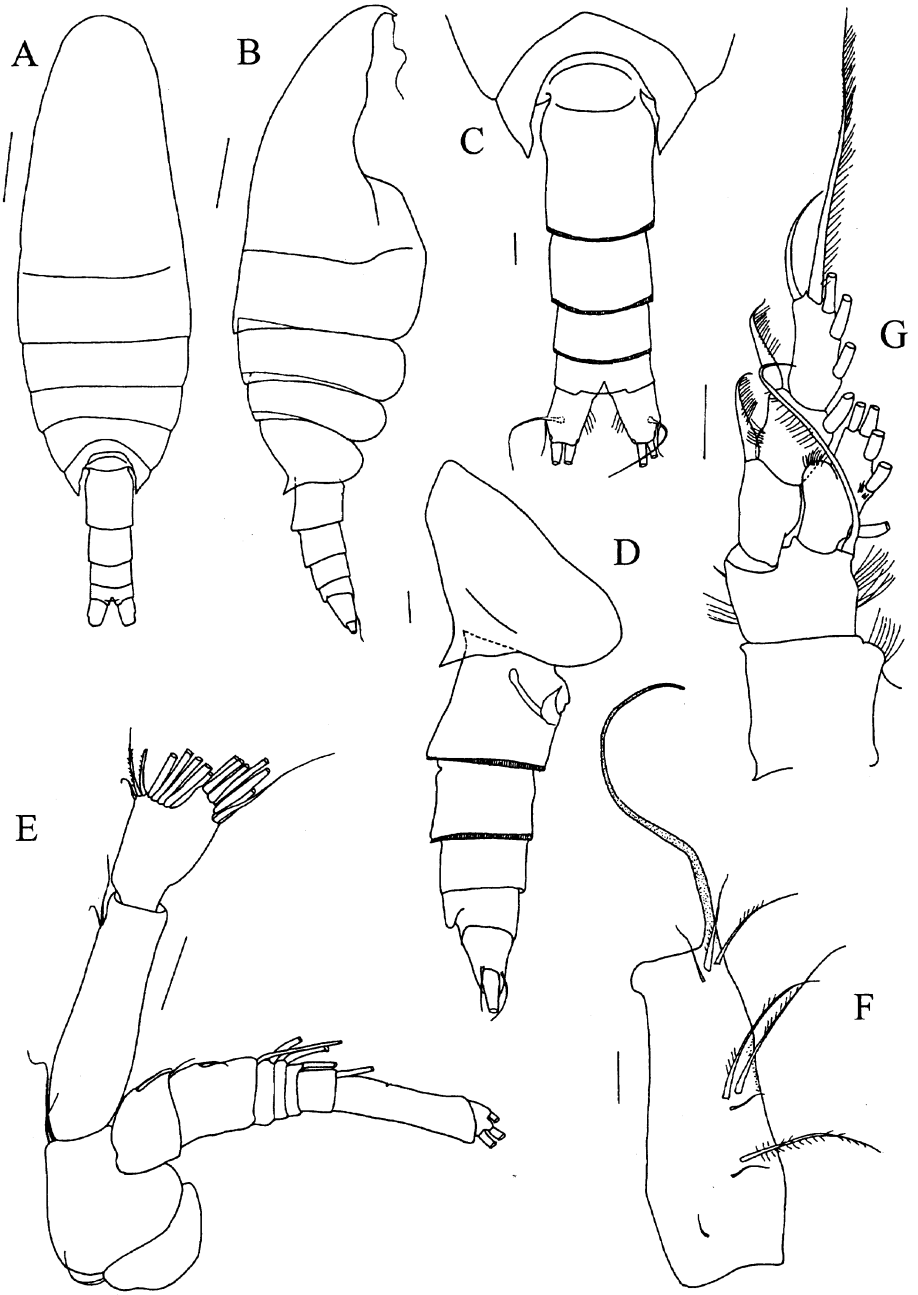

Fig. 4. *Bradyetes curvicornis* **sp.n.** Female, holotype.
A — habitus, dorsal; B — habitus, right lateral view; C — posterior prosome and urosome, dorsal view; D — posterior prosome and urosome, right lateral view; E — antenna; F — syncoxa of maxilliped; G — P1. Scales: A, B — 0.5 mm, remaining figures 0.1 mm.

Рис. 4. *Bradyetes curvicornis* **sp.n.** Самка, голотип.
A — общий вид, вид со спины; B — общий вид, справа; C — задняя часть просомы и уросома, вид со спины; D — задняя часть просомы и уросома, справа; E — антенна; F — синкокса максиллипеды; G — P1. Масштаб: A, B — 0,5 мм, остальные детали — 0,1 мм.

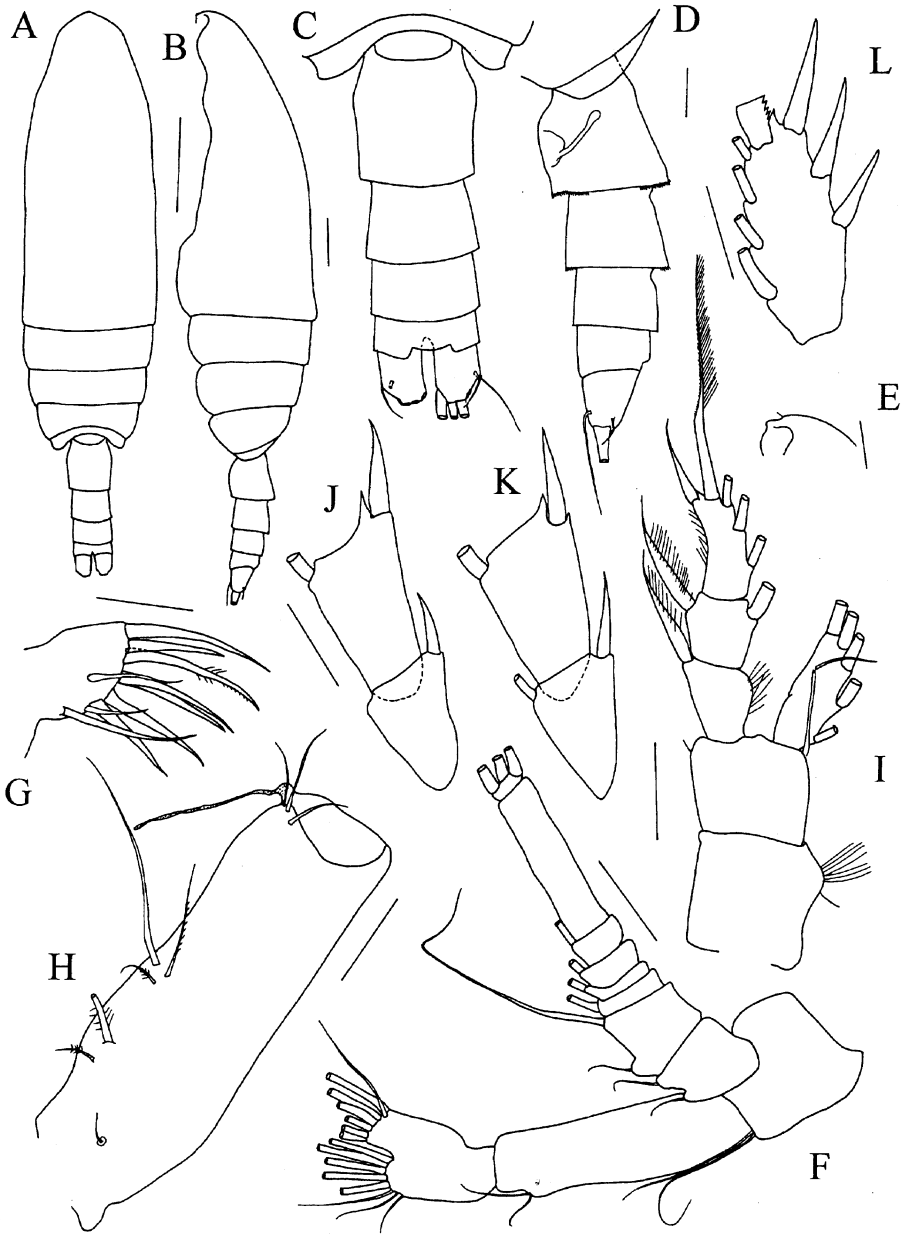

Fig. 5. *Bradyetes* cf. *inermis*. Female.
A — habitus, dorsal; B — habitus, left lateral view; C — posterior prosome and urosome, dorsal view; D — posterior prosome and urosome, left lateral view; E — rostrum, left lateral view; F — antenna; G — maxillule, praecoxal arthrite; H — maxilliped, syncoxa; I — P1; J — P3, exopodal segments 1 and 2; K — P4, exopodal segments 1 and 2; L — P2, exopodal segment 3. Scales: A, B — 0.5 mm, remaining figures 0.1 mm.

Рис. 5. *Bradyetes* cf. *inermis*. Самка.
A — общий вид, вид со спины; B — общий вид, слева; C — задняя часть просомы и уросома, вид со спины; D — задняя часть просомы и уросома, слева; E — рострум, слева; F — антенна; G — максиллула, прекоксальный артрит; H — максиллипеда, синкокса; I — P1; J — P3, сегменты экзоподита 1 и 2; K — P4, сегменты экзоподита 1 и 2; L — P2, третий сегмент экзоподита. Масштаб: A, B — 0,5 мм, остальные детали — 0,1 мм.

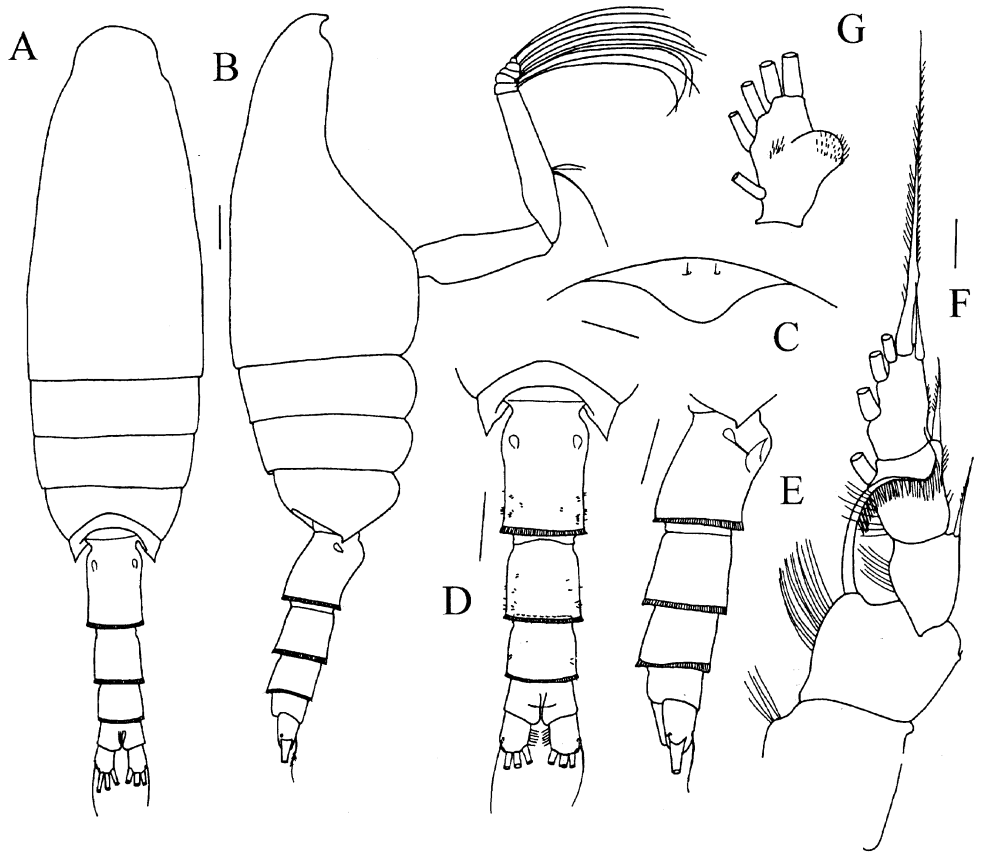

Fig. 6. *Pseudeuchaeta acuticornis* **sp.n.** Female, holotype.
A — habitus, dorsal; B — habitus, right lateral view; C — rostrum, ventral view; D — posterior prosome and genital double-somite, dorsal view; E — posterior prosome and genital double-somite, right lateral view (small dorsal subterminal seta broken); F — P1 (endopod omitted); G — P1 endopod. Scales: A–D, D–E — 0.5 mm, remaining figures 0.1 mm.

Рис. 6. *Pseudeuchaeta acuticornis* **sp.n.** Самка, голотип.
A — общий вид, вид со спины; B — общий вид, справа; C — рострум, вентрально; D — задняя часть просомы и генитальный сомит, вид сзади; E — задняя часть просомы и генитальный сомит, справа (маленькая дорсальная субтерминальная щетинка сломана); F — P1 (без эндоподита); G — P1 эндоподит. Масштаб: A–B, D–E — 0,5 мм, остальные детали 0,1 мм.

P2 (Fig. 5L), lateral spines of exopod segment 3 about subequal in size, other characters as in *B. weddellanus*.

P3 (Fig. 5J) outer distal spine of exopodal segment 2 about 1.5 times longer than spine of exopodal segment 1. P4 (Fig. 5K) outer distal spine of exopodal segment 2 about 1.1 times longer than spine of exopodal segment 1. Other characters of swimming legs similar to those of *B. weddellanus* (Table 1).

Remarks. *B. inermis* was originally described by Farran (1905) from a single female from the northwestern coast of Ireland. Grice (1972) recorded males and females from the NW Atlantic and the male of *B. inermis* was the first male of the genus to be described. The species was also reported from Madeira in the NE Atlantic by Vives (1982) who did not provide any figures. Farran (1905) gave the size of the female as 2.57 mm, while Grice (1972) reported the length of females ranging between 3.00 and 3.20 mm. However, up to now descriptions of *B. inermis* are not very detailed and suffer from some inconsistencies, i.e. the lateral lobe of P1 endopod is figured as being well-developed by Grice (1972: Fig. 10), but it is poorly-developed in drawings by Farran (1905). The present specimens from the Southern Ocean are considered *Bradyetes* cf. *inermis* until the type specimens can be redescribed or specimens from the type locality in the N Atlantic have been described.

Pseudeuchaeta acuticornis **sp.n.**
Figs 6–8.

Material. Holotype, adult female, partly dissected, body length 8.10 mm (ZMH K– 41166) Weddell Sea, 67°31' S, 00°00' E, station 059–5, supranet, 14.02.2005, above the sea bed at depths 4655–4651 m. The holotype is deposited at the Zoological Museum Hamburg, University of Hamburg.

Description. Adult female, total length 8.10 mm; prosome 2.3 times longer than urosome. Rostrum as a blunt plate without filaments (Fig. 6C). Cephalosome and pediger1 fused and pedigers 4 and 5 fused laterally and separate dorsally; posterior corners pointed (Fig. 6A–B, D–E). Spermathecae narrow ventrally and oblong-globular dorsally (Fig. 6E). Caudal rami with 4 terminal setae, 1 ventral seta and a small dorsolateral subterminal seta (Fig. 6D–E).

Antennule extending to distal part of pediger3. Antennule (Fig. 7A–E), of 24 free segments, armature as follows: I — 1s, II–IV — 2s + [2s + 1ae] +2s, V — 2s + 1ae, VI toVII — 2s each, IX — 1s, X–XI — 4s+1ae, XII — 1s, XIII — 2s, XIV — 2s+1ae, XV toXX — 2s each, XXI — 1s + 1ae, XXII toXXIII — 1s each, XXIV to XXVI — 2s each, XXVII–XXVIII — 4s + 1ae.

Antenna (Fig. 7F), coxa with 1 seta, basis with 1 seta, exopod of 9 free segments (second and third segments partly fused), with 2, 1, 1, 1, 1, 1, 1, 0 and 3 setae; exopod nearly as long as endopod; first endopodal segment without seta, second with 8 and 6 setae.

Mandible (Fig. 7G–I), gnathobase with 6 strong teeth plus seta; basis with 1 seta, exopod of 5 segments with 1, 1, 1, 1 and 2 setae; endopod segment 1 with 1 seta, endopod segment 2 with 5 setae, 2 of these very small.

Maxillule (Fig. 7J–K), praecoxal endite with 10 setae and small spinules present near base of 2 distal setae. Coxal endite with 3 setae and tiny denticles near base of setae; proximal basal endite with 1 long and 2 shorter setae; distal basal endite with 5 setae; endopod with 16 setae, of these 12 setae long and well sclerotized, 3 short and thin, and 1 small, vestigial; exopod with 11 setae; coxal epipodite with 9 setae.

Maxilla (Fig. 8A–B), praecoxal and coxal endites with 3 setae each; proximal basal endite with 3 setae of nearly same shape; distal basal endite with 1 seta, ramus with 5 setae, all well sclerotized. Praecoxal and coxal endites supplied with short surface spinules.

Maxilliped (Fig. 8C–E), syncoxa with 1 small seta on proximal praecoxal endite, 2 setae on middle endite, 3 setae and row of surface spinules between distal praecoxal and coxal endites; coxal endite with 3 setae and finger-like sensory appendage. Basis with 3 medial (1 broken) and 1 distal setae. Endopod 5-segmented with 4, 4, 3, 3+1 and 4 setae; 1 seta of terminal segment and lateral seta of penultimate segment very small, vestigial.

P1 (Fig. 6F–G), coxa without seta, basis with small distolateral seta, and medial distal seta strongly curved; endopod 1-segmented with well developed lateral lobe ornamented with denticles, and a group of denticles on anterior surface. Exopod segments 1, 2 and 3 with lateral spines each; spine of exopod segment 1 not reaching base of following spine, spine of exopod segment 2 reaching base of following spine. Spines of exopod segments 1 and 2 with short sparse hairs along inner border.

P2 (Fig. 8G), coxa with medial seta; basis without seta; endopod 2-segmented; exopod 3-segmented.

P3 (Fig. 8H), coxa with medial seta, basis without seta; endopod and exopod of 3 segments.

P4 (Fig. 8I), coxa apparently with seta broken, basis without seta, endopod and exopod of 3 segments.

Male unknown.

Etymology. The species epithet is given for the acute shape of posterior corners of the prosome. Gender masculine.

Remarks. *Pseudeuchaeta* includes 6 species (*P. brevicauda* Sars, 1905, *P. major* Wolfenden, 1911, *P. flexuosa* Bradford, 1969, *P. magna* Bradford, 1969, *P. arctica* Markhaseva, 1986, and *P. spinata* Markhaseva, 1986). To date only *P. brevicauda* has been recorded from the Southern Ocean (Park, 1978; Markhaseva, 1996).

Pseudeuchaeta acuticornis is distinguished from congeners by: i) presence of a lateral spine on P1 exopod segment 1 (character shared with *P. spinata*); ii) 5 setae on mandible endopod 2 (shared with *P. major*), (3, 4, 7, 8/9 setae in other species of the genus); iv) 10 setae on maxillule praecoxal arthrite (shared with *P. major*; 11–13 setae in other congeners); v) 3 setae on maxillule coxal endite (shared with *P. major*; 2 or 4 setae in other species of *Pseudeuchaeta*); vi) the most primitive, incompletely 9-segmented antenna exopod is shared with *P. flexuosa*. Some other characteristics are listed in Table 2. The new species resembles the rather poorly described *P. major*, however, it differs in the presence of a lateral spine on P1 exopodal segment 1, shape of the posterior corners of prosome and in setation of maxillule proximal basal endite (Table 2).

Discussion

Sewell (1947) and Grice (1972) emphasized the close relationship of *Pseudeuchaeta* and *Bradyetes* considering, however, a morphological difference between both genera in the presence of 1 enlarged seta on the proximal

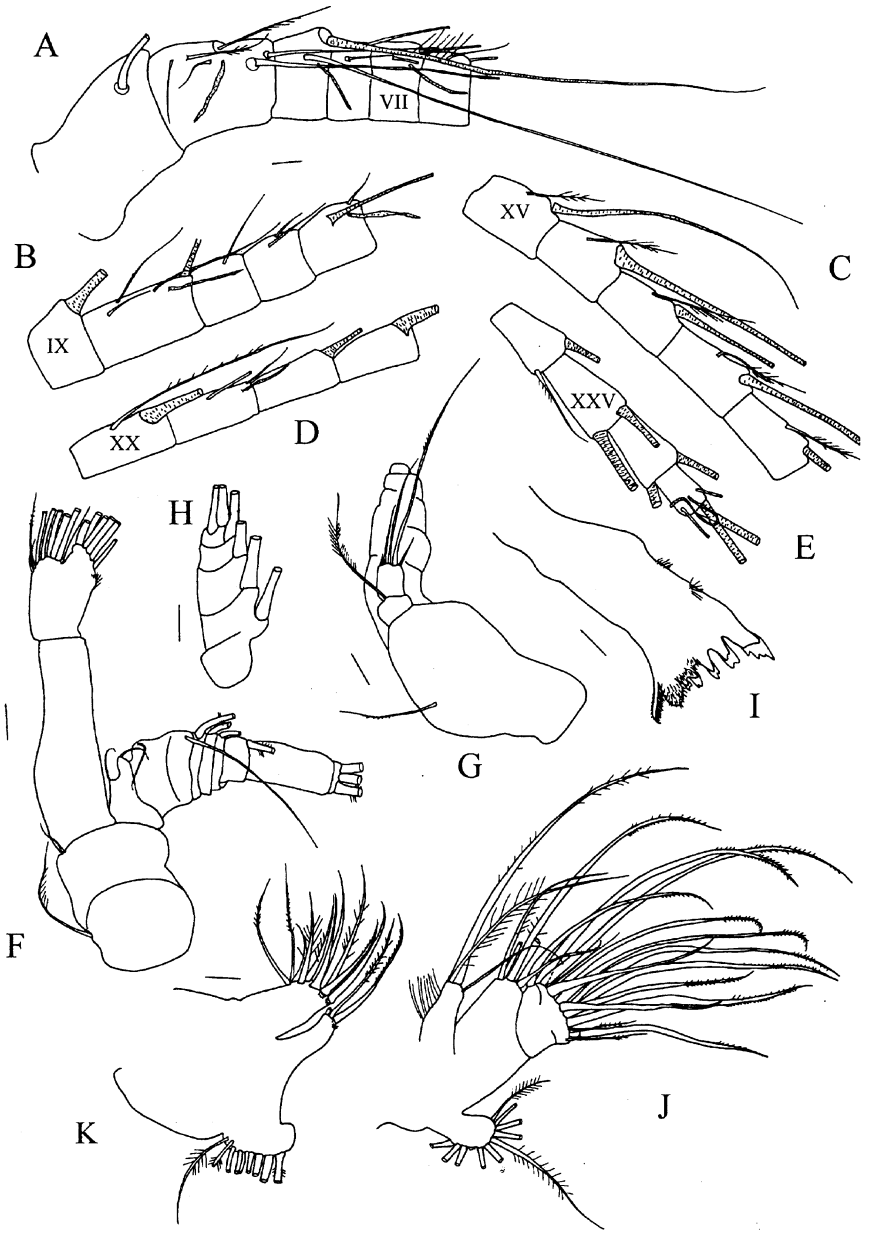

Fig. 7. *Pseudeuchaeta acuticornis* **sp.n.** Female, holotype.

A — antennule, segments I (1st) to VIII (6th); B — antennule, segments IX (7th) to XIV (11th); C — antennule, segments XV (12th) to XIX (16th); D — antennule, segments XX (17th) to XXIII (20th); E — antennule, segments XXIV (21st) to XXVIII (24th); F, antenna; G — mandibular palp; H — mandible, exopod; I — mandibular gnathobase; J — maxillule, basis, endopod and exopod (1 seta broken); K — maxillule, praecoxal arthrite, coxal endite and epipodite. Scales 0.1 mm.

Рис. 7. *Pseudeuchaeta acuticornis* **sp.n.** Самка, голотип.

A — антеннула, сегменты с I (первого) по VIII (6-й); B — антеннула, сегменты с IX (7-й) по XIV (11-й); C — антеннула, сегменты с XV (12-го) по XIX (16-й); D — антеннула, сегменты с XX (17-го) по XXIII (20-й); E — антеннула, сегменты с XXIV (21-го) по XXVIII (24-й); F, антенна; G — щупик мандибулы; H — мандибула, экзоподит; I — мандибула, гнатобаза; J — максиллула, базис, эндоподит и экзоподит (1 щетинка сломана); K — максиллула, прекоксальный артрит, коксальный эндит и эпиподит. Масштаб 0,1 мм.

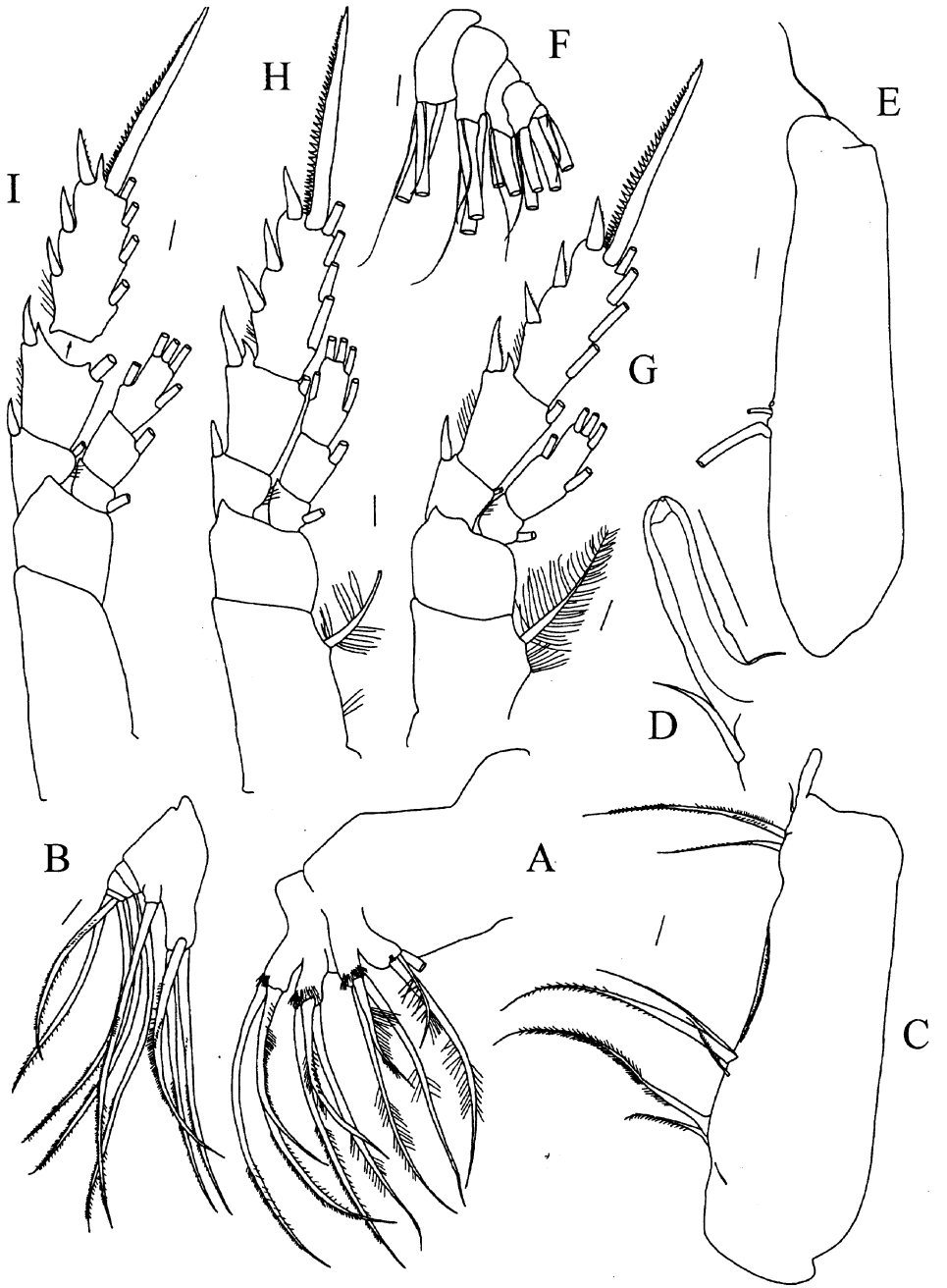

Fig. 8. *Pseudeuchaeta acuticornis* **sp.n.** Female, holotype.
A — maxilla, praecoxal and coxal endites; B — maxilla, basal endites and ramus; C — maxilliped, syncoxa; D — sensory appendage of coxal endite with adjacent seta; E — maxilliped, basis (1 seta broken); F — maxilliped, endopod; G — P2; H— P3; I— P4. Scales 0.1 mm.

Рис. 8. *Pseudeuchaeta acuticornis* **sp.n.** Самка, голотип.
А — максилла, прекоксальные и коксальные эндиты; В — максилла, базальные эндиты и ветвь; С — максиллипеда, синкокса; D — сенсорный придаток коксального эндита с прилежащей щетинкой; Е — максиллипеда, базис (1 щетинка сломана); F — максиллипеда, эндоподит; G — P2; H — P3; I — P4. Масштаб 0,1 мм.

Character	*B. inermis*	*B.* cf. *inermis*	*B. matthei*
Total length (mm)	2.57-3.20	2.95	1.19-1.32
Prosome/urosome ratio	-	3.2	-
Cephalosome & pedigerous somite 1	partly separated	fused	partly separated
Pedigerous somites 4 & 5	fused	fused	partly separated
Shape of posterior corners of prosome	rounded	rounded	pointed
Posterior corners of prosome dorsally	not bifurcate	not bifurcate	not bifurcate
Length of antennule	slightly longer than prosome	exceeding posterior border of genital double-somite	extending to posterior border of pediger 3
Antenna: setation of coxa/basis/Enp1	1/1/2	?/2/2	1/2/2
Presence and length of seta on penultimate segment of antenna exopod	absent	absent	present, long
Mandible: setation of basis/Enp1/Enp2	1/1/3	1/1/4	2/2/9
Maxillule: setation of praecoxal endite setation of coxal endite setation of proximal basal endite setation of distal basal endite setation of Enp setation of Exp setation of epipodite	-	 10 4 3 4 12 11 7+?	 13 5 4 5 15 10 9
Maxilla: setation of terminal part (distal basal endite & exopod)	?	6 +2	6
Maxilla: setation of proximal basal endite	1 thin, short seta, 1 longer seta, thick, claw-like + 1 thin seta, the longest	1 thin, short seta, 1longer seta, thick, claw-like + 1thin seta, the longest	1 thick claw-like seta + 2 thin longer setae
Length of sensory appendage on coxal endite of maxilliped syncoxa	nearly as long as longest distal seta	nearly 1.5 times length of longest distal seta	much shorter than longest distal seta
P1 Enp lateral endite	moderately/poorly developed	poorly developed	well developed
P1 Exp lateral spine 1	extending to distal third of lateral spine 2	extending to distal third of lateral spine 2	extending base of lateral spine 2
P1 Exp lateral spine 2	extending base of lateral spine 3	extending base of lateral spine 3	extending base of lateral spine 3

Table 1. Selected character states of species included in *Bradyetes* (females).
Таблица 1. Основные признаки, характеризующие виды, включенные в *Bradyetes* (по самкам).

B. pacificus	***B. weddellanus* sp.n.**	***B. curvicornis* sp. n.**
2.96-2.98	4.75-5.50	4.15
3.4	2.6-2.9	3.35
partly separated	fused	separate
partly separated	fused	partly separated
pointed	rounded	pointed
bifurcate	not bifurcate	not bifurcate
extending to posterior border of pediger 3	nearly as long as prosome, or exceeding prosome by distal segment	extending to posterior border of genital somite
1/2/2	1/2/2	1/2/2
present, long	present, vestigial	present, vestigial
1/0/4	1/1/4	1/1/5
13 4 3 4 12 11 6	11 4 3 4 12 11 9	11 4 3 4 14 11 9
6+2	6+2	6+2
1 thin, short seta, 1longer seta, thick, claw-like + 1 seta, the longest	1 thin, short seta, 1 longer seta, thick, claw-like + 1thin seta, the longest	1 thin, short seta, 1 longer seta, thick, claw-like + 1 thin seta, the longest
more than twice length of longest distal seta	about 6 times shorter than longest distal seta	about 3 times length of longest distal seta
well developed	moderately or poorly developed	well developed
extending to distal third of lateral spine 2	nearly to mid-length of lateral spine 2	apparently extending to the distal third of lateral spine 2
extending base of lateral spine 3	not reaching base of lateral segment 3	slightly extending base of lateral spine 3
0.85	1.04	about 1.2

P3 Exp 2 and Exp 1, lateral spines length	-	Exp2 about 1.5 times longer	Exp2 about 1.4 times longer

Character	*P. arctica*	*P. brevicauda*	*P. flexuosa*
Total length (mm)	10.30-10.50	4.80-6.58	6.8
Prosome/urosome ratio	2.8-3.0	3.4-3.9	3.5
Cephalosome & pedigerous somite 1	partly fused	separate	partly fused
Pedigerous somites 4 & 5	partly fused	separate	partly fused
Shape of posterior corners of prosome, lateral view	pointed, directed slightly upwards	rounded-triangular	pointed, directed upwards
Length of antennule	about as long as prosome	extending to anterior border or to the end of pedigerous somite 5	shorter than prosome
Presence of seta on penultimate segment of antenna exopod	present	absent	absent
Antenna: setation of coxa/basis/Enp1	1/1/0	1/1/0	1/1/0
Mandible: seation of basis/Enp1/Enp2	1/1/8	1/1/8-9	1/1/7
Maxullule:			
setation of praecoxal endite	12	13	?
setation of coxal endite	4	4	4
setation of proximal basal endite	3	3	3
setation of distal basal endite	5	5	5
setation of Enp	15	13-14	14
setation of Exp	11	11	11
setation of epipodite	9	8	9
Maxilla : setation of terminal part (distal basal endite & exopod)	6	6	6
Maxilla: setae on proximal basal endite	similar shape and length	similar shape and length	? similar shape and length
Length of sensory appendage on coxal endite of maxilliped syncoxa	shorter than distal setae	shorter than longest distal seta	shorter than distal setae
P1 Exp lateral spine 1	absent	absent	absent

Table 1 (continuing).
Таблица 1 (продолжение).

Exp2 about 2 times longer	Exp2 ca. 2.4 times longer	Exp2 ca. 2.4 times longer

Table 2. Selected character states of species included in *Pseudeuchaeta* (females).
Таблица 2. Основные признаки, характеризующие виды, включенные в *Pseudeuchaeta* (по самкам).

P. magna	***P. major***	***P. spinata***	***P. acuticornis* sp.n.**
9.4	8.15	6.50	8.10
4.0	?	3.1	2.3
partly fused	separate	partly fused	fused
partly fused	fused	partly fused	partly fused
short straight points	short straight points	rounded-triangular	pointed, directed slightly upwards
nearly as long as prosome	slightly shorter than prosome	exceeding prosome	Extending to posterior part of pedigerous somite 3
absent	?	absent	absent
1/1/0	?	1/1/0	1/1/0
1/1/4	/?/?/5	3-4/1/1	1/1/5
11 2 3 5 14 11 9	?10 3 ?4 ? 15 ? 9	11 4 3 5 15-16 11 9	10 3 3 5 16 11 9
6	?	6	6
?	?	similar shape and length	similar shape and length
shorter than distal setae	present, length ?	longer than distal setae	shorter than distal setae
absent	absent	present	present

basal endite of maxilla and "the setae on the distal end of maxilliped normal" in *Bradyetes*, while in *Pseudeuchaeta* although none of these setae is enlarged "the distal setae of the maxilliped have transverse lamellae" (Grice, 1972: 234). Some additional characters distinguishing these genera are proposed below and in Tables 1, 2.

Pseudeuchaeta, apparently, appears to be a more derived genus than *Bradyetes* on account of: i) antenna basis with 1 seta (2 setae in the latter, except for *B. inermis*, see Table 1); ii) antenna endopod segment 1 without seta (2 setae in *Bradyetes*); iii) maxilla distal basal endite plus ramus with 6 setae (6 plus 2 small setae in *Bradyetes*, except for *B. matthei*, see Table 1).

Further, maxillule endopod, maxilla, and maxilliped of *Pseudeuchaeta* are marked by robust setae (Figs 6B, 7J, 8A–B) that are typical of predatory copepods.

However, among Aetideidae both *Bradyetes* and *Pseudeuchaeta* share a most primitive antennal segmentation pattern of the proximal exopodal segments: 2 segments are fused to form the most proximal segment in a compound segment bearing 2 setae (Fig. 7F), following 2 proximal segments in primitive state are incompletely separate (*B. inermis* see Grice, 1972, Fig. 4, *P. flexuosa* Bradford, 1969 see Fig. 109 and *P. acuticornis* sp.n.) each bearing 1 seta, but in derived state in these genera they are fused in a compound segment bearing 2 setae. The similar fusion pattern is true of *Crassantenna mimorostrata* Bradford, 1969, *Sursamucro spinatus* Bradford, 1969, *Paracomantenna goi* Ohtsuka, Boxshall et Shimomura, 2005 and *Jaschnovia* Markhaseva, 1996, where the two most proximal segments of antenna are compound segments: each bearing 2 setae. In all remaining aetideids the most proximal segment is not compound but the following segment is a compound segment of 3 or even 4 fused segments (see Park, 1978; Markhaseva, 1993, 1996; Schulz, Markhaseva, 2000; Schulz, 2002) resulting in a large segment complex, a morphological pattern highly comparable to that established in bradfordian families of Clausocalanoidea and analyzed by Markhaseva et Ferrari (2005: 160, Fig. 30).

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