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TWO INTERESTING DAMAEID MITES (ACARI, ORIBATIDA, DAMAEIDAE BERLESE, 1896) FROM THE BRITISH ISLES AND SVALBARD (SPITSBERGEN, NORWAY), WITH A DESCRIPTION OF *KUNSTIDAMAEUS ARCTICUS* N.SP.

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ABSTRACT — Two species of the family Damaeidae (Acarina, Oribatida) are described and documented. *Kunstidamaeus arcticus* **n.sp.** was found in Svalbard (Spitsbergen) and differs from all other known species of the genus by having only five pairs of genital setae; by the specific development at the base of the prodorsum, where tubercles *Ba* are replaced by a multiple of small tubercles, by minute and hardly visible spinae adnatae, by the characteristic shape of the sensillus and other characters. The other species, belonging to the genus *Epidamaeus*, was found in North-West England and stands near to *E. floccosus* Behan-Pelletier and Norton, 1985, but differs by the development of sensillus, spinae adnatae unilaterally with one tooth and by the notogastral setae inserted on cuticular thickenings. The single available specimen did not allow us to decide with certainty about it´s specific status, which in the future may prove to be a separate species. The relationships of the two species found are discussed.

KEYWORDS — *Kunstidamaeus*; *Epidamaeus*; *Damaeidae*; arctic; new species.

INTRODUCTION

Oribatid mites of the genus *Kunstidamaeus* and *Epidamaeus* were differentiated at generic level only recently (see Miko, 2006, 2010; Miko and Mourek, 2008). *Kunstidamaeus* Miko, 2006 can be distinguished from *Epidamaeus* (and other *Damaeus* sensu lato) species by presence of typical set of tubercles *Ba* and *La* in dorsosejugal area, absence of centrodorsal tubercles *Da*, and by presence of more or less developed, usually pointed or finger-form perpendicular apophysis *P* laterally on prodorsum. Species of this genus are represented in northern and western Europe by 9 species (see Subías, 2004; updated Internet version 2011), and morphologically can be grouped into three groups (*"lengersdorfi"*, *"tecticola"*, and *"tenuipes"* groups, see Miko and Mourek, 2008 for details). The species of genus *Epidamaeus* are known from a broad range of habitats, mostly in mountain, boreal, subarctic and arctic zones of the Holarctic ecozone, what was well documented by e.g. Behan-Pelletier and Norton (1983, 1985). *Epidamaeus* is a species-rich genus (over 75 species), with many undescribed species still to be expected. At least some of the known species may be, however, after further study transferred to *Kunstidamaeus*. This article brings together the descriptions of two interesting species collected



FIGURE 1: *Kunstidamaeus arcticus* **n.sp.**: A – dorsal view, legs only partly depicted; B – ventral view, legs and gnathosoma only partly depicted (scale bar = 200 μm).

in the British Isles and Spitsbergen, with a designation of *Kunstidamaeus arcticus* as a new species.

MATERIALS AND METHODS

Material has been provided from the collection of the second author (F.D.M.) with details of location and date found given in the descriptions below. The British material (*Epidamaeus* sp.) was collected from sieved coarse detritus and extracted using the standard method of Berlese-Tullgren funnels. Details of the collection and extraction of the Svalbard material are unknown.

All individuals, previously preserved in alcohol, were examined unmounted and studied after maceration in lactic acid in open cavity slides. Holotypes of *K. arcticus* will be deposited in the Acarological collection of Prague National Museum (Czech Republic), whilst paratypes will be kept (in alcohol) in the collections of L. Miko (1 paratype) and F.D. Monson (3 paratypes). Single individual of *Epidamaeus* sp. will be kept in the collection of L. Miko.

In the present paper, we follow the morphological terminology and abbreviations developed by Grandjean (1960) and modified by subsequent authors (see Miko and Mourek, 2008 for complete references and a list of abbreviations). For leg setae, Grandjean´s notations, as reviewed by Norton (1977) were used. The drawings and measurements were made following the same methodology as in our previous works (see Mourek, Miko and Skubała, 2011 for details).

DESCRIPTION OF THE TWO SPECIES

Kunstidamaeus arcticus n.sp. (Figs. 1-3)

Diagnosis — *Kunstidamaeus* with a short, slightly dilated sensillus covered distally by cerotegument; tubercle *Ba* absent; with a set of variably developed

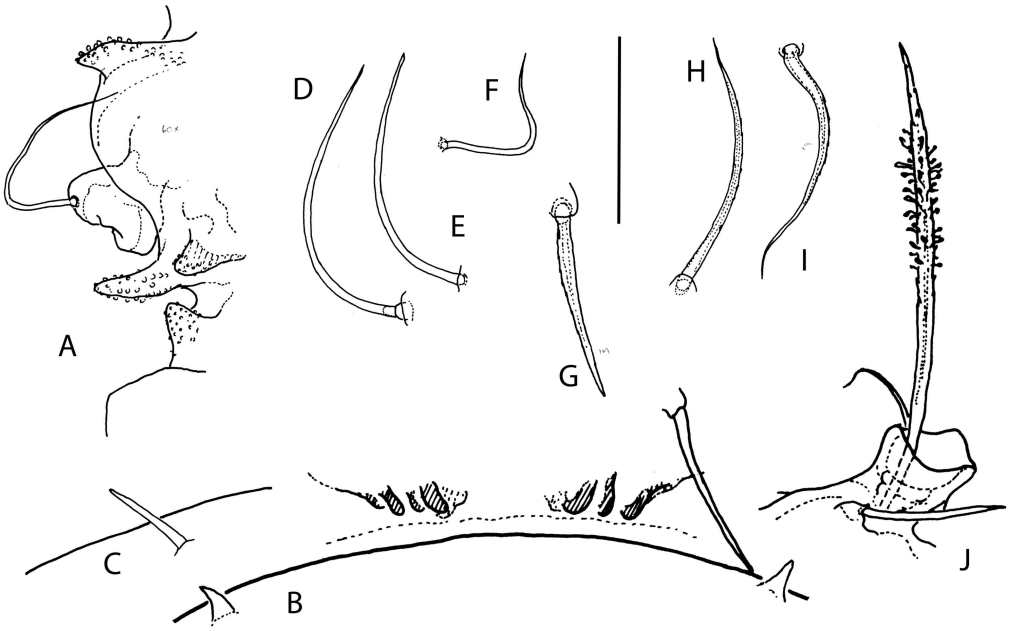


FIGURE 2: *Kunstidamaeus arcticus* **n.sp.**: A – lateral part of prodorsum with apophyses *P*, *Sa* and *Sp*, and tubercle *La*; B – dorsosejugal area with tubercles at posterior end of prodorsum and spinae adnatae; C – spina adnatum of another individual; D – lamellar seta; E – rostral seta; F – exobothridial seta; G – interlamellar seta; H – notogastral seta *c1*; I – notogastral seta *lm*; J – sensillus and bothridium (scale bar = 50 μm).

small tubercles present at the basis of prodorsum; and with weakly developed spinae adnatae. Ventral side with a paired anterior ventromedial apophyse, with most epimeral setae inserted on distinct tubercles; only 5 pairs of genital setae present.

Description of the adult.

Material examined — Holotype and four paratypes, collected by S. Coulson from soil of tundra heath in Svalbard (Spitsbergen, Norway), sample number OR 804, 1991 - 1993. More detailed information about the collected material is not available to us.

Measurements — Body ventral length 470 – 500 μm (n=5), body length in dorsal view about 500 – 530 μm. Length of prodorsum 180 – 210 μm, width (between the tips of *P* apophyses) around 200 μm (n=2), width of notogaster 260 – 320 μm (n=5).

Integument — Surface of body and legs, except distal parts of tarsi, covered mostly by filamentous and columnar cerotegument, which has, on prodorsum, anterior and central part of notogaster and on ventral plate, a very characteristic appearance: individual, rather short and distinctly attenuated filaments each with a slightly expanded, button-like base. Lateral part of sejugal area, propodolateral apophyse and parastigmatic apophyses with granular cerotegument. Distal part of sensillus with a very specific, short, but distinct, fine "leaf-like" cerotegument (Fig. 2J). Body surface under cerotegument finely granulated, with the granulation well visible on the prodorsum and the ventral plate.

Prodorsum (Figs. 1A, 2A-B, D-G, J) — Shape of prodorsum triangular, with well developed, blunt apophysis *P*, perpendicular to body. Lateral tubercles *La* small, distinct, but hardly visible beneath a layer of cerotegument. A series of 3 – 4

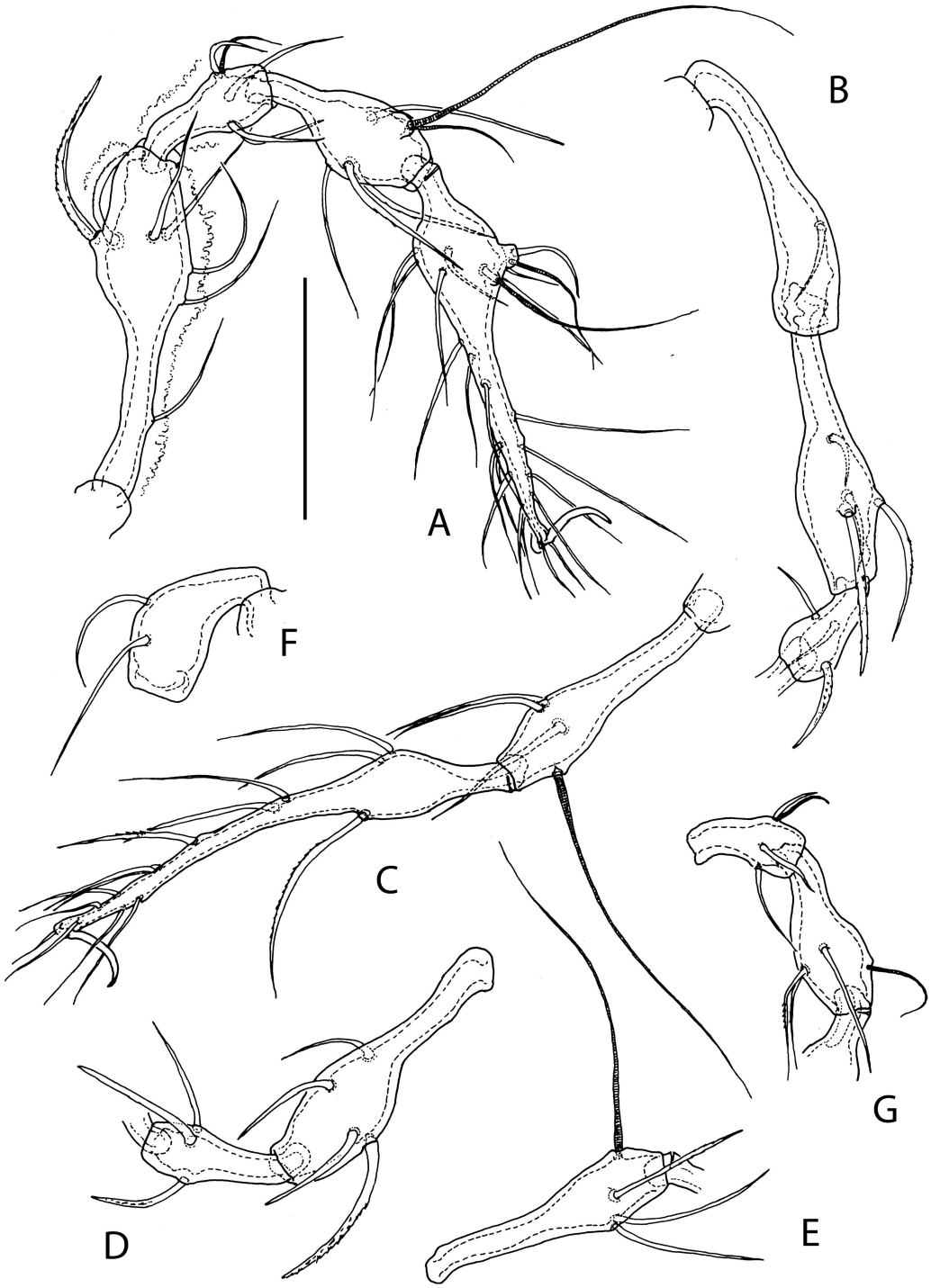


FIGURE 3: *Kunstidamaeus arcticus* **n.sp.**: A – leg I; B – trochanter, femur and genu IV; C – tibia and tarsus IV; D – femur and genu IV, axial view; E – tibia IV, axial view; F – trochanter III; G – genu and tibia III (scale bar = 50 μm).

small tubercles present at the basis of the prodorsum, replacing postbothridial or centrodorsal tubercles, partly merging and creating a tuberculate ridge. In some individuals, however, the ridge only weakly developed and basis of the prodorsum just with a rugged and an irregularly thickened cuticle (Fig. 2B). Parastigmatic apophyses strong and distinct, *Sa* longer, sharp, 'thorn-like', perpendicular to body, *Sp* shorter, dentiform, with broader basis than *Sa* (Fig. 2A). Rostrum with a slightly projecting central lobe, partly separated from the rest of the prodorsum by short, distinct and slightly arched ridges anterior to insertion points of the lamellar setae, projecting anteromediad. Bothridium 'funnel-like', with an expanded, round rim, sometimes with an indistinct, blunt, antiaxial projection (Fig. 2J). Sensillus relatively short (110 – 130 μm), slightly dilated in distal part, and attenuated towards tip; sparsely, but distinctly scabrose distally. The distal, dilated portion covered by specially formed, leaf-like cerotegument, giving the sensillus an overall fusiform appearance. Rostral (ca 75 μm) and lamellar (ca 83 μm) setae subequal in length, arched, smooth and relatively fine (Fig. 2D-E). Interlamellar setae relatively short (about 50 μm), strong, dilated at the base, with a finely dentate posterior edge, projecting posteriad or posterolaterad (Fig. 2G). Exobothridial setae very fine, smooth, strongly curved or almost curly, with an attenuated tip (Fig. 2F), about as long (45 – 50 μm) as the interlamellar setae.

Notogaster (Figs. 1A, 2B-C, H-I) — Oval or subglobular in dorsal view. Spinae adnatae very weakly developed, small and almost invisible in the layer of cerotegument, unpigmented and transparent, variable in shape - either small and triangular (Fig. 2B), or narrowly ceratiform (Fig. 2C). Notogastral setae in two subparallel rows, medium long, posterior ones slightly shorter (*c1* and *c2* around 65 – 70 μm, *la* 65 μm, *h1* 55 μm). Setae *ps1-ps3* finer and shorter (*ps1* 45 – 50 μm, *ps3* 40 – 45 μm). Lyrifissures normally developed.

Ventral characters (Fig. 1B) — Gnathosoma relatively broad, cuticle with characteristically fine transverse ridges. Mouthparts and palps as usual in *Kunstidamaeus*, setae *h* and *a* quite long (around 35 μm), with setae *a* shorter. Tectum of podocephalic fossa slightly projecting posteriad into a blunt, 'beak-like' tip. Epimeral tubercles *E2a*, *E2p* absent, in medial part of sejugal area with distinctly paired tubercle *VM*; tubercles *Va* and *Vp* absent (see remarks for potential analogies). Discidium strong, pointed, triangular or 'beak-like' projecting laterad or slightly anteriolaterad. Anterior part of epimeral region laterally with a longitudinal, more sclerotised ridge, bearing epimeral seta *1c*. Epimeral setal formula 3-1-3-4, setae of epimeres 1-3 and seta *4a* on distinct tubercles, these most pronounced around insertions points of *3a*, *4a*, *2a* and *3b*. Length of all ventral setae around 25 – 35 μm; setae *3c* the longest (ca 40 μm), oriented anteriad. Genital plates, in some individuals, posteriorly with a fine longitudinal striation, and with only 5 genital setae of medium length (18 – 24 μm). From the position of genital setae, it is assumed seta *g2* or *g6* is reduced (absent). Otherwise, normal set and positions of setae (*5g*, *1ag*, *2an*, and *3ad*) in anogenital area. Posterior end of ventral plate behind anal plates with postanal sclerite, developed as a short, transverse, sclerotised lath or indistinct ridge. Notogastral margin behind postanal sclerite possibly undulate or indented axially.

Legs (Fig. 3) — Only leg IV distinctly longer than body; legs I and III almost as long as or only slightly longer than body, leg II distinctly shorter than body. Tibiae I and IV longer than their respective genua, with trochanter IV and femur IV subequal in length. Proximal part of tarsus II and IV before bulb, ventrally with strongly thickened cuticle (Fig. 3C). Leg setation (famulus included, with solenidia in parenthesis): leg I 1-7- 4(1)-4(2)-21(2), leg II 1-6-4(1)-4(1)-17(2), leg III 2-5-3(1)-3(1)-17, leg IV 1-4-3-3(1)-14. Dorsal setae of femora, particularly of femur I, strong, unilaterally with fine 'saw-like' dentation or with dark scales. Tarsus I with accessory ventral seta *v2'*, which is absent on tarsus IV. Famulus normally developed, emergent, setiform. Genual solenidia σ on leg I-II slightly longer than coupled seta. Tibial solenidia of leg I ($\varphi 1$) and leg IV (φ) tactile, very long, fine, about 160 – 170 μm long, solenidion $\varphi 2$ of tibia I setiform, but much shorter. Both solenidia of tarsus I ($\omega 1$, $\omega 2$) also fine, setiform,

relatively long (75 – 85 μm).

Remarks — The species has several unusual characters distinguishing it from all other *Kunstidamaeus* (and *Epidamaeus*) species. The most unusual being the presence of only 5 genital setae per plate, whilst, the normal number for both genera and all Damaeidae is 6 setae per plate. The combination of the presence of a typical apophyse *P* perpendicular to the body axis together with prodorsal tubercles *La* and *Ba* is typical for *Kunstidamaeus*, and the similar combination of apophysis *P* and tubercle *La* let us to assign the species to this genus. However, in *K. arcticus* **n.sp.**, postbothridial tubercles are absent, whilst a row of 3-4 small tubercles at each side of prodorsum base has developed instead, in some individuals. One could speculate about the homology of this structure with tubercles *Ba* or *Da*. However, this structure is variable in our material, and in some individuals is only weakly developed. This suggests that the homology is questionable and the structure may have evolved independently. The idea is, in our view, supported also by the very unusual presence of paired tubercles *VM* in the medial part of the ventrosejugal groove. The single, unpaired ventromedial tubercle *VM* is known from this area in only a few species of *Epidamaeus* eg. *E. fortispinosus* Hammer, 1967 and *E. hastatus* Hammer, 1967. The latter of the two species shares some more similarities (see Behan-Pelletier and Norton, 1985 for details), e.g. shape of spinae adnatae, exobothridial setae and partly also the relatively short, lanceolate sensillus, and, more importantly, a thickened cuticle at the basis of prodorsum. To our knowledge, unique to *K. arcticus* **n.sp.** is also the presence of a distinctly thickened cuticle at the ventral part of the proximal end of tarsi III and IV. Another unusual character belonging to the new species is the presence of a second antiaxial accessory seta, ventral to seta *v2'* on tarsus I, whilst the same seta on tarsus IV is absent. Absence of this seta on tarsi I and IV is a typical character shared by most of the species of *Epidamaeus* and *Kunstidamaeus* within the *Damaeus* (sensu lato) complex, and, if occasionally present, they are developed always on both legs. On the other hand, the weak development of the spinae adnatae is not surprising - the tendency of minimization and weakening of spinae adnatae seems to be quite common within the Damaeidae from northern Arctic areas, as demonstrated by Behan-Pelletier and Norton (1983). This unique combination of characters, combined with the very characteristic shape of the cerotegument, sensillus and presence of only 5 genital setae clearly differentiates this species from all other known species. Based on the presence of short sensillus (appearing distally slightly dilated), shape and size of the notogastral setae and presence of granular cerotegument, the new species shows similarities to the species-group "tenuipes", but given the specific characters described above, it should be considered as self-standing within the *Kunstidamaeus*.

Epidamaeus sp. (aff. *floccosus* Behan-Pelletier and Norton, 1985) (Fig.4-7)

This species of *Epidamaeus* resembles the species *Epidamaeus floccosus* Behan-Pelletier and Norton, 1985 (see discussion below), but bears also some differing characters, namely a conspicuous transverse ridge behind the prodorsal tubercles *Ba*; elongated anterior parastigmatic apophyse *Sa*; spinae adnatae with lateral dents; and smooth, long notogastral setae inserted on cuticular thickenings. These characters would allow to establish a new species within *Epidamaeus*. However, taking into account that we had only a single, even slightly damaged, individual available, it was impossible to decide on stability and variability of the characters. Therefore, the potential decision on the specific status is left for later until broader material is available.

Description of the adult.

Material examined — Single individual (female), collected by F.D. Monson from rotting straw, situated just within the shelter of a Dutch barn with open aspect, Barn Hey Farm, Tarbock Green, south Lancashire, England, sample OR 908, 10th Oct 2009.

Measurements — Body length 520 μm, prodorsum length 200 μm, prodorsum largest width (at the level of the posterior end of bothridia) 192 μm, notogaster width 325 μm.

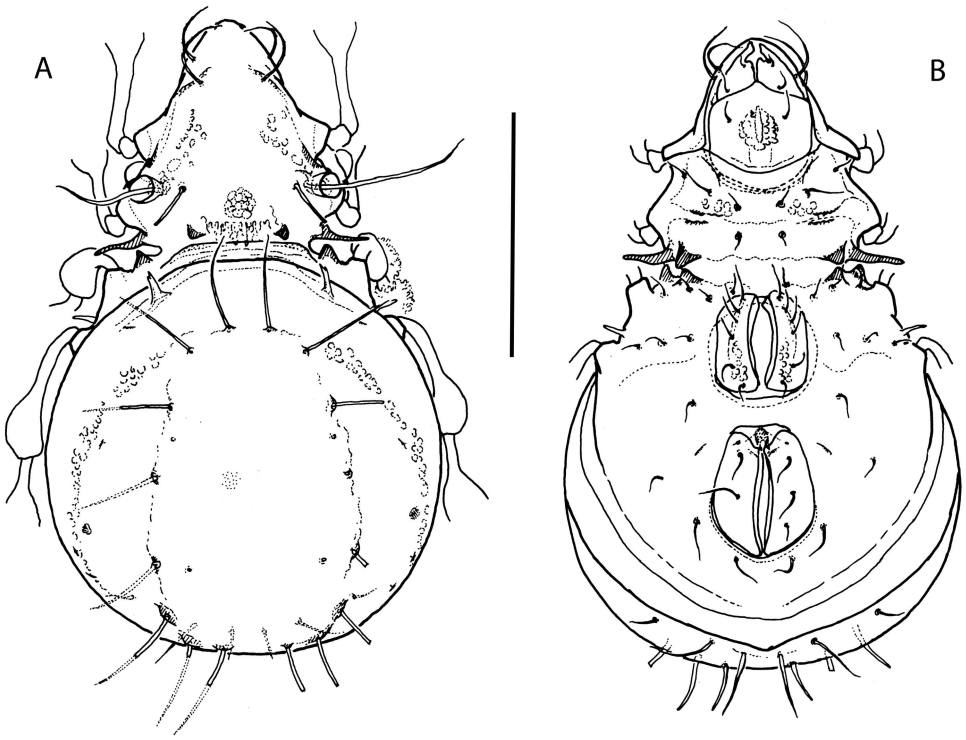


FIGURE 4: *Epidamaeus* sp. (aff. *floccosus* Behan-Pelletier and Norton, 1985): A – dorsal view, legs only partly depicted; B – ventral view, legs and gnathosoma only partly depicted (scale bar = 200 μm).

Integument — Body covered by cotton-like filamentous cerotegument in the sejugal area and laterally around leg insertions. Cuticle of prodorsum smooth, with notogaster finely granulated. Ventrally, with net-like pattern on the mentum, epimeres I-II and genital plates. Cuticle of all femora and trochanters II-IV with a distinct 'net-like' pattern.

Prodorsum (Figs. 4A, 5A-B, D-E, 6A-E) — Regularly triangular in shape, with lateral part above insertions of legs II rounded and without an apophysis *P*. Proximal part of trochanters I and II covered by the tectum, projecting laterad and lateroposteriad from the lateral part of prodorsum (Fig. 5D). Parastigmatic apophyses very different in shape; anterior apophyse *Sa* prolonged, narrow, pointed, perpendicular to the body axis, about four times longer than *Sp*, which is short, triangular, blunt and pointing anteriad (Fig. 5E). Anterior postbothridial tubercles (*Ba*) present, distinct but relatively small and opposed posteriorly by a broad, transverse, transparent ridge. Rostrum broadly rounded, with an indistinct, broad central lobe. Short, indistinct oblique ridges present latero-anteriorly to insertion points of lamellar setae. Similarly, short ridges present laterally, behind insertions of leg I, projecting anteriad from bothridial area. Both structures combined together slightly resemble lamellar ridges present in other oribatids. Prodorsal setae fine and relatively long; rostral and lamellar setae unilaterally with small, hardly visible spines; other prodorsal setae smooth. Lamellar setae (75 μm) slightly longer than rostral (58 μm). Exobothridial setae strongly curved, fine, and slightly shorter than *ro* (50 μm) (Figs. 6C-E). Interlamellar setae clearly the most robust on the prodorsum, nevertheless, both broken and missing distal part. Remaining basal part around 37 – 40 long, overall length is difficult to judge, but it is assumed they may reach about 60-80 μm (Fig. 6B). Bothridium typical of the

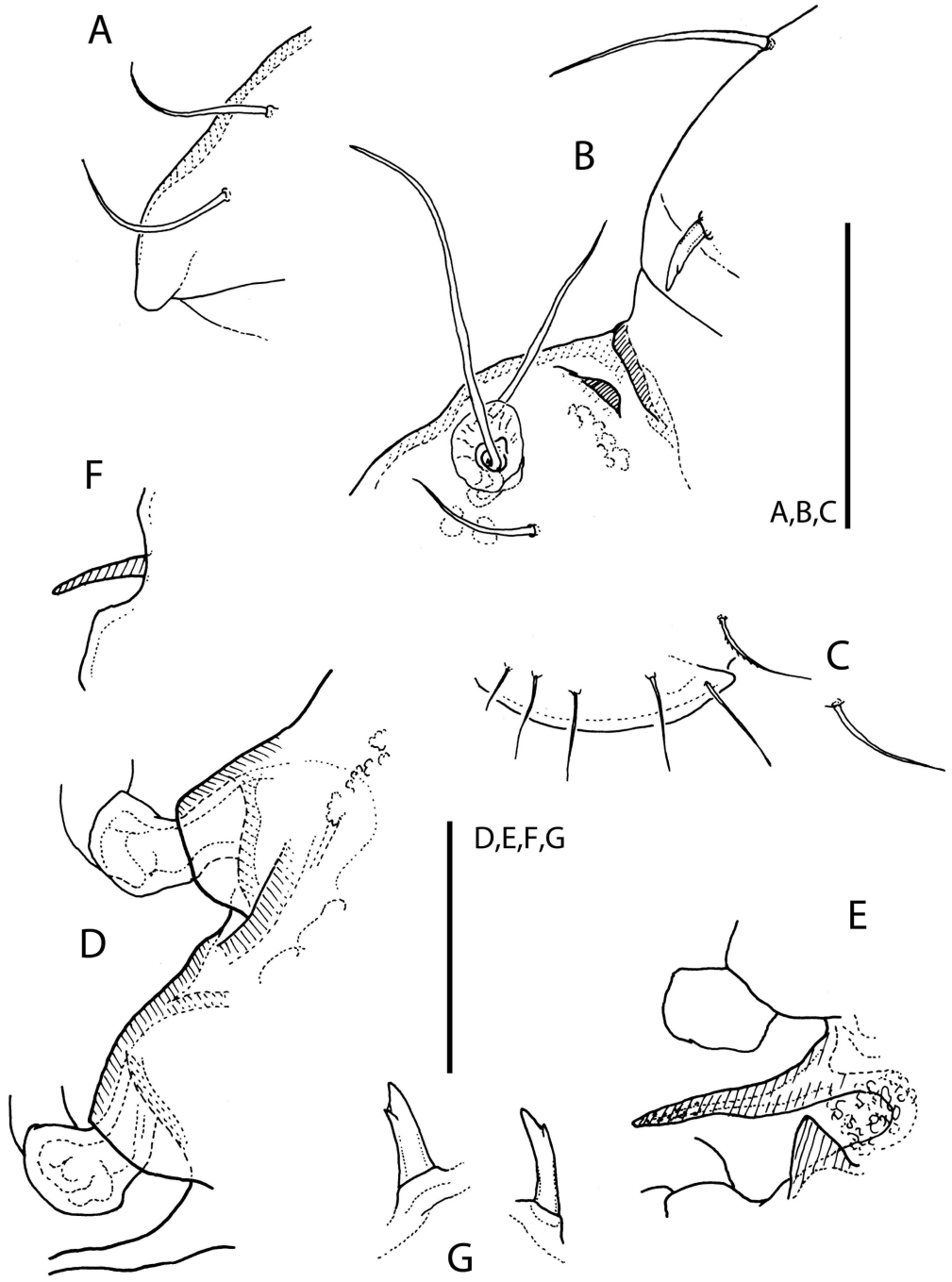


FIGURE 5: *Epidamaeus* sp.(aff. *floccosus* Behan-Pelletier and Norton, 1985): A – lateral view of rostrum, B – lateral view on bothridial area and anterior part of notogaster, C – genital setae g1-g5, aggenital seta and adanal seta ad3; D – lateral part of prodorsum; E – parabothridial apophyses Sa and Sp; F – discidium; G – spinae adnatae (scale bars = 25 μm).

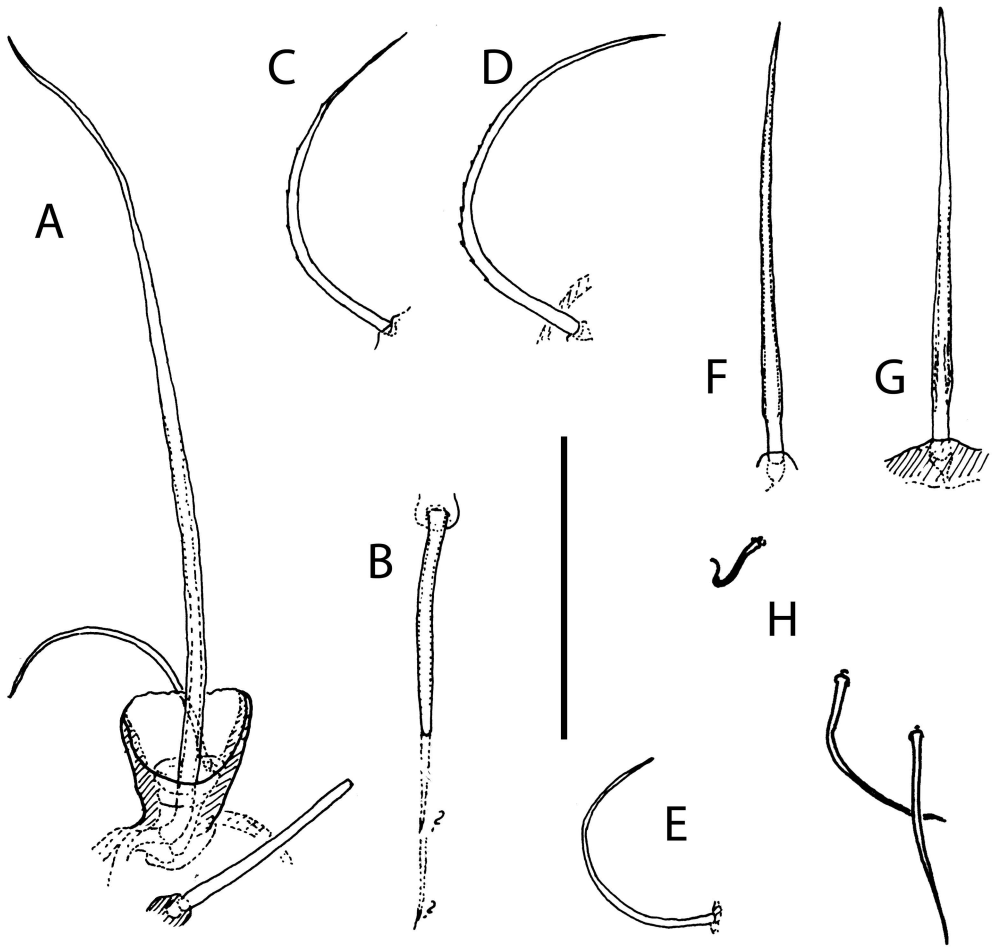


FIGURE 6: *Epidamaeus* sp. (aff. *floccosus* Behan-Pelletier and Norton, 1985): A – sensillus and bothridial area; B – interbothridial seta; C – rostral seta; D – lamellar seta; E – exobothridial seta; F – notogastral seta *c1*; G – notogatsral seta *la*; H – notogastral setae *ps1-ps3* (from right to left) (scale bar = 50 μm).

Damaeidae, funnel-like, with a transparent, round and expanded rim. Sensillus smooth, elongate, setiform, attenuated distally, without a flagellate tip; about 140 μm long (Fig. 6A).

Notogaster (Figs. 4A, 5G, 6F-H) — Circular, with strong, medium long spinae adnatae, both distally with strong, lateral teeth (Fig. 5G). Notogastral setae fine, smooth and relatively long (*c1* and *c2* about 75 μm), some, however, with broken distal parts, with *lm*, *lp* (one side only) broken in part, or completely (Figs. 4A, 6F-G). All notogastral setae inserted on cuticular thickenings, forming small tubercles or short ridges, and more pronounced on posterior part of notogaster. Proximal part of setae, near insertion points, slightly narrower and more transparent than remainder of setae. Setae of *ps* series finer and shorter than remainder, *ps2* about 50 μm with *ps3* about 25 μm long (Fig. 6H). Lyrifissures normally developed; openings of notogastral glands well visible, with a small "cap" of a transparent secretion. A pair of pores present in posterior central part of notogaster, axial to insertions of setae *lp*.

Ventral characters (Figs. 4B, 5F) — Gnatho-

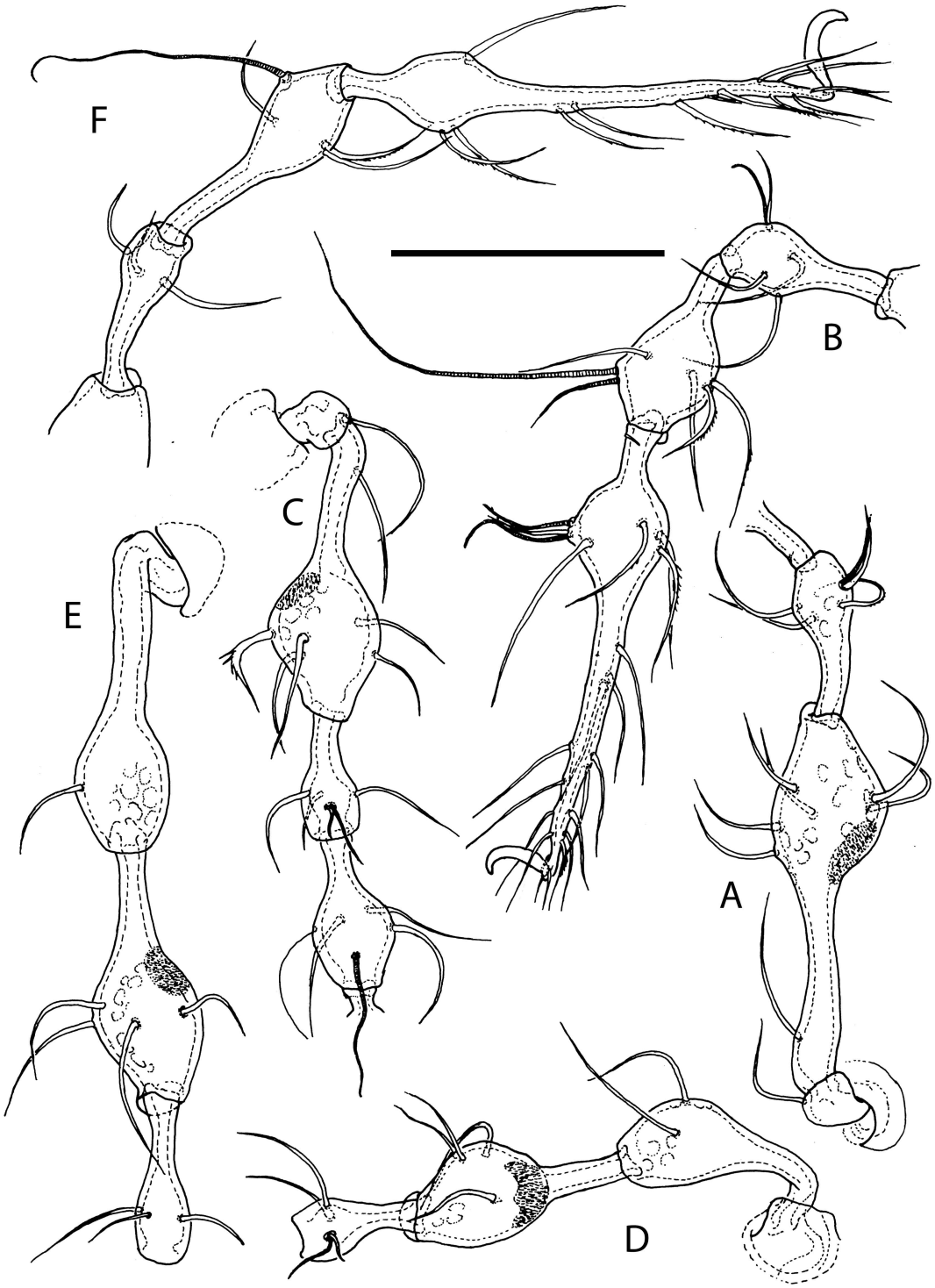


FIGURE 7: *Epidamaeus* sp. (aff. *floccosus* Behan-Pelletier and Norton, 1985): A – femur and genu I; B – genu, tibia and tarsus I; C – femur, genu and tibia II; D – trochanter, femur and genu III; E – trochanter, femur and genu IV; F – genu, tibia and tarsus IV (scale bar = 50 μm).

soma normal for the Damaeidae; mentum relatively broad, setae *h* about 25 μm long, setae *m* slightly, but distinctly shorter. Tectum of podocephalic fossa simple, with an angular, blunt, external tip, hardly projecting over lateral edge of ventral plate. Enantiophyse *E2* absent, with only a slight thickening visible in this area. Ventrosejugal enantiophyse well developed, positioned laterally, close to the parastigmatic apophyses. *Va* slightly stronger than *Vp*, with both apophyses dentiform, triangular, and strong. Discidium fine, narrow and relatively long, almost straight, and gracile (Fig. 5F). Epimeral setae, except *4d*, inserted on small, but distinct tubercles. Epimeral setal formula 3-1-4-3; epimeral setae relatively short, with *1b* the longest (about 25 μm). Anogenital region with normal setation, with *6g*, *1ag*, *3ad* and 2*an* present. One of the anal plates with additional smaller seta posteriorly. Anal and adanal setae longer than other ventral setae (over 40 μm) with genital setae only slightly shorter. No postanal sclerite observed.

Legs (Fig. 7) — All leg segments with quite distinct bulbs and with fine setation. Only leg IV longer than body (about 1,1 times), other legs shorter (leg I about 0,85 of body length). Femur IV slightly shorter than, or sub-equal in length as trochanter IV; genua I-IV shorter than respective tibiae. Porose areas on all femora and trochanters III-IV well visible. Setae generally smooth, only on ventral side of tibiae and tarsi with short barbs unilaterally. Dorsal setae of femur II and III of unusual shape, stronger, bent, pectiniform with 3-4 distinct barbs dorsally, proximal being the longest in the row. Setal formula of legs (famulus included, solenidia in parenthesis): leg I 1-7-4(1)-4(2)-20(2), leg II 1-6-4(1)-4(1)-17(2), leg III 2-4-3(1)-3(1)-17, leg IV 1-4-3-3(1)-14. Famulus normal, setiform and quite long. Seta *ft"*, famulus and solenidia *ω1* and *ω2* close together, of similar length, only *ω1* slightly longer, curved distally. Tibial solenidia of leg I (*φ1*, about 145 μm) and IV (*φ*, 105 μm) long, setiform, and tactile. Genual solenidia I-III always longer than coupled seta *d*, and bent distally. Tarsi I and IV with only 2 posterior accessory setae, with *v2´* absent.

Remarks — The individual stands very near to *Epidamaeus floccosus* Behan-Pelletier and Norton, 1985, having very similar or identical development of tubercles and ridges in the sejugal area; parastigmatic apophyses or ventral tubercles are generally of very similar appearance as well. Still, there are also several characters which clearly differ. The british individual is larger; sensillus is shorter, without flagellate end and not covered distally by cerotegument as in *E. floccosus*. Notogastral setae (particularly *l* and *h* series) are inserted on tubercles or short ridges; anterior notogastral setae are finer and longer and, conversely, setae *ps1-ps3* are much shorter than in *E. floccosus*. Ventral setae of our individual are shorter and most of the epimeral setae are inserted on tubercles. Legs differ slightly, also, in having finer and generally shorter setae, and all genual solenidia are longer than the coupled setae *d* (whilst in *E. floccosus*, coupled setae are longer than solenidia). Presence of teeth on spinae adnatae on our individual may be an easily observable difference, but it is difficult to judge if this character is stable. Similarly developed spinae adnatae have been observed on some individuals of *E. aborigensis* Behan-Pelletier and Norton, 1985, together with individuals where they had developed normally, without teeth or protuberances. As stated above, if the differences found will be proved stable by study of broader material, they justify in our view a status of new species to be proposed. As our attempts to find more individuals were not successful, we brought detailed description here to allow for comparison, and hopefully also for finding of more individuals by other authors, who may have collected the species without attempting detailed determination. Authors will be greatly appreciating if such a material, if exists, was provided them for further study.

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