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THE EUPODOID MITES OF ALASKA
(Acarina: Prostigmata)[1]

By **R. W. Strandtmann**[2]

Abstract: Mites of the families Eupodidae, Penthalodidae and Rhagidiidae, collected primarily in central and northern Alaska, with small samplings from British Columbia and the McKenzie River Delta, N. W. T., Canada are described and illustrated. Described as new are *Eupodes alaskanensis, Cocceupodes breweri, Cocceupodes shepardi, Coccorhagidia sateri, Coccorhagidia capitata, Coccorhagidia pittardi, Rhagidia whartoni, Rhagidia shibai, Rhagidia hilli,* and *Rhagidia mariehammerae.*

Established species redescribed are *Protereunetes boerneri* Sig Thor, *Penthalodes ovalis* (Duges), *Rhagidia longisensilla* Shiba, *R. uniseta* Sig Thor, *R. gelida* Thorell.

Keys to the known species are included.

Both qualitative and quantitative collecting of terrestrial microarthropods has been done in northern Alaska and northern Canada by a number of people. Noteworthy collections have been made by Hurd (1958), Bohnsack (1968), and by MacLean from about 1966 to 1970. MacLean, to my knowledge, has not yet reported on his work, but it has been very thorough and when the report finally becomes available it should give us the best quantitative information yet available on soil microarthropods, *except the mites*! The reports of Hurd and of Bohnsack do include lists of mites, but they are for the most part only lists of genera or families. Evans (1955) reports on a collection of mesostigmatic mites based on Hurd's collection, and Hammer (1952, 1955) reports on oribatid mites of northern Canada and Alaska respectively. So, although there has been a great deal of collecting of terrestrial arthropods in Canada and northern Alaska, the mite species still remain relatively unknown.

I collected specifically for terrestrial mites in northern Alaska and Canada during the summers of 1967 and 1968, and along the Alaska Hiway in British Columbia, the Yukon Territory, and central Alaska from 1965 to 1969 inclusive. Further collections were made in the Tanana River basin in the vicinity of Nenana and Minto in the summer of 1965.

Although the idea was to establish what mites occur in Alaska, one other objective was to compare the mites that occur north of the Arctic Circle with those that occur south of the Antarctic Circle. The present paper is limited to those mite families that have representatives in both polar zones. The only mites that occur in continental Antarctica (i.e., south of the Antarctic Circle) are Oribatei and Prostigmata. The Oribatei are not considered in this paper; they have already been extensively worked by Hammer (1952, 1955), and Bohnsack (1968) for the north, and Wallwork (1967) for the south.

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The families of prostigmatic mites that occur in Antarctica are the Tydeidae, Nanorchestidae, Eupodidae, Penthalodidae, and Rhagidiidae. I have restricted myself to the last three families. The Tydeidae were excluded because they are currently the particular objective of Edw. W. Baker. The Nanorchestidae are not considered at the present because they offer peculiar difficulties of study that will take time to resolve. The family is represented by the single genus *Nanorchestes*. In Antarctica there is one species, very numerous, widespread, and circumpolar. In the Arctic, *Nanorchestes* seems also to be circumpolar. It has been reported from Norway and is common in Alaska and Canada. In both the Arctic and the Antarctic there is considerable variability in those characters which have been considered of taxonomic use, such as the cheliceral seta, number of rays on the tarsal claw, length and shape of the trichobothria, total body length. At this writing, it appears that the Arctic and Antarctic forms may be conspecific; at least the variations that occur show considerable overlap. A much more detailed study involving many measurements and statistical analysis of measurements will have to be made before this can be resolved. If they should prove to be the same, it would pose a most interesting problem of distribution and evolution.

Nanorchestes occurs also in Europe and, no doubt, elsewhere. On this survey, we recovered *Nanorchestes* at all collecting sites except Reindeer Station, NWT. They seem to be most abundant in exposed areas overgrown with lichens.

The family Eupodidae includes the genera *Eupodes*, *Cocceupodes*, *Protereunetes*, and *Linopodes*; and according to some authors (Baker & Wharton 1952, Strandtmann & Tilbrook 1968) also the genera *Penthaleus* and *Halotydeus*. In continental Antarctica, only *Eupodes* and *Protereunetes* occur. *Cocceupodes*, *Penthaleus*, and *Halotydeus* occur in the subantarctic islands. No *Linopodes* has been reported from either the Antarctic or Arctic regions. In Arctic Alaska, we found *Eupodes*, *Cocceupodes*, *Protereunetes*, and *Penthaleus*. We found no *Halotydeus*, and *Linopodes* was found only in central Alaska and on south.

The incomplete evidence we have to the present indicates that speciation in this family is progressing at about the same rate for the Arctic and the Antarctic.

Number of Species

	In Antarctica	In the Arctic
Eupodes	2	1
Protereunetes	2	1
Cocceupodes	1	3
*Penthaleus**	0	1 (?)

The family Penthalodidae is considered by us to contain only two genera, *Penthalodes* and *Stereotydeus*, although four genera are listed by Thor & Willmann (1941). We believe both *Tectopenthalodes* and *Chromotydaeus* (the other two genera) to be junior synonyms of *Stereotydeus*.

Penthalodes is boreal and *Stereotydeus* is austral although Baker (1947) reported both genera as occurring in central Mexico. It could be that eventually it will be found that the two genera are sympatric throughout the tropics. For the polar regions, however,

* (Note: although *Penthaleus* was found in Alaska, it is not included in this paper.)

only *Penthalodes* occurs in the Arctic and only *Stereotydeus* in the Antarctic. This is noteworthy, but it is even more interesting that in the Arctic *Penthalodes* is represented by only one species (*ovalis*), and it is not particularly abundant; whereas, in Antarctica *Stereotydeus* is the dominant mite both in number of individuals and in number of species. Some 7 species occur. The reasons for the extensive speciation of *Stereotydeus* in Antarctica, and the lack of speciation of *Penthalodes* in the Arctic are not clear, but it may be due to the fact that habitable environments are physically isolated in Antarctica while in the Arctic the whole circumpolar region is habitable, and populations are not subject to physical isolation.

The family Rhagidiidae contains two genera, *Rhagidia* and *Coccorhagidia*. Since they differ only by the shape of one pair of sensory setae, the trichobothria, it could be potently argued that the family Rhagidiidae is in fact monogeneric. But we will continue to recognize the two types as distinct genera, at least for the present. Both types are represented in both polar regions, but they are much more numerous in the Arctic, both in numbers of individuals and in numbers of species. It is remarkable that in Antarctica there is no sympatry of genera; the genus *Coccorhagidia* in Antarctica is restricted to Victoria Land, ca 165° E longitude, and *Rhagidia* to the Antarctic Peninsula, ca 65° W longitude. Species within the genus are sympatric, however. In the Arctic, the two genera, and the species within each genus, are sympatric.

In numbers of individuals, the rhagidiids of Antarctica and the Arctic are about equally abundant, but in the Arctic the family seems to be speciating at a much greater rate. In Antarctica there are two species of *Coccorhagidia* and two of *Rhagidia*; in the Arctic, there are three species of *Coccorhagidia* and seven of *Rhagidia*.

The Rhagidiidae are the only predaceous terrestrial arthropods found on the Antarctic continent; in the Arctic the rhagidiids are only one of many predaceous forms. While this implies greater competition, there is also a greater variety of prey to choose from. Perhaps the combination of these factors accounts for the higher rate of speciation.

Discussion of the species

In the following treatment of the species, I have included keys to the genera and to those known species that have been well enough described to allow for diagnosis. Explanation of symbols used is found at the end of the text.

Families can be keyed in any of several available texts. An excellent recent text giving keys to all the families of mites is that of Krantz, 1970 (A Manual of Acarology; O. S. U. Book Stores, Inc., Corvallis, Oregon, U.S.A.).

Family EUPODIDAE Koch

Soft-bodied, delicate, small to very small mites. No epirostrum but with a distinct epivertex.

Key to genera of Eupodidae

1a. Legs I very long and slender, 3-4× length of body. Tarsus I long, flexible, and divided into several pseudosegments ..... **Linopodes**

1b. Legs I not more than 2× length of body. Tarsus I at most consisting of 2 pseudosegments 2
2a. Pedipalps short, thick, the end segment very short, shorter than 3rd segment 3
2b. Pedipalps longer, the segments more slender and the end segment tapering and as long or longer than 3rd segment 4
3a. With some nude body setae; polytrichy not uncommon; excretory pore dorsal ..... **Penthaleus**
3b. Few or none of the body setae nude; never (?) polytrichous. Excretory pore terminal ..... **Halotydeus**
4a. Internal vertical setae inserted posterior to epivertex. Femur IV swollen ..... **Cocceupodes**
4b. Epivertex bears 2 small internal vertical setae. Femora IV may or may not be swollen ... 5
5a. Anterior rostral setae (fig. 1b) inserted at apex of rostrum (hypostome); dorsal setae as long as distances between bases, rarely shorter; femora IV generally swollen. Legs I generally longer than body, from 1.25-2.0 body length ..... **Eupodes**
5b. Anterior rostral seta (fig. 2b) inserted about midway between apex and midpoint of rostrum. Dorsal setae 1/2 as long as interbasal distances. Legs I no longer than body. Femur IV slender ..... **Protereunetes**

Genus **Eupodes** C. L. Koch, 1835

Type: *Eupodes hiemalis* C. L. Koch, 1838 by designation of Koch in 1842.

Small, soft-bodied mites. Suture between pro- and metapoda generally present. Trichobothria slender, lightly plumose. Frequently the 4 anterior pairs of dorsal setae (i.h., e.h., d_1, d_2) are long, stiff and coarse, and posterior 4 pairs (i.l., e.l., i.s., e.s.) thin and fine and more or less clustered at end of body. Three pairs of anal setae, of which 1 or 2 pairs may be on dorsal side.

Coxae in 2 groups, not well defined. Coxal seta formula, 3-1-3-3, or 3-1-4-3. Genital pore covered by 2 flaps each bearing 5 or 6 setae. Two pairs of genital knobs, and in the adult a variable number of internal setae. Paragenital setae, 4 to 7 pairs. Anal pore subterminal; 3 pairs of anal setae of which the 1st, (A_1), are very much the shortest. All ventral setae tend toward clavate.

Hypostome narrowly cone-shaped, with 2 pairs of small, plumose setae, *of which 1 pair is at apex*. Chelicera long and narrow, bearing a small nude seta at base of small, malformed shears. Pedipalps 4-segmented, with 0-2-3-6/7 setae; end segment elongated and with small outer basal solenidion in addition to the 6 or 7 setae.

Legs, except IV, slender. Leg I as long or longer than body, II and III shorter than body, IV about body length and almost always with thickened femur. Tarsi I and II each with 2 rhagidiform organs. Solenidia small and variable.

In life they are white, yellow, orange, or red, frequently with black lines or flecks. They occur in grasses, lichens, mosses, under stones, boards, and logs, and probably feed on the lower plant forms such as lichens, algae, and fungi. They occur wherever such plant forms are found, provided there is sufficient moisture.

Some 45 species have been named, but very few have been described well enough to identify with some degree of assurance. Thor & Willmann (1941) give a key to ca 38 species but the characters used are not really differential. Using characters that in my opinion are differential, only 9 species could be diagnosed sufficiently well to separate from all others. They are keyed out below.

KEY TO THE SPECIES OF EUPODES

1a. Dorsal setae short, not 1/2 as long as distance between setal bases 2
1b. Dorsal setae longer, as long as interspaces or longer 4
2a. Dorsal setae hair-like, not prominently swollen basally. Femur IV very thick, as wide as long. L. 325-420 μm. Germany ..... **ocellatus** Willmann, 1952
2b. Dorsal and most body setae noticeably swollen basally, except 1 or 2 pairs posteriorly (what are apparently the internal lumbars and internal sacrals are fine and hairlike). Legs I, about as long as body 3
3a. The i.l. only, and trichobothria, are slender, all other body setae and most of the leg and pedipalpal setae are swollen basally. L. 420 μm. Intertidal zone of the Red Sea ..... **riedli** Schuster, 1965
3b. The i.l., i.s., and trichobothria, slender. Other body setae swollen basally. Leg setae not swollen. 450-600 μm long. Italy ..... **fusifer** R. Canestrini, 1886
4a. All legs slender; femur IV not noticeably swollen. Legs I ca 1.5 length of body; leg IV slightly longer than body; legs II and III about body length. Coxae, 3-1-4-3. Genital setae, 6 pairs, 1 pair more lateral than others; paragenital setae, 5 pairs. Dorsal setae slender, just barely as long as interspaces. L. 450 μm. Antarctica ..... **tottanfjella** Strandtmann, 1967
4b. Femur IV swollen 5
5a. Epivertex sharply pointed. Three pairs of setae in humeral row. Leg I slightly longer than body; dorsal setae overlap. 300 μm long. Germany ..... **acuminatus** Willmann, 1952
5b. Epivertex rounded. Only the usual 2 pairs of setae in humeral row. (i.h. and e.h.) 6
6a. Leg I ca 2× length of body 7
6b. Leg I varying from about as long as body to 1.0-1.5 length of body 8
7a. Dorsal and humeral setae 2× as long and 2× as thick as lumbars and sacrals; the latter, along with anals 2 and 3, are clustered at the posterior end. Length of body 400± μm. Campbell Island (subantarctic); Japan ..... **longisetatus** Strandtmann, 1964
7b. Similar to the above, according to the illustrations and descriptions, but body is 650 μm long. Italy ..... **berlesei** Sig Thor, 1891
8a. Dorsal suture not prominent; humerals and dorsals not quite as long as interspaces. Legs I not longer than body. Anals I short and clavate; 2 and 3, longer, filiform. 480 μm. Antarctica ..... **wisei** Strandtmann, 1963
8b. Dorsal suture obvious, humerals and dorsals longer than interspaces. Legs I longer than body, anals I are shorter than 2 and 3 but no different in form. Body 450 μm (350-600). Alaska ..... **alaskanensis***

Eupodes alaskanensis Strandtmann, new species Fig. 1 a-i.

♀. 450 μm (390-600). Fig. 1 a-c. Trochanter, 1-1-1-1. Coxal setae, 3-1-4-3. Outer apical seta of coxa I about 1/2 as long as inner apical seta. Genital setae, 6 pairs; paragenital setae, 6 pairs. All ventral and coxal setae slightly clavate. Anal or excretory pore terminal; with 3 pairs of setae, the 1st pair (A_1) 1/2 as long as 2nd and 3rd. Dorsal side. Setae of dorsum longer than trichobothrium, about 1/4 length of body. Setae i.v. and sc. equal, about 2/3 length of dorsal setae. Legs. Leg I about 1.5 length of body. Tarsi I and II each with 2 rhagidiform organs lying tandem in confluent fields; tibiae I and II each with an apical rhagidiform and a basal solenidion. Femora I, III, and IV are divided, femur II, partially divided.

Nympha III. 375 μm long. Trochanters, 1-1-1-1. Coxae, 3-1-4-3. Genital setae, 3 pairs; paragenitals 5 pairs. Legs I slightly longer than body. Rhagidial organs and solenidia as in ♀.

* Described as new.

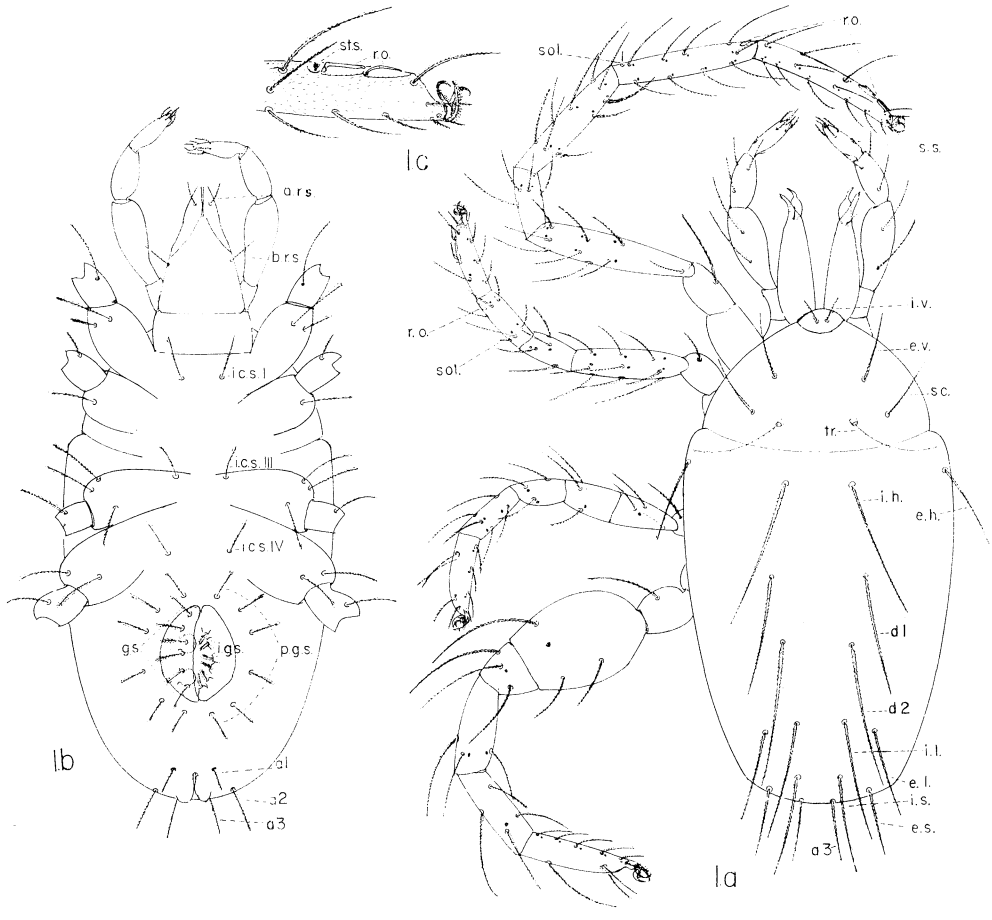


Fig. 1. a-c, *Eupodes alaskanensis* n. sp. ♀ : a, dorsal view ; b, ventral view with left genital cover removed ; c, lateral view of tarsus I.

Dorsal setae longer than interspaces. Nympha II. 275 μm long. Fig. 1 d, e. Trochanters, 1-1-1-0. Coxae, 3-1-4-2. Genital setae, 2 pairs ; paragenitals 2 pairs. Setae of dorsum a bit shorter than trichobothria and not quite as long as interbasal spaces. Leg I about as long as body. Tarsus I with 2 rhagidiforms, the apical one only 1/2 as long as basal. Tarsus II, with 1 rhagidiform. Tibiae I and II as the ♀. Femora I and II not divided. Nympha I. 200 μm (190-240). Fig. 1 f-i. Trochanters, 0-0-1-0. Coxae 3-1-3-0. Genital setae, 1 pair ; no paragenital setae. One pair genital knobs. Setae of dorsum approximately 1/2 as long as trichobothria, and about 1/2 as long as spaces between bases. Leg I as long as body. Tarsi I and II each with 1 rhagidiform. Tibia I and II with 1 apical r.o. and 1 basal solenidion, as the ♀. Leg IV devoid of setae except on tarsus, which has 4 ventral and 3 dorsoapical setae. Femora not divided. ♂, none found.

Holotype ♀ (BISHOP 9342), Cape Beaufort, Alaska, 12.VII.1968, R. W. & M. R. Strandtmann. Berlesed from moss and prostrate birch.

DISTRIBUTION : Described from 6 ♀♀, 1 tritonymph, 3 deutonymphs, and 4 proto-

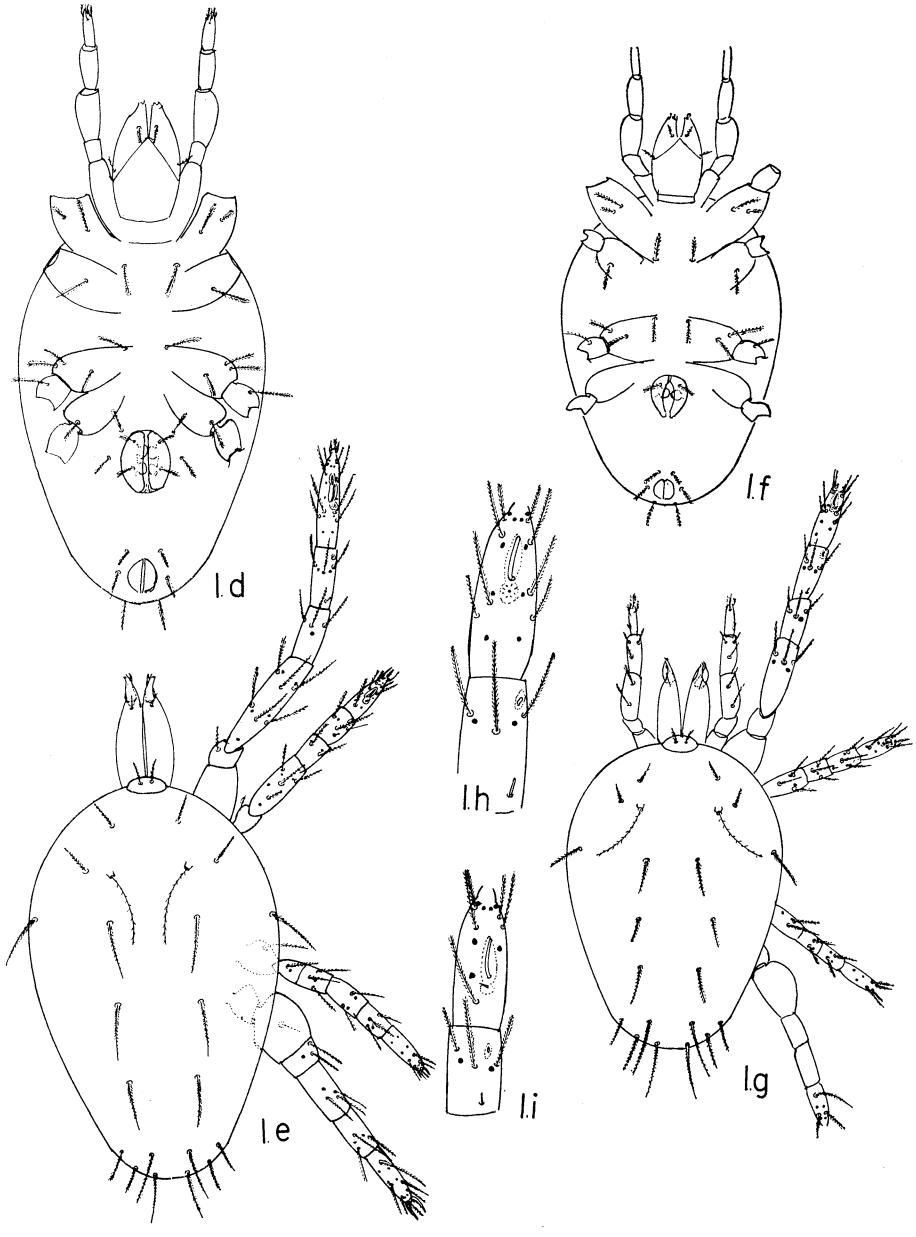


Fig. 1. d–i, *Eupodes alaskanensis* n. sp., nymphs : d, venter of deutonymph ; e, dorsum of deutonymph ; f, venter of protonymph ; g, dorsum of protonymph ; h, tibia and tarsus I of protonymph ; i, tibia and tarsus II of protonymph.

nymphs collected in central and northern Alaska: Fairbanks, Anaktuvik Pass in the Brooks Range, and the North Slope from Umiat to Cape Beaufort and Wainwright. Probably occurs also at Barrow. All specimens were collected from tundra samples. Fairbanks, 2 ♀♀, 22.VI.1968; Anaktuvik Pass, 2 Ny I, 3 Ny II, 17.VI.1968; Umiat, 1 ♀, 30.VI.1967; Cape Beaufort, 3 ♀ (including the holotype), 1 Ny, 12.VII.1968; Wainwright, 1 Ny I, 1 Ny III, 1.VII.1968.

Genus **Protereunetes** Berlese, 1923

Genotype: *Micrereunetes* (*Protereunetes*) *agilis* Berlese, 1923.

Small to very small, delicate mites. Hypostome with 4 small, plumed setae. The anterior pair is distinctly subapical. Dorsal and ventral chaetotaxy sparse and all setae normally short and lightly plumose.

With 2 pairs of genital knobs and a variable number of setae on elongate genital covers. Genital setae, which seem to be constant at 6 per cover, are in single file, i.e., none more lateral than the others. ♂ with an internal sperm sac. 4th segment of pedipalp longer than broad. Tarsi I and II with 2 or more rhagidiform organs. Coxal formula, so far as known, is 3-1-4-3.

The genus is probably cosmopolitan, although not many species are known. At present it has been collected only in Europe, the Arctic, and Antarctica.

Key to the species of Protereunetes

1a. Tarsi I and II each with 2 rhagidiform organs; on tarsus I they are tandem, unequal, and in confluent fields; on tarsus II they are staggered, unequal, and in separate fields. Genua I, II, III, each with a dorsobasal solenidion. Length 280-350 μm. Arctic form ..... **boerneri** Sig Thor, 1934

1b. Tarsus I with 2 r.o., tandem in a common field but of equal size. Tarsus II with 3 r.o., 2 forward and 1 basal. Genua of all legs without solenidia. Antarctic forms 2

2a. Tibiae I-IV without solenidia, but tibiae I and II with a dorsal, depressed sensory seta, similar to a rhagidial organ. Length 250 μm. Antarctic Peninsula ..... **minutus** Strandtmann, 1967

2b. Tibiae I-IV each with a dorsobasal, erect, solenidion. No rhagidial organs except on tarsi. Length 450 μm. Victoria Land, Antarctica ..... **maudae** Strandtmann, 1967

Species Inquierenda

The following species all are well enough described to place them as *Protereunetes*, but not sufficiently well to separate them.

P. agilis (Berlese) 1923, length 350 μm. Tibia I longer than Tarsus I. Italy.

P. brevipes (Berlese) 1923, length 220 μm. Tibia I and Tarsus I same length. All legs much shorter than body. Italy.

P. lapidarius (Oudemans) 1906, length 330 μm. 4th segment of pedipalp with only 2 setae (sic!). Holland.

P. striatellus (Koch) 1838, length 350-400 μm. Germany, Estonia, Holland.

Protereunetes boerneri Sig Thor Fig. 2 a–i.

Length 300 μm (280-310). Trochanters, 1-1-1-1. Coxae, 3-1-4-3. Genital setae 6 pairs; paragenitals 5 pairs. Anal pore subterminal, with 3 pairs of setae, the anterior pair noticeably shorter than the 2 following. Paragenital setae longest anteriorly, become progressively shorter posteriorly. All ventral setae subequal and rather small. Dorsal side: (fig. 2a). Setae of dorsum small, equal, about 1/2 as long as interspaces. Setae e.l., and i.s. longer by about 50% than others. Setae e.v. and sc. equal and about as long as dorsals 1 and 2. Legs shorter than body. Femora III and IV divided. Tarsus I with 2 rhagidiforms subtended by a stellate seta, lying tandem in confluent fields; basal rhagidiform 2× as long as apical. Tibia I with an apical rhagidiform which has a small spine at its apex, and a long dorsobasal rhagidiform. Tarsus II with 2 rhagidiforms, in separate fields, the basal 2× length of apical and with a small spine at its proximal end. Tibia II with 2 dorsal, equal, rhagidiforms, 1 apical, 1 basal. Tibia III with a dorsobasal rhagidiform field but organ in it seems to be missing. Genua I, II, III, each have a dorsomedial solenidion. Tarsus IV has a mediodorsal seta which other species of the genus lack.

♂. 300 μm. Similar to ♀ in all respects except for the presence of a sperm sac.

Leg chaetotaxy of adult:

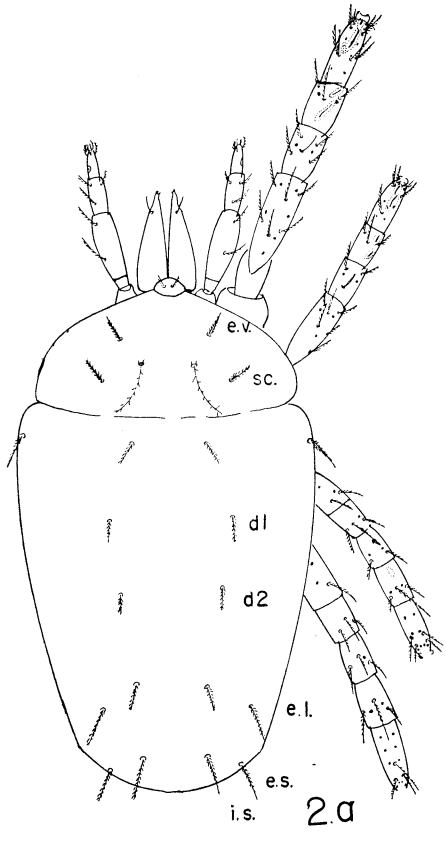
Leg	Tarsus	Tibia	Genu	Femur
I	21	5	6	12
II	13	5	4	10
III	12	5	4	8
IV	13	5	4	6

Nympha III. 250 μm long. Trochanters, 1-1-1-1; coxae 3-1-4-3. Genital setae 3 pairs; paragenitals, 4 pairs. Otherwise as in ♀. Nympha II. 200 μm. Trochanters, 1-1-1-0; coxae 3-1-4-2. Genital setae 2 pairs; paragenitals 2 pairs. Sensory setae of the legs as in the ♀. Nympha I. 160 μm. Trochanters, 0-0-1-0. Coxae 3-1-3-0. Genital setae, 1 pair; no paragenital setae; only 1 pair genital knobs. Leg IV without setae except on tarsus. Sensory setae of tibiae and genua as in the ♀. Tarsi I and II each with only 1 rhagidiform, the basal. Larva. 135 μm. Only 6 legs. Trochanters, 0-0-0. Coxae 2-1-2. No genital nor paragenital setae. No genital knobs. Dorsal chaetotaxy complete, anal chaetotaxy complete but all anal setae small. Sensory setae of tibiae and genua I and II essentially as in ♀.

DISTRIBUTION: About 50 specimens including all life stages collected mostly at Barrow from tundra samples and from the nests, both old and new, of the brown Lemming, *Lemmus trimucronatus*. Other collection sites include Anaktuvik Pass, 4 ♀♀; and Wainwright, 1 ♂, 4 ♀♀, 3 Nys. All collections were made during June and July, 1967 and 1968.

Discussion: Differs from the Antarctic forms of *Protereunetes* (*maudae* and *minutus*) in having an extra, anterior ventral seta on tarsus I, (see !, fig. 2d), a solenidion on each of genua I, II, and III, and by having a dorsomedian seta on tarsus IV (fig. 2g).

Two ♀♀ of a variant form were collected from tundra at Cape Thompson July 14, 1968. They differ from the typical form as described above in being larger (350 and 375 μm) and in the sensory setae of legs I and II (fig. 2 k, l). Tarsus I has 2 rhagidial organs of equal size, in *boerneri* they are unequal; tibia I has 1 r.o. and 1 solenidion, whereas *boerneri* has 2 r.o. Tibia II of the variant form has 3 r.o. lying tandem in a common field; in *boerneri* there are only 2 r.o., and they lie in separate fields. They



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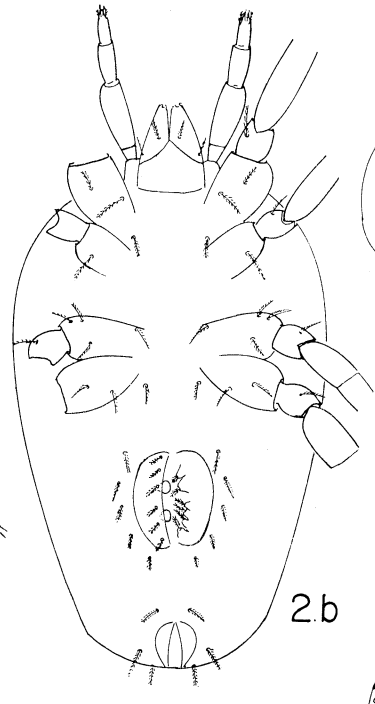

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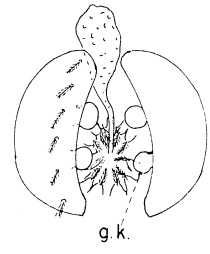

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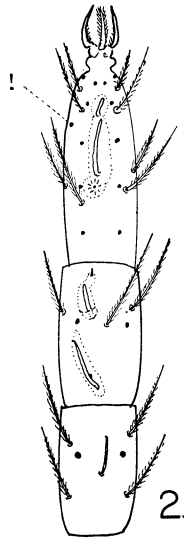

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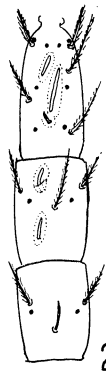

2.e

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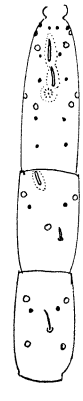

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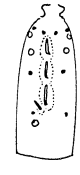

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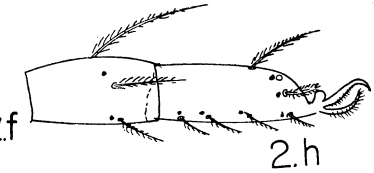

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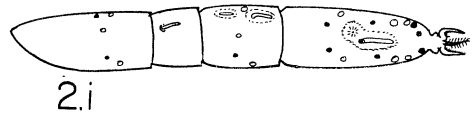

2.i

possibly represent a new species, but I would like to see more specimens before giving them a name.

Genus **Cocceupodes** Sig Thor, 1934

Type: *Eupodes clavifrons* R. Canestrini, 1886.

Small to very small, soft-bodied mites. Transverse suture on podosoma generally lacking. Body setae of variable length but generally shorter than in *Eupodes*. Femur of leg IV noticeably swollen. Setae i.v. (internal verticals) clavate or threadlike, inserted on dorsum just posterior to the epivertex. *With 2 pairs of anal setae.* These 2 pairs, in my opinion, represent Anals 1 and 3, it being Anals 2 which are lost. A pair of porelike, circular structures are present near Anals 1 and may represent the lost A2. The cheliceral seta is ciliated, whereas in *Eupodes* and most other eupodiform genera it is nude.

Key to the species of Cocceupodes

1a. Setae i.v. threadlike 2
1b. Setae i.v. clavate or capitate 3
2a. Body 360-425 μm long. Genital setae, 6 pairs; dorsal setae about as long as interspaces. Alaska ..... **shepardi***
2b. Body 200-250 μm long. Six pairs of genital setae, dorsal setae short, not 1/2 as long as interspaces. Denmark ..... **paradoxus** Weis Fogh 1948
3a. Genital covers each with 6 setae. Tarsi I and II each with 2 rhagidiform organs. Apical seta of coxa I about 1/2 as long as the middle seta. Body length 357 μm. Japan ..... **communis** Shiba, 1969
3b. Genital covers each with 4 setae. Tarsus I with 2 r.o.; tarsus II with 3 r.o.; apical seta of coxa I about 1/4 length of middle seta 4
4a. Dorsal setae as long as interspaces. Body length from 300 to 400 μm. Rhagidial organs of tarsi I and II tandem and in confluent fields. Alaska ..... **breweri***
4b. Dorsal setae short, about 1/2 length of interspaces. Body length, from 150 to 290 μm. Rhagidial organs of tarsi I and II in separate fields. Antarctic Peninsula ..... **australis** Strandtmann and Tilbrook, 1968

Three species are not adequately described to include in the foregoing key. These are *C. clavifrons* (R. Canestrini, 1886), *C. curviclava* Thor, 1934, and *C. mollicellus* (Koch, 1838).

In the opinion of Haarlov (1957), *C. mollicellus* and *C. clavifrons* are synonymous and I can find nothing to refute that conclusion. According to the brief descriptions, the body varies from 140-250 μm in length; leg I is less than 1.5 length of body and the claviform setae iv are without a noticeable pedicle. Everything else in the description is nondiagnostic. It is reported from Italy, Norway, and Sweden (*clavifrons*) and Germany, Denmark, and Norway (*mollicellus*).

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* Described as new.

Fig. 2. *Protereunetes boerneri* Sig Thor: a, dorsum; b, venter of ♀; c, genitalia of ♂; d, left leg I of adult; e, left leg II of adult; f, leg III; g, tarsus IV; h, lateral view of tarsus and tibia IV; i, dorsal view of left leg of larva; k, left leg I of variant form of adult; l, tarsus II of variant form of adult.

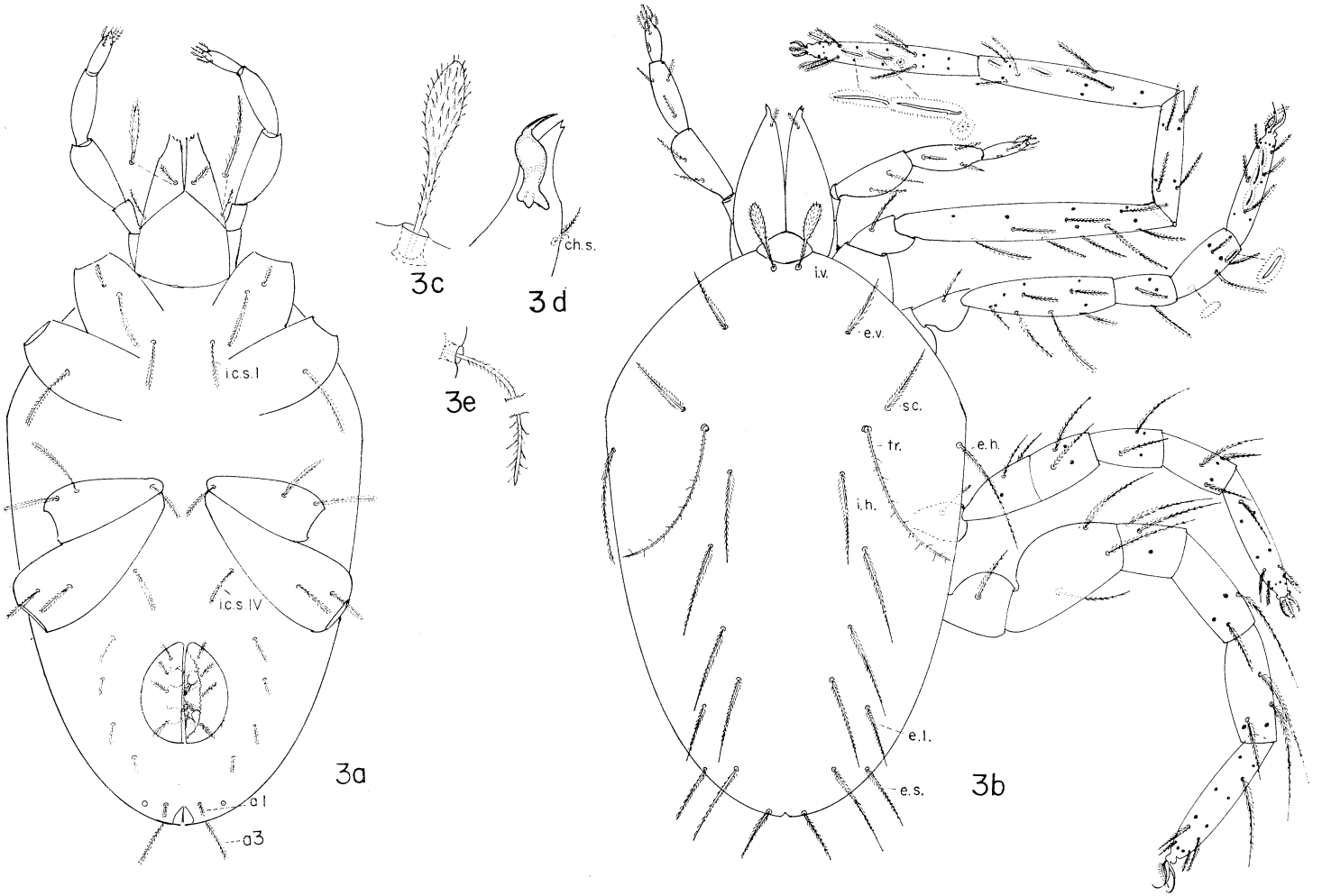


Fig. 3. a–e, *Cocceupodes breweri* n. sp. : a, venter of ♀ ; b, dorsum of adult ; c, internal vertical seta ; d, chela, lateroventral view ; e, trichobothrium.

C. curviclava is described as 150 to 280 μm long, the body setae short, the claviform setae i.v. with a distinct pedicle, and the enlarged portion depressed on one side, forming a groove. Reported from Italy, Norway, and Sweden. McAlpine (1965) reports it from Isachsen, Ellef Ringes Island, saying it was the most abundant and widespread mite in 1960. Hurd (1958) reported it from Barrow, Alaska, but I believe this is incorrect. (See Discussion under *C. breweri*).

Cocceupodes breweri Strandtmann, new species Fig. 3 a–i.

♀. (Fig. a–e). Length of body 350 μm (300–425). Trochanter, 1-1-1-1. Coxae 3-1-3-3. Genital setae, 4 pairs; paragenitals, 4 pairs. Anal pore subterminal, with 2 pairs of setae of which A_1 is about 1/4 to 1/3 length of A_3; a pair of circular pores lateral of setae A_1. The anterior pair of paragenital setae noticeably longer than the others. On coxa I, the apical seta is about 1/4 as long as the medial, which is longer than the basal seta. Dorsal side: (Fig. 3b). Setae i.v., e.v., and sc. about equal and shorter than middorsal setae, which are just longer than distance between bases. Legs. Leg I about 1.5 length of body, leg IV about body length; II and III are shorter. Tarsus I with 2 rhagidiforms lying tandem in a common field, subtended by a stellate seta. Tibia I with an apical and subapical rhagidiform. Tarsus II with 3 rhagidiforms, tandem in confluent fields. Tibia II with an apical rhagidiform and a basal area that might be a rhagidiform. Legs otherwise without sensory setae. Femora III and IV divided. Tarsus I is slightly constricted just posterior to the stellate seta.

Nympha II (fig. 3 f, g). Length 250 μm (225–300). Trochanters, 0-0-1-0. Coxae 3-1-3-2. Genital setae 2 pairs, paragenitals 2 pairs, anals 2 pairs. Dorsal side: setae e. v. and sc. equal and about 1/2 as long as clavate i.v.'s. Middorsal setae about 1/2 as long as interspaces. Leg I about length of body. Tarsus II with only 2 rhagidiforms; sensory setae of legs otherwise as in ♀. Nympha I (fig. 3 i–h). Length 210 μm (185–275). Trochanter, 0-0-0-0; coxae 3-1-3-0. Genital setae, 1 pair. No paragenitals. One pair of genital knobs. The capitate i.v. setae are prominent, trichobothria long and slender, all other setae small. Leg I about as long as body. Leg IV without setae, except 4 ventral and 2 dorsal setae on tarsus. Tarsi I and II each with only 1 rhagidiform. Tibia I with an apical rhagidiform. No other sensory setae. No ♂, no Nympha III.

Holotype ♀ (BISHOP 9343), Anaktuvik Pass, Alaska, 17.VI.1968, Kay and Don Pittard. Berlesed from tundra samples.

DISTRIBUTION: Described from 40 specimens, including 30 ♀♀, 6 Ny II and 4 Ny I. Widespread in northern Alaska. Collection sites include Fairbanks, Anaktuvik Pass, Barrow, Wainwright, Cape Beaufort, and Cape Thompson. All specimens were collected from tundra samples via Berlese funnels during the months of June and July.

Discussion: What I have described as *Cocceupodes breweri* n. sp. is common and widespread in Alaska. It is possible that if *curviclava* were better described, differences between it and my new species might disappear. But, in the absence of contrary information, I must assume that *C. breweri* is indeed different from *C. curviclava* and, further, that Hurd's reference to *curviclava* in 1958 actually is *C. breweri*.

Cocceupodes breweri differs from *C. curviclava* in 1) size (140–280 μm for *curviclava*, 300–425 μm for *breweri*); 2) body setae (short in *curviclava*, long in *breweri*); 3) palp segments (short and thick in *curviclava*, elongated in *breweri*); 4) leg IV (short and slightly swollen in *curviclava*, long as body and distinctly swollen in *breweri*).

The mite is named for the inimitable Dr Max Brewer, Director of the Arctic Research Lab at Barrow.

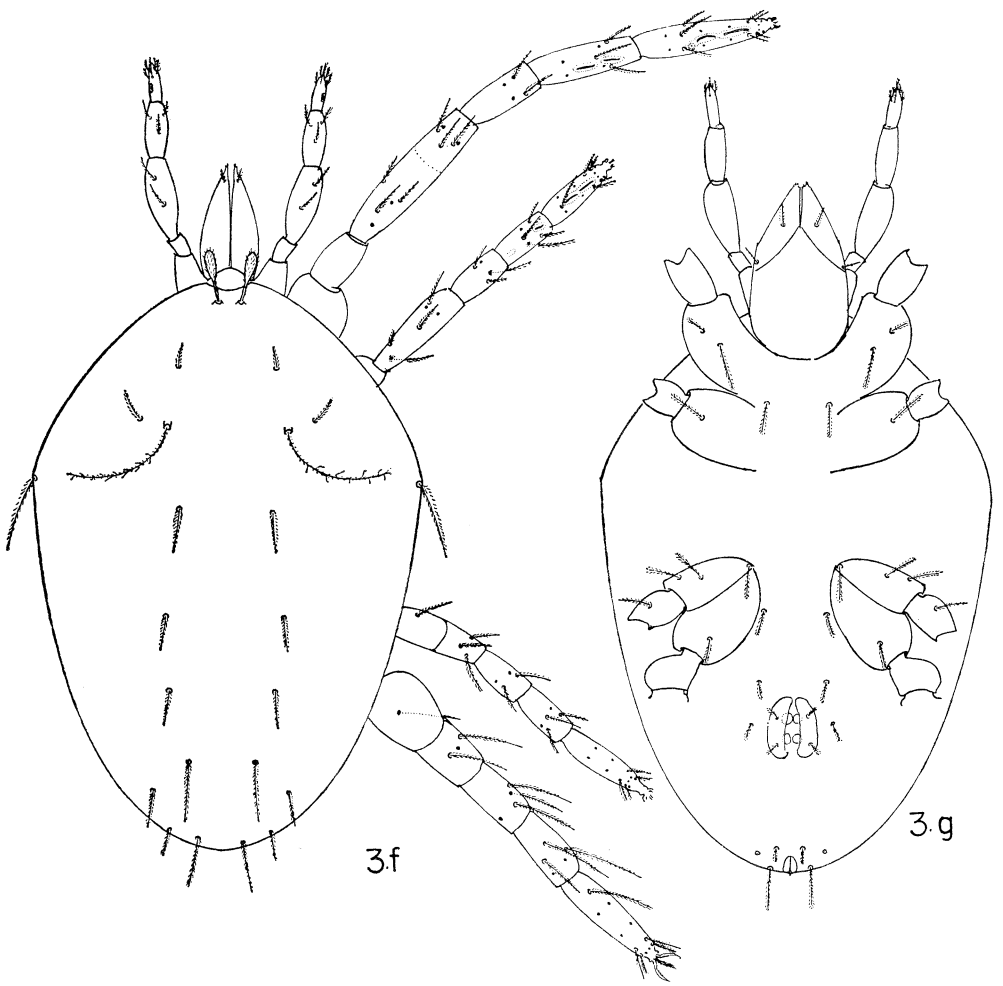


Fig. 3. f-g, *Cocceupodes breweri* n. sp., Deutonymph : f, dorsum ; g, venter.

Cocceupodes shepardi Strandtmann, new species Fig. 4 a-f.

Only the ♂ is known. Length 380 μm (365-425). Trochanter, 1-1-1-1 ; the seta on II is only 1/2 as long as that on I, III, and IV. Coxae, 3-1-3-3. Genital setae, 6 pairs ; paragenitals, 4 pairs. Sperm sac flacid, not as long as genital cover. Anal pore subterminal, with 2 pairs of setae ; seta A_1, 1/2 as long as A_3. Dorsal side (fig. 4b). Internal vertical setae filiform, plumose, not clavate, inserted in pits posterior to epivertex. Setae e.v. and sc. equal and not much shorter than i.v. Middorsal setae about 1/3 to 1/2 longer than e.v. and sc. and as long as interspaces between setae. Legs (fig. 4 c-f). Tarsus I with 2 rhagidiforms lying tandem but in separate fields. The stellate seta separate and well basal. Tibia II with an apical and an apicomedial rhagidiform. Tarsus II with 3 rhagidiforms, loosely tandem, in separate fields. Tibia II with 2 very small rhagidiforms, one dorsoapical, the other dorsobasal. Femora III and IV divided.

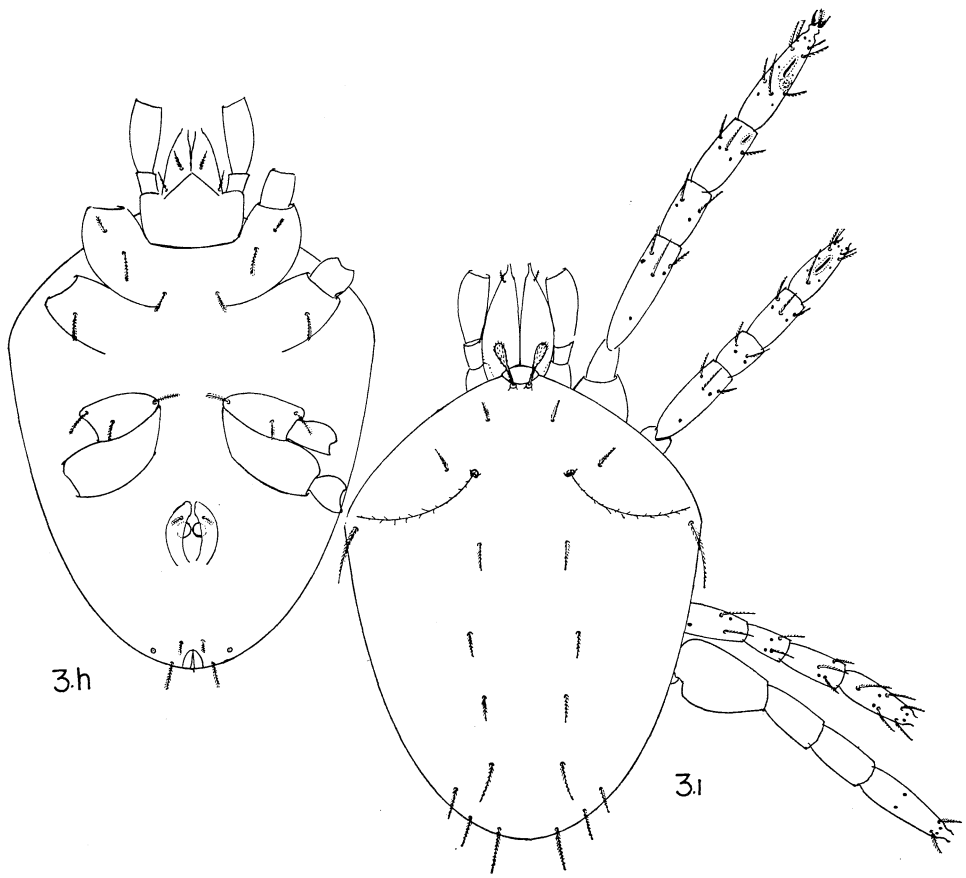


Fig. 3. h-i, *Cooceupodes breweri* n. sp., Protonymph: h, venter; i, dorsum.

Holotype ♂ (BISHOP 9344), Cape Beaufort, Alaska, 17.VII.1968, tundra (moss and prostrate birch), R. W. & M. R. Strandtmann.

DISTRIBUTION: Known only from 3♂♂, collected from tundra samples taken at Cape Beaufort, an abandoned DEW line station on the north Alaskan coast.

Discussion: There is a possibility that this is the ♂ of *C. breweri*, although it has filiform i.v. setae, whereas *breweri* has clavate i.v. setae. The genus *Cocceupodes* is still too poorly known to be able to say whether there may be sexual dimorphism of this extent.

The mite is named for Guy Shepard, pilot for N.A.R.L. at Barrow, who is an astute observer of, and has an intense interest in, the wild animals of Alaska.

Family PENTHALODIDAE Sig Thor

Small to very small mites. Characterized by a more or less prominent epirostrum extending over the base of the gnathosoma. Many species are sclerotized and most are

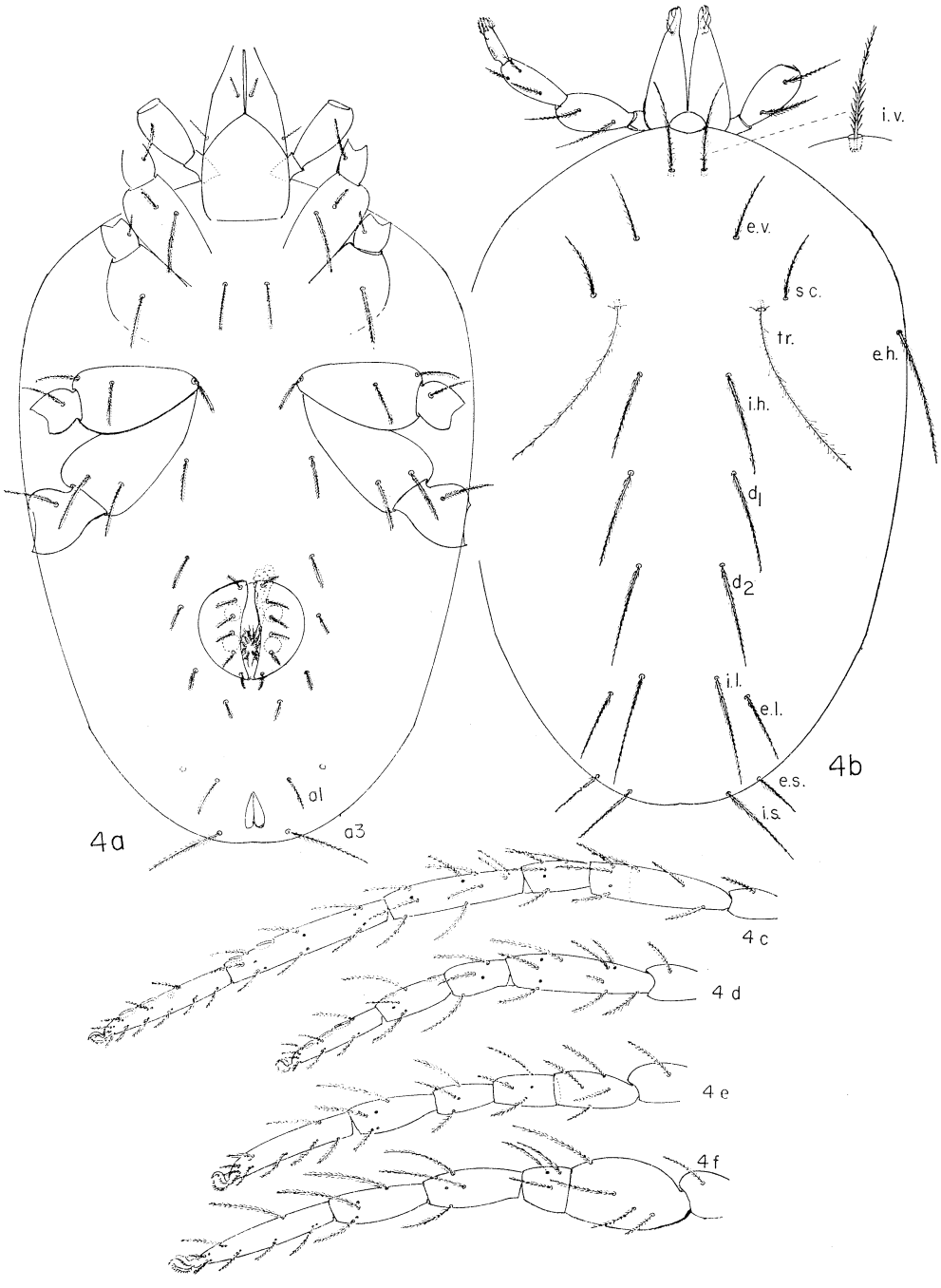


Fig. 4. *Cocceupodes shepardi* n. sp. ♂ : a, ventral view ; b, dorsal view ; c, d, e, f, lateral view, legs I-IV respectively of left side.

ornamented with reticulations, lines, tubercles, or punctations. They are very pretty mites, being red or red and black in color. Frequently the legs and body are not the same color. As far as is known they feed on fungi and primitive algae.

The two genera may be separated as follows:

A distinct groove between pro- and metapodosoma. Tarsus I without a median dorsobasal seta. Hysterosoma generally with 2 parallel, longitudinal lines or depressions ..... **Stereotydeus**

No division between pro- and metapodosoma. Two lateral lines, or sulci, on podosoma which converge and meet on hysterosoma and then may continue posteriorly as a single, median line. Tarsus I with a medial, dorsobasal seta ..... **Penthalodes**

Genus **Penthalodes** Andrew Murray, 1877

Genotype: *Megamerus ovalis* Ant. Duges, 1834.

Small, bright red mites with a prominent trilobed epirostrum, and a rather well sclerotized and reticulated body. Epivertex small, not well demarked, and because the body is almost globose, may be difficult to find.

Pair of cryptic eyes present. Trichobothria very fine. Three pairs of split pores arranged in 2 lines dorsomedially. Dorsal setae small, weakly plumed; setae D_1 and e.l. are apparently lacking. Anal pore subterminal and bracketed by 3 pairs of setae. One slit pore lies each side of anterior margin of anal pore. Genital pore, nearly circular, is covered by 2 distinct flaps; each flap bears 6-9 setae, one of which is more lateral than the others. Underneath the flaps are 2 pairs of genital knobs, and in the adult, several internal setae. All tarsi, including tarsus I, with a dorsal midline seta in the basal position and tarsus IV with 4 pairs of apical setae just as tarsi I, II, III, differing in this respect from most other Penthalodidae, which have only 3 pairs in this position on tarsus IV. Legs slender, shorter than the body.

Key to the species of Penthalodes

1a. Epirostrum distinctly trilobed (i.e., with shoulders) 2
1b. Epirostrum with only a medial lobe (i.e., without shoulders) 3
2a. Body reticulate dorsally and laterally, tuberculate ventrally, 9 pairs of genital setae. Tarsus I with 3 rhagidial organs, tandem. L. 433 μm. Mexico..... **boneti** Baker, 1946
2b. Body reticulate all over. 6 pairs of genital setae. Tarsus I with 2 r.o., tandem. L. 250-425 μm. Norway, Canada, Alaska; probably circumpolar ..... **ovalis** (Duges, 1834)
3a. Epirostrum long, large, evenly and broadly rounded, entirely covering rostrum. Palp segments I to IV measure 19, 23, 40, and 20 μm respectively. L. of body - 327 μm. Oregon ..... **oregonensis** Baker, 1946
3b. Epirostrum bluntly pointed, shorter, not entirely covering rostrum. Palp segments I to IV measure 20, 40, 40, and 20 μm respectively. Length of body 286 μm. Missouri, Texas, South Carolina ..... **turneri** Baker, 1946

Species inquerienda

Penthalodes australicus Womersley 1941: 294. I have not seen the literature describing this species.

Penthalodes columbiae (Berlese) 1921. Description too brief for diagnosis. Said to be 280 μm long. Otherwise similar to *ovalis*.

Penthalodes inflatus (Duges) 1834. Description too brief for diagnosis. Described as

very small, with long, *linopodes*-like front legs. Thor & Willmann (1941 : 62) say it is impossible to identify and is probably not a *Penthalodes*.

Penthalodes ovalis (Duges, 1834) Fig. 5 a-c.

♀. L. 375 μm (350-425). Trochanters 1-1-1-1. Coxae 3-1-3-3. Genital setae 7 pairs (1 more lateral than others). Paragenital setae, ca 8 pairs. All ventral setae approximately equal. Venter reticulopunctate, delicately medially, more coarsely peripherally. Coxae I have posterior half strongly rugose; coxae II, III, and IV finely striated and basally reticulated. Dorsum (fig. 5a) uniformly reticulated. All dorsal setae plumose, small, cryptic. The internal verticals (i.v.) on epivertex especially small. Gnathosoma: Apical segment of pedipalp more than 3× as long as wide but not as long as 3rd segment. It has apparently 8 setae, 2 of which are nude, plus a dorsolateral rhagidiform sensory seta on outer margin near base (fig. 5c). Legs: Tarsus I has 2 rhagidiform setae lying tandem in a common field, subtended by a stellate seta. Tarsus II has 3 such rhagidid setae. Tibiae I and II have each a dorsoapical sensory seta in a pit, and a solenidion just basal thereof. Tibia III and IV each have a *dorsomedial* solenidion. Genua I-IV each have a dorsal solenidion anteriorly, and genua I and II have each a tiny sensory seta at dorsal anterior margin. Legs thinly pubescent and faintly striated.

Nympha III. Length 380 μm. Trochanters 1-1-1-1. Coxae 3-1-3-3. Genital setae, 4 pairs; paragenitals, 8 pairs. Epirostrum not developed.

Otherwise as the ♀ except tarsus II has only 2 rhagidiform organs.

DISTRIBUTION: Described from 15 ♀♀, 1 ♂ and 1 Ny III. All specimens were collected from tundra samples. Anaktuvik Pass, 16.VI.1968; Cape Thompson, 8.VII.1968; Cape Beaufort, 14.VII.1968; Barrow, 15.VII.1967; Barter Island, 17.VI.1967. Found throughout northern Alaska, from the Brooks Range northward. Probably circumpolar.

Discussion: Almost without exception in the Eupodoidea, nympha III has 3 pairs of genital setae. Hence, it is noteworthy that the single Nympha III we have seen of this species has 4 pairs of genital setae. One wonders if this is normal for *P. ovalis* or if the lone specimen we have is unique in this respect.

Family RHAGIDIIDAE

Soft bodied, long legged, delicate, medium to large, raptorial mites. In life they are white, yellow, orange, or red in color. The dorsal chaetotaxy is unvarying in all life stages, consisting of 1 pair of setae on the epivertex, 3 pairs (including the sensillae) on the propodosoma, 8 pairs on the hysterosoma. Frequently 1 or 2 pairs of the anal setae are on the dorsal side, but they are not, strictly speaking, dorsal setae. The suture between pro- and metapodasoma is distinct. On the venter, the coxae are distinct, large, and in 2 groups. Coxae I and II always have 3 and 1 setae respectively. Coxae III and IV bear a variable number of setae. The genital pore is large, centrally located in the opisthosoma and covered by 2 flaps bearing from 5 to 10 setae each. There are 2 pairs of genital knobs and a number of internal setae in the adult. The genital pore is surrounded by a variable number of paragenital setae.

The anal, or excretory, pore is terminal or subterminal and bracketed by 4 pairs of anal setae. 1 or 2 pairs of anal setae are frequently on the dorsal side. The ventral setae, including the coxal setae, are generally clavate. Tarsi I and II have rhagidial organs (r.o.) which vary in number and placement. Tibiae I and II have a small

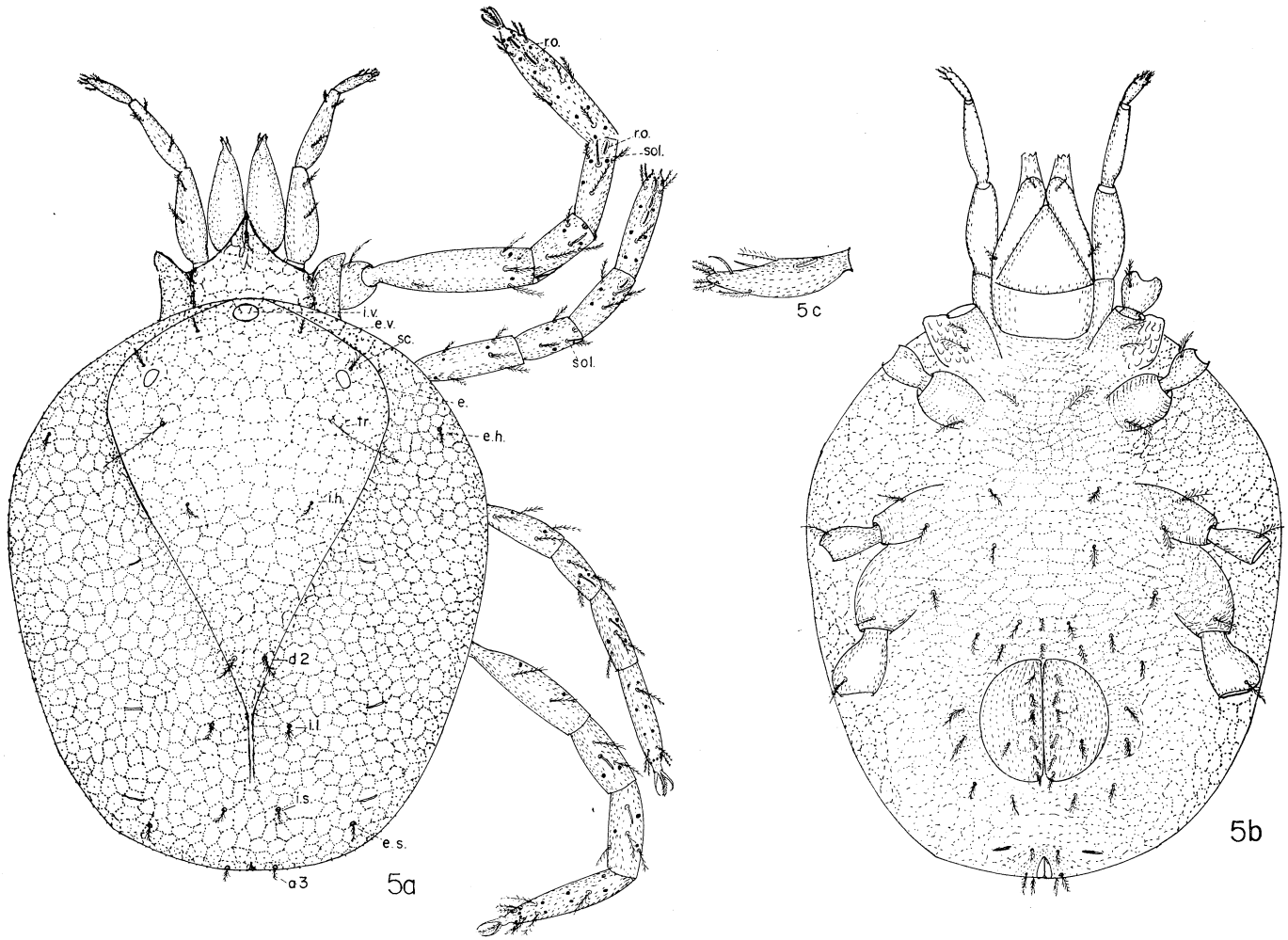


Fig. 5. *Penthalodes ovalis* (Duges): a, dorsum; b, venter of ♀; c, lateral view of 4th segment of right pedipalp.

sensory seta at the dorsal apex. On tibia I this seta is generally in a depression and resembles a rhagidial organ. On tibia II it is almost always in a pit with a small anterior opening (see fig. 11d). Small, cryptic solenidia, varying in number and position, may be found on some or all of the tarsi, tibiae, and genua. All legs have claws and pulvillus. The claws are ciliated basally on inner margin and may have basal clawlets. The pulvillus is linguiform, ciliated and as long as the claws.

The hypostome (=rostrum) is triangular, longitudinally split from the apex to the middle and bears 8 setae; the 4 apical are nude, the 4 basal are longer and plumose (fig. 7c). The pedipalp consists of 4 movable segments, the 1st and 3rd are short, the 2nd and 4th long. There is a small, thornlike seta on the dorsal side of the pedipalpal coxa (fig. 6a). The chaetotaxy of the free palpal segments is, segment 1, no setae; 2, two setae; 3, three setae; 4, from 10 to 14 setae plus a small solenidion (fig. 12d). The chelicerae are heavy, strong, larger than the hypostome, with well developed shears. The movable arm is sharply pointed and minutely serrate along the inner margin. The immovable arm is cusped at the tip and bears two, or infrequently one, nude setae (fig. 14g).

Males have an internal, forwardly directed sperm sac (fig. 6c). Otherwise, the sexes are indistinguishable. There are 4 immature stages, in addition to the egg. They are larva, protonymph, deutonymph, and tritonymph. The larva is hexapod and lacks external genitalia. In all three nymphal stages the gnathosomal, dorsal, and anal chaetotaxy is as in the adult. Leg and ventral setae become progressively more numerous with each stage of development. The 3 nymphal stages can be readily recognized by the fact that nympha I has 1 pair of genital disks, 1 pair of genital setae, and no paragenital setae; nympha II has 2 pairs of genital disks, 2 pairs of genital setae, and 2 pairs of paragenital setae; nympha III has 2 pairs of genital disks, 3 pairs of genital setae and 4 or more pairs of paragenital setae.

The mites prefer moist habitats and can be found under boards, logs, stones, etc. and in leaf litter, moss, grasses, herbs and the like. I have never observed them in clusters, always singly.

The two genera *Rhagidia* and *Coccorhagidia* differ only by the form of the trichobothria.

Genus **Coccorhagidia** Sig Thor, 1934

Type species: *Norneria clavifrons* R. Canestrini, 1886.

Trichobothria clavate, capitate, or paddle shaped. Otherwise similar to *Rhagidia*. A character not previously mentioned is a short, spiniform seta on the dorsal side of the pedipalpal coxa. It is normally covered by the chelicera (fig. 6a).

Key to the species of Coccorhagidia

1a. With 7 pairs of genital setae. Austral forms 2
1b. With 5 pairs of genital setae. Boreal forms 3
2a. Posterolateral angles of rostrum dentate. Basal cheliceral seta overlaps base of apical cheliceral seta by 1/2 its length. Larger forms, 1000-1100 μm long. North Victoria Land, Antarctica..... **gressitti** Womersley & Strandtmann, 1963
2b. Posterolateral angles of rostrum not dentate. Basal cheliceral seta small, barely reach-

ing base of the apical seta. Smaller forms, 800-1000 μm long. South Victoria Land, Antarctica..... **keithi** Strandtmann, 1967

3a. Rhagidial organs of tarsus I oblique or irregularly transverse 6

3b. Rhagidial organs of tarsus I parallel to long axis of leg 4

4a. Small forms, 300-350 μm long. Recorded from England, Italy..... **subterranea** (Berlese, 1905)

4b. Larger forms, ca 500-1200 μm 5

5a. Coxal formula 3-1-5-3, occasionally 3-1-6-3. Tarsus I with 4 r.o., —3 apical, 1 basal. Cheliceral setae do not overlap. Tibiae I and II each with 2 solenidia. Sensillae narrowly claviform. Average body length, 1100 μm. Alaska ..... **sateri***

5b. Coxal formula 3-1-4-3. Tarsus I with 3 r.o., 2 apical, 1 basal. Cheliceral setae close together at middle of fixed digit and overlapping. Tibiae I and II each with 1 solenidion, and *it is at the base of the tibial r.o.* Sensillae capitate. Average length, 900 μm. Alaska ..... **capitata***

6a. Tarsus I with 4 oblique rhagidial organs, well separated, not crowded together at apex. Tibiae I and II with 1 solenidion each, *on basal half of segment*. Cheliceral setae not overlapping. Outer anterior rostral setae spatulate. Average length 600 μm. Alaska ..... **pittardi***

6b. Tarsus I with 4 r.o. crowded together at tip. Tibiae I and II each with 1 solenidion, *on apical 1/2 of segment, very close to tibial r.o.* Anterior rostral setae not spatulate. Average length less than 600 μm 7

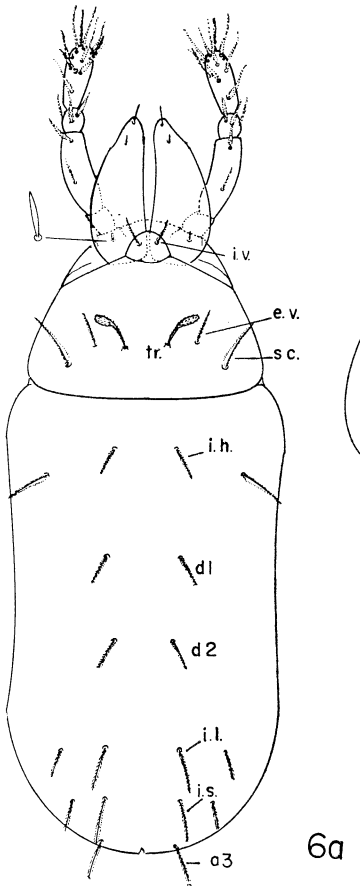
7a. Coxal formula 3-1-4-3 or 3-1-5-3. Cheliceral shears comprises 1/4 to 1/3 total length of chelicera. Cheliceral setae well separated, barely or not at all overlapping. Trichobothria long, clavate. Length, 400-450 μm spatulate. Europe, Japan ... **clavifrons** (Canestrini, 1886)

7b. Coxal formula 3-1-6-2 (sic). Cheliceral shears comprise 1/3 to 1/2 total length of chelicera. Cheliceral setae closer together, distinctly overlapping. Trichobothria, slender, barely clavate. Fixed digit of chela with 5 cusps. Average length 530 μm. Japan..... ..... **semiclavifrons** Shiba, 1969

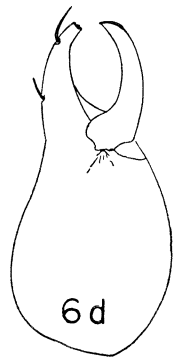
Coccorhagidia sateri Strandtmann, new species Fig. 6 a-n.

♀. 1100 μm (1000-1275). Fig. 6 a-b. Ventral side : Coxal formula 3-1-5-3 (occasionally 3-1-6-3). Trochanters 1-1-2-2. Genital setae, 5 pairs ; paragenitals, 5 pairs. Ovipositor, when everted, seen to have 20 ciliated setae. On coxa I, apical seta shorter than middle which in turn is shorter than most medial. *All ventral setae filiform* ; not showing a tendency toward clavate. Dorsal side : Trichobothria slender-clavate, ciliated uniformly to base. Scapulars 2× as thick and long as external verticals. External humerals about as long, but not as heavy as scapulars. Lumbars and sacrals equal ; the i.e. and i.s. longer than the e.l. and e.s. respectively. Gnathosoma : 4 basal setae ciliated, the 2 inner shorter than the 2 outer. 4 apical setae nude, equal, reaching only to apex of hypostome. Chelicera (fig. 6 d, e) with chelate portion about 1/3 total length. Fixed arm 4-cusped ; the apical seta originating near tip, basal seta much shorter and not reaching base of apical seta. Pedipalps with most of setae lance-shaped ; solenidion near tip. Legs : fig. 6 f-n. Rhagidial organs of tarsi I and II similar ; each has 3 organs lying side by side along longitudinal axis, plus 1 more basal on same axis, each in separate fields ; a stellate seta at base of apical anterior organ. No spiniform associated with r.o.'s on tarsus II. Claws of tarsus I apparently without clawlets ; claws of legs II, III, and IV, with clawlets. Solenidia—small, cryptic ; number and position as follows : Tarsi I-IV, 0 ; tibia I, 2, on anterior side apically ; tibia II, 2, anterior side, about as on tarsus I ; tibia III—2 medial, anterior side (close together) ; tibia IV—1 medial, anterior side ; genua I and II—each with 1 ventriapical ; genu III—with 1 ventrimedial ; genu IV—0. Ventral setae of legs, particularly apical ones, lanceolate. Leg segments finely pubescent, dorsally and coarsely pubescent, almost tuberculate, ventrally.

* Described as new.



6a



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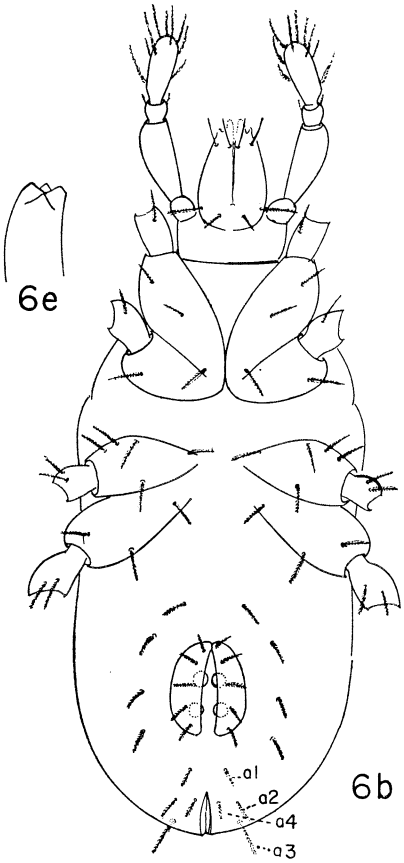

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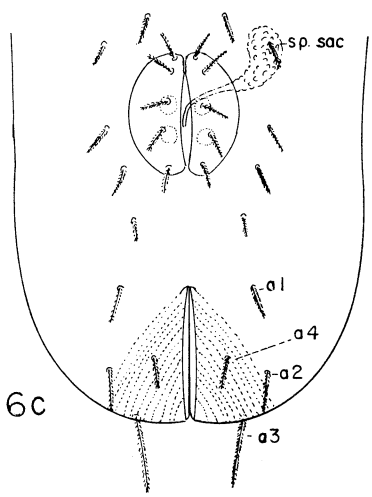

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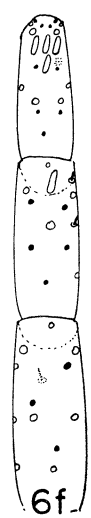

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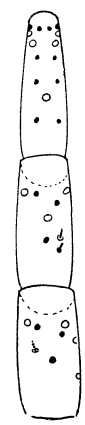

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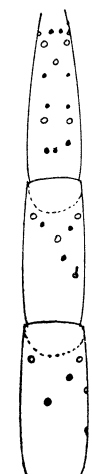

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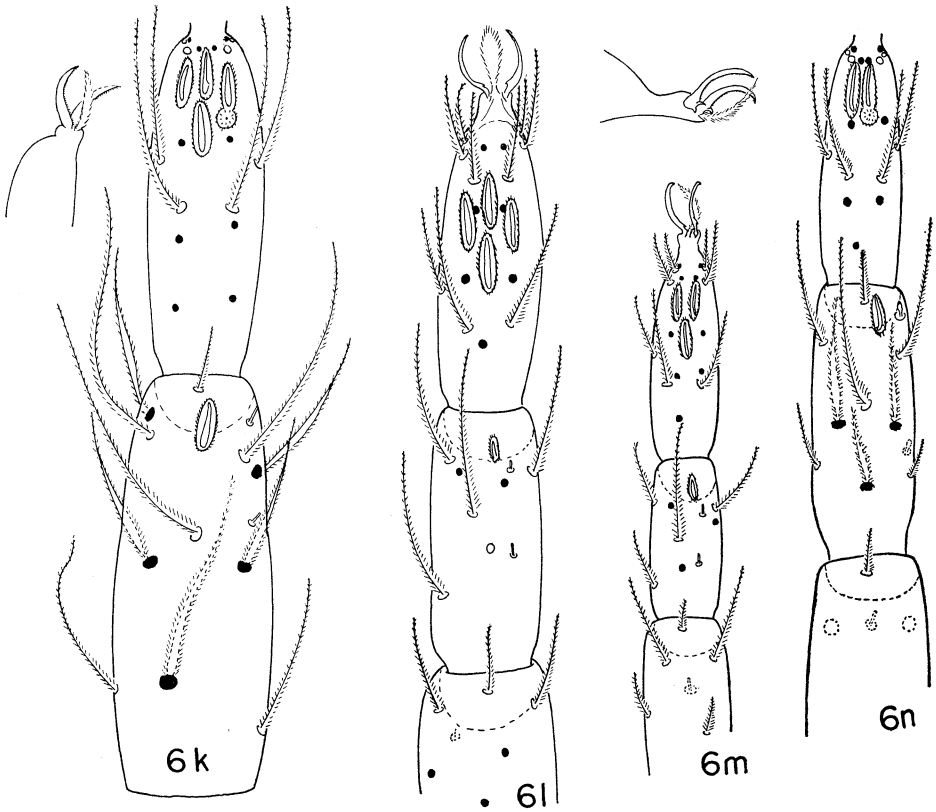


Fig. 6. a-i, *Coccorhagidia sateri* n. sp.: a, dorsum, with supracoxal seta of pedipalp enlarged; b, venter of ♀; c, ventral opisthosoma of ♂; d, chelicera; e, tip of fixed digit of chela; f, g, h, i, terminal 3 segments of legs I-IV respectively, showing position of setae and sensory setae. k-n, *Coccorhagidia sateri* n. sp.: k, tarsus and tibia I of adult, with claws and empodium of ♀; l, tarsus, tibia and end of genu of adult; m, same as l except of tritonymph (the claws and empodium represent those of legs II-IV); n, leg I of deutonymph.

This is especially true of the femora.

♂. 1050 μm (975-1200). Fig. 6c. Sperm sac almost always slightly sigmoid; about as long as genital plates. Clawlets of tarsal claws seemingly more prominent than in ♀. On tarsal claws I, the basal clawlets are quite obvious, whereas in the ♀ the clawlets on tarsus I seem to be lacking. Otherwise the ♂ is exactly like the ♀.

Nympha III. Fig. 6m. 850 μm (750-1000). Coxal formula as in ♀, 3-1-5-3; trochanter 1-1-2-2. Tarsus I and II each with 3 rhagidiforms, the apical anterior organ missing in each case. Genital setae, 3 pairs ; paragenital setae, 4 pairs. Chaetotaxy of body otherwise as ♀. Leg solenidia, as in the ♀. Nympha II. Fig. 6n. 600 μm (525-700). Coxal formula, 3-1-4-1. Trochanters 1-1-2-1. Tarsi I and II each with 2 rhagidiform organs. In both cases, basal and apical anterior organs missing. Genital setae, 2 pairs ; paragenital setae, 2 pairs. Body chaetotaxy otherwise as the adult. Nympha I. 500 μm (425-600). Coxal formula, 3-1-3-0. Trochanters 0-1-1-0. Tarsi I and II each with 1 rhagidial organ, the posterior apical. Genital

setae, 1 pair; no paragenital setae. Body chaetotaxy otherwise as in adult. Leg IV has 1 seta on tibia, none on genu, femur, and trochanter. Description based on 7 ♀♀, 2 ♂♂, 7 Ny III, 6 Ny II, and 4 Ny I.

Holotype ♀ (BISHOP 9345), Barrow, Alaska, 14.VI.1968, from tundra.

DISTRIBUTION: Barrow, 6 ♀♀, 2 ♂♂, 6 Ny II, 4 Ny I; Umiat, 1 ♀; Cape Thompson, 1 Ny III. All specimens were berlesed from tundra samples, and all were collected during June and July of 1967 and 1968.

This was the most abundant form of *Coccorhagida* found at Barrow. All but two of the specimens studied were from within a 3-mile radius of the Navy Arctic Research Lab, but the fact that 1 specimen was from Umiat, 100 miles south of Barrow, and 1 from Cape Thompson, on the western tip of Alaska, indicates that it is more widespread.

The mite is named for Dr John E. Sater, the personable and efficient Coordinator of Research for the Arctic Institute of North America.

Coccorhagidia capitata Strandtmann, new species Fig. 7 a–e.

♀. 900 μm. Coxae 3-1-4-3; trochanters 1-1-2-2; genitals, 5 pairs; paragenitals, 5 pairs; all ventral setae filiform, none tending toward clavate. Middle setae of coxa I somewhat longer than either apical or basal, which are about equal. Anal pore terminal; 2 pairs of anal setae ventral and 2 dorsal. Dorsal side: Trichobothria capitate, pedicel rather short (fig. 7d). Scapulars narrowly lanceolate, about 4 × as long as external verticals. External humerals shorter by about 25 % than the scapulars. Legs: Fig. 7 a, b. Shorter than body (I and IV about 800 μm). Tarsus I with 3 rhagidiforms in separate fields; 2 apical and parallel, with stellate seta opposite posterior (fig. 7a). Tarsus II with 3 r.o.; placed as in tarsus I, with a small spine opposite basal r.o. on posterior side (fig. 7b). Tibiae I and II each with a small, dorsoapical r.o., just posterior to which lies a small spine, which is probably a solenidion. Genu I has a very small, ventriapical solenidion, and tibiae III and IV each have a very small, cryptic, dorsomedial solenidion. Gnathosoma: Fig. 7 c, e. Chelicera with chelate portion comprising approximately 1/3 total length. Fixed arm 4-cusped, with 1 tooth a bit longer and acutely pointed. Anterior cheliceral seta inserted about midway on fixed digit; the basal seta about 1/2 as long as apical and overlapping its base. Hypostome strongly pubescent. 4 nude, apical setae extend slightly beyond apex. External basal setae about 45 μm long, inner basal about 25 μm.

Nympha III. Coxae 3-1-4-3; trochanters 1-1-2-2. Tarsi I and II each with 3 r.o. as in the ♀. Tibiae I and II as in the ♀; genital setae, 3 pairs; paragenitals, 5 pairs.

Holotype ♀ (BISHOP 9346), Anaktuvik Pass, Alaska, in the Brooks Range, 16.VI.1968, Kay & Don Pittard.

DISTRIBUTION: Described from only 2 specimens, the holotype ♀ and a tritonymph. Ny III taken on the north coast at Cape Beaufort, 12.VII.1968, from grass, moss and willow at edge of bluff facing ocean. Distinct on basis of solenidia, and capitate sensillae from which the name is derived.

Coccorhagidia pittardi Strandtmann, new species Fig. 8 a–i.

♀. 625 μm (600–700). Ventral side: Fig. 8 a, d. All the ventral and coxal setae short, approximately 15–18 μm long; coxal formula 3-1-5-3. Genital setae, 5 pairs; paragenitals, 5 pairs. Ovipositor, when everted, is seen to bear 20 ciliated setae in 3 circles (fig. 8d). None of the

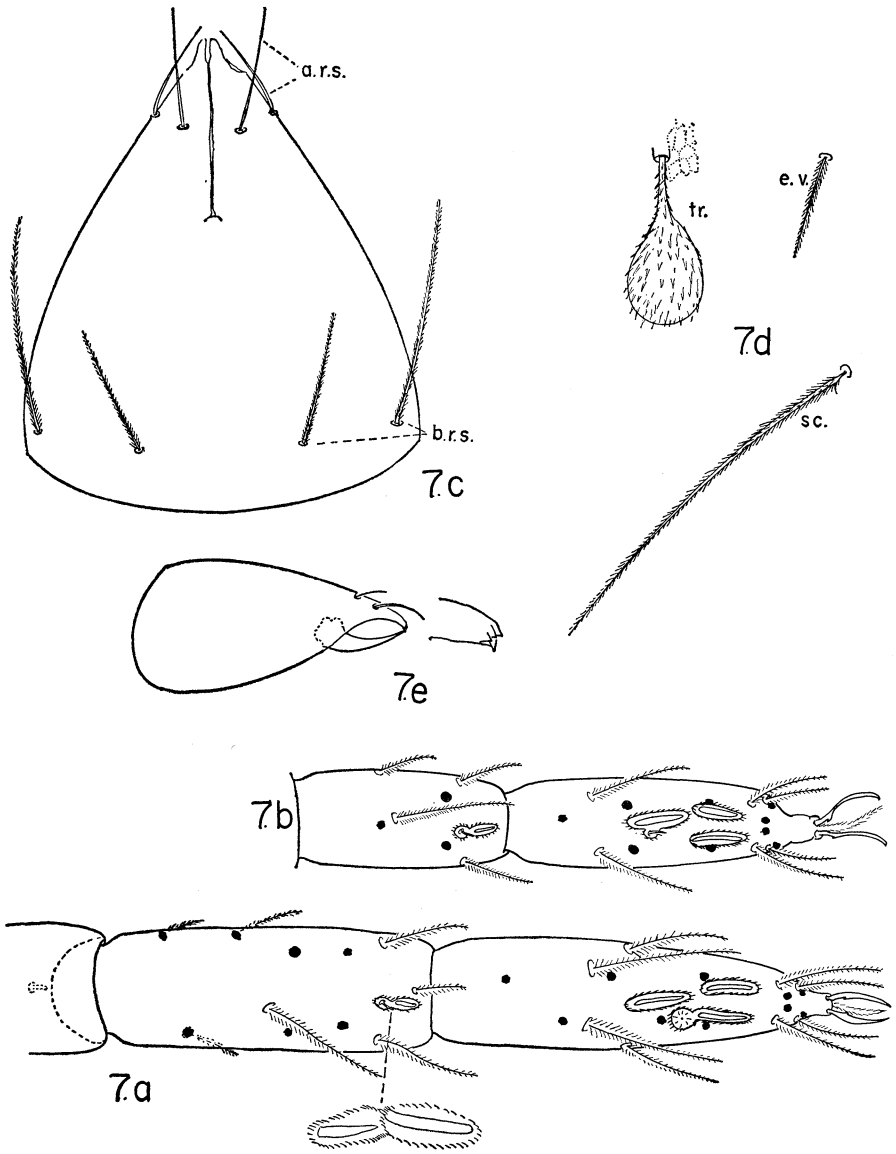


Fig. 7. *Coccorhagidia capitata* n. sp.: a, tarsus and tibia I, right leg of adult, with enlarged view of sensory area of tibia; b, tarsus and tibia II, right leg of adult; c, hypostoma; d, capitate trichobothrium, external vertical and scapular seta, right side; e, chelicera, with enlarged view of tip of fixed digit.

ventral setae are clavate. Dorsal side: Fig. 8b. Trichobothria clavate, with slender pedicle, the pedicle nearly 2× as long as the swollen tip. Scapulars thicker and about 2× length of external verticals, of uniform diameter, not lanceolate as in *sateri*. Dorsal setae rather short, i.h., d_1, d_2, and all 4 lumbars being about 17 μm long. The internal sacrals are longer, about

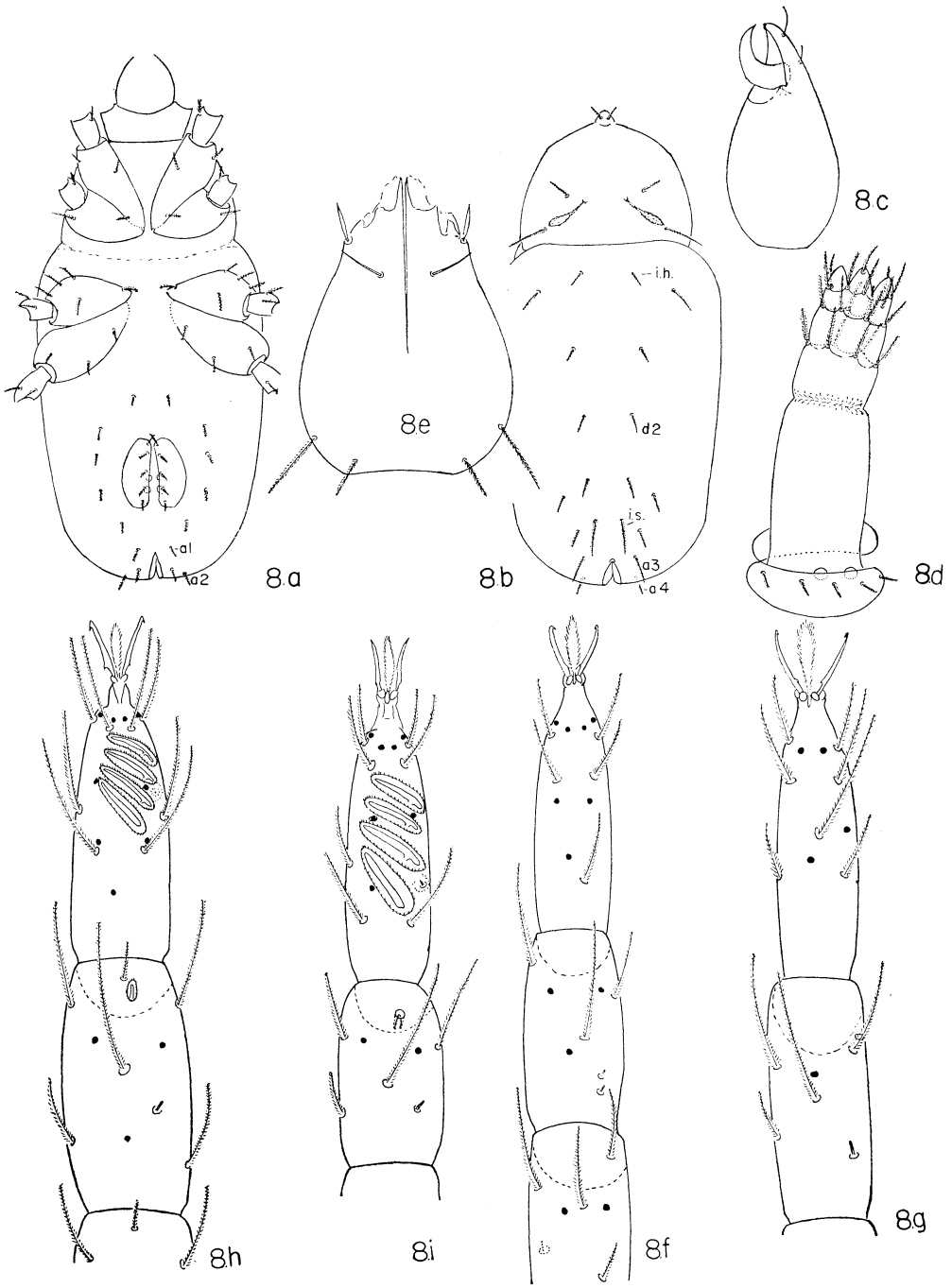


Fig. 8. *Coccorhagidia pittardi* n. sp.: a, venter of ♀; b, dorsum; c, chelicera; d, ovipositor of ♀, extruded; e, hypostoma or rostrum; f, leg III, dorsal view of terminal 3 segments; g, tarsus and tibia IV, dorsal view; h, tarsus and tibia I, dorsal view of right leg; i, tarsus and tibia II, right leg.

35 μm. Gnathosoma : Fig. 8e. The 4 nude, apical setae rather spiniform, or lanceolate—not extending beyond apex. Shears of chelicera (fig. 8c) a bit less than 1/3 total length ; both cheliceral setae rather short ; apical setae inserted near apex : basal setae not reaching base of apical. Legs : Fig. 8 f-i. I and IV about as long as body ; II and III shorter. Tarsi I and II each with 4 rhagidiform organs, obliquely transverse in separate fields ; stellate seta between 2 center r.o. Tibiae I and II each with a dorsoapical r.o. and a dorsolateral solenidion toward base. Tibia III with 2 solenidia, close together, on dorsolateral side near base. Genua I, II, and III each with 1 ventriapical solenidion. Trochanters, 1-1-2-2 ; tarsal claws with basal clawlets.

Holotype ♀ (BISHOP 9347), Anaktuvik Pass, Alaska, 17.VI.1968, Kay & Don Pittard.

DISTRIBUTION : Apparently widely distributed in northern Alaska. Only 5 ♀♀ have been recovered but they are from widely scattered points. Anaktuvik Pass, 17.VI.1968, 2 ♀♀ ; Wainwright, Alaska, 1.VII.1968, 1 ♀ ; Barrow, 14.VI.1968, 1 ♀ ; Tuktoyuktuk, N. W. T., Canada, 24.VII.1968, 1 ♀. All specimens were berlesed from tundra samples.

It is a pleasure to name this mite for Donald A. Pittard, a most adaptable and resourceful young man, who was my companion on two trips to Antarctica and one to Alaska.

Genus **Rhagidia** Thorell, 1872

Type species : *Rhagidia gelida* Thorell, 1872.

The trichobothria are filiform. Otherwise similar to *Coccorhagidia* and with the characters of the family. The genus is widespread. It occurs in temperate grasslands, alpine meadows, caves, arctic and alpine tundra, and in barren Antarctica and subantarctic islands.

More than 50 species have been proposed but the descriptions are not always diagnostic. The following key to species is based for the most part on characters gleaned from the literature. Species descriptions that did not include at least some diagnostic characters could, therefore, not be incorporated into the key. For reference to omitted names, see Thor & Willmann (1941).

KEY TO THE SPECIES OF RHAGIDIA

1a. Chela with only 1 seta 2
1b. Chela with 2 setae 3
2a. Cheliceral seta posterior to shears. Rhagidial organs long, longitudinal, parallel ..... **longisensilla** Shiba, 1969
2b. Cheliceral seta anterior to shears. Rhagidial organs smaller, tandem ..... **uniseta** Sig Thor, 1909
3a. The 2 setae both proximal to shears ..... **diversicolor** (Koch, 1838), (Haarlφv, 1957)
3b. One or both setae apical to base of shears 4
4a. Cheliceral shears about 1/5 total length of chelicera, (see the 2 choices immediately following)
1. Body, 950 μm ; legs I only 1/2-2/3 length of body (400-600 μm) (N. Siberia) ... **birulae** Sig Thor, 1909
2. Body 525 μm, leg I 480 μm. Tarsus I and II each with 2 rhagidial organs. (Germany) ..... **paxi** Willmann, 1942
4b. Shears comprising 1/3 or more of cheliceral length. Legs I at least as long as body 5
5a. Tarsal claws cleft. Clawlets long and slender. Legs I ca 2× length of body. Cave form ..... **longipes** Tragardh, 1912

5b. Tarsal claws not cleft. Clawlets absent or not long 6
6a. Tarsus I with 4 oblique rhagidiforms 7
6b. Tarsus I with more than 4 rhagidiforms, or with less, or with the rhagidiforms lying tandem, or longitudinally parallel 24
7a. Tarsus II with 2 rhagidiforms, oblique, in separate fields, L. 350-500 μm. Shears 1/3-1/2 of total length of chelicera; cheliceral setae wide apart; basal proximal to shears. (Probably a nymph) ..... **mordax** Oudemans, 1906
7b. Tarsus II with 3 or 4 r.o. 8
8a. Tarsus II with 4 r.o. (5 species have this character; they are not easily separated) 9
8b. Tarsus II with 3 r.o. 12
9a. Stellate seta of tarsus I between middle 2 rhagidiforms 10
9b. Stellate seta of tarsus I between basal 2 rhagidiforms 11
10a. L. 735 μm—ex. the Mediterranean Littoral ..... **fragosa** Schuster, 1957
10b. L. 1050 μm—coxal setae, 3-1-6-4. 5 pairs of genital setae, 4 pairs paragenitals; ex. Mammoth Cave, Kentucky ..... **cavernarum** (Packard, 1884); Holsinger (1965)
11. Three species key to here. The characters given in the literature are insufficient to separate them. The species are
    1. *terricola* (Koch, 1835)—Norway, Hungary, Central Europe. 1000-1200 μm.
    2. *gigas* (Canestrini, 1886)—Natal, Italy, Egypt. 1100-1500 μm.
    3. *osloensis* Sig Thor, 1934—Norway (moss). 1400 μm.
12a. Body less than 700 μm long 13
12b. Body over 800 μm long 15
13a. Stellate seta of tarsus I between basal 2 rhagidiforms. Solenidion on tibia I dorsoapical; dorsobasal on II, III, and IV; coxal seta, 3-1-5-3; 650 μm long. Alaska ..... **shibai***
13b. Not entirely as above (the descriptions leave most characters unmentioned) 14
14a. "Shears Large." (? 1/2 total length of chelicera?). Stellate seta on tarsus I between middle 2 r.o. 500-600 μm. Germany and central Europe ..... **pratensis** (Koch, 1835)
14b. Shears 1/3 total length of chelicera. *Digitus fixus* with an inner tooth near base. Apical seta of chelicera near apex, basal near base of shears; not overlapping. Germany... ..... **mucronata** Willmann, 1936
15a. *Digitus fixus* with a prominent, blunt, subapical, inner tooth, shears large, 1/2 total length. 16
15b. *Digitus fixus* without a blunt, prominent, subapical tooth, although there may be 1 or 2 smaller ones medially 17
16a. 6 pairs of genital setae. Coxal setae 3-1-6-3. Tibia I has 2 small rhagidiforms dorsally at apex. 1000 μm. Macquarie Island, Antarctica ..... **macquariensis** Strandtmann, 1963
16b. Not as above, presumably, although the description fails to mention any differentiating characters. Length 1000-1360 μm. Caves of central Europe ..... **spelea** (Wankel, 1861)
17a. Genital covers with 6 or more pairs of setae. Found in Antarctic or subantarctic regions 18
17b. Genital covers with 5 pairs of setae. Found in northern hemisphere 20
18a. Trochanter setae 1-2-2-2. 7 pairs of genital setae. Shears large, 1/2 total length of chelicera. 1400 μm. Antarctic ..... **gerlachei** Trouessart, 1903
18b. Trochanter setae 1-1-2-2. Shears 1/3 total length 19
19a. 9 pairs genital setae. Coxae, 3-1-4-3 or 3-1-4-4. 1350 μm. Antarctica ..... **leechi** Strandtmann, 1963
19b. 6 pairs genital setae. Coxae, 3-1-6-3. 1000 μm. Campbell Island... **mildredae** Strandtmann, 1964
20a. Rhagidiforms of tarsus II lying tandem in a confluent field 21
20b. Rhagidiforms of tarsus II lying oblique in separate fields. Shears ca 1/3 of total, cheliceral setae not overlapping. 1000-1100 μm long. ex. Wangerooge .....

..... **arenaria** Willmann, 1952

21a. Tarsus I with a dorsobasal solenidion. Coxal setae 3-1-6-4 22

21b. Tarsus I without a solenidion. Coxal setae 3-1-6-3 23

22a. Solenidion of genu I dorsoapical. 970 μm. Mammoth Cave, Kentucky. .... *weyerensis* (Packard, 1888); Holsinger (1965)

22b. Solenidion of genu I ventriapical. 900-1000 μm. Alaska ..... **whartoni***

23a. Leg I nearly 2× body length (body 1000 μm; leg I 1900 μm); cheliceral setae close together, near base of shear, overlapping. Japan. ..... **crenata** Shiba, 1969

23b. Leg I not much longer than body; cheliceral setae further apart, not overlapping. Length 750-900 μm. Alaska, Canada ..... **hilli***

24a. Tarsus I of adult with 2 or 3 rhagidiforms 25

24b. Tarsus I of adult with 4 or more rhagidiforms; if 4, they are tandem to each other 29

25a. Tarsus I and II each with 2 rhagidiforms in adult. Cheliceral shears 1/3 to 1/2 of total length. *Digitus mobilis* with an inner tooth near base. Cheliceral setae both remote from tip and barely overlap. Belgian caves ..... **unidentata** Willmann, 1939

25b. Tarsus I in adult, with 3 rhagidiforms, tarsus II with 3 or 4 r.o. 26

26a. Tarsus I and II each with 3 rhagidiforms 27

26b. Tarsus I with 3 r.o.; tarsus II with 4 r.o., of which 3 are anterior, side by side and parallel to long axis of leg, all in separate fields. Coxae, 3-1-5-3. Length 1200 μm. Alaska ..... **mariehammerae***

27a. The 3 rhagidiforms on both tarsi I and II lie obliquely in separate fields. The stellate seta is proximal. 810 μm. Germany ..... **buetenneri** Willmann, 1955

27b. The rhagidiforms parallel to long axis of leg 28

28a. Tarsus I with 2 r.o. 1 behind the other, the 3rd to 1 side, all in separate fields; the stellate seta at base of apical r.o. On tarsus II, 2 r.o. side by side apically, the 3rd proximal, in separate fields; the small spiniform is proximal .... **janetscheki** Willmann, 1953

28b. The rhagidiform organs are tandem in a common field on both tarsi I and II. The 4th segment of the pedipalp is by far the longest and bears 13 setae which are longer than the segment. Length 1050 μm; leg I, 1620 μm. Dalmatia and Bosnia .... **dalmatina** Willmann, 1939
The var., *R. d. gigantea* Willmann, 1941, is stated by Willmann to be exactly like *dalmatina* except 2× as large. Length 2100 μm, leg I, body length. In caves of Jugoslavia.

29a. Tarsus I with 5 or more oblique rhagidiforms 30

29b. Tarsus I with 4 rhagidiforms lying tandem to one another 33

30a. Tarsus I with 10 rhagidiforms. Chelae long and slender ..... **gineti** Cooreman, 1959

30b. Tarsus I with 8 rhagidiforms, the stellate seta between 7 and 8. The apicolateral setae of tarsi II-IV broadened and oarlike. Austrian caves ..... **vornetscheri** Willmann, 1953

31b. Tarsus I with 5 or 6 r.o. 32

32a. Tarsus I, 6 r.o.; stellate setae between 5 and 6; tarsus II, 6 oblique r.o. Tarsi II to IV with dorsolateroapical setae oar-shaped. Shears very long, more than 1/2 length of chelicera. 1550-2150 μm. Cave form, Italy, lower Danube ..... **strasseri** Willmann, 1932

32b. Tarsus I with 5 r.o.; tarsus II with 2 r.o. Length 675 μm. Belgium. .... **mordax** var. **grandis** Willmann, 1936

33a. Rhagidial organs tandem but in separate fields 34

33b. Rhagidial organs tandem and in confluent fields 35

34a. Length 1110 μm; leg I, 1770 μm. Shears 1/2 total length of chela; cheliceral setae medial on digitus fixus, close together and overlapping. Glaciers of Germany and Balkan Caves ..... **wolmsdorfensis** Willmann, 1935

34b. Length 1000-1155 μm. Leg I, 1140-1330 μm. Cheliceral shears 1/2 of total, the setae

forward, barely or not at all overlapping. Fixed arm 3 cusped; movable arm with 2 small teeth, wide apart, on inner margin. Stellate seta between r.o. 3 and 4. Coxal setae 3-1-6-3 or 3-1-6-4; 6 pairs of genital setae, 8 pairs of paragenitals. Japan. ... . **japonica** Morikawa, 1963
(Also see *uenoi* Morikawa, 1963, said to be like **japonica** except all setae are longer; cave form).

35a. Leg I from 1.5-2.0 length of body. Body, 1135-1350 μm, leg I, 1875-2100 μm. Caves, upper Austria..... **strouhali** Willmann, 1953

35b. Leg I approximately same length as body. Coxal setae, 3-1-6-4 to 3-1-11-8. Genital setae 5 pairs; paragenitals, 6-12 pairs. Solenidia dorsobasal on tibia I-IV (double on III); dorsomedial on genua I-III. Length 1050-1800 μm. Northern Siberia, Spitzbergen, Alaska, northern Canada ..... **gelida** Thorell, 1871

Rhagidia longisensilla Shiba, 1969 Fig. 9 a-h.

♀. 550 μm long. Trochanters 1-1-2-2. Coxae 3-1-4-3. (The only specimens available, 1 ♀ and 1 Nympha I, were both so poorly preserved that details of body features could not be clearly determined. The chelicerae and sensory setae of the legs could be determined, however, and they leave little doubt that we are dealing with Shiba's species *longisensilla*.) Chelicera with shears approximately 1/3 total length; the single seta inserted posterior to shears; movable arm finely serrate on inner margin; fixed digit ending in 4 blunt cusps. All the legs have rhagidial organs; there are apparently no solenidia. Tarsus I with 4 long, parallel rhagidiforms and a short, brush-like seta between them and claws. Tarsus II with 3 rhagidiforms, 2 apical side by side. Tibia I with 2 rhagidiforms, 1 dorsoapical, 1 dorsomedial; tibia II with 3 rhagidiforms, 1 small apical, 2 larger but unequal, dorsomedial; tibia III with 2 long dorsomedial rhagidiforms; tibia IV with 1 medial. Genua I and II each with a ventriapical rhagidiform, genua III with a dorsomedial.

Nympha I. 320 μm (fig. 9h). Trochanters 0-1-1-0. Coxae 3-1-3-0. Four pairs of anal setae.

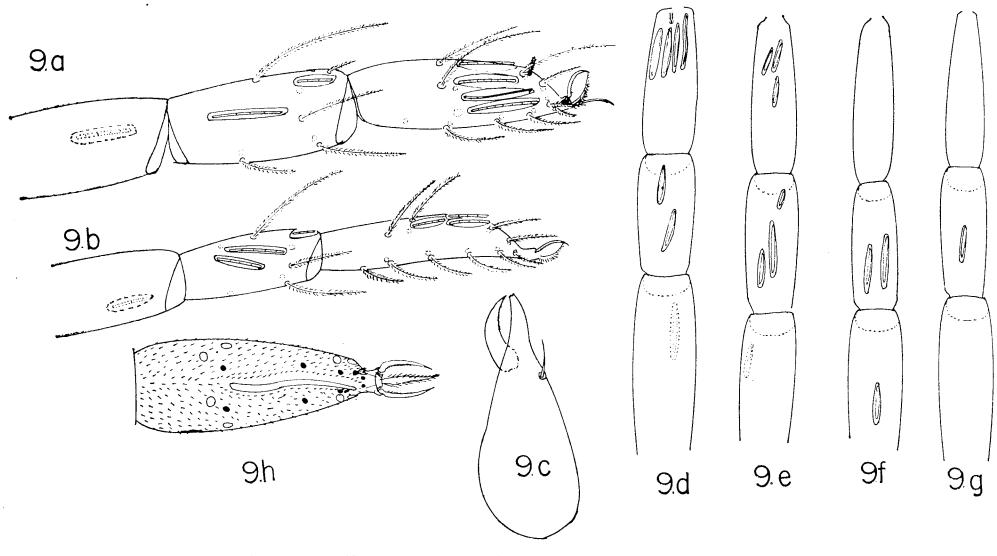


Fig. 9. *Rhagidia longisensilla* Shiba: a, dorsolateral view of leg I of adult; b, lateral view of leg II of adult; c, chelicera; d, e, f, and g, legs of I-IV, showing location of rhagidial organs; h, dorsal view of tarsus I of nympha I.

Genital setae, 1 pair; no paragenitals; 1 pair of genital knobs. Legs with rhagidiforms only, no solenidia. Tarsus I (fig. 9h) with a single, long rhagidiform. Tarsus II with 1 short rhagidiform; tibia II has 2 rhagidiforms, 1 apical, 1 basal.

DISTRIBUTION: 1 Ny I, 9 km (5 mi.) N of Fairbanks, 22.VI.1968; 1 ♀, Umiat, Alaska, 2.VII.1967, from *Astragalus* plants via Berlese funnel.

Rhagidia uniseta Sig Thor, 1909 Fig. 10 a–e.

♀. Length 700 μm. Trochanters 1-1-2-2. Coxae 3-1-4-3. In the only ♀ available for study, the genital setae were not determinable. Dorsal side: Trichobothria short, less than 2 × as

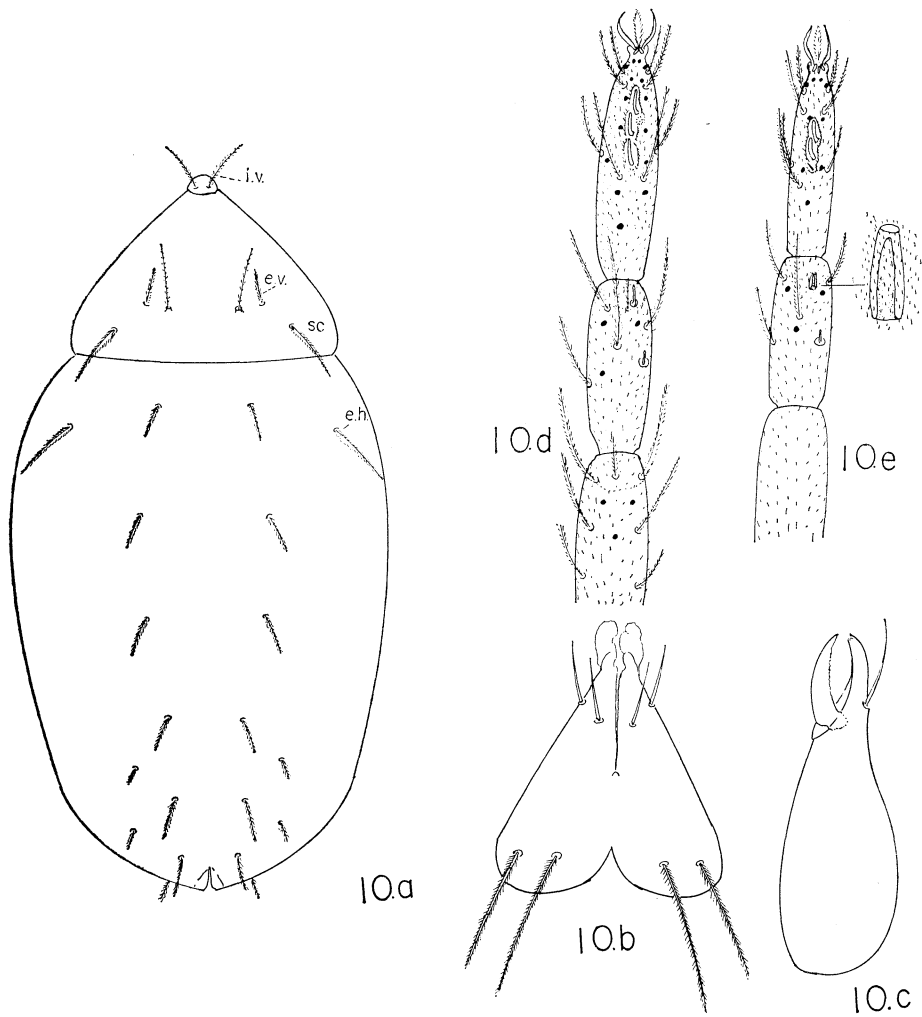


Fig. 10. *Rhagidia uniseta* Sig Thor: a, dorsum; b, hypostoma; c, chelicera; d, tarsus, tibia and genu I, right leg of adult; e, tarsus and tibia II of right leg of adult, with an enlarged view of the dorsal sensory pit of tibia II.

long as external verticals (e.v.). Internal verticals longer than e.v. Scapulars and external humerals 2× as long as dorsals. Anal pore terminal, with 4 pairs of setae. Gnathosoma (fig. 10 b, c) broadly triangular. The 4 posterior setae long, with inner pair a bit longer than outer, which is unusual. Chelicera slender, shears approximately 1/4 total length. Single seta inserted apical to base of shears and extending beyond tip of digit. Movable digit finely serrated along inner margin. Legs: (fig. 10 d, e). Tarsus I; 3 rhagidial organs tandem but in separate fields; stellate seta between the 2 basal r.o. Tarsus II with 2 r.o. tandem in separate fields; tibia I and II each with a dorsomedial solenidion on posterior margin. Apical sensory seta of tibia I recumbent but not in an obvious depression. Apical sensory seta of tibia II is completely hidden in a tube opening anteriorly. Legs III and IV without solenidia.

Nympa III. 500 μm. Trochanters 1-1-2-2. Coxae 3-1-4-3. 3 pairs of genital setae, chaetotaxy of legs as in ♀.

DISTRIBUTION: 1 ♀ with no other data than "Alaska, 1968." 1 Ny III from Barrow, Alaska, 11.VI.1968.

Discusson: The only discrepancy between the specimen here recorded and the original description is size. The original description gave the length as 1000 to 1300 μm; our specimen measured 700 μm. This is the first record from Alaska. Sig Thor described it from upper Norway.

Rhagidia gelida Thorell, 1871 Fig. 11 a-q.

♂. 1350 μm (1050-1500). Venter (fig. 11b): Coxal formula highly variable, from 3-1-6-3 to 3-1-9-8, to 3-1-11-6, and other combinations. The 2 distal setae of coxa I, single setae of coxa II, 3 distal setae of coxa III and 2 distal setae of coxa IV filiform; all others clavate. Each genital cover with 5 setae. *5 to 14 pairs* of paragenital setae. Sperm sac clavate, enlarged portion about same length as genital cover. Dorsum (fig. 11a): Internal verticals and trichobothria slender filiform; all other dorsal setae narrowly lanceolate. External humeral seta 3× length of internal humerals. Dorsals 1 and 2 equal and same length as i.h. Anal pore terminal, with anal setae 3 and 4 on dorsum. Gnathosoma broadly rounded laterally, almost onion-shaped. Shears about 1/3 total length of chelicera. Movable arm serrulate on inner margin; fixed arm bidentate at apex; apical seta arising about middle of digit and extending well beyond tip; basal setae about 1/3 length of apical and reaching its base. Apical segment of pedipalp with 14 setae. Legs (fig. 11 c-k): Trochanter formula 1-1-2-2. Legs I and IV longer than body by about 1/4. Tarsus I (fig. 11c) with 4 rhagidiforms lying tandem in confluent fields, stellate seta between 2 basal rhagidiforms. No solenidion on tarsus I. Tibia I with a small dorsobasal solenidion, and usual dorsoapical rhagidiform (fig. 11c). Tarsus II with 3 or 4 rhagidiforms tandem in a common field, subtended by a spiniform seta (fig. 11d). Tibia II with sensory seta hidden in a pit with a small anterior opening; solenidion dorsobasal (fig. 11d). Tibia III and IV each with a small dorsobasal solenidion, that on tibia III sometimes double. Genua I, II, and III each with a dorsomedial solenidion. On tarsus III, the dorsobasal seta is sometimes paired. Tarsi I-IV frequently have an upaired ventribasal seta. Tarsal claws without noticeable clawlets.

♀. Length 1725 μm. Coxae, 3-1-10-6; genital setae, 5 pairs; paragenital setae, 16 pairs.

Nympha III (fig. 11e, l-q). Length 950 μm (850-1000). Coxal formula variable, 3-1-5-4 to 3-1-7-8 and various combinations in between. Genital setae, 3 pairs. Paragenitals varying from 5 to 8 pairs. Tarsi I and II each with 3 rhagidiforms. Tarsus I has 5 pairs of ventral setae of which the 4th pair is very short, and the 5th pair is much longer than all the others (fig. 11n). An unpaired basal seta is often present, as figured. Sensory setae, except as noted for tarsi I and II are as in the adult.

DISTRIBUTION: Widely distributed on the northern coast, having been collected from Cape Beaufort to Tuktoyuktuk. Total number observed, 3 ♀♀, 10 ♂♂, 7 Ny III. Alaska: Fairbanks, 22.VI.1968, 3 Ny III from moss and leaf litter; Cape Beaufort, 12.VII.1968, 1 ♂, 1 Ny III from tundra; Barrow, 15.VII.1967, 3 Ny III from tundra; Canada, Tuktoyuktuk, NWT, 25.VII.1968, 3 ♀♀, 10 ♂♂, 3 Ny III, from under wood and stones.

Discussion: This is a very distinctive mite as to rhagidial organs and sensory setae. The ventral setae are highly variable, but for the most part there is hypertrichy of the paragenital setae and of coxae III and IV. The paragenital setae vary from 5 to 16 pairs in the adult, and the setae of coxae III and IV from 6 and 4 respectively to 11 and 8 respectively. One ♂ from Tuktoyuktuk had a coxal formula of 3-1-8-6 on one side and 3-1-11-6 on the other. Another ♂ from Tuktoyuktuk had a coxal formula of 3-2-8-6. The ♀ from Tuktoyuktuk also had 2 setae on coxa II. A ♂ from Cape Beaufort had the coxal formula of 3-1-9-8 as shown in fig. 11b. The ♂ and ♀ above mentioned are the only specimens of *Rhagidia* I have ever seen with 2 rather than 1 setae on coxa II.

The reason for designating this mite *Rhagidia gelida* Thorell as described in Thor & Willmann's 1941 "Acarina" is that it is the only *Rhagidia* commonly occurring in the Arctic which has ventral hypertrichy coupled with tandem rhagidiforms in a confluent field on tarsi I and II. Considering how variable this species is, the description fits very well. Some descrepancies in the description, such as "Maximellen (i.e., hypostoma) kurz, vorn gespalten, mit lateralen, gespalteten fein gezahnelten Anhangen ('Aussenmalae') und 4 Paar kraftigen, gefiederten Haaren.", are very likely in error. No *Rhagidia* has all 4 pairs of hypostomal setae plumose, only the posterior 2 pairs; and the anterior, rather hyaline, margin of the "maxillae" is so irregular and variable it could well be interpreted in occasional specimens as having lateral, toothed divisions.

Rhagidia whartoni Strandtmann, new species Fig. 12 a-k.

♀. Length 1000 μm (850-1200 μm). Venter: (fig. 12b). Coxal formula 3-1-6-4. Genital setae, 5 pairs. Paragenitals 5 pairs. All coxal and paragenital setae slender and not or only barely tending toward clavate. Dorsum (fig. 12a): Hysteronotal setae long, over 1/2 as long as interspaces between setae. Scapular and external humeral setae lanceolate and about 2× length of d_1 and d_2. Trichobothria slender, about same length as scapulars. Gnathosoma: Shears large, comprising about 1/2 total length of chelicera. Movable arm serrulate along inner margin and with 2 small but sharp teeth, 1 medial and 1 basal. Fixed digit with 3 terminal cusps. Cheliceral setae inserted about middle; basal seta 1/3 to 1/2 length, and reaching base of, apical. 4th segment of pedipalp with 10 setae some of which, especially the basal, are strongly lanceolate (fig. 12d). Legs: Leg I a bit shorter than body. Trochanters 1-1-2-2. Tarsus I with 4 obliquely transverse rhagidiforms, with the stellate seta between the basal two or between the medial two; *with a prominent dorsobasal solenidion* (fig. 12 c, g, h, l). Tibia I with an apical rhagidiform and a mediodorsal solenidion. Tarsus II with 3 rhagidiforms tandem in confluent fields, subtended by small spiniform. Tibia II with an apical sensory seta buried in a tubular pit, and a dorsobasal solenidion. Tibiae III and IV each with a dorsobasal solenidion, frequently double on tibia III.

♂. Only 1 ♂ was found. It measured 850 μm. Chaetotaxy as in the ♀. The sperm sac was shorter than the length of the genital flap (fig. 12b).

Nympha II. Length 500 μm. Trochanters 1-1-2-1. Coxae 3-1-4-1. Genital setae, 2 pairs; paragenital setae, 2 pairs. Anals, 4 pairs. Tarsus I with 2 rhagidiforms and a stellate

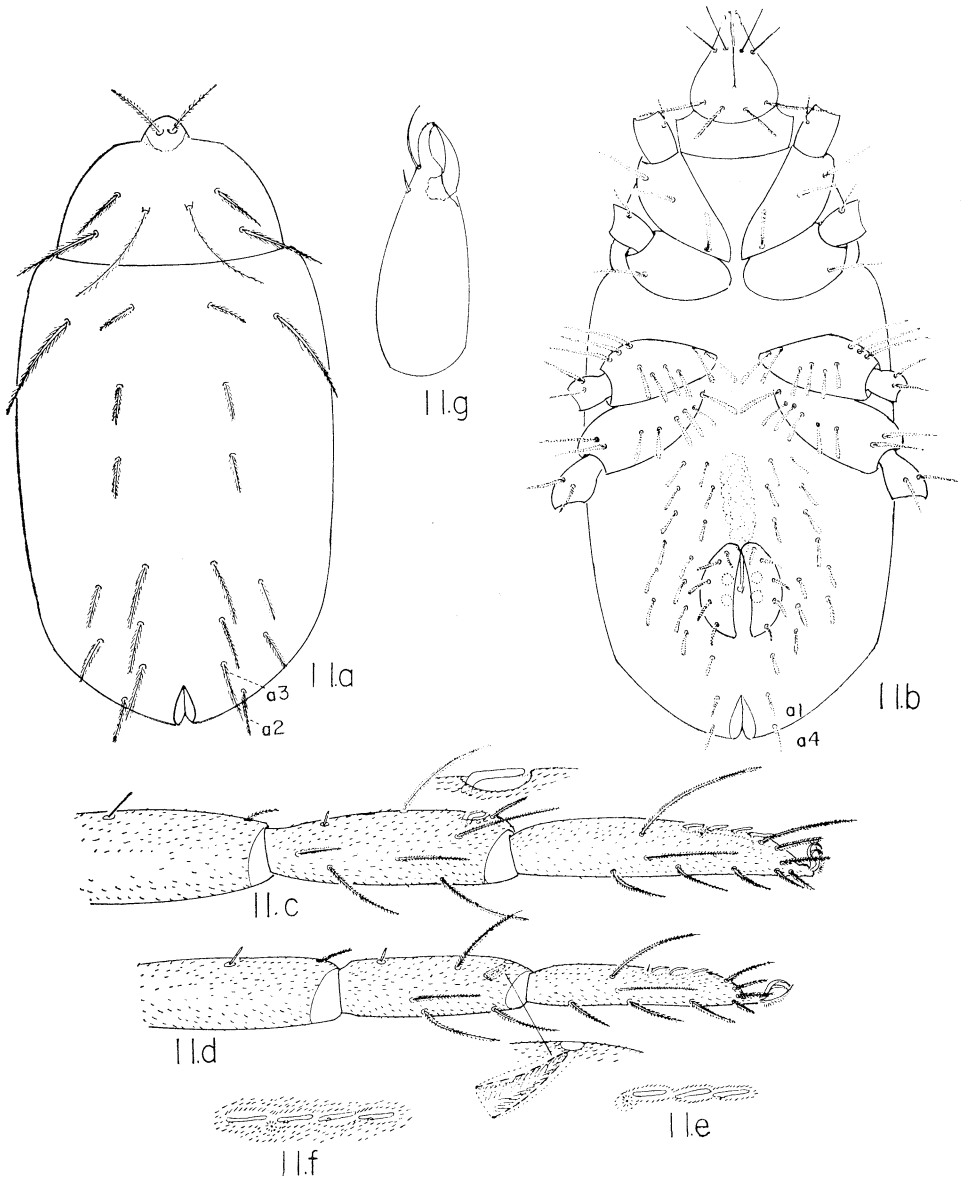


Fig. 11. a-g, *Rhagidia gelida* Sig Thor : a, dorsum ; b, venter of ♂ ; c, lateral view of leg I with enlarged view of sensory pit of tibia I ; d, lateral view of leg II with enlarged view of sensory pit of tibia II ; e, rhagidial organs of tarsus I of Ny III ; f, rhagidial organs of tarsus I of adult ; g, chelicera.

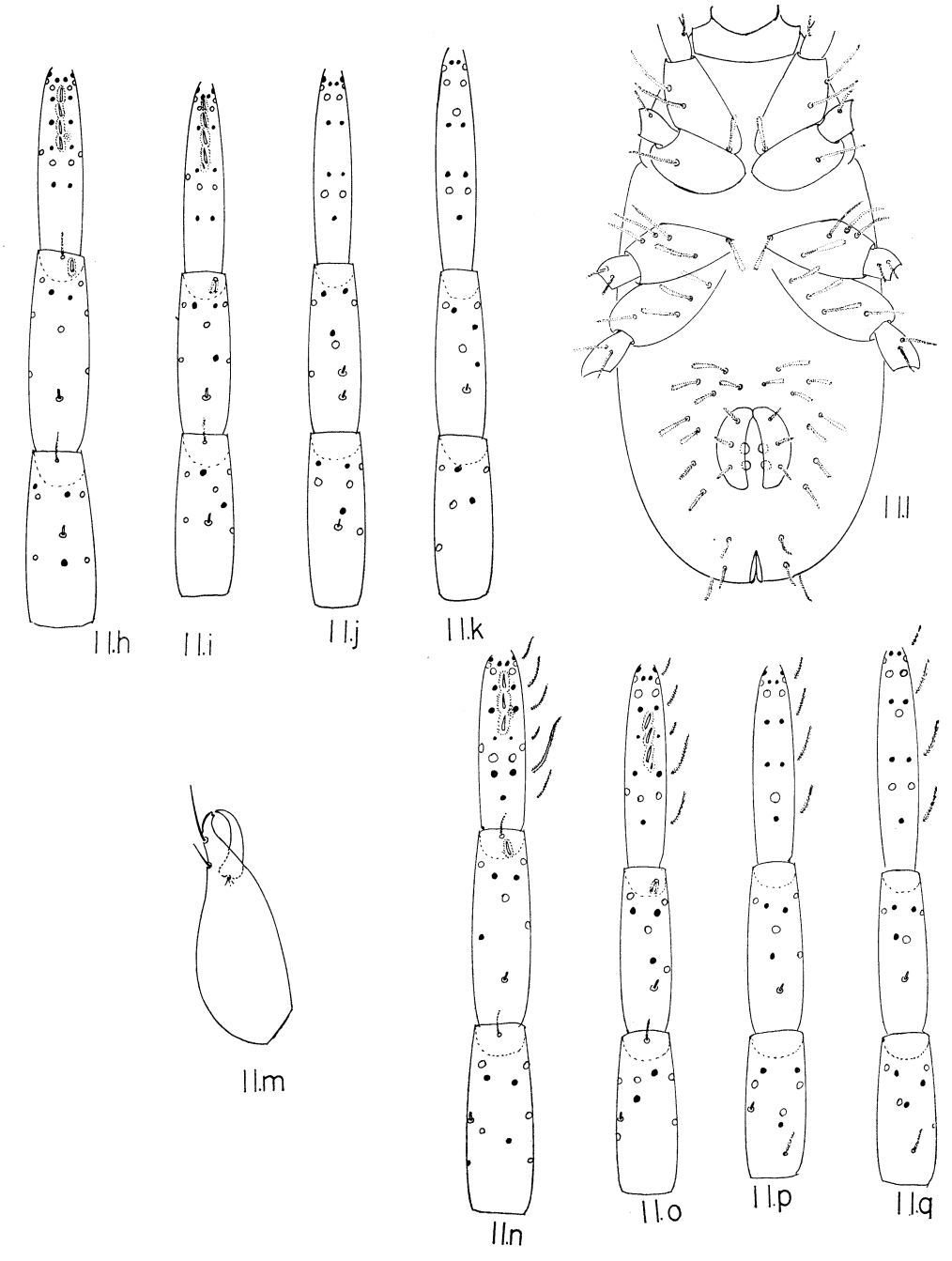


Fig. 11. h-q, *Rhagidia gelida* Sig Thor: h, i, j, and k, legs I-IV of adult; l, venter of tritonymph; m, chelicera of tritonymph; n, o, p, and q, legs I-IV of tritonymph, with one set of the ventral setae of the tarsi shown on the side.

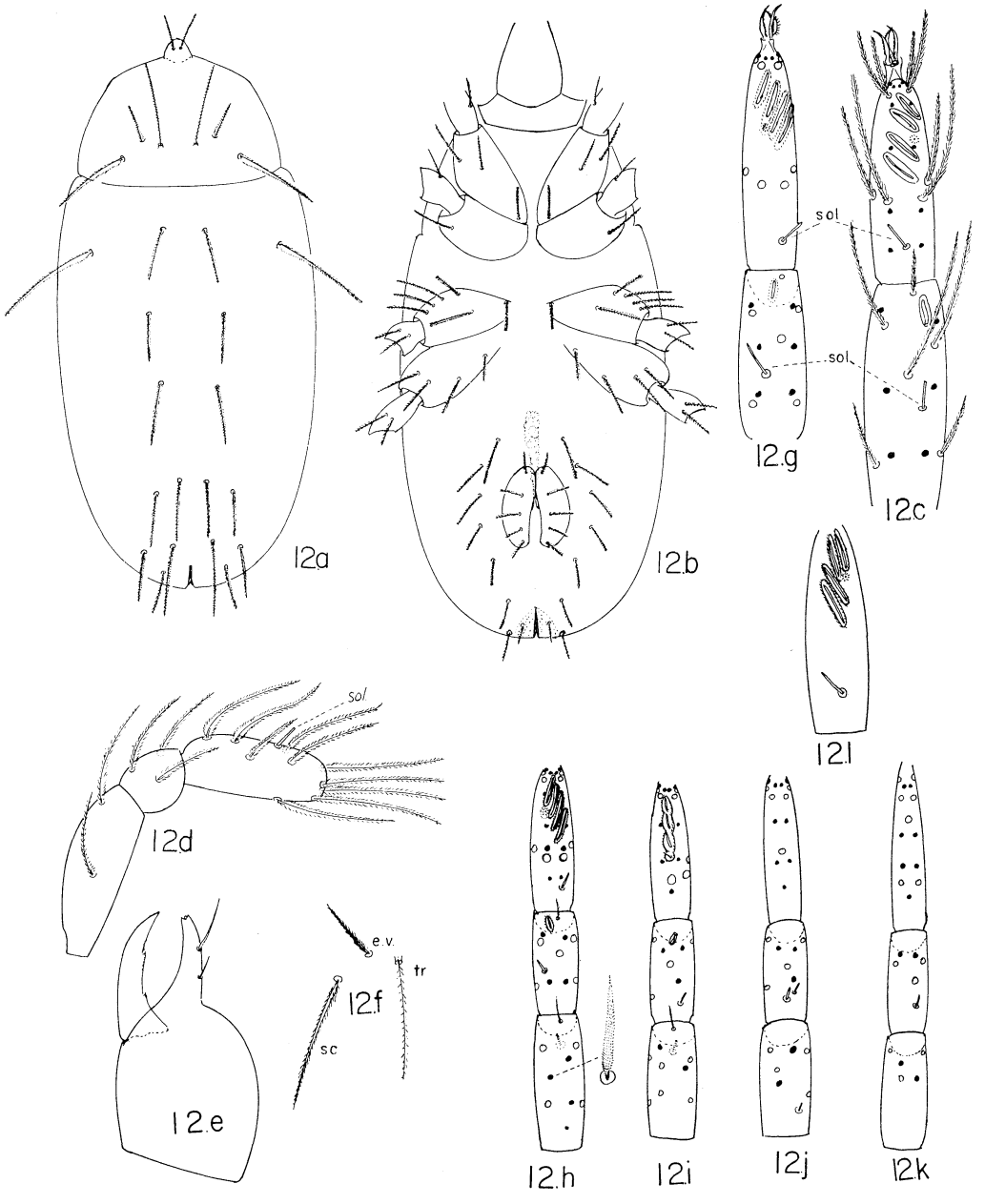


Fig. 12. *Rhagidia whartoni* n. sp.: a, dorsum of adult; b, venter of ♂; c, tarsus and tibia I, right leg of adult; d, dorsolateral view of right pedipalp; e, chelicera; f, scapular, internal vertical and trichobothrium, left side; g, tarsus and tibia I, left leg of adult; h, i, j, and k, terminal 3 segments of legs I-IV respectively, with an enlarged view of one of the ventral setae.

seta between them ; tarsus II with 2 r.o. and a spiniform seta. Sensory seta otherwise as in the ♀.

Holotype ♀ (BISHOP 9348), slough on Big Minto Lake, central Alaska, 5.IX.1965, under log.

DISTRIBUTION : This species seems to be more southern in distribution. Only 1 specimen was collected N of Brooks range, all the others from central Alaska, central Yukon Territory and the McKenzie River Delta. Otter Falls, Y. T., 29.VIII.1965, under logs, 5 ♀♀ ; slough near Big Minto Lake, Alaska, 5.IX.1965, under logs, 6 ♀♀ (including holotype) ; Fairbanks, Alaska, 20.VII.1968, 2 Ny III, old nest of a Fox Sparrow, 22.VIII. 1968, 1 Ny III, from sample of turf, 22.VI.1968, 1 ♀, under sticks and rocks ; Umiat, Alaska, 2.VII.1967, 1 ♀, grass sample ; Inuvik, NWT, 31.VII.1967, 1 ♂ under log.

Differs from all other *Rhagidia* described in this paper by the longer setae *and the solenidion on tarsus I.* The position of the rhagidial organs on tarsus I varies somewhat. Fig. 12c, 12g, and 12h indicate some of the variations. The mite is named for George W. Wharton, Director of the Institute of Acarology, Columbus, Ohio, who has probably inspired more acarologists, young and old alike, than any other man living today.

Rhagidia shibai Strandtmann, new species Fig. 13 a-k.

♀. Length 650 μm (of 5 ♀♀, 3 were 650, one 675 and one 800. The latter possibly a variety.) Venter : (fig. 13b). Coxal formula 3-1-5-3, (sometimes 3-1-6-3). All setae short and not noticeably clavate. Genital setae 5 pairs ; paragenital, 5 pairs, the anterior longest. Dorsum : (fig. 13a). Middorsal setae short, about 1/3 as long as interspaces. Trichobothria not especially slender, slightly longer than scapulars. Gnathosoma : Shears large, almost 1/2 total length of chelicera (fig. 13e). Fixed digit with 4 apical cusps, 1 of which is distinctly longer and toothlike. Apical cheliceral seta medial, about 3× length of basal ; the basal just reaches base of the apical seta. Movable digit minutely serrate, without teeth. 4th segment of pedipalp with 10 setae, of which 4 dorsals are rather broadly lanceolate and shorter than the segment. Legs : (fig. 13 c, d, f-k). Legs I about as long as body. Tarsus I with 4 obliquely transverse r.o. ; stellate seta between basal 2. Tibia I with an apical r.o. and *a solenidion just behind it.* Tarsus II with 3 r.o. tandem in confluent fields, subtended by a small spiniform. Sensory seta at apex of tibia II in a deep, tubular pit. Tibiae II, III, and IV each with a dorsobasal solenidion, that on tibia III generally double. Genua I and II each with a ventriapical solenidion. Solenidia lacking on genua III and IV. All the tarsal claws have small, basal clawlets. The empodium of tarsus I small, not 1/2 as long as claws (fig. 13j).

♂. None found.

Nympha III. Length 475 μm (460-500 μm). Coxal formula 3-1-4-3 or 3-1-5-3. Trochanters 1-1-2-2. Genital setae 3 pairs ; paragenital, 4 pairs. Tarsi I and II each with 3 rhagidiforms. Sensory setae otherwise as in the ♀. Nympha II. 450 μm (440-465 μm). Coxal formula 3-1-4-1. Trochanter 1-1-2-1. Genital and paragenital setae, 2 pairs each. Tarsi I and II each with 2 r.o. Sensory setae otherwise as in the ♀. Nympha I. 425 μm. Coxal formula 3-1-3-0. Trochanters 0-1-1-0. 1 pair genital setae, no paragenitals, 1 pair of genital knobs. Tarsi I and II with each 1 r.o.

Holotype ♀ (BISHOP 9349), Anaktuvik Pass, 17.VI.1968, Kay & Don Pittard.

DISTRIBUTION : Although not commonly found, it apparently has a wide distribution having been collected in northern British Columbia, central Alaska, the Brooks

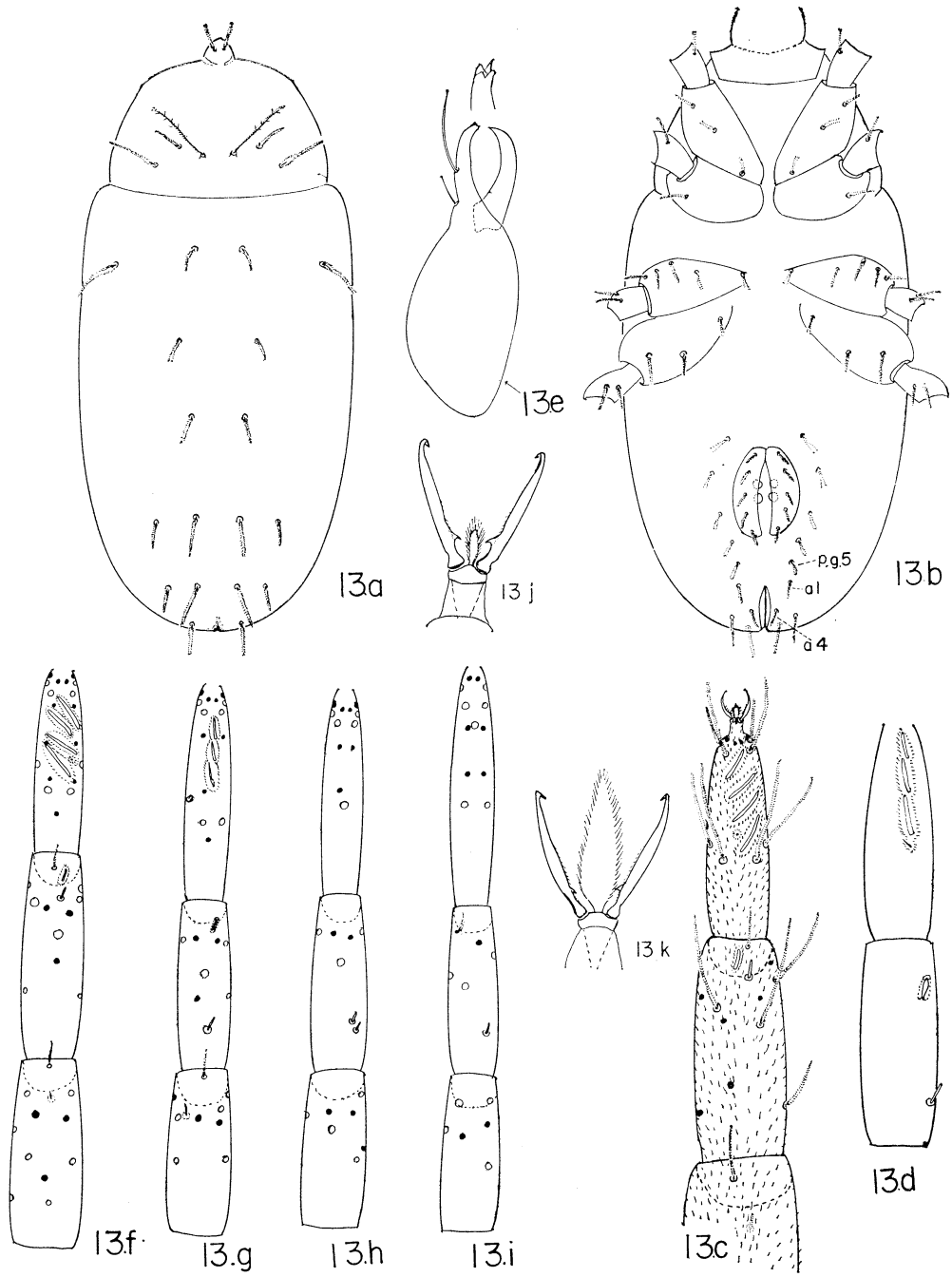


Fig. 13. *Rhagidia shibai* n. sp.: a, dorsum of adult; b, venter of ♀; c, tarsus, tibia, and genu I, left leg of adult; d, tarsus and tibia II, right leg of adult showing sensory setae only; e, chelicera; f, g, h, and i, terminal 3 segments of legs I-IV respectively, right side, adult; j, ambulacrum of tarsus I; k, ambulacrum of tarsi II-IV.

Range, and the Arctic Coast. Description based on 5 ♀♀, 2 Ny III, 2 Ny II, and 1 Ny I. White Court, B. C. (on Alaska Highway at mile 43), 24.VII.1965, 1 ♀ ; Chatimka River, Alaska. 1 ♀, 4.IX.1965, under dead wood ; Anaktuvik Pass, Alaska, 17.VI.1968, 1 ♀ (holotype), 1 Ny III, 2 Ny II, from tundra ; Cape Beaufort, Alaska, 12.VII.1968, 1 ♀, 1 Ny I, tundra ; Barrow, Alaska, 1 Ny III, 10.VI.1967, wet mosses.

Named for Minoru Shiba of Matsuyama Junior College, Matsuyama, Japan.

Rhagidia hilli Strandtmann, new species Fig. 14 a-h.

♀. Length 800 μm (750-900). Ventral side : (fig. 14b). Coxal formula, 3-1-6-3 ; on coxa I, apical and medial setae equal, inner a bit shorter. Inner coxal setae, and paragenital setae, tending toward claviform, with truncate tips. External genital setae, 5 pairs. Paragenitals, 5 pairs. Dorsal side : (fig. 14a). Scapular and external humeral setae long and prominent, slightly over 2× as long as internal humeral and dorsals 1 and 2. Trichobothrium about as long as sc., slender. Gnathosoma : Shears ca. half as long as entire chelicera ; fixed arm tricusped at apex ; basal seta not reaching apical seta, and less than 1/2 as long as apical seta. Movable arm of chela minutely serrate on inner margin. Legs I about as long as body. Tarsus I with 4 rhagidiform organs lying obliquely in separate fields, stellate seta between the 2 proximal (fig. 14 c, h). Tibia I with a dorsoapical rhagidiform and a dorsomedial solenidion. Tarsus II with 3 rhagidiforms tandem in a common field, with a small spiniform at base of proximal rhagidiform. Tibia II with a peg-like seta in a dorsoapical pit, and a dorsomedial solenidion (fig. 14d). Both genua I and II have a ventriapical solenidion. Tibia III has 2 dorsobasal solenidia and tibia IV has one. Genu I has 1 dorsobasal solenidion. Claws with tiny basal clawlets.

♂. None available.

Nympha III. Length 650 μm (610-700). Genital setae, 3 pairs ; paragenitals, 4 pairs. Coxal seta formula, 3-1-5-3. Trochanter formula, 1-1-2-2. Tarsus I with 2 rhagidiforms ; tarsus II with 3. Otherwise as ♀. A single Ny III from Anaktuvik Pass, Alaska, has 3 rhagidiforms on tarsus I. Nympha II. 500 μm (500-550). Genital setae 2 pairs ; paragenitals, 2 pairs. Coxal formula 3-1-4-1 ; trochanter, 1-1-2-1. Tarsi I and II each with 2 rhagidiforms. Nympha I. 370 μm (315-375). One pair of genital knobs, 1 pair of genital setae, no paragenital setae. Coxal formula, 3-1-3-0 ; trochanter 0-0-1-0. Tarsi I and II with 1 rhagidiform each. Described from 5 ♀♀, 2 Ny III, 1 Ny II, 2 Ny I.

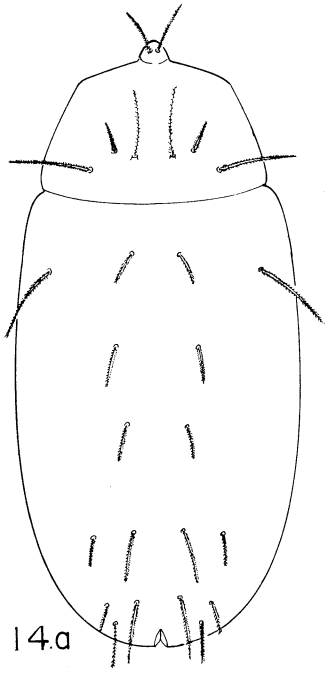
Holotype ♀ (Bishop 9350), 8 km (5 mi) N of Fairbanks, Alaska, 22.VI.1968, berlesed from moss samples.

DISTRIBUTION : 8 km (5 mi) N. of Fairbanks, Alaska ; wooded hillside (birch-aspen forest), Steel Creek Road, under rocks and logs, and in moss and lichens, 22.VI.1968, 3 ♀♀, 2 Ny III, 1 Ny II, 2.VII.1968, 2 Ny I ; 16 km (10 mi) N of Fairbanks, in lichen, 31. VIII.1965, 1 ♀ ; Anaktuvik Pass, 18.VI.1968, 1 ♀ ; Tuktoyuktuk, N.W.T., 24.VII.1967, 1 Ny III.

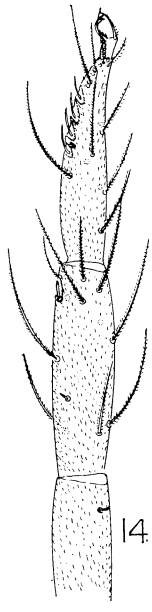
Named for Dick Hill, Director of the Canadian Research Lab at Inuvik, N.W.T. He and his staff made my stay on the MacKenzie River Delta a most pleasant and profitable one.

Rhagidia mariehammerae Strandtmann, new species Fig. 15 a-i.

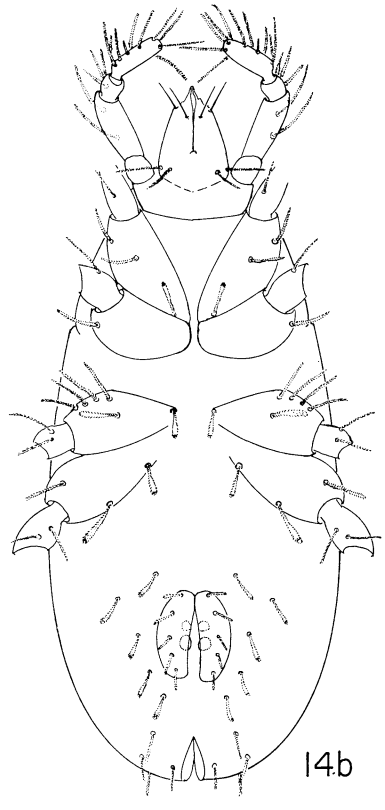
♀. Length 1500 μm. Trochanter formula, 1-1-2-2 ; coxae, 3-1-5-3. Genital setae, 5 pairs ; paragenitals, 5 pairs. Dorsum. Setae short, from 1/2-1/3 as long as interspaces. Legs :



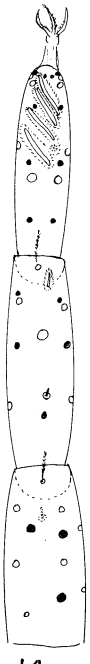
14.a



14.h



14.b



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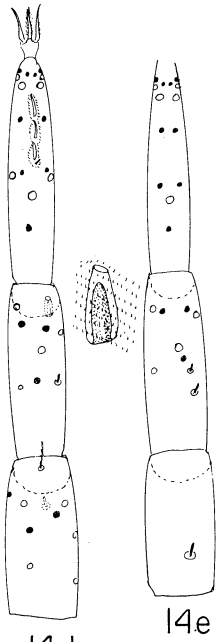
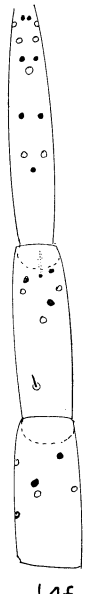
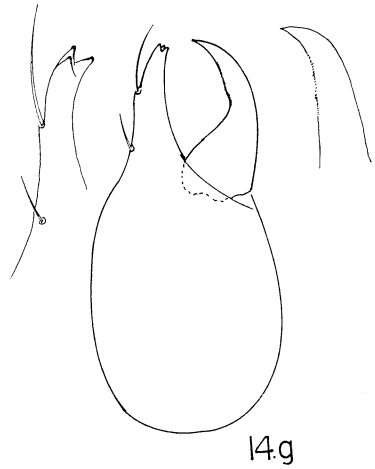


14.d 14.e



14.f



14.g

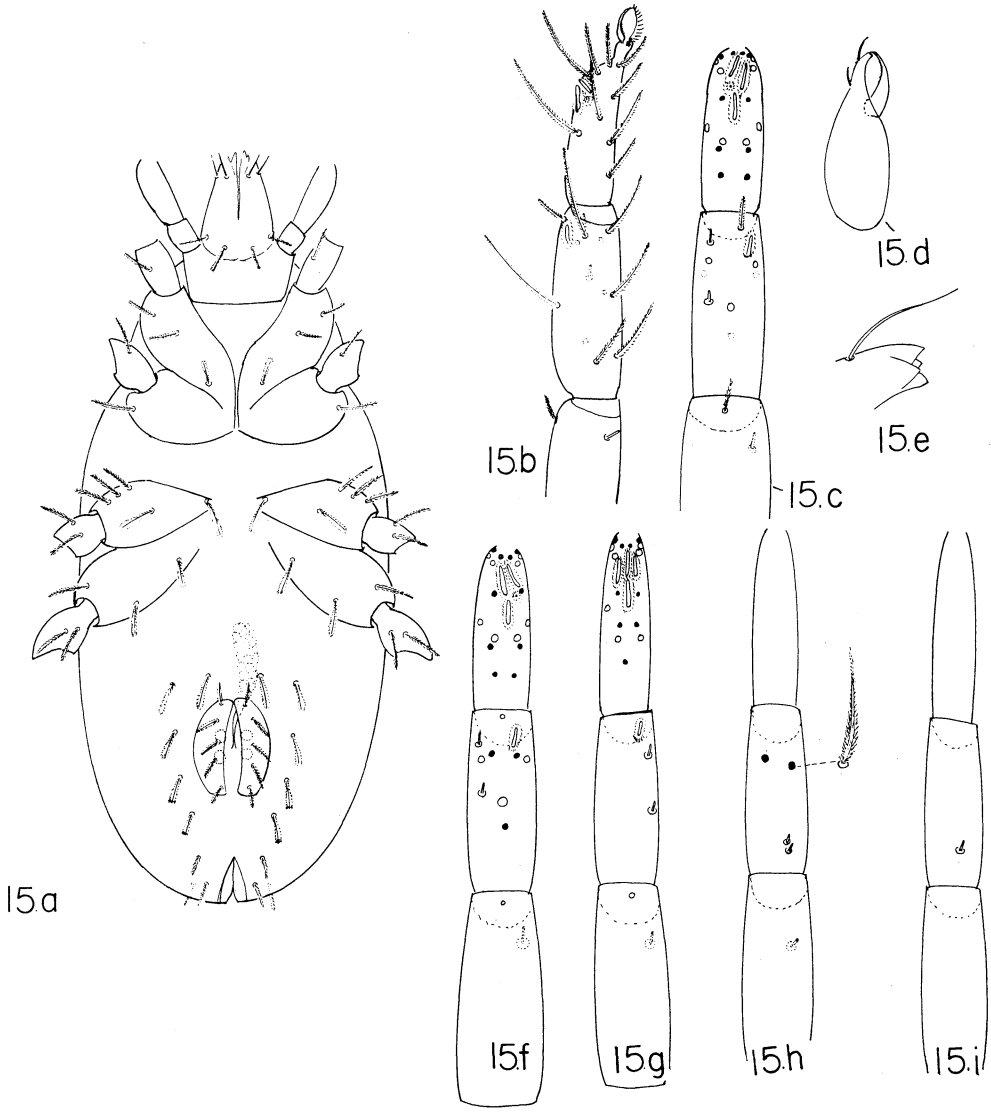


Fig. 14. *Rhagidia hilli* n. sp. : a, dorsum of adult; b, venter of ♀ ; c, d, e, and f, legs I-IV respectively, with an enlarged view of the sensory pit on tibia II; g, chelicera; h, lateral view of tarsus and tibia I, right leg.

Fig. 15. *Rhagidia mariehammerae* n. sp.: a, venter of ♂ ; b, lateral view of tarsus and tibia I of the right leg; c, dorsal view of tarsus and tibia I to show location of setae; d, chelicera; e, tip of fixed digit of chela with apical seta; f, g, h, and i, legs I-IV, showing sensory setae and one of the ventral setae (15h).

(fig. b, c, f-i). Tarsus I rising steeply from claw petiole; with 3 crowded rhagidiforms, the apical 2 side by side, the stellate seta at base of posterior apical r.o. (fig. b, c). Tibia I with an apical rhagidiform and 2 small solenidia on anterior face, 1 apical, 1 medial. Tarsus II with 4 r.o., parallel to long axis of leg, 3 apical and 1 basal to them. Tibia II with an apical r.o. (not sunk in a tube) and 2 solenidia on posterior face, 1 apical, 1 medial; tibiae III and IV each with a solenidion dorsobasally, that on tibia III usually double. Genua I-III each with a ventriapical solenidion. Shears slightly more than 1/3 total length of chelicera. Fixed arm with 4 apical cusps. Anterior cheliceral seta arises near apex of digit (fig. 15 d, e). Posterior seta only 1/2 as long and does not reach base of apical seta. Fixed arm finely serrate on inner margin.

♂. (fig. 15a). 1100 μm long. The sperm sac about as long as the genital covers.

Nympha III. Length 1000 μm. Trochanters 1-1-2-2. Coxa 3-1-4-2. Genital setae, 2 pairs; paragenitals, 3 pairs. Tarsi I and II each with 3 r.o. Described from 2 ♂♂, 3 ♀♀, 1 Ny III.

Holotype ♀ (BISHOP 9351), Cape Beaufort, Alaska, 12.VII.1968, R. W. & M. R. Strandtmann. Berlesed from moss and lichens.

DISTRIBUTION: So far, recovered only from the northwest coast of Alaska. Cape Beaufort, Alaska, 1 ♂, 2 ♀♀, 12.VII.1968, grass, moss, willow from edge of bluff facing the Arctic Ocean (1 ♀), tundra, moss, lichens and small orange toadstool (1 ♂, 1 ♀) Cape Thompson, Alaska, 6.VII.1968, wet moss near pond (1 Ny III).

Named for Marie Hammer of Fredensborg, Denmark, a very charming lady who has done a great deal of work on polar soil mites.

Explanation of Symbols Used

a1 - Anal seta 1
a2 - Anal seta 2
a3 - Anal seta 3
a4 - Anal seta 4
a.r.s. - apical rostral setae
b.r.s. - basal rostral setae
ch.s. - cheliceral seta
d1 - Dorsal seta 1
d2 - Dorsal seta 2
e. - eye
e.h. - external humeral seta
e.l. - external lumbar seta
e.s. - external sacral seta
e.v. - external vertical seta
g.k. - genital knobs
g.s. - genital setae
i.g.s. - internal genital setae
i.h. - internal humeral seta
i.l. - internal lumbar seta
i.s. - internal sacral seta
i.v. - internal vertical seta
i.c.s. I - inner coxal seta of coxa I
i.c.s. III - inner coxal seta of coxa III
i.c.s. IV - inner coxal seta of coxa IV
p.g.s. - paragenital setae
r.o. - rhagidial organ
sc. - scapular seta
sol. - solenidion
sp.s. - sperm sac
s.s. - sensory seta
st.s. - stellate seta
tr. - trichobothrium (=pseudostigmatic organ; = sensillium)

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Disposition of type material. Holotypes and some paratypes of the new species are in the type collection of the Bernice P. Bishop Museum, Honolulu, Hawaii. Paratypes have been sent also to the U. S. National Museum, Washington, D. C.

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