

New species of *Eutarsopolipus* (Acari: Podapolipidae)
from *Harpalus caliginosus* (F.) and *Agonodorus comma* (F.)
(Coleoptera: Carabidae) from Kansas and Wyoming, U.S.A.

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(With 7 figures)

Abstract

Eutarsopolipus rackae sp. n. (Acari: Podapolipidae) is described from *Harpalus caliginosus* (F.) and *Harpalus* sp. (Coleoptera: Carabidae), compared with related *Eutarsopolipus* in the *acanthomus* group and with other *Eutarsopolipus* from the Western Hemisphere. *E. elzingai* sp. n. is described from *Agonodorus comma* (F.) and *A. pallipes* (F.). The species is compared with related *Eutarsopolipus* in the *biunguis* group and with other species of *Eutarsopolipus*.

Introduction

Mites in the family Podapolipidae (Acari: Tarsonemini) are all highly specialized ecto- and endoparasites of insects of the orders Blattaria, Orthoptera, Heteroptera, Hymenoptera and especially Coleoptera. All mites in the genus *Eutarsopolipus* are ectoparasites of carabid beetles. Recent papers on the podapolipid genus *Eutarsopolipus* in the Western Hemisphere are: Husband 1995, Husband and Eidelberg 1996, Husband and Husband 1996 and Husband (in press).

In the process of examining carabid beetles near Manhattan, Kansas, U.S.A. in the 1960's and 1970's, Phillip A. Nickel and Richard J. Elzinga of Kansas State University collected numerous specimens of podapolipid mites. The mites were sent to Freiburg, Germany to Hans Regenfuss as he was the authority on associations of podapolipid mites with carabid beetles. Before Dr. Regenfuss could complete studies on specimens from Kansas, he became ill. He passed away in 1979. In the past two years, podapolipid mites have been collected from carabid beetles from Wyoming, Colorado and Missouri. These mites were compared with *Eutarsopolipus* from Kansas. These and other American *Eutarsopolipus* were placed in groups established by Regenfuss (1968) and compared with specimens from Europe and elsewhere. Relatively few of the podapolipids which are thought to exist on American carabid beetles have been discovered. Twenty seven species of podapolipid mites have been described from European carabid beetles compared to thirteen species described from carabids from the Western Hemisphere. It is the purpose of this paper to describe the first *Eutarsopolipus* mites found on carabid beetles in the Central United States and

compare them with related species in the *biunguis* and *acanthomus* groups and other *Eutarsopolipus* from the Western Hemisphere.

American *Eutarsopolipus* in the Regenfuss collection at the Zoological Museum of the University of Hamburg were made available through the cooperation of Dr. H. Dastych. This includes all stages of *Eutarsopolipus* from *Agonodorus comma* (F.) and females and larvae from *Harpalus caliginosus* (F.). Additional specimens from the Snow Entomological Museum at the University of Kansas were examined. Carabids borrowed from the University of Wyoming, Michigan State University and the University of Michigan yielded additional specimens of *Eutarsopolipus* from the Central United States for study.

Measurements were taken with the aid of a Zeiss phase contrast microscope with a drawing tube and stage micrometer. All measurements in the text are in micrometers. Setae no longer than the diameter of their setal sockets are listed as microsetae (m). Terminology is based on Lindquist (1986).

Description

Family Podapolipidae Ewing, 1922
Genus *Eutarsopolipus* Berlese, 1913

Eutarsopolipus rackae sp. n.
(Figs 1 - 3)

HOST AND LOCALITY. Holotype female: from Wheatland, Wyoming, U.S.A., collected from *H. caliginosus* at light on 6 July 1949 by D.G. Denning (RWH101097-15), deposited in the Museum of Entomology, Michigan State University, East Lansing, MI, U.S.A.- on extended loan to the Zoological Museum Hamburg.

Paratypes: Allotype male (RWH101097-4), same data as holotype. 4 females, 3 larval females from Jardine Terrace, Manhattan, Riley County, Kansas, U.S.A., under the elytra of *Harpalus caliginosus* (Carabidae), collected 21 August 1967 by P. Nickel; 2 females, 1 larva from *Harpalus* sp. from Lawrence, Kansas, collected by R.E. Beer, 6 June 1962; 3 males, 6 larvae, 7 females, eggs on slides and additional material in a vial in alcohol from Wheatland, Wyoming, collected from *H. caliginosus* by D.G. Denning on 6 July 1949. Three females and 2 larval paratypes from Manhattan, Kansas are deposited in the collection at the Zoological Museum Hamburg (ZMH) along with 1 larva and 1 female collected in Wheatland, Wyoming (ZMH Reg. No. A15/98). One female and one larval paratype each from Wheatland, Wyoming deposited in the Entomology Museum, Michigan State University, East Lansing, Michigan, Entomology Museum, Kansas State University and Museum of Zoology, University of Michigan Ann Arbor, MI, U.S.A. Remainder of paratypes, including mites in a vial with same data as holotype, deposited in the collection of the author, 1035 Scottsdale Dr., Adrian, MI 49221, U.S.A.

ETYMOLOGY. The species is named for Dr. Gisela Rack, retired from the Zoological Museum, University of Hamburg, Germany, in recognition of her contributions to the understanding of Tarsonemini and for her many years of support of colleagues in acarological research.

FEMALE (Fig. 1). Gnathosoma length 63-67, width 62-64. Cheliceral stylet length 84-98, with a well sclerotized, 12 micrometer bar perpendicular to the base. Palp length 17-18; pharynx width 14-20, dorsal gnathosomal seta 35-50, ventral seta 16-22, distance between ventral setae 18-20. Stigmata prominent, at anterolateral margin of prodorsal plate. Idiosoma; length 205-356, width 190-282. Prodorsal plate wider than long, setae v_1 , v_2 vestigial, sc_2 123-147. Distance between setae v_1 68; v_2 on a line con-

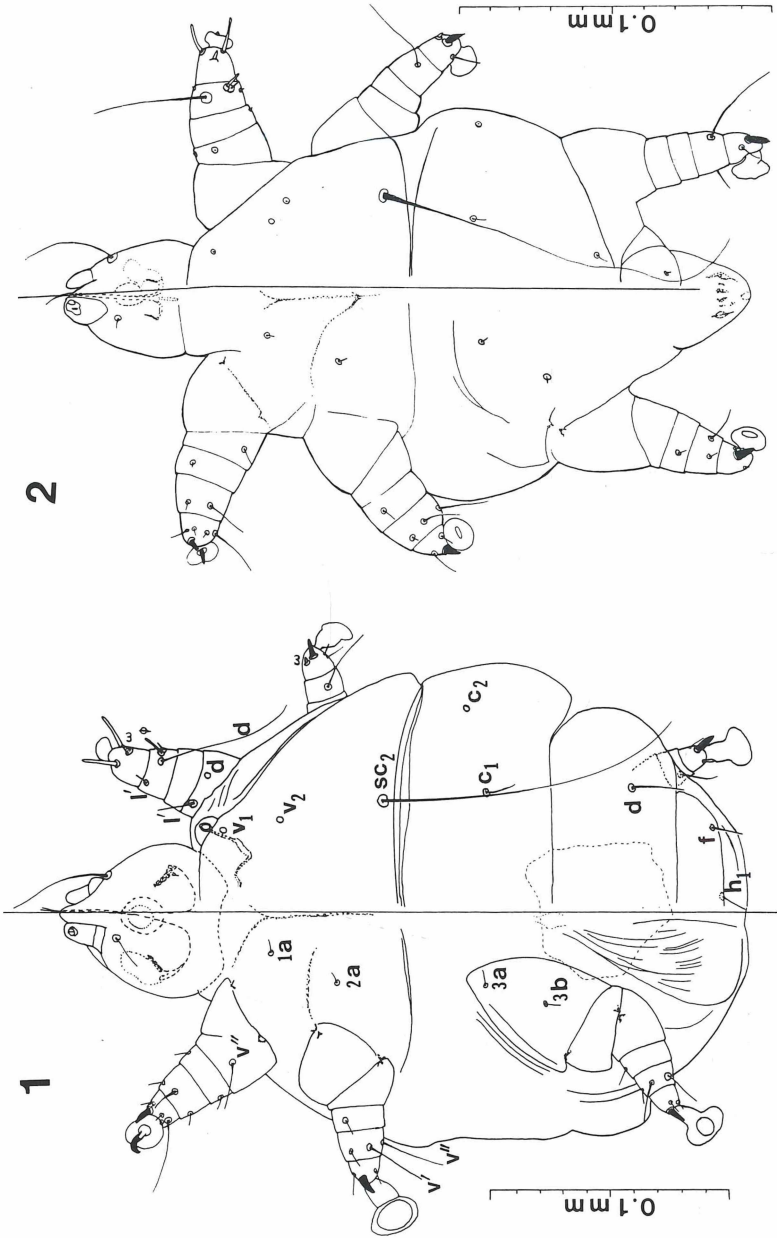
necting v_1 and sc_2 . Plate C length 60, width 196; width vs. length ratio about 3:3:1. Setae c_1 10-18, c_2 vestigial. Plate D length 50, width 130, seta d 17-30. Plate EF length 30, width 100, seta f 14-27. Venter with apodemes 1 moderately developed, meeting sternal apodeme medially; apodemes 2 not extending to sternal apodeme. Coxal setae thin, $1a$ 5-6, $2a$ 5-7, $3a$ 5-7, $3b$ 8-10. Distance between setae $1a$ 28, distance between setae $2a$ 55, distance between setae $3a$ and $3b$ 23. Setae h_1 38, no setae h_2 . Legs; leg setation as in Table 1. Ambulacrum I, II, III without claws. Femur I seta l' 16-17. Single tarsus I spine, 2 terminal spines on each of tarsi II, III. Tarsus I solenidion ω 4-5. Tibia I solenidion ϕ 8. Seta k 4-5. Setae d tibia I 72, tibia II 42, tibia III 25.

MALE (Fig. 2). Gnathosoma length 38, width 37. Cheliceral stylet length 43, with a well sclerotized, 5 micrometer bar perpendicular to the base. Palp length 13; pharynx width 10, dorsal gnathosomal seta 29, ventral seta 4, distance between ventral setae 13. Idiosoma; length 170, width 122. Prodorsal plate bluntly triangular, setae v_1 and v_2 vestigial, sc_2 2. Setae c_1 , c_2 , d vestigial. Venter with apodemes 1 moderately developed, meeting sternal apodeme medially; apodemes 2 not extending to sternal apodeme. Coxal setae thin, $1a$, $2a$ and $3a$ (m), $3b$ 2. Legs; leg setation as in Table 1. Ambulacrum I with one claw, ambulacra II, III without claws. Single tarsus I spine, 2 terminal spines on each of tarsi II, III. Tarsus I solenidion ω 3. Tibia I solenidion ϕ 7. Seta k 3. Tibia I seta d 48, tibiae II, III setae d 28-30. Femoral and tibial I setae l' short and thick.

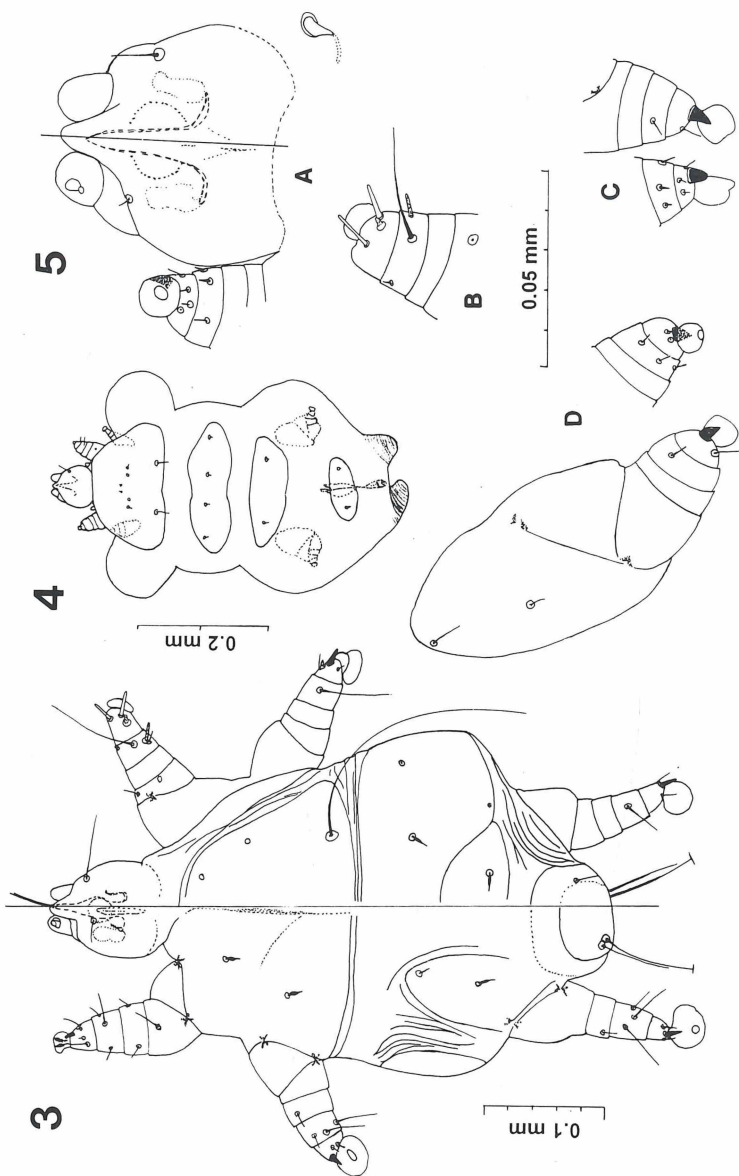
LARVA (Fig. 3). Gnathosoma length 60, width 50. Cheliceral stylet length 50-60, with a well sclerotized, 8 micrometer bar perpendicular to the base. Palp length 10-12; pharynx width 9-10, dorsal gnathosomal seta 14-26, ventral seta 2-10, distance between ventral setae 10-11. Idiosoma; length 177-220, width 106-178. Setae v_1 , v_2 vestigial, sc_2 133-140. Distance between setae v_1 23; distance between setae sc_2 56. Setae c_1 8-10, c_2 (m), d 8-12, f 8-12. Venter with apodemes 1 poorly developed, meeting sternal apodeme medially; apodemes 2 extending to sternal apodeme. Coxal setae $1a$ 7-8, $2a$ 7-8, $3a$ 6-8, $3b$ 8-10; setae $3a$ thin, other coxal setae thick. Distance between setae $3a$ and $3b$ 25. Setae h_1 188-245, h_2 18-36. Distance between setae h_1 17-18. Legs; setation pattern as in the male. Ambulacrum I with two claws, ambulacra II, III without claws. Single tarsus I spine, 2 terminal spines on each of tarsi II, III. Tarsus I solenidion ω 2. Tibia I solenidion ϕ 6-8, seta k 3-4. Tibia I seta d 28-48, tibiae II, III setae d 18-27.

EGG. Length 113-123, width 188-197.

REMARKS. Regenfuss (1968) defined the *acanthomus* group of *Eutarsopolipus* in part as follows: females with claw on leg I well developed, no claws on legs II, III, plates C, D evident and femur I l' long. *E. rackae* sp. n. has these characteristics in common with the other 10 species in the *acanthomus* group. Cheliceral stylets, setae sc_2 and dorsal gnathosomal setae are about twice the length of similar structures in related species. At right angle to the base of the cheliceral stylet is a sclerotized bar which is not evident in related species. Setae d , f and h_1 are longer in *E. rackae* sp. n. than in adult females of related species. Male *E. rackae* sp. n. have cheliceral stylets, setae sc_2 and dorsal gnathosomal setae which are at least 25% longer than identical structures in related species. Cheliceral stylets and setae h_2 of larval females are at least 30% longer than in related species.



Figs 1-2. *Eutarsopolipus rackae* sp. n.: 1- adult female; ventral and dorsal aspects; 2- male, ventral and dorsal aspects.



Figs 3-5. *E. rackae* sp. n.: 3- larval female, ventral and dorsal aspects; *E. elzingai* sp. n.: 4- adult female, idiosoma, dorsum; 5- adult female; a - gnathosoma, stigmata and ventral aspect of leg I, b - dorsal aspect of leg I, c - dorsal and ventral aspects of leg II, d - ventral and dorsal aspects of leg III.

Eutarsopolipus elzingai sp. n.
(Figs 4 - 7)

HOST AND LOCALITY. H o l o t y p e female: from Jardine Terrace, Manhattan, Riley Co., Kansas, from under the elytra of *Agonodorus comma* (Carabidae), 26 June 1967, collected by P. Nickel (A30/1985-449). The holotype is deposited in the Zoological Museum Hamburg (ZMH Reg. No. A16/98).

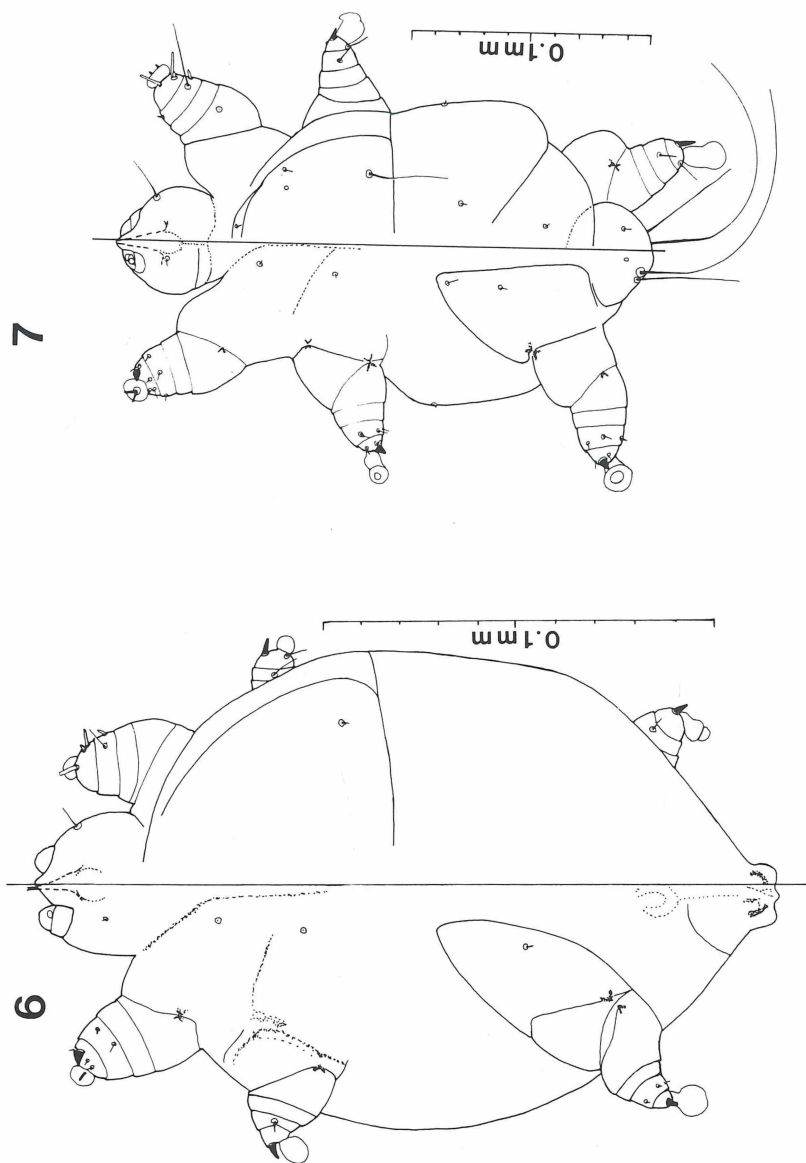
P a r a t y p e s : 3 females, 16 larval females and one slide with 2 eggs from the same locality and host as the holotype. Five larval females from Lawrence, Kansas, 12 May 1959, from *Agonodorus pallipes* (F.) at light, collected by R. E. Beer. One paratype (allotype) from Manhattan, Kansas, *A. comma*, 5 June 1968, is collected by P. Nickel (A30/1985-689). Specimens from Lawrence, Kansas are deposited in the Snow Entomological Museum, University of Kansas, Lawrence, Kansas, U.S.A. One larva and one female from the type locality are deposited in the Entomological Museum, Kansas State University, Manhattan, Kansas and the collection of the author, 1035 Scottsdale Drive, Adrian, Michigan, U.S.A. The balance of the specimens (15 paratypes, including allotypic male) deposited in the Zoological Museum Hamburg, Germany (ZMH Reg. No. A17/98).

ETYMOLOGY. The species is named for Richard J. Elzinga, Kansas State University, Manhattan, Kansas, in tribute to his work in the field of entomology and acarology and for his aid to colleagues over a period of many years.

FEMALE (Figs. 4,5). Gnathosoma length 54-57 width 57-63. Cheliceral stylet length 37-44, pharynx width 18-21, dorsal gnathosomal seta 10-12, ventral seta 4, distance between ventral setae 23-31. Stigmata prominent, at anterolateral margin of prodorsal plate. Idiosoma; length 410-630, width 247-570. Prodorsal plate length 90-105, width 180-218, setae v_1 3-4, v_2 6-7, sc_2 17-20. Distance between setae v_1 8-12, v_2 lateral to a line connecting v_1 and sc_2 . Plate *C* length 70-78, width 187-255; width vs. length ratio about 3:1. Setae c_1 4-6, c_2 7-9. Plate *D* length 162-223, width 55-66, seta *d* 4-5. Plate *EF* length 29-40, width 97-107, seta *f* 3. No setae *h*, with posterior lobes, conspicuously wrinkled in some specimens. Venter with apodemes 1 moderately developed, meeting sternal apodeme medially; apodemes 2 extending to sternal apodeme. Coxal setae thin, *1a* 2, *2a* 2, *3a* 7-9, *3b* 3-5. Distance between setae *1a* 17-22, distance between setae *2a* 20-32, distance between setae *3a* and *3b* 24-30. Legs; leg setation as in Table 1. Ambulacrum I, II, III without claws. Femur I without seta *l'*, with vestigial seta *d*. Single tarsus I spine, 2 terminal spines on each of tarsi II, III. Tarsus I solenidion ω 2-3. Tibia I solenidion ϕ 5. Tibia I seta *d* 30, tibia II, III setae *d* 5.

MALE (Fig. 6). Gnathosoma length 30, width 35. Cheliceral stylet length 14. Palp length 9; pharynx width 7, dorsal gnathosomal seta 6, ventral seta *m*, distance between ventral setae 11. Idiosoma; length 163, width 122. Prodorsal plate semilunar, setae v_1 , v_2 and sc_2 (*m*). Setae c_1 , c_2 , *d* (*m*). Venter with apodemes 1 moderately developed, meeting sternal apodeme medially; apodemes 2 not extending to sternal apodeme. Coxal setae thin, *1a*, *2a* and *3a* *m*, *3b* 2. Legs; leg setation as in Table 1. Ambulacrum I with one claw, ambulacra II, III without claws. Single tarsus I spine, 2 terminal spines on each of tarsi II, III. Tarsus I solenidion ω 2. Tibia I solenidion ϕ 2. Tibia I seta *d* 6, tibiae II, III setae *d* 3.

LARVA (Fig. 7). Gnathosoma length 38, width 44. Cheliceral stylet length 26-29. Palp length 10; pharynx width 8-11, dorsal gnathosomal seta 14-20, ventral seta 2, distance between ventral setae 15-17. Idiosoma; length 186-188, width 124-144. Setae v_1 2, v_2



Figs 6-7. *E. elzingai* sp. n.: 6- male, ventral and dorsal aspects; 7- larval female, ventral and dorsal aspects.

2, sc_2 30-43. Distance between setae v_1 15; distance between setae sc_2 62. Setae c_1 (m), c_2 2, d 2, f 2. Venter with apodemes 1 moderately developed, meeting sternal apodeme medially; apodemes 2 extending to sternal apodeme. Coxal setae $1a$ (m)-2, $2a$ (m) or 2, $3a$ 9-10, $3b$ 3; all coxal setae thin. Distance between setae $3a$ and $3b$ 20-22. Setae h_1 127, h_2 43-47. Distance between setae h_1 , 10-11. Legs; setation pattern as in the male. Ambulacrum I with two claws, ambulacra II, III without conspicuous claws. Single tarsus I spine, 2 terminal spines on each of tarsi II, III. Tarsus I solenidion ω 2. Tibia I solenidion ϕ 3-4, seta k (m). Tibia I seta d 35, tibiae II, III setae d 6-8.

EGG. Length 229, width 143.

REMARKS. Regenfuss (1968) defines the *biunguis* group of *Eutarsopolipus* as follows: females with no claws on legs I, II, III, idiosomal plates *C*, *D* evident, v_1 , v_2 setae evident, femur I setae *I'* short or not present. *E. elzingai* sp. n. shares these characteristics with 5 other species. Female *E. elzingae* sp. n. differ from other species in the *biunguis* group in having a pair of lateral idiosomal lobes and two posterior lobes. Most species are oval and without lobes. *E. globosus* and *E. agonobius* have divided plates *C* while the remaining species have plates *C* undivided. The distance between setae v_1 in North American species, *E. lindquisti* and *E. elzingai* sp. n. is less than the distance between setae v_1 and v_2 . These distances are about equal in related species.

Setae c_2 are distinctly longer than setae d in female *E. elzingai* sp. n. while these setae are equal in length in other species. Seta $3a$ (7-9) is nearly twice the length of setae $3b$ (3-5) in *E. elzingai* sp. n. In related species, seta $3a$ (4) is shorter and is about equal to setae $3b$. Dorsal gnathosomal setae (6) of male *E. elzingai* are at least two times the diameter of the acetabulum. These setae (2) are about equal to the diameter of the acetabulum in related species. A pair of slight to moderate bulges exist at the distal margin of the aedeagi of males in the *biunguis* group. Setae h_2 of larval female *E. elzingai* sp. n. are more than twice the length of setae h_2 in other species. Setae h_1 of larval female *E. elzingai* sp. n. are separated by 11 micrometers while these setae are not separated in related species. The group of *Eutarsopolipus* described as the *biunguis* group by Regenfuss (1968) included *Eutarsopolipus biunguis*, *E. agonobius* and *E. globosus*. Regenfuss described but did not illustrate the male and larval female instars of *E. biunguis*. Only adult females are known for *E. agonobius* and *E. globosus* and these females were described and illustrated by Regenfuss. *E. trichognathi* Husband and Eidelberg, 1996 and *E. lindquisti* Husband, 1998 are recent additions to the *biunguis* group. Regenfuss (1968) placed the *biunguis* group as the sister group of the *acanthomus* group. Both the *biunguis* and *acanthomus* groups share more apomorphic character states than the *myzus*, *pterostichi*, *desani* or *lagenaeformis* groups. Of females of species in the *acanthomus* group, *E. rackae* sp. n. has cheliceral stylets which are about 85-95 micrometers in length. Lengths in the other 10 species range from 30-45 micrometers. Stylets in male and larval female *E. rackae* sp. n. are also longer than are stylets on related species. The aedeagi of all species in the *acanthomus* group are bluntly conical apically and about as long as wide. Although lengths of various structures of *E. rackae* sp. n. differ considerably from related *acanthomus* species, all of the criteria proposed for the *acanthomus* group by Regenfuss (1968) are met by *E. rackae* sp. n. The *acanthomus* group is the largest and most cohesive group of *Eutarsopolipus* groups.

Table I. Leg setation for femora, genua, tibiae, tarsi for *Eutarsopolipus elzingai* sp. n., *E. rackae* sp. n. and other species of *Eutarsopolipus* from the Western Hemisphere

	Leg I				Leg II				Leg III			
	F	G	Ti	Ta	F	G	Ti	Ta	F	G	Ti	Ta
<u>desani-group</u>												
<i>E. latus</i>	2	0	7	9	0	0	4	6	0	0	4	6
<i>E. regenfussi</i>	2	0	7	9	0	0	4	6	0	0	4	5
<u>myzus-group</u>												
<i>E. quebecensis</i>	2	0	6	9	0	0	4	6	0	0	4	5
<u>pterostichi-group</u>												
<i>E. inermis</i>	2	0	6	8	0	0	4	8	0	0	4	5
<u>biunguis-group</u>												
<i>E. trichognathi</i>	2	0	7	9	0	0	4	7	0	0	4	6
<i>E. lindquisti</i>	2	0	6	8	0	0	4	6	0	0	4	5
<i>E. elzingai</i> sp. n.	1	0	7	9	0	0	4	6	0	0	4	5
<u>acanthomus-group</u>												
<i>E. capowayensis</i>	3	2	7	9	0	1	4	7	0	1	4	6
<i>E. porteri</i>	3	2	7	8	0	1	4	6	0	1	4	5
<i>E. crassisetus</i>	3	2	7	8	0	1	4	6	0	1	4	5
<i>E. rackae</i> sp. n.	3	2	7	9	0	1	4	6	0	1	4	5
<u>ochoai-group</u>												
<i>E. ochoai</i>	3	2	7	10	0	1	4	8	0	1	4	7

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