

NEW ORIBATID MITES OF THE GENERA *PULCHROPPA* AND *LINEOPPIA* (ACARI: ORIBATIDA: OPPIIDAE) FROM CAT TIEN NATIONAL PARK IN SOUTHERN VIETNAM

Sergey G. ERMILOV¹ and Alexander E. ANICHKIN²

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¹ Laboratory of Entomology, Center of Independent Examinations-NN, Gagarin 97, 603107 Nizhniy Novgorod, Russia. ermilovacari@yandex.ru

² Institute of Ecological and Evolutionary Problems, Russian Academy of Sciences, Lenin 33, 119071 Moscow, Russia; Joint Russian-Vietnamese Research and Technological Center, Southern Branch, Dstr. 10, Str. 3/2, 3, Ho Chi Minh City, Vietnam. repetty@yandex.ru

ABSTRACT — Two new species of oribatid mites of the family Oppiidae, *Pulchroppia roynortoni* n. sp. and *Lineoppia microseta* n. sp., are proposed and described. Both are from dark loamy soil of *Lagerstroemia* forest from the Cat Tien National Park (Southern Vietnam). *Pulchroppia roynortoni* n. sp. differs from all the known species of the genus by the specific structure of rostrum and morphology of sensillus. *Lineoppia microseta* n. sp. is similar in its lineate anogenital region only to *Lineoppia frouini* Balogh and Balogh, 1983, but differs from this species in body length, notogaster integument, length of costular lines, interlamellar setae morphology, as well as in the position of some notogastral setae, of lyrifissures *iad*, and of apodemes 4. We present the first detailed descriptions of the ovipositor, gnathosoma and leg setation and solenidia of *Pulchroppia* and *Lineoppia* species. Diagnostic keys to the Vietnamese species of *Pulchroppia* and to known species of *Lineoppia* are presented. The genus *Lineoppia* is recorded for the first time in the Oriental region. *Pulchroppia elegans* is recorded for the first time in Vietnam.

KEYWORDS — oribatid mites; new species; Oppiidae; *Pulchroppia*; *Lineoppia*; Cat Tien National Park; Southern Vietnam

INTRODUCTION

Oppiidae is a very large family of oribatid mites, which comprises more than 130 genera and 950 species (Subías, 2004, online version 2010). At present, the oribatid fauna of Vietnam have been sparsely studied, and only 25 identified species of this family have been registered in Vietnam (Balogh and Mahunka, 1967; Golosova, 1983; Mahunka, 1988; Krivolutskiy *et al.*, 1997; Vu, 2007).

In the course of faunistic studies of oribatid mites of Cat Tien National Park (southern Vietnam) we have found two new species of Oppiidae from

the genera *Pulchroppia* and *Lineoppia* which are described below.

Pulchroppia is a small genus that was proposed by Hammer (1979) with *Pulchroppia elegans* Hammer, 1979 as type species. It can be recognized by the sensilli pectinate, ten (exception nine) pairs of notogastral setae, long epimeres 3+4, reach posterior of the genital plates (setae 4a posterior to genital plate), apodemes 4 absent, epimeral setal formula 3-1-3-3, five pairs of genital setae, lyrifissures *iad* direct apoeanal. Currently, the genus comprises seven species, which are distributed in the Oriental region. Only one species of this genus, *Pulchrop-*

pia granulata Mahunka, 1988 has been recorded from Vietnam (Mahunka, 1988). In the Cat Tien National Park we found two species of *Pulchroppia*: *P. elegans* Hammer, 1979 (it is a first record for Vietnam); and a new species.

Lineoppia is a very small genus that was proposed by Balogh and Balogh (1983) with *Lineoppia frouini* Balogh and Balogh, 1983 as type species. It can be recognized by rostrum rounded, costular lines present, sensilli setiform, anterior margin of notogaster with one pair of humeral processes, ten pairs of notogastral setae, apodemes 4 present, epimeral setal formula 3-1-3-3, five or six pairs of genital setae. Currently, the genus comprises three species, which are distributed in the Pantropical (except Oriental) region. The new species is the first record of the genus for the Oriental region.

MATERIALS AND METHODS

Collection localities and habitats of the new species are characterized in the "Material examined" sections.

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. All body measurements are presented in micrometers (μm). Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate, to avoid discrepancies caused by different degrees of notogastral distortion. Notogastral width refers to the maximum width in dorsal aspect. Lengths of body setae were measured in lateral aspect. Some specimens were dissected for detailed study of the gnathosoma, ovipositor and legs. Formulae for leg setation are given in round brackets according to the sequence trochanter-femur-genu-tibia-tarsus (femulus included). Formulae for leg solenidia are given in square brackets according to the sequence genu-tibia-tarsus.

FAMILY OPPIIDAE

Pulchroppia roynortoni n. sp.

(Figures 1 – 3)

Diagnosis

The new species is characterized by size of body, 315 – 365 x 149 – 166; smooth body surface; rostrum with two deep incisions, central protruding and two small lateral tubercles; sensillus with five-six branches, each branch divided into two long cilia distally; ten pairs of short and smooth notogastral setae; leg setae *a''* and *pv''* on tarsi IV modified, with radiate cilia distally.

Description

Measurements — Body length 365 (holotype), 315 – 365 (mean 336, 12 paratypes); body width 166 (holotype), 149 – 166 (mean 159, 12 paratypes). Females slightly larger than males: body length of females (holotype and four paratypes) 348 – 365 (mean 355), body width of all females (holotype and four paratypes) 166; body length of males (eight paratypes) 315 – 348 (mean 328), body width of males (eight paratypes) 149 – 166 (mean 155).

Integument — Body color light brown to brown. Surface of body smooth. Distinct polygonal sculpturing in anogenital region absent.

Prodorsum — (Figure 1A, C; Figure 2A–D). Rostrum with two deep incisions, central protruding and two small lateral tubercles (Figure 2A). Costular lines slightly developed. Small median tubercles of interbothridial region and lateral tubercles of postbothridial region directed towards dorsose-jugal scissure, rounded posteriorly. Rostral (*ro*, 24 – 28), lamellar (*le*, 12), interlamellar (*in*, 12 – 20) and exobothridial (*ex*, 8) setae setiform, thin, smooth. Sensilli (*ss*, 53 – 61) with five-six branches, each branch divided into two long cilia distally.

Notogaster and lateral part of body — (Figure 1A, C). Ten pairs of notogastral setae. Setae *c* very short (2 – 4), others setae longer (12 – 16), straight, thin, smooth. Lyrifissures (*ia*, *im*, *ip*, *ih*, *ips*) well-developed, long. Opisthosomal gland opening indistinct. Discidia (*di*) strongly, triangular.

Anogenital region — (Figure 1B; Figure 2E, F). Two pairs anal (*an*₁, *an*₂, 8 – 12), three pairs adanal (*ad*₁–*ad*₃, 12), one pair aggenital (*ag*, 6 – 8) and five

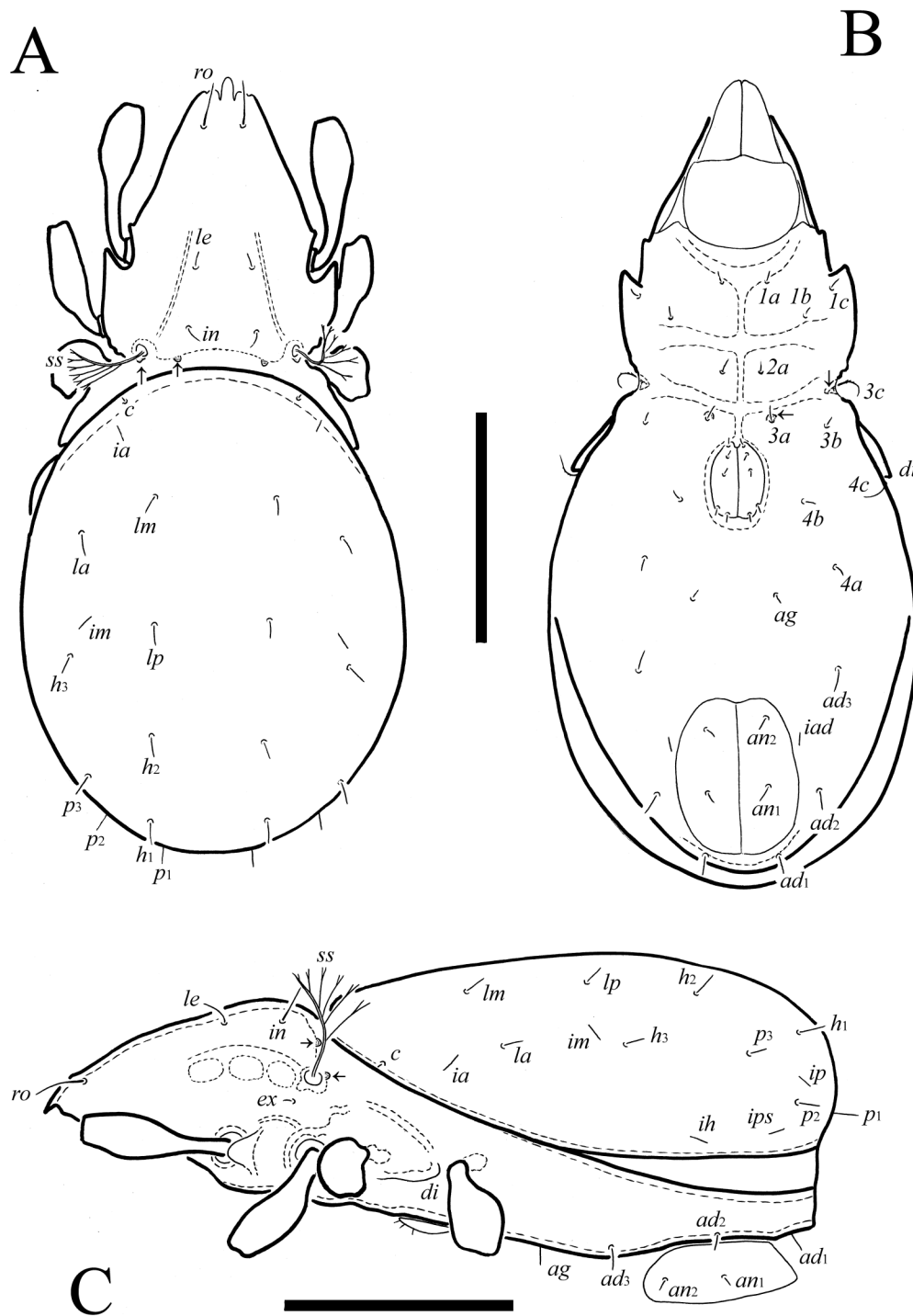


FIGURE 1: *Pulchroppia roynortoni* n. sp. A – dorsal view, legs partly removed; B – ventral view, legs removed; C – lateral view, legs partly removed, gnathosoma and epimeral setae removed. Scale bars (A + B, C) 100 µm.

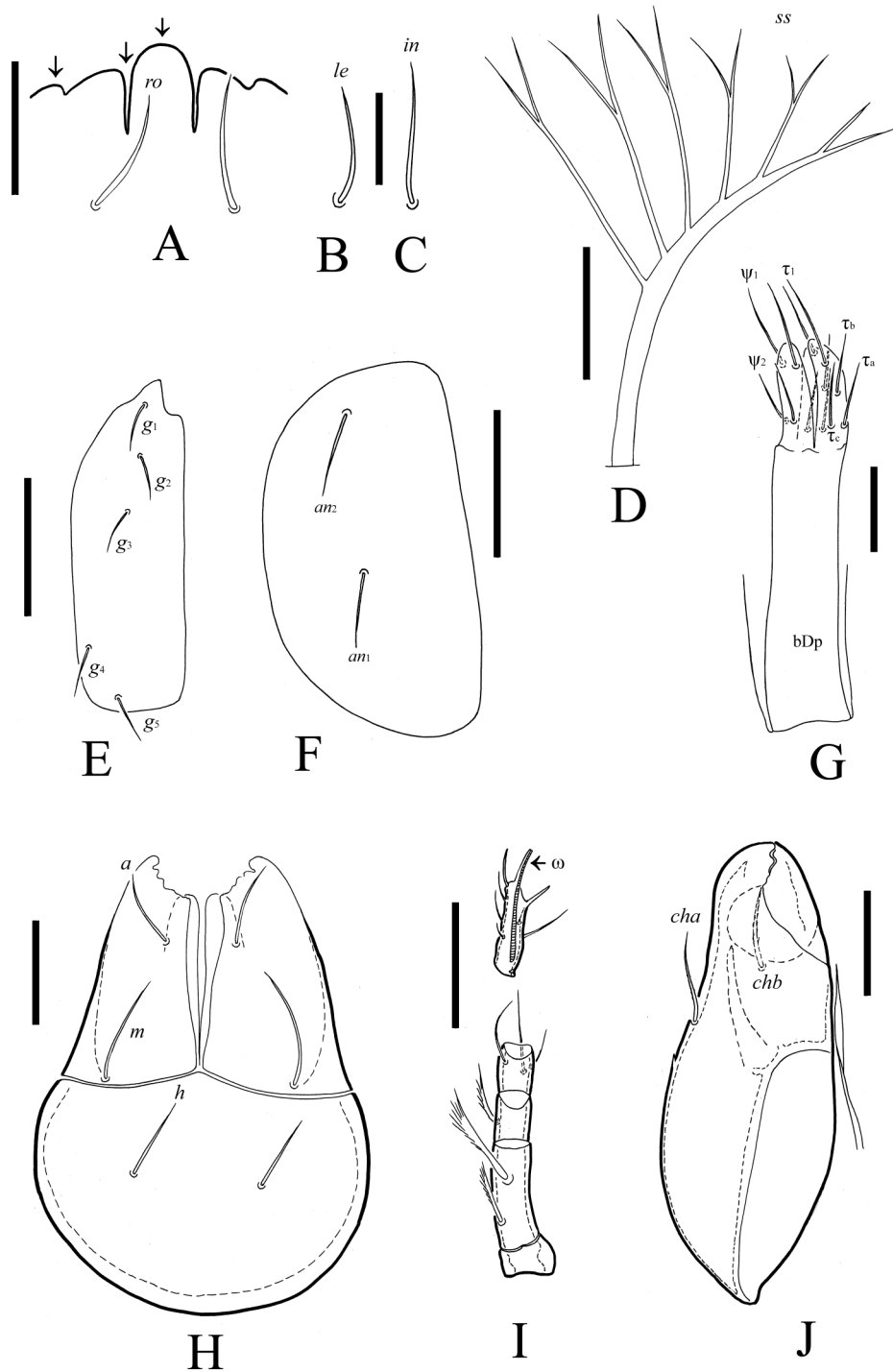


FIGURE 2: *Pulchroppia roynortoni* n. sp. A – rostrum and rostral setae; B – lamellar seta; C – interlamellar seta; D – sensillus; E – genital plate, right; F – anal plate, right; G – ovipositor; H – subcapitulum; I – palp; J – chelicera. Scale bars (A, D – J) 20 μ m, scale bar (B + C) 10 μ m.

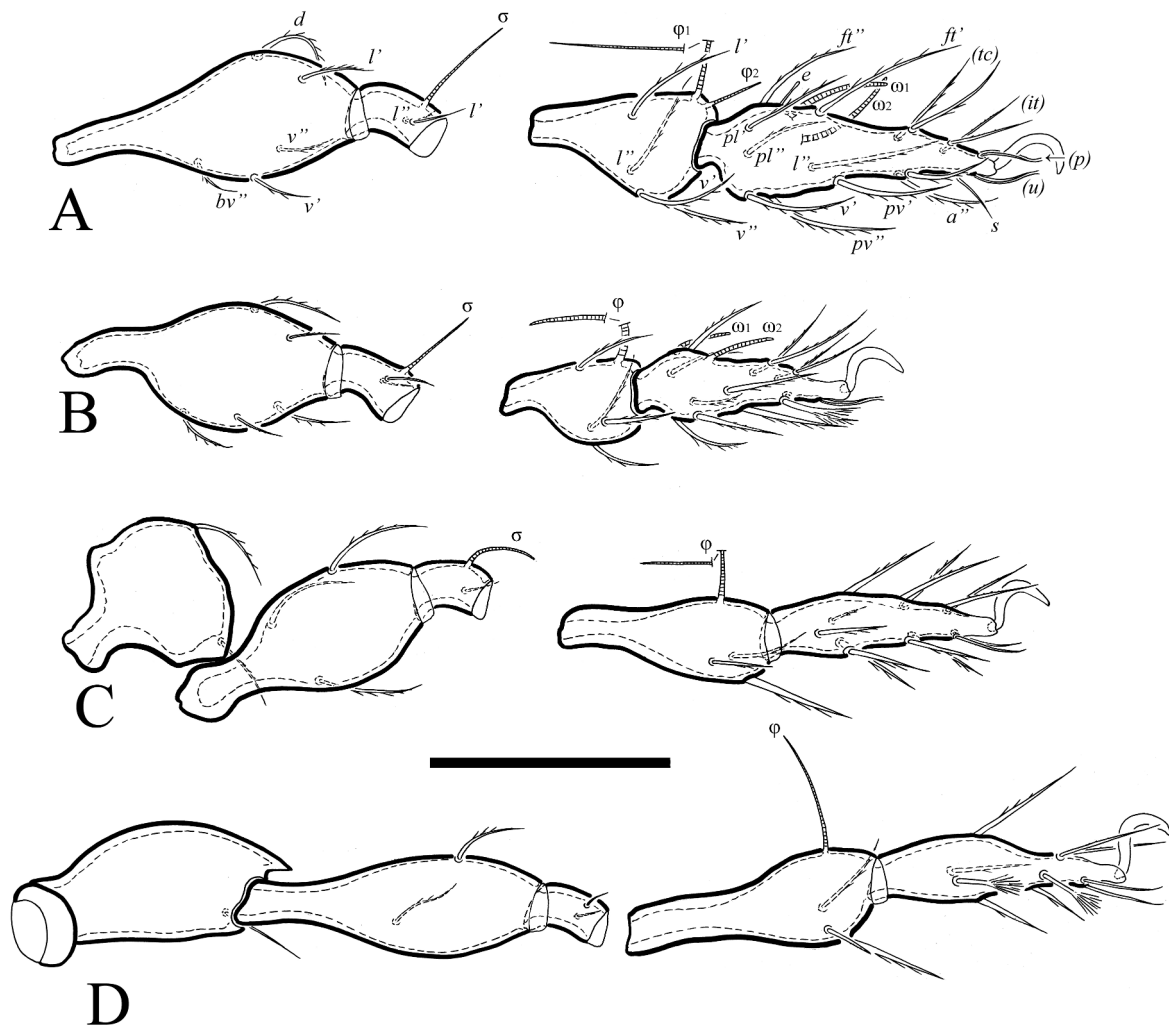


FIGURE 3: *Pulchroppia roymortoni* n. sp. A – leg I, without trochanter, left, paraxial view; B – leg II, without trochanter, left, paraxial view; C – leg III, right, paraxial view; D – leg IV, right, paraxial view. Scale bar (A + B + C + D) 50 μ m.

pairs genital (g_1 – g_5 6 – 8) setae, thin, smooth. Lyri-fissures *iad* well-developed, in typical position for genus. Anterior part of genital plates with short, triangular projections and with rectangular concavity between them. Ovipositor (Figure 2G) elongate, narrow (89 – 93 x 16); length of lobes 24 – 28, length of cylindrical distal part (bDp) 65. Lobes with 12 pairs thin, smooth setae; $\psi_1 \approx \tau_1$ (20 – 24) longer than $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$ (16). Setae *k* absent.

Epimeral region — (Figure 1B). Setae 3*c* and 4*c*

24, setiform, curved, barbed. Others setae shorter (12 – 16), straight, smooth. Setae 3*a* set adjacent to small tubercles. Setae 3*c* set on small apophyses laterally.

Gnathosoma — (Figure 2H–J). Subcapitulum longer than wide: 86 – 102 x 61 – 69. Hypostomal setae setiform, smooth; *a* and *h* (14 – 16) shorter than *m* (24). Lateral lips wide and rectangular distally, adoral setae absent. Palps (length 53 – 57) with setation 0-2-1-3-8(+1 ω). All setae (except on tarsi) with

long cilia (on femora and genua) or barbs (on tibiae). Palptarsal solenidion very long, thickened, lying adjacent to *acm* distally. Chelicerae (length 82 – 94) chelate-dentate, with small thorn on dorsal side. Cheliceral setae setiform, barbed, *cha* (20) slightly longer than *chb* (16).

Legs — (Figure 3). All legs with one simple claw. Formulae of leg setation and solenidia: I (1-5-2-4-20) [1-2-2], II (1-5-2-4-15) [1-1-2], III (2-3-1-3-13) [1-1-0], IV (1-2-2-3-10) [0-1-0]; homology of setae and solenidia indicated in Table 1. Setae (except *p* and famulus) with cilia or barbs. Setae *a''* and *pv''* on tarsi IV modified in all specimens, with radiate cilia distally. Setae *p* on tarsi II – IV absent. Famulus short, dilated distally. Solenidia ω_1 and ω_2 on tarsi I, ω_1 and ω_2 on tarsi II, φ_1 on tibiae II, φ on tibiae IV, σ on genua III thickened, rod-like. Others solenidia setiform, straight, with thinner tips, blunt-ended.

Material examined — Holotype (female) and 12 paratypes (eight males and four females) were obtained from southern Vietnam, 11°25' N, 107°25' E, 149 m a.s.l., in dark loamy soil of *Lagerstroemia* forest, February-March 2009, collected by A.E. Anichkin.

Type deposition — The holotype is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; 11 paratypes are deposited in the collection of Siberian Zoological Museum, Novosibirsk, Russia; one paratype are in the personal collection of the first author.

Etymology — The specific name is dedicated to our colleague, the acarologist Roy A. Norton, Syracuse N.Y., USA.

Distribution — At present, this species is only known from Cat Tien National Park of southern Vietnam.

Remarks — *Pulchroppia roynortoni* n. sp. clearly differs from all the species of *Pulchroppia* (*P. burckhardti* Mahunka, 1987 from Borneo, *P. elegans* Hammer, 1979 from Java, *P. granulata* Mahunka, 1988 from Oriental region, *P. malapectinata* (Corpuz-Raros, 1979) from Philippines, *P. pendula* (Balogh, 1970) from Sri Lanka, *P. ramifera* Wang and Li, 1997 from China — see Wang, Li and Zheng 1997 —, *P. sculpturata* Mahunka, 2008 from Thailand) by the specific structure of rostrum (with two deep incisions, central protruding and two small lateral tubercles in new species; rounded in the other species) and the morphology of sensillus (each branch divided into two long cilia distally in new species; not divided or only partially divided in the other species).

Key to species of *Pulchroppia* from Vietnam

1. Rostrum with two incisions... *P. roynortoni* n. sp.
— Rostrum rounded 2
2. Notogastral setae smooth..... *P. elegans* Hammer
— Notogastral setae with cilia.....
..... *P. granulata* Mahunka

Lineoppia microseta n. sp. (Figures 4 – 6)

Diagnosis

The new species is characterized by the size of body, 180 – 200 x 90 – 98; surface of anogenital

TABLE 1: Leg setation and solenidia of *Pulchroppia roynortoni* n. sp.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	<i>v'</i>	<i>d, l', bv'', (v)</i>	(<i>l</i>), σ	(<i>l</i>), (<i>v</i>), φ_1, φ_2	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), <i>v'</i> , (<i>pl</i>), <i>l''</i> , e, ω_1, ω_2
II	<i>v'</i>	<i>d, l', bv'', (v)</i>	(<i>l</i>), σ	(<i>l</i>), (<i>v</i>), φ	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), (<i>l</i>), ω_1, ω_2
III	<i>l', v'</i>	<i>d, l', ev'</i>	<i>l', \sigma</i>	<i>l', (v), \varphi</i>	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)
IV	<i>v'</i>	<i>d, ev'</i>	<i>d, l'</i>	<i>l', (v), \varphi</i>	<i>ft'', (tc), (u), (a), s, (pv)</i>

Roman letters refer to normal setae, *e* to famulus, Greek letters to solenidia. Single prime (') marks setae on anterior and double prime (") setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

region and epimeres 3+4 with long longitudinal striae; costular lines short and thin; interlamellar setae minute; apodemes 4 fused posterior to genital plates, straight; lyrifissures *iad* located in direct apoanal position; tibiae of leg II with antero-ventral projection, having fusiform seta *v''*.

Description

Measurements — Body length 180 (holotype), 196 – 200 (mean 198, two paratypes); body width 90 (holotype), 94 – 98 (mean 96, two paratypes).

Female slightly larger than males: body length of female (paratype) 200, body width 98; body length of males (holotype and one paratype) 180 – 196 (mean 188), body width 90 – 94 (mean 92).

Integument — Body color light brown. Surfaces of prodorsum and notogaster smooth; surface of anogenital region and epimeres 3+4 with well-developed long longitudinal striae. Epimeral region with muscle sigillae.

Prodorsum — (Figure 4A, C; Figure 5A). Rostrum rounded. Costular lines short and thin. Lateral striae long. Interbothridial region with one pair of small median tubercles and two pairs of muscle sigilla. Postbothridial region with one pair of tubercles directed towards dorsosejugal suture. Rostral setae 10 – 14, setiform, slightly barbed (barbs visible only under high magnification). Lamellar and exobothridial setae (both 8) setiform, smooth. Interlamellar setae minute (1 – 2). Sensillus 53 – 61, setiform, thickened, curved, with barbs unilaterally.

Notogaster and lateral part of body — (Figure 4A, C). Slightly convex anteriorly. Anterior margin with one pair of robust humeral tubercles directed to postbothridial tubercles. Ten pairs of notogastrol setae similar in length (8 – 12), setiform, thin, smooth. Setae *c*, *p*₁ and *p*₂ little shorter than others. Lyrifissures (*ia*, *im*, *ip*, *ih*, *ips*) well-developed, elongate. Opisthosomal gland opening indistinct. Discidia elongate.

Anogenital region — (Figure 4B; Figure 5B, C). All apodemes well-developed. Apodemes 4 fused posterior to genital plates, straight. Two pairs anal, three pairs adanal, one pair aggenital and five pairs genital setae similar in length (4 – 6), setiform,

smooth. Lyrifissures *iad* conspicuously long, located in direct apoanal position. Ovipositor (Figure 5D) elongate, narrow (77 × 12); length of lobes 28, length of cylindrical distal part 49. Lobes with 12 pairs thin, smooth setae; $\psi_1 \approx \tau_1$ (18) longer than $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$ (12). Setae *k* absent.

Epimeral region — (Figure 4B). Setae similar in length (8–12), setiform, thin, smooth. Setae 3c set on small apophyses laterally.

Gnathosoma — (Figure 5E–G). Subcapitulum longer than wide: 45 × 36. Hypostomal setae similar in length (8 – 10), setiform, smooth. Adoral setae absent. Palps (length 32) with setation 0-2-1-3-9(+1 ω). All setae (except on tarsi) slightly barbed. Palptarsal solenidion long. Chelicerae (length 49) chelate-dentate. Cheliceral setae setiform, barbed, *cha* (12 – 14) longer than *chb* (8).

Legs — (Figure 6). All legs with one simple claw each. Formulae of leg setation and solenidia: I (1-5-2-4-20) [1-2-2], II (1-5-2-4-13) [1-1-2], III (2-3-1-3-13) [1-1-0], IV (1-2-2-3-10) [0-1-0]; homology of setae and solenidia indicated in Table 2. Many setae slightly barbed. Tibiae II with antero-ventral projection, having fusiform seta *v''*. Setae *p* on tarsi II – IV absent. Famulus minute. Solenidia ω_2 on tarsi I and φ_1 on tibiae I setiform; others solenidia thickened, blunt-ended. Solenidia of genua pressed to segments, curved.

Material examined — Holotype (male) and two paratypes (male and female) were obtained from southern Vietnam, 11°25' N, 107°25' E, 149 m above sea level, in dark loamy soil of *Lagerstroemia* forest, February–March 2009, collected by A.E. Anichkin.

Type deposition — The holotype is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; one paratype is deposited in the collection of Siberian Zoological Museum, Novosibirsk, Russia; one paratype is in the personal collection of the first author.

Etymology — The name "*microseta*" refers to the very short interlamellar setae.

Distribution — At present, this species is only known from Cat Tien National Park of southern Vietnam.

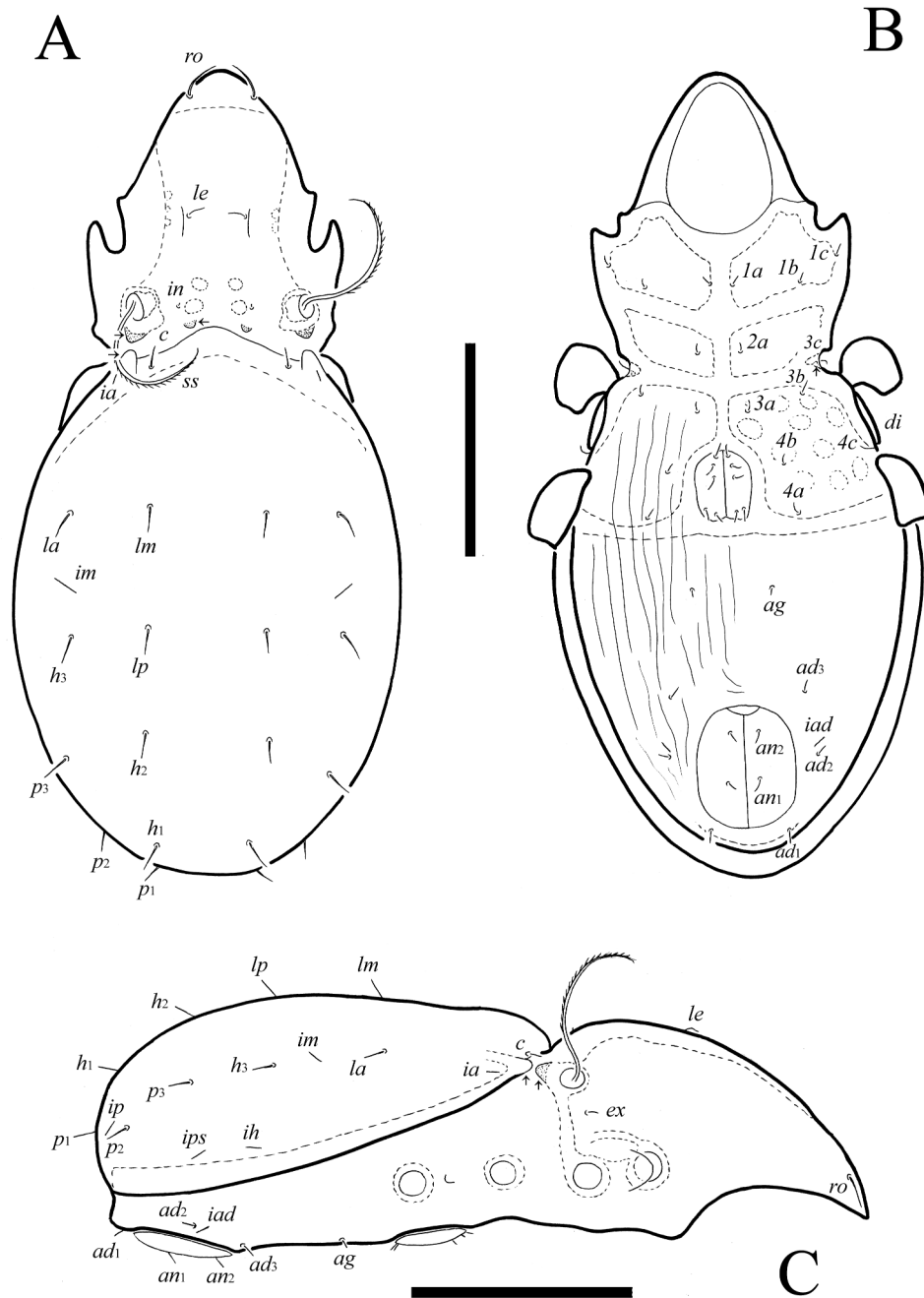


FIGURE 4: *Lineoppia microseta* n. sp. A – dorsal view, legs removed; B – ventral view, legs partly removed, gnathosoma removed; C – lateral view, legs gnathosoma and epimeral setae removed. Scale bars (A + B, C) 50 μm.

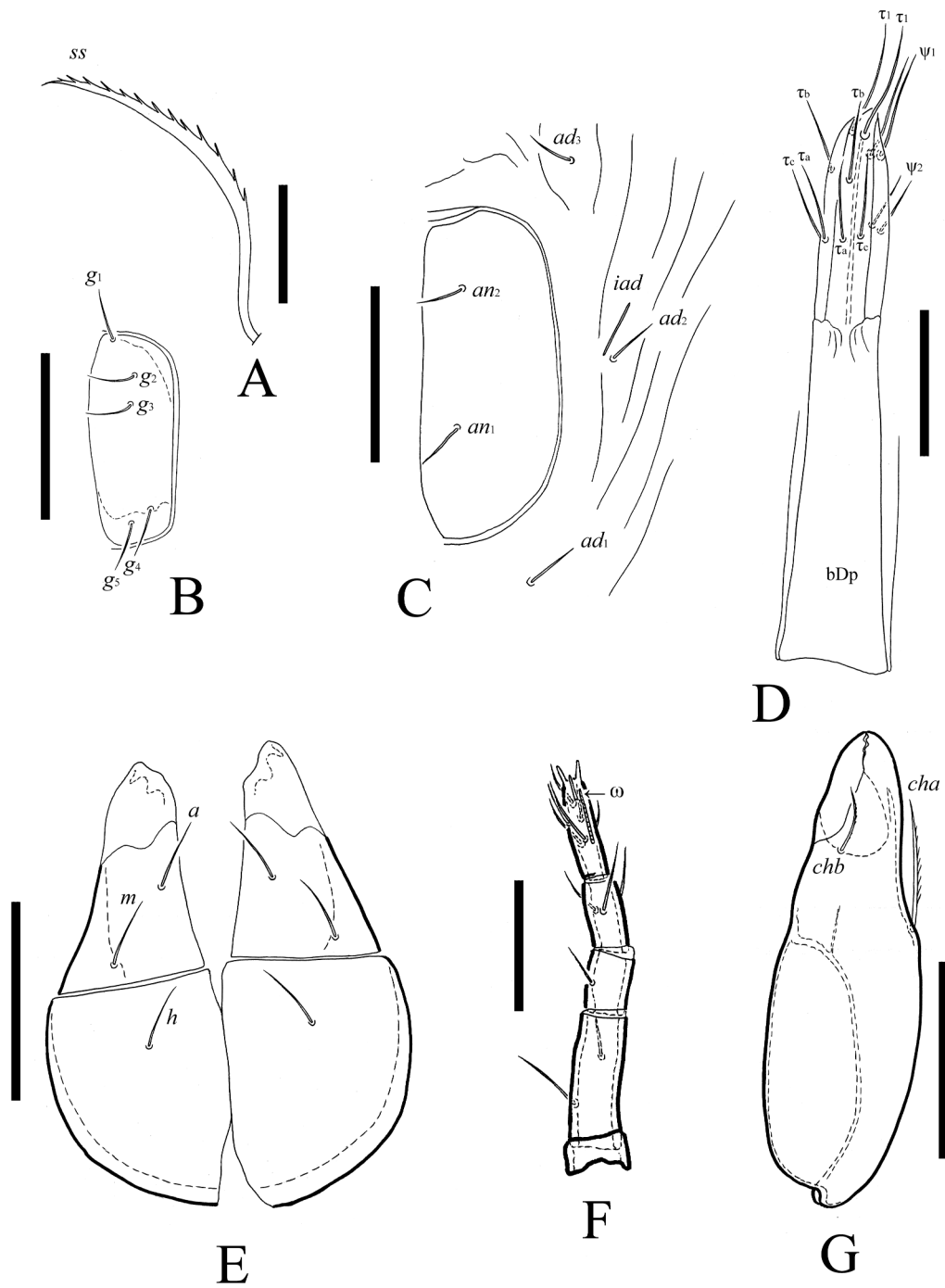


FIGURE 5: *Lineoppia microseta* n. sp. A – sensillus; B – genital plate, left; C – anal plate, left and adanal setae; D – ovipositor; E – subcapitulum; F – palp; G – chelicera. Scale bars (A – E, G) 20 μ m, scale bar (F) 10 μ m.

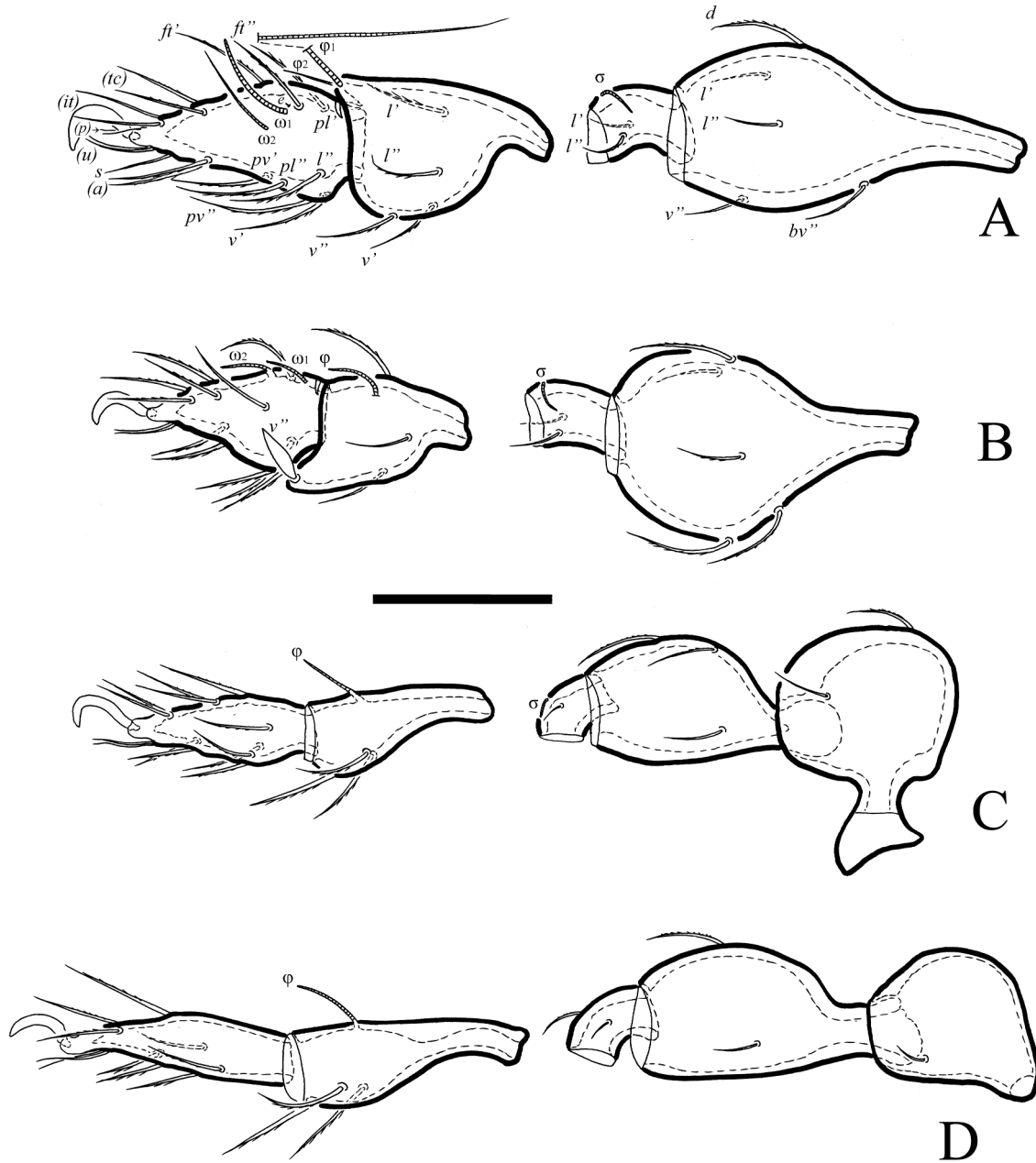


FIGURE 6: *Lineoppia microseta* n. sp. A – leg I, without trochanter, left, antiaxial view; B – leg II, without trochanter, left, antiaxial view; C – leg III, right, antiaxial view; D – leg IV, right, antiaxial view. Scale bar (A + B + C + D) 20 μ m.

TABLE 2: Leg setation and solenidia of *Lineoppia microseta* n. sp.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	$d, (l), bv'', v''$	$(l), \sigma$	$(l), (v), \Phi_1, \Phi_2$	$(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', e, \omega_1, \omega_2$
II	v'	$d, (l), bv'', v''$	$(l), \sigma$	$(l), (v), \Phi$	$(ft), (tc), (it), (u), (a), s, (pv), \omega_1, \omega_2$
III	l', v'	d, l', ev'	l', σ	$l', (v), \Phi$	$(ft), (tc), (it), (u), (a), s, (pv)$
IV	v'	d, ev'	d, l'	$l', (v), \Phi$	$ft'', (tc), (u), (a), s, (pv)$

See Table 1 for explanation.

Remarks — *Lineoppia microseta* n. sp. is similar in having a lineate anogenital region to *Lineoppia frouini* Balogh and Balogh, 1983 from New Caledonia. The anogenital region is not lineate in the other known species of the genus *Lineoppia mastax* (Balogh and Mahunka, 1977) from Neotropical region and *Lineoppia tuberosa* (Mahunka, 2009) from Madagascar. The new species differs from *Lineoppia frouini* by the smaller body length (180–200 in new species; 287 in *Lineoppia frouini*), very short costular lines (costular lines longer in *Lineoppia frouini*), the morphology of interlamellar setae (minute in the new species; absent, only alveoli present, in *Lineoppia frouini*), absence of integumental lines on notogaster (lines well-developed in *Lineoppia frouini*), position of notogastral setae *la* and *lm* (on one horizontal line in new species; *la* considerably anterior to *lm* in *Lineoppia frouini*), position of lyrifissures *iad* (direct apoanal in new species; inverse apoanal in *Lineoppia frouini*), position of apodemes 4 (straight in new species; inclined in *Lineoppia frouini*).

Key to known species of *Lineoppia*

1. Anogenital region lineate, five pairs of genital setae 2
- Anogenital region not lineate, six pairs of genital setae 3
2. Lyrifissures *iad* in direct apoanal position *L. microseta* n. sp.
- Lyrifissures *iad* in inverse apoanal position *L. frouini* Balogh and Balogh
3. Notogaster with six pairs of long setae *L. mastax* (Balogh and Mahunka)

— Notogaster without long setae
 *L. tuberosa* (Mahunka)

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