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MORPHOLOGY OF NYMPHAL INSTARS OF *MONTIZETES ABULENSIS* (ACARI, ORIBATIDA, ORIBELLIDAE)

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ABSTRACT: The morphology of nymphal instars of the oribatid mite *Montizetes abulensis* Pérez-Íñigo, 1984 (Oribellidae) is described and illustrated. In most aspects all these instars are similar: body with granular cerotegument; gastronotum with sclerites; sensilli elongate, spindle-shaped; interlamellar setae minute, spiniform; setal formulae of body (proto- to tritonymph): genital (1–3–5), aggenital (0–1–1), anal (0–0–2), adanal (0–3–3), gastronotic (15–15–15) and epimeral (3–1–2–1, 3–1–2–2, 3–1–3–3); palpal setation: 0–2–1–3–8(+ω); tarsi II with one solenidion. The nymphal instars of *M. abulensis* differ from those of *M. alpestris* by having fewer gastronotic sclerites and shorter sensillar apex. The juveniles of *Montizetes* and *Pantelozetes* differ from those of *Banksinoma* by the presence of body sclerites.

KEY WORDS: oribatid mites, juvenile instars, nymphs, morphology, ontogeny, diagnosis, *Montizetes*, *Pantelozetes*, *Banksinoma*

INTRODUCTION

The oribatid mite genus *Montizetes* Kunst, 1971 of the family Oribellidae currently includes seven species, which collectively are distributed in the Holarctic region (Subías 2004, updated 2013). At present, the morphology of juvenile instars in Oribellidae was described in detail only for *Montizetes alpestris* (Willmann, 1929) (see Shaldybina 1969, 1971), but partial descriptions are available for several other oribellid species. Michael (1888) briefly described a nymph of *Oribella pectinata* (Michael, 1885), Tuxen (1943) briefly presented figures of a larva and nymph of *Pantelozetes paolii* (Oudemans, 1913) and Fujikawa (1979) briefly described a nymph of the latter species. Some authors (for example, Weigmann 2006; Bayartogtokh 2011) include these oribellid genera in a broad concept of Thyrisomidae, along with *Banksinoma*. Juveniles of the latter are known to some extent, as Ermilov (2010) described and illustrated all juvenile instars of *Banksinoma lanceolata* (Michael, 1885), and Hammer (1958) briefly described a nymph of *B. spinifera* (Hammer, 1952). However, Subías (2004) considered Oribellidae a distinct family, with *Banksinoma* being the sole genus in Thyrisomidae.

The primary goal of the present work is to describe and illustrate the morphology of nymphal instars of *Montizetes abulensis* Pérez-Íñigo, 1984, a species currently known only from Iberica (Subías 2004, updated 2013). Adults of this species were clearly described and illustrated by Pérez-Íñigo (1984). A secondary goal is compare juvenile instars among species of *Montizetes* and other oribellid genera, based on our data and others from the literature.

MATERIALS AND METHODS

Material. Nymphs of *Montizetes abulensis* were collected at the following locality: Eastern Spain, Alicante Province, Aitana Mountains, soil traps, 26.01.2012, collected by V. Ortuño. The field-collected material included: four protonymphs, two deutonymphs, and five tritonymphs.

Methods of study. All specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the gastronotum. Gastronotic width refers to the maximum width in dorsal aspect. All body measurements are presented in micrometers (μm). Formulae for leg setation are given in parentheses according to the sequence trochanter–femur–genu–tibia–tarsus (famulus included). Formulae for leg solenidia are given in square brackets according to the sequence genu–tibia–tarsus.

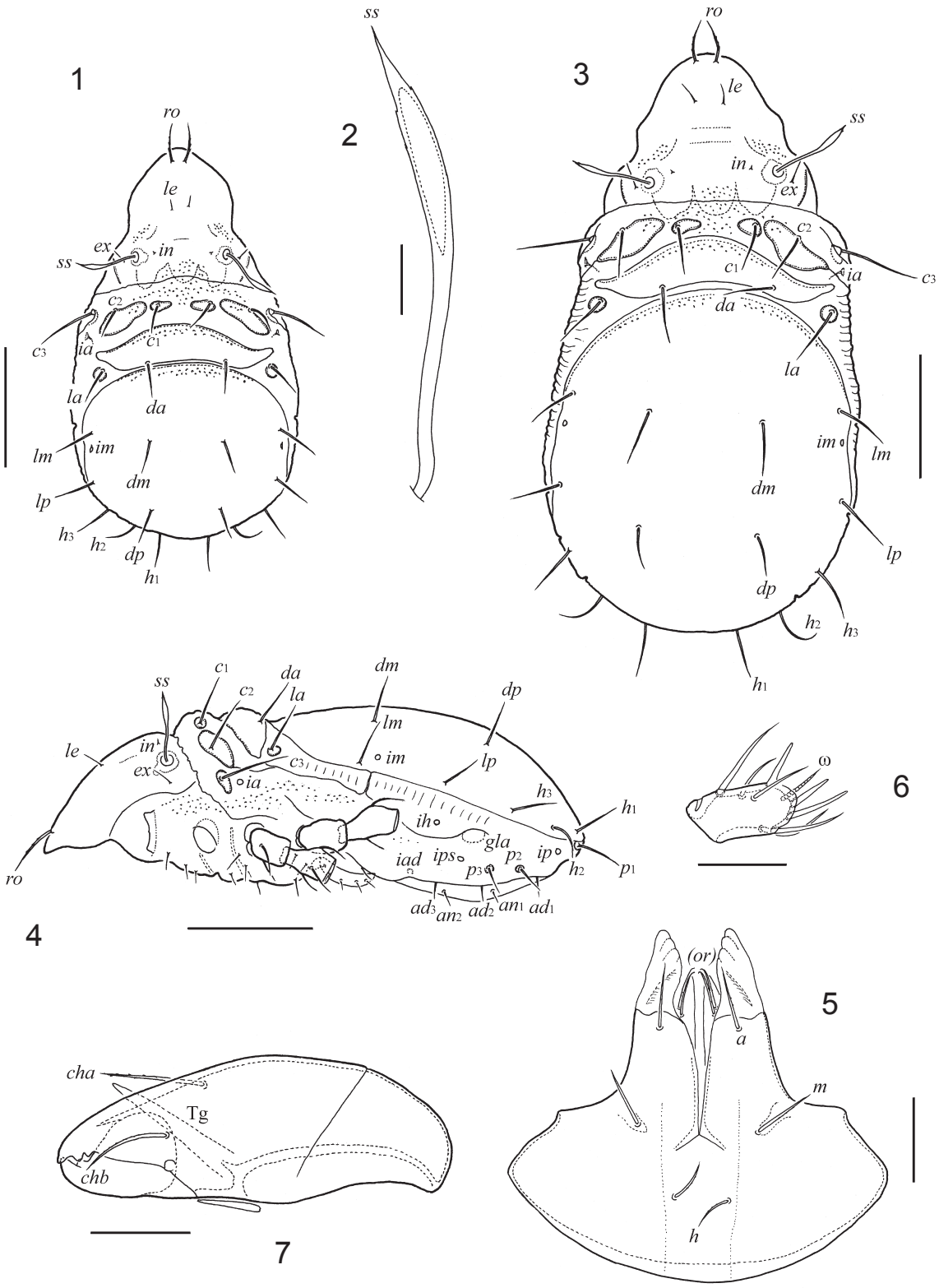
General terminology used in this paper mostly follows that of F. Grandjean (see Travé and Vachon 1975 for many references).

Description of nymphal instars *Montizetes abulensis* Pérez-Íñigo, 1984

Figs 1–17

Dimensions. Body length: protonymph 332–348, deutonymph 398–415, tritonymph 431–498. Body width: protonymph 166–182, deutonymph 199–215, tritonymph 249–265. Body longer than wide, approximately by 1.8–1.9.

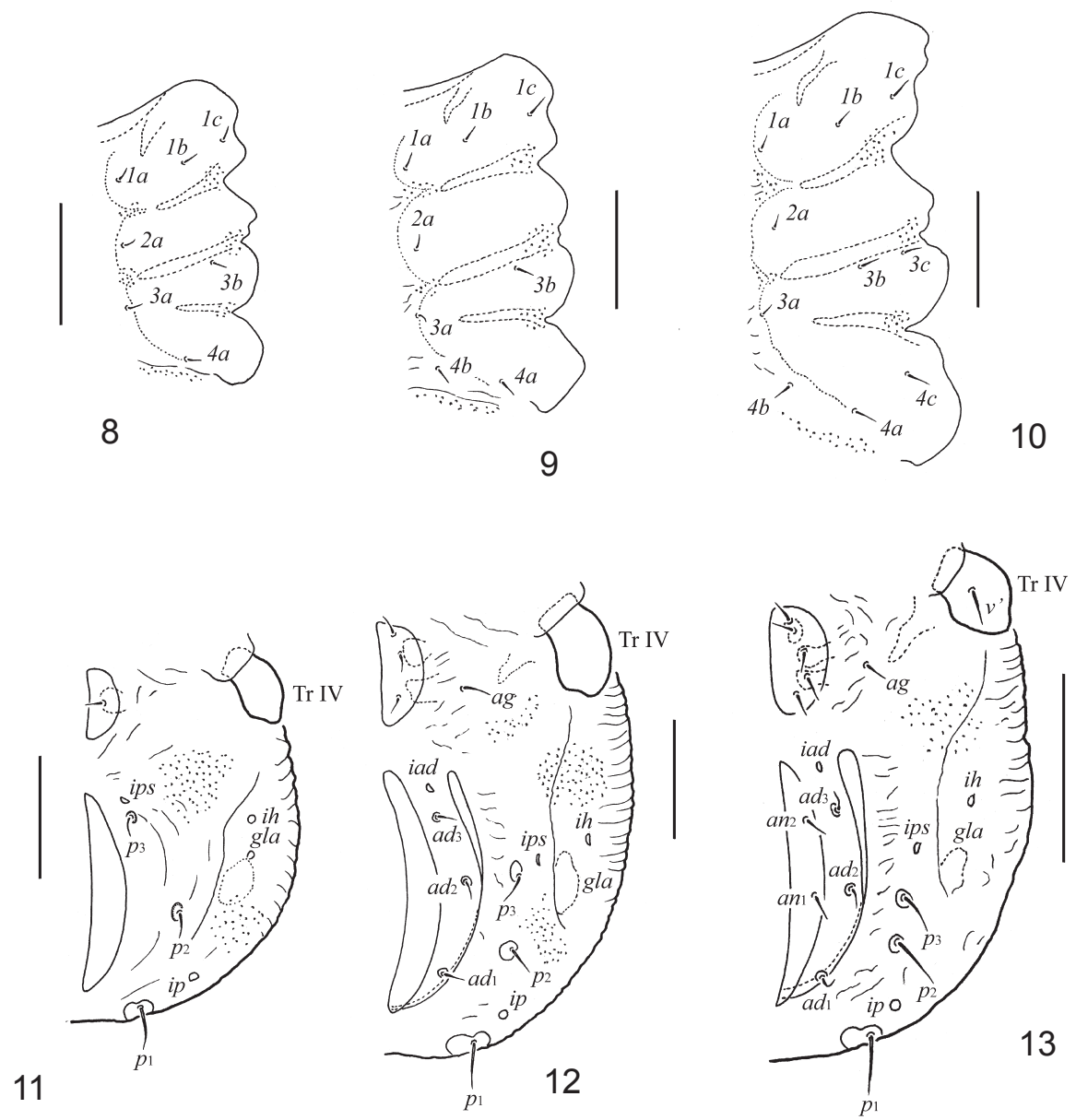
Integument. Body cuticle colourless, smooth. Granular cerotegument covers lateral and anogenital regions (also partially dorsal side and epimeral region). Granules small (diameter <1), spherical.



Figs. 1–7. *Montizetes abulensis*, proto- (1, 2, 5–7) and tritonymphal (3, 4) instars: 1, 3 — dorsal view; 2 —sensillus; 4 — lateral view; 5 — subcapitulum; 6 — palptarsus; 7 — chelicera. Scale bars 100 μm (1, 3, 4), 10 μm (2, 6), 20 μm (5, 7).

Body setae without cerotegument. Gastronotum with sclerites.

Prodorsum (Figs 1–4). Roughly triangular, relatively short, about 1/2–2/5 times length of gastronotic region in lateral view. Rostrum widely rounded in dorsal view. Rostral setae (*ro*) of medium size, setiform, weakly thickened, with short cilia unilaterally, set on tubercles. Lamellar (*le*)

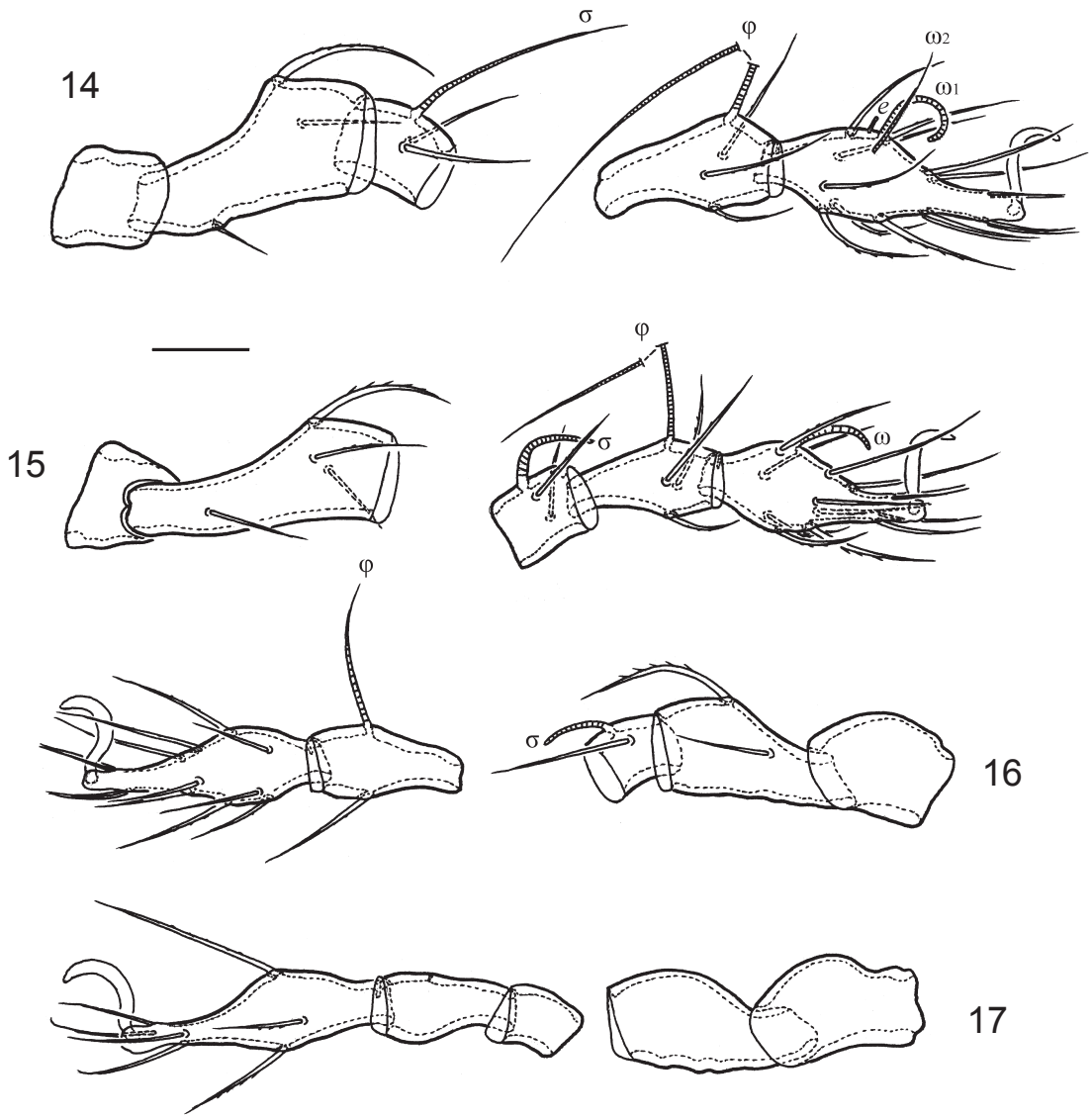


Figs. 8–13. *Montizetes abulensis*, epimeral (8–10) and anogenital (11–13) regions of nymphal instars: 8, 11 — protonymph; 9, 12 — deutonymph; 10, 13 — tritonymph. Scale bars 50 μm (8–12), 100 μm (13).

and exobothridial (*ex*) setae shorter, thin, smooth, set on very small tubercles. Interlamellar setae (*in*) minute, spiniform. Sensilli (*ss*) longest setae of prodorsum, elongate spindle-form, with short thin apex. Several indistinctly visible barbs present on head nearly to the apex. Length of prodorsal setae: *ss* > *ro* > *ex* ≈ *le* > *in*.

Gastronotic region (Figs 1, 3, 4). Rounded posteriorly. All nymphal instars with 15 pairs of gastronotic setae. Setae of medium size, approximately identical length (except c_3 longer, and p_2, p_3 shorter), setiform, indistinctly barbed, set on small tubercles. Gastronotum with 16 (in protonymphal instar) or 18 (in deuto- and tritonymphal instars) sclerites. Setae c_1, c_2, c_3, *la*, p_1, p_2, p_3 inserted on separate sclerites. Sclerites bearing setae c_2 larger, oblong; other sclerites small, rounded or oval. Setal pair *da* inserted on large, transversally elongate, unpaired sclerite. Setae *dm*, *lm*, *dp*, *lp*, h_1, h_2, h_3 inserted on very large cap-like sclerite. Cupules *ia*, *im* and *ip* well visible. Opisthonotal gland openings (*gla*) well visible.

Gnathosoma (Figs 5–7). Subcapitulum wide than longer. Subcapitular setae *h* shorter than *a* and *m*. Lips with two adoral setae (or_1, or_2). All subcapitular setae setiform, indistinctly barbed. Palpal setation 0–2–1–3–8(+ω). Palpal solenidion ω setiform, not combined as "double horn" to eu-



Figs. 14–17. *Montizetes abulensis*, legs of protonymphal instar: 14 — leg I, right, antiaxial view; 15 — leg II, right, antixial view; 16 — leg III, right, antiaxial view; 17 — leg III, right, antiaxial view. Scale bar 20 μm.

pathidium. Chelicerae with two or three blunt teeth on fixed and movable digits. Cheliceral setae long, setiform, barbed; *cha* little longer than *chb*. Trägårdh's organ (Tg) distinct, elongate conical.

Epimeral region (Figs 4, 8–10). Setal formulae for epimeres: protonymph 3–1–2–1; deutonymph 3–1–2–2, tritonymph 3–1–3–3. Epimeral setae rather short, smooth or indistinctly barbed, set on small tubercles.

Anogenital region (Figs 11–13). Ontogenetic genital, aggenital, adanal, anal formulae (proto- to tritonymph) 1–3–5, 0–1–1, 0–3–3, 0–0–2 respectively. All setae rather short, setiform, smooth or indistinctly barbed. One pair of longitudinally elongate sclerites located lateral to adanal setae ad_2, ad_3 in deuto- and tritonymphal instars. Cupules *ih*, *ips*, *iad* appearing in normal ontogenetic pattern.

Legs (Figs 14–17). Formulae of leg setation and solenidia: protonymph I (0–3–2–3–16) [1–1–2], II (0–4–2–3–13) [1–1–1], III (1–2–1–1–13) [1–1–0], IV (0–0–0–0–7) [0–0–0]; deutonymph I (0–4–2–3–16) [1–2–2], II (0–4–2–3–13) [1–1–1], III (1–3–1–2–13) [1–1–0], IV (0–2–2–1–12) [0–1–0]; tritonymph: I (1–4–2–3–18) [1–2–2], II (1–4–2–3–15) [1–1–1], III (2–3–1–2–15) [1–1–0], IV (1–2–2–2–12) [0–1–0]; homology of setae and solenidia indicated in Table. Setae setiform, mostly slightly barbed. Famulus (*e*) short, straight, weakly dilated distally. Solenidia ω_1 on tarsi I, ω

Table.
Development of leg setation of *Montizetes abulensis* during ontogeny.
Larva unknown; most setae of protonymph probably formed in larval instar (see Ermilov 2010)

	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I					
Protonymph	–	*d*, *l′*, *bv″*	*(l)*, σ	*(l)*, *v′*, φ_1	*(ft)*, *(tc)*, *(p)*, *(u)*, *(a)*, *s*, *(pv)*, *(pl)*, *e*, ω_1 ω_2
Deutonymph	–	*l″*	–	φ_2	–
Tritonymph	*v′*	–	*v′*	–	*(it)*
Leg II					
Protonymph	–	*d*, *(l)*, *bv″*	*(l)*, σ	*(l)*, *v′*, φ	*(ft)*, *(tc)*, *(p)*, *(u)*, *(a)*, *s*, *(pv)*, ω
Deutonymph	–	–	–	–	–
Tritonymph	*v′*	–	–	–	*(it)*
Leg III					
Protonymph	–	*d*, *ev′*	*l′*, σ	*v′*, φ	*(ft)*, *(tc)*, *(p)*, *(u)*, *(a)*, *s*, *(pv)*
Deutonymph	*v′*	*l′*	–	*v″*	–
Tritonymph	*l′*	–	–	–	*(it)*
Leg IV					
Protonymph	–	–	–	–	*ft″*, *(p)*, *(u)*, *(pv)*
Deutonymph	–	*d*, *ev′*	*d*, *l′*	*v′*, φ	*(tc)*, *(a)*, *s*
Tritonymph	*v′*	–	–	*v″*	–

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. Setae are listed only for the instar in which they first appear.

on tarsi II, σ on genua I, II thickened, blunt-ended; other solenidia longer, setiform, thin.

REMARKS

Nymphal instars of *Montizetes abulensis* and *M. alpestris* (see Shaldybina 1969, 1971; Ermilov 2010) are similar in the following traits: body form; granular cerotegument on body; similar proportions of lengths of prodorsal setae (*ss* > *ro* > *ex* ≈ *le* > *in*); sensilli spindle-form; interlamellar setae minute, spiniform; gastronotum with sclerites; all gastronotic setae set on sclerites; setae c_3 longer than other gastronotic setae; identical gastronotic (15–15–15), epimeral (3–1–2–1, 3–1–2–2, 3–1–3–3), genital (1–3–5), aggenital (0–1–1), adanal (0–3–3) and anal (0–0–2) setal formulae; leg tarsi II with one solenidion. We believe that the majority of the listed characters are diagnostic for juveniles of *Montizetes*.

The most distinctive differences between nymphal instars of *Montizetes abulensis* and *M. alpestris* are as follows:

1) notogastral setae *da* inserted on one, large, unpaired sclerite in *M. abulensis* but on two small separate sclerites in *M. alpestris*;

2) sensilli with short apex in *M. abulensis* but with long apex in *M. alpestris*.

Descriptions of juveniles of *Pantelozetes paolii* (larval and one nymphal instar: see Tuxen 1943; Fujikawa 1979) and *Oribella pectinata* (one nymphal instar: see Michael 1888) are very brief (only some characters are visible), therefore we can not make a detailed comparison with *Montizetes abulensis* and *M. alpestris*.

Juvenile instars of *Montizetes* (*M. abulensis* and *M. alpestris*) (see our data; also Shaldybina 1969, 1971), *Pantelozetes* (*P. paolii*: see Tuxen 1943; Fujikawa 1979) and *Banksinoma* (*B. lanceolata*, *B. spinifera*: see Ermilov 2010; Hammer 1958; also Grandjean 1953a, b) are similar in general appearance (see *Discussion* section in Ermilov 2010), but they differ in a clear and important trait. *Montizetes* and *Pantelozetes* juveniles have gastronotic sclerites, but those of *Banksinoma* do not. Probably, this character (and also others listed above) can help inform the controversy concerning the distinction of Oribellidae and Thyrisomidae and the genera included in them (Subías 2004; Weigmann 2006; Bayartogtokh 2011).

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