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Previous volumes (2010-2018): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

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TENUIALIDAE (ACARI : ORIBATEI): NEW DIAGNOSES FOR SUPRASPECIFIC TAXA

BY Roy A. NORTON*

ABSTRACT: Diagnoses are presented for the oribatid mite family Tenuialidae, the subfamily Tenuialinae, and the genera Tenuiala, Tenuialoides, Hafenrefferia, and Hafenrefferiali. A new subfamily, Peltenuialinae, is proposed, based on Peltenuiala pacifica, n. gen., n. sp. Hafenrefferiella is considered a junior synonym of Hafenrefferia. The following new combinations are proposed: Hafenrefferia nevesi (Sellnick); Hafenrefferia hyrcanica (Krivolutsky); Tenuialoides translamellatus (Aoki and Fujikawa); Peltenuiala orbiculata (Aoki and Ohnishi). A close relationship is suggested between the Liacaroidea and the Cepheidae.

The oribatid mite family Tenuialidae, most members of which are arboreal or leaf litter inhabitants in forests of the Northern Hemisphere, currently comprises five genera, each with two or three nominal species. Currently available generic diagnoses are incomplete or difficult to compare, and the most incisive family diagnosis, that of Grandjean (1965) is based only on one genus. The objectives of this paper are to correct misconceptions of the identity of Hafenrefferia, to propose a new genus and subfamily for mites currently under this name, and to present new diagnoses for supraspecific taxa, with comments on systematic relationships and biogeography. Morphological terminology used in these diagnoses is that developed by F. Grandjean (see Travé and Vachon, 1975 for references).


Acarologia, t. XXIV, fasc. 2, 1983.
FAMILY TENUIALIDAE JACOT, 1929 (pg. 428)

**Type-genus:** 
*Tenuiala* Ewing, 1913.

**Diagnosis.** Medium to large (700-1,100 μm) pycnonotic brachypnline oribatid mites with smooth shiny integument. Lamellae well developed, with distinct cusp. Pedotectum I well developed; pedotectum II small or absent. Tutorium, discidial carina and posterior circumpedal carina present. Six pairs of genital setae, aligned near medial border of each plate. Notogaster without true pteromorphs, but each anterolateral corner with an anteriorly directed, pointed scapular process. Nine or ten pairs of notogastral setae or alveoli. All femora, and trochanters III and IV, with ventral blade-like processes (sometimes poorly developed on femur I). Ambulacra tridactyl. One pair of aggenital, two pairs of anal, and three pairs of adanal setae present. Lateral podosomal region with concavities for reception of retracted legs (Fig. 5A). Epimeral border IV usually with taenidium and minitectum (Fig. 5B).

Subfamily TENUIALINAE Jacot, 1929

**Type-genus:** 
*Tenuiala* Ewing, 1913, by original designation.

**Diagnosis.** Tenuialidae with notogaster rather strongly convex (Fig. 1A), with breadth approximately 1.5 to 2.0 times its height; with normally constructed border (Fig. 3A). Lenticulus absent. Notogaster glabrous (except p, developed in *Tenuialoides*) with ten pairs of setal alveoli (p, present) and normal complement of lyrifissures (ia, im, ip, ih, ips) (Fig. 1B, 2A-C). Tutorium well developed for protection of leg I, broad in middle portion, extending anteriad near or beyond insertion of rostral seta. Exobothridial seta absent, represented only by alveolus near posterior end of tutorium. Free edge of pedotectum I entire or partially serrated (Fig. 2D). Rostrum variously emarginate (e.g. Fig. 1D).

Genus *Tenuiala* Ewing, 1913 (pg. 133)

**Type-species:**  
*Tenuiala nuda* Ewing, 1913 by original designation.

**Diagnosis.** Tenuialinae with long, broad lamellae, overlapping lateral contour of prodorsum in dorsal aspect; lamellae distally remote or approximate, with or without a translamella. Lamellar cusp extending anteriad to or beyond tip of rostrum (except *T. crenulata*); lamellar seta inserted on ventral surface of cusp, removed from terminal and lateral cusp margins. Tutorium distally broad (Fig. 2D) with well developed anterodorsal tooth or corner; does not extend anteriad of insertion of rostral seta. Scapular process of notogaster long, far surpassing the anteromedial notogastral margin and reaching anteriad approximately to or beyond level of origin of lamellar cusp; usually with anteromedial serrations. Epimeral setation 3-1-3-3; seta 1d absent. Sternal border distinct or weakly developed; third pair of epimeral borders incomplete, not connected medially. Taenidium and minitectum of epimeral border IV present, extending from acetabulum IV to genital valve. Lyrifissure 1ad located between levels of setae 1d and 2d, parallel to margin of anal valves and adjacent to it (removed no more than the length of the lyrifissure).

1. Although Woolley and Higgins (1966) characterized the rostrum of *Tenuialoides* as entire, I have examined the type specimen (now slightly crushed) and found the rostrum to be emarginate, like all other known Tenuialinae.
2. *Tenuiala nuda* does not have a translamella, although one is figured and described by Woolley and Higgins (1955). The prodorsum steepens its contour immediately anteriad of the origin of the cusps, causing a dark transverse band to appear when viewed dorsally in transmitted light.
3. Woolley and Higgins (1955, 1966) figured representatives of three species with a dorsally inserted lamellar seta. From my examinations of type-specimens, this is an observational error; it has a ventral origin in all.
**Nominal species.** *Tenuiala crenulata* Woolley and Higgins, 1966; *T. kurti* Woolley and Higgins, 1955; *T. nuda* Ewing, 1913. A specimen of an undescribed species most similar to *T. nuda* has recently been collected from the Lafayette Experiment Station, Syracuse, New York, by Dr. J. R. Philips and Behan et al. (1978) have recorded undetermined specimens of *Tenuiala* from Quebec.

Genus *Hafenferenia* Jacot, 1939 (pg. 325)

**Type-species:** *Galumna nitidula* Banks, 1906 by original designation.

**Diagnosis.** Tenuialinae with broad lamella, overhanging lateral contour of prodorsum in dorsal aspect (Fig. 1B); translamella absent. Lamellar cusp relatively short or of moderate length (up to one-fourth total lamellar length); lamellar seta removed from tip of cusp, inserted ventrally or along lateral margin. Tutorium distally broad with well developed anterodistal corner (Fig. 1C); does not extend anteriad of insertion of rostral seta. Scapular process extends anteriad to or slightly beyond anteromedial margin of notogaster; no marginal serrations. Epimeral setation 3-1-3-3; seta 1d absent. Sternal border distinct, weakly developed; third pair of epimeral borders incomplete medially. Taeuvidium and minitectum of epimeral border IV present, extending from acetabulum IV to genital cavity. Lyrifissure iad located between levels of setae ad1 and ad2, parallel to margin of valve and closely adjacent to it.

**Remarks.** 1. *Hafenferenia* was proposed by Jacot (1939) with *Galumna nitidula* Banks as type-species. Jacot worked extensively with Banks' collections at the Museum of Comparative Zoology during the 1920's and 1930's, and there is no doubt that he observed the single specimen from Franconia, New Hampshire (labeled "type") and here considered as holotype, since no other type material is known or was mentioned in the original description) on which Banks (1906) based his description. A revised generic diagnosis and redescription of *H. nitidula* was subsequently attempted by Higgins and Woolley (1957) based principally on specimens from Oregon and Washington which they assumed to belong to this species; there is no indication in this paper that the type-specimen was examined. Because of certain discrepancies between this redescription and the original descriptions of Banks and Jacot, the type-specimen was reexamined during the preparation of my own generic diagnosis, and found to differ in many ways from the mites studied by Higgins and Woolley (1957). The latter belong to a genus and species newly proposed below.

2. When proposing the genus *Hafenferferiella*, Sellnick (1952) indicated that Banks' *Galumna nitidula* might be congeneric with the type-species, *H. nevesi*. He was apparently unaware of Jacot's (1939) proposal of the genus *Hafenferenia* which was based on the former species. Specimens of *H. nevesi* were not observed during my study, but based on Sellnick's description and illustrations the two species do indeed appear to be congeneric. They share many character states, and synapomorphies include the position of lyrifissure iad close to the anal valves and the anteriorly broadened tutorium. Principal differences are the relatively longer, narrower lamellar cusp, longer sensillus and apparently longer scapular process in *H. nevesi*. The latter character is difficult to judge because Sellnick's (1952) Figure 1 and especially Figure 2 seem to be drawn with the specimen somewhat elevated in front.

The two synapomorphies mentioned are also shared with members of the genus *Tenuiala*, which have usually been distinguished from other tenuialid mites by having a relatively long scapular process and lamellar cusps which (except in *T. crenulata*) reach or surpass the rostral margin. At present, it seems most reasonable to consider *Hafenferferiella* a junior subjective synonym of *Hafenferenia* and the latter a genus distinct from *Tenuiala*. Detailed descriptions of ontogeny and leg setations may prove valuable in further classificatory decisions.
Fig. 1: *Hafenferrefia nitidula* (Banks), holotype.

A. — Posterior aspect (setal alveoli and lyrifissures omitted); B. — Dorsal aspect (lyrifissures omitted, tip of left sensillus broken); C. — Partial ventral aspect; D. — Rostrum, oriented as in B except anterior end elevated about 45°.
Nominal species. Hafenrejeria hyrcanica (Krivolutsky, 1966) (fide Krivolutsky, 1975) 4 new combination; H. nevesi (Sellnick, 1952) new combination; H. nitidula (Banks, 1906) "Hafenrejeria" translamellata, described by Aoki and Fujikawa (1969), is transferred below to Tenuialoides.

Genus Hafenrejeria Oudemans, 1906 (pg. 62)

Type-species: Oribata gilvipes C. L. Koch, 1839, by original designation.

Diagnosis. Tenuialinae with lamellae close together in distal half, so that lateral contour of prodorsum visible in dorsal aspect; lamellae appear to touch or fuse together at level of cusp origin. Lamellar cusp narrow, elongate, gradually tapering distally and accounting for approximately one-third total lamellar length; lamellar seta inserted terminally on cusp, although a small tooth may be present medially or laterally of insertion. Tutorium broad in middle region, gradually narrowing distally until effaced slightly anterior of insertion of rostral seta. Scapular process moderately large, extending anteriorly past anteromedial border of notogaster; no marginal serrations. Epimeral setation 4-1-3-3; seta 1d present, inserted near corner formed by podocephalic fossa and mentotectum. Sternal borders thin, but distinct; third epimeral border coalesces with fourth epimeral border lateral of mid-sagittal plane. Taenidium and minitectum of epimeral border IV present, but very short, extending only from acetabulum IV to circumpedal ridge (see Grandjean, 1969, Fig. 4). Lyrifissure iad in usual brachygyline position, anterior of seta ad, well removed from anal valve and oriented almost perpendicularly to it.

Remarks. Grandjean (1965), in his diagnosis of the family Tenuialidae, indicated that H. gilvipes (on which the family diagnosis was totally based), has the vestiges of nine setae on its notogaster. My own observations of specimens from various locations in Poland and from Regensburg, Germany, are that ten alveoli are invariably present, as indicated in Fig. 2C.

Nominal species. Hafenrejeria acuta Aoki, 1966; H. gilvipes (C. L. Koch, 1839).

Genus Tenuialoides Woolley and Higgins, 1966 (pg. 233)

Type-species: Tenuialoides medialis Woolley and Higgins, 1966, by original designation.

Diagnosis. Tenuialinae with lamellae close enough to each other so that lateral contour of prodorsum visible in dorsal aspect; lamellae removed from each other by approximately length of cusp, and connected by distinct, narrow translamella. Lamellar cusp narrow, tapering distally and accounting for approximately one-third total lamellar length; lamellar seta inserted terminally on cusp, although small tooth may be present medially or ventrally of insertion. Tutorium broad in middle region, gradually narrowing distally until effaced slightly anterior of insertion of rostral seta. Scapular process moderately long, extending anteriorly approximately to translamella; no marginal serrations. Seta p, developed 5. Epimeral setation 4-1-3-3; seta 1d present, inserted near corner formed by podocephalic fossa and mentotectum. Sternal border absent or very weakly developed anteriorly; if present behind ventrosejugal groove it is very narrow. Epimeral border III complete medially; epimeral border IV absent, indistinct, or at least medially incomplete, not reaching anterior margin of genital cavity. Taenidium and minitectum of epimeral border IV absent. Lyrifissure iad located slightly posteriord of level of seta ad; usually oriented at acute angle with anal valve.

4. The original description of H. hyrcanica could not be located, but Krivolutsky (1975) gives a figure.
5. Although not noted in the original description (Woolley and Higgins, 1966) seta p, is present on the right side of the type specimen of T. medialis.
 REMARKS. The presence of a fourth pair of setae ($id$) on the first epimera is of considerable interest. The usual condition in the higher oribatids (Grandjean, 1934), and undoubtedly the ancestral one, is to have three pairs. The presence of this neotrichous fourth seta in an unusual location near the podocephalic fossa therefore represents an apomorphy. It is shared only by Hafenrefferia, which it resembles in general facies and lamellar structure to a large degree. Based on this synapomorphy and the shared derived shape of the tutorium, these two genera can be considered sister groups. If the taenidium and minitectum of epimeral border IV is an ancestral condition in the Tenuialidae, as is suggested later, then they also share the derived secondary regression of this structure; it is very short in Hafenrefferia and absent, corresponding to an almost total loss of epimeral border IV, in Tenuioioides.

 NOMINAL SPECIES. Tenuialoides fusiformis Aoki, 1969; T. medialis Woolley and Higgins, 1966; T. translamelatus (Aoki and Fujikawa, 1969) new combination. Specimens of an undescribed species have been collected from Crescent City, Del Norte Co., California.

 Subfamily Peltenuialinae n. subfam.

 TYPE-GENUS: Peltenuiala n. gen.

 DIAGNOSIS. Tenuialidae with notogaster distinctly depressed, breadth approximately 2.5 times height, with reflected rim (Figs. 2E, 3B); lenticulus present (Fig. 3C, len). Nine pairs of well-developed notogastral setae (seta p3 absent) and four pairs of lyrifissures (ips absent), distributed as in Fig. 3C. Tutorium (Fig. 6C, tu) a weakly developed, narrow ridge, tapering and effacing about midway between acetabulum I and rostral seta. Exobothridial seta present. Pedotectum I incised. Rostral margin entire.

 Genus Peltenuiala n. gen.6

 TYPE-SPECIES: Peltenuiala pacifica n. sp.

 DIAGNOSIS. With the character states of the subfamily. Also; lamellae widely separated, hiding lateral contour of prodorsum in dorsal aspect, no translamella (Fig. 6A). Insertion of lamellar seta terminal on cusp. Scapular process broad, with no marginal serrations, but with integumental striation and ventral reticulation; reaches anteriad well past anteromedial margin of notogaster. Epimeral setation 3-1-3-3. Sternal borders poorly defined or absent. Epimeral border III complete, coalescing with epimeral border IV before reaching mid-sagittal plane. Teanidium of epimeral border IV present (Fig. 6D), but does not reach laterad to acetabulum IV; minitectum developed only at medial end of teanidium. Lyrifissure iad with usual location, anteriad of insertion of setae ad, near level of anterior margin of anal cavity.

 Peltenuiala pacifica n. sp.

 DIAGNOSIS. Peltenuiala with lamellar cusp elongate and mostly parallel-sided; with or without a small lateral or ventral tooth adjacent to insertion of lamellar seta. Rostral rim extends farther anteriad than lamellar cusp. Scapular process not reaching anteriad as far as origin of cusp. Leg setation as follows (famulus included, solenidia in parentheses): leg I, 1-5-4(1)-5(2)-20(2); leg II, 1-4-4(1)-5(1)-16(2); leg III, 2-3-3(1)-4(1)-15; leg IV, 1-2-3-4(1)-12. Setae distributed on legs I and IV as shown in Figs. 3D-E and 4A-B. Leg II differs from I in being slightly shorter, lacking femoral seta v', tibial solenidion v2 and tarsal setae pv', pv", v' and e. Leg III differs from leg IV in being shorter and having a second trochanteral seta, l', a third femoral seta, l', a genual solenidion coupled to a reduced seta d, and having setae ft', it' and it" on the tarsus. Except

6. The generic prefix is from the Latin pelta (shield) and refers to the nature of the notogaster.
Fig. 2: A. — *Tenuiula kurti* Woolley & Higgins, partial notogaster; B. — *Tenuialoides* sp., partial notogaster; C. — *Hafenoresserria gilvipes* (C. L. Koch), partial notogaster; D. — *Tenuiula kurti*, partial lateral aspect of prodorsum with legs and subcapitulum removed (pdI = pedotectum I, tu = tutorium); E. — *Peltenuiula pacifica* n. gen., n. sp., posterior aspect (lyrillures omitted).
Fig. 3: A. — Tenuiula kurti, cross section of margin of notogaster and ventral plate near level of seta te (the thinness of the unsclerotized connective cuticle is an artifact of clearing in lactic acid); B-D, Peltenuiula pacifica; B. — Same aspect as A; C. — Notogaster, dorsal aspect; D. — Right femur I (antiaxial aspect); E. — Left femur and genu IV (antiaxial aspect). D and E to same scale.
for genu IV, all genua and tibiae with minute, regressive setae d (e.g. Fig. 4C), coupled in same alveolus with respective solenidion. Setae p', p" and s eupathidic on tarsus I. Palp with setal formula 0-2-1-3-9(1); setae acm, u', u" and sul eupathidic. Setae acm and solenidion ω very closely associated, but not fused. Mean total length of eight specimens 765 μm (range 714-813 μm).

**Material Examined.** The holotype and two paratypes (alcoholic) were collected from litter of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, and Port-Oxford cedar, *Chamaecyparis lawsoniana* (A. Murr.) Parl., near Rt. 199 in the Six Rivers National Forest, del Norte Co., California on 8 July 1973 by myself. Deposition will be as follows: holotype to the Field Museum of Natural History, Chicago, Illinois; one paratype to the Harvard University Museum of Comparative Zoology, Cambridge, Massachusetts; one paratype to the Hungarian National Collection, Budapest. Specimens have been collected from the following states and counties (WOOLLEY and HIGGINS, 1957 and new records): California (Del Norte Co.); Oregon (Benton, Lane Co.); Washington (Clallam Co.). Most specimens were extracted from litter in forests with overstories of Douglas-fir, Port-Orford-cedar, coast redwood, *Sequoia sempervirens* (D. Don) Endl., or bigleaf maple, *Acer macrophyllum* Pursh, although some were found in rotting stumps or logs.

**Remarks.** Further descriptive comments and illustrations are presented by HIGGINS and WOOLLEY (1957) under the name *Hafenferrejia nitidula*, as discussed above. One other known species is congeneric, *Peltenuiala orbiculata* (Aoki and Ohnishi) new combination, from Japan and the Soviet Far East (AOKI and OHNISHI, 1974; KRIVOLUTSKY, 1975). The known Asian specimens differ from *P. pacifica* in: being larger (890-923 μm); having a shorter, rather triangular lamellar cusp; having a scapular process which reaches anteriad approximately to origin of cusps, and having a shorter rostrum which does not extend farther anteriad than lamellar cusps.

With regard to other diagnostic characters suggested by AOKI and OHNISHI (1974), the sensillus of *P. pacifica* has sparse, very minute barbs on the sensillar head, but appears to be smooth at low to moderate magnification. WOOLLEY and HIGGINS (1957) described and illustrated *P. pacifica* with six pairs of notogastral setae, but it has nine; perhaps the others were broken from their specimens. Sculpturing of the lamella and scapular process ("pteromorph") of *P. pacifica* is similar to that described by AOKI for *P. orbiculata*. Most of the scapular ornamentation is on the ventral surface, but can appear to be on the dorsal surface in transmitted light, as figured by AOKI.

**Systematic Relationships**

Tenuialid mites were included in the superfamily Liacaroidea as it was originally conceived by BALOGH (1961); other families originally included were Astegistidae, Liacaridae and Metriopidae, with Ceratoppiidae, Gustaviidae and Multiribulidae added more recently (KUNST, 1971; BALOGH, 1972). The Liacaroidea apparently has never been accorded a formal diagnosis; one must perform the unsatisfactory and often misleading practice of extracting appropriate couplets from diagnostic keys, such as those provided by BALOGH (1963, 1965) or BULANOVA-ZACHVATKINA (1975). Most recent authors (e.g. WOOLLEY, 1972; KRIVOLUTSKY, 1975) have followed this placement of the Tenuialidae, but neither this relationship, nor the validity of the family has

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7. **Balogh** (1961) proposed this superfamily as new, but authorship actually belongs to **Sellnick** (1929), who first used the family group name.
**FIG. 4: Peltenuala pacifica n. gen., n. sp.**

A. — Right genu, tibia and tarsus I; B. — Left tibia and tarsus IV; C. — Tibia IV seta d. All antiaxial aspect.
FIG. 5: Tenuiala kurti Woolley & Higgins.

A. — Lateral aspects, legs partially retracted. When fully retracted: femur IV fits into depression 1; tibia IV fits into the less well-defined depression 2; femur II is in place in its own depression (as in photo); tibia and tarsus II can be lowered behind pedotectum I (4); tarsus I fits behind the tutorium (5); trochanter III covers the base of femur II; femur III fits against the antiaxial depression (3) of femur II; the ventral blade-like expansions of femora III and IV provide partial protection of the flexed repetitive tibiae. B. — Right epimeral border IV (genital plate and leg IV, except for trochanter, removed); the circumpedal carina (1) ends at the minitectum (2) which overhangs the taenidium, running from the genital cavity to acetabulum IV.
gone unquestioned. SELLNick (1952), for example, considered Hafenreferfiera and Hafenreferfierella to be members of the Liacaridae. At the other extreme, GRANDJEAN (1953, 1965), who based systematic hypotheses on nymphal morphology, indicated considerable difference between Hafenreferfiera gilvipes (the only tenuialid mite sufficiently known to him) and the Liacaridae. The most salient was that tenuialid nymphs are eupheredermous (carrying gastronomic exuvia or "scalps" of previous instars) whereas liacarid nymphs are aphere­dermous (without these scalps).

Does the latter fact preclude suggestions of close evolutionary ties between the Tenuialidae and other families currently placed in the Liacaroidea? A major current problem in researching this question is the lack of knowledge of tenuialid immatures, other than those of Hafenreferfiera gilvipes. We must assume at this point that immatures of all tenuialid genera are eupheredermous. The immatures of the Gustaviidae are also eupheredermous, but all other liacaroid families for which immatures are described (Liacaridae, Xenilidae, Ceratoppiidae, Metrioppiidae) are aphere­dermous. As a group, however, they are unique among aphere­dermous higher oribatid mites in having a "dorso-deficient" gastronomic chaeto­taxy (GRANDJEAN, 1953), that is, dorsal setae da, dm and dp are lost between the larval and pro­tonymphal instars and never regained. This character state is otherwise restricted to eupheredermous oribatid mites and is presumably an adaptation associated with the accommodation of gastronomic scalps. Whether or not the dorso-deficient condition is an apomorphy derived only once in the eupheredermous mites is not known. In any event, the presence of families with ephere­dermous nymphs and others with aphere­dermous nymphs in the Liacaroidea, as presently concei­ved, does not necessarily argue against the homo­geneity of the superfamily. It seems reasonable to suggest that taxa with dorso-deficient aphere­dermous nymphs were derived within the Liaca­roidea from taxa with dorso-deficient eupheredermous nymphs by the secondary development of aphere­dermery. This could have been accomplished by a simple modification in the molting pro­cedure in which the line of dehiscence (GRAND­JEAN, 1947) secondarily becomes incomplete in the dorsoscutal region.

Assuming this view is accurate, the nearest relatives of the Liacaroida must be sought among eupheredermous taxa. Although a detailed analysis of this subject is currently unfeasible, there are indications that of the extant families the Cepheidae is most closely related to the Liacaroida. Perhaps their most striking synapomorphy is the presence of a taenidium, or channel, and a minute tectum associated with the fourth epimeral bor­der. GRANDJEAN (1968) studied this interesting derived state in a number of higher oribatid taxa, most of which were Liacaroid mites, such as the aphere­dermous genera Ceratoppia, Liacarus, Astegistes, Furcoribula and Cultorribula and the eupheredermous genus Gustavia. I have already noted the presence of this apomorphy in genera of both tenuialid subfamilies. The apomorphy also exists, however, in the cepheid genus Conoppia, which in unusual in that its members have a rather liacaroid facies as adults.

The significance of this synapomorphy between certain Cepheidae and Liacaroidea is somewhat clouded by its existence also in the thyrisomid genera Banksinoma and Oribella (Thyrisoma and

8. Wooley and Higgins (1955) figured a nymph suggested to be that of Tenuiala kurti, but Grandjean (1965) considered this a mistaken association.

9. The molting process of liacaroid mites is undescribed, but it is also possible that a complete line of dehiscence is present in some groups, but that earlier scalps do not adhere. I have observed immatures of an undescribed genus (near Metrioppiia) which are truly eupheredermous, but the scalps are very easily dislodged.

10. Sellnick (1952) described on specimens of Hafenreferfierella nevesi a channel in the "chitinous bridge (which) unites insertion of leg IV with the rim around the genital opening ", which is this structure.

11. The integument of Conoppia adults is mostly smooth and shiny, unlike the rugose, foveolate or reticulate integument of other Cepheidae. Also, the notogastral setae are regressive, represented only by alveoli, and alveolus ta is located on a scapular process, although the latter is rounded and much less well developed than in the Tenuialidae. Also, Conoppia shares the unusual pretarsi of legs II-IV with the liacaroid genus Ceratoppia (Grandjean, 1953).
Fig. 6: *Peltenuiala pacifica* n. gen., n. sp.  
A. — Partial dorsal aspect; B. — Ventral aspect; C. — Partial lateral aspect (tu = tutorium); D. — Right epimeral border IV (the taenidium runs from the genital cavity at the right to the point where the circumpedal carina (1) merges with the mini-tectum (2)).
Pantelozetes, respectively of Grandjean, 1968),
the only other group known to have this derived
state. The adults of Thyrisomidae, a problematic
family presently included in the superfamily
Oppioidea by most authors, resemble certain
metrioppiid mites (e.g. Pyroppia
and related
genera) but the nymphs are unideficient (Grand­
jean, 1953) and apparently possess gastronotic
sclerites resembling those of Ceratozetes nymphs
(Figs. 19A, C of Fujikawa, 1979).

ASPECTS OF BIOGEOGRAPHY

Present knowledge of members of the Tenui­lia­
dae suggests that the group is a relatively old
one. The few extant genera exhibit, for the most
part, disjunct ranges which appear to be relics of
earlier Holarctic or Laurasian distributions, as
reflected in Table 1. Curiously, the distribution
of two sister taxa Tenuialoides and Hafenreferria
seems to be complementary, with sympatry only
known in Japan. Tenuiala and Tenuialoides are
unknown from central North America. Their
disjunction may be due to Pliocene mountain
building and subsequent loss of temperate forests
in this region, as suggested by Norton (1979) for
certain Damaeidae.

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<th>Table 1. — Known distribution of the genera of Tenuialidae.</th>
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<tr>
<td>Peltenuiala</td>
</tr>
</tbody>
</table>

a. East of the Mississippi River.
b. Rocky Mountain and Pacific states.

ACKNOWLEDGEMENTS

I would like to thank Dr. J. R. Philips (Babson Col­
lege, Massachusetts) for allowing me to use his un­
published record of Tenuiala from New York. Dr. Her­
bert W. Levi (Museum of Comparative Zoology, Cam­
bridge, Massachusetts) and R. L. Smiley (U.S.D.A.,
Agricultural Research Service, Beltsville, Maryland) pro­
vided loans of the type specimens of Hafenreferria nitid­
ula, and Tenuiala crenulata and Tenuialoides medialis,
respectively. The scanning electron micrographs were
obtained with the generous help of Ms. Deborah Sil­
man.

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 Parsu en mai 1983.

ADDENDUM

Since this manuscript was submitted, another Peltenuiala species has been proposed : P. lata (Golosova, 1980 ; Zool. Zh. 59 : 782) n. comb., from the Kuril Islands.