

## Four new species of oribatid mites (Acari: Oribatida) from Vietnam

## Четыре новых вида панцирных клещей (Acari: Oribatida) из Вьетнама

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Four new species of oribatid mites, *Unguizetes cattienensis* sp. nov. (Mochlozetidae), *Gigantoppia zryanini* sp. nov. (Granuloppiidae), *Caucasiozetes frankeae* sp. nov. (Microzetidae) and *Otocephus (Acrotocephus) vietnamicus* sp. nov. (Otocephidae) from forest soil, litter and decaying wood of Cat Tien National Park in southern Vietnam are described. The representative of the genus *Gigantoppia* as well as *Unguizetes sphaerula* is recorded for the first time in Vietnam, and the genus *Caucasiozetes* is firstly recorded in the Oriental Region. A new generic diagnosis of *Caucasiozetes* is presented, and an identification key to the Vietnamese species of *Otocephus (Acrotocephus)* is presented.

Четыре новых вида панцирных клещей – *Unguizetes cattienensis* sp. nov. (Mochlozetidae), *Gigantoppia zryanini* sp. nov. (Granuloppiidae), *Caucasiozetes frankeae* sp. nov. (Microzetidae) and *Otocephus (Acrotocephus) vietnamicus* sp. nov. (Otocephidae) описаны из лесной почвы, мусора и подстилки в Кат Тьене национальном парке в южном Вьетнаме. Представитель рода *Gigantoppia* и вид *Unguizetes sphaerula* впервые отмечены во Вьетнаме, *Caucasiozetes* впервые отмечен в Ориентальной области. Представлен новый диагноз рода *Caucasiozetes*. Предложен идентификационный ключ к вьетнамским видам *Otocephus (Acrotocephus)*.

**Key words:** Cat Tien National Park, Vietnam, oribatid mites, *Unguizetes*, *Gigantoppia*, *Caucasiozetes*, *Otocephus*, key, new diagnosis, new species

**Ключевые слова:** Национальный парк Кат Тьен, Вьетнам, панцирные клещи, *Unguizetes*, *Gigantoppia*, *Caucasiozetes*, *Otocephus*, ключ, новый диагноз, новые виды

### INTRODUCTION

This is a part of our continuing studies on Vietnamese oribatid mite fauna (see Ermilov & Anichkin, 2010, 2011a, 2011b, 2011c; Ermilov et al., 2011), and includes the data on four new species belonging to the following genera: *Unguizetes* Sellnick, 1925 (Mochlozetidae), *Gigantoppia* Mahunka, 2008 (Granuloppiidae), *Caucasiozetes* Shtanchaeva, 1984 (Microzetidae), *Otocephus* Berlese, 1905 (subgenus

*Acrotocephus* Aoki, 1965) (Otocephidae) collected from the Cat Tien National Park. Earlier we presented a brief history of the research on oribatid mites of Vietnam and the geographical and floristic descriptions of the Cat Tien National Park in the southern part of the country (Ermilov & Anichkin, 2010).

The genus *Unguizetes* comprises 15 species that are collectively distributed in the Pantropical and Subtropical regions (Subías, 2004, online version 2011). By present,

a single species *U. clavatus* Aoki, 1967, has been recorded from Vietnam. We found two additional species, a new one, *U. cattienensis* **sp. nov.**, and *U. sphaerula* (Berlese, 1905) which was known previously from elsewhere in the Oriental Region including Japan (Subías, 2004, 2011). These two species are sympatrically found in the same place (see below in the description of *U. cattienensis* **sp. nov.**).

The genus *Gigantoppia* is currently monotypic, and the type species is distributed in Thailand (Subías, 2004, 2011). The species described below, *G. zryanini* **sp. nov.**, is a first reported representative of *Gigantoppia* in Vietnam.

The genus *Caucasiozetes* also contains one species that was described from Dagestan (the Caucasus). A species described below, *C. frankeae* **sp. nov.**, is the first finding of this genus in the Oriental Region. Since some aspects of morphology (insertion of interlamellar setae, shape of distal part of lamellae, morphology of rostral setae) are not entirely consistent with the existing diagnosis of *Caucasiozetes*, we propose here below a new broader diagnosis slightly expanding the list of characters usually included.

The subgenus *Otocephus* (*Acrotocephus*) comprises more than 30 species (Mahunka, 2000; Subías, 2004, 2011; Corpuz-Raros, 2009), many of which are distributed in the Oriental Region. So far, two species of this subgenus have been recorded from Vietnam (Balogh and Mahunka, 1967): *O. (A.) duplicornutus* Aoki, 1965 and *O. (A.) triplicornutus* (Balogh & Mahunka, 1967), and we describe the third species, *O. (A.) vietnamicus* **sp. nov.**

In conclusion, we presented an identification key to the Vietnamese species of *Otocephus* (*Acrotocephus*), based on own materials and literature data.

## MATERIALS AND METHODS

Collection localities and habitats of the new species are characterised in the respective sections below.

Specimens were studied in lactic acid, mounted in temporary cavity slides for the duration of the study, and then stored in 70% alcohol in tubes. Body measurements are presented in micrometers ( $\mu\text{m}$ ). 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 distension. Notogastral width refers to the maximum width in dorsal aspect. Length of body setae was measured in lateral aspect. Some paratypes of each species were dissected for a detailed examination (gnathosoma, ovipositor, legs).

Formulae for leg setation are given in parentheses 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.

## RESULTS

### Family MOCHLOZETIDAE

#### Genus *Unguizetes* Sellnick, 1925

#### *Unguizetes cattienensis* **sp. nov.**

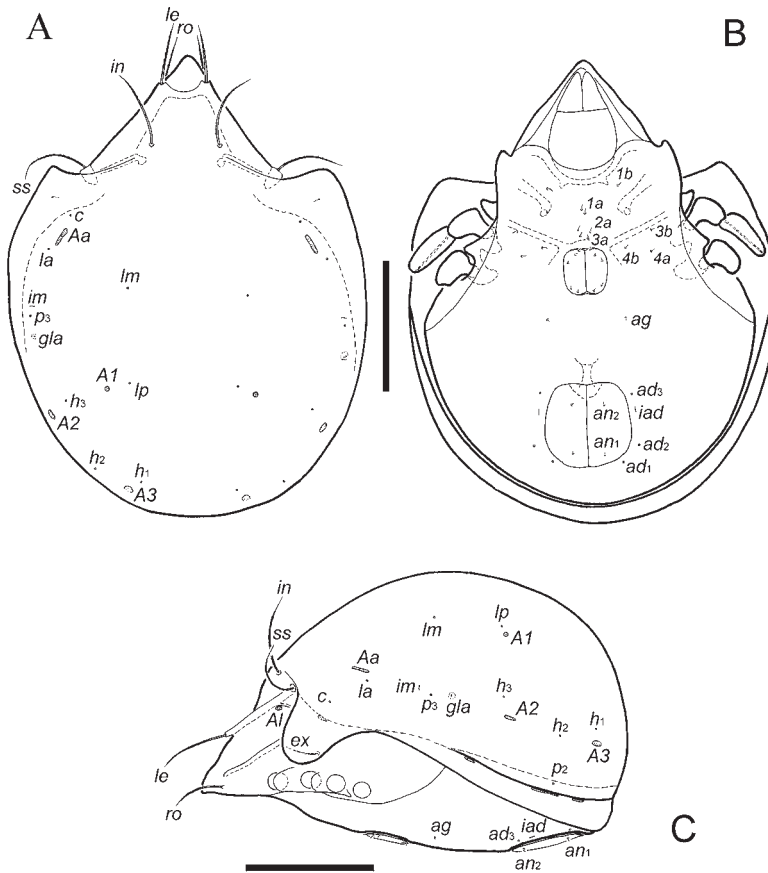
(Figs 1–3)

Character states of *Unguizetes* as summarized by Sellnick (1925), Balogh & Balogh (1992).

**Type material.** *Holotype* (male) and two *paratypes* (female and male) were obtained from: Vietnam, 11°26'N, 107°19'E, Cat Tien National Park, near Bau Sau village, yellow trail, 200 m a. s. l., in decaying wood on ferralitic soil from polydominate forest, 28 Apr. 2010, coll. V.A. Zryanin. Two other *paratypes* (female and male) were obtained from Vietnam, 11°26'N, 107°26'E, Cat Tien National Park, 137 m above sea level, in sandy soil of dipterocarp forest, Febr.–March 2009, coll. A.E. Anichkin.

#### **Deposition of holotype and paratypes.**

The holotype is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia (ZIN); three paratypes are deposited in the



**Fig. 1.** *Unguizetes cattienensis* sp. nov.: **A**, dorsal view, legs not shown; **B**, ventral view, legs partly, palps and subcapitular setae not shown; **C**, lateral view, gnathosoma and legs not shown. Scale bar: 200  $\mu$ m.

collection of the Center for Biodiversity Resources Education and Development, Hanoi National University of Education, Hanoi, Vietnam (CEBRED HU); one paratype is in the personal collection of the first author.

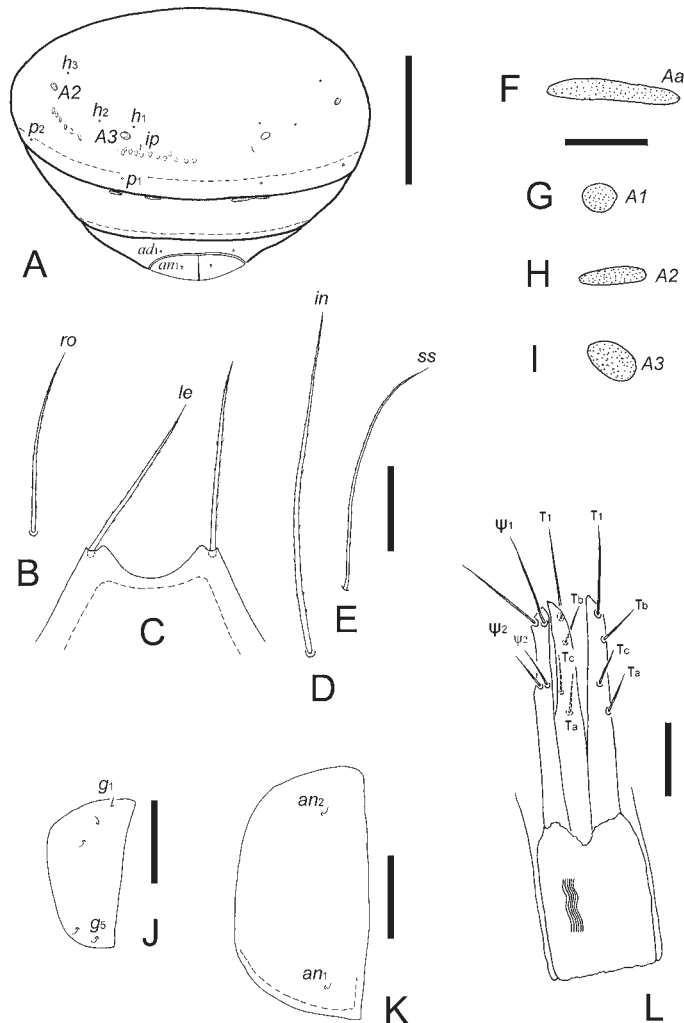
**Diagnosis.** The new species is characterised by a combination of the following character states: body size 680–780  $\times$  498–581; lamellar cusps with minute, pointed outer tooth and blunt or pointed inner tooth; translamella with distinct concavity medially; rostral (*ro*), lamellar (*le*), interlamellar (*in*), exobothridial (*ex*) setae and sensilli (*ss*) setiform, barbed; rostral setae located on small tubercles, separate from tutorium; area porosae *Aa* obviously ob-

long, *A2* slightly oblong, *A1* round, *A3* oval; five pairs of genital setae.

**Description.** *Measurements.* Body length 713 (holotype), 680–780 (four paratypes); body width 531 (holotype), 498–581 (four paratypes).

*Integument.* Body color brown. Cuticular surface smooth.

*Prodorsum* (Figs 1A, C; 2B–E). Rostrum conical, rounded in dorsal view, without lateral teeth. Lamellar cusps with minute pointed outer tooth and blunt or pointed inner tooth. Translamella distinctly arched, concave. Rostral (86–90), lamellar (98–110), interlamellar (164–188), exobothridial (36–41) setae and sensilli (135–147)



**Fig. 2.** *Unguizetes cattienensis* sp. nov.: **A**, caudal view; **B**, rostral seta; **C**, lamellae, translamella and lamellar setae; **D**, interlamellar seta; **E**, sensillus; **F**, area porosa *Aa*; **G**, area porosa *A1*; **H**, area porosa *A2*; **I**, area porosa *A3*; **J**, genital plate, right; **K**, anal plate, right; **L**, ovipositor. Scale bars: 200  $\mu$ m (**A**), 50  $\mu$ m (**B**–**E**, **J**–**L**), 20  $\mu$ m (**F**–**I**).

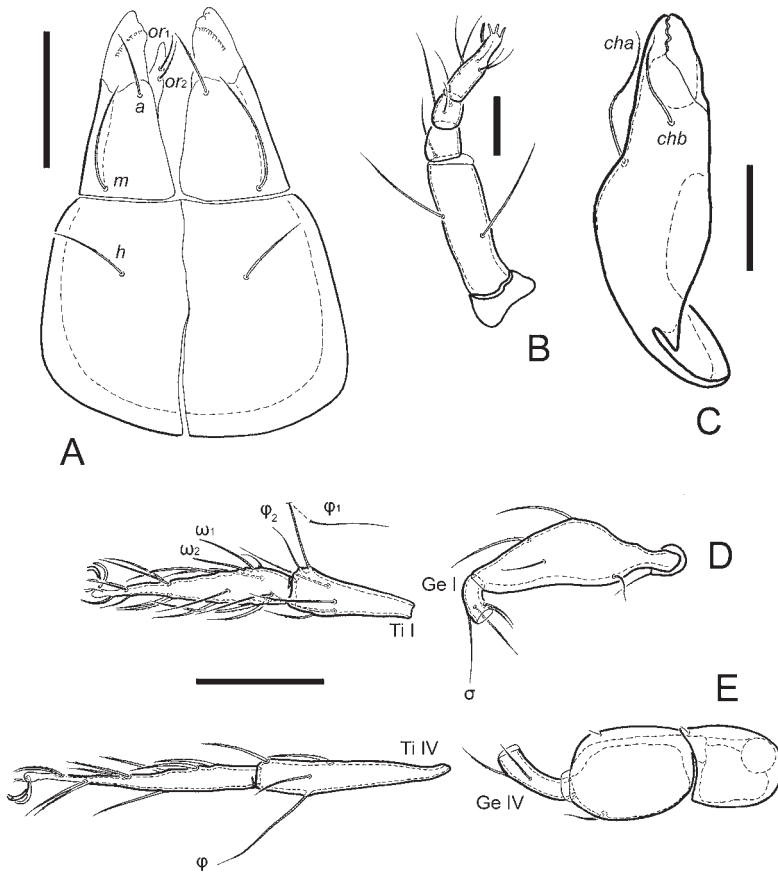
setiform, barbed. Rostral setae located on tubercles separate from tutorium.

*Notogaster* (Figs 1A, C; 2A, F–I). Ten pairs of notogastral setal alveoli present. Four pairs of areae porosae different in shape: *Aa* obviously oblong, *A2* slightly oblong; *A1* small, round; *A3* oval.

*Lateral part of body* (Fig. 1C). Tutorium well developed. Marginoventral areae porosae oval or narrow, oblong; their num-

ber and morphology varied among specimens.

*Anogenital region* (Figs 1B; 2J–L). Two pairs of anal (*an<sub>1</sub>*, *an<sub>2</sub>*), one pair aggenital (*ag*) and five pairs of genital (*g<sub>1</sub>*–*g<sub>5</sub>*) setae short (8), setiform. Three pairs of adanal setae (*ad<sub>1</sub>*–*ad<sub>3</sub>*) very short (2–4) or absent (only alveoli present). Ovipositor elongate, narrow (237  $\times$  57). Length of terminal blades 143, length of cylindrical distal part 94. Se-



**Fig. 3.** *Unguizetes cattienensis* sp. nov.: **A**, subcapitulum (mentum broken); **B**, palp; **C**, chelicera; **D**, leg I, left, antiaxial view; **E**, leg IV, left, antiaxial view. Scale bars: 50  $\mu$ m (A, C), 20  $\mu$ m (B), 100  $\mu$ m (D–E).

tae smooth,  $\psi_1 \approx \tau_1$  (61) longer than  $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$  (32). Setae *k* and their alveoli absent.

**Epimeral region** (Fig. 1B). Epimeral setal formula: 3–1–3–3. Setae setiform, barbed, with different lengths: *1a*, *2a*, *3a*, *3b*, *4a*, *4b*, 16–20; *1b*, *1c* 24–28; *3c* 36–41, *4c* 20–36. Setae *1c*, *3c*, *4c* well visible only in dissected specimens.

**Gnathosoma** (Fig. 3A–C). Subcapitulum longer than wide: 159  $\times$  114. Hypostomal setae *a*, *m*, *h* setiform, barbed; *h* and *a* (both 28) shorter than *m* (49). Two pairs of adoral setae short (16), setiform, barbed. Palp (length 114) with setation 0–2–1–3–9(+1 $\omega$ ). All setae (except some on tarsus) barbed. Chelicera (length 176) with few blunt teeth on fixed and movable digits.

Cheliceral setae long, setiform, barbed: *cha* (73) longer, than *chb* (45).

**Legs** (Fig. 3D–E). Formulae of leg setation and solenidia: I (1–4(or 5)–3–4–20) [1–2–2], II (1–5–3–4–15) [1–1–2], III (2–3–1–3–15) [1–1–0], IV (1–2–2–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1. Almost all setae well barbed. Famulus minute, inserted between solenidion  $\omega_2$  and seta *ft*<sup>2</sup>. Solenidia  $\omega_1$  and  $\omega_2$  on tarsi II,  $\sigma$  on genua III rod-like, other solenidia setiform.

**Etymology.** The specific name “*cattienensis*” refers to the Cat Tien National Park, where the species was collected.

**Remarks.** Known species of *Unguizetes* can be ascribed to one of the two groups: 1)

**Table 1.** Leg setation of *Unguizetes cattienensis* sp. nov. Roman letters refer to normal setae (*e* – famulus), Greek letters refer to solenidia. 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.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	<i>v'</i>	<i>d, l' or (l), v", bv"</i>	<i>(l), v', σ</i>	<i>(l), (v), φ<sub>1</sub>, φ<sub>2</sub></i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l", e, ω<sub>1</sub>, ω<sub>2</sub></i>
II	<i>v'</i>	<i>d, (l), v", bv"</i>	<i>(l), v', σ</i>	<i>(l), (v), φ</i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv), ω<sub>1</sub>, ω<sub>2</sub></i>
III	<i>l', v'</i>	<i>d, l', ev'</i>	<i>l', σ</i>	<i>l', (v), φ</i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv)</i>
IV	<i>v'</i>	<i>d, ev'</i>	<i>d, l'</i>	<i>l', (v), φ</i>	<i>ft", (tc), (p), (u), (a), s, (pv)</i>

species with clavate sensilli which includes 14 species; 2) species with setiform sensilli which included only *U. setiger* (Balogh et Mahunka, 1978). *Unguizetes cattienensis* sp. nov. becomes the second species in the latter group. In addition to sharing setiform sensilli with the Brazilian *U. setiger* (Balogh & Mahunka, 1978; Mahunka, 1983), both are similar in body size and having five pairs of genital setae. However, these two species differ as follows: *U. cattienensis* has an obviously oblong area porosae *Aa* (oval in *U. setiger*), a slightly oblong area porosae *A2* (oval in *U. setiger*), a distinctly concave translamella (straight in *U. setiger*), and rostral setae inserted separately from the tutorium (setae *ro* on the tutorium in *Unguizetes setiger*).

#### Family GRANULOPPIIDAE

Genus *Gigantoppia* Mahunka, 2008

#### *Gigantoppia zryanini* sp. nov.

(Figs 4–6)

Character states of *Gigantoppia* as proposed by Mahunka (2008).

**Type material.** *Holotype* (male) and three *paratypes* (all males) were obtained from: Vietnam, 11°26'N, 107°19'E, Cat Tien National Park, near Bau Sau village, yellow trail, 170 m a. s. l., in decaying wood in a dipterocarp forest, on ferralitic soil under *Dipterocarpus alatus*, 2 May 2010, coll. V.A. Zryanin.

#### Deposition of holotype and paratypes.

The holotype is deposited in the ZIN collection; two paratypes are deposited in the CEBRED HU collection; one paratype is in the personal collection of the first author.

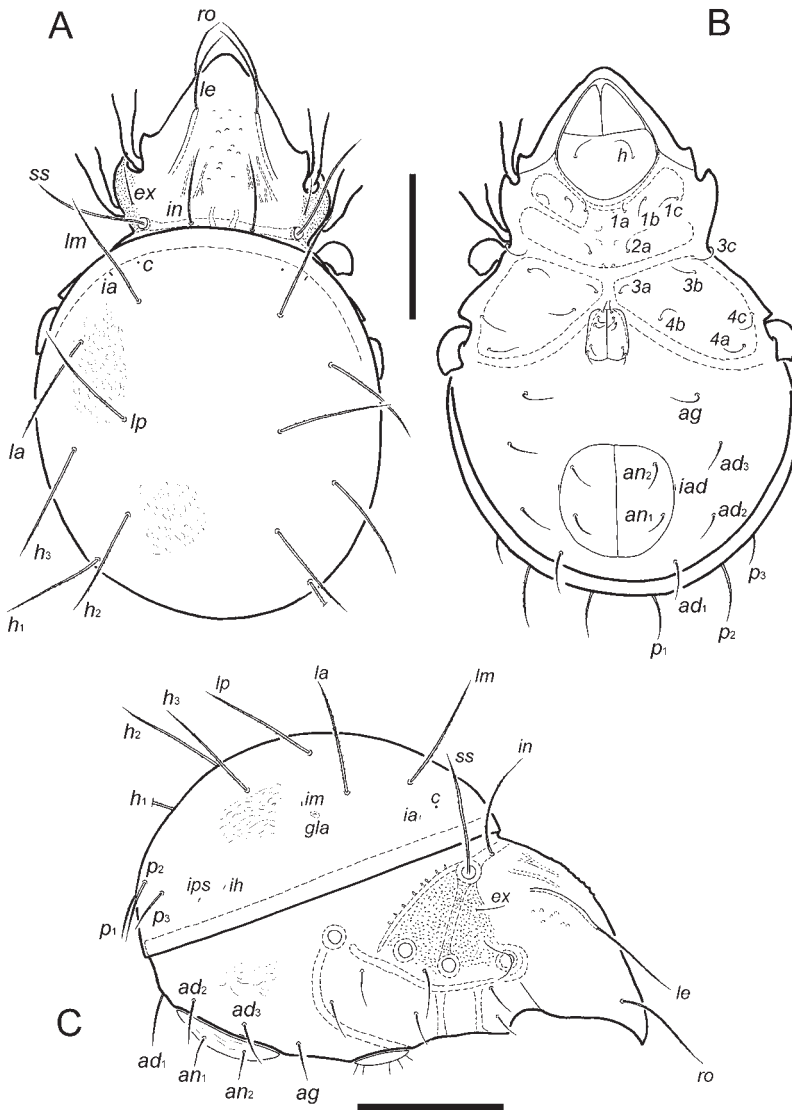
**Diagnosis.** The new species is characterised by the combination of the following character states: body size 763–830 × 464–531; cuticle between lamellae with tubercles and etched lines; notogaster and anogenital region with wavy folds; rostral, lamellar, interlamellar and exobothridial setae setiform, barbed; sensilli setiform, thickened, slightly dilated in median part, barbed; notogastral setae setiform, thickened, barbed, only *p*<sub>1</sub>–*p*<sub>3</sub> considerably shorter than other setae; *ad*<sub>1</sub> in adanal position; anal plates with wavy folds.

**Description.** *Measurements.* Body length 796 (holotype), 763–830 (three paratypes); body width 481 (holotype), 464–531 (three paratypes).

*Integument.* Body color brown. Region between lamellae with tubercles (diameter up to 12 μm) and etched lines. Lateral surfaces between bothridia and legs I–III with small granules (diameter up to 4 μm). Notogaster and anogenital region with wavy folds.

*Prodorsum* (Figs 4A, C; 5A–B). Rostrum rounded in dorsal view. Lamellar lines well-developed. Rostral (123–131), lamellar (127–135), interlamellar (164–172) and exobothridial (41–49) setae setiform, barbed. Sensilli (221–233) setiform, barbed, thickened, slightly dilated in median part.





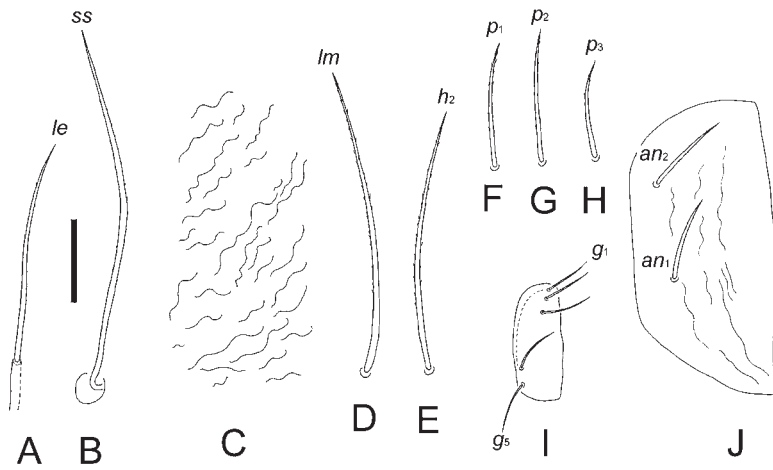
**Fig. 4.** *Gigantoppia zryanini* sp. nov.: **A**, dorsal view, legs partly not shown; **B**, ventral view, legs partly, palps and subcapitular setae partly not shown; **C**, lateral view, gnathosoma and legs not shown. Scale bar: 200  $\mu$ m.

*Notogaster* (Figs 4A, C; 5C–H). Nine pairs of setiform, thickened, barbed notogastral setae present. Anterior setae *la*, *lm*, *lp* (164–188) little longer than *h*<sub>1</sub>–*h*<sub>3</sub> (155–176). Setae *p*<sub>1</sub>–*p*<sub>3</sub> considerably shorter than others: *p*<sub>2</sub> (82–90)  $\geq$  *p*<sub>1</sub> (73–82) > *p*<sub>3</sub> (53–61). Setae *c* absent (only alveoli present).

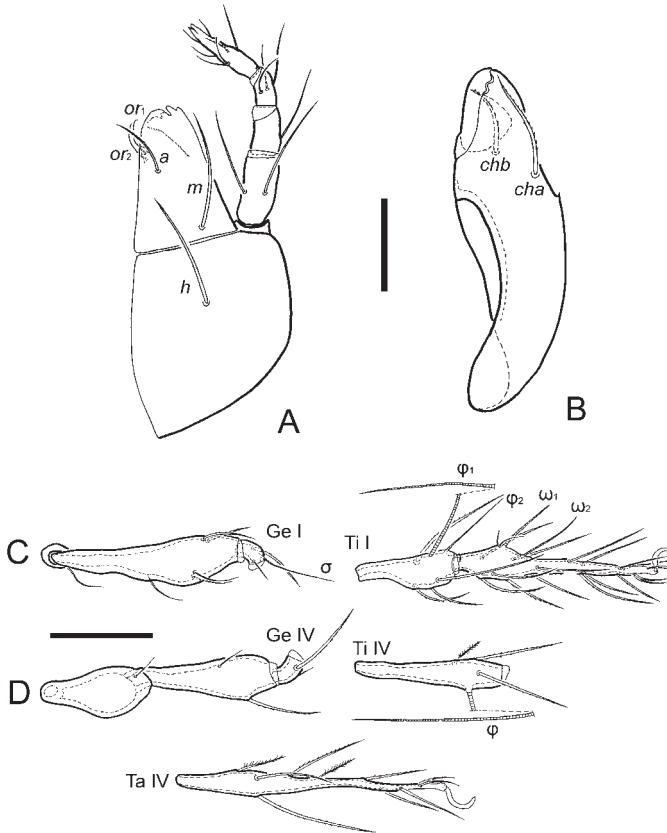
*Anogenital region* (Figs 4B; 5I–J). Two pairs of anal (53–61), three pairs of adanal

(73–82; *ad*<sub>1</sub> little longer than *ad*<sub>2–3</sub>), one pair of aggenital (73–82) and five pairs of genital (28–36; *g*<sub>5</sub> little longer than *g*<sub>1–4</sub>) setae setiform, slightly barbed. Setae *ad*<sub>1</sub> in adanal position.

*Epimeral region* (Fig. 4B). Epimeral setal formula: 3–1–3–3. Setae setiform, slightly barbed, with different lengths: *1a*, *2a*, *3a* 32–45; *3c* 86–90; other setae 61–82.



**Fig. 5.** *Gigantoppia zryanini* sp. nov.: **A**, lamellar seta; **B**, sensillus; **C**, folds in dorsolateral part of notogaster; **D**, notogastral seta *lm*; **E**, notogastral seta *h*<sub>2</sub>; **F**, notogastral seta *p*<sub>1</sub>; **G**, notogastral seta *p*<sub>2</sub>; **H**, notogastral seta *p*<sub>3</sub>; **I**, genital plate, right; **J**, anal plate, right. Scale bar: 10 μm.



**Fig. 6.** *Gigantoppia zryanini* sp. nov.: **A**, left half of subcapitulum and palp; **B**, chelicera; **C**, leg I, right, antiaxial view; **D**, leg IV, right, antiaxial view. Scale bars: 50 μm (A–B), 100 μm (C–D).



**Table 2.** Leg setation of *Gigantoppia zryanini* sp. nov. For explanations see Table 1.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	<i>v'</i>	<i>d</i> , ( <i>l</i> ), <i>v''</i> , <i>bv''</i>	( <i>l</i> ), $\sigma$	( <i>l</i> ), ( <i>v</i> ), $\varphi_1$ , $\varphi_2$	( <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> , <i>e</i> , $\omega_1$ , $\omega_2$
II	<i>v'</i>	<i>d</i> , ( <i>l</i> ), <i>v''</i> , <i>bv''</i>	( <i>l</i> ), $\sigma$	( <i>l</i> ), ( <i>v</i> ), $\varphi$	( <i>ft</i> ), ( <i>tc</i> ), ( <i>it</i> ), ( <i>u</i> ), ( <i>a</i> ), <i>s</i> , ( <i>pv</i> ), <i>v'</i> , $\omega_1$ , $\omega_2$
III	<i>l'</i> , <i>v'</i>	<i>d</i> , <i>l'</i> , <i>ev'</i>	<i>l'</i> , $\sigma$	<i>l'</i> , ( <i>v</i> ), $\varphi$	( <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</i> , <i>ev'</i>	<i>d</i> , <i>l'</i>	<i>l'</i> , ( <i>v</i> ), $\varphi$	<i>ft''</i> , ( <i>tc</i> ), ( <i>u</i> ), ( <i>a</i> ), <i>s</i> , ( <i>pv</i> )

*Gnathosoma* (Fig. 6A–B). Subcapitulum longer than wide: 184 × 143. Hypostomal setae *a*, *m*, *h* setiform, barbed; *h* and *m* (both 69) longer than *a* (41). Two pairs of adoral setae short (20), setiform, smooth. Palp (length 127) with setation 0–2–1–3–6(+1 $\omega$ ). Palptarsus distally divided (probably it is two modified setae), only six setae well developed. Palpal solenidion setiform, free. All setae (except on tarsus) slightly barbed. Chelicera (length 188) with few blunt teeth on fixed and movable digits. Cheliceral setae long, setiform, barbed: *cha* (65) longer, than *chb* (49).

*Legs* (Fig. 6C–D). Formulae of leg setation and solenidia: I (1–5–2–4–20) [1–2–2], II (1–5–2–4–14) [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. Almost all setae well barbed. Solenidia  $\omega_1$  on tarsi I,  $\omega_1$  and  $\omega_2$  on tarsi II, thickened, rod-like. Other solenidia rather long, setiform, with thin tips.

**Etymology.** The species is named in honor of the entomologist, Vladimir A. Zryanin (Nizhniy Novgorod State University, Nizhniy Novgorod, Russia), for his support on pedobiological investigations in Vietnam.

**Remarks.** This species differs from *Gigantoppia magna* Mahunka, 2008 from Thailand by the following features: body size 763–830 × 464–531 (845–997 × 581–638 in *G. magna*); setae *ro* and *le* approximately identical in length or *le* slightly longer than *ro* (in *G. magna* setae *le* obviously longer than *ro*); tubercles present in lamellar region (absent in *G. magna*); wavy folds present on notogaster, anogenital region and

anal plates (absent in *G. magna*); setae *p*<sub>2</sub> little longer than *p*<sub>1</sub> (shorter than *p*<sub>1</sub> in *G. magna*); setae *ad*<sub>1</sub> in adanal position (in preanal position in *G. magna*).

### Family MICROZETIDAE

#### Genus *Caucasiozetes* Shtanchaeva, 1984

**New diagnosis of the genus.** Rostrum medially with wide, rounded ledge visible in dorso-frontal and ventral views. Lamellae slightly longer than prodorsum, more or less truncate distally, with lateral tooth; adjacent in median-distal parts, but well separated anterior to translamella. Medial margins of lamellae excised to form small pentagonal or drop-shaped space just anterior to translamella. Tutoria long. Lamellar setae long, distally flagellate, inserted dorsally on lamellae. Interlamellar setae of medium size, setiform, inserted on interlamellar region or translamella. Sensilli long, unilaterally ciliate, directed posterolaterally. Dorsosejugal suture convex. Pteromorphae small, triangular. Epimeral setal formula 3–1–3–3. Six pairs of genital, one pair of aggenital, two pairs of anal, three pairs of adanal setae.

**Remarks.** *Caucasiozetes* sensu stricto comprises only two known species. Subías (2004, 2011) has a broader view of the genus. He considered *Teraja* Mahunka, 1995 as a junior synonym of *Caucasiozetes*, including *Microzetes flagellifer* Mahunka, 1989. However, Subías presented no rationale for these changes and, pending a detailed explanation, we do not recognize them. Both species of *Caucasiozetes* differ from species of *Teraja* and *Microzetes flagellifer*, by the

morphology of lamellar apices, positions of interlamellar and lamellar setae, and form of lamellar setae.

***Caucasiozetes frankeae* sp. nov.**

(Figs 7–8)

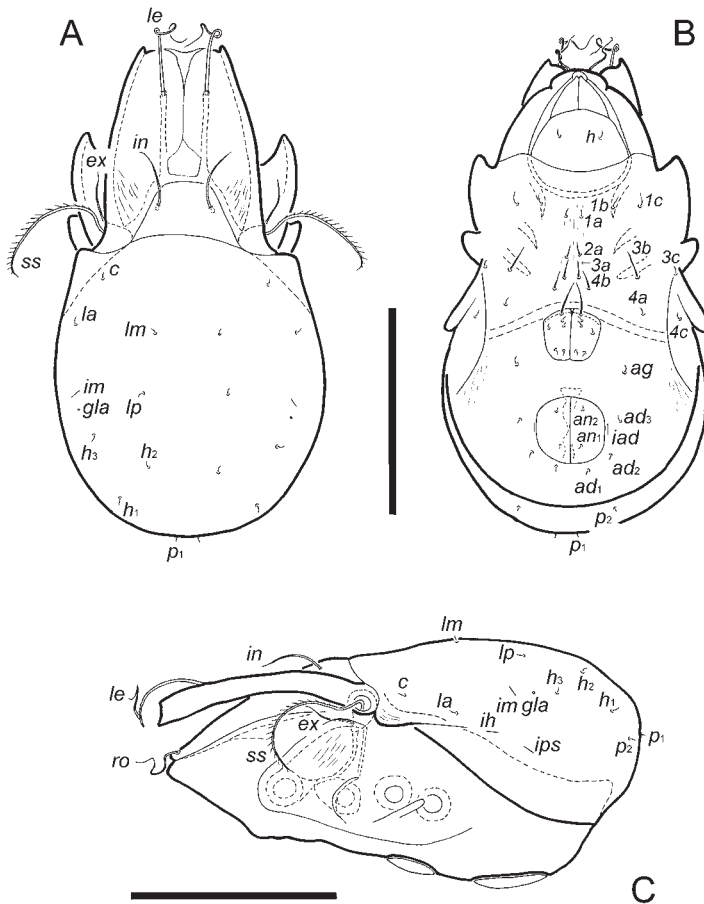
**Type material.** The *holotype* (male) and two *paratypes* (female and male): Vietnam, Cat Tien National Park, 11°26'N, 107°26'E, 137 m a. s. l., in sandy soil of a dipterocarp forest, Febr.–March 2009, coll. A.E. Anichkin.

**Deposition of holotype and paratypes** The holotype is deposited in the ZIN collection; both paratypes are deposited in the CEBRED HU collection.

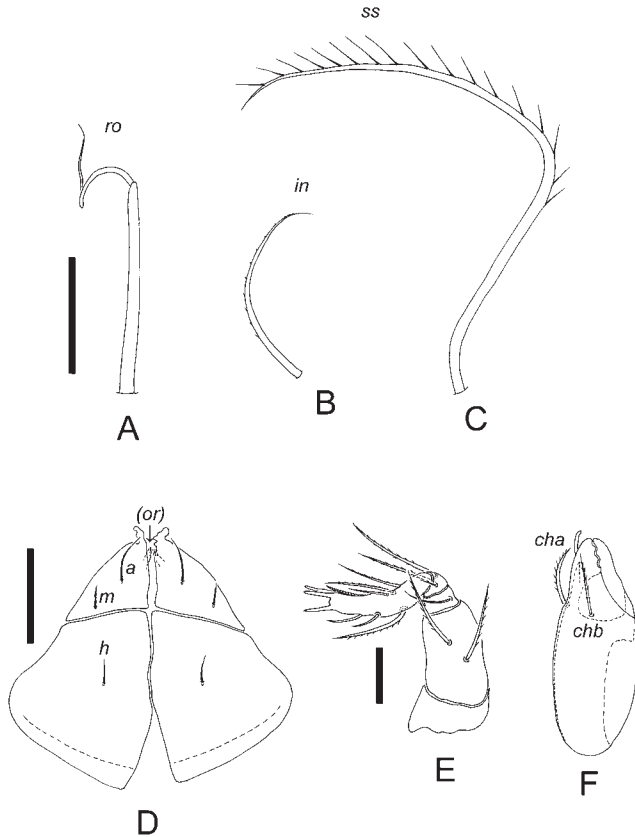
**Diagnosis.** The new species is characterised by the combination of following character states: body size 233–249 × 132–149; inner distal part of lamellae rounded; rostral setae smooth, long, distally flagellate and strongly undulating; interlamellar setae inserted on interlamellar region of prodorsum.

**Description. Measurements.** Body length 249 (holotype), 233–249 (two paratypes); body width 149 (holotype), 132–149 (two paratypes).

**Integument.** Body color pale brown to grey-brown. Cuticle smooth, only lateral part of anogenital region and epimeral region weakly rugose.



**Fig. 7.** *Caucasiozetes frankeae* sp. nov.: **A**, dorsal view, legs not shown; **B**, ventral view, palps, some subcapitular setae and legs not shown; **C**, lateral view, gnathosoma and legs not shown. Scale bar: 100  $\mu$ m.



**Fig. 8.** *Caucasiozetes frankeae* sp. nov.: **A**, lamellar seta; **B**, interlamellar seta; **C**, sensillus; **D**, subcapitulum (mentum broken); **E**, palp; **F**, chelicera. Scale bars: 20  $\mu$ m (A–D, F), 10  $\mu$ m (E).

*Prodorsum* (Figs 7A, C; 8A–C). Rostrum, lamellae typical for genus. Lamellae with lateral tooth well developed; inner distal part rounded. Rostral (*ro*) and lamellar (*le*) setae smooth, long, with strongly undulating, flagellate tips; *le* longer and thicker than *ro*. Interlamellar (*in*) and exobothridial (*ex*) setae setiform, slightly barbed; *in* inserted on interlamellar region of prodorsum. Sensilli (*ss*) long, thickened, unilaterally ciliate (with 16–20 cilia).

*Notogaster* (Fig. 7A, C). Dorsosejugal suture convex. Pteromorphae with rugose surface. Nine pairs short, smooth notogastral setae present. All lyrifissures developed in typical arrangement for family.

*Lateral part of body* (Fig. 7C). Tutoria typical for genus. All pedotecta weakly rugose. Discidia well developed.

*Anogenital region* (Fig. 7B). Two pairs anal, three pairs of adanal, one pair aggenital and six pairs genital setae, all short, smooth except anterior pair of genital setae thicker, longer and slightly barbed.

*Epimeral region* (Fig. 7B). All epimeral setae slightly barbed. Setae *3a*, *3b*, *4b* thicker and longer than others.

*Gnathosoma* (Fig. 8D–F). Subcapitulum slightly shorter than wide. Hypostomal setae setiform, barbed; *a* longer than *m* and *h*. Adoral setae minute. Palps with setation 0–2–1–3–9(+1 $\omega$ ). All setae (except some ventral and distal on tarsus) barbed. Chelicerae chelate-dentate. Cheliceral setae long (*cha* longer *chb*), barbed.

*Legs*. General form similar to those of other Microzetidae (see Engelbrecht, 1972a, 1972b). Formulae of leg setation and

**Table 3.** Leg setation of adult *Caucasozetes frankeae* sp. nov. For explanations see Table 1.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	<i>v'</i>	<i>d, (l), bv'', v''</i>	<i>l', v', σ</i>	<i>(l), (v), φ<sub>1</sub>, φ<sub>2</sub></i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv), (pl), e, ω<sub>1</sub>, ω<sub>2</sub></i>
II	<i>v'</i>	<i>d, (l), bv'', v''</i>	<i>l', v', σ</i>	<i>(l), (v), φ</i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv), ω<sub>1</sub>, ω<sub>2</sub></i>
III	<i>l', v'</i>	<i>d, l', ev'</i>	<i>l', σ</i>	<i>l', (v), φ</i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv)</i>
IV	<i>v'</i>	<i>d, ev'</i>	<i>d, l'</i>	<i>l', (v), φ</i>	<i>ft'', (tc), (p), (u), (a), s, (pv)</i>

solenidia: I (1–5–2–4–18) [1–2–2], II (1–5–2–4–15) [1–1–2], III (2–3–1–3–15) [1–1–0], IV (1–2–2–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 3.

**Etymology.** The new species is named in honor of Kerstin Franke (Senckenberg Museum für Naturkunde Görlitz, Germany) for her constant support of our investigations.

**Remarks.** The new species differs from *C. lamellatus* by having: interlamellar setae that insert above of translamella (on the translamella in *C. lamellatus*); the inner distal part of lamellae rounded (pointed in *C. lamellatus*); and rostral setae with long, strongly undulating flagellate tips (short, setiform in *C. lamellatus*).

#### Family OTOCEPHEIDAE

Genus *Otocephus* Berlese, 1905

Subgenus *Acrotocephus* Aoki, 1965

#### *Otocephus (Acrotocephus)*

#### *vietnamicus* sp. nov.

(Figs 9–10)

**Holotype** (male): Vietnam, Cat Tien National Park, 11°25'N, 107°25'E, 149 m a. s. l., in dark loamy soil of lagerstroemia forest, Febr.–March 2009, coll. A.E. Anichkin.

**Deposition of holotype.** The holotype is deposited in the ZIN collection.

**Diagnosis.** With character states of *Otocephus (Acrotocephus)* as summarized by Aoki (1965). The new species is characterized by the combination of following character states: body size 830 × 348; surface densely punctate, lateral parts of prodorsum, notogaster and anogenital region foveolate, genital plates striate; rostral

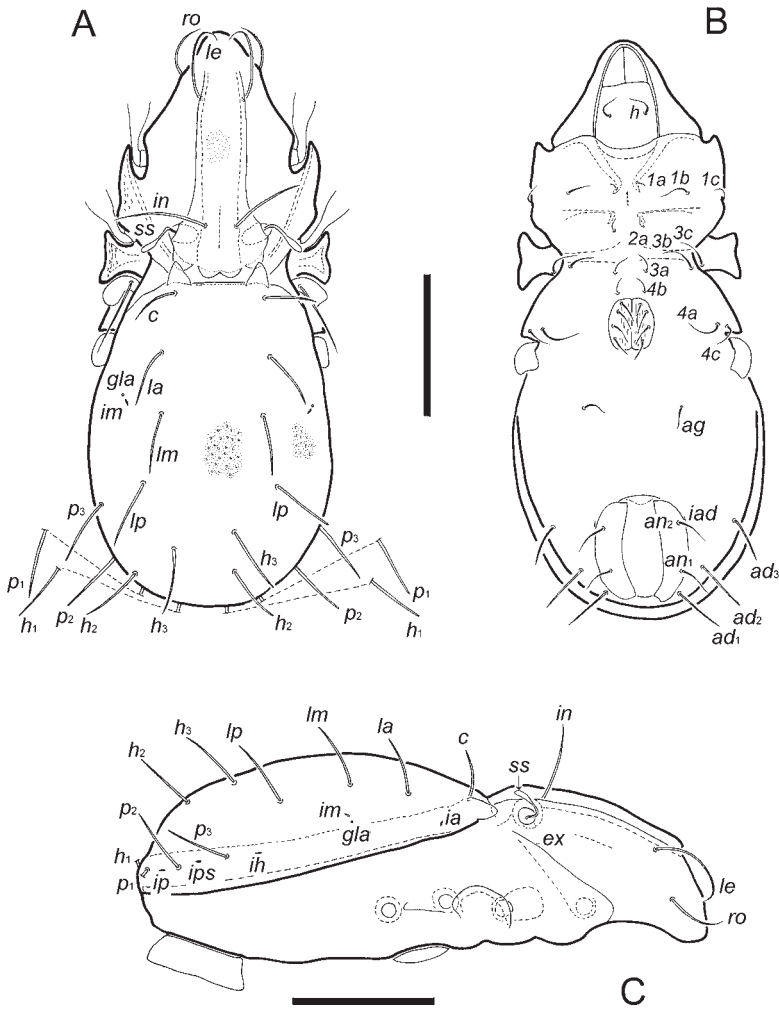
and lamellar setae setiform, with curved tips, barbed; interlamellar setae long, rigid, slightly barbed; sensilli clavate, smooth, with long stalk and oblong head; two pairs of prodorsal condyles well developed, median condyles weakly fused; notogastral lateral condyles triangular, notogastral median condyles absent; 10 pairs of notogastral setae of medium length (except shorter *c*), rigid, slightly barbed; lyrifissures *ips* located between *p*<sub>2</sub> and *p*<sub>3</sub>; adanal setae *ad*<sub>1</sub> and *ad*<sub>2</sub> longer than *ad*<sub>3</sub>; leg setae *u* setiform on tarsi I and thorn-like on tarsi II–IV.

**Description. Measurements.** Body length 830 (holotype); body width 348 (holotype).

**Integument.** Body color light brown. Surface densely punctate; lateral parts of prodorsum, notogaster and anogenital region foveolate. Genital plates striate.

**Prodorsum** (Figs 9A, C; 10A–E). Rostrum simple, broadly rounded in dorsal view. Rostral and lamellar setae setiform, with curved tips, barbed. Rostral setae shorter than lamellar setae. Interlamellar setae long, longer than lamellar setae, rigid, slightly barbed. Sensilli clavate, smooth, with long stalk and oblong head. Exobothridial setae minute. Two pairs of prodorsal condyles well developed, rounded, similar in size; median condyles partly fused.

**Notogaster** (Figs 9A, C; 10A, F, G). Notogastral lateral condyles triangular, directed anteriorly; median condyles absent. Ten pairs of notogastral setae medium in length (*c* slightly shorter than others), rigid, slightly barbed. All lyrifissures (*ia*, *im*, *ip*, *ih*, *ips*) and opisthonotal gland opening (*gla*) developed. Lyrifissures *ips* located between *p*<sub>2</sub> and *p*<sub>3</sub>.



**Fig. 9.** *Otocephus (Acrotocephus) vietnamicus* sp. nov.: **A**, dorsal view, legs partly not shown; **B**, ventral view, palps, some subcapitular setae and legs partly not shown; **C**, lateral view, gnathosoma and legs not shown. Scale bar: 200  $\mu$ m.

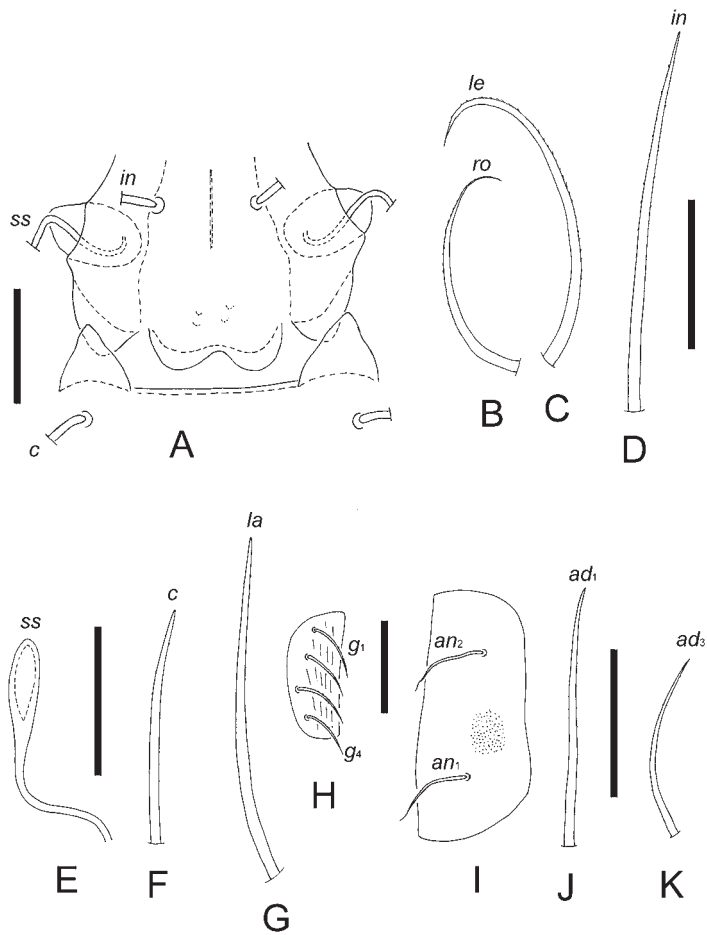
*Lateral part of body* (Fig. 9C). Tutorium indistinct, weakly developed.

*Anogenital region* (Figs 9B; 10H–K). Two pairs of anal setae setiform, with short thin tips, slightly barbed. Three pairs of adanal setae rigid, slightly barbed;  $ad_1$  and  $ad_2$  longer than  $ad_3$ . One pair of aggenital setae and four pairs of genital setae similar in length, setiform, slightly barbed. Lyrifissures *iad* weakly visible.

*Epimeral region* (Fig. 9B). 3–1–3–3. Setae setiform, slightly barbed. Setae *1b*, *3b*, *3c*, *4a*, *4c* longer than others.

*Gnathosoma*. Not examined.

*Legs*. Similar to those of other *Otocephus* (Aoki, 1965). Formulae of leg setation and solenidia: I (1–4–3–4–16) [1–2–2], II (1–4–3–3–15) [1–1–2], III (2–3–1–2–15) [1–1–0], IV (1–2–2–2–12) [0–1–0]; homology of setae and solenidia indicated



**Fig. 10.** *Otocephalus (Acrotocephalus) vietnamicus* sp. nov.: **A**, condyles; **B**, rostral seta; **C**, lamellar seta; **D**, interlamellar seta; **E**, sensillus; **F**, notogastral seta *c*; **G**, notogastral seta *la*; **H**, genital plate, right; **I**, anal plate, left; **J**, adanal seta *ad*<sub>1</sub>; **K**, adanal seta *ad*<sub>3</sub>. Scale bar: 50 µm.

in Table 4. Leg setae *u* setiform on tarsi I and thorn-like on tarsi II–IV.

**Etymology.** The specific name “*vietnamicus*” refers to the country of origin, Vietnam.

**Remarks.** The new species can be included among the species group having following combination of characters: 1) both pairs of prodorsal condyles present; 2) notogastral lateral condyles triangular; 3) notogastral median condyles absent; 4) notogastral setae of medium length, rigid. This species group currently comprises two species: *O. (A.) bucephalus* Balogh, 1970

from Sri Lanka and *O. (A.) malindangensis* Corpuz-Raros, 2007 from the Philippines. The new species differs from the *O. (A.) bucephalus* by having: larger body (830 × 348 versus 760 × 279 in *O. (A.) bucephalus*); long interlamellar setae (short in *O. (A.) bucephalus*); notogastral condyles and median notogastral setae (*c*, *la*, *lm*, *lp*) removed from respective pairs (located near each other in *O. (A.) bucephalus*); and notogastral condyles of medium size (very large in *O. (A.) bucephalus*). The new species differs from *O. (A.) malindangensis* by having:



**Table 4.** Leg setation of adult *Otocepheus (Acrotocepheus) vietnamicus* sp. nov. For explanations see Table 1.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	<i>v'</i>	<i>d, (l), bv''</i>	<i>(l), v', σ</i>	<i>(l), (v), φ<sub>1</sub>, φ<sub>2</sub></i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv), e, ω<sub>1</sub>, ω<sub>2</sub></i>
II	<i>v'</i>	<i>d, (l), bv''</i>	<i>(l), v', σ</i>	<i>l', (v), φ</i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv), ω<sub>1</sub>, ω<sub>2</sub></i>
III	<i>l', v'</i>	<i>d, l', ev'</i>	<i>l', σ</i>	<i>(v), φ</i>	<i>(ft), (tc), (it), (p), (u), (a), s, (pv)</i>
IV	<i>v'</i>	<i>d, ev'</i>	<i>d, l'</i>	<i>(v), φ</i>	<i>ft'', (tc), (p), (u), (a), s, (pv)</i>

sensilli with oblong head (oval or round head in *O. (A.) malindangensis*); only median prodorsal condyles fused (all prodorsal condyles fused in *O. (A.) malindangensis*); notogastral setae *c* removed from the base of notogastral condyles (located on their base in *O. (A.) malindangensis*); setae *p*<sub>2</sub> and *p*<sub>3</sub> similar to other notogastral setae in length (except *c*) (shorter than others in *O. (A.) malindangensis*); and lyrifissures *ips* located between *p*<sub>2</sub> and *p*<sub>3</sub> (anterior to setae *p*<sub>3</sub> in *O. (A.) malindangensis*).

#### Key to Vietnamese species of *Otocepheus (Acrotocepheus)*

1. Lateral notogastral condyles triangular . . . . .  
 . . . . . *O. (A.) vietnamicus* sp. nov.
- Lateral notogastral condyles wide, with an excavated anterior margin . . . . . 2
2. Interlamellar setae longer than rostral setae; notogastral setae apically extending beyond insertion of succeeding setae . . . . .  
 . . . . . *O. (A.) duplicornutus* Aoki, 1965
- Interlamellar setae not longer than rostral setae; notogastral setae apically not extending beyond insertion of succeeding setae . . . . .  
 . . . . . *O. (A.) triplicornutus* (Balogh et Mahunka, 1967)

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