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A new species of *Reticulolaelaps* Costa (Acari: Laelapidae) associated with *Tapinoma* sp. (Hymenoptera: Formicidae) from Iran, with a review of the world species

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ABSTRACT — We describe a new mite species from Iran — *Reticulolaelaps costai* **n. sp.** (Acari: Laelapidae). The new species was collected from the nest of *Tapinoma* sp. (Hymenoptera: Formicidae) in Alborz Province. The additional morphological characters for complementing the description of *Reticulolaelaps lativentris* Karg is presented. A revised diagnosis for *Reticulolaelaps*, as well as a key to the world species of the genus, is presented.

KEYWORDS — *Reticulolaelaps*; Laelapidae; myrmecophily; Formicidae

INTRODUCTION

The genus *Reticulolaelaps* Costa, 1968 was first described from forest litter in Israel. This genus currently includes only three described species, *Reticulolaelaps faini* Costa, 1968, *Reticulolaelaps lativentris* Karg, 1978, and *Reticulolaelaps hallidayi* Joharchi, Nemati and Babaeian, 2013; two which were found in association with ants, the other one was found in soil and litter. *Reticulolaelaps lativentris* was transferred to the *Pseudoparasitus* Oudemans by Nemati *et al.*, 2013 which we confirmed here by examining the paratypes of that species. The genus *Reticulolaelaps* was first reported from Iran, in Isfahan province, associated with the bark of elm trees (Ghafarian *et al.*, 2012). The most recent taxonomic work to the genus was by Nemati *et al.* (2013), who clarified the diagnosis of this genus. We now remove a species that has been wrongly

placed in *Reticulolaelaps*, and move it into *Pseudoparasitus* Oudemans. We also describe a new species of *Reticulolaelaps* found in Iran and review the world records, and provide a key for identification of the species. Using these additional data, we redefine the genus *Reticulolaelaps* more precisely.

MATERIALS AND METHODS

Laelapidae were collected from ant nests mainly over a period of five years (2008–2014), mainly in Alborz Province. Mites were removed from ants' nests by hand picking or by extraction from ant nest material using Tullgren funnels. Mites were cleared in Nesbitt's solution and slide-mounted in Hoyer's medium. The nomenclature used for the dorsal idiosomal chaetotaxy is that of Lindquist and Evans (1965), the leg chaetotaxy is that of Evans (1963a),

the palp chaetotaxy is that of Evans (1963b), and names of other anatomical structures mostly follow Evans and Till (1979). We use the terms "lyrifissures" to refer to slit-shaped sensilli, "gland pores" to refer to structures that we believe are the openings of secretory pores, and "poroids" for circular or oval-shaped cuticular of unknown function. Holotype of the new species is deposited in the Acarological collection, Department of Plant Protection, Yazd Branch, Islamic Azad University (YIAU); paratype is deposited in the Jalal Afshar Zoological Museum, College of Agriculture, University of Tehran, Iran (JAZM). All measurements in the descriptions are given in micrometres (μm).

Genus *Reticulolaelaps* Costa

Reticulolaelaps Costa, 1968: 26.

Type species: *Reticulolaelaps faini* Costa, 1968.

Diagnosis — The genus is characterised by a well sclerotised hypertrichous holodorsal shield, convex dorsal shield and flat venter, and a large genito-ventral shield, strongly expanded posterior to coxae IV, abutting the anal shield, bearing six pairs of setae, with strong reticulated ornamentation. Pre-sternal absent; female sternal shield deeply concave in posterior margin and lateral corners extended to the posterior level of coxa III, with three pairs of simple sternal setae; endopodal shields between coxae II and III fused with sternal shield. Metasternal setae *st4* apparently absent; poroids *iv3* present on the posterolateral extensions of sternal shield; exopodal plate behind coxa IV large and triangular, more or less contiguous with but separate from peritrematal shields and genito-ventral shield; peritrematal shield extending posteriorly well past coxae IV; anal shield large and nearly twice as wide as long, cribrum relatively broad; opisthogastric membrane with five pairs of smooth setae; surface of epistome faintly reticulated, its anterior margin smooth, curved and well extended; chelicera with small and robust digits with few teeth. Hypostomal groove relatively narrow, with four rows of denticles on the anterior half of the groove, each bearing 2-5 small teeth; hypostome with two large membranous flaps near the insertion of corniculi. Corniculi relatively short, and

somewhat membranous. All the sclerotised parts of the body are well ornamented throughout, including the legs. Legs significantly shorter than idiosoma, genu III (2 2/1 2/0 1) and IV (2 2/1 3/1 1) with eight and ten setae respectively. Male with sterno-genitiventral shield with ten pairs of setae, with separate anal shield similar to that of the female.

Reticulolaelaps costai n. sp.

(Figures 1-2)

Specimens examined — Holotype, female, Iran, Qazvin, Savojbolagh, Khoznan, 36.71° N, 50.32° E, alt. 1595 m, 3 August 2012, O. Joharchi coll., in nest of *Tapinoma* sp. (Formicidae) (in YIAU). Paratype, one female same data as holotype (in JAZM).

Description of the Female

Dorsal idiosoma — Dorsal shield length 618 – 622, width 385 – 396 ($n = 2$) (Fig. 1A). Shield oval shaped, convex, well sclerotized, strongly reticulated; with about 117 – 120 thick, falciform setae, setae similar in length (50 – 62) and thickness, most long enough to reach well past base of next posterior seta, except *j1* (12 – 13) and *z1* (17 – 18). Shield with six pairs of pore-like structures, apparently including three pairs of gland pores and three pairs of poroids; lyrifissures near the base of *z1* large and slit-like, others smaller and ovoid.

Ventral idiosoma — (Fig. 1B). Tritosternum with paired pilose laciniae (57 – 62), columnar base ($22 \times 5 - 6$ wide); pre-sternal shields absent, some minute irregular platelets present behind coxa I. Sternal shield (length 57 – 65) narrowest between coxae II (99 – 100), widest at level between coxae II and III (183 – 185), with biconvex anterior margin and extending very slightly beyond level of *st1*; posterior margin deeply concave; shield bearing three pairs of smooth pointed setae (*st1* 37 – 38, *st2* 52 – 54, *st3* 52 – 53) and two pairs of lyrifissures, one pair adjacent to setae *st1* and the other between *st2* and *st3*; surface with distinct reticulate ornamentation, posteriorly smooth, behind level of *st2*. Metasternal setae *st4* apparently absent but metasternal poroids present on the posterolateral extensions of sternal shield; endopodal plates II/III fused to sternal

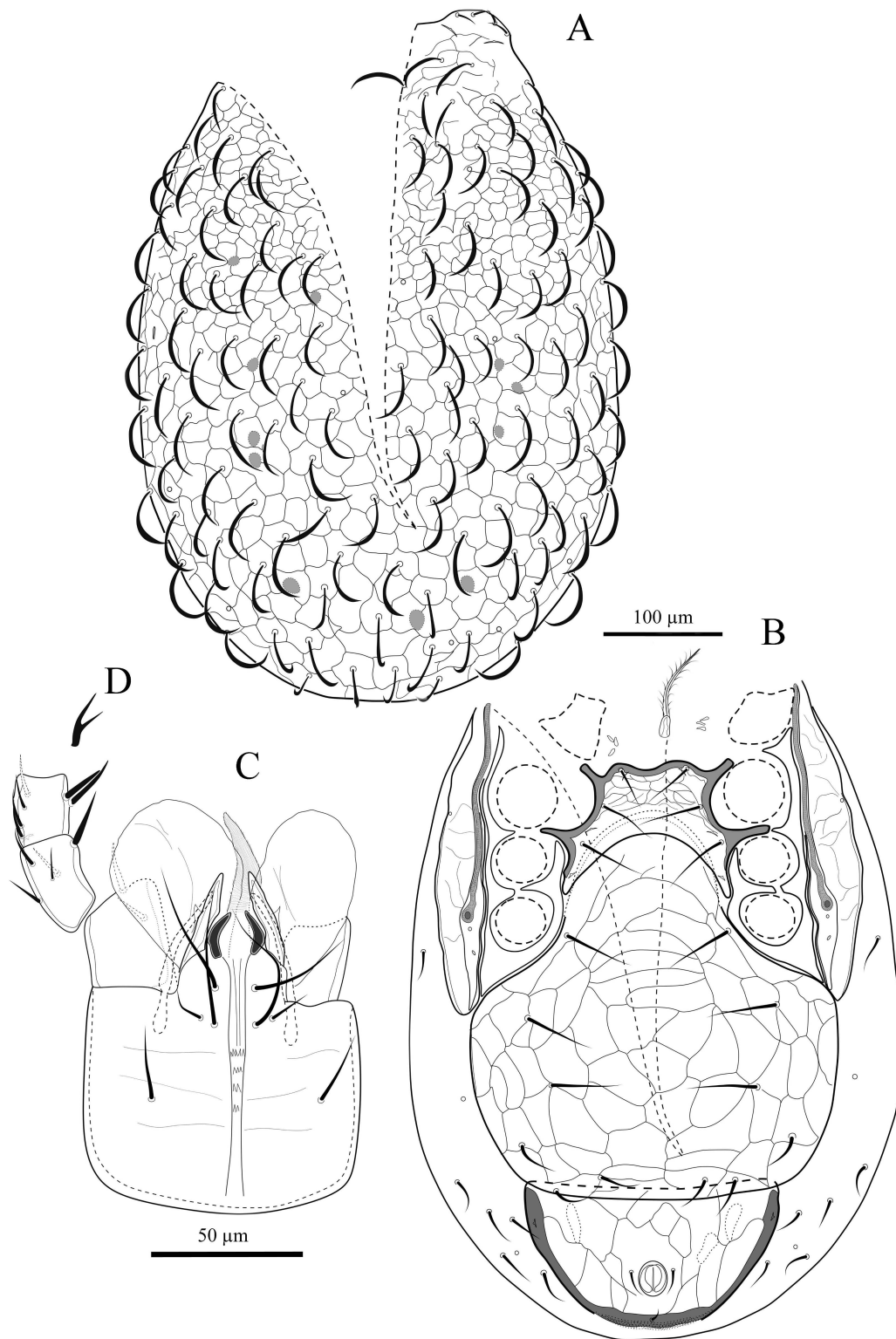


FIGURE 1: *Reticulolaelaps costai* n. sp., female: A – Dorsal shield; B – Ventral idiosoma; C – Hypostome; D – Palp tarsal claw.

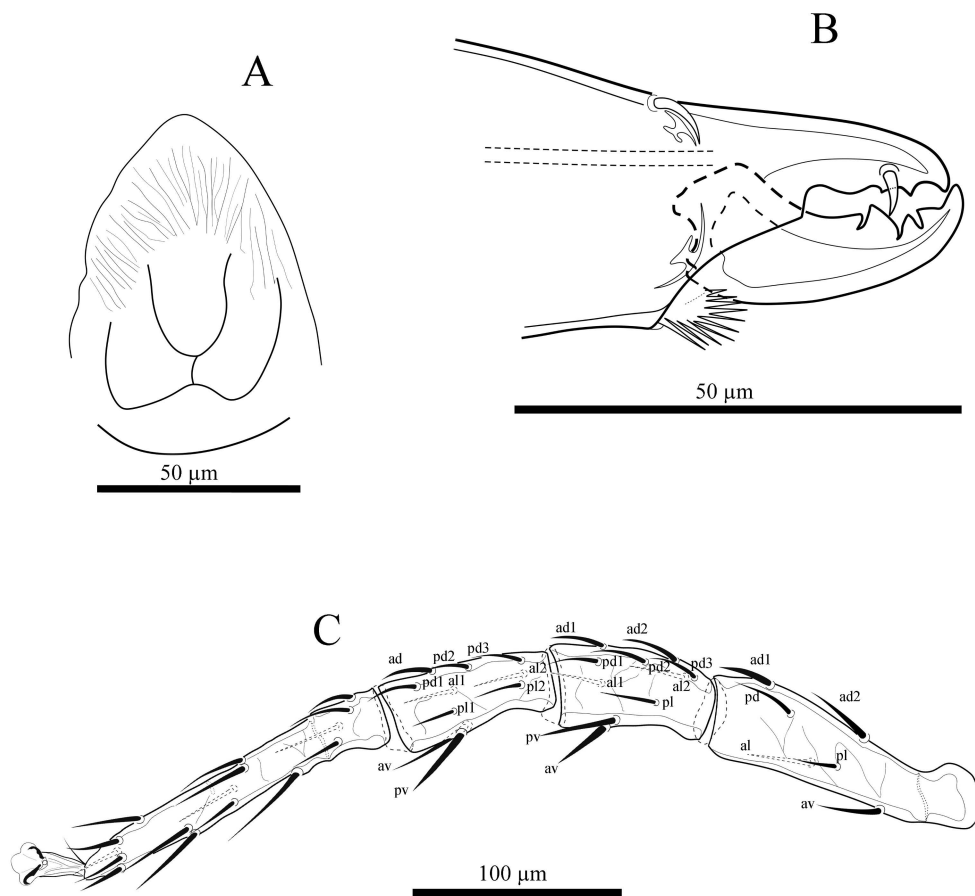


FIGURE 2: *Reticulolaelaps costai* n. sp., female: A – Epistome; B – Chelicera; C – Leg IV (excluding coxa and trochanter).

shield, endopodal plates III/IV elongate, narrow, curved and fused to large triangular podal shields posterior to coxae IV. Genito-ventral shield broad, length 326 – 330, maximum width 302 – 305, posterior edge straight, abutting anal shield, reticulate throughout, bearing genital setae *st5* (62 – 63) and five additional pairs of setae on its surface (*Jv1* 45 – 47, *Jv2* 25 – 26, *Zv1* 59 – 60, *Zv2* 29 – 30, *Zv3* 27 – 28), paragenital poroids present. Anal shield semi-circular, large, twice as wide as long (104 – 105 × 208 – 209 wide), reticulate throughout, with a pair of poroids near the edge at level of *Jv4*, para-anal setae (20) longer than post-anal seta (12), cribrum relatively broad. Opisthogastric skin with five pairs of smooth setae and two pair of pores; metapodal plates absent. Peritreme extending from mid-coxa IV to anterior level of coxa I, peritrematal shield wide, with a very wide outer margin, one pair of pores only slightly posterior to mid-coxa II level, post-stigmatal section well extended posteriorly, with two pairs of poroids.

Gnathosoma — Hypostomal groove with four rows of denticles each bearing 2–5 small teeth (Fig. 1C). Corniculi short and weakly sclerotised. Internal malae complex, with two pairs of lobes, inner lobes narrow, with smooth edges, outer lobes long, narrow, pointed. Hypostome with two large membranous flaps, extending anteriorly until the half of palp femur; hypostomal setae *h1* (44), *h2* (8), *h3* (47), palp coxal seta (25). Palp chaetotaxy: trochanter 2, femur 5, genu 6, tibia 14, tarsus 15, all setae smooth and needle-like; palp tarsal claw with two pointed tines of unequal length, without any hyaline membranes (Fig. 1D). Epistome somewhat subtriangular, with a smooth margin, anterior part membranous, posterior well sclerotised, with some reticulation (Fig. 2A). Fixed digit of chelicera with two small pointed teeth, each flanking the pilus dentilis, and a proximal indistinct rounded bulge (Fig. 2B); pilus dentilis moderately thick, dorsal seta short, thick, prostrate; movable digit (30 – 33) with four large teeth and the largest tooth is retrorse; arthrodial membrane with a rounded flap and a row of short filaments.

Legs — Legs short, well ornamented, legs II and III shorter (258 – 262, 288 – 294), I and IV longer (410

– 415, 420 – 426) (excluding pre-tarsus). Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/2 1/1 1, femur 2 2/1 3/3 2, genu 2 3/2 3/1 2, tibia 2 3/2 3/1 2. Leg II: coxa 0 0/1 0/1 0, trochanter 1 0/2 0/1 1, femur 2 3/1 2/2 1, genu 2 3/1 2/1 1, tibia 2 2/1 2/1 2. Leg III: coxa 0 0/1 0/1 0, trochanter 1 0/2 0/1 1, femur 1 2/1 1/0 1, genu 2 2/1 2/0 1, tibia 1 2/1 2/1 1. Leg IV: 0 0/1 0/0 0, trochanter 1 0/2 0/1 1, femur 1 2/1 1/0 1 (Fig. 2C), genu 2 2/1 3/1 1 (Fig. 2C), tibia 2 1/1 3/1 2 (Fig. 2C); all setae fine and needle-like. Tarsi I–IV with 18 setae 3 3/2 3/2 3 + *mv*, *md*. All pre-tarsi with a pair of claws and a long thin membranous ambulacral stalk.

Insemination structures — Not seen, apparently unsclerotised.

Etymology — This species is named in honour of Michael Costa, who made many important contributions to the systematics of the family Laelapidae.

Remarks — *Reticulolaelaps costai* **n. sp.** differs from *R. faini* Costa, 1968 and *R. hallidayi* Joharchi, Nemati and Babaeian, 2013 by having thick and falciform dorsal setae (in *R. faini* and *R. hallidayi* the dorsal setae simple and delicate), genitoventral shield wider than in the two other described species in this genus.

Pseudoparasitus lativentris (Karg)
new combination
(Figure 3)

Reticulolaelaps lativentris Karg, 1978: 26.

Specimens examined — The two paratype specimens of Karg's collection were examined by the first author: Slide ZMB Kat. Nr. 40559 ♀ and 40560 ♂, labelled *Hypoaspis* (*Reticulolaelaps*) *lativentris* Karg, 1978, paratypus, Chile Umgebung von La Union (Prov. Valdivia). Modrige Erde aus feucht. Wald in tief. Tal. 26.10.1965.

Notes — Here are morphological features of *P. lativentris* that complement the original description of Karg (1978): The dorsal shield with 39 pairs of setae 21 podonotal, 17 opisthonotal, including three pairs of *Zx* setae between *J* and *Z* setae, and four unpaired median *Jx* setae; setae increasing in length from anterior to posterior, except *Z5*, shorter than

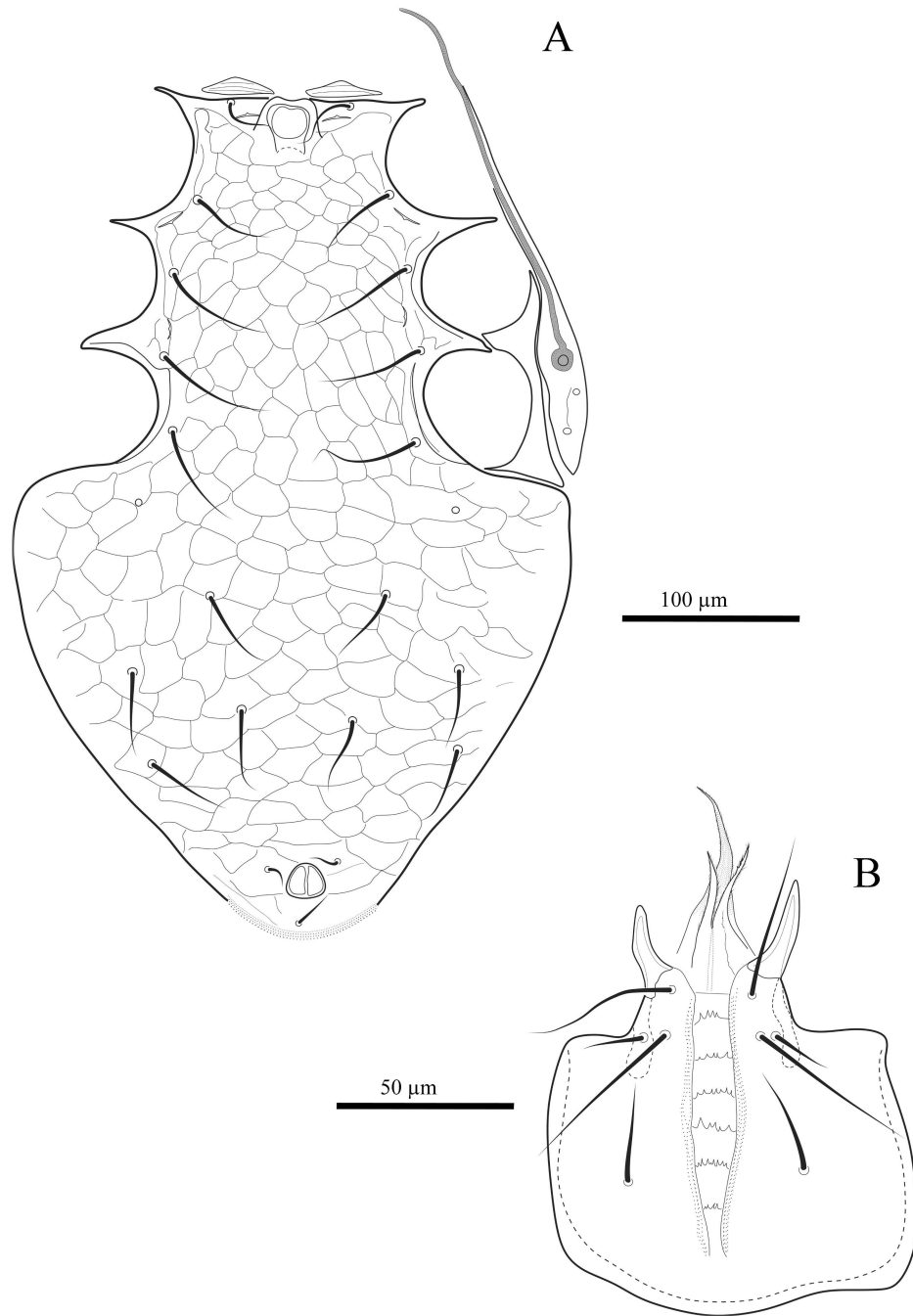


FIGURE 3: *Pseudoparasitus lativentris* (Karg, 1978), male: A – Ventral idiosoma; female: B – Hypostome.

surrounding setae; most setae long enough to reach well past base of next posterior seta. Dorsal shield wrapping around onto the ventral idiosoma, forming a marginal strip, except for the caudal end of the idiosoma. Genito-ventral shield very wide, bearing four pair of setae (including *st5*), with truncate posterior margin, and its surface reticulated. Hypostomal groove wide, with six rows of denticles each bearing 6–10 very small teeth, except the first row with four teeth, and a smooth anterior transverse line (Fig. 3B). The palp tarsal claw has two pointed tines of unequal length; palp trochanter setae simple, needle-like. Genu IV with nine setae (2 2/1 3/0 1), anteroventral seta spine-like. Male with sternal, genital, endopodal, ventral and anal shields fused into a holovenral shield, with nine pairs of setae and four pairs of poroids, with strong reticulation throughout. Unpaired post-anal seta shorter than para-anal setae, cribrum small, paranal gland pores not visible (Fig. 3A).

DISCUSSION

Nemati *et al.* (2013) have recently modified the diagnosis of this genus, included a new species, *R. hallidayi*, and tentatively placed *Reticulolaelaps lativentris* Karg (1978) in the genus *Pseudoparasitus*, which we follow here. Maybe, the genus *Reticulolaelaps* is superficially similar in morphology to *Pseudoparasitus* Oudemans in having a large genito-ventral shield of the female which is expanded to posterior to coxae IV, so that its posterior margin abuts the anal shield and the large genito-ventral shield usually captures some pairs of setae on the surface of the shield.

Herein, we further refined the diagnosis of *Reticulolaelaps*. *Reticulolaelaps lativentris* Karg (1978) does not fit easily into the genus *Pseudoparasitus*, because the epistome has smooth anterior edge, palp tarsal claw has two pointed tines (three-tined, posterior tine small in almost all *Pseudoparasitus*) and metasternal setae *st4* apparently absent (always present in *Pseudoparasitus*). These characters are not present in other *Pseudoparasitus* species. However, we believe that erecting a new monotypic genus for *P. lativentris* would be precocious, without a better understanding of related laelapid taxa.

We exclude this species of *Reticulolaelaps* because it lacks the hypostomal flap characteristic of *Reticulolaelaps* species, the chaetotaxy of genu IV (2 2/1 3/0 1) is normal, its hypostomal groove has six rows of denticles, and the male has a holovenral shield. For these reasons *R. lativentris* fits better in *Pseudoparasitus* than in *Reticulolaelaps* or any other genera.

The ecological role of *Reticulolaelaps* is unknown. Our specimens were found in the nest of *Tapinoma* sp. (Hymenoptera: Formicidae), but not on the ants (it is unknown whether *Reticulolaelaps* species are phoretic on ants). This is consistent with the observations of Nemati *et al.* (2013) for *R. hallidayi*. *Reticulolaelaps faini* Costa, 1968 has previously been reported from Israel (forest litter), Iran (soil and associated with elm tree bark) and Iraq (Cogan grass around the base of date-palm trees) (Costa, 1968; Ghafarian *et al.*, 2012; Nemati *et al.*, 2013; Abulhab, 1984). Therefore, species of this genus have been collected on only a few occasions, so it is difficult to draw any firm conclusions about their host specificity. Related to its cheliceral morphology, we may speculate that they are predators that feed on other small invertebrates in their hosts' nests, but do not appear to be harmful to the ants. This has not been established experimentally, and it will be necessary to do feeding experiments to establish the true ecological role of these mites. The following key is based on direct examination of specimens.

Key to species of *Reticulolaelaps*.

1. Dorsal shield setae thick and falciform
..... *Reticulolaelaps costai* n. sp.
— Dorsal shield setae simple and delicate 2
2. Endopodal plates III/IV free from sternal shield, fixed digit of the chelicera with a large bifid proximal tooth, one small median tooth and one distal tooth, posterior portion of genitoventral shield subquaddate, enlarged..... *Reticulolaelaps hallidayi* Joharchi, Nemati and Babaeian, 2013
— Endopodal plates III/IV fused to sternal shield, fixed digit of chelicera with four relatively small teeth, posterior portion of genitoventral shield

rounded *Reticulolaelaps faini* Costa, 1968


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