Acarina 17 (2): 201–209

MORPHOLOGY OF JUVENILE STAGES OF *HERMANNIELLA DOLOSA* (ACARI, ORIBATIDA, HERMANNIELLIDAE)

S. G. Ermilov

Center of Independent Examinations-NN, Nizhniy Novgorod 603107, Russia;
e-mail: ErmilovAcari@yandex.ru

ABSTRACT: The morphology of juvenile stages of the oribatid mite *Hermanniella dolosa* (Oribatida, Hermanniellidae) is described and illustrated. Juvenile stages of *Hermanniella dolosa* are very similar in structure to those of the only other known juvenile stages of this family (*Sacculobates horologiorum, Ampullobates nigriclavatus*), showing only fine differences in setation and setal structure. These differences include the absence of seta h_3 in the larva, the absence of one seta a from all leg tarsi and pair *(p)* from tarsi II–IV. Also, *Hermanniella dolosa* has two characters noted for the first time in nymphs of Hermanniellidae: 1) sensilli well developed, with well developed clubs (sensilli weakly developed in nymphs of other studied species), 2) deutonymphs with 2 pairs of vestigial alveoli (complete paraproctal atrichosy in other studied species).

KEY WORDS: *Hermanniella dolosa*, Hermanniellidae, morphology, juvenile stages, ontogeny, development, oribatid mite

INTRODUCTION

The oribatid mite family Hermanniellidae (Acari, Oribatida) includes 9 genera with 53 species. Collectively, the family is cosmopolitan, being widespread, except for Antarctica (Subías 2004). The nominate genus *Hermanniella* Berlese, 1908 includes 35 named species and is the largest genus in this family. Grandjean (1953) noted several important features of juvenile stages in his family diagnosis, which was based only on *Hermanniella* prior to his more inclusive diagnosis (1962a). But ontogeny has not yet been fully described for any *Hermaniella* species and the little published information about juveniles of other genera is incomplete: Grandjean (1962 a, b) described larvae, proto- and deutonymphs of *Sacculobates horologiorum* Grandjean, 1962 and proto- and tritonymphs of *Ampullobates nigriclavatus* Grandjean, 1962.

The purpose of the present work is to describe and illustrate the morphology of all juvenile stages of the palearctic species *Hermanniella dolosa* Grandjean, 1931.

MATERIALS AND METHODS

The available material included 29 juveniles of *Hermanniella dolosa*: 11 larvae, 7 protonymphs, 4 deutonymphs, 7 tritonymphs. All studied specimens (except 8 larvae) of these species were collected by myself in the European part of Russia (the Nizhniy Novgorod Region, Volodarskiy District) during the spring of 2007–2009. Mites were found in soil near marsh (geographical coordinates: 56º12′N, 43º21′E) and in soil of a mixed wood (56º15′N, 43º40′E). Eight additional larvae were obtained from a laboratory culture. Methods of cultivation were presented earlier (Ermilov 2008), but the specific diet of *Hermanniella dolosa* I was not determined.

The illustrated specimens were permanently mounted and studied on flat microscope slides.

Leg setation is given in parentheses, according to the sequence trochanter-femur-genu-tibia-tarsus. All formulas of leg solenidia are given in square brackets, according to the sequence genu-tibia-tarsus. All body measurements are presented in micrometers.

RESULTS

Dimensions. Total length of: larva 199–215 (mean 209), protonymph 315–332 (mean 325), deutonymph 381–448 (mean 410), tritonymph 498–564 (mean 526). Total width of: larvae 116, protonymph 182, deutonymph 215–265 (mean 223), tritonymph 282–298 (mean 589). Measurements and setation changes of juvenile stages given in Tables 1 and 2.

Integument. Body cuticle of larva colourless. Body cuticle of nymphs light grey, often with weak, pale green shade. Legs and gnathosoma more sclerotized, brownish; rutelli black-brownish, digits of chelicerae black-brownish.

Cerotegument covers body in all stages. Cerotegument of larva weakly visible, that of nymphs well visible. Two types of cerotegument in nymphs: microgranules (very small) and almost hemispherical tubercles (diameter 4–8). Body setae always without cerotegument.

Prodorsum (Figs. 1, 2, 31, 32, 35, 38). Relatively short, about half-length of gastronotic region in lateral view. Triangular form in dorsal

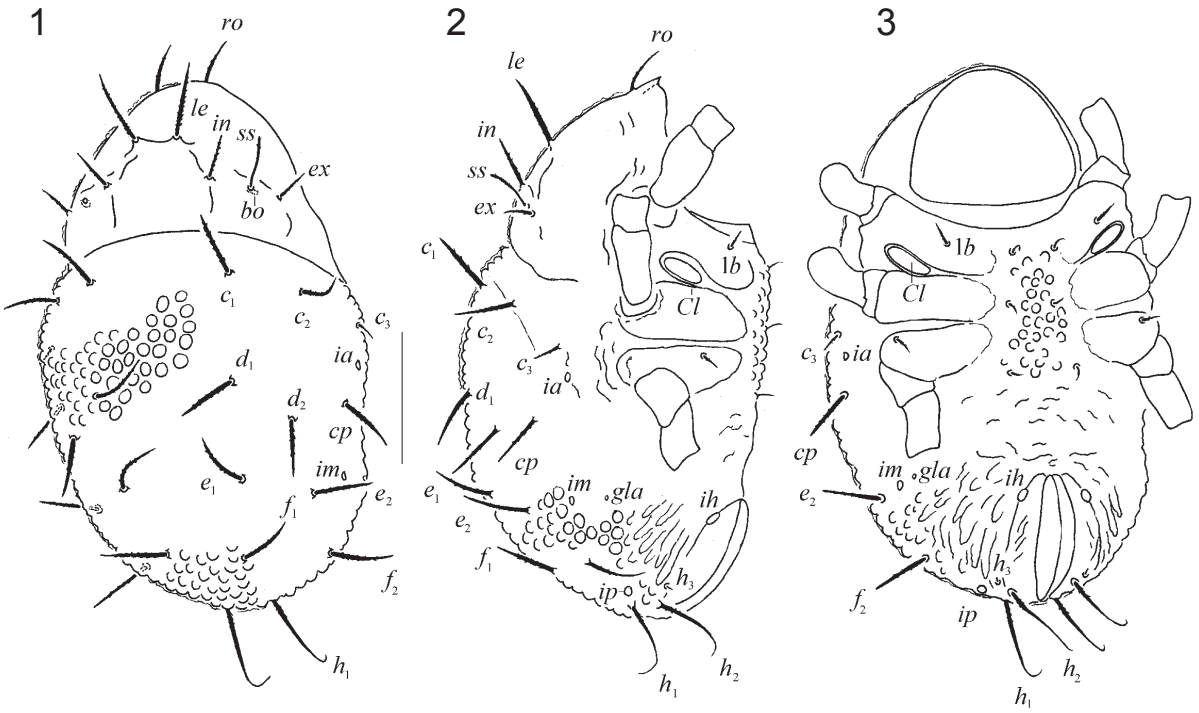

Fig. 1–3. *Hermanniellla dolosa*, larva: 1 — dorsal view, legs removed; 2 — lateral view, gnathosoma and legs (partly) removed; 3 — ventral view, gnathosoma and legs (partly) removed. Scale bar 50 μm.

Table 1

Comparison of body and prodorsal setae measurements of *Hermanniella dolosa* during ontogeny

Character	Larva	Protonymph	Deutonymph	Tritonymph
Length of rostral setae	20	20–24	24–32	28–45
Length of lamellar setae	28–32	41–45	53–61	61–82
Length of interlamellar setae	16–20	28	36–45	53–69
Length of sensilli	20–24	53–61	61–69	69–86
Length of exobothridial setae	12–16	16–20	20–28	20–28

view. Rostrum broadly rounded, tip arrow-shaped (well visible if to look at a copy laterally; Fig. 2). Cuticle with rare folds.

Setae *ro, le, in* strongly developed, straight or weakly curved, barbed, set on small apophyses. Setae *le* longest and thickest setae of prodorsum (Fig. 4). Setae *ex* shortest, setiform or sometimes weakly lanceolate (in larva), barbed (Fig. 5). Larval sensilli (*ss*) and bothridia (*bo*) weakly developed; sensillus setiform, barbed (Fig. 6), and bothridium sack-shaped. Nymphal sensilli and bothridia well developed; sensillus with well developed club, barbed (Fig. 7), and bothridium funnel-shaped, with large opening.

Gastronotic region (Figs. 1–3, 8, 31–39). Rounded posteriorly. Cuticle of larva with large with convexities (tubercles, diameter 6–9) that are almost hemispherical, and crowded together (Fig. 8). Typical distance between tubercles much more less than their diameter. Cuticle of nymphs with tubercles (diameter of tubercles 4–6), but less dense than in larva. Typical distance between tubercles greater to slightly less than their diameter Deutonymphs and tritonymphs with well developed dehiscence lines (Figs. 34, 35, 37, 38), becoming indistinct posteriorly; larva and protonymph with dehiscence line developed only anteriorly (Figs. 2, 31, 32).

Larvae with 13 pairs of gastronotic setae; nymphs with 16 pairs. Setae c_1, c_2, cp, d_1, d_2, e_1, e_2, f_2 long, strongly developed, straight or weakly curved, barbed, set on small apophyses. Setae c_3, p_3 (Figs. 18, 19) shorter, setiform, barbed, set on small apophyses. Setae p_1 long, with flagellate tips, smooth or weakly barbed proximally, on apophyses. Morphology of other setae changes during ontogeny. Setae f_1: long, strongly, barbed in larva (Fig. 8); short, spine-like, slightly thickened,

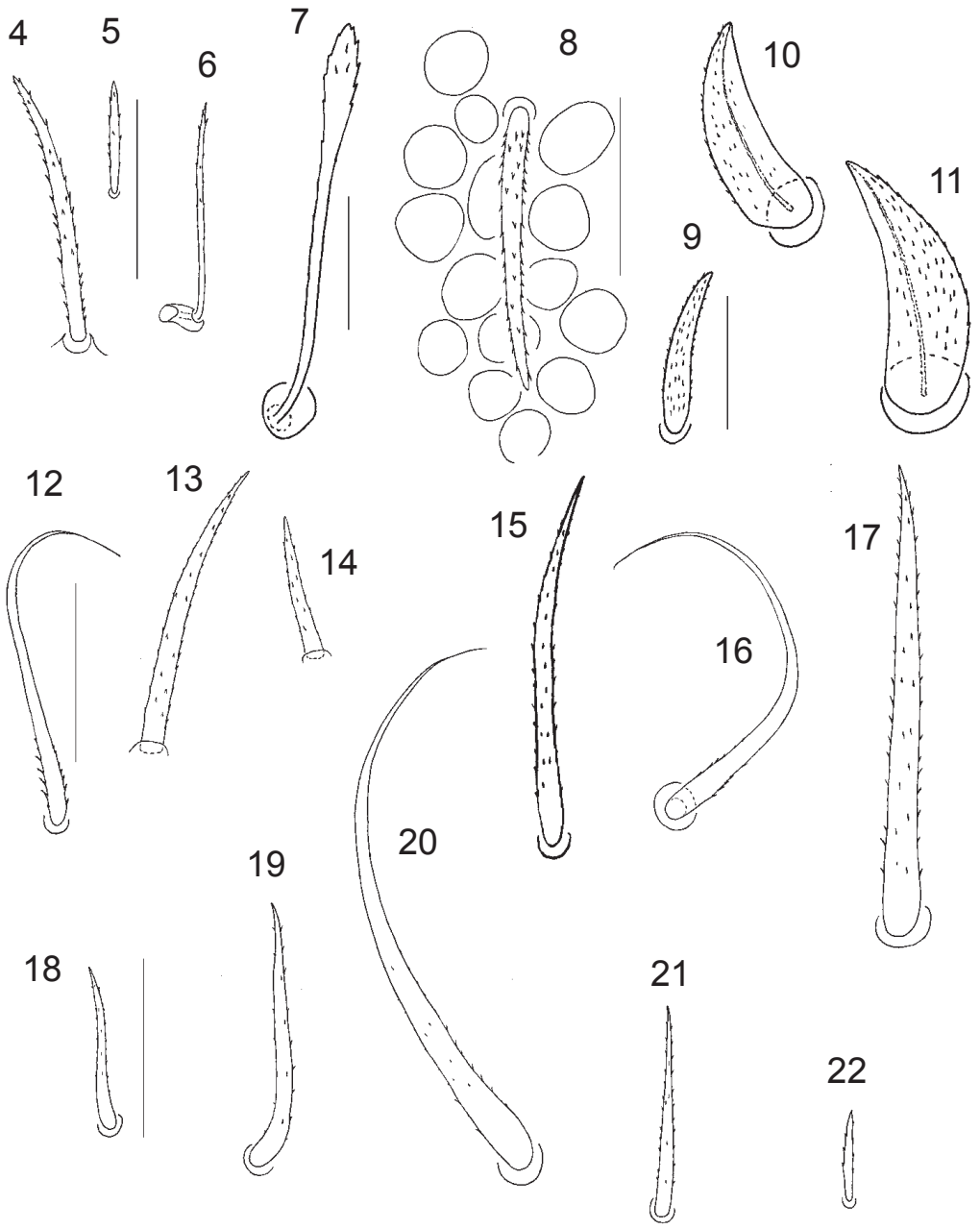

Fig. 4–22. *Hermanniellla dolosa*, juveniles, shapes of various setiform organs of larva (La), protonymph (Pn), deutonymph (Dn) and tritonymph (Tn): 4 — seta *le* (La); 5 — seta *ex* (La); 6 — sensillus (L); 7 — sensillus (Pn); 8 — seta f_1 with tubercles (L); 9 — seta f_1 (Pn); 10 — seta f_1 (Dn); 11 — seta f_1 (Tn); 12 — seta h_1 (L); 13 — seta h_1 (Pn); 14 — seta h_2 (Pn); 15 — seta h_3 (Pn); 16 — seta p_2 (Pn); 17 — seta p_2 (Dn); 18 — seta p_3 (Pn); 19 — seta p_3 (Dn); 20 — seta ad_1 (Dn); 21 — seta ad_3 (Dn); 22 — seta 1*b* (L). Scale bars 20 μm, the following groups to same scale: 4–6, 9–11, 12–22.

barbed in protonymph (Fig. 9); thorn-like, thick, with very thin internal core, barbed in deuto-, tritonymph (Fig. 10, 11). Setae h_1: largest seta, with flagellate tips, weakly barbed proximally in larva (Fig. 12); long, straight, without flagellate tips, barbed in nymphs (Fig. 13). Setae h_2: largest seta, with flagellate tips, weakly barbed proximally in larva; shorter, strongly, without flagellate tips, barbed in nymphs (Fig. 14). Setae h_3: minute in larva; long, straight, barbed in nymphs (Fig. 15). Setae p_2: long, with flagellate tips, smooth or weakly barbed proximally in protonymph (Fig. 16); long, strongly, without flagellate tips, barbed in deuto- and tritonymph (Fig. 17).

Cupules *ia*, *im*, *ip* and opisthosomal gland opening (*gla*) well visible in larva and protonymph, but indistinct in deuto- and tritonymph. Apertures of opisthosomal glands normal, without tube shape.

Anogenital region (Figs. 3, 33, 36, 39). Cuticle of anogenital region with tubercles. Ontogenetic genital, aggenital, adanal, anal formulas,

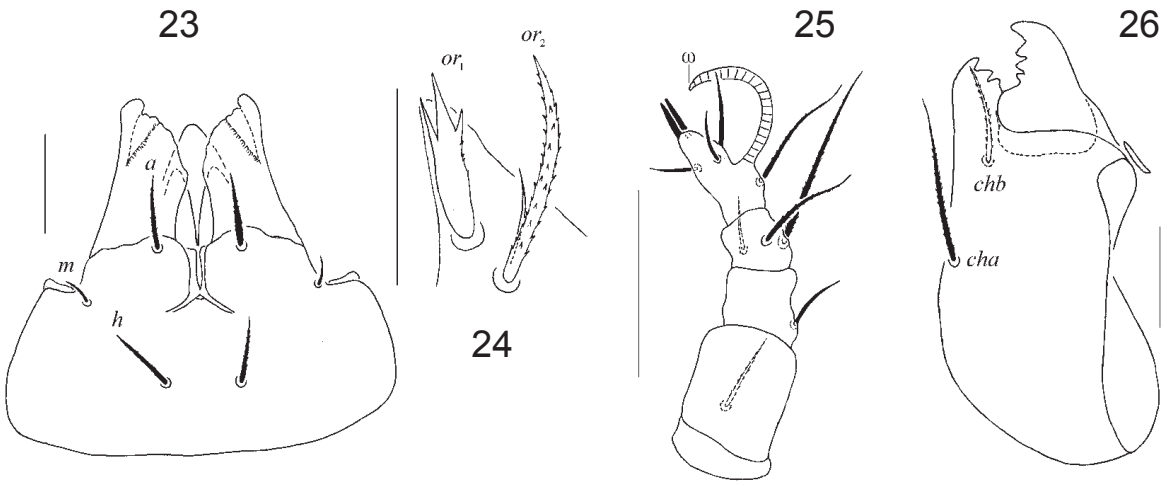

Fig. 23–26. *Hermanniellla dolosa*, larva: 23 — infracapitulum; 24 — setae or_1 and or_2; 25 — palp; 26 — chelicera. Scale bars 20 μm (23, 25, 26), 10 μm (24).

Table 2
Setation of *Hermanniella dolosa* during ontogeny*

Character	Larva	Protonymph	Deutonymph	Tritonymph
Epimeral setation	3–1–2	3–1–2–1	3–1–2–3	3–1–2–3
Number of notogaster setae	13	16	16	16
Number of genital setae	0	1	4	6
Number of aggenital setae	0	0	1	1
Number of adanal setae	0	0	3	3
Number of anal setae	0	0	0	2

* In pairs

larva to tritonymph, are 0–1–4–6, 0–0–1–1, 0–0–3–3, 0–0–0–2 respectively. Genital setae setiform, barbed, with different lengths (lateral setae longer than medial). Aggenital setae setiform, barbed. Adanal setae: ad_1 long, with flagellate tips, weakly barbed proximally (Fig. 20); ad_2 and ad_3 shorter, setiform, barbed (Fig. 21). Deutonymphs with 2 pairs of vestigial alveoli (Fig. 36). Tritonymphal anal setae setiform, smooth; an_1 longer, than an_2).

Cupules (*ih*, *ips*, *iad*) well visible in larva and protonymph, indistinct in deutonymph, nearly invisible in tritonymph.

Epimeral region (Figs. 3, 33, 36, 39). Epimera with paired, smooth plates having well defined borders; soft sternal region with tubercles. Setal formulas for epimeres: larva: 3–1–2 (third setae of the first epimeres (1*c*) forms protective scale over Claparède's organ); protonymph: 3–1–2–1; deuto-, tritonymph: 3–1–2–3. Epimeral setae short, setiform, weakly barbed (Fig. 22).

Gnathosoma (Figs. 23–26). Infracapitular mentum wider than long (Table 3). Hypostomal setae *a* and *h* long, setiform, barbed; seta *a* sometimes weakly expanded in middle-proximal parts. Seta *m* shorter, setiform, weakly barbed (Fig. 23). Lateral lips with 2 pairs of adoral setae (*or*) in all instars. Seta or_1 expanded, with 3 distinct points; or_2 long, thick, barbed, but with short, thin, smooth branch near base (Fig. 24).

Palps slender, with 5 segments. Palpal setation: larvae and protonymphs: 0–1–1–3–6 (+1ω); deuto- and tritonymphs: 0–2–1–3–6 (+1ω). Palpal setae smooth and barbed. Palpal solenidion long, thick, claw-shaped (Fig. 25, Table 3).

Chelicerae with few blunt teeth on fixed and movable digits. Cheliceral setae long, setiform, barbed (*cha* longer, than *chb*) (Fig. 26, Table 3).

Legs (Figs. 27–30, 40–43) Tarsi with 1 simple claw. Most setae long, barbed. Setae *p* of tarsus I short, thin, smooth; setae *p* absent from tarsi II–IV. Setae *u* large, mostly barbed, distally flattened, ribbon-like. Tibia I–III and genua I–III with seta *d* and solenidion coupled on dorsal side; relative lengths of some change during ontogeny: larva with seta *d* of all genua and of tibia I, II shorter than

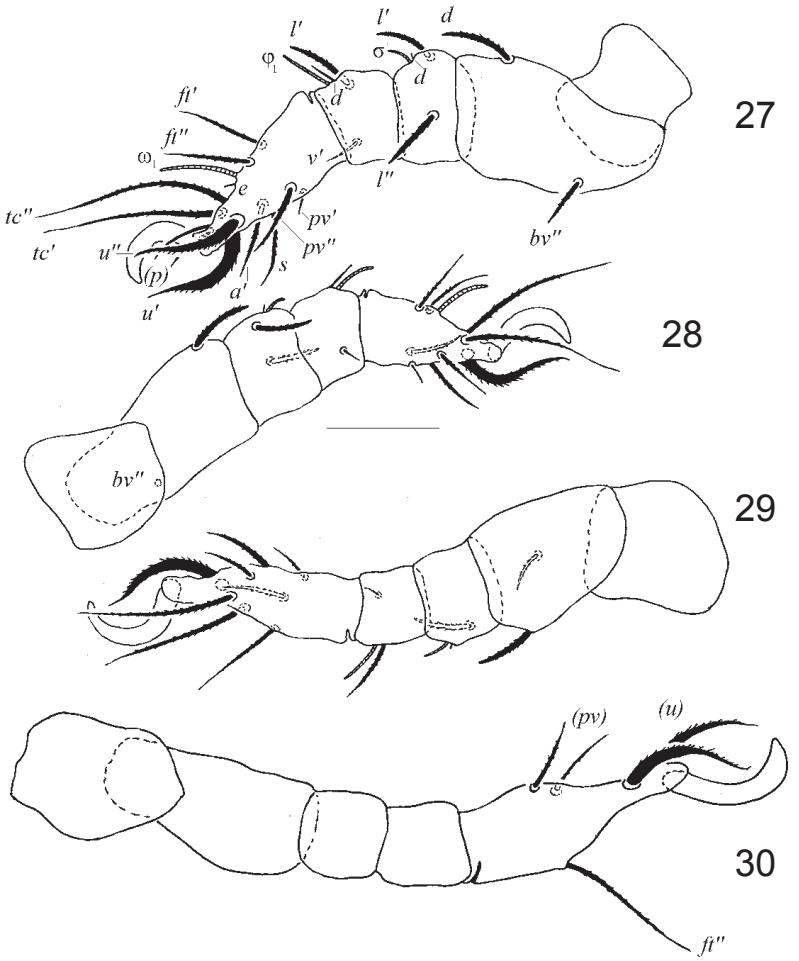

Fig. 27–30. *Hermanniella dolosa*, juveniles: 27–29 — larva, legs I–III, respectively; 30 — protonymph, leg IV. Scale bar 20 μm.

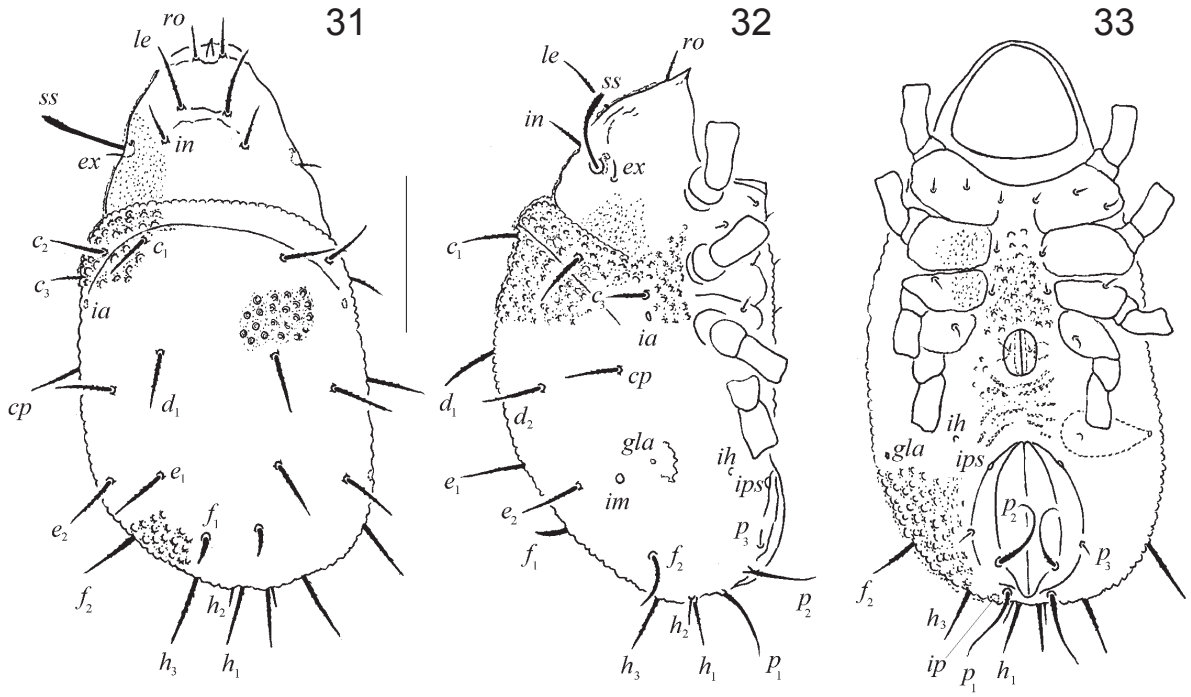

Fig. 31–33. *Hermanniella dolosa*, protonymph: 31 — dorsal view, legs removed; 32 — lateral view, legs partly removed; 33 — ventral view, legs partly removed. Scale bar 100 μm.

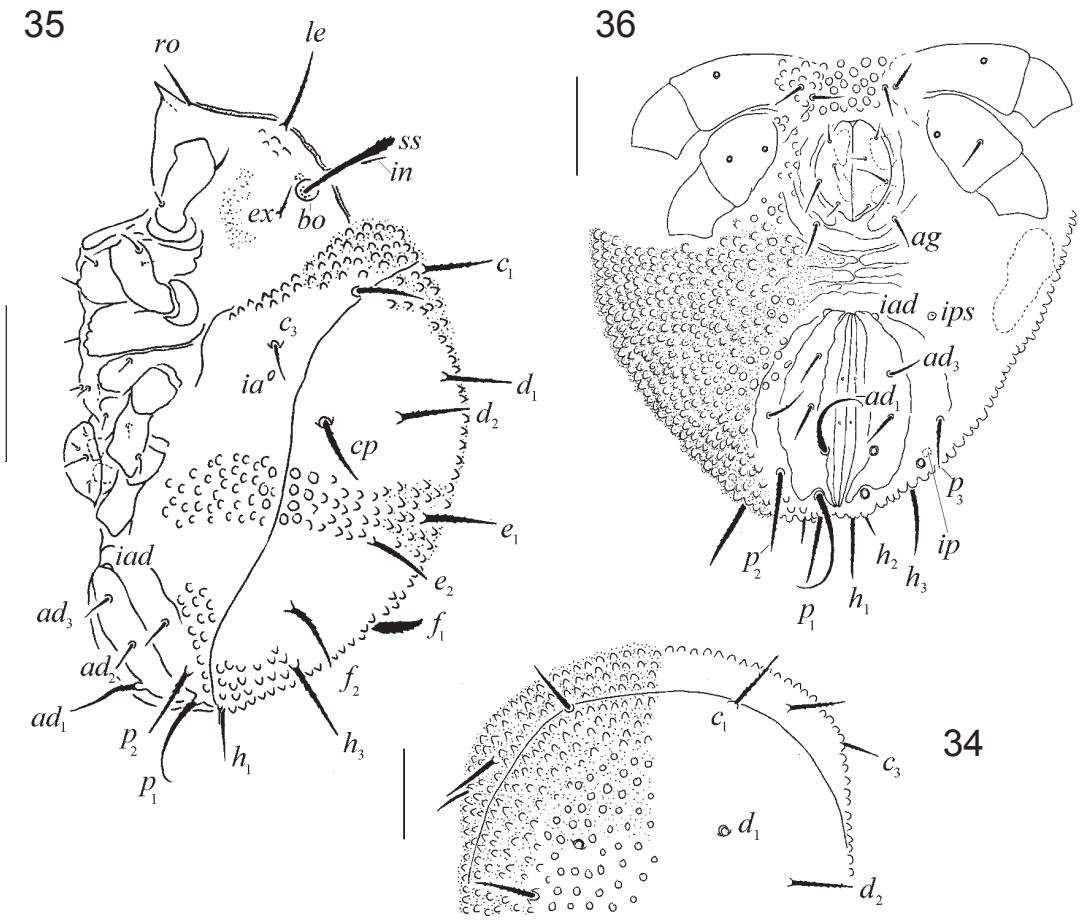

Fig. 34–36. *Hermanniella dolosa*, deutonymph: 34 — gastronotic anterior margin; 35 — lateral view, legs partly removed; 36 — anogenital region, legs partly removed. Some setae of gastronotic region and epimeres is broken. Scale bars 50 μm (34, 36), scale bar 100 μm (35).

Table 3

Size changes in the gnathosoma of *Hermanniella dolosa* during ontogeny

Character	Larva	Protonymph	Deutonymph	Tritonymph
Length of infracapitulum	65–73	73–77	86–94	98–106
Width of infracapitulum	77–82	77–86	98–102	110–118
Length of palps	28–41	36–45	41–49	49–57
Length of chelicerae	86–90	94–102	106–114	118–127

solenidion, on tibia III setae *d* longer than solenidion; nymphs with setae *d* shorter than solenidion on tibia I, often similar to solenidion on genua and on tibia II, and longer than solenidion on tibia III, IV. Solenidia ω_1 (tarsus I), ω_1, ω_2 (tarsus II) rod-shaped, sharp at tip; other solenidia setiform.

Leg formulas: larva: I (0–2–3–3–13) [1–1–1], II (0–2–3–2–10) [1–1–1], III (0–2–2–2–9) [1–1–0]; protonymph: I (0–2–3–3–13) [1–1–2], II (0–2–3–2–10) [1–1–1], III (0–2–2–2–9) [1–1–0], IV (0–0–0–0–5) [0–0–0]; deutonymph: I (0–2–3–3–13) [1–2–2], II (0–2–3–2–10) [1–1–2], III (1–2–2–2–9) [1–1–0], IV (0–2–1–1–9) [0–1–0]; tritonymph: I (1–4–3–4–15) [1–2–2], II (1–4–3–3–10) [1–1–2], III (2–3–2–3–9) [1–1–0], IV (1–2–2–2–9) [0–1–0]; adult: I (1–5–5–5–17) [1–2–2], II (1–5–5–5–12) [1–1–2], III (2–3–3–3–10) [1–1–0], IV (1–3–3–3–10) [0–1–0]. Specific ontogeny of leg setae and solenidia given in Table 4.

DISCUSSION

Juvenile stages of *Hermanniella dolosa* are very similar in structure to those of other studied Hermanniellidae (Grandjean 1953, 1962 a, b): *Hermanniella* sp., *Sacculobates horologiorum* and *Ampullobates nigriclavatus*. For example, they are identical in genital, aggenital, adanal, anal and epimeral setal formulas and have similar structure

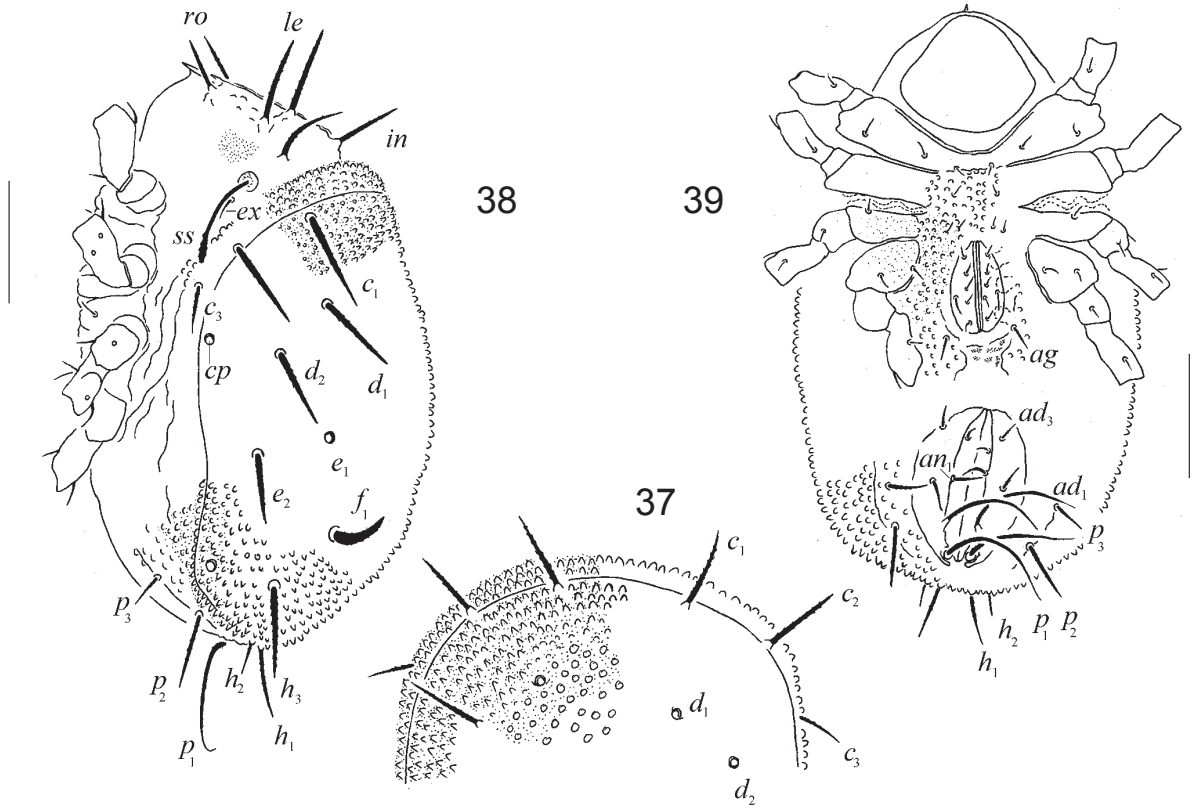

Fig. 37–39. *Hermanniella dolosa*, tritonymph: 37 — gastronotic anterior margin; 38 — lateral view, legs partly removed; 39 — anogenital region, legs partly removed. Some setae of gastronotic region, epimeres and legs is broken. Scale bar 50 μm (37), scale bars 100 μm (38, 39).

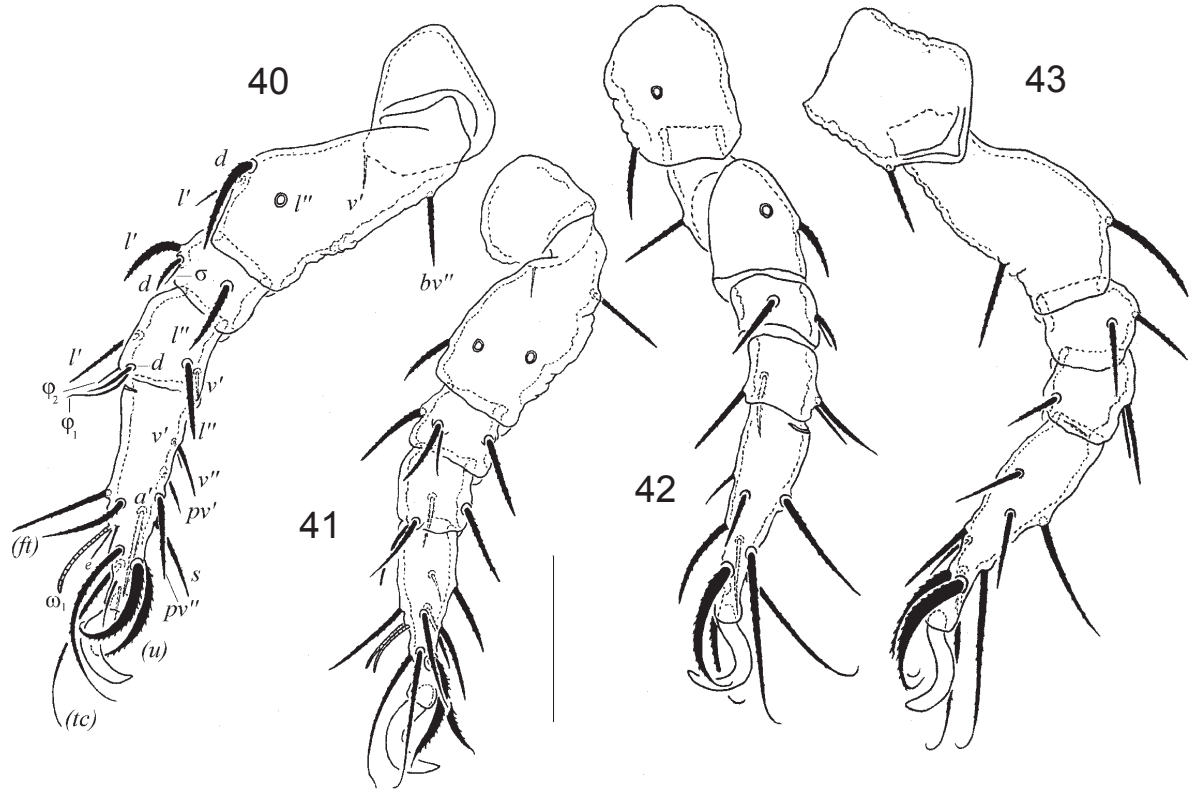

Fig. 40–43. *Hermanniella dolosa*, tritonymph: legs I–IV, respectively. Some setae of legs is broken. Scale bar 50 μm.

Table 4

Development of legs setation of *Hermanniella dolosa* during ontogeny*

	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I					
Larva	–	*d, bv″*	*dσ, (l)*	$d\phi_1$, *l′, v′*	*(ft), (tc), (p), (u), a′, s, (pv), e,* ω_1
Protonymph	–	–	–	–	ω_2
Deutonymph	–	–	–	ϕ_2	–
Tritonymph	*v′*	*(l)*	–	*l″*	*(v)*
Adult	–	*v″*	*(v)*	*v″*	*(l)*
Leg II					
Larva	–	*d, bv″*	*dσ, (l)*	*dϕ, v′*	*(ft), (tc), (u), a′, s, (pv),* ω_1
Protonymph	–	–	–	–	–
Deutonymph	–	–	–	–	ω_2
Tritonymph	*v′*	*(l)*	–	*l″*	–
Adult	–	*v″*	*(v)*	*l′, v″*	*(v)*
Leg III					
Larva	–	*d, ev′*	*dσ, l′*	*dϕ, v′*	*ft″, (tc), (u), a″, s, (pv)*
Protonymph	–	–	–	–	–
Deutonymph	*v′*	–	–	–	–
Tritonymph	*l′*	*l′*	–	*v″*	–
Adult	–	–	*v′*	–	*v′*
Leg IV					
Protonymph	–	–	–	–	*ft″, (u), (pv)*
Deutonymph	–	*d, ev′*	*d*	*dϕ*	*(tc), a″, s*
Tritonymph	*v′*	–	*l′*	*v′*	–
Adult	–	*l′*	*v′*	*v″*	*v′*

* Roman letters refer to normal setae, Greek letters refer to solenidia, *e* — famulus, *dσ* and *dϕ* — solenidia and seta coupled. 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. Setae are listed only for the stage in which they first appear.

of cuticle and cerotegument. Gastronotic setation differs slightly, because seta h_3 forms in the larva of *H. dolosa*, but not that of *S. horologiorum*; also, there are other fine differences in form of the body setation (Table 5). Leg setation of *Hermanniella dolosa* also differs, for example: 1) tarsi II–IV without setae *p* (present in *S. horologiorum*, *A. nigriclavatus*), 2) all tarsi (except tarsus I of tritonymphs) with 1 seta *a* (2 setae *a* in *S. horologiorum*, *A. nigriclavatus*), 3) on trochanter III seta *l'* appears in deutonymph (protonymph in *S. horologiorum*, *A. nigriclavatus*).

Grandjean (1953, 1962a) listed several characters as representing the family Hermanniellidae, one of which was paraproctal atrichosy from larva to deutonymph. However, deutonymphs of *Hermanniella dolosa* have 2 pairs of vestigial alveoli, so the regression is incomplete. This should be indicated in any future diagnosis of the family.

ACKNOWLEDGEMENTS

The author cordially thanks Prof. Dr. Roy A. Norton, State University of New York, Syracuse, USA, for his consultation and help with collecting literature, for his thorough review of this manuscript and many valuable suggestions.

REFERENCES

Ermilov, S.G. 2008. *Laboratornoe kul'tivirovanie oribatidnykh kleshchey nadsemeystva Crotonioidea (Acari, Oribatida) s tsel'yu izucheniya ikh razvitiya*. Nizhniy Novgorod, 54 pp. [In Russian]

Grandjean, F. 1953. Essai de classification des Oribates (Acariens). *Bull. Soc. zool. France*, 78 (5–6): 421–446.

Grandjean, F. 1962a. Au sujet des Hermanniellidae (Oribates). *Acarologia*, 4 (2): 237–273.

Grandjean, F. 1962b. Au sujet des Hermanniellidae (Oribates). Deuxième partie. *Acarologia*, 4 (4): 632–670.

Table 5
Differentiation of juvenile stages of *Hermanniella dolosa, Sacculobates horologiorum* and *Ampullobates nigriclavatus*[*]

Character	*H. dolosa*		*S. horologiorum*		*A. nigriclavatus*
	Larva	Nymphs	Larva	Nymphs	Nymphs
Setae *le*	Setiform	Setiform	Expanded distally	Expanded distally	Hardly expanded distally
Length *le* and *in*	*le* longer than *in*	*le* longer than *in*	*le* shorter than *in*	*le* shorter than *in*	*le* shorter than *in*
Sensilli	Weakly developed	Well developed	Weakly developed	Weakly developed	Weakly developed
Gastronotic setae, in pairs	13	16	12	16	16
Setae *c, d, e,* f_2	Setiform	Setiform	Expanded distally	Expanded distally	Setiform or expanded distally
Setae f_1	Setiform	Thorn like	Expanded distally	Expanded distally	Setiform or expanded distally
Setae h_3	Minute	Setiform	Absent	Expanded distally	Tape-shaped

[*] Data for *Sacculobates horologiorum* from Grandjean (1962a); data for *Ampullobates nigriclavatus* from Grandjean (1962b).

Subías, L.S. 2004. Listado sistematico, sinonimico y biogeografico de los acaros oribatidos (Acariformes, Oribatida) del mundo (1758–2002). *Graellsia*, 60. Numero extraordinario: 3–305. Listado sistematico, sinonimico y biogeografico de los acaros oribatidos (Acariformes, Oribatida) del mundo (excepto fosiles). Actualizado en abril de 2009. http://www.ucm.es/info/zoo/Artropodos/Catalogo.pdf