Three new species of *Laelaspis* Berlese from Iran (Acari: Laelapidae), with a review of the species occurring in the Western Palaearctic Region

OMID JOHARCHI¹, BRUCE HALLIDAY² & ALIREZA SABOORI³

¹ Department of Plant Protection, Yazd Branch, Islamic Azad University, Yazd, Iran. E-mail joharchi@iauyazd.ac.ir, j.omid2000@gmail.com

² CSIRO Ecosystem Sciences, GPO Box 1700, Canberra ACT 2601, Australia. E-mail: Bruce.Halliday@csiro.au.

³ Department of Plant Protection, College of Agriculture, University of Tehran, Karaj, Iran. E-mail: saboori@ut.ac.ir.

Abstract

This paper reports on five species of mites of the genus *Laelaspis* associated with ants in Iran – *Laelaspis astronomicus* (Koch) from *Tapinoma simrothi*, *L. equitans* (Michael) from *Messor* sp. and *Camponotus* sp., *L. kamalii* Joharchi & Halliday sp. nov. from *Tapinoma* sp., *L. pennatus* Joharchi & Halliday sp. nov. from *Tetramorium caespitum*, and *L. persicus* Joharchi & Halliday sp. nov. from *Pheidole pallidula*. *Laelaspis imitatus* Reitblat has also been reported from Iran, in association with an unknown insect. A key to species of *Laelaspis* occurring in the Western Palaearctic Region is presented, with a summary of their host associations and biology.

Key words: Laelapidae, *Laelaspis*, ants, Iran.
Introduction

The Laelapidae is one of the biggest families of free-living Mesostigmata, but it has not yet achieved a stable classification. *Hypoaspis* Canestrini and related genera have had an especially complicated and confusing history. Faraji *et al.* (2008) published a key to 21 Iranian species of mites in the genus *Hypoaspis sensu lato*, but commented that the identification of some of these species remains unconfirmed, and that the fauna has been very little studied. The present paper continues a series which has the objective of increasing our knowledge of the little-known Iranian fauna of Laelapidae, based on extensive recent collecting of free-living and insect-associated species. We have previously reported on five species of Laelapidae associated with ants (Joharchi *et al.*, 2011), and on several genera associated with scarabaeid beetles (Joharchi & Halliday, 2011). We now expand the study to include further species associated with ants, in the genus *Laelaspis* Berlese, 1903.

*Laelaspis* has often been treated as a subgenus of *Hypoaspis* Canestrini, 1884, but we here consider it to be a separate genus, following Lindquist *et al.* (2009). The genus *Laelaspis* is superficially similar in morphology to *Gymnolaelaps* Berlese, 1916 and *Pseudoparasitus* Oudemans, 1902. This problem was discussed in the previous paper (Joharchi *et al.*, 2011), which attempted to distinguish between these genera.

Unidentified species of *Laelaspis* were also reported from Iran by Babaeian *et al.* 2008; Hajizadeh *et al.* 2010a, 2010b; Nemati & Babaeian 2010; Joharchi *et al.* 2011). Unidentified species of *Laelaspis* were also reported from Iran by Kamali *et al.* (2001) and Nemati & Babaeian (2010). Haddad Irani-Nejad *et al.* (2003) recorded an unidentified species as *Laelaspis near humerata* (Berlese, 1904), but the identity of that species cannot be confirmed because the specimens have been destroyed. We believe that some of these records are based on misidentifications, or refer to species that should be placed in other genera. The purpose of this paper is to review those records and summarise the available information about the species of *Laelaspis* that occur in the Western Palaearctic Region.

**Materials and Methods**

Mites associated with ants were collected mainly in Alborz Province over a period of three years (2007-2010). Mites were removed from ants’ nests by individual hand picking and by extraction from ant nesting material using Tullgren funnels. Mites were cleared in Nesbitt’s solution and mounted in Hoyer’s medium. The nomenclature used for the dorsal idiosomal chaetotaxy is that of Lindquist & Evans (1965), the leg chaetotaxy is that of Evans (1963a) the palp chaetotaxy that of Evans (1963b), and names of other anatomical structures mostly follow Evans & Till (1979). We use the term "lyrifissures" to refer to slit-shaped sensilli, and "pore" for circular or oval-shaped cuticular openings of unspecified function. Holotypes and paratypes of the new species are deposited in the Jalal Afshar Zoological Museum, College of Agriculture, University of Tehran, Iran (JAZM). Paratypes are also deposited in the Australian National Insect Collection, CSIRO Ecosystem Sciences, Canberra, Australia (ANIC).
Genus *Laelaspis* Berlese


Type species *Laelaps astronomicus* Koch, 1839, by original designation.

**Diagnosis**

Laelapidae with a two-tined palp tarsal claw; genital shield wide, strongly expanded posterior to coxae IV, with characteristic ornamentation including two distinct Λ-shaped lines. Pre-sternal shield usually absent. Genu IV with nine setae including one ventral seta. Dorsal shield setae smooth or slightly serrated, sometimes with paired Zx setae between J and Z series setae, and sometimes also with unpaired Jx setae.

**Notes on the genus**

*Laelaspis* belongs to a group of genera of Laelapidae in which the genital shield of the female is greatly expanded, so that its posterior margin abuts the anal shield and its lateral margins extend outward behind coxae IV. The expanded genito-ventral shield in these genera captures at least two pairs of ventral setae in addition to the genital setae. *Laelaspis* is distinguished from *Gymnolaelaps* by its two-tined palp tarsal claw, the absence of pre-sternal shields, and the presence of two distinct Λ-shaped lines on the genital shield. *Laelaspis* differs from *Pseudoparasitus* because *Pseudoparasitus* has at least two pairs of setae on the surface of the genital shield, well separated from the edges of the shield, while all the genital setae *Laelaspis* and *Gymnolaelaps* are on the extreme edges of the shield.
Laelaspis astronomicus (Koch)

Iphis astronomicus Koch, 1839: 18.


Laelaspis dubiatus (sic).— Nemati et al., 2000: 381.

Hypoaspis (Laelaspis) dubitatus.— Faraji et al., 2008: 208.

Specimens examined. Three females, Karaj, Shahrestanak, 35°56' N, 51°22 E, alt. 2330 m, 11 July 2011, O. Joharchi coll., in nest of Tapinoma sp.

Remarks

Nemati et al. (2000) reported the Neotropical species L. dubitatus from Iran on the basis of one specimen collected from the nest of the ant Tapinoma simrothi. We have not had the opportunity to examine that specimen, but on the basis of some unpublished photomicrographs of the specimen kindly supplied by Dr. Nemati, we believe this was a misidentified specimen of L. astronomicus. Laelaspis astronomicus was also reported from
Iran by Hajizadeh et al. (2010a, 2010b). This species is very widespread in Europe and elsewhere, in soil, organic litter, mammal nests, and ant nests (Table 1).

*Laelaspis equitans* (Michael)


*Laelaps (Laelaspis) equitans.*— Berlese, 1904: 423.


*Hypoaspis (Laelaspis) equitans.*— Karg, 1993: 162.


Specimens examined. Three females, Karaj, Dizin, 36°03' N, 51°24 E, alt. 2665 m, 7 June 2009, O. Joharchi coll., in nest of *Messor* sp.; 14 females, Karaj, Damarvand, 35°52' N, 52°07' E, alt. 2422 m, 12 July 2009, O. Joharchi coll., in nest of *Camponotus* sp. (in JAZM and ANIC).

Notes

*Laelaspis equitans* was described from Corsica (Michael, 1891), and has been recorded from Denmark (Haarløv, 1957), Italy, Russia and Luxembourg (Berlese, 1904; Bregetova, 1977), England (Evans & Till, 1966), USA (Oudemans, 1937) and China (Bai & Gu, 1993). It has been found with several genera of ants, and is easily recognised by the large number of long, thick and wavy opisthonotal setae. It is now recorded in Iran for the first time. This species
has been found associated with at least six genera of ants, but has not been reported as free-living in soil and litter, or from the nests of mammals (Table 1).

Berlese (1904) described a new variety of this species as *Laelaspis equitans* var. *longitarsa*, but his description is very brief and not accompanied by any illustrations. This form has never been redescribed apart from a brief mention in Hunter (1961), and its status is unknown. According to Castagnoli & Pegazzano (1985), the specimens of *L. equitans* var. *longitarsa* are lost, so we can add nothing to the available information.

**Laelaspis imitatus** Reitblat

*Laelaspis imitatus* Reitblat, 1963: 76.


**Notes**

This species was described from USSR in association with the rodent *Meriones tristrami* Thomas (Reitblat, 1963). It was reported from unidentified insects in Iran by Nemati & Babaeian (2010), but we have not had the opportunity to examine any specimens to confirm this identification.

**Laelaspis kamalii** Joharchi & Halliday sp. nov.

(Figures 1-7)

*Specimens examined.* Holotype, female, Iran, Alborz, Arrange, 35˚55’ N, 51˚04’ E, alt. 1890 m, 15 April 2010, O. Joharchi coll., in nest of *Tapinoma* sp. Paratypes, one female, same data
as holotype (in JAZM); two females, Karaj city, 35°48’ N, 50°59’ E, alt. 1384 m, in nest of *Pheidole pallidula* (in ANIC).

**Description**

**Female**

*Dorsal idiosoma*. Dorsal shield length 475-485 µm, width 334-374 µm (n = 2) (Fig. 1). Shield oval shaped, with surface reticulation, more distinct in opisthonotal section; with 39 pairs of long setae, 22 podonotal, 17 opisthonotal, including two pairs of Zx setae between J and Z setae; all setae lanceolate, most with a slight swelling at the base, very long, long enough to reach well past base of next posterior seta (j5 42-54 µm, j6 50-54 µm, J1 57-69 µm). Lateral setae thicker than those in centre of shield; almost all marginal setae slightly serrated, Z5 distinctly serrated (Figs 2, 3). Seta Z5 (40-50 µm) similar in length to J5 (42-52 µm); opisthonotal region also with three unpaired supernumerary seta Jx in each specimen. Shield with ten pairs of large circular to oval-shaped pores, other pores inconspicuous.

* Ventral idiosoma* (Fig. 4). Tritosternum with columnar base 25-27 µm long and paired pilose laciniae 52-54 µm long. Pre-sternal area with one or two transverse lines, pre-sternal shields absent. Sternal shield length 106-111 µm, narrowest between coxae II (87-94 µm), widest between coxae II & III (156-166 µm), with straight anterior margin and slightly concave posterior margin; with three pairs of smooth sternal setae, lengths st1 32-42 µm, st2 37-42 µm, st3 32-37 µm, one pair of lyrifissures adjacent to setae st1, another pair of larger lyrifissures between st2 and st3; antero-lateral surface of shield with polygonal ornamentation, central area smooth. Metasternal platelets absent, metasternal setae st4 and
metasternal pores located in soft skin; endopodal plates II/III fused to sternal shield, endopodal plates III/IV elongate, narrow, curved. Genital shield wide, length 230-248 µm, maximum width 210-240 µm, posterior edge rounded, abutting anal shield, surface with characteristic ornamentation including distinct Λ-shaped lines and polygonal cells, bearing the genital setae st5 and three pairs of setae on its lateral edges. Paragenital pores located on soft skin lateral to shield between seta st5 and a pair of minute platelets behind coxae IV. Anal shield subtriangular, length 87-97 µm, width 124-130 µm, its anterior half with lineate ornamentation and a pair of lateral pores; post-anal seta 20-25 µm long, equal in length to para-anal setae but thicker. Opisthogastric skin with one pair of long narrow metapodal plates (length 54-62 µm) very close to genital shield, and 13 pairs of slightly serrate setae (Jv1 69-89 µm, Jv2 57-62 µm, Jv3 45-50 µm, Jv5 45-57 µm, Zv1 22-25 µm, Zv2 22-27 µm), and three pairs of pores near the metapodal plate. Exopodal plates behind coxae IV widened and triangular. Peritreme extending from coxa IV to mid level of coxa I, peritrematal shield wide, with two large protrusions on outer margin, a pair of pores opposite coxa II, post-stigmatal section conspicuous, with a pair of pores and a longitudinal incision, and one pair of large pores anterior to the stigmata.

**Gnathosoma.** Epistome triangular, smooth (Fig. 5). Hypostomal groove with six rows of denticles each bearing 8-10 small teeth, and smooth anterior and posterior transverse lines (Fig. 6). Hypostomal seta h1 25 µm, h2 20 µm, h3 40 µm, palp coxal seta 30 µm. Corniculi robust and horn-like, reaching mid-level of palp femur. Palp chaetotaxy: trochanter 2, femur 5, genus 6, tibia 12, tarsus 15; all setae smooth and needle-like, palp tarsal claw two-tined. Fixed digit of chelicera with two small triangular distal teeth (Fig. 7), pilus dentilis small and slender, dorsal seta short, thick, prostrate. Movable digit without teeth; arthrodial membrane with a rounded flap and a few short filaments.
Legs. Leg III shortest (272-285 µm), leg I longest (433-446 µm). Chaetotaxy: Leg I: coxa 0/1/0/1 0, trochanter 1/0/1/2 1, femur 2/3/2/3 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 1/0/1/0/2 1, femur 2/3/1/2/1 2 (ad1 thick), genu 2/3/1/2/1 2, tibia 2/2/1/2/1 2 (pv thick). Leg III: coxa 0/0/1/0/1 0, trochanter 1/0/1/0/1 1, femur 1/2/1/1/0 1, genu 2/2/1/2/1 1, tibia: 2/1/1/2/1 1. Leg IV: 0/0/1/0/0 0, trochanter 1/0/2/0/1 1 (al thick), femur 1/2/1/0/1 1 (al1 and ad2 thick), genu 2/2/1/3/0 1 (al1, al2 and ad2 long), tibia 2/1/1/3/1 2 (al1 and al2 long); all setae fine and needle-like unless otherwise noted. Tarsi I-IV with 18 setae, 3/2/3/2/3 + mv, md. All pre-tarsi with a pair of claws and a long thin membranous ambulacrum.

Insemination structures not seen, apparently unsclerotised.

Etymology

This species is named in honour of Prof. Karim Kamali, who devoted many years to teaching acarology and training acarologists in Iran.

Notes

Laelaspis kamalii differs from almost all other species in the genus by the very long setae on its dorsal shield, with Z5 similar in length to J5 and the other dorsal setae. Laelaspis kamalii is similar to L. badrii Nasr & Nawar, 1989 in the length of the dorsal shield setae, but differs from it by having only 22 podonotal and 17 opisthonotal pairs of setae including two pairs of Zx setae between J and Z setae (23 podonotal and 24 opisthonotal pairs including four pairs of Zx setae between J and Z setae in L. badrii). The anal shield of L. kamalii is much wider than
that of *L. badrii*, and the sternal shield of *L. kamalii* has polygonal ornamentation (smooth in *L. badrii*). *Laelaspis kamalii* is also unusual in having only one very low blunt swelling on the movable digit of the chelicera, instead of the usual two distinct teeth.

*Laelaspis pennatus* Joharchi & Halliday sp. nov.
(Figures 8-15)

*Specimens examined.* Holotype, female, Iran, Esfahan, 25 February 2011, O. Joharchi coll., in nest of *Tetramorium caespitum* (in JAZM). Paratype, one female, same data as holotype (in JAZM).

*Description*

*Female*

*Dorsal idiosoma.* Dorsal shield length 450-488 µm, width 324-354 µm (n = 2) (Fig. 8). Shield oval shaped, with reticulation, more distinct in opisthnonotal region; with 39 pairs of long setae, 22 podonotal, 17 opisthnonotal, including two pairs of Zx setae between J and Z setae, all setae lanceolate, most with a slight swelling at the base (Fig. 9) and very long, long enough to well past base of next posterior setae (j6 54-69 µm, J1 59-69 µm), lateral setae thicker than central setae, almost all marginal setae including Z5 slightly serrated (Fig. 10), 69-75 µm long, almost double length of J5, 40-45 µm; opisthnonotal region with three unpaired supernumerary seta Jx in each specimen. Shield with five pairs of large circular to oval-shaped pores, other pores inconspicuous.
Ventral idiosoma (Fig. 11). Tritosternum with narrow base 20 µm long, paired pilose laciniae 54-72 µm long, pre-sternal shields absent, pre-sternal area with some weak transverse lines. Sternal shield length 109-111 µm, narrowest between coxae II (79-82 µm) widest between coxae II & III (136-146 µm), with straight anterior margin and concave posterior margin, with three pairs of smooth sternal setae, \( s_1 \) 30-35 µm, \( s_2 \) 37-42 µm, \( s_3 \) 40-43 µm, one pair of lyrifissures adjacent to setae \( s_1 \), a pair of larger lyrifissures between \( s_2 \) and \( s_3 \); antero-lateral surface of sternal shield with lineate ornamentation, central area smooth. Metasternal platelets absent, metasternal setae \( s_4 \) (27-35 µm) and metasternal pores located in soft skin; endopodal plates II/III fused to sternal shield, endopodal plates III/IV elongate, narrow, curved. Genital shield broad, length 235-248 µm, maximum width 181-196 µm, posterior margin rounded, abutting anal shield, surface with characteristic ornamentation including distinct \( \Lambda \)-shaped lines and polygonal ornamentation, bearing the genital setae \( s_5 \) (50-52 µm) and two pairs of long setae (60 µm) on its lateral edges. Paragenital pores located on soft skin lateral to shield behind coxae IV. Anal shield subtriangular, length 79-89 µm, width 97-106 µm; its anterior half with lineate ornamentation and a pair of lateral pores; post-anal seta 40 µm, longer and thicker than para-anal setae, 25 µm. Opisthogastric skin with long, narrow and oval metapodal plates very close to genital shield, one metapodal plate on the right side and two on the left side in both specimens, and 15 pairs of slightly serrate setae (\( Jv_1 \) 67-79 µm, \( Jv_2 \) 67-74-53 µm, \( Jv_3 \) 52-54 µm, \( Jv_5 \) 77-79 µm, \( Zv_1 \) 22-25 µm, \( Zv_2 \) 37-50 µm) and five pairs of pores. Exopodal plates forming subtriangular extensions behind coxae IV, narrow elongate exopodal plates II/III not fused to peritrematal shield. Peritreme extending from coxa IV to anterior of coxa I, peritrematal shield narrow, post-stigmatal section conspicuous, with two pairs of pores.
Gnathosoma. Epistome triangular, smooth (Fig. 12). Hypostomal groove with six rows of denticles each bearing 6-10 small teeth, and smooth anterior transverse line (Fig. 13). Hypostomal seta h1 30 µm, h2 20 µm, h3 50 µm, palp coxal seta 20 µm. Corniculi robust and horn-like, reaching mid-level of palp femur. Palp chaetotaxy: trochanter 2 (v1 very thick), femur 5, genu 6, tibia 12, tarsus 15; all setae smooth and needle-like, palp tarsal claw two-tined (Fig. 15). Fixed digit of chelicera with a small blunt proximal tooth, followed by a slightly larger median tooth, and two small blunt distal teeth (Fig. 14); pilus dentilis moderately long and robust; dorsal seta short, prostrate; movable digit with two teeth; arthrodial membrane with a rounded flap and short filaments.

Legs. Legs II and III short (272-298 µm, 272-282 µm), I and IV longer (372-410 µm, 372-382 µm). Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/1 1/2 1, femur 2 3/2 2/1 2 (ad2, ad3, al1, pl1 and pl2 thick), 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 0/1 1/2 1, femur 2 3/1 2/2 1, genu 2 3/1 2/1 2, tibia 2 2/1 2/1 2. Leg III: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/1 1 (all setae thick), femur 1 2/1 1/0 1, genu 2 2/1 2/1 1 (ventral setae thick), tibia: 2 1/1 2/1 1 (ventral setae thick). Leg IV: 0 0/1 0/0 0, trochanter 1 0/1 0/1 1 (al thick), femur 1 2/1 1/0 1 (al, ad1 and ad2 thick), genu 2 2/1 3/0 1, tibia 2 1/1 3/1 2 (al1 and al2 long); all setae fine and needle-like unless otherwise noted. 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 ambulacrum.

Insemination structures not seen, apparently unsclerotised.

Etymology
The name *pennatus* (Latin *penna*, feather) refers to the feather-like appearance of many of the dorsal shield setae.

**Notes**

*Laelaspis pennatus* is similar to *L. kamalii*, but differs from it by its dorsal shield seta Z5 much longer than J5; seta v1 on the palp trochanter very thick, movable digit of chelicera with two teeth, and the genital shield narrower than that of *L. kamalii*.

*Laelaspis persicus* Joharchi & Halliday sp. nov.

(Figures 16-22)

*Specimens examined.* Holotype, female, Iran, Alborz province, Taleghan city, 36°71’ N, 50°32’ E, alt. 1595 m, 13 May 2010, O. Joharchi coll., in nest of *Pheidole pallidula* (Insecta: Formicidae: Myrmicinae) (in JAZM). Paratype, one female, same data as holotype (in ANIC).

**Description**

**Female**

*Dorsal idiosoma.* Dorsal shield length 436-475 µm, width 376-400 µm (n = 2) (Fig. 16). Shield oval shaped without distinct striations. Podonotal shield with 21 pairs of setae, r5 and r6 absent; with three pairs of distinct oval-shaped pores, and a pair of lyrifissures near the base of seta z1. Opisthonotal shield with 16 pairs of setae including three pairs of Zx setae between J and Z setae, S4 and S5 on lateral soft skin; with five pairs distinct circular pores,
other pores inconspicuous. Most marginal setae long, radiating prominently from the shield, curved forward, slightly serrated, 3-4 times as long as setae in central area of the shield, J1 20-25 µm (Fig. 17). Setae in central area lanceolate, short, smooth, with a slight swelling at the base (Fig. 18). Lengths of longest setae: z1 62-66 µm, j2 124-130 µm, Z4, Z5 89-107 µm, Z5 4-5 times as long as J5 (15-23 µm).

**Ventral idiosoma** (Fig. 19). Tritosternum with paired lightly pilose laciniae (50-55 µm) columnar base 15-17 µm long; pre-sternal shields absent. Sternal shield length 84-89 µm, narrowest between coxae II (77-82 µm), widest between coxae II & III (138-141 µm), surface smooth, with slightly concave posterior margin and undulating anterior margin, with three long pairs of smooth sternal setae (st1 35-41 µm, st2 42-44 µm, st3 42-47 µm), long enough to reach past base of next posterior seta, one pair of very small lyrifissures adjacent to st1, and a pair of very large curved lyrifissures between st2 and st3. Metasternal platelets absent, metasternal setae st4 (37-40 µm) and metasternal pores located in soft skin; endopodal plates II/III fused to sternal shield, endopodal plates III/IV elongate, narrow, curved. Genital shield length 230-268 µm, maximum width 191-200 µm, posterior edge slightly tapering, abutting anal shield, surface with characteristic ornamentation including two distinct Λ-shaped lines enclosing longitudinal polygonal cells, with genital setae st5 (50-53 µm) and three pairs of setae on its lateral edges. Paragenital pores located on soft skin close to st5. Anal shield sub-triangular (69-75 µm x 74-80 µm wide), with concave anterior margin, without distinct markings, with a pair of lateral pores; post-anal seta (50-52 µm) more than double length of para-anal setae (17-20 µm). Opisthogatsric skin with one pair of wide oval metapodal plates (length 45-50 µm) and 11 pairs of thick pilose setae (Jv1 52-59 µm, Jv2 55-62 µm, Jv3 52-59 µm, Jv5 87-81 µm, Zv1 42-44 µm, Zv2 58-65 µm). Exopodal plates behind coxae IV triangular, exopodal plates II/III absent. Peritreme extending from coxa IV to mid level of
coxa I, peritrematal shield very narrow anterior to stigmata, post-stigmatal section wide and conspicuous, with a pair of small pores, and one pair of large pores anterior to the stigmata.

_Gnathosoma_. Epistome triangular, smooth (Fig. 20). Hypostomal groove with six rows of denticles each bearing 6-8 small teeth, and smooth anterior and posterior transverse lines (Fig. 21). Hypostomal seta h1 25 μm, h2 25 μm, h3 35 μm, palp coxal seta 25 μm. Corniculi robust and horn-like, reaching mid-level of palp femur. Palp chaetotaxy: trochanter 2, femur 5, genu 6, tibia 12, tarsus 15; genu with a distinct dorso-distal triangular condyle; all setae smooth and needle-like, palp tarsal claw two-tined. Fixed digit of chelicera with two small median triangular teeth (Fig. 22); pilus dentilis small and slender; dorsal seta short, thick, prostrate; movable digit without teeth; arthrodial membrane with a rounded flap and a few short filaments.

**Legs.** Legs very short (leg I: 225-240 μm, leg II: 205-212 μm, leg III: 210-218, Leg IV: 248-256). Chaetotaxy: Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/1 1/2 1, femur 2 3/2 2/2 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 1/1 0/1 1, femur 2 3/2 1/1 1 (ad1 and ad2 thick), genu 2 3/1 2/1 2 (ventral setae all thick), tibia 2 2/1 2/1 2 (ventral setae all thick). Leg III: coxa 0 0/1 0/0 1, trochanter 1 0/1 0/1 1 (ad1 thick), femur 1 2/1 1/0 1 (ad1 very long and thick), genu 2 2/1 2/1 1, tibia: 2 1/1 2/1 1. Leg IV: 0 0/1 0/0 1, trochanter 1 0/1 0/2 1 (ad1 very thick), femur 2 1/1 0/1 1 (ad1 very long and thick), genu 2 2/1 3/0 1, tibia 2 1/1 3/1 2 (ventral setae long and thick); all setae fine and needle-like unless otherwise noted. 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 ambulacrum.

_Insemination structures_ not seen, apparently unsclerotised.
Etymology

The name of this species refers to type locality, Iran (old Persia).

Notes

*Laelaspis persicus* differs from all other species in the genus by the presence of 21 pairs of setae on the podonotal shield, with r5 and r6 absent. The opisthonorotal shield is distinctive, with 16 pairs of setae on the shield including three pairs of Zx setae between J and Z setae, S4 and S5 on lateral soft skin. The marginal setae on the dorsal shield are very long, including z1, j2, Z4 and Z5. All the setae on the central area of the shield are much shorter, with small swelling at the base, and the movable digit of the chelicera is almost completely edentate.

Discussion

Before the start of this study, five species of *Laelaspis* had been reported from Iran. We have added new information on *L. astronomicus*; *L. austriacus* is transferred to the genus *Pseudoparasitus*; *L. dubitatus* was a misidentification of *L. astronomicus*; *L. missouriensis* is transferred to *Pseudoparasitus*, and the record of *L. imitatus* remains unconfirmed.

We have previously discussed the distinction between *Laelaspis* and some related genera (Joharchi et al., 2011). Using those criteria, some species that have been described or classified in the genus *Laelaspis* are now considered to belong to other genera. For example, *Laelaspis austriacus* Sellnick, 1935 is a junior synonym of *Pseudoparasitus missouriensis* (Ewing, 1909), *Hypoaspis (Laelaspis) paucidentis* Karg, 1989, *Hypoaspis (Laelaspis)*
quinquepara Karg, 2000, and *Laelaspis orientalis* Osipova, 1969, all appear to be species of *Pseudoparasitus*, because they have at least two pairs of setae on the surface of the genital shield, well inside the edges of the shield. *Laelaps laevis* Michael, 1891, *Laelaspis ningxiaensis* Bai & Gu, 1994, *L. markewitschi* Pirianyk, 1959, *Hypoapis heselhausi* Oudemans, 1902 and *Hypoaspis nidicorva* Evans & Till, 1966 are excluded from *Laelaspis* because they lack the characteristic ornamentation of the sternal shield, and all appear to be species of *Gymnolaelaps*. On the other hand, Figure 12.56E in Lindquist et al. (2009) appears to represent a species of *Laelaspis*, not "*Pseudoparasitus*?", because all the genitoventral setae are on the extreme edges of the shield, and the shield has the typical *Laelaspis*-type ornamentation.

Most of the species of *Laelaspis* occurring in the Western Palaeartic Region are associated with ants or their nests, while a few have been collected with small mammals or in soil. The available information on these species is summarised in Table 1. Most of these species have only been collected on only a few occasions, so it is difficult to draw any firm conclusions about their host specificity. The only species for which we have a reasonable amount of information are *L. astronomicus*, *L. equitans*, and *L. humeratus*, and none of these appears to be host specific. *Laelaspis astronomicus* is a common mite in the Western Palaeartic region, and occurs in various microhabitats associated with a variety of hosts including ants and mammals. *Laelaspis equitans* is often collected but has only been found with ants, and not in soil or mammal nests. It has been reported as clinging to the body of its ant hosts (Michael, 1891), and that is consistent with our observations of this species. The question of host or microhabitat specificity of the other species can not be analysed in detail until all of the available collections are re-examined to confirm the identifications.

The biology of most species of *Laelaspis* has not been studied, but the limited information that is available shows that they are predatory. Hunter (1964b) reared a species
identified as *L. vitzthumi* (Womersley, 1956), and found that it fed on the soft tissue of crushed houseflies, and was sometimes cannibalistic. Rasmy *et al.* (1987) showed that *L. astronomicus* (referred to as *L. zaheri* Shereef & Soliman) is also a predator, which fed on *Tyrolichus casei* (Acaridae), and Metwally *et al.* (1990) found that *L. astronomicus* can feed on free-living nematodes. Wasmann (1897a, 1897b) found that *Holostaspis oophila* (Wasmann, 1897) received nourishment from substances around the egg masses of ants, but did not attack the eggs themselves. This idea was repeated by Vitzthum (1923), and André (1939) and Hunter (1961) speculated that the same may be true for *Laelaspis*. *Laelaspis* appears to be a genus of predators that feed on other small invertebrates in their hosts' nests, but are not harmful to the ants. High populations of acarids may be harmful to ants, so the presence of predators such as *Laelaspis* may be beneficial, forming a symbiotic relationship with its ant hosts. The ecological role of *Laelaspis* in mammal nests is also unknown, but it appears likely that they are predators, feeding on other nest inhabitants such as acarid mites (Rasmy *et al.*, 1987).

The following key is based on published descriptions and illustrations, except for the species from Iran. The description of *Laelaspis* (*Laelaspis*) *equitans* var. *longitarsa* Berlese, 1904 is very brief and not accompanied by any illustrations. This form has never been redescribed apart from a brief mention in Hunter (1961), and its status is unknown. According to Castagnoli & Pegazzano (1985), the specimens of *L. equitans* var. *longitarsa* are lost, so the information in the key is taken from Hunter (1961).

**Key to species of *Laelaspis* occurring in the Western Palaearctic**

1. Dorsal shield setae very long, central opisthnotal setae long enough to reach well past base of next posterior seta........................................................................................................ 2

2. ...
- Dorsal shield setae shorter, central opisthonoatal setae short, sometimes reaching base of next posterior seta but never past it ................................................................. 9

2 Seta Z5 equal or shorter than J5................................................................. 3

- Seta Z5 two to three times as long as J5 .................................................. 4

3. Dorsal shield normally with 39 pairs of setae, including two pairs of Zx setae between J and Z setae; postero-lateral R setae absent (Fig. 1) ............ *Laelaspis kamalii* sp. nov.

- Dorsal shield with 47 pairs of lanceolate setae, four pairs of Zx setae between J and Z setae; five pairs of R setae present on the lateral soft skin ...........................................

........................................................................................................*Laelaspis badrii* Nasr & Nawar, 1989

4. Posterior margin of genital shield rounded.......................................................... 5

- Posterior margin of genital shield truncate .................................................. 8

5. Peritreme extends at most to posterior margin of coxa I........................................ 6

- Peritreme extends to anterior margin of coxa I (Fig. 11)........... *Laelaspis pennatus* sp. nov.

6. Genital shield greatly expanded, wider than long, extending laterally beyond outer edges of coxae IV; opisthonoatal area with four unpaired Jx setae between J series

........................................................................................................*Laelaspis volgini* Shereef & Afifi, 1980

- Genital shield longer than wide, lateral edges reaching only to mid-level of coxae IV; opisthonoatal area with six unpaired Jx setae between J series................................. 7

7. Leg I equal to length of body; tarsi of normal length; dorsal shield setae shorter........

........................................................................................................*Laelaspis equitans* (Michael, 1981)

- Leg I longer; tarsi longer; dorsal shield setae longer ........................................

........................................................................................................*Laelaspis equitans* var. *longitarsa* (Berlese, 1904)

8. Posterior margin of sternal shield straight or slightly concave, body small (450 x 350 µm)................................................................. *Laelaspis finitimus* (Berlese, 1904)

- Posterior margin of sternal shield obviously concave, body larger (600 x 460 µm)
9. Genital shield wider than long, without a conspicuous notch in anterior margin of sternal shield .................................................. *Laelaspis aviator* Berlese, 1920
   - Genital shield longer than wide; anterior margin of sternal shield with a conspicuous notch ........................................................................................................ 10

10. Fixed digit of chelicera without pilus dentilis ..................... *Laelaspis patulus* Allred, 1969
    - Fixed digit of chelicera with a slender pilus dentilis ........................................ 11

11. Dorsal shield seta z3 absent ........................................................................ 12
    - Dorsal shield seta z3 present ........................................................................... 13

12. Dorsal shield seta z1 present and three to four times as long as j1; podonotal shield with more than 20 pairs of setae; r5 in normal position on edge of dorsal shield; opisthonorotal shield with more than 15 pairs of setae; S4 and S5 present but on lateral soft skin (Fig. 16) ................................................................. *Laelaspis persicus* sp. nov.
    - Dorsal shield seta z1 absent; podonotal shield with 20 pairs of setae, r5 very long, displaced medially near s4; opisthonorotal shield with 15 pairs of setae including two pairs of Zx setae between J and Z setae .................. *Laelaspis variopilus* (Greim, 1969)

13. Dorsal shield setae z6 and j2 present; setae j5, j6, z5 forming a normal-shaped hexagonal pattern ........................................................................................................ 14
    - Dorsal shield setae z6 and j2 absent; seta z5 displaced laterally to form a very elongate hexagonal pattern with j5 and j6 ........................................... *Laelaspis myrmicae* (Greim, 1969)

14. Dorsal shield setae very short, none long enough to reach the base of the next posterior seta ........................................................................................................... *Laelaspis ovisugus* (Berlese, 1904)
    - Dorsal shield setae longer, at least some long enough to reach the base of the next posterior seta ........................................................................................................... 15

15. Seta j6 on dorsal shield long enough to reachi base of seta J1 ..........................
- Seta j6 on dorsal shield not long enough to reach base of seta J1 .................................. 16

16. Genital shield longer than wide, lateral edges reaching only to mid-level of coxae IV ..... 

..............................................................................................................Laelaspis secedens (Berlese, 1920)

- Genital shield width equal with length, extending laterally beyond outer edges of coxae IV .................................................................Laelaspis astronomicus (Koch, 1839)

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References


Solomon, L. (1969) Gamaside noi din România. Studii si Cercetari de Biologie, Seria
Zoologie, 21, 11–23.


FIGURE CAPTIONS


Table 1. Host and locality records for *Laelaspis* species that occur in the Western Palaearctic Region

<table>
<thead>
<tr>
<th>Species</th>
<th>Host or microhabitat</th>
<th>Locality</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>L. astronomicus</em></td>
<td>unknown</td>
<td>Germany</td>
<td>Koch, 1839</td>
</tr>
<tr>
<td></td>
<td>moss</td>
<td>Italy</td>
<td>Berlese, 1889</td>
</tr>
<tr>
<td></td>
<td>vagrant</td>
<td>Italy</td>
<td>Berlese, 1903</td>
</tr>
<tr>
<td></td>
<td>soil and litter</td>
<td>Austria</td>
<td>Willmann, 1951</td>
</tr>
<tr>
<td></td>
<td><em>Clettrionomys glareolus,</em> <em>Microtus arvalis</em> (mammals)</td>
<td>former USSR</td>
<td>Pirianyky, 1959a</td>
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<td></td>
<td>leaf litter</td>
<td>Switzerland</td>
<td>Schweizer, 1961</td>
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<td></td>
<td>several species of small mammals</td>
<td>Czechoslovakia</td>
<td>Mrciak, 1963</td>
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<td><em>Microtus arvalis</em> (mammal)</td>
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<td>burrows of small mammals</td>
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<td>Zahe, 1986; Rasmy et al., 1987</td>
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<td>soil under trees</td>
<td>Iran</td>
<td>Nemati et al., 2000</td>
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<td></td>
<td></td>
<td>Iran</td>
<td>Hajizadeh et al., 2010a, 2010b</td>
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<td>Michael, 1891</td>
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<td>Italy</td>
<td>Leonardi, 1899</td>
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<td>Italy</td>
<td>Leonardi, 1899</td>
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<td>Berlese, 1904</td>
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