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## New Species and Additional Records of Protura from Michigan

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## NEW SPECIES AND ADDITIONAL RECORDS OF PROTURA FROM MICHIGAN<sup>1</sup>

Ernest C. Bernard<sup>2</sup>

### ABSTRACT

Three new species, *Eosentomon antrimense*, *E. pinusbanksianum*, and *Berberentulus macqueeni*, and one new record, *E. australicum* Womersley are added to the known Protura fauna of Michigan. Further records of *E. wheeleri* Silvestri, *Protentomon michiganense* Bernard, *Proturentomon iowaense* Womersley, *Acerentulus confinis* (Berlese) and *Amerentulus americanus* (Ewing) are listed from various parts of the state.

### INTRODUCTION

In a previous paper (Bernard, 1976), several new species of Protura were described and other known species were listed from Michigan. The present paper contains descriptions of two new species of *Eosentomon* Berlese and a new *Berberentulus* Tuxen, in addition to previously unpublished records of other species. Nearly all of the specimens listed herein were collected by a sugar flotation-centrifugation method (Jenkins, 1964). Collectors are listed when known. Holotypes and allotypes will be deposited in the Michigan State University Entomology Museum, East Lansing, Michigan, USA 48824.

### Family EOSENTOMIDAE

Genus EOSENTOMON Berlese, 1909

*Eosentomon australicum* Womersley

(Figs. 1-5)

*Eosentomon australicum* Womersley, 1939. Primitive Insects of South Australia, p. 289, figs. 79N-Q.

Three females, Kellogg Forest, Kalamazoo County, Michigan, 23 June, 1963, from pine forest-floor litter, H. O. Schooley, coll.; and the following specimens from Monahan Lake, Livingston County, Michigan, in moss, E. Bernard, coll.:

	Males	Females	Mat. Jun.	LII	LI	Prelarvae
13 April, 1974	2	3	4	4	—	—
19 May, 1974	5	4	2	1	—	1

These are the first records of *E. australicum* from North America.

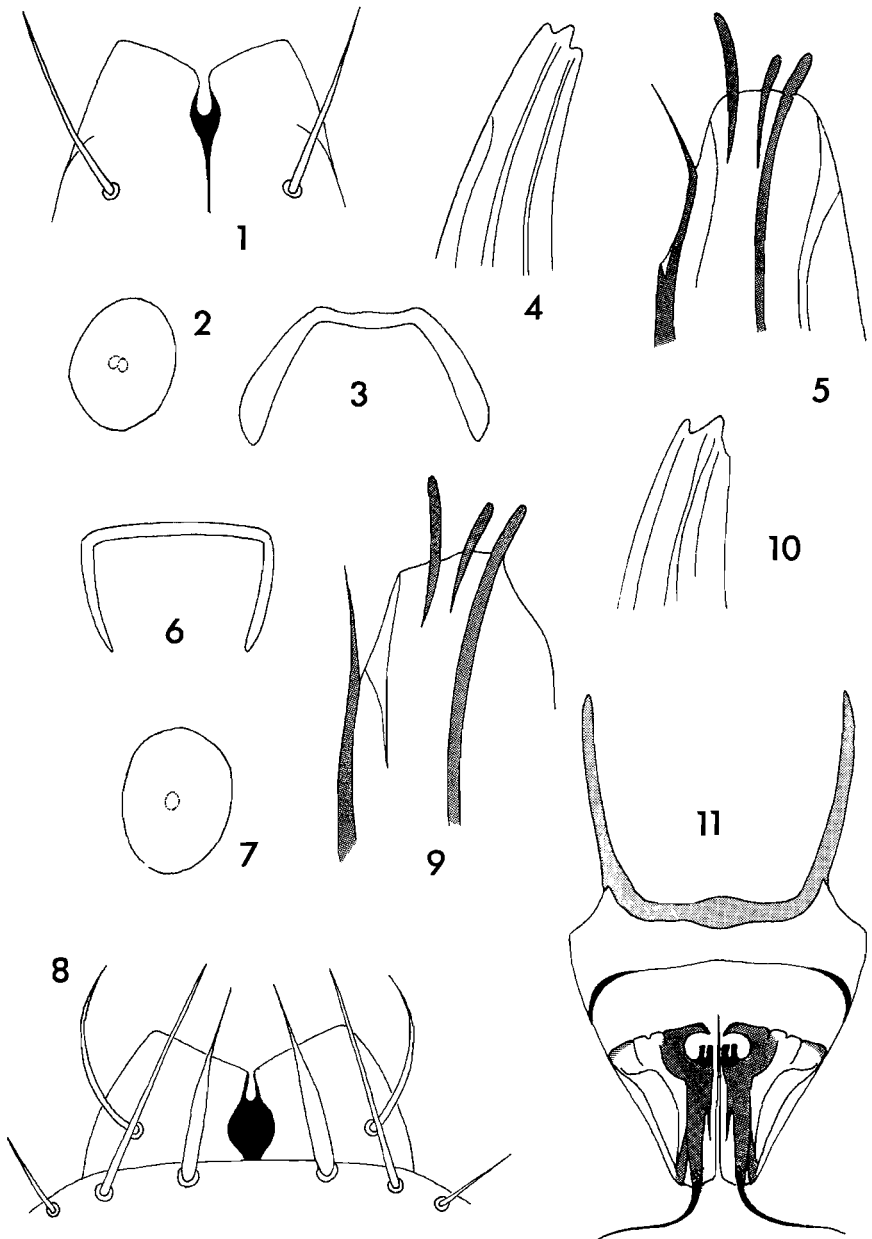
*Eosentomon wheeleri* Silvestri

*Eosentomon wheeleri* Silvestri, 1909. Atti Acad. Lincei 18:8.

This species, previously reported from Kalamazoo County, is here recorded from Monahan Lake, Livingston County, Michigan, 28 July, 1974, one female from moss; and Central Lake, Antrim County, Michigan, 30 July, 1974, five females from a pea (*Pisum sativum* L.) garden, George MacQueen, coll.

<sup>1</sup>Michigan Agricultural Experiment Station Journal Article 7344.

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Figs. 1-5. *Eosentomon australicum*. Fig. 1. Labrum. Fig. 2. Pseudoculus. Fig. 3. Clypeal apodeme. Fig. 4. Mandible. Fig. 5. Lobus internus. Figs. 6-11. *Eosentomon antrimense* n.sp. Fig. 6. Clypeal apodeme. Fig. 7. Pseudoculus. Fig. 8. Labrum and rostral setae. Fig. 9. Lobus internus. Fig. 10. Mandible. Fig. 11. Female squama genitalis.

*Eosentomon antrimense*, new species

(Figs. 6-13)

*Color and Dimensions.*—Body fragile in appearance, with little sclerotization. N = 3. Mean length of body, 792  $\mu$ m; mean length of head, 72  $\mu$ m; mean length of foretarsus without claw, 43.6  $\mu$ m.

*Morphology.*—Pseudoculus (Fig. 7) broadly oval, with a light oval spot centrally, PR = 9.7. Clypeal apodeme (Fig. 6) thin with side bars extending inward distally. Labrum (Fig. 8) quite small, each lobe obliquely truncated, the labral notch U-shaped; labral setae present. The central pair of rostral setae swollen basally, narrowing distally. Mandible (Fig. 10) stout with two terminal teeth and a slight expansion on the inner side. Lobus internus (Fig. 9) with outer spine, median digit and two shorter inner digits, the innermost one with a sclerotization running proximally.

Claw of foretarsus relatively short, TR = 6.0. EU = 0.9, BS = 0.772. Empodia of middle and hind legs short.

Central lobe of precosta not incised. Female squama genitalis (Fig. 11) of a peculiar appearance, the caput processus shaped like the bill of a bird, the corpus processus plus the median sclerotization terminating apically as two pegs, the entire structure somewhat resembling a mechanical micrometer; the median sclerotization free from the corpus distally as a long, thin spur. Alae processus weakly developed, filum processus long, apex styli truncate.

*Chaetotaxy.*—All sensillae and setae of the foretarsus present except *c'* (Figs. 12-13). Sensilla a short and inconspicuous; b long and broadened; c slightly shorter than d; e and g spatulate, larger than is usual for *Eosentomon*; f2 more than half the length of f1. Sensilla t1 closer to a3 than to a3'; t2 a little shorter than d; t3 shorter than f1. Sensilla a' long, slightly enlarged, reaching a4; b'1 quite similar to c; b'2 narrowly spatulate.

Abdominal chaetotaxy is as follows:

	I	II-III	IV-VI	VII	VIII	IX-X	XI	XII
Tergum	$\frac{4}{12}$	$\frac{8^a}{16}$	$\frac{8^a}{16}$	$\frac{8^a}{16}$	$\frac{6}{9}$	8	8	$\frac{6}{3}$
Sternum	$\frac{4}{4}$	$\frac{6}{4}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{2}{7}$	6	8	$\frac{8}{4}$

<sup>a</sup>a3 missing.

Accessory setae p1' and p2' similar in length to those of other *Eosentomon*.

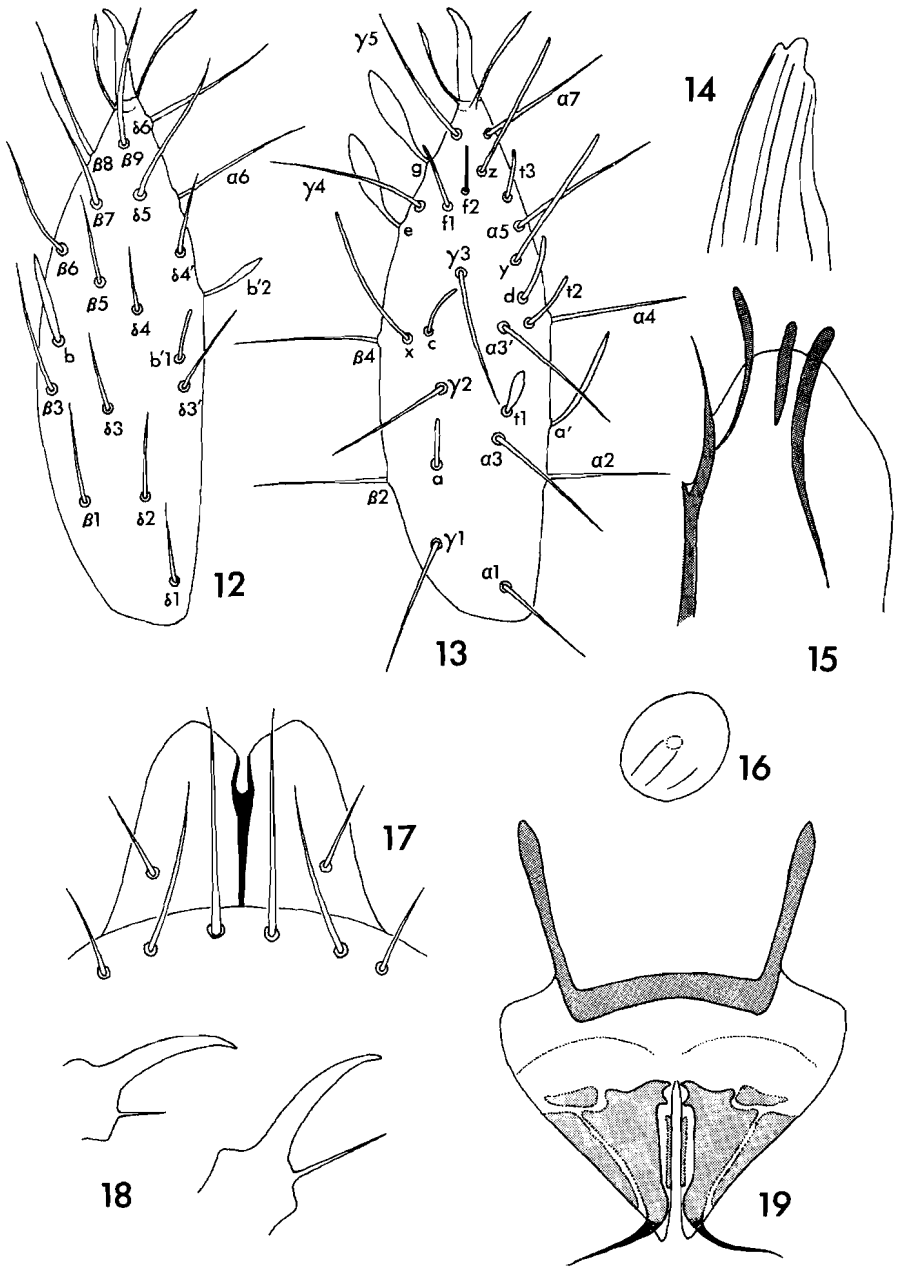
*Discussion.*—This peculiar species appears to fall, on the basis of the female squama genitalis, into Tuxen's *machadoi*-group (1964), but does not key to species in that author's key. The squama genitalis is quite distinctive in the form of the corpus processus and the truncate apex styli. *E. antrimense*, n.sp., is also related to *E. dusun* and *E. gimangi* Imadate (1965) but possesses a markedly different abdominal chaetotaxy.

*Collection Data.*—One female, 15 July, 1974, and holotype female and one paratype female, 30 July, 1974, from a pea garden, Central Lake, Antrim County, Michigan, George MacQueen, coll.

*Eosentomon pinusbanksianum*, new species

(Figs. 14-21)

*Color and Dimensions.*—Body whitish-translucent, with yellowish sclerotization posteriorly and on the head. N = 4. Mean length of body, 905  $\mu$ m; mean length of head, 86  $\mu$ m; mean length of foretarsus without claw, 60  $\mu$ m.



Figs. 12-13. *Eosentomon antrimense* n.sp. Fig. 12. Foretarsus, dorsal view. Fig. 13. Foretarsus, ventral view. Figs. 14-19. *Eosentomon pinusbanksianum* n.sp. Fig. 14. Mandible. Fig. 15. Lobus internus. Fig. 16. Pseudoculus. Fig. 17. Labrum and rostral setae. Fig. 18. Claws of middle and hind legs. Fig. 19. Female squama genitalis.

*Morphology.*—Pseudoculus (Fig. 16) broadly oval, with a circular spot centrally and three longitudinal lines extending posteriorly, PR = 10.0. Clypeal apodeme not visible. Labrum (Fig. 17) slightly broader than long, terminating in a pair of obliquely truncated lobes, medially with a U-shaped notch; labral setae present. Rostral setae normal, without basal swelling. Mandible (Fig. 14) with a strong terminal central tooth, a weak outer tooth and a moderate inner expansion. Lobus internus (Fig. 15) with outer spine, median digit, and two fairly stout inner digits, the more central one shorter and the other with a long proximal sclerotization.

Claw of foretarsus of medium length, TR = 5.7; EU = 0.9, BS = 0.773. Empodia of middle and hind legs long, EUII = 0.34, EUIII = 0.62 (Fig. 18).

Central lobe of precosta not incised. Sclerotizations of the female squama genitalis weak (Fig. 19), the caput processus appearing as two thin, divergent lobes (like the open bill of a bird), median sclerotizations weak, and each stylus with two weak triangular sclerotizations, one on the outer edge and one proximally. Filum processus short.

*Chaetotaxy.*—All foretarsal setae and sensillae present (Figs. 20-21). Sensilla a short, not reaching  $\gamma_2$ ; b slightly clavate apically, almost level with  $\beta_4$ ; c about equal to b and reaching  $\gamma_3$ ; d short and clavate; e and g spatulate; f1 long, f2 more than half the length of f1. Sensilla t1 closer to  $a_3$ ; t2 large and slightly spatulate; t3 a short peg. Sensilla a' of moderate length, not reaching  $a_3'$ ; b'1 short, b'2 slightly spatulate, fairly long; c' nearly level with  $\delta_5$ . Seta x sensilliform, y and z setiform.

Abdominal chaetotaxy is as follows:

	I	II-III	IV-VI	VII	VIII	IX-X	XI	XII
Tergum	$\frac{4}{12}$	$\frac{10}{16}$	$\frac{8^a}{16}$	$\frac{8^a}{16}$	$\frac{6}{9}$	8	8	$\frac{6}{3}$
Sternum	$\frac{4}{4}$	$\frac{6}{4}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{2}{7}$	6	8	$\frac{8}{4}$

<sup>a</sup>a3 missing.

Accessory setae of the abdomen of the usual lengths.

*Discussion.*—*E. pinusbanksianum*, n.sp., keys to couplet 6 in Tuxen (1964) but fits neither choice. The female squama genitalis resembles that of *E. udagawai* Imadate (1961), but is less strongly sclerotized. *E. pinusbanksianum* also possesses labral setae (absent in *E. udagawai*) and a long empodial appendage on the middle legs (short in *E. udagawai*).

*Collection Data.*—Holotype female, allotype male, and one female, one male, and one LII (paratypes), 26 March, 1974, Berrien County, Michigan, from a jack pine (*Pinus banksiana* Lamb) forest. Both females are missing both forelegs.

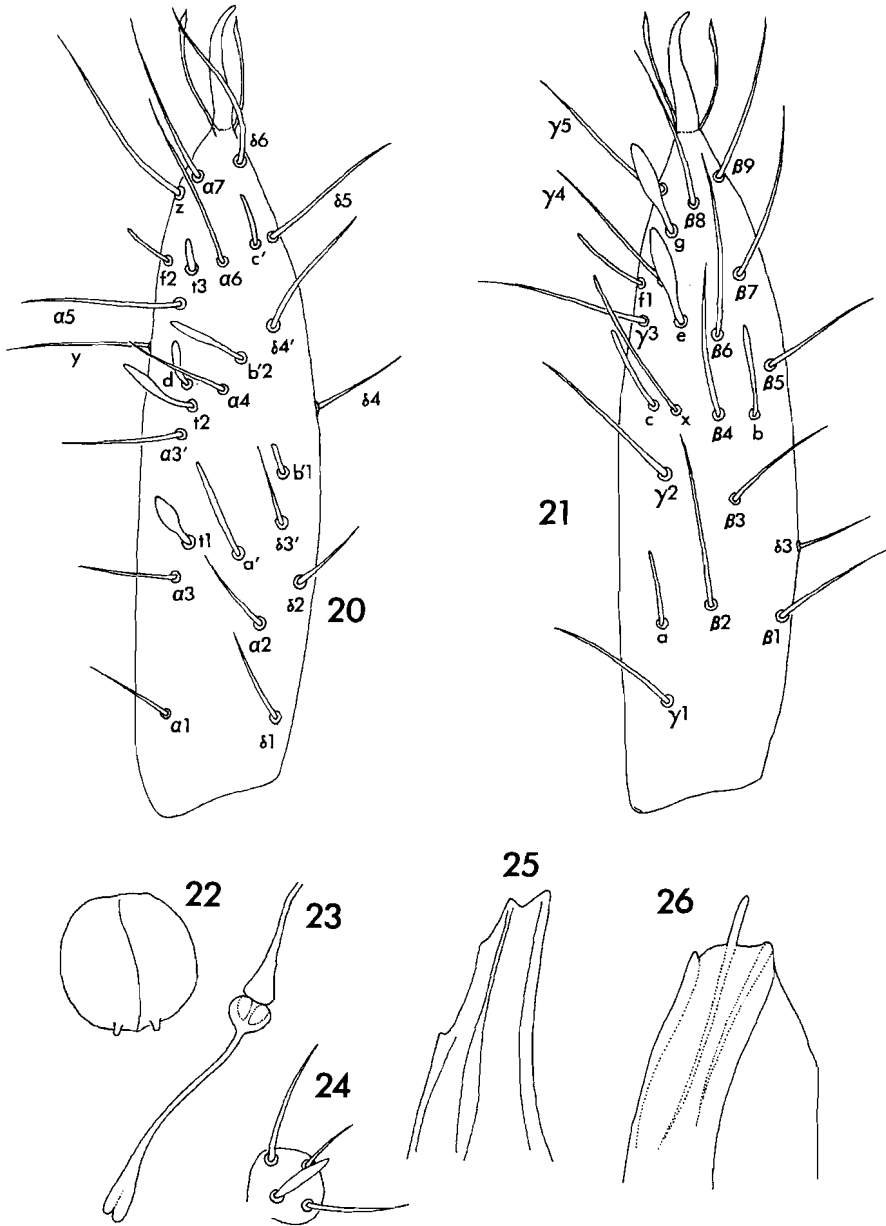
#### Family PROTENTOMIDAE

##### Genus PROTURENTOMON Silvestri, 1909

##### *Proturentomon iowaense* Womersley

*Proturentomon iowaense* Womersley, 1938. Bull. Brooklyn Entomol. Soc. 33:221, pl. XII, figs. a-c.

Specimens of *P. iowaense* have been recovered, in addition to previous records, from Oakland County, Michigan, 1 June, 1974, three females and one matusus junior from a weedy field.



Figs. 20-21. *Eosentomon pinusbanksianum* n.sp. Fig. 20. Foretarsus, dorsal view. Fig. 21. Foretarsus, ventral view. Figs. 22-26. *Berberentulus macqueeni* n.sp. Fig. 22. Pseudoculus. Fig. 23. Canal of maxillary gland. Fig. 24. Labial palpus. Fig. 25. Mandible. Fig. 26. Lobus internus.

Genus *PROTENTOMON* Ewing, 1921*Protentomon michiganense* Bernard

*Protentomon michiganense* Bernard, 1976. Great Lakes Entomol. 8(4):171-176, figs. 48-65.

This species has been recovered at the following sites: East Lansing, Ingham County, Michigan, 3 December, 1973, from sandy soil in a vineyard, 23 females, 2 maturi juniores, 3 larvae II and one larva I, D. C. Ramsdell, coll.; and Watervliet, Berrien County, Michigan, 18 February, 1974, from sandy orchard soil, one matusus junior.

## Family ACERENTOMIDAE

Genus *ACERENTULUS* Berlese, 1908*Acerentulus confinis* (Berlese)

*Acerentomon confine* Berlese, 1908. Redia 5:16, figs. 3-5.

One female, one matusus junior and one larva II were collected from soil in a jack pine forest in Berrien County, Michigan, 26 March, 1974.

Genus *AMERENTULUS* Tuxen, 1963*Amerentulus americanus* (Ewing)

*Acerentomon americanum* Ewing, 1921. Proc. Entomol. Soc. Wash. 29:197, fig. 6.

This common species has been found at three additional sites: two maturi juniores from moss at Monahan Lake, Livingston County, Michigan, 19 May, 1974; one female from vineyard soil, Ingham County, Michigan, 17 June, 1974, D. C. Ramsdell, coll.; and one female, one larva I and one prelarva, Benzie County, Michigan, 16 July, 1974.

Genus *BERBERENTULUS* Tuxen, 1963*Berberentulus macqueeni*, new species

(Figs. 22-32)

*Color and Dimensions.*—Body yellowish. N = 5. Mean length of body, 754  $\mu$ m; mean length of head, 80  $\mu$ m; mean length of foretarsus without claw, 13.2  $\mu$ m.

*Morphology.*—Pseudoculus (Fig. 22) round, PR = 11.6. Canal of maxillary gland (Fig. 23) with bilobed apical dilation, heart-shaped calyx, and an expansion of the duct adjacent to the calyx. Mandible (Fig. 25) with four teeth: one apically, one subterminally, and two proximally. Lobus internus (Fig. 26) stout, with a long median digit and an inner lamella. Labial palpus reduced, with three setae and a lanceolate sensilla (Fig. 24). Labrum not produced.

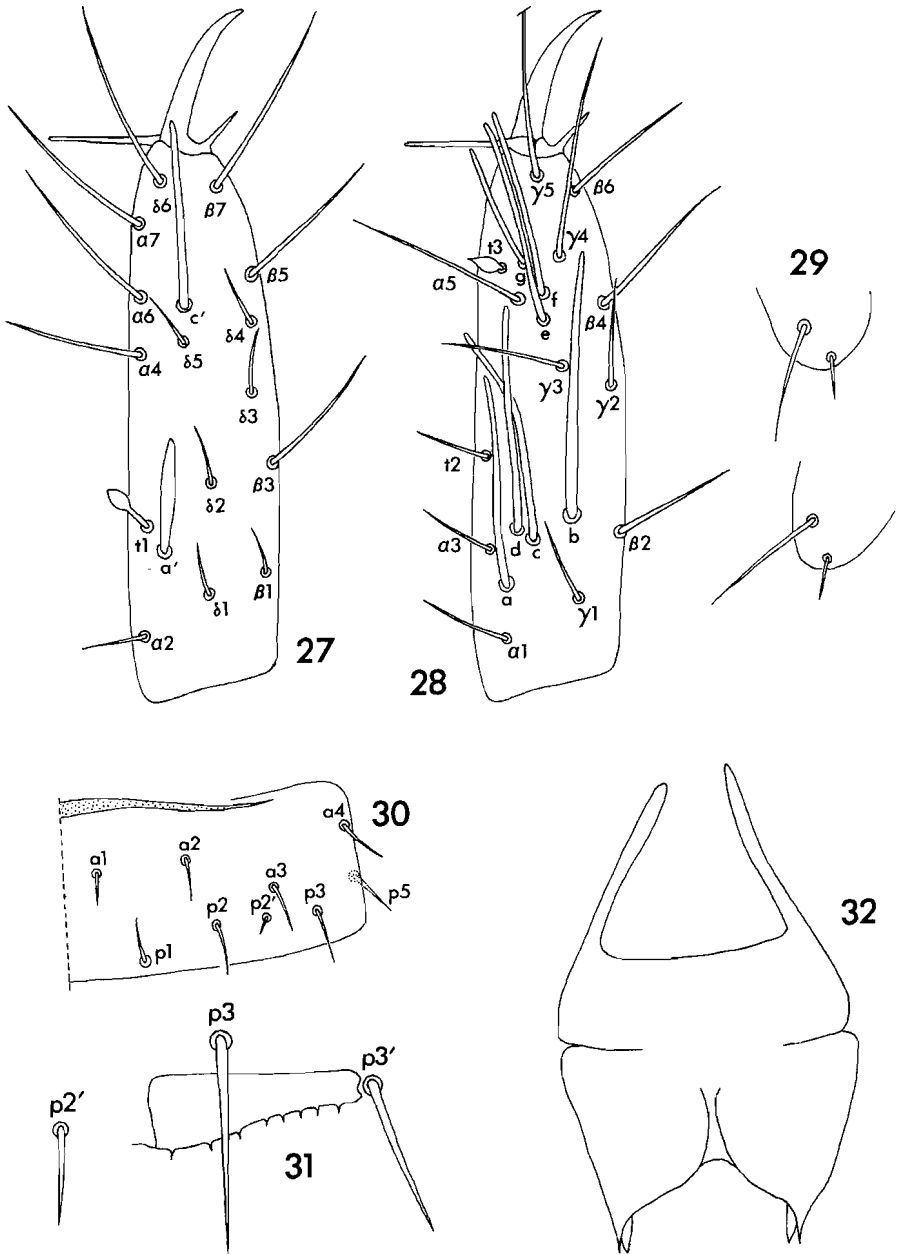
Claw of foretarsus untoothed, TR = 3.95; EU = 0.25; BS = 0.505.

Abdominal appendages II and III (Fig. 29) each with two setae, the apical seta about 37% the length of the subapical. Striate band reduced, without longitudinal striations. The large pectine of Abd. VIII (Fig. 31) well-developed, narrowing toward the pleural region, with eight small teeth. Female squama genitalis with slender basal apodemes and a pointed stylus and acrostylus (Fig. 32).

*Chaetotaxy.*—All foretarsal sensillae present except b' (Figs. 27-28). Sensillae a, c, and d about equal in length, d just reaching a5. Sensilla b very long, reaching  $\gamma$ 4, thicker than the other sensillae; f, immediately above, and slightly shorter than, sensilla e; g reaching to the claw base. Sensilla t1 baculiform, t2 setiform and only as long as a3, t3 small, ventricose. Sensilla a' long, narrowly fusiform; c' placed above  $\delta$ 5, reaching beyond the claw base.

Abdominal chaetotaxy is as follows:





Figs. 27-32. *Berberentulus macqueeni* n.sp. Fig. 27. Foretarsus, interior view. Fig. 28. Foretarsus, exterior view. Fig. 29. Abdominal appendages II-III. Fig. 30. Right side of terg. III. Fig. 31. Comb VIII. Fig. 32. Female squama genitalis.

	I	II-III	IV-VI	VII	VIII	IX-X	XI	XII
Tergum	$\frac{4}{10}$	$\frac{8}{10^a}$	$\frac{8}{10^a}$	$\frac{4^b}{16}$	$\frac{6^c}{15}$	12	6	9
Sternum	$\frac{3}{2}$	$\frac{3}{5}$	$\frac{3}{8}$	$\frac{3}{8}$	4	4	4	6

<sup>a</sup>p1', p3', p4, p4' missing (see Fig. 30).

<sup>b</sup>a1-3 missing.

<sup>c</sup>one specimen with an a1 missing (5 a-setae).

*Discussion.*—This new species is closely related to *B. berberus* (Conde, 1948) and *B. polonicus* Szeptycki (1968), and with them forms a well-defined species group in *Berberentulus* by the reduction in p-seta number of terga II-VI. In Tuxen's key (1964), *B. macqueeni*, n.sp., keys to couplet 10 but fits neither of the alternatives. It is distinguished from *B. berberus* by the broad sword-like sensilla a (filiform in *B. berberus*); baculiform t1 (rather than claviform); c' extending past the claw base; and the presence of only four, rather than six a-setae on tergum I. From *B. polonicus*, it is distinguished by the fusiform labial sensilla (rather than filiform); baculiform t1; the width of sensilla a (narrow in *B. polonicus*); ten p-setae on tergum I, rather than 12 (p2'' absent); and six a-setae on tergum VIII, instead of four.

*Collection Data.*—One female and a larva I, 15 July, 1974, and holotype female and three paratype females, 30 July, 1974, all collected at Central Lake, Antrim County, Michigan, George MacQueen, coll. It is my pleasure to name this species after Mr. George MacQueen, who collected the type material of both this species and the newly described species *Eosentomon antrimense*.

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