

## The millipede family Striariidae Bollman, 1893. VII. *Petra sierwaldae*, n. gen., n. sp., a minute millipede from Idaho, USA (Diplopoda, Chordeumatida, Striariidae)

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### Abstract

*Petra sierwaldae*, n. gen., n. sp. is described from males and females collected at four localities in Kootenai County, Idaho, USA. The new genus is defined by its unique gonopod and ninth leg anatomy, a notched collum and single ommatidium on each side of the head, and lacking third coxal flasks as well as having modified fifth coxae.

**Key words:** Kootenai County, new genus, new species, Striariinae

### Introduction

The family Striariidae Bollman, 1893, has been the subject of six previous papers in this series (Shear 2020, 2021a, 2021b; Shear & Marek 2022a, 2022b; Shear *et al.* 2022). Familiarity with the large to moderate-sized striariid millipedes of the genera *Striaria* Bollman, 1888 and *Amplaria* Chamberlin, 1941, does not prepare one for the surprising array of small-bodied species of the family, mostly 5 mm or less in length, found in the leaf litter and soil of moist forests in northwestern North America. Striariids, endemic to temperate North America, are most diverse in the southern Appalachian Mountains and in, and west of, the Cascade and Coast Ranges of the Pacific northwest, with additional species found in northern Idaho. The Appalachians are home to the single genus *Striaria*, four species of which also occur in Idaho. The remainder of the genera are found in the western coastal mountains and many of the species may be short-range endemics. The millipedes of this family are likely the most unusual members of the diplopod order Chordeumatida, distinguished by 12-crested rings, a hood-like collum, a cerotegument over a thick, heavily sclerotized cuticle and a three-lobed telson. In some species, individual crests are exaggerated, adding to the strange appearance (Shear & Marek 2022a, 2022b). The gonopods of these small species are often difficult to interpret and homologies with the gonopods of the larger forms have not been reliably established. Such is the case with *Petra sierwaldae*, n. gen., n. sp., described below. In addition to the uniqueness of the gonopods, several somatic characters of the males diverge from those of known genera, and justify a new genus for this tiny inhabitant of the forests of northern Idaho.

### Methods

Specimens were field-preserved in various solutions and later transferred to 70% ethanol. Morphological studies were done using an Olympus SZH stereomicroscope and an Olympus BX50 compound microscope equipped with

Nomarski optics. Gonopods were temporarily mounted on microscope slides in glycerine for study up to 400X magnification and drawings were made from these slides using a drawing tube on the BX50. For scanning electron microscopy (SEM), specimens were first cleaned in an ultrasonic cleaner, then mounted on 12.7 mm diameter aluminum stubs using double-sided adhesive carbon discs and allowed to air-dry. These were sputter coated with a 40 nm thick layer of platinum and palladium, using a Leica EM ACE600 high vacuum sputter coater. SEM micrographs were taken with a FEI Quanta 600 FEG environmental scanning electron microscope. Photographs were edited and refined using GIMP, and plates were composed in InkScape. Age, poor preservation and the small size of the specimens made dissection and cleaning difficult, hence some SEM preparations were less suitable than others. Further, details of the anatomy are difficult to impossible to see clearly under a dissecting microscope and necessitate the use of SEM pictures and drawings executed at 200–400X under the compound microscope.

### Abbreviations used in the figures

|                 |                       |
|-----------------|-----------------------|
| <b>aac</b>      | anterior angiocoxite  |
| <b>cc</b>       | colpocoxite           |
| <b>cn</b>       | notch in collum       |
| <b>col</b>      | collum                |
| <b>cx</b>       | coxa                  |
| <b>cxp</b>      | coxal process         |
| <b>fc</b>       | flagellocoxite        |
| <b>hp</b>       | hypoproct             |
| <b>lab</b>      | labrum                |
| <b>m</b>        | mandibular stipes     |
| <b>numerals</b> | ring numbers          |
| <b>om</b>       | ommatidium            |
| <b>pac</b>      | posterior angiocoxite |
| <b>pp</b>       | paraproct             |
| <b>s</b>        | sternum               |
| <b>tel</b>      | telson                |
| <b>t9</b>       | telopodite 9          |

### Taxonomy

#### Family Striariidae Bollman, 1893

#### Subfamily Striariinae Bollman, 1893

#### *Petra* Shear, Marek, Bond & Wesener, new genus

*Type species: Petra sierwaldae* Shear, Marek, Bond & Wesener, new species

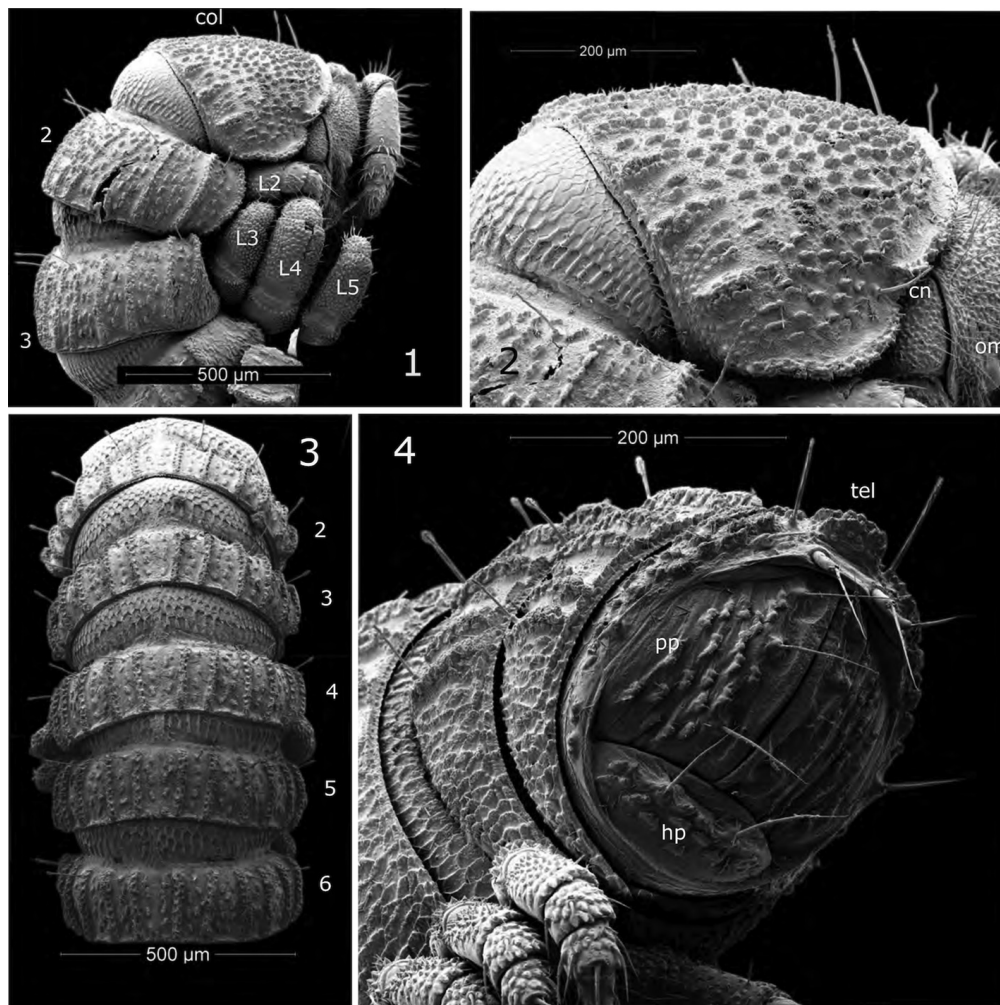
**Diagnosis.** A genus of Striariinae composed of a single species, distinct from other small striariids in having a single ommatidium on each side of the head (**om**, Fig. 2), a notch in the collum at the position of the outermost metazonal seta (**cn**, Fig. 2), absence of coxal flasks on the third legs (**L3**, Fig. 6), characteristically modified coxae of the fifth legs (Fig. 7) and the telopodites of the ninth legs enveloping the gonopods at rest (Fig. 9). None of these characters are found in previously described genera of striariids.

**Etymology.** The genus name is feminine in gender and honors our respected colleague, mentor, and friend, Dr. Petra Sierwald, Curator of Arachnida and Myriapoda at the Field Museum of Natural History, Chicago, IL, USA, in recognition of her many contributions to Myriapodology, Arachnology, and to natural history collections and education.

**Description.** As for the single species described below.

**Distribution.** Currently known from only four localities in Kootenai County, Idaho, USA.

**Notes.** This genus is part of a complex of genera yet to be described that includes very small species (<5 mm long) with subequal crests, distributed from northern California to the Puget Sound region of Washington, but is a geographic outlier found in northern Idaho. The biogeographic connections between northern Idaho and the Cascade and Coast Ranges further west, despite the intervening arid Snake River Plain, are well known and extend to both floristic and faunistic evidence (Brunsfeld *et al.* 2011; Richart & Hedin 2013; Shelley 1990).



**FIGURES 1–4.** Male paratype (FMNH) of *Petra sierwaldae* n. gen., n. sp. **1.** Lateral view of anterior end showing head, collum and anterior rings. **2.** Collum, lateral view. **3.** Rings 2–6, dorsal view. **4.** Telson and posterior rings, oblique view. **Abbreviations:** numerals, ring numbers; **cn**, notch in collum; **hp**, hypoproct; **L(numeral)**, leg numbers; **om**, ommatidium; **pp**, paraproct; **tel**, telson.

***Petra sierwaldae* Shear, Marek, Bond & Wesener, new species**

Figs 1–14

**Types:** Male holotype, two male paratypes and three female paratypes from Beauty Creek, Panhandle National Forest, 47.6018°N, -116.6405°W, collected 4 November 2004 by W. Leonard, C. Richart and J. Baugh; male paratype from Beauty Creek Road (FSR438), 1.3 mi SE of SR97, 698' asl, 47.6015°N, -116.6579°W collected 18 October 2009 by W. Leonard and C. Richart; Beauty Creek, 2.5 mi E of Lake Coeur d'Alene, 3202' asl, 47.6124°N, -116.6355°W, 14 April 2004, W. Leonard, J. Baugh; male paratype from Bumblebee Creek, Panhandle National Forest, 2240' asl, 47.6325°N, -116.2965°W, 6 November 2004, W. Leonard, C. Richart, J. Baugh. All localities are in Kootenai County, Idaho, USA. Parts of a male paratype are on SEM stub WS36-16. All specimens, including SEM stubs, deposited in Field Museum of Natural History, Chicago IL, USA (FMNH).

**Etymology.** As for the genus, the specific epithet is a patronym in honor of Petra Sierwald.

**Diagnosis.** As for the genus, see above.

**Description.** Based on male holotype from Beauty Creek. Length, 3.8 mm, greatest width 0.56 mm. Twenty-eight rings (collum + 26 leg-bearing rings + telson).

Head (Figs 1, 2, 5) densely setose, with single ommatidium (**om**, Fig. 2) on each side. Lateral corners of labrum (**lab**, Fig. 5) rounded. Mandibular stipes (**m**, Fig. 5) with distal, short, acute process.

Collum (**col**, Fig. 1) with distinct anterior rim, notched at position of lateralmost segmental seta (**cn**, Fig. 2), crests short, limited to posterior fourth of collum, sixth crest marginal.

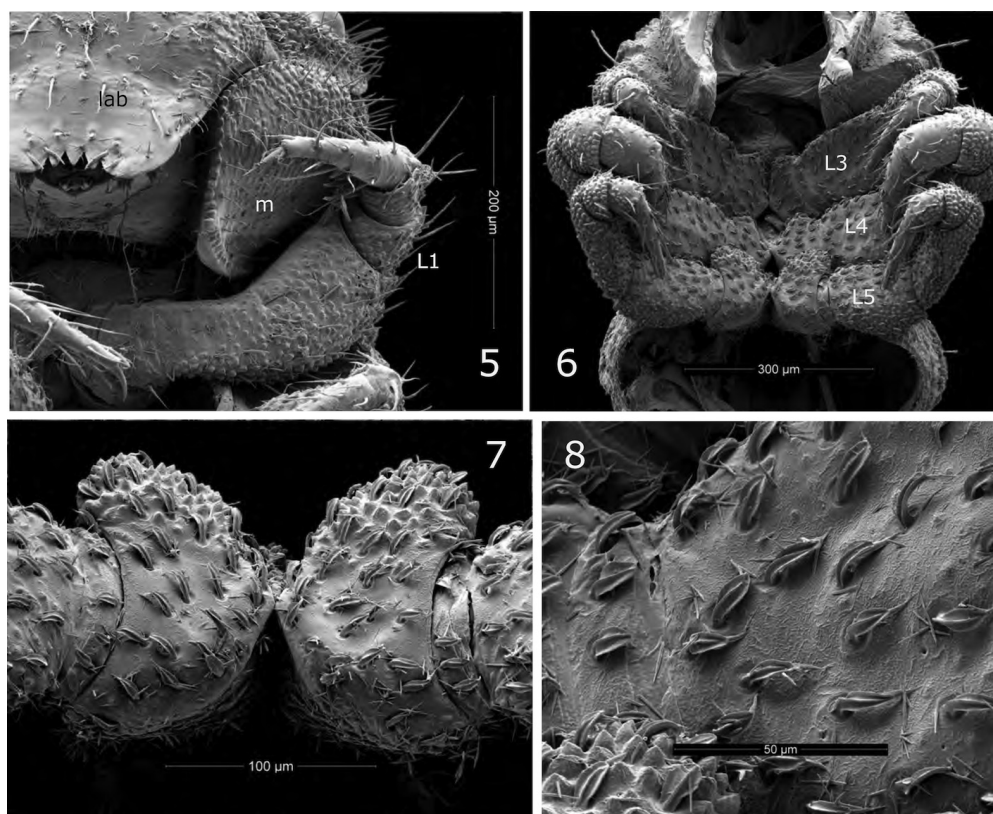
Subsequent rings (Figs 1, 3) with crests extending full length of metazonite, subequal in height. Metazonital setae long, with brush-like tips.

Telson (**tel**, Fig. 4) short, lacking crests, lateral lobes suppressed but middle lobe obvious. Spinnerets directed posterioventrad. Paraprocts (**pp**, Fig. 4) with three setae, ornamented with elongate tubercles. Hypoproct (**hp**, Fig. 4) with two setae, similar tubercles.

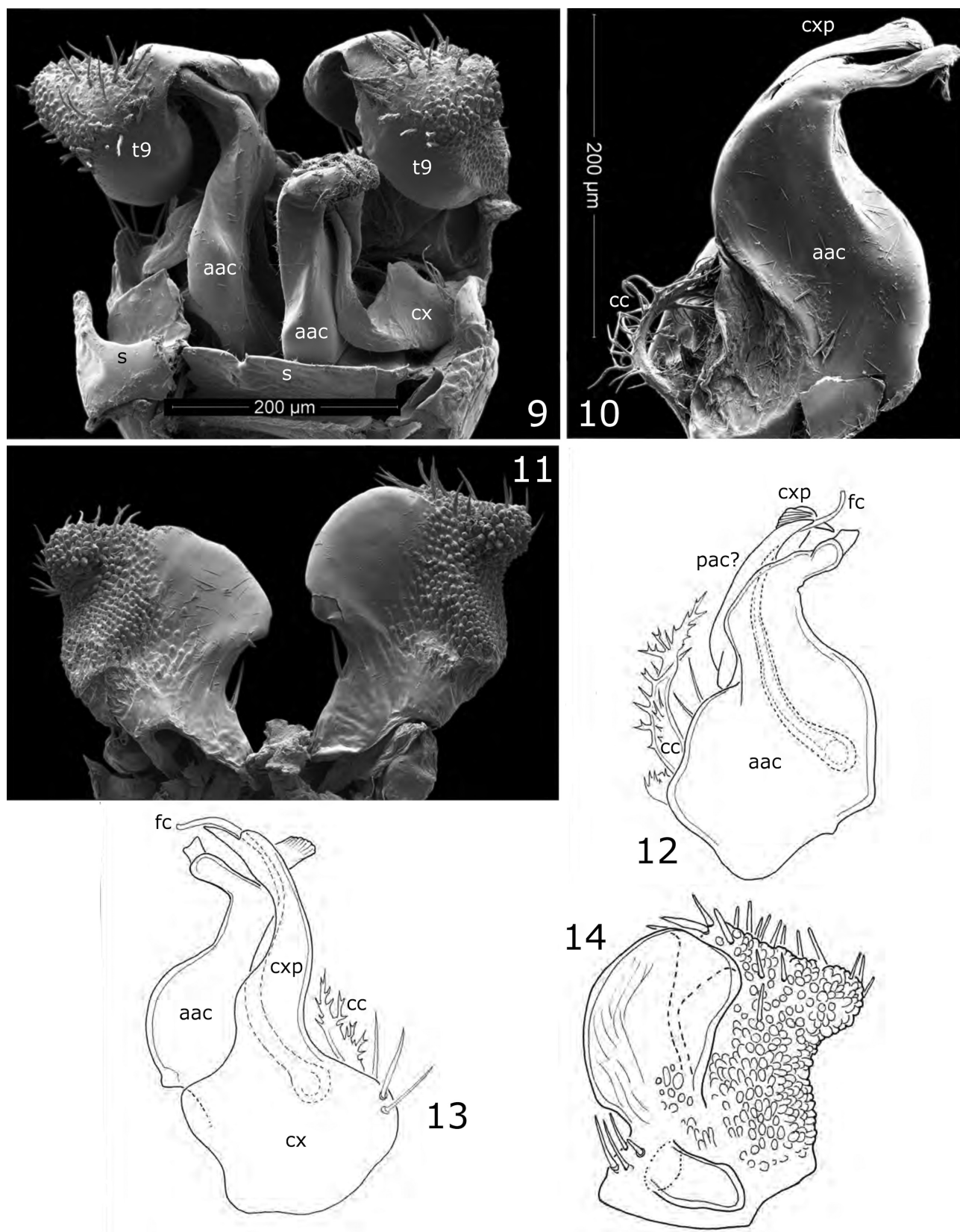
First leg pair (**L1**, Fig. 5) encrassate, without needle-like setae, few flattened, twisted setae on distal podomeres. Second leg pair (**L2**, Fig. 1) reduced, femora clavate. Leg pairs 3–7 strongly encrassate, third leg pair (**L3**, Fig. 6) lacking coxal flasks; fourth leg pair (**L4**, Fig. 6) the largest, coxae slightly excavated anteriorly; coxae of fifth leg pair (**L5**, Fig. 6) enlarged, with blunt anterior lobes set with acute tubercles (Fig. 7); sixth and seventh leg pair coxae unmodified. Proximal segments of all legs ornamented with typical flattened setae (Fig. 8).

Gonopods (Figs 9, 10, 12, 13) with broad sternum (**s**, Fig. 9) bearing lobes extending laterally. Coxae (**cx**, Figs 9, 13) with 3–5 setae, long coxal process (**cxp**, Figs 10, 12, 13) parallels anterior angiocoxites (**aac**, 9, 10, 12, 13). Posterior angiocoxae (**pac?**, Fig. 12) sheaths single, large flagellocoxite (**fc**, Figs 12, 13). Colpocoxite (**cc**, Figs 10, 12, 13) as elongate, fimbriate, weakly sclerotized branch. Tips of gonopod elements insert into cavities in ninth leg pair telopodites (see Fig. 9). Ninth leg pair (Figs 11, 14) with weak, narrow sternum, coxae and telopodites appearing fused; coxal part with mesal group of acute setae, telopodite portion laterally heavily tuberculate, with setae somewhat ensiform, mesally a large, smooth lobe envelopes tips of gonopods. Tenth coxae unmodified, with gland openings.

*Female paratype* similar to male but lacking secondary sexual modifications, 4.2 mm long.



**FIGURES 5–8.** Male paratype (FMNH) of *Petra sierwaldae* n. gen., n. sp. **5.** Labrum, mandible and first leg pair, ventral view. **6.** Leg pairs 3–5, ventral view. **7.** Coxae of leg pair 5, posterior view. **8.** Specialized setae of base of prefemur. **Abbreviations:** **L(numeral)**, leg numbers; **lab**, labrum; **m**, mandible.



**FIGURES 9–14.** Male paratype (FMNH) of *Petra sierwaldae* n. gen., n. sp. 9. 9. Gonopods and leg pair 9, anterior view. 10. Right gonopod, mesal view, anterior to the right. 11. Coxotelopodites leg pair 9, posterior view. 12. Right gonopod, mesal view, anterior to the right. 13. Right gonopod, lateral view, anterior to the left. 14. Coxotelopodite of left leg 9, posterior view. **Abbreviations:** aac, anterior angiocoxite; cx, gonopod coxa; cc, colpocoxite; cyp, coxal process; fc, flagellocoxite; pac?, posterior angiocoxite; s, sternum; t9, telopodite of leg 9.

## Discussion

With the discovery of many additional genera and species, the original interpretation of gonopod structure by Shear (2020) has become difficult to maintain and homologies of gonopod branches and processes across genera are questionable, but we maintain the same nomenclature here until further detailed study is possible. Similarly, it now seems rather unlikely that the composition of the two subfamilies will remain as in previous papers in this series. Some of the characters used to separate the two subfamilies seem no longer distinct, but again, with numerous taxa yet to be described it seems premature to revise the suprageneric classification, and we reluctantly maintain it here. Perhaps the most surprising feature of *P. sierwaldae* **n. gen., n. sp.** is the absence of a coxal flask on leg pair three of males. This structure is present in males of every other striariid species we have examined, and further, is present in all species of the related striarioid families Caseyidae and Urochordeumatidae. Likewise, no other striariid known to us has modified coxae of leg pair five.

Specially modified setae are found on the podomeres of striariids (*i.e.*, Fig. 8). Though variable from taxon to taxon in exact shape, these setae, unlike any found elsewhere in the Diplopoda, are typically recumbent, short and somewhat heart-shaped. The lateral margins are defined by ridges, and there may be either a central ridge or an array of small tubercles. Usually a thin, acuminate projection extends from beneath the tip of the heart-shaped base, in some taxa quite long and filamentous. Examining these setae from basal podomeres to distal, there is a gradual transition to more ordinary looking setae. The functional significance of these strangely modified setae is unknown. Not present in *Petra sierwaldae* **n. gen., n. sp.**, but found in other taxa are long, needle-like setae with spiral grooves, limited to the femora, postfemora and possibly tibiae of the first pair of legs of the males. In this species and others, long, flattened setae with one to three spiral turns appear on the tibiae and tarsi of the male first pair of legs. The function of these setae is likewise unknown, but they may have to do with the clasping function of the enlarged anterior legs of the males. Species of the order Chordeumatida typically present an array of six setae distributed across the collum and metazonites. In striariids, these setae are often reduced or show distinct modification, such as a distal brush of setulae seen in *Petra sierwaldae* **n. gen., n. sp.** In other North American chordeumatidan families, these metazonital setae are arranged in a triangle on each side of the metazonite, but in Striariidae, they are in a straight row at the anterior margin of the metazonite (Figs 2, 3). In some species, the metazonital setae are so reduced as to be visible only under the higher magnifications of the scanning electron microscope, or in fact absent. These and other peculiarities of the Striariidae will be discussed in more detail in a summary installment of this series of papers.

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