

REDEFINITION OF PELOPSIS (ACARI: ORIBATIDA:
MYCOBATIDAE), WITH DESCRIPTION OF PELOPSIS
BALOGHI SP. N. FROM COSTA RICA

BEHAN-PELLETIER, V. M. and EAMER, B.

*Biodiversity Section, ECORC, Agriculture and Agri-Food Canada
K.W. Neatby Bldg., 960 Carling Ave., Ottawa, ON, Canada K1A 0C6
E-mail: behanpv@agr.gc.ca*

The oribatid mite genus *Pelopsis*, found in forest litter and swamp habitats in the Americas is redefined. Current information indicates that *Pelopsis* is most closely related to *Minunthozetes*, *Punctoribates* and *Zachvatkinibates* in the mycobatid subfamily Minunthozetinae. A new species, *P. baloghi*, is proposed, based on material from swamp vegetation in lowland tropical rainforest of Costa Rica.

INTRODUCTION

Pelopsis is a genus of oribatid mites with two described species, known from North and South America (HAMMER 1961, MARSHALL *et al.* 1987). The type species, *P. bifurcata* (EWING, 1909) is widely distributed throughout eastern North America, and is also recorded from the Northwest Territories, Canada (HAMMER 1952). It has been recorded from coniferous forest litter, under logs, and in beach debris (NORTON 1979), and is often the most common species in drying swamps (pers. observ.). In contrast, *Pelopsis bidentatus* HAMMER has been recorded only from dripping wet meadows, by a spring, and by water drains at elevations of 3000–4800 m in Peru (HAMMER 1961).

HALL (1911) proposed the genus *Pelopsis*, with *P. nudiuscula* as type species. He (HALL 1911) considered *Pelopsis* to be a relative of *Pelops* (now in the family Phenopelopidae). NORTON (1979) established the synonymy of *Pelopsis nudiuscula* HALL with *Pelops bifurcatus* EWING, 1909, and also the synonymy of *Parapelops* JACOT and *Ewingozetes* HAMMER with *Pelopsis*. WOOLLEY (1958) considered *Pelopsis* a member of the Pelopidae (now Phenopelopidae), and redescribed *P. bifurcata*. BALOGH (1961, 1965, and subsequent references) placed the genus in the Mycobatidae, a placement supported by NORTON (1979) and examination of adult character states (BEHAN-PELLETIER 1988). In his redescription, WOOLLEY (1958) noted and illustrated three pairs of porose areas on the notogaster. As the octotaxic system in *Pelopsis* comprises four pairs of saccules, WOOLLEY's (1958) observation has caused confusion in the literature: these porose organs were noted correctly as saccules by BALOGH and BALOGH (1990),

but noted incorrectly as porose areas by BALOGH (1972) and BALOGH and BALOGH (1992).

In this paper we redefine *Pelopsis*, based on examination of adults of described species, to clarify diagnostic character states of the genus. We propose a new species, *P. baloghi*, based on material from a swamp in the lowland tropical rainforest at La Selva, Costa Rica. The systematics and ecology of the oribatid mite fauna of lowland tropical rainforest are the subjects of ongoing research as part of the Arthropods of La Selva (ALAS) Project (Colwell 1996). Estación Biologica La Selva at 10°26'N 84°1'W and 50–150 m elevation, is the biotically rich field station of the Organization for Tropical Studies in the Atlantic lowland, evergreen tropical rainforest of Costa Rica (MCDADE *et al.* 1993), and it is the type locality for several other species of Mycobatidae (BEHAN-PELLETIER 1999).

MATERIALS AND METHODS

Morphological terminology used in this study follows that developed by F. GRANDJEAN (see TRAVÉ & VACHON 1975 for references). The following conventions of measurement and description are used: prodorsal setae, measured on dissected, slide mounted specimens; *ro*, rostral seta; *le*, lamellar seta; *in*, interlamellar seta; *ex*, exobothridial seta; *ss*, sensillus; total length, measured from tip of rostrum to posterior edge of notogaster, on specimens in cavity slides; notogastral length to width ratio, measured when viewed perpendicular to circumgastric scissure, on specimens in cavity slides; leg setal formula, famulus is included in tarsal setal count on leg I and solenidial counts are in parentheses.

The unidifferent nomenclature for notogastral setae is used herein. Synonymies of this nomenclature with the holotrichous nomenclature based on probable homologies among GRANDJEAN's notogastral setal nomenclatures, are outlined by R. A. NORTON in BALOGH and BALOGH (1988).

Specimens for scanning electron microscopy were cleaned by soaking in Terg-a-zyme® solution for 6–12 hours, followed by brief (1–2 sec.) submersion in an ultrasonic bath. Specimens were then critical point dried, mounted on Al-stubs with double sided sticky tape, and gold-coated in a Hummer sputter apparatus.

SYSTEMATICS

Pelopsis HALL, 1919

Type species: *Pelops bifurcatus* EWING, 1909 (= *Pelopsis nudiuscula* HALL, 1911)

Diagnosis. Adults are unique among the Mycobatidae in having the following combination of character states: granular cerotegument extending ventrally in groove at edge of ventral plate; rostrum with lateral minitecta; enantiophysis pres-

ent between base of seta *in* and bothridium; seta *in* borne on ridge extending between enantiophysis; seta *in* broad, heavily barbed dorsally and laterally, bifurcate distally; tutorium with large triangular cusp; pedotectum I with proximal third concave, expressed as narrow ridge, strongly convex medially; semicircular carina present close to margin of ventral plate, between circumpedal carina and porose area Ah; circumpedal carina not merging with discidium; octotaxic system of four pairs of saccules; posterior notogastral tectum without overlapping lobes; subcapitulum without mental tectum.

Description. Poronotic, brachypline oribatid mites, with character states of the Mycobatidae (GRANDJEAN 1954). *Adult:* Granular cerotegument restricted to region between pteromorphs, pedotectum I, tutorium, and lateral body wall, extending medially along dorsosejugal scissure and circumventrally in groove at edge of ventral plate (Fig. 14). Rostrum convex, margin medially concave, with or without lateral dens. Rostrum with pair of lateral minitecta extending from ventral of lamellar setae to edge of genal process (Fig. 12). Rostral seta barbed, directed anteromedially. Lamella present or reduced to ridge, with or without cusp; translamella absent. Lamellar setae borne anteriorly or anteroventrally on cusp, or borne directly on prodorsum. Interlamellar seta broad, strongly barbed dorsally and laterally, bifurcate distally (Figs 7, 9), borne on ridge (Fig. 9). Enantiophysis well-developed between base of seta *in* and bothridium (Fig. 9). Bothridium cup-shaped (Fig. 9). Sensillus clavate (Figs 1, 8, 9). Porose area Ad present. Tutorium with well-developed triangular cusp. Pedotectum I with proximal third concave, expressed as narrow ridge, strongly convex medially; not covering base of exobothridial seta (Fig. 3). Porose areas Am and Ah present, porose area Al absent. Discidium large, triangular (Fig. 2). Posteriorly directed, semicircular carina present posterodorsal of acetabulum IV, between circumpedal carina and porose area Ah (Fig. 3; arrowhead). Postanal porose area present or absent. Dorsal apodemes (dorsophragmata) separate. Notogaster with 10 pairs of setae or their alveoli. Notogaster with medial process on anterior tectum, process flattened or slightly convex, often covering base of seta *in* (Fig. 8). Pair of thickened bands of integument bordering medial process, evident in transmitted light. Concave ridges extending from medial process almost to anterior edge of pteromorph (Figs 9, 10). Lenticulus present. Octotaxic system present as four pairs of saccules. Pteromorphs curved ventrally, with line of desclerotization clearly evident, extending four-fifths length of pteromorph (Fig. 7). Undivided posterior notogastral tectum present. Epimeral setal formula 3–1–3–3. Small custodium present. Circumpedal carina ending on ventral plate medial to discidium (Fig. 13). Spermapositor (male genital sclerite) normal for family, approximately half length of genital plate, when measured in ventral view on slide-mounted specimens. Genital papilla Va of male and female subequal in size and shape to Vm and Vp. Palp setal formula 0–2–1–3–9(1). Subcapitulum without mental tectum. Gena without posteriorly directed tectum covering base of seta *m*. Seta *l'* of palptibia setiform. Axillary sacculae of subcapitulum present. Tarsi tridactylous. Dorsal integument of tibiae and tarsi II and IV thickened (Fig. 5). Femora II to IV with projection ventrally and abaxially. Seta *s* of tarsus I eupathidial; seta *l''* on genua I and II setiform (Fig. 14). Tarsus II with or without dens abaxial to solenidia.

Immatures – Unknown.

Relationship. We have examined the syntypes of *Pelopsis bidentatus* (HAMMER 1961). The purported longitudinal groove and the “sense papillae” on the rostrum noted by HAMMER (1961) are thickenings of the base of the rostral tectum.

These, present in all species of *Pelopsis*, are visible in transmitted light, but being enclosed in the camerostome, are not evident in scanning electron micrographs (Figs 10, 12). The lamellae are lamellate proximally and ridge-like distally. The “short ridges” on the anterior of the notogaster are the thickenings of the notogastral tectum present in all species of *Pelopsis*.

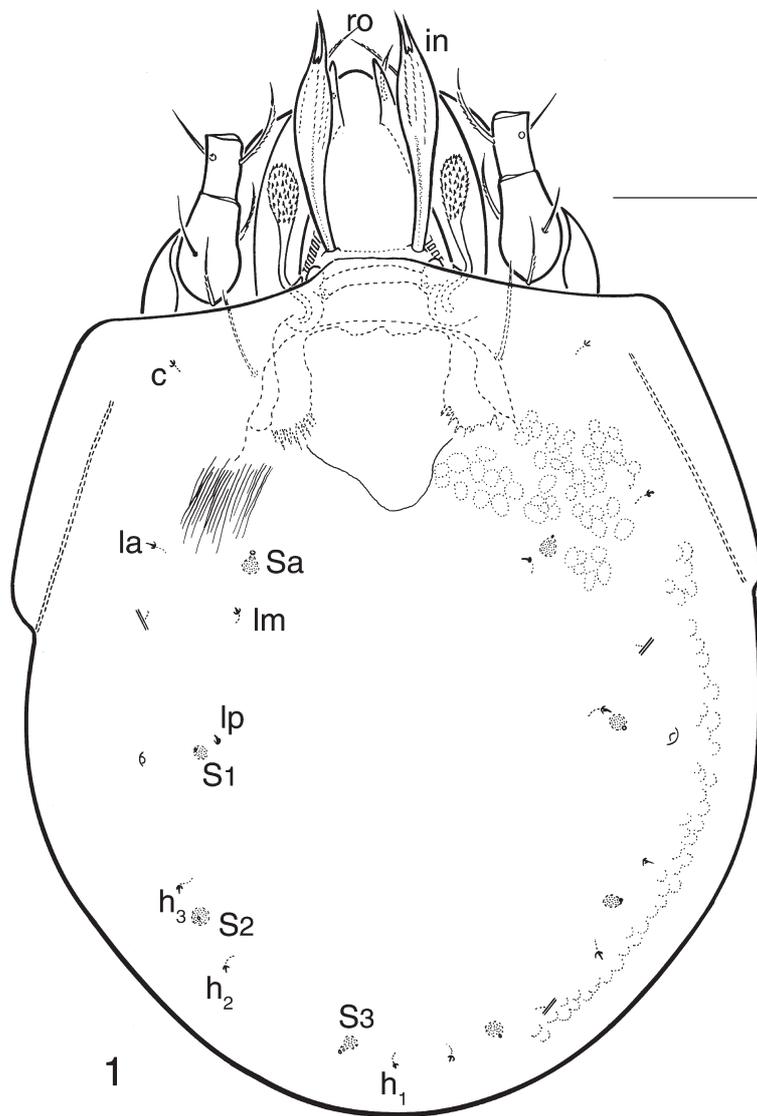
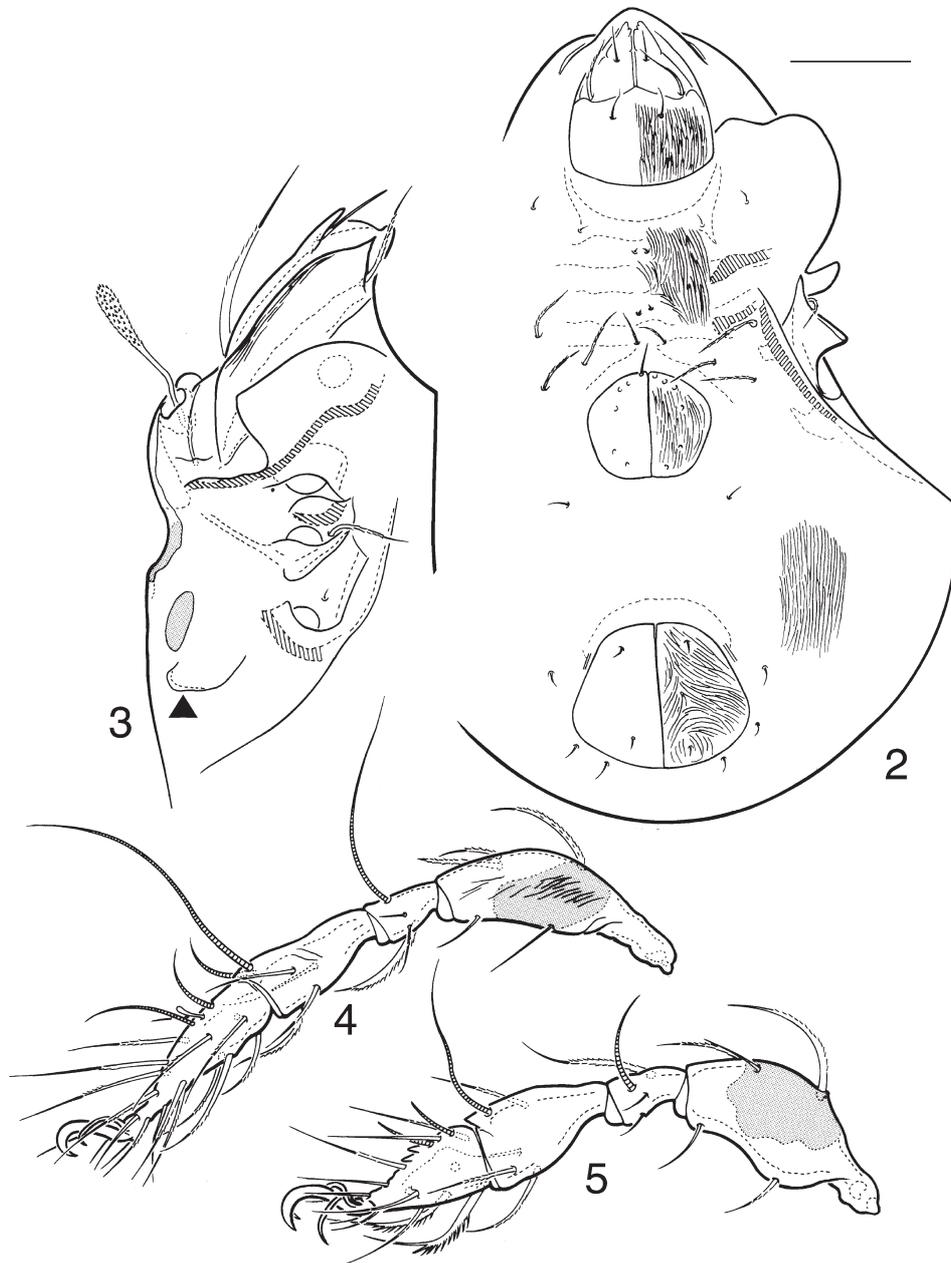


Fig. 1. *Pelopsis baloghi*, adult female; dorsal aspect. Scale bar represents 50 μm



Figs 2–5. *Pelopsis baloghi*, adult female: 2 = ventral aspect; 3 = lateral aspect, with semicircular carina indicated by arrowhead; 4 = leg I abaxial aspect, trochanter removed; 5 = leg II abaxial aspect, trochanter removed. Scale bar represents 50 μ m

In *Pelopsis* the cerotegument extends as a circumventral band in the groove formed at the edge of the ventral plate. A similar development of the cerotegument is found in all members of the ceratozetoid family Zetomimidae (BEHAN-PELLETIER & EAMER 2003). It is possible that in *Pelopsis* this band of cerotegument forms a “circumventral plastron” as has been observed in the zetomimid genus *Heterozetes* (BEHAN-PELLETIER & EAMER 2003).

The presence of a semicircular carina posterodorsal of acetabulum IV and close to the margin of the ventral plate, is a character state shared with the mycobatid genera *Mycobates* and *Punctoribates*. These latter genera also have a linear carina, anterior to the semicircular carina, which is also found in the mycobatid genus *Zachvatkinibates* (BEHAN-PELLETIER 1994). The pedotectum I with strongly concave dorsal margin is a character state also found in the genera *Punctoribates* and *Minunthozetes* and in some species of *Zachvatkinibates* (BEHAN-PELLETIER 1988).

The presence of (1) minitecta on the rostrum; (2) bifurcate and barbed interlamellar setae, and (3) octotaxic system developed as saccules, are character states unique to *Pelopsis* among the Mycobatidae (BEHAN-PELLETIER 1988). *Pelopsis* shares the following four character states with the mycobatid genera *Zachvatkinibates*, *Punctoribates* and *Minunthozetes*: interlamellar setae borne on a ridge; enantiophysis present between interlamellar setae and bothridium; notogaster with medial process; thickened bands bordering medial process. These character states are considered synapomorphic (BEHAN-PELLETIER 1988), and define the subfamily Minunthozetinae GRANDJEAN (sensu SHALDYBINA (1975) and PAVLITSHENKO (1994)) of the family Mycobatidae.

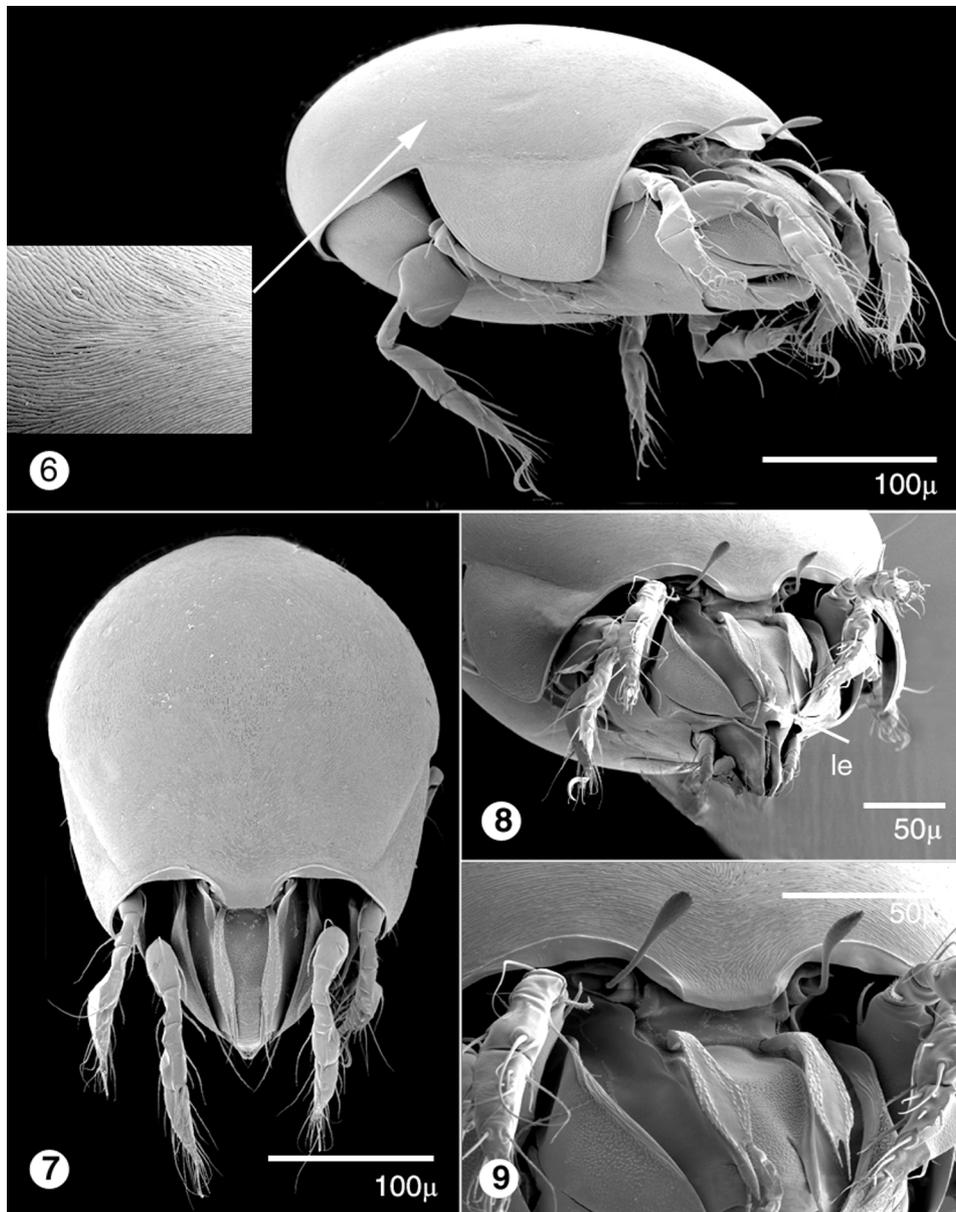
***Pelopsis baloghi* sp. n.**

(Figs 1–14)

Material examined – Holotype: adult ♂. Costa Rica: Heredia, Estación Biologica La Selva, Swampo Experimentale, 10°26'N 84°01'W, 9 June 1997 (V. BEHAN-PELLETIER), aquatic vegetation and debris, deposited in the Acari collections of INBio, Insitituto Nacional de Biodiversidad, Santo Domingo, Costa Rica.

Paratypes: 10 with same data as holotype; 2 with same data as holotype, except 17 May 1995, from saturated soil. Paratypes deposited in the Canadian National Collection of Insects and Arachnids, Agriculture and Agri-Food Canada, Ottawa, Canada, INBio, the collections of R. A. NORTON and the Hungarian Natural History Museum, Budapest.

Etymology – This species is named in honor of Professor JÁNOS BALOGH for his outstanding contributions to knowledge of Oribatida worldwide.



Figs 6–9. *Pelopsis baloghi*, scanning electron microscope images of adult female: 6 = lateral aspect, with detail of striate integument of notogaster indicated by arrow; 7 = dorsal aspect; 8 = dorsolateral aspect of anterior third, with lamellar seta indicated by arrowhead; 9 = dorsolateral aspect of anterior of notogaster and posterior of prodorsum

Diagnosis. Adult – Total length 420–508 μm ; integument striate on notogaster, pteromorphs, epimeres, ventral, genital and anal plates and mentum; lamella developed as very strong ridge, 91–101 μm long; lamellar setae arising anteroventrally on lamellar cusps; seta *in* 98–127 μm long; sensillus 60–72 μm long, with heavily barbed, long clavate head; notogastral setae very short, thin, at most 6 μm long.

Description. Adult: Measurements – Mean total length: females ($n = 10$) 454 μm (range 420–508); males ($n = 3$) 441 μm (range 422–499). Mean notogastral width: females ($n = 10$) 304 μm (range 288–336), males ($n = 3$), 303 μm (range 288–336).

Integument. Microtuberculate on prodorsum, tutorium, genal process, pedotectum I, anterolaterally on epimere I, and on leg segments. Striate on notogaster, pteromorphs, epimeres, ventral, genital and anal plates, mentum, abaxially on femora III and IV and dorsodistally on trochanters III and IV.

Prodorsum – Rostral margin strongly concave medially, with 2 lateral dens (Figs 11, 12). Seta *ro* 53–58 μm long, weakly barbed, acuminate (Figs 1, 12). Lamella developed as very strong ridge, 91–101 μm long, almost parallel (Figs 1, 9), ridge undulating in bothridial region (Fig. 9); lamellar cusp 17–19 μm long, parallel (Fig. 8). Seta *le* barbed, 19–24 μm long, arising anteroventrally on lamellar cusp, directed anterolaterally, extending beyond tip of rostrum (Figs 10, 11). Seta *in* 98–127 μm long, inserted on transverse ridge, dorsoventrally flattened, strongly barbed dorsally and laterally, narrow proximally and distally, broadening medially, with conspicuous medial and lateral dens about 24 μm long and small dens between them about 4–7 μm long (Figs 1, 10). Mutual distance of setal pairs *ro-ro*, *le-le* and *in-in*, about 60 μm , 22–24 μm and 29–31 μm , respectively. Seta *ex* barbed, about 35 μm long. Sensillus 60–72 μm long, with heavily barbed, long clavate head, rounded distally, curved anteromedially (Figs 1, 8). Dorsal apodemes (dorsophragmata) well separated basally (Fig. 1). Porose area Ad circular and medial to bothridium.

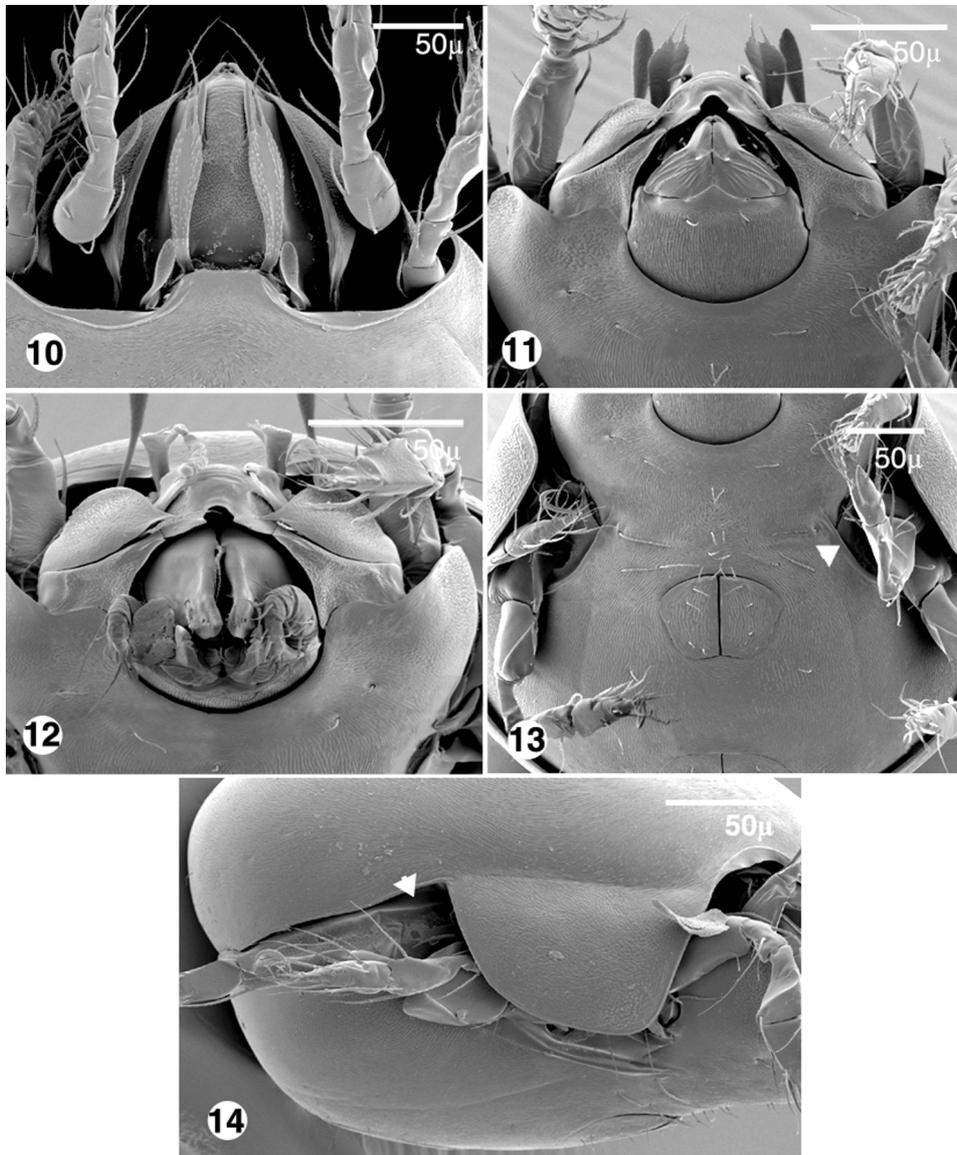
Lateral aspect of prodorsum – Genal process triangular, tapered to point, with well-developed ridge (Fig. 12). Tutorium, including cusp, about 112 μm long, distinctly pointed distally, (Figs 3, 12), with longitudinal ridges dorsoproximally (Fig. 9); tutorial cusp about 36 μm long. Tutorium strongly curved medially forming concise fit with ridge on genal process (Figs 11, 12). Pedotectum I with strongly concave dorsal margin, with dorsal insertion posterior of seta *ex* (Fig. 3). Custodium about 12 μm long (Fig. 14). Circumpedal carina strongly developed, curving to level of setae *3b* (Figs 3, 13, 14).

Notogaster – Longer than wide, ratio 1.2:1. Lenticulus well-developed, subrectangular in shape (Fig. 1). Notogastral striae with thumb-print pattern, directed longitudinally on anterior third of notogaster and transversely posterior to level of saccule S1 (Fig. 6). Notogastral setae very short, thin, at most 6 μm long (Fig. 1). Saccules small, clearly evident, Sa positioned anterior of seta *lm*, S1 posterolateral of *lp*, S2 midway between setae *h₃* and *h₂*, S3 lateral of seta *h₁* (Fig. 1).

Ventral region – Epimere I tuberculate anterolaterally, remainder of epimeres I to IV striate (Figs 11, 12). Epimeral setae weakly barbed, tapered, *3b* longest setae, about 34 μm , other epimeral setae 16–24 μm long. Genital plates with longitudinal striae, anal plates with predominantly transverse striae, striae on ventral plate predominantly longitudinal (Fig. 2). Genital setae about 17 μm , *g₁* and *g₂* weakly barbed, positioned on anterior margin of plate (Fig. 13). Aggenital, anal and adanal setae smooth, thin, about 6–10 μm long. Postanal porose area not evident.

Gnathosoma – Mentum with predominantly longitudinal striae; gena with striae directed anteromedially (Figs 2, 11). Axillary saccule of subcapitulum about 10 μm long.

Legs – Setation (I–IV): trochanters, 1–1–2–1; femora, 5–5–2–2; genua 3(1)–3(1)–1(1)–2; tibiae, 4(2)–4(1)–3(1)–3(1); tarsi, 20(2)–15(2)–15–12 (Figs 4, 5). Tibia I with small anterodorsal dens



Figs 10–14. *Pelopsis baloghi*, scanning electron microscope images of adult female: 10 = dorsal aspect of prodorsum and anterior of notogaster; 11 = ventral aspect of gnathosoma and epimere I; 12 = frontal aspect of gnathosoma and rostrum; 13 = ventral aspect of ventral plate and genital plates, circumpedal carina indicated by arrowhead; 14 = lateral aspect of notogaster and ventral plate, anterior of circumventral groove indicated by arrowhead

(Fig. 4). Tibiae I and II indented abaxially (Fig. 10). Femur II with ventral ridge and ventral projection, with seta *bv* positioned abaxial to ridge (Fig. 5). Tibia and tarsus II with dorsal ridge; tarsus II with two tandem dorsal spines abaxial of solenidia (Fig. 5). Trochanters and femora III and IV with ventral carina and ridge; femora III and IV and trochanter IV with striae abaxially. Tibia and tarsus IV thickened dorsally; dorsal integument of tibia and tarsus III not thickened.

Remarks – The presence of dens dorsally on tarsus II is one of the character states used by HAMMER (1961) to separate *Pelopsis bidentatus* from the type species, *Pelopsis bifurcata*. Neither EWING (1909), in the original description of the type species, or WOOLLEY (1958) who redescribed the species, noted dens dorsally on tarsus II. Dens are not evident on a cotype slide specimen of *P. bifurcata* that we have examined. However, variation in this character state in specimens from North America argues for caution in its use as a key character.

Adults of *Pelopsis baloghi* though similar to the two other described species in the genus, can be easily distinguished on the basis of character states outlined in the following key.

KEY TO ADULTS OF PELOPSIS

- 1 Integument of notogaster, mentum, ventral, genital and anal plates distinctly striate *P. baloghi* sp. n.
- Integument of notogaster, mentum, ventral, genital and anal plates microtuberculate 2
- 2 Lamellar cusps short, 4–6 μm long; lamellar setae arising distally on cusp *P. bidentatus* (HAMMER)
- Lamellar cusps about 24 μm long; lamellar setae arising anteroventrally on cusp *P. bifurcata* (EWING)

*

Acknowledgments – We thank BARRY FLAHEY (Research Branch, Agriculture and Agri-Food Canada, Ottawa) for inking the line drawings; NIKOLAJ SCHARFF (Zoological Museum, University of Copenhagen, Denmark) and DAVID FURTH (National Museum of Natural History, Smithsonian Institution, Washington, USA) for the loan of type material, and our colleagues EVERT LINDQUIST (Research Branch, Agriculture and Agri-Food Canada), and ROY NORTON (State University of New York, Syracuse) for their helpful comments on this manuscript.

Field work by the senior author at La Selva, Costa Rica was supported by National Science Foundation Grants BSR-9025024 and DEB-9401069 and by the Office of Forestry, Environment and Natural Resources, Bureau of Science and Technology, of the US Agency for International Development under NSF grant BSR-9025024.

REFERENCES

- BALOGH, J. (1961) Identification keys of world oribatid (Acari) families and genera. *Acta zool. hung.* **7**: 243–344.
- BALOGH, J. (1965) A synopsis of the world oribatid (Acari) genera. *Acta zool. hung.* **11**: 5–99.
- BALOGH, J. (1972) *The Oribatid Genera of the World*. Akadémiai Kiadó, Budapest. 188 pp. + 71 pls
- BALOGH, J. & BALOGH, P. (1988) Oribatid mites of the neotropical region I. In BALOGH, J. & MAHUNKA, S. (eds): *The soil mites of the world*. Vol. 2. Akadémiai Kiadó, Budapest, 335 pp.
- BALOGH, J. & BALOGH, P. (1990) *Oribatid mites of the Neotropical Region*. Vol. II. Elsevier, New York, 333 pp.
- BALOGH, J. & BALOGH, P. (1992) *The oribatid mites genera of the world*. Hungarian Natural History Museum, Budapest. Vol. I. 263 pp. Vol. II: 375 pp.
- BEHAN-PELLETIER, V. M. (1988) Redefinition of Zachvatkinibates (Acari: Mycobatidae) with description of a new species and immatures of *Z. maritimus* Shaldybina, 1973. *Can. Ent.* **120**: 797–813.
- BEHAN-PELLETIER V. M. (1994) Mycobates (Acari: Oribatida: Mycobatidae) of America north of Mexico. *Can. Ent.* **126**: 1301–1361.
- BEHAN-PELLETIER, V. M. (1999) Ceratozetoidea (Acari: Oribatida) of lowland tropical rainforest, La Selva, Costa Rica. *Acarologia* **39**: 349–381.
- BEHAN-PELLETIER, V. M. & EAMER, B. (2003) Zetomimidae (Acari: Oribatida) of North America. In SMITH, I. M. (ed.): *An acarological tribute to David R. Cock*. Indira Publ. House. [in press]
- COLWELL, R. (1996) ALAS Web site: <http://viceroy.eeb.uconn.edu/ALAS/ALAS.html>.
- EWING, H. E. (1909) New American Oribatoidea. *J. N. Y. Ent. Soc.* **17**: 116–136.
- GRANDJEAN, F. (1954) Essai de classification des oribates (acariens). *Bull. Soc. Zool. France* **78**: 421–446.
- HAMMER, M. (1952) Investigations on the microfauna of Northern Canada, Part I. Oribatidae. *Acta Arctica* **4**: 1–108.
- HALL, H. V. M. (1911) Studies in Acarina I. *Pomona Coll. J. Ent.* **3**: 504–510.
- HAMMER, M. (1961) Investigations on the oribatid fauna of the Andes Mountains. II. Peru. *Biol. Skr. Dan. Vid. Selsk.* **13**: 1–157.
- MARSHALL, V. G., REEVES, R. M. & NORTON, R. A. (1987) Catalogue of the Oribatida of continental United States and Canada. *Memoirs Ent. Soc. Canada* **139**: 418 pp.
- MCDADE, L. A., BAWA, K. S., HESPENHEIDE, H. A. & HARTSHORN, G. S. (eds) (1993) *La Selva, ecology and natural history of a neotropical rainforest*. Univ. Chicago Press, Chicago, Illinois. 486 pp.
- NORTON, R. A. (1979) The identity of *Pelopsis nadiuscula* (Acari: Oribatei). *Proc. Ent. Soc., Washington* **81**: 696–697.
- PAVLITSHENKO, P. G. (1994) *A guide to the ceratozetoid mites (Oribatei, Ceratozetoidea) of Ukraine*. Kiev, 143 pp.
- SHALDYBINA, E. S. (1975) Ceratozetoidea. Pp. 275–319. In GILYAROV, M. S. (ed.) *A key to soil-inhabiting mites. Sarcoptiformes*. Izdatel'stvo Nauka, Moscow. 491 pp. [in Russian]
- TRAVÉ, J. & VACHON, M. (1975) François Grandjean 1882–1975 (Notice biographique et bibliographique). *Acarologia* **17**(1): 1–19.
- WOOLLEY, T. A. (1958) Redescriptions of Ewing's oribatid mites, VIII–IX. *Trans. Am. Microsc. Soc.* **77**: 258–279.

Received December 20, 2002, accepted February 3, 2003, published March 12, 2003