

## **SACCULOBATES INDICUS SP. N. (ACARI: ORIBATIDA: HERMANIELLIDAE), A NEW SPECIES OF ORIBATID MITES FROM INDIA**

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**ABSTRACT:** A new hermanniellid oribatid mite species of the genus *Sacculobates*, *S. indicus* n. sp., from the Indian soil is described. The description is based upon the adult and tritonymphal instars. The adult instar of the new species differs from the both known species of the genus by the presence of epimeral neotrichy and the morphology of exuvial setae. An identification key to the known species of *Sacculobates* is provided.

**KEY WORDS:** oribatid mites, Hermanniellidae, *Sacculobates*, new species, tritonymph, ontogeny, key, India

### **INTRODUCTION**

The oribatid mite genus *Sacculobates* (Acari: Oribatida) from the family Hermanniellidae was proposed by Grandjean (1962a), with *Sacculobates horologiorum* Grandjean, 1962 as the type species, which was collected from Columbia. Later, Mahunka (1997) described the genus *Bruneiella* with *Bruneiella sultan* Mahunka, 1997 as the type species, collected from Brunei. However, the diagnostic characters of *Bruneiella* are generally similar to *Sacculobates*, therefore Subias (2004) proposed *Bruneiella* as the junior synonym of *Sacculobates*. At present, only two species, *S. horologiorum* and *S. sultan*, are included in the genus.

During taxonomic study of oribatid mites from India, a new species of *Sacculobates* was found, which is described and illustrated here under the name *S. indicus* n. sp. The main diagnostic characters of the genus *Sacculobates* are as follows (data from Grandjean 1962a; Mahunka 1997; J. Balogh, P. Balogh 1992; including our additions): Hermanniellidae with bothridial openings, which are located close to each other; sensilli long, with a weakly developed head; interlamellar setae dilated distally, shorter than sensilli; exuvial setae of medium size, dilated distally or phylliform; epimeral neotrichy absent or present; leg segments have normal, reduced or neothichial setation. An identification key to adults of *Sacculobates* is presented below.

Additionally, the tritonymphal instar of a new species is studied. The morphology of the juveniles of *Sacculobates* was described for one species: Grandjean (1962a) described larval, proto- and deutonymphal instars of *S. horologiorum*.

### **MATERIAL AND METHODS**

Specimens of *Sacculobates indicus* sp. n. (holotype and 11 paratypes; three tritonymphs) were

collected: India, 28°19'32" N 95°57'31" E, Arunachal Pradesh, Hunli vicinity, 1300 m a.s.l., soil, L. Dembický & O. Šauša on 01.06.2012.

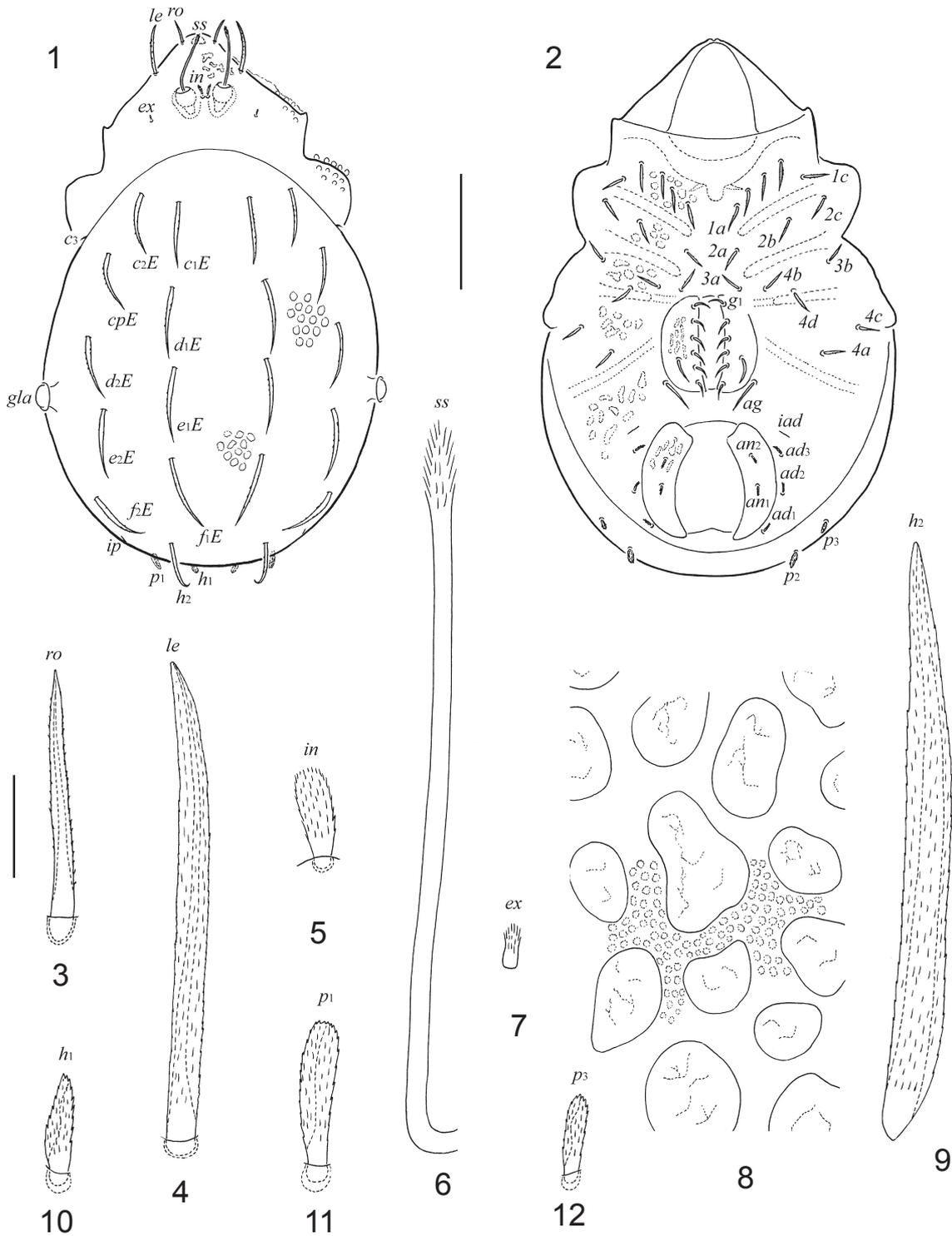
Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. All body measurements are presented in micrometers. The body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate. Notogastral width refers to the maximum width in dorsal aspect. Lengths of body setae were measured in lateral aspect. 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. General terminology used in this paper follows that of Grandjean (1962a, 1962b), Norton and Behan-Pelletier (2009).

### **Description of *Sacculobates indicus* sp. n.**

#### **Adult**

Figs 1–27

**Diagnosis.** Body size 846–996 × 547–664. Body surface foveolate and microgranulate. Rostral, lamellar and exuvial setae narrowly phylliform. Interlamellar setae weakly dilated distally. Sensilli bacilliform, with a small, barbed head. Alveoli of notogastral setae (under exuvium) absent. Subcapitular setae *h* narrowly phylliform; *m* setiform; *a* spindle-form. Adoral setae *or*<sub>1</sub> have two widely phylliform branches; *or*<sub>2</sub> setiform, thickened, with tooth in ventro-distal part. Epimeral formula: 5–3–2–4. Genital and aggenital setae setiform, smooth. Anal and adanal setae weakly dilated distally or rectangular. Leg femora I and II with eight setae. Setae *p* absent on tarsi II–IV. Solenidia thickened, blunt-ended.

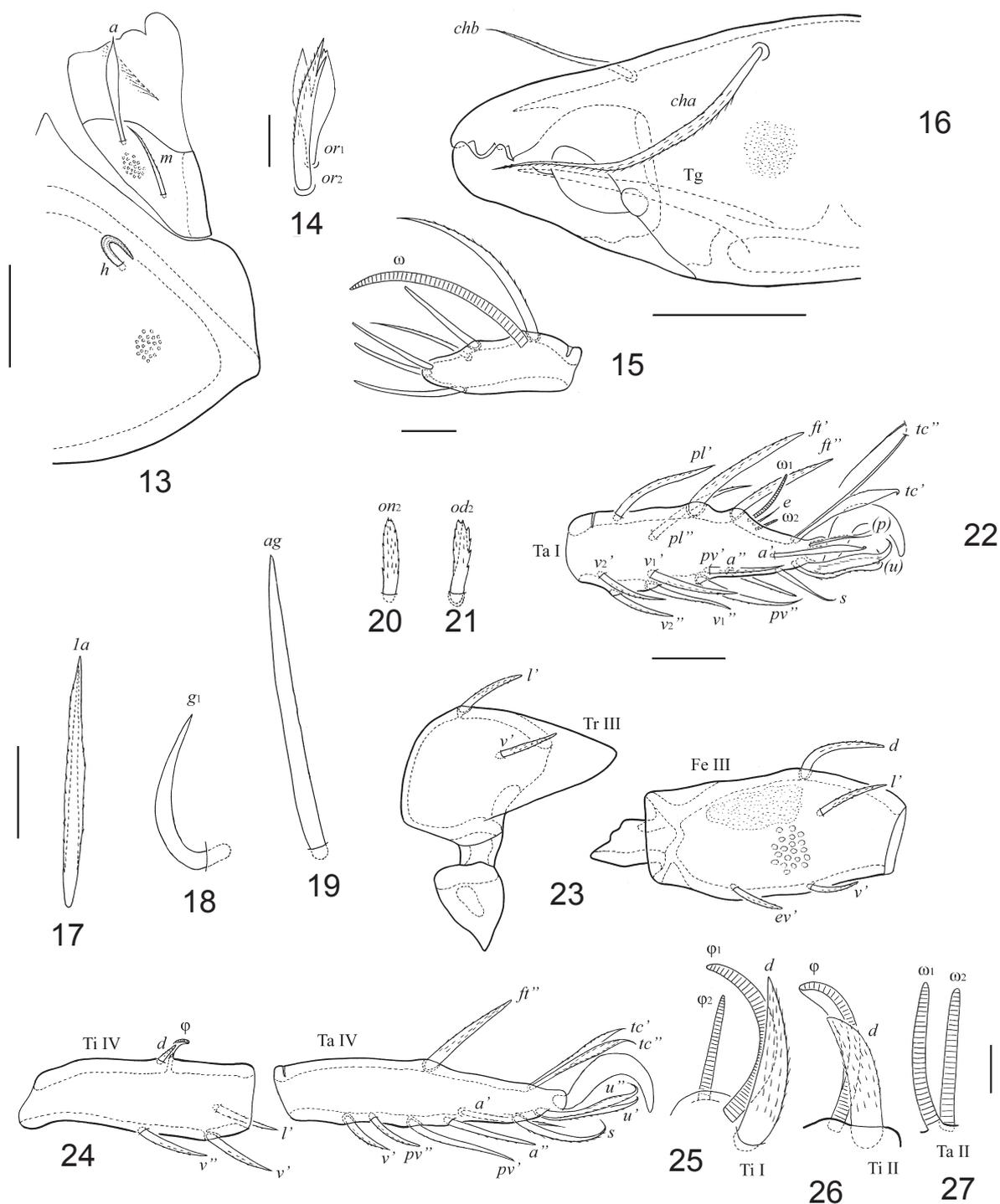


Figs 1–12. *Sacculobates indicus* sp. n., adult: 1 — dorsal view; 2 — ventral view (gnathosoma and legs not shown); 3 — rostral seta; 4 — lamellar seta; 5 — interlamellar seta; 6 — sensillus (posterior part not shown); 7 — exobothridial seta; 8 — part of exuvium nearly to the seta *e1E*; 9 — exuvial seta *h2*; 10 — notogastral seta *h1*; 11 — notogastral seta *p1*; 12 — notogastral seta *p3*. Scale bar 200  $\mu$ m (1, 2); 20  $\mu$ m (3–12).

**Description.** *Measurements.* Body length 846 (holotype), 846–996 (five paratypes); notogaster width 547 (holotype), 547–664 (five paratypes).

*Integument* (Figs 1, 2, 8). Body color black to brown. Cerotegumental layer covers body and

legs, colorless, thin, gel-like. Surface of prodorsum, notogastral exuvium, epimeral and anogenital region, leg femora with round (diameter up to 28) or elongate foveolae and internal microgranules (located under cuticular layer; diameter up to



Figs 13–27. *Sacculobates indicus* sp. n., adult: 13 — subcapitulum, left half, ventral view; 14 — adoral setae; 15 — palptarsus; 16 — chelicera, anterior part; 17 — epimeral seta *la*; 18 — genital seta *g*<sub>1</sub>; 19 — aggenital seta; 20 — anal seta *an*<sub>2</sub>; 21 — adanal seta *ad*<sub>2</sub>; 22 — tarsus of leg I, right, paraxial view; 23 — trochanter and femur of leg III, left, anti-axial view; 24 — tibia and tarsus of leg IV, right, paraxial view; 25 — solenidia and dorsal seta on tibia of leg I; 26 — solenidion and dorsal seta on tibia of leg II; 27 — solenidia on tarsus of leg II. Ta — tarsus, Ti — tibia, Fe — femur, Tr — trochanter. Scale bar 50 μm (13, 16, 22–24); 10 μm (14, 15, 25–27); 20 μm (17–21).

4). Lateral sides of prodorsum tuberculate (diameter up to 20).

*Prodorsum* (Figs 1, 3–7). Rostrum widely rounded, with a poorly developed median indentation, that is visible only in dissected specimens.

Rostral (*ro*, 41–61) and lamellar (*le*, 90–102) setae thickened, weakly phylliform, barbed. Interlamellar setae (*in*, 20–28) weakly dilated distally, barbed. Exobothridial setae short (*ex*, 6–8), thickened, rectangular, barbed. Sensilli long (*ss*, 164–

Table.

Leg setation and solenidia of adult and tritonymph *Sacculobates indicus* sp. n.

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

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. Tn — tritonymph, Ad — adult.

180), bacilliform, with a weakly developed, barbed head.

*Notogaster* (Figs 1, 2, 9–12). Anterior margin convex. Exuvium with nine pairs of narrowly phylliform, barbed setae (*c*<sub>1</sub>*E*, *c*<sub>2</sub>*E*, *d*<sub>1</sub>*E*, *d*<sub>2</sub>*E*, *cp*, *e*<sub>1</sub>*E*, *e*<sub>2</sub>*E*, *f*<sub>1</sub>*E*, *f*<sub>2</sub>*E* similar in length, 155–188). Alveoli of these setae completely absent on notogaster. Only six pairs of notogastral setae presented: *c*<sub>3</sub> (16–20) setiform, thin, slightly barbed; *h*<sub>1</sub>, *p*<sub>2</sub> (both 18–20), *p*<sub>1</sub> (28–32), *p*<sub>3</sub> (12–16) thickened, weakly dilated distally or rectangular-form, barbed; *h*<sub>2</sub> (118–127) narrowly phylliform, barbed. Lyrifissures and opisthonotal gland openings (*gla*) located typically for the family.

*Gnathosoma* (Figs 13–16). Subcapitulum longer than wide (221–233 × 159–176). Subcapitular setae *h* (36–41) narrowly phylliform, barbed; *m* (32–41) setiform, barbed; *a* (45–53) spindle-form, smooth. Adoral setae *or*<sub>1</sub> (20–28) have two widely phylliform, indistinctly barbed branches; *or*<sub>2</sub> (20–28) setiform, thickened, densely barbed, have a strong tooth in their ventro-distal part. Palps (length 102–106) with setation 0–2–1–3–6(+ω). Solenidion longer than palptarsus, not attached with eupathidium. Chelicerae (length 225–233) with two setiform, barbed setae: *cha* (102–106) longer than *chb* (45–53). Trägårdh's organ (Tg) long, narrowly conical.

*Epimeral region* (Figs 2, 17). Epimeral neotrichy present, formula: 5–3–2–4. Setae (49–53) narrowly phylliform, barbed.

*Anogenital region* (Figs 2, 18–21). Seven pairs of genital (six pairs of medial setae, 36–45; one pair of lateral setae, 53–61) and one pair of aggenital (*ag*) setae setiform, slightly thickened, smooth. Two pairs of anal (*an*<sub>1</sub>, *an*<sub>2</sub>, 16–20) and three pairs of adanal (*ad*<sub>1</sub>–*ad*<sub>3</sub>, 16–20) setae weak-

ly dilated distally or rectangular, barbed. Lyrifissures *iad* located in inverse apoanal position, located antero-laterad to *ad*<sub>3</sub>.

*Legs* (Figs 22–27). Tarsi with one smooth claw. Femora III and IV with posterior “collars”. Formulae of leg setation and solenidia: I (1–8–5–5–20) [1–2–2], II (1–8–5–5–17) [1–1–2], III (2–4–4–4–12) [1–1–0], IV (1–4–4–4–11) [0–1–0]; homology of setae and solenidia indicated in Table. Setae setiform (thin or thickened), spindle-form (*tc* on tarsi II–IV, *a'* and *tc'* on tarsi I) or ribbon-like (*u* on all tarsi), barbed (except smooth *p* and *s* on tarsi I). Setae *p* absent on tarsi II–IV. Famulus (*e*) setiform, thin. Tibiae I–IV and genua I–III with seta *d* and solenidion (only φ<sub>1</sub> on tibiae I) coupled on dorsal side. Solenidia of medium size or short, thickened (with ventral expansion on tibiae II–IV and genua I–III), blunt-ended.

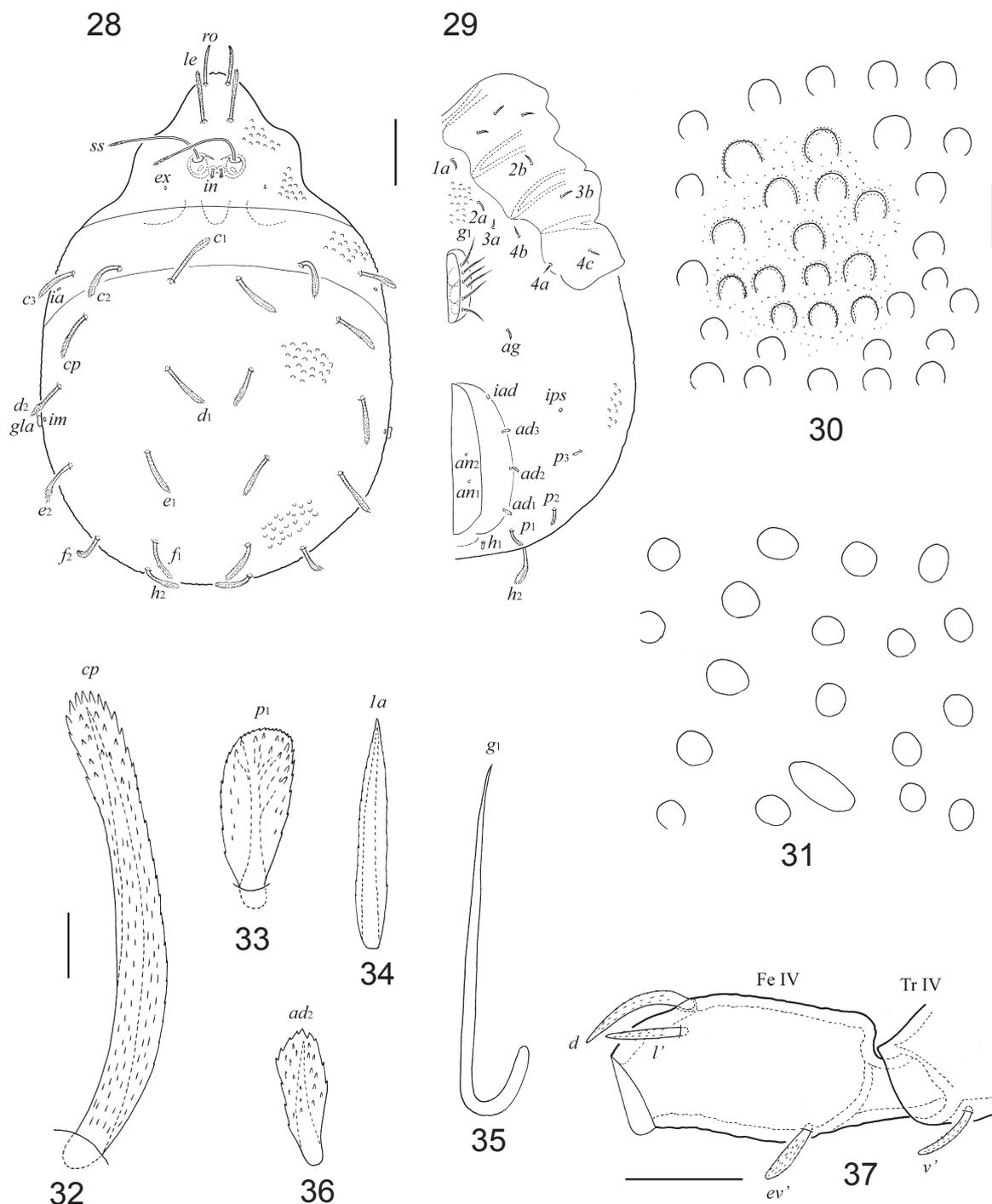
### Tritonymph

Figs 28–37

**Description.** *Measurements.* Body length 780–830 (three specimens); body width 531–581 (three specimens).

*Integument* (Figs 28–31). Body color light grey to light brownish. Cerotegument well developed, tuberculate. Body cuticle foveolate.

*Prodorsum* (Figs 28, 29). Relatively short, about half-length of gastronotic region in lateral view. Rostrum rounded, with poorly developed median indentation (visible in dissected specimens). Rostral (57–65) and lamellar (77–90) setae weakly phylliform, barbed. Interlamellar setae (12–16) weakly dilated distally, barbed. Exobothridial setae minute (4–6), barbed. Sensilli (139–147) bacilliform, with indistinct, barbed head. Bothridia developed.



Figs 28–37. *Sacculobates indicus* sp. n., tritonymph: 28 — dorsal view; 29 — ventral view, left half (rostrum, gnathosoma and legs not shown); 30 — part of cerotegument nearly to the seta  $e_1$ ; 31 — part of cuticle nearly to the seta  $e_1$ ; 32 — notogastral seta  $cp$ ; 33 — notogastral seta  $p_1$ ; 34 — notogastral seta  $la$ ; 35 — genital seta  $g_1$ ; 36 — adanal seta  $ad_2$ ; 37 — anterior part of trochanter and femur of leg IV, right, antiaxial view. Fe — femur, Tr — trochanter. Scale bar 100  $\mu$ m (28, 29); 10  $\mu$ m (30–36); 50  $\mu$ m (37).

**Gastronotic region** (Figs 28, 29, 32, 33). Anterior margin straight, posterior margin rounded. Dehiscence line typical for Hermanniellidae. Gastronotic setae represented by 15 pairs ( $h_3$  absent) of setae, which are weakly dilated distally, barbed. Dorsal setae of medium size;  $p_1$  and  $p_2$  short;  $h_1$  and  $p_3$  shortest. Cupules located in typical position

for Hermanniellidae. Tube of opisthonotal gland openings presented.

**Gnathosoma.** Similar to adult instar.

**Epimeral region** (Figs 29, 34). Sternal region triangular, bordered. Epimeral formula: 4–2–2–3. Setae narrowly phylliform, barbed.

**Anogenital region** (Figs 29, 35, 36). Six pairs

of genital and one pair of aggenital setae setiform, smooth. Two pairs of anal setae minute, visible only under high magnification. Three pairs of adanal setae weakly dilated distally, barbed. Cupules *iad* and *ips* distinct, *ih* not evident.

**Legs** (Fig. 37). Tarsi with one smooth claw. Femora III and IV without “collars”. Formulae of leg setation and solenidia: I (1–5–3–5–16) [1–2–2], II (1–5–3–4–13) [1–1–2], III (2–3–2–4–10) [1–1–0], IV (1–3–2–4–10) [0–1–0]; homology of setae and solenidia indicated in Table. Setae and solenidia similar to adult instar.

**Type deposition.** The holotype (ethanol) is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; five paratypes (ethanol) are deposited in the collection of the Siberian Zoological Museum, Novosibirsk, Russia; six paratypes and tritonymphs (ethanol) are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

**Etymology.** The specific name “*indicus*” refers to the country of origin, India.

**Comparison.** All known species of the genus *Sacculobates* (adult instar) can be distinguished by the key, which is presented below.

Usually, nymphal instars of oribatid mites are similar morphologically. Tritonymph of *S. indicus* sp. n. (our data) differs from proto- and deutonymph of *S. horologiorum* (Grandjean 1962a) by the weakly dilated distally dorsal notogastral setae (versus well-dilated in *S. horologiorum*). Larva, proto- and deutonymph of a new species are absent in our material, therefore detailed comparison of juveniles of these two species is not possible.

#### Key to known species of *Sacculobates* (adults)

1. Dorsal exuvial setae narrowly phylliform; epimeral neotrichy present, formula 5–3–2–4; aggenital setae considerable longer than adanal setae  $ad_2$  and  $ad_3$ ; adanal lyrifissures located diagonally to the anal plates; body size: 846–996 × 547–664 ....  
..... *Sacculobates indicus* sp. n.  
Distribution: India

— Dorsal exuvial setae dilated distally or widely phylliform; epimeral neotrichy absent, formula 3–1–2–3; aggenital and adanal setae  $ad_2$ ,  $ad_3$  little differ in length; adanal lyrifissures located transversely to the anal plates ..... 2

2. Interlamellar setae inserted medio-anteriad to bothridia; rostral and lamellar setae phylliform; anterior parts of genital plates with one seta; adanal setae  $ad_1$  short, not dilated distally, similar in length to  $ad_2$  and  $ad_3$ ; body size: 314–360 × 176–219 .....  
..... *Sacculobates sultan* (Mahunka, 1997).  
Distribution: Indonesia

— Interlamellar setae inserted between bothridia; rostral and lamellar setae setiform; anterior parts of genital plates with two setae; adanal setae  $ad_1$  of medium size, dilated distally, considerably longer than  $ad_2$  and  $ad_3$ ; body length: 610–725 .....  
..... *Sacculobates horologiorum* Grandjean, 1962.  
Distribution: Neotropical region

#### ACKNOWLEDGEMENTS

We gratefully acknowledge L. Dembický and O. Šauša for help with the collecting of oribatid mites.

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