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DESCRIPTION OF TWO NEW SPECIES OF *EOSENTOMON* FROM THE OUACHITA MOUNTAINS OF ARKANSAS WITH A KEY TO THE SPECIES WITH THE 6/4 SETAL PATTERN ON STERNA IX/X (PROTURA: EOSENTOMIDAE)

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Abstract.—Two new species of Eosentomon, E. megatibiense and E. maryae, are described from Village Creek Park and Hot Springs National Park, Arkansas. Both species display the 6/ 4 setal arrangement on sternites IX/X. A key is provided to separate the North American (north of Mexico) species of Eosentomon that exhibit this setal pattern.

MATERIALS AND METHODS

The material examined included seventeen specimens of *Eosentomon megatibiense* and twenty specimens of *Eosentomon maryae*. All material was from the T. P. Copeland Protura slide collection, currently housed at the University of Arkansas. All measurements are in micrometers (μ m) and were made with the JAVA Image Analysis System (Jandel Scientific) linked to a Nikon Optiphot 2 phase contrast microscope. The terminology used in species descriptions is consistent with Tipping and Allen (1994), Bernard (1990), Copeland (1962, 1964), and Tuxen (1964). Setal pattern designation conforms to Tuxen's system with the lowest Arabic numeral starting at the midline and progressing outward. Measurements of the head were made dorsally. Illustrations were made with the aid of a drawing tube attached to a Nikon Labophot 2 phase contrast microscope.

Eosentomon megatibiense, new species Figs. 1–13

Body slightly sclerotized and pale yellow, with a mean length of 1,349 microns (1170-1480, N = 17).

Head. Length of head (Fig. 1) without labrum, 135 μ m (131–140, N = 17). Labrum medium, 14.5 μ m (12.3–15.2, N = 17) without setae. LR = 9.8 (9.4–10.2, N = 17). Mandibles broad, straight, and striated, with four distinct apical teeth. Digits of galea (Fig. 3) well developed, inner, median, and outer digits rounded apically with a small projection between outer digit and exterior spine. Exterior spine straight, not reaching beyond apex of galea. Outer lobe of lacinia greatly curved at distal end. First pair of rostral setae (I) hair-like without modification. Rostral setae ratio (RSR) of I and III = 0.76. Pseudoculus oval, with no visible markings, PR = 12.5 (11.7–13.8, N = 17). Cephalic setae *aa* absent, *pa* present and long. Anterior sensillum *as* present. Seta *sp* very long, 3.1 times the length of seta *p* (2.8–3.6, N = 17). Clypeal apodemes not distinct. Labial arm, cardo, and maxillary ramus of tentorium very distinct. Sag-



Figs. 1–3. *Eosentomon megatibiense:* 1, Head, dorsal view; 2, Galea; 3, Male squama genitalis; (50 μ m scale refers to Figs. 1 and 3; 10 μ m scale refers to Fig. 2.)

ittal keel or postoccipital apodeme as described by Copeland (1962) and Tuxen (1964) visible but not distinct.

Thorax. Dorsum of pronotum with four posterior setae. Seta p1 1.3 times longer than p2. (1.28–1.35, N = 17). On mesonotum, (Fig. 4) setae p1 slightly longer than p1' in length. Seta p2 4.2 times the length of p2' (4.08–4.29, N = 17). Seta p3 5.1 times the length of p3' (4.8–5.4, N = 17). Seta p3' long as width of mesothoracic spiracle. Spiracular gland pore present. Seta a2 long, subequal to p2. Setal pattern on posterior and lateral margin of metanotum (Fig. 5) same as mesonotum except p3 is 4.1 times longer than p3' (3.7–4.3, N = 17). Seta p35.2 times longer than p3' (4.9–5.4, N = 17). Seta a2 long, subequal to p3. Seta p5' present and gemmate.

288



Figs. 4–5. *Eosentomon megatibiense:* 4, Postero-lateral margin of the mesonotum; 5, Postero-lateral margin of the metanotum.

289



Figs. 6-7. Eosentomon megatibiense: 6, Foretarsus, dorsal view; 7, Fortarsus, ventral view.

Tarsi. Foretarsi (Figs. 6, 7) without claw 117.8 μ m (111–122, N = 17). Length of claw 21.7 μ m (21.0–22.5, N = 17); TR = 5.4. Empodium of foretarsi medium, EU = 0.73. Meso and metatarsi empodia short. EU II = 0.07 (0.06–0.09, N = 1). EU III = 0.08 (0.06–0.08, N = 17). Foretarsal sensilla *a* and *c* linear; sensillum *b'1* absent; sensilla *a'*, *b*, *b'2*, *t2*, linear, pointed with same length and shape; sensillum *f1* pointed spatulate; sensillum *a'* medium, not reaching base of *t2*; sensillum *c'* short, pointed, oblong; sensilla *d*, *f2*, and *t3* short, more oblong than oval; sensilla *e* and *g* thinly pointed spatulate clubs similar in size; sensillum *t1* large, inserted close to $\alpha 3'$ with shank one half the length of club. BS = 1.42 (1.35–1.47, N = 17).

290

Abd	I	п	III	IV	V	VI	VII	VIII	IV	v	VI	VII
Abd	1	11	111	IV	v	VI	VII	VIII	IA	л	Л	ЛП
Tergum	$\frac{4}{12^a}$	$\frac{10}{16}$	$\frac{10}{16}$	$\frac{10}{16}$	$\frac{8}{16}$	$\frac{8}{16}$	$\frac{8}{16}$	$\frac{6}{9}$	8	8	8	9
Sternum	$\frac{4}{4}$	$\frac{6}{4}$	$\frac{6}{4}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{2}{7}$	6	4	8	12

^a Two primary, two accessory, and two microchaetae on each side.

Abdomen. Abdominal chaetotaxy given in Table 1 with pleural setae included with tergal setae. Posterior row of tergum I (Fig. 8) with two primary, two accessory, and two microchaetae. First microchaeta long gemmate. Second microchaeta described by Bernard (1990) and Copeland (1962), located near each posterior corner, not easily distinguished. Tergites I–V (Fig. 9) have primary setae distinctly longer than associated accessory setae. First pair of accessory setae on tergum VII (Fig. 12) one-tenth length of corresponding primaries. Tergum VIII (Fig. 10) with p2' pointed. Tergal gland easily distinguished. Sternum VIII possessing two anterior and seven posterior setae. Sterna IX and X (Fig. 11) with six and four setae respectively. Precosta of tergites with slightly incised edge as described by Bernard (1990).

Genitalia. Female squama (Fig. 13) basal apodemes curving outward; *processus sternales* well sclerotized with caput process shaped like a "robin's head" in profile. Posterior valves long, consisting of two distinct parts. Male genitalia (Fig. 2) not unusual.

Holotype. Female. Slide AK 49-47: Village Creek Park, Arkansas, August 23, 1977. T. Copeland. Type Deposition: American Museum of Natural History (USNM), New York, USA.

Paratypes. 12 females, 4 males. Village Creek Park, Arkansas, August 23, 1977. T. Copeland. Type Deposition: University of Arkansas Arthropod Collection, Fayette-ville, Arkansas, USA.

Etymology. This species is named after the enlarged prothoracic tibia.

Discussion. Eosentomon megatibiense displays the 6/4 setal arrangement on sternites IX/X found in *E. quapawense* Tipping and Allen (in press). A key for determination of the members of this group is found at the end of this publication. Eosentomon megatibiense appears similar to *E. montanum* (Copeland 1964). Similarities include: same abdominal tergal chaetal patterns, broad straight mandibles, and similar RSR. Differences include: the 6/4 setal arrangement on the IX/X sterna, primary abdominal setae distinctly longer than associated accessories, and sensillum *s* on pretarsus with distinct club. Eosentomon montanum exhibits: six setae on both IX/X sterna, primary and accessory abdominal setae subequal in length, and pretarsal sensillum *s* with club extremely small or absent.

Eosentomon maryae, new species Figs. 14–26

Sample consists of thirty-eight maturus juniors, two males, and one female. Measurements with MJ preceding are derived from the maturus juniors. Only the twenty best MJ specimens were used in determining measurements and ratios. Body pale with little sclerotization; mean length of adults 1,137 μ m (1,085–1,152, N = 3); MJ = 897 μ m (569–1,074, N = 20).



Figs. 8–10. *Eosentomon megatibiense:* 8, Postero-lateral margin of tergum I; 9, Postero-lateral margin of tergum II; 10, Postero-lateral margin of tergum VIII.



Fig. 11. Eosentomon megatibiense: 11, Sterna IX-XII.

Head. Head oblong (Fig. 14). Length of head excluding labrum 108.5 μ m (98.5–122.0, N = 3); MJ = 97.4 μ m (91.2–105.4, N = 20). Labrum short 8.6 μ m (7.6–9.0, N = 3); MJ = 9.7 μ m (9.1–10.3, N = 20) with two setae reaching apex of labium. LR = 12.6 (11.7–13.2 N = 3); MJ = 10.0 (9.5–10.9). Mandibles short, curved distally with 2 distinct apical teeth. Digits of galea (Fig. 15) well developed. Inner, median and outer digits rounded apically. Exterior spine long, reaching beyond apex of galea. Outer lobe of lacinia slightly curved distally. First pair of rostral setae (I) slightly inflated along basal third. RSR of both adult and maturus juniors = 0.70. Pseudoculus roughly circular with slight striations in adult, no visible markings in maturus juniors. PR = 11.5 (10.8–11.8, N = 3); MJ = 13.9 (13.3–14.4, N = 20). Cephalic seta *aa* present. Cephalic sensilla *ps* and *as* distinct. Seta *sp* 1.7 times length of seta *p* (1.4–1.9, N = 3); MJ = 1.8 (1.4–2.1, N = 20). Cardo and maxillary ramus of tentorium distinct in the adults, not visible in maturus juniors.

Thorax. Dorsum of pronotum with four posterior setae. Seta p1 1.2 times longer



Figs. 12–13. *Eosentomon megatibiense:* 12, Postero-lateral margin of tergum VII; 13, Fe-male squama genitalis.

(1.13–1.39, N = 23) than seta p2 for both adult and maturus juniors. Gland openings distinctly visible anterior to seta p2. Mesonotum (Fig. 17) seta p1 and p1' subequal in length. Seta p2 3.7 times length of p2' (3.2–3.9, N = 3); MJ = 3.5 (3.2–3.9, N = 20). Seta p3 2.8 times length of p3' (2.7–3.1, N = 3); MJ = 2.6 (2.2–2.8, N = 20). Seta p3' as long as width of mesothoracic spiracle. Setal and spiracular gland pattern on posterior and lateral margin of metanotum (Fig. 19) same as mesonotum except for presence of seta p5'.

Tarsi. Foretarsi (Figs. 21, 22) without claw, 78.2 μ m (77.6–78.8, N = 3); MJ = 65.7 μ m (64.8–67.1, N = 20). Length of claw, 17.7 μ m (16.9–18.1, N = 3); MJ = 15.0 μ m (14.6–15.7). TR = 4.4 (MJ = 4.5); EU = 0.76 (MJ = 72). Empodia of mesotarsi short. EU II = 0.10 (0.09–0.12, N = 3); MJ = 0.10 (0.09–0.12, N



Figs. 14–16. *Eosentomon maryae*. 14, Head, adult, dorsal view; 15, Galea; 16, Metatarsus. (50 μ m scale refers to Figs. 15 and 10 μ m scale refers to Figs. 14 and 16.)

= 20). Empodia of metatarsi (Fig. 16) short. EU III = 0.12 (0.10–0.14, N = 3); MJ = 0.12 (0.09–0.14). Foretarsal hairs and sensilla in adults and maturus juniors similar except that sensilla a' does not reach t2 in MJ (Fig 23). Foretarsal sensilla a and c small, linear; sensillum b'1 absent; sensilla a', b, b'2, linear; f1 pointed spatulate; t2, linear, pointed; sensillum a' linear, long, reaching base of t2; sensilla c', f2, and t3 appear short and oblong but not distinct. Sensillum d oblong, linear; sensilla e and g thinly pointed spatulate clubs similar in size; t1 oval with medium shank inserted closer to $\alpha3'$ than to $\alpha3'$. BS = 1.26 (1.14–1.30, N = 3); MJ = 1.10 (1.08–1.12, N = 20).

Abdomen. Abdominal chaetotaxy with plurals included in terga presented in Table 2. Posterior row of tergum I (Fig. 24) with three primary, one accessory, and two microchaetae. Tergites II–VI (Fig. 25) with accessory posterior setae subequal in length to associated primaries. First pair of accessory setae on tergum VII (Fig. 26) approximately one-fourth length of corresponding primaries, possessing a distinct brush tip. Tergum VIII (Fig. 27) with p2' slightly capitulate. Sternum VIII possessing two anterior and seven posterior setae. Sterna IX and X (Fig. 28) with six and four setae respectively. Central lobe of precosta deeply sinuate.



Figs. 17–20. *Eosentomon maryae*. 17, Postero-lateral margin of the mesonotum; 18, Female squama genitalis; 19, Postero-lateral margin of the metanotum; 20, Male squama genitalis.

Genitalia. Female squama (Fig. 18) with basal apodemes curving outward; processus sternales well sclerotized. Male genitalia (Fig. 20) not unusually distinctive. **Holotype.** Female. Slide AK 56-31: Hot Springs National Park, Arkansas, August 26, 1977. T. Copeland. Type Deposition: American Museum of Natural History, New York, USA.



Figs. 21–23. *Eosentomon maryae*. 21, Fortarsus, ventral view; 22, Fortarsus, dorsal view; 23, Fortarsus, maturus junior, sensilla *t1* region.

Paratypes. 2 males, 20 matures junior. Village Creek Park, Arkansas, August 23, 1977. T. Copeland. Type Deposition: University of Arkansas Arthropod Collection, Fayetteville, Arkansas, USA.

Etymology. This species is named after the primary author's mother.

Discussion. Eosentomon maryae is distinctive among the other members of Eosentomon exhibiting 6/4 setal arrangement on the sternites IX/X. The following key will be useful for separating the species of this group.

Abd	Ι	II	III	IV	v	VI	VII	VIII	IX	Х	XI	XII
Tergum	$\frac{4}{12^a}$	$\frac{10}{16}$	$\frac{10}{16}$	$\frac{8}{16}$	$\frac{8}{16}$	$\frac{8}{16}$	$\frac{6}{16}$	<u>6</u> 9	8	8	8	9
Sternum	$\frac{4}{4}$	$\frac{6}{4}$	$\frac{6}{4}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{2}{7}$	6	4	8	12

Table 2. Abdominal chaetotaxy of Eosentomon maryae n. sp.

^a Three primary, one accessory, and two microchaetae on each side.



Figs. 24–26. *Eosentomon maryae.* 24, Postero-lateral margin of tergum I; 25, Postero-lateral margin of tergum II; 26, Postero-lateral margin of tergum VII.



Figs. 27–28. *Eosentomon maryae*. 27, Postero-lateral margin of tergum VIII; 28, Sterna IX–XII.

KEY TO SPECIES OF *EOSENTOMON* WITH 6/4 SETAL PATTERN ON STERNA IX/X

1.	a. First abdominal terga with 2:2:2 configuration of primary, accessory and microchaeta
	(Fig. 29) E. megatibiense Tipping n. sp.
	b. First abdominal terga with 3:1:2 configuration of primary, accessory and microchaeta
	(Fig. 31)
2.	a. Empodia of metathoracic tarsi long, greater than fifty percent the length of claw (Fig.
	33); cephalic seta aa absent E. quapawense Tipping
	b. Empodia of metathoracic tarsi short, less than thirty percent the length of claw (Fig.
	32); cephalic seta aa present (Fig. 30) E. maryae Tipping n. sp.



Figs. 29–33. *Eosentomon* sp. 29, Postero-lateral margin of tergum I showing 2:2:2 setal pattern; *Eosentomon maryae*. 30, Lateral margin of head; *Eosentomon* sp. 31, Postero-lateral margin of tergum I showing 3:1:2 setal pattern; *Eosentomon maryae*. 32, Metatarsal claw with empodium; e, empodium. *Eosentonom quapawense*. 33, Metatarsal claw with empodium; e, empodium.

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