

# New Data on Oribatid Mites of the Family Oppiidae (Acari: Oribatida) from the Philippines

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**Abstract:** Twelve species of nine genera of the family Oppiidae are recorded in the Philippines. One subspecies (*Arcoppia bidentata bidentata*), six species (*Arcoppia robusta*, *A. waterhousei*, *Discoppia (Discoppia) limae*, *Heteroppia orthodactyla*, *Karenella (Karenella) acuta* and *Lasiobelba (Lasiobelba) vietnamica*) and three genera (*Discoppia*, *Heteroppia* and *Karenella*) are recorded in this country for the first time. One new species of the genus *Arcoppia* is described, *A. luzonensis* sp. n.; it is similar to *Arcoppia bidentata sabahensis*, but differs by the long notogastral setae  $p_1$  and lamellar setae longer than exobothridial setae.

**Key words:** oppiid mites, fauna, systematics, new species, morphology, *Arcoppia*, record, Oriental region

## Introduction

The oribatid mite species of the family Oppiidae (Acari, Oribatida) in the Philippines are insufficiently known (e.g. CORPUZ-RAROS 1979, 1992; CORPUZ-RAROS & LIT 2005). In the course of taxonomic identification of new materials in the collections of the Museum of Natural History (University of the Philippines Los Baños), we discovered 12 species of 9 genera of oppiids. One of them belonging to the genus *Arcoppia* HAMMER, 1977 is new to science. The aim of the present article is to describe and illustrate this new species and to add new data of the oppiid taxa in the Philippines.

## Materials and Methods

The collection locality and habitat for each species are given in the respective *Material examined* section. All mites were extracted from samples by means of Berlese funnel extraction.

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. The body length was measured in lateral view, from the tip of the rostrum to the posterior edge of

the ventral plate. Notogastral width refers to the maximum width in dorsal aspect. Length of body setae were measured in lateral view. All body measurements are presented in micrometers. Formulas for leg setation are given in parentheses according to the sequence trochanter–femur–genu–tibia–tarsus (famulus included). Formulas for leg solenidia are given in square brackets according to the sequence genu–tibia–tarsus.

Morphological terminology used in this paper follows that of F. GRANDJEAN: see TRAVÉ & VACHON (1975) for references, NORTON (1977) for leg setal nomenclature, and NORTON & BEHAN–PELLETIER (2009) for overview.

Drawings were made with a camera lucida using a Carl Zeiss transmission light microscope “Axioskop-2 Plus”.

## Results

### Description of a new species

*Arcoppia luzonensis* ERMILOV & CORPUZ-RAROS sp. n. (Figs 1–4)

**Table 1. Leg setation and solenidia of *Arcoppia luzonensis* ERMILOV & CORPUZ-RAROS sp. n.**

Leg	Tr	Fe	Ge	Ti	Ta
I	v'	d, (l), bv'', v''	(l), σ	(l), (v), φ <sub>1</sub> , φ <sub>2</sub>	(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', ε, ω <sub>1</sub> , ω <sub>2</sub>
II	v'	d, (l), bv'', v''	(l), σ	(l), (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv), l'', ω <sub>1</sub> , ω <sub>2</sub>
III	l', v'	d, l', ev'	l', σ	l', (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv)
IV	v'	d, ev'	d, l'	l', (v), φ	ft'', (tc), (p), (u), (a), s, (pv)

Roman letters refer to normal setae, Greek letters refer to solenidia (except ε – famulus). One apostrophe (') marks setae on anterior and double apostrophe (') setae on posterior side of the given leg segment. Parentheses refer to a pair of setae. Tr – trochanter, Fe – femur, Ge – genu, Ti – Tibia, Ta – tarsus.

**Diagnosis:** Size variable, 348–680 × 199–431. Rostrum tridentate, median tooth larger than lateral ones. Prodorsal setae setiform, barbed; interlamellar setae longer than rostral and lamellar setae; exobothridial setae shortest. Bothridial setae with fusiform heads, having one long setiform apex and often one or two cilia; stalks shorter than setiform apices. Notogastral setae *la*, *lm*, *lp*, *h*<sub>2</sub>, *h*<sub>3</sub> and *p*<sub>1</sub> long, setiform, barbed; *c*, *h*<sub>1</sub>, *p*<sub>2</sub> and *p*<sub>3</sub> thin, slightly barbed. Genital setae short, smooth, *g*<sub>1</sub> and *g*<sub>2</sub> distanced from anterior edges of genital plates. Epimeral, aggenital adanal and anal setae setiform, slightly barbed. Adanal setae *ad*<sub>1</sub> in postanal position, *ad*<sub>3</sub> inserted laterally to adanal lyrifissures.

**Description: Measurements.** Body size strongly variable. Length: 531 (holotype, male), 531–581 (12 paratypes: six females and six males); two paratypes (one female and one male) clearly smaller (348 and 398, respectively) and two paratypes (one female and one male) clearly larger (614 and 680, respectively). Notogaster width: 315 (holotype), 315–348 (12 paratypes); in two small paratypes 199 and 232, in two large paratypes: 381 and 431. No clear difference between females and males.

**Integument** (Fig. 3A). Body colour light brownish to dark brown. Body surface smooth, lateral parts of body tuberculate (diameter of tubercles up to 6). Muscle sigillae poorly visible in epimeral region.

**Prodorsum** (Figs 1, 2A, B, 3A). Rostrum tridentate, incisions very narrow, median tooth (*t*<sub>m</sub>) large, trapezoid (Fig. 1) or triangular (Fig. 2A); lateral teeth (*t*<sub>lat</sub>) smaller, slightly rounded distally. Costulae (*cos*) and transcostula (*tcos*) well-developed, costulae not reaching bothridia. Lateral ridges (*r*) semi-oval, distinct. Rostral (*ro*, 57–65, up to 45 in two small paratypes and 82 in two large paratypes), lamellar (*le*, 41–45, up to 32 in two small paratypes and 73 in two large paratypes), interlamellar (*in*, 94–102, up to 53 in two small paratypes and 123 in two large paratypes) and exobothridial (*ex*, 32, up to 24 in two small paratypes and 41 in two large paratypes) setae setiform, barbed; *in* thickest, *ex* thinnest, *le* located close and posterior to trans-

costula. Bothridial setae (*bs*, 195–207, up to 175 in two small paratypes and 224 in two large paratypes) with short, fusiform heads, having one long setiform apex and often one or two additional cilia; stalks shorter than setiform apices. Longitudinal rows of muscle sigillae well-visible anterior to bothridia. Interbothridial muscle sigillae distinct, represented by two pairs (*ms*<sub>1</sub>, *ms*<sub>2</sub>).

**Notogaster** (Figs 1, 2C, 3A, B). Ten pairs of setae present; *la*, *lm*, *lp*, *h*<sub>2</sub> and *h*<sub>3</sub> (164–176, up to 90 in two small paratypes and 205 in two large paratypes) and *p*<sub>1</sub> (90–106, up to 57 in two small paratypes and 114 in two large paratypes) long, setiform, barbed; *c*, *h*<sub>1</sub>, *p*<sub>2</sub> and *p*<sub>3</sub> (16–32) setiform, thin, slightly barbed. Lyrifissures *ia* and *im* distinct; *ih*, *ips* and *ip* not visible. Opisthonotal gland openings (*gla*) located posteriorly to *im*.

**Gnathosoma** (Figs 2C, 3C–E). Subcapitulum longer than wide: 118–131 (up to 98 in two small paratypes and 147 in two large paratypes) × 90–98 (up to 73 in two small paratypes and 110 in two large paratypes). Three pairs of subcapitular setae setiform, slightly barbed, two pairs of adoral setae the thinnest, straight, smooth; *h* (28–41) longer than *a* (20–34), *m* (16–32) and *or*<sub>1</sub>, *or*<sub>2</sub> (10–14). Length of palps: 65–77. Palpal setation: 0–2–1–3–9(+ω). Solenidia (4/5 length of palptarsi) thickened, slightly dilated medio-distally, blunt-ended, pressed to the palptarsi surface. Postpalpal setae (*ep*, 6–8) spiniform. Length of chelicerae: 106–114 (up to 94 in two small paratypes and 131 in two large paratypes). Cheliceral setae setiform, barbed; *cha* (28–36) longer than *chb* (16–24). Trägårdh's organ (*Tg*) narrowly triangular, rounded distally.

**Lateral podosomal and epimeral regions** (Figs 2C, 3A). Epimeral setal formula: 3–1–3–3. Setae setiform, barbed; *3c* (61–69, up to 49 in two small paratypes and 77 in two large paratypes) longer than *1b*, *1c*, *3b*, *4a*, *4b* and *4c* (36–41, up to 28 in two small paratypes and 57 in two large paratypes) and *1a*, *2a* and *3a* (20–32). Discidia (*dis*) well developed, triangular distally.

**Anogenital region** (Figs 2C, 3B). Six pairs of



Municipality, Eastern Samar Province, Samar Island, 21 October 2003, collected by W. Sm. Gruezo, sample of secondary forest litter; one paratype (male): Sibulan watershed, Polillo Municipality, Polillo Island, Quezon Province, 27 September 2003, I. L. Lit, Jr. and O. L. Eusebio, sample of moss; one paratype (male): Mt. Isarog, Barangay Panicuason, Naga City, Camarines Sur Province, Luzon Island, 1 November 2004, collected by Dave General, sample of leaf litter in secondary forest; two paratypes (female and male): Quezon National Park, Atimonan Municipality, Quezon Province, Luzon Island, 2–4 May 2008, collected by I. L. Lit, Jr. *et al.*, sample of secondary forest litter; one paratype (female): Barangay Burdeos, Polillo Municipality, Polillo Island, Quezon Province, 16 February 2004, collected by O. L. Eusebio, sample of bamboo litter near entrance to Mapanghe Cave; one paratype (female): Puff Cliff, Benguet State University campus, La Trinidad Municipality, Benguet Province (within the Cordillera Mountain Ranges), 13 February 2010, collected by R. C. Garcia, sample of litter from pine (*Pinus kesiya*) forest.

**Type deposition:** The holotype and two paratypes are deposited in the collection of the Senckenberg Museum, Görlitz, Germany; 14 paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

**Etymology:** The specific name “*luzonensis*” refers to Luzon, the Philippine Province, where some paratypes of the new species were discovered.

**Remarks:** *Arcoppia* HAMMER, 1877 is a large genus, with *Arcoppia brachyramosa* HAMMER, 1977 as the type species (HAMMER 1977). At present, it comprises 57 species and nine subspecies, which are distributed in the tropics and subtropics (SUBÍAS 2004, online version 2016). The generic characters were summarized by HAMMER (1977) and RODRÍGUEZ & SUBÍAS (1984). Identification keys to selected species of *Arcoppia* were given by RODRÍGUEZ & SUBÍAS (1984), BALOGH & BALOGH (1986, 2002) and SANYAL *et al.* (2000).

*Arcoppia luzonensis* sp. n. is morphologically most similar to *Arcoppia bidentata sabahensis* MAHUNKA, 1987 from the Oriental region in having long dorsal notogastral setae, a tridentate rostrum with a larger median tooth than laterals and bothridial setae with one distal setiform apex, which is not shorter than the bothridial stalk. However, the new species clearly differs from the latter by the long notogastral setae  $p_1$ , which are considerably longer than  $h_1$ ,  $p_2$  and  $p_3$  (vs.  $p_1$  comparatively very short, and not longer than  $h_1$ ,  $p_2$  and  $p_3$ ), and lamellar setae

longer than exobothridial setae (vs. lamellar setae not longer than exobothridial setae).

Due to the fact that *A. luzonensis* sp. n. and *A. bidentata sabahensis* are morphologically similar and registered in the Philippines, it can be assumed that the new species could be a subspecies of *A. bidentata*. However, we support the species status for *A. luzonensis* sp. n. for the following important reason: the family Oppiidae is very large but there are no records of any cases of strong variability of notogastral setae  $p_1$ . Also, our material (holotype and 16 paratypes) was collected from nine biotopes from various Philippine Islands, and setae  $p_1$  always were long in the new species.

HAMMER (1979) described *Arcoppia bidentata* from Java. Later, MAHUNKA (1987) described a new subspecies, *A. bidentata sabahensis*, based on material from East Malaysia; however, the subspecies status has been proposed by the author arbitrarily. These subspecies differ well from one another by the length of dorsal notogastral setae, the morphology of costulae and the position of some genital and adanal setae (p. 802 in MAHUNKA 1987). Therefore, theoretically, *A. bidentata bidentata* and *A. bidentata sabahensis* have to be considered distinct species. Genetic analyses may help in future for understanding the taxonomic status of these taxa.

### New Records

The following list includes new localities of oppiid mite species and the known general distribution (see SUBÍAS 2004, online version 2016).

***Arcoppia processigera* (BALOGH & MAHUNKA, 1967)**

**Distribution:** Congo, Oriental Region, New Guinea.

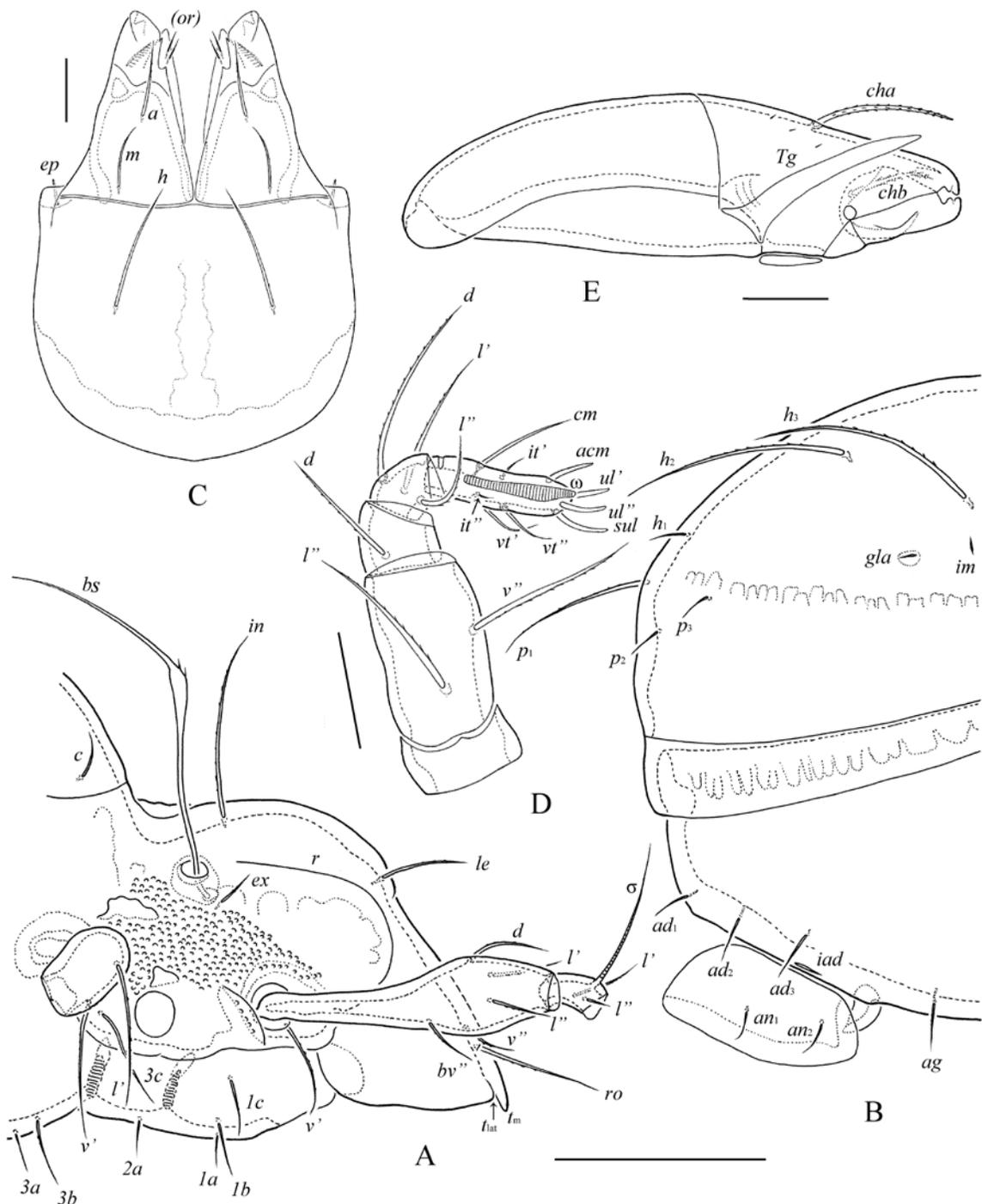
**Material examined:** five specimens: Mt. Malindang, Sitio Old Liboron, Barangay Sibucal, Oroquieta City, Misamis Oriental Province, Mindanao Island, 24 October 2004, collected by W. Sm. Gruezo, sample of mixed litter and soil from secondary forest.

***Arcoppia bidentata bidentata* HAMMER, 1979**

**Distribution:** Oriental Region. First record of the subspecies in the Philippines.

**Material examined:** 1) six specimens: Barangay Bagong Silang, Basey Municipality, Western Samar Province, Samar Island, 7 July 2003, collected by W. Sm. Gruezo, sample of secondary forest litter; 2) nine specimens: Barangay Burdeos, Polillo Municipality, Polillo Island, Quezon Province, 16 February 2004, collected by O. L. Eusebio, sample of bamboo litter near entrance to Mapanghe Cave.

***Arcoppia robusta* MAHUNKA, 1988**



**Fig. 3.** *Arcoppia luzonensis* ERMILOV & CORPUZ-RAROS sp. n., adult: A – anterior part of body, lateral view (legs except basal part I, III not illustrated); B – posterior part of body, lateral view; C – subcapitulum, ventral view; D – palp, right, antiaxial view; E – chelicera, left, paraxial view. Scale bars 100  $\mu$ m (A, B), 20  $\mu$ m (C–E)

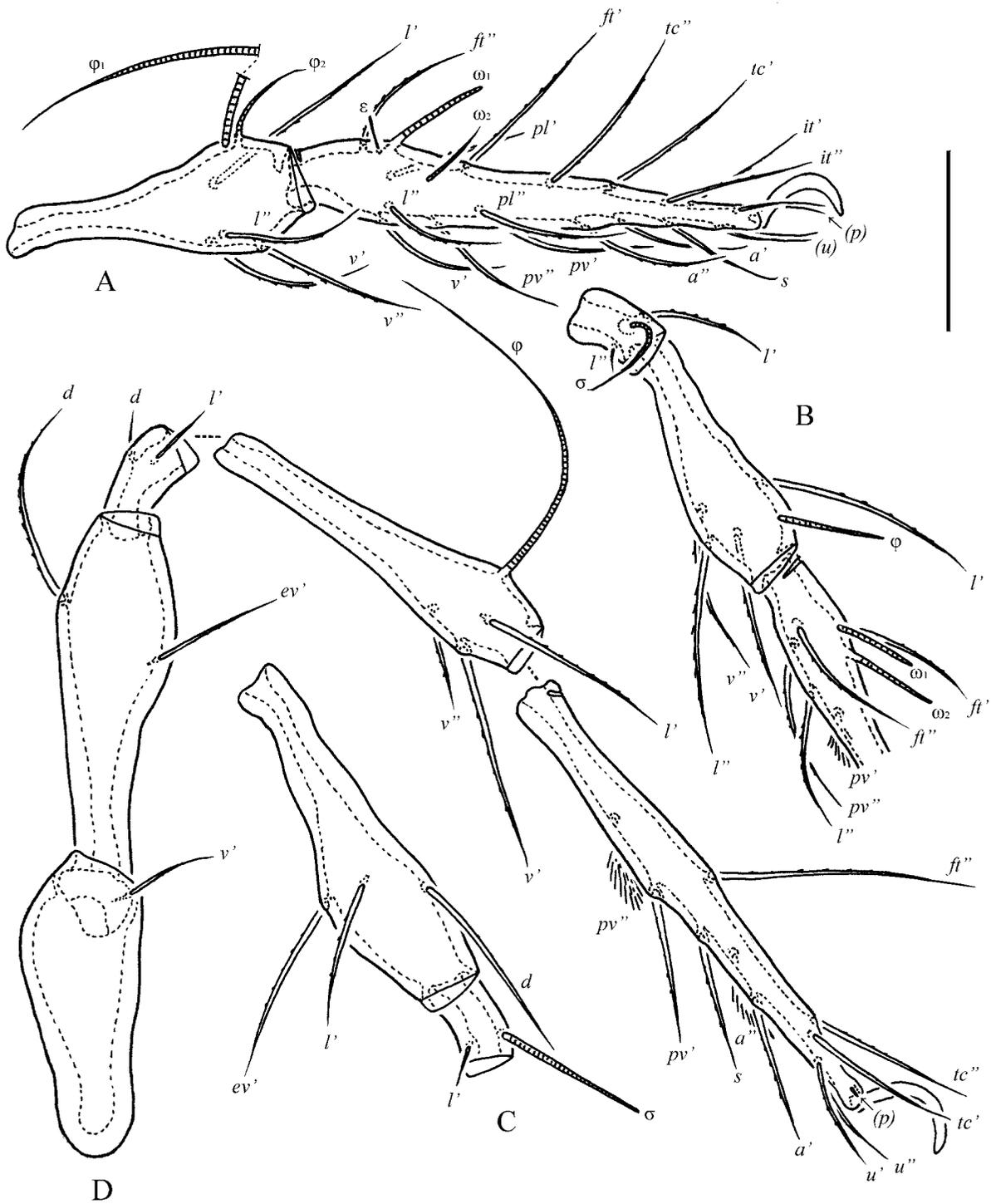
**Distribution:** Borneo. First record of the species in the Philippines.

**Material examined:** four specimens: Pearl Farm Resort, Davao City, Samal Island off Mindanao Island, 17 May 2009, collected by W. Sm. Gruezo *et al.*, sample of litter and soil taken from the base of low limestone hill with coconut trees and typical beach plants, about 10 m from shoreline.

***Arcoppia waterhousei* J. & P. BALOGH, 1983**

**Distribution:** Australia and Vietnam. First record of the species in the Philippines.

**Material examined:** two specimens: Sitio South Kamparema, Barangay Benowangan, Borongan Municipality, Eastern Samar Province, Samar Island, 17 July 2003, collected by W. Sm. Gruezo, sample of secondary forest litter.



**Fig. 4.** *Arcoppia luzonensis* ERMILOV & CORPUZ-RAROS sp. n., adult: A – tibia and tarsus of leg I, right, antiaxial view; B – genu, tibia and basal part of tarsus of leg II, right, antiaxial view; C – femur and genu of leg III, left, antiaxial view; D – leg IV, left, antiaxial view. Scale bar 50  $\mu$ m

***Discoppia (Discoppia) limae* (BALOGH & MAHUNKA, 1974)**

**Distribution:** Malay Peninsula. First record of the genus and species in the Philippines.

**Material examined:** 1) one specimen: Sitio South Kamparema, Barangay Benowangan,

Borongan Municipality, Eastern Samar Province, Samar Island, 17 July 2003, collected by W. Sm. Gruezo, sample of secondary forest litter; 2) one specimen: Pearl Farm Resort, Davao City, Samal Island off Mindanao Island, 17 May 2009, collected by W. Sm. Gruezo *et al.*, sample of litter and soil

taken from the base of low limestone hill with coconut trees and typical beach plants, about 10 m from shoreline.

***Heteroppia orthodactyla* (WILLMANN, 1931)**

**Distribution:** Java. First record of the genus and species in the Philippines.

**Material examined:** seven specimens: Puff Cliff, Benguet State University campus, La Trinidad Municipality, Benguet Province (within the Cordillera Mountain Ranges), 13 February 2010, collected by R. C. Garcia, sample of litter from pine (*Pinus kesiya*) forest.

***Karenella (Karenella) acuta* (CSISZÁR, 1961)**

**Distribution:** Oriental region. First record of the genus and species in the Philippines.

**Material examined:** one specimen: Sitio South Kamparema, Barangay Benowangan, Borongan Municipality, Eastern Samar Province, Samar Island, 17 July 2003, collected by W. Sm. Gruezo, sample of secondary forest litter.

***Lasiobelba (Lasiobelba) vietnamica* BALOGH, 1983**

**Distribution:** Vietnam. First record of the species in the Philippines.

**Material examined:** 1) one specimen: Sibulan watershed, Polillo Municipality, Polillo Island, Quezon Province, 27 September 2003, collected by I. L. Lit, Jr. and O. L. Eusebio, sample of decaying log; 2) two specimens: Barangay Bagong Silang, Basey Municipality, Western Samar Province, Samar Island, 7 July 2003, collected by W. Sm. Gruezo, sample of secondary forest litter; 3) one specimen: Mt. Huraw, San Jose de Buan Municipality, Western Samar Province, Samar Island, 25 October 2002, collected by W. Sm. Gruezo, sample of secondary forest litter.

***Oppiella (Oppiella) nova nova* (OUDEMANS, 1902)**

**Distribution:** Cosmopolitan.

**Material examined:** 1) one specimen: Barangay Bagong Silang, Basey Municipality, Western Samar Province, Samar Island, 7 October 2003, collected by W. Sm. Gruezo, sample of secondary forest litter over limestone; 2) one specimen: Mt. Malindang, Oroquieta City, Misamis Oriental Province, Mindanao Island, 25 October 2004, collected by W. Sm. Gruezo, sample of mixed litter and soil from secondary forest; 3) two specimens: Sitio San Isidro, Barangay Guirang, Basey Municipality, Western Samar Province, Samar Island, 5 October 2003, collected by W. Sm. Gruezo, sample of secondary forest litter.

***Pseudoamerioppia barrancensis* (HAMMER, 1961)**

**Distribution:** Neotropical region and Philippines.

**Material examined:** 1) three specimens: Sitio South Kamparema, Barangay Benowangan, Borongan Municipality, Eastern Samar Province, Samar Island, 17 July 2003, collected by W. Sm. Gruezo, sample of secondary forest litter; 2) two specimens: Sitio San Isidro, Barangay Guirang, Basey Municipality, Western Samar Province, Samar Island, 5 October 2003, collected by W. Sm. Gruezo, sample of secondary forest litter; 3) seven specimens: Mt. Huraw, San Jose de Buan Municipality, Western Samar Province, Samar Island, 25 October 2002, collected by W. Sm. Gruezo, sample of secondary forest litter.

***Pulchroppia malapectinata* (CORPUZ-RAROS, 1979)**

**Distribution:** Philippines.

**Material examined:** one specimen: Puff Cliff, Benguet State University campus, La Trinidad Municipality, Benguet Province (within the Cordillera Mountain Ranges), 13 February 2010, collected by R. C. Garcia, sample of litter from pine (*Pinus kesiya*) forest.

## Conclusions

In the course of taxonomic studies of the Oppiidae in the Philippines, we found 12 species of nine genera. One species is new to science (*Arcoppia luzonensis* sp. n.). One subspecies (*Arcoppia bidentata bidentata*), six species (*Arcoppia robusta*, *A. waterhousei*, *Discoppia (Discoppia) limae*, *Heteroppia orthodactyla*, *Karenella (Karenella) acuta*, *Lasiobelba (Lasiobelba) vietnamica*) and three genera (*Discoppia*, *Heteroppia*, *Karenella*) are recorded for the first time in this country.

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