ISRAEL JOURNAL OF ENTOMOLOGY, Vol. 34, 2004, PP. 19-27

Tuxenidia hermonensis (Protura: Acerentomidae), a new species from Israel, and notes on the systematics of *Tuxenidia*

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ABSTRACT

Tuxenidia hermonensis n. sp. (Protura: Acerentomidae) from Mt. Hermon, Israel, is described. It differs from *T. balcanica* Nosek and Cvijovid, ,1969the only other species of the genus, by the presence of two setae on abdominal legs II and III, four setae on urosternite VIII, and by less reduction of labial palps and the length of foretarsal sensilla *b* and *t3. Tuxenidia* Nosek and Cvijovic is revised to include species with a well-developed, but modified, striate band on urotergite VIII and reduced labial palp. Foretarsal sensillum *fi* is cylindrical and sensillum bl is very long. These species possess one or two setae on abdominal legs **II—III** and 2or 4setae on urosternite VIII.

INTRODUCTION

The study of the proturan fauna of Israel started only recently. Intensive sampling of soil taken under oak and pine trees on Mt. Carmel (at altitude of 400m) yielded the following three proturan species previously known only from Europe: *Acerentomon meridionale* Nosek, *Acerella muscorum* (Ionesco), and *Berberentulus berberus* (Conde) (Broza et al., 1996).

Mt. Hermon can be divided into three altitudinal zones, of which the lowest (300-1200m) is comprised of an oak maquis typical of northern Israel, including Mt. Carmel. The other two zones are unique high-altitude ecosystems, characterized by their flora: the Oro-East-Mediterranean formation (1200-1900m), and the Alpino-Tragacanthus zone at the top of the mountain (altitude: 1900-2814m). Both zones are exposed to long and dry summers, and both include many Irano-Turanian floral and faunal elements. A typical conifer timberline belt is missing on Mt. Hermon, but it is represented in the Oro-Mediterranean belt by scattered specimens of *Juniperus drupacea* (Cupressaceae). Under one of these trees, which can be as tall as 12m and are rare on Mt. Hermon, specimens of Protura were collected and are described here as a new species. *J. drupacea* is a Tertiary relict of a northern flora and occurs only in southern Turkey, Lebanon, and on Mt. Hermon. It is the largest tree on Mt. Hermon, and its cones are dry

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and accumulate in large numbers under each tree because their decomposition is very slow.

The only species of *Tuxenida* known hitherto, *T. balcanica,* was described as a new genus and species by Nosek and Cvijovič (1969) from Bosnia (Magalič Plateau, 1070 m), primeval forest Peručica, *Abieto-Fagetum* (fir–beech forest). These authors considered the new genus to be similar to *Silvestridia* Bonet 1942 and *Bolivaridia* Bonet 1942. The discovery of a new species of *Tuxenidia* necessitates a discussion of the relationship of *Tuxenidia* to other genera of Acerentomidae and a revision of the diagnosis of the genus.

MATERIALS AND METHODS

Dry litter and soil samples were collected on Mt. Hermon, Israel, under *Juniperus drupacea* growing on the steep north-facing slope of Nahal Havushit, at Yifa't Ridge, altitude 1600 m. Specimens were extracted from the litter by Tullgren funnels directly into glass tubes filled with 95% ethyl alcohol and were permanently mounted in Hoyer's mounting medium. The holotype and paratype are deposited in the National Collection of Insects, Department of Zoology, Tel Aviv University (TAU), Israel. Terminology follows Tuxen (1964), Szeptycki (1980, 1991, 1995), and Bernard (1990).

TAXONOMY

Tuxenidia Nosek and Cvijovič, 1969

Diagnosis

Head chaetotaxy, pseudoculus, and mouthparts similar to those of *Acerentulus.* Canal of maxillary gland with oval, smooth calyx. Maxillary palp of medium length, sensilla equal, long, thin, almost seta-like. Labial palp reduced, with 3 setae and remnant of terminal tuft, composed of bifurcate seta. Thorax with two anterior setae (A2 and A4). Accessory setae *P*1a and *P*2a developed as gemmate microchaetae (Bernard, 1990). Pore *l* on mesonotum and metanotum, pore *al* on mesonotum only. Prosternum with two "*A*" setae (*A*2 present).

Foretarsus with baculiform sensillum *t*1; sensillum *t*3 long, nearly cylindrical; *e* situated closer to *f* than to *d; c* situated halfway between *d* and *b; b′* present. Setae β1 and δ5 shorter than other setae of "δ" group, resembling sensilla; δ5 situated proximally to *c′*. Claw short, without teeth, empodial appendage relatively long (EU about 0.3).

Abdominal seta *P3* on urotergites II–VI situated in anterior position. Abdominal legs with one or two setae. Accessory setae on segments II–VII shorter than 1/5 the length of the main setae, setiform on both urotergites and urosternites. Pore *psm* on urotergites I–VIII, *psl* on VI–VII, *al* on II–VII.

Abdominal segment VIII with well-developed striate band, with strong striae and distinct, granulated anterior line. Comb VIII with convex hind margin. Hind margin of

segments IX–XI and telson smooth. Segments IX–XI without pores. Anterior pore of dorsal lobe of telson present.

Systematics of *Tuxenidia*

The genus *Tuxenidia* was described by Nosek and Cvijovic (1969) and considered similar to *Bolivaridia* Bonet 1942 and *Silvestridia* Bonet 1942 on the basis of the presence of only one seta on abdominal legs II–III and the strong reduction of the labial palp. Tuxen and Imadaté (1974) assigned it to the "*Silvestridia* complex" and Yin (1983) placed it in the subfamily Silvestridiinae, together with *Madagascaridia* Nosek, 1978.

There are some notable differences that suggest that *Tuxenidia* is not closely related to the other two genera. Sensilla *c* and *d* are very close to each other in *Bolivaridia* and *Silvestridia* but well separated in *Tuxenidia;* sensillum *t*3 is long in *Tuxenidia* but short in the other genera. Comb VIII is convex in *Tuxenidia,* whereas in the other two genera its hind margin is concave (Tuxen and Imadaté, 1974; Nosek 1978). The striate band in *Tuxenidia* is distinctive; the striae are distinct but stronger and not as dense as in *Acerentulus* and related genera, but are similar to the striae of *Silvestridia solomonis* Imadaté,1960 (Tuxen and Imadaté, 1974). The anterior line on the striate band, which is distinct and granulated, resembles that of many species with a reduced striate band, especially the *Berberentulus* group (Tuxen, 1981).

One of the most distinctive characters of *Tuxenidia* is the long, nearly cylindrical foretarsal sensillum *t*3. The other genera with this character, *Delamarentulus* Tuxen 1963, *Maderentulus* Tuxen 1963, *Brasilentulus* Nosek 1973a, *Proacerella* Bernard 1975, and *Amazonentulus* Yin 1984, differ in many other important characters, and none of them is closely related to *Tuxenidia* (Bernard, 1975; Tuxen, 1976, 1979, 1982; Yin, 1984).

Tuxenidia hermonensis n. sp.

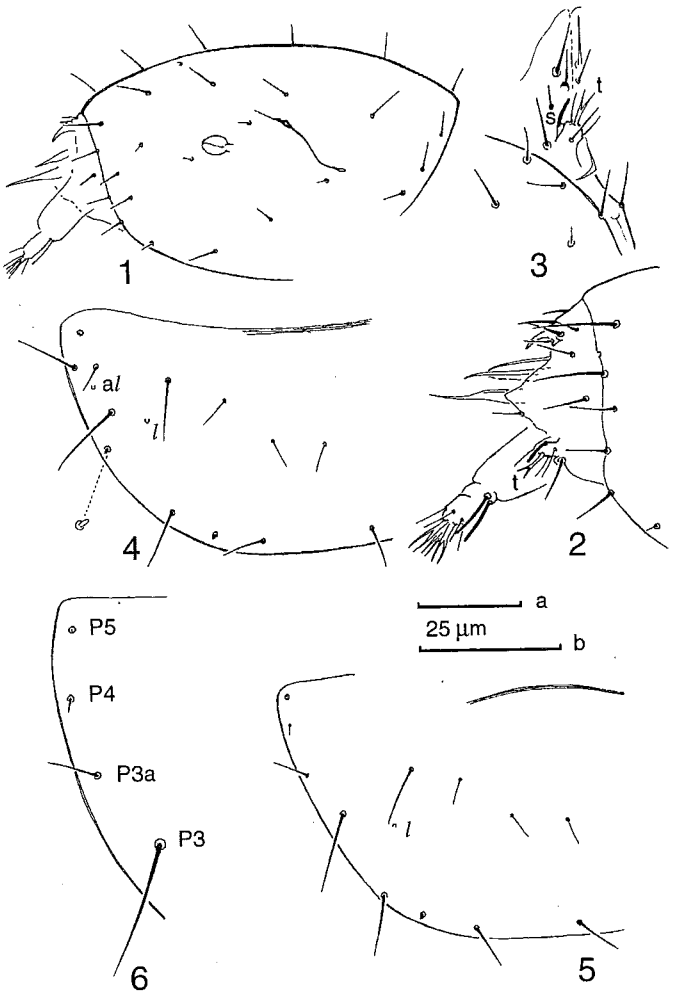
Type material: Holotype: Male, ISRAEL, Mt. [Har] Hermon, 1600 m, 6.vi.1993, Broza (TAU), slide-mounted. Paratype: same collecting data, one adult specimen, slide-mounted, last abdominal segment damaged (sex could not be determined).

Diagnosis

The new species differs from *T. balcanica* Nosek and Cvijovič 1969 by the longer foretarsal sensillum *b* (in *T. hermonensis* it surpasses the base of the claw while in *T. balcanica* it reaches the base of β6), longer sensillum *t*3 (which surpasses the base of α7 while in *T. balcanica* it does not reach α7), the terminal tuft of the labial palp only partially reduced (composed of two branches while in *T. balcanica* it is absent), the presence of two setae on abdominal legs II–III, and the absence of the posterior setae on urosternite VIII.

Description

Measurements (μm): body length 1000, head 122–125, pseudoculus 7–8, canal of maxillary gland 27–29, mesonotal *P*1 12–13, mesonotal *P*2 about 19, foretarsus about 75, claw 21–22, empodial appendage 6–7.



Figs. 1–6. *Tuxenidia hermonensis.* 1. head, lateral view; 2. mouthparts, lateral view; 3. labium, ventral view (s-sensillum, t-terminal tuft); 4. mesonotum; 5. metanotum; 6. anterolateral part of metanotum (3—holotype, all others—paratype); scales: 25 µm (b = Figs. 2, 3; a = all other Figs.).

Head (Fig. 1): typically acerentomid, setae short, additional setae absent. 4 + 4 setae dorsally and 1 + 1 ventrally, shaped as small setiform sensilla.

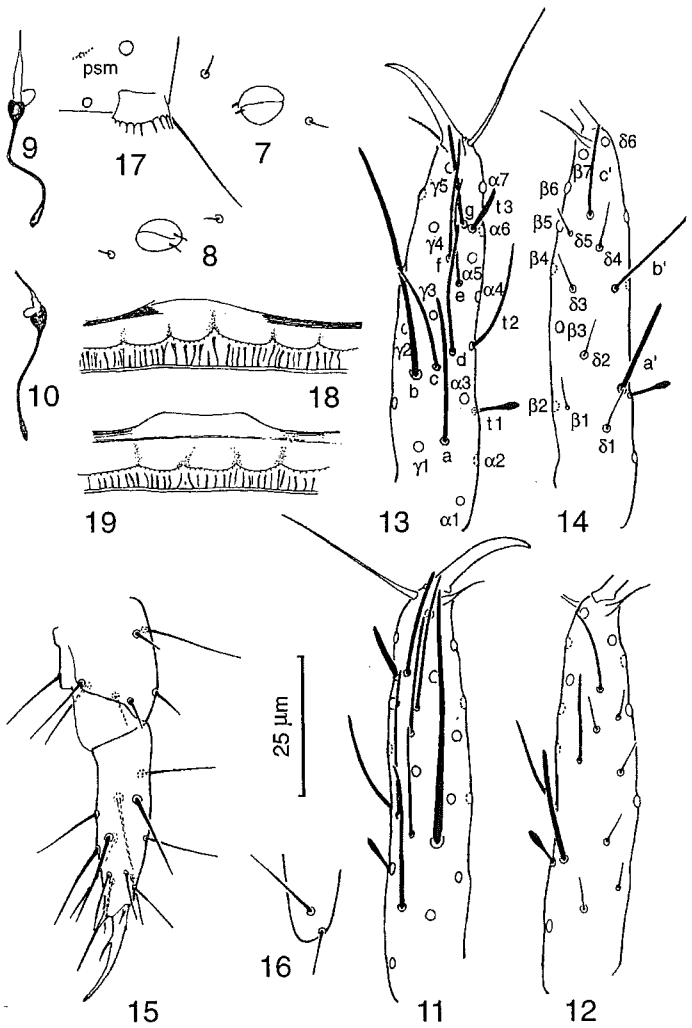
Pseudoculus (Figs. 7, 8) round or slightly elongated, with short lever, PR 15–17. Calyx of canal of maxillary gland (Figs. 9, 10) oval, with smooth surface, terminal filament long (CF 4.3–4.6), distal dilation not divided. Mouthparts (Fig. 2) unmodified;

Table 1
Chaetotaxy of *Tuxenidia hermonensis* n. sp.

	Dorsal		Ventral	
	Setae composition	Formula	Setae composition	Formula
Thorax				
I	1 2	4	A1 A2 M1 M2 P1 P2 P3	4 + 4 6
II	M A2 A4 P1 P1a P2 P2a P3 P3a P4 P5	6 16	Ac A2 A3 M P2 P3	5+2 4
III	M A2 A4 P1 P1a P2 P3 P3a P4 P5	6 14	Ac A2 A3 A4 M P2 P3	7+2 4
Abdomen				
I	A1 A2 P1 P2 P2a P3 P4	4 10	Ac A2 P1 P1a	3 4
II–III	A1 A2 A5 P1 P2 P2a P3 P4 P4a P5	6 14	Ac A2 Pc P1a P2	3 5
IV–V	A1 A2 A5 P1 P2 P2a P3 P4 P4a P5	6 14	Ac A2 P1 P1a P2 P3	3 8
VI	A1 A2 A4 A5 P1 P2 P2a P3 P4 P4a P5	8 14	Ac A2 P1 P1a P2 P3	3 8
VII	A2 A4 A5 P1 P1a P2 P2a P3 P3a P4 P4a P5	6 18	Ac A2 P1 P1a P2 P3	3 8
VIII	A1 A3 A5 M1 P1 P1a P2 P2a P3 P3a P5	6 16	1 2	4
IX–X	1 1a 2 2a 3 4	12	1 2	4
XI	1 2 3	6		4
Telson		6 3		6

maxillary palp of medium length, sensilla (Fig. 2) long and thin. Labial palp (Fig. 3) reduced, with 3 setae and bifurcate tuft, sensillum short and thin (Fig. 3).

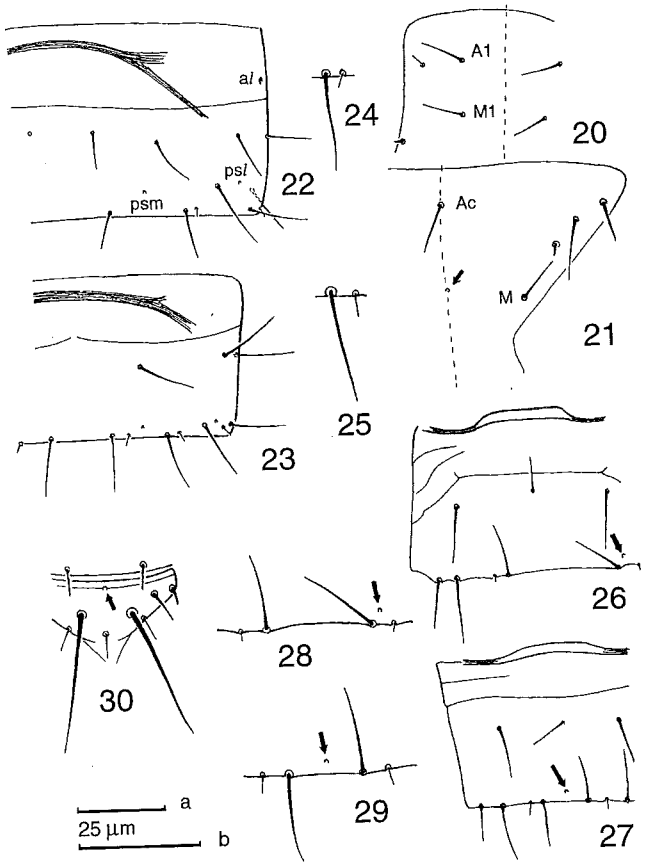
Thorax: Chaetotaxy as in Table 1. Mesonotum (Fig. 4) and metanotum (Fig. 5) with two anterior setae (*A*2 and *A*4); main setae short, accessory setae small, similar to sensilla of "gemmate" type (Bernard, 1990). Length ratio of *P*1:*P*2 is 1:1.4–1.5. Seta *P*2a on mesonotum closer to *P*3 than to *P*2 and absent on metanotum. Pronotum without pores, mesonotum 2 + 2 (*a*1 and 1), and metanotum 1+1 (1) pores. Setae *A*2 and *M*2 on prosternum (Fig. 20), seta A2 on mesonotum and metanotum (Fig. 6) developed as linear



Figs. 7–19. *Tuxenidia hermonensis*. 7, 8. pseudoculus; 9, 10. canal of maxillary gland; 11, 13. foretarsus, external view; 12, 14. foretarsus, internal view; 15. Leg III, exterior view; 16. abdominal leg III; 17. comb VIII; 18. striate band in the middle of urotergite; 19. striate band in the middle of urosternite (7, 9, 11, 12, and 16—holotype, all others—paratype); scale 25 µm.

microchaeta (Bernard, 1990). Prosternum and mesosternum without pores, metasternum (Fig. 21) with single pore situated medially, slightly anteriorly to level of setae *M*.

Legs: Claw of foretarsus (Figs. 11–14) short, without inner teeth (TR = 3.4–3.5). Empodial appendage relatively long (EU about 0.3). External foretarsal sensillum *a* of



Figs. 20–30. *Tuxenidia hermonensis*. 20. anterior part of prosternum; 21. anterior part of metasternum (21); 22. urotergite VI. 23. urotergite VII; 24. setae *P2* and *P2a* on urotergite VI; 25. setae *P2* and *P2a* on urotergite VII; 26. urosternite VI; 27. Urosternite VII; 28. middle part of hind margin of urosternite VI; 29. middle part of hind margin of urosternite VII; 30. dorsal lobe of telson. Arrows represent pores (20–25—paratype, 26–30—holotype); scales: 25 µm (a = Figs. 22, 23, 26, 27; b = all other Figs.).

medium length, slightly surpassing level of γ3; *c* short, slightly surpassing base of *e* and situated halfway between *d* and *b; e* closer to *f* than to *d; b* extremely long and thick, surpassing base of claw (Fig. 13); *a* and *g* thicker than *c, d, e,* or *f*. Dorsal sensillum *t*1 baculiform; *t*2 thick and long, reaching level of α5; *t*3 long, surpassing level of α7, nearly cylindrical, slightly dilated basally. Internal sensillum *a′* long, reaching level of α6, parallel-sided and situated at level of *t*1; *b′* slightly shorter than *c′*. Setae β1 and δ5

short (shorter than other setae of the group), equal. BS 0.4–0.5. Tarsus of leg II and III (Fig. 15) about 1.5 times longer than tibia.

Abdomen: Chaetotaxy as in Table 1. Seta *P3* on urotergites II–VI in anterior position (Fig. 22). Accessory seta *P2a* on urotergite I of same shape as *P1a* on nota (gemmate microchaeta), accessory setae on urotergites II–VII as short setiform sensilla, slightly longer on VII (Fig. 25) than on VI (Fig. 24). Pores *psm* on urotergites I–VII, *psl* on VI–VII, and *al* on II–VII present (Figs. 22, 23). Pore *al* situated dorsally to seta A5 on urotergites II–VI, but ventrally to it on urotergite VII.

Abdominal legs II and III with two setae (Fig. 16), subapical seta about twice as long as apical seta. Accessory setae on urosternites I–VII as those on urotergites. Lineation indistinct, connecting line absent (Figs. 26, 27). Pores on urosternites I–IV absent, single pore on V and VI (Fig. 28), asymmetrically situated near seta *P*1; on VII the single pore situated medially near posterior margin of urosternite (Fig. 29).

Striate band of abdominal segment VIII well developed, with distinct, granulated line in anterior part (Figs. 18, 19). Granulation indistinct or absent. Comb VIII (Fig. 17), slightly concave, with 9 teeth. Inner teeth short, shorter than others. Seta 1*a* identical to seta 1, both on urotergites IX and X; seta *2a* short, spine-like. Hind margin of segments IX–XI and telson smooth. Segments IX–XI without pores, telson (Fig. 30), with median pore in anterior part on dorsal lobe, and 1 + 1 pores in anterolateral part of ventral lobe. Penis with 4 + 4 setae.

Female unknown.

DISCUSSION

Tuxenidia hermonensis n. sp. differs from *T. balcanica,* Nosek and Cvijovič, 1969 in some important characters, such as the number of setae on abdominal legs (1 in *T. balcanica,* 2 in *T. hermonensis)*, degree of reduction of labial palp, and the chaetotaxy of urosternite VIII. However, in many genera these characters have only specific value (Rusek, 1965; Nosek, 1973b; Szeptycki, 1980, 1991; Yin and Dallai, 1985). On the other hand, the new species is similar to *T. balcanica* in several substantial characters such as the structure of foretarsus (position of setae, the shape of sensillum *b* and *t3*, and long empodium), the shape of maxillary palps (long with two equal and parallel sensilla), and strong reduction of terminal tuft on labial palp. Therefore we decided not to create a new genus for *T. hermonensis*.

ACKNOWLEDGMENTS

Many thanks are due to Mrs. Dina Poliakov for her help in carrying out the research on soil microarthropod fauna of Israel, and to Dr. Amnon Freidberg, Dr. Ilan Yarom, and two anonymous reviewers for thorough reviewing and constructive editing of an earlier version of the manuscript.

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