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# A new species of *Gaeolaelaps* Evans and Till (Mesostigmata: Laelapidae) from northwestern Iran with a key to the species with three-tined apotele

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## ABSTRACT

In this study, *Gaeolaelaps urumiensis* sp. n. is described and illustrated from Iran. A key to the species of *Gaeolaelaps* with three-tined apotele is provided.

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## KEYWORDS

Acari; soil; Gamasina; Urmia; taxonomy

## Introduction

The family Laelapidae is highly diverse in form and habits (Lindquist et al. 2009) with about 90 genera and approximately 1316 species (Beaulieu et al. 2011). One of the largest genera is *Gaeolaelaps* Evans and Till, 1966 that has about 103 species. Mites of this genus are usually soil-dwelling or, in some cases, they have been reported in association with arthropods (Moreira and de Moraes 2015). Some predatory species of *Gaeolaelaps* have been used for the biological control of some edaphic pests (Zhang 2003; Beaulieu and Weeks 2007; Halliday and Lindquist 2007; Gerson et al. 2008; Lindquist et al. 2009; Moreira and de Moraes 2015).

Historically, this genus has been treated as a subgenus of *Hypoaspis* or a junior synonym of *Hypoaspis* (Rosario 1981; Tenorio 1982; Karg, 1993), but is currently treated as a separate genus. The modern concept, diagnosis, and description of this genus were reviewed by Beaulieu (2009) seriously for the first time. This review has been supplemented by Kazemi et al. (2014) and Saeidi et al. (2016).

A total of 21 species of *Gaeolaelaps* have been reported from Iran, of which 11 have been described as new species (Saeidi et al. 2016). In Iran, the ratio of new to established species of *Gaeolaelaps* is much higher than other genera of Hypoaspidinae, suggesting it is highly diverse. In this article, a new species of *Gaeolaelaps* is described. This species has the unusual character state of a three-tined apotele, and a key to species of *Gaeolaelaps* with this feature is presented.

## Materials and methods

Soil and litter samples were collected from different areas of Urmia, West Azarbaijan province, Iran, during 2015–2016. Samples were transferred to the laboratory and mites were extracted in a Berlese funnel. The mites were preserved in 70–75% ethanol, cleared in warm lactic acid, and mounted in Hoyer's medium. Slides were dried and ringed with insulating varnish. Drawings were made with the aid of a drawing tube and primary figures were improved by the Corel X-draw software. Measurements (in  $\mu\text{m}$ ) were made by using a stage-calibrated ocular micrometer. Lengths of the dorsal and ventral shields were measured along their midline, and dorsal shield width was measured at level of  $r_3$ . Measurements of legs were made from the coxa to the tip of the tarsi. Idiosomal and leg chaetotaxy follows Evans and Till (1965) and Evans (1963). To

determine the geographical location of sampling points, GPS Data+, Version 2.91, Operation System: Android was used.

## Results

### Genus *Gaeolaelaps* Evans and Till, 1966

#### Type species

*Laelaps aculeifer* Canestrini (1884), by original designation (Evans and Till 1966).

#### Diagnosis

As of Beaulieu (2009) and augmented by Kazemi et al. (2014) and Saeidi et al. (2016).

#### *Gaeolaelaps urumiensis* sp. n.

Figures 1–10

#### Diagnosis

Dorsal shield with 39 pairs of small simple acicular setae and one unpaired seta between  $J$  series; genital shield large, elongate, extending to anterior margin of anal shield; peritremes long; poststigmatal plate, ensiform; anal shield wider than long; apotele three-tined; seta  $al$  on trochanter II visibly thick, lanceolate; dorsal shield without distinctive constriction at lateral margins.

#### Description (female)

##### Dorsal idiosoma

(Figure 1) Dorsal idiosoma oval-shaped, 422–427 long, 210–213 wide, lateral margin slightly concave medially, with narrow strip of unsclerotised integument visible from  $r_4$  to  $S_2$ ; podonotal area without reticulation, opisthonotal area posterior to  $J_1$  with fine net-like reticulation, shield with 39 pairs of thin, short, simple setae, 22 pairs on podonotal area ( $j_1-6$ ;  $z_1-6$ ;  $s_1-6$ ;  $r_2-5$ ) and 17 pairs on opisthonotal area ( $J_1-5$ ;  $Z_1-5$ ;  $S_1-5$ ;  $PX_2-3$ , and one  $JX$ ), no dorsal setae reach base of following setae; setal lengths: podonotal area ( $j_1-6 = 12-14$ ;  $z_1 = 8$ ;  $z_2-6 = 10-13$ ;  $s_1-2 = 7-8$ ;  $s_3-4 = 10-12$ ;  $s_5-6 = 14-15$ ;  $r_2-4 = 12-13$ ;  $r_5 = 14-15$ ) and opisthonotal area ( $J_1-4 = 10-13$ ;  $J_5 = 15-17$ ;  $Z_1-2 = 11-13$ ;  $Z_3 = 16-19$ ;  $Z_4 = 20-21$ ;  $Z_5 = 17$ ;  $S_1-2 = 14-17$ ;  $S_3 = 17-18$ ;  $S_4-5 = 20-23$ ;  $JX = 10-12$ ;  $PX_2-3 = 12-13$ ), lateral soft integument with  $r_6$  10–11 and  $R_1$  12; pores and pore-like structures as shown in Figure 1.

**Ventral idiosoma** (Figure 2)

Tritosternum with columnar base 17–19 long, 9–10 wide, and pilose laciniae 63–37 long; presternal plates 19–21 long, 30–32 wide (at widest part), granulated with three horizontal curved lines; sternal plate 117–119 long, 116–118 wide (distance between coxa II–III), 83–85 wide (at level of *st2*), with reticulated lateral areas, smooth medially and posteriorly, with three simple acicular pairs of setae, *st1* 13–15, *st2* 15–17, *st3* 12–13, *iv1* slit-like, *iv2* pore-like, posterior margin of sternal shield slightly concave; *iv3* pore-like, situated behind posterior margin of sternal shield, *st4* 10–12, located behind *iv3*; genital shield elongated, tongue-shaped 167–169 long, 58–59 wide (at level of epigynal setae), 83–86 (at widest part), ratio of length to width of these two points 2.87–2.86 and 2.01–1.96, respectively, posterior margin of genital shield reaches anterior margin of anal shield, reticulation comprising elongated oblique irregular cells. Setae *st5* 12–14 simple, acicular, situated in approximately upper one third of genital shield on lateral margins; anal shield reticulated, subtriangular 37–45 long, 57–60 wide, lateral margins slightly concave, para-anal setae 11–13, post-anal seta 10–12, cribrum small; opisthogastric area with one pair of oval metapodal plates 12–14 long, 5 wide, eight pairs of smooth acicular setae *JV1*–*5* 11–17; *ZV1*–*3* 12–17 and *R4* 12–13, *R6* 10–11, pore-like structures as shown in Figure 2; peritremes long, extending anteriorly to posterior margin of coxa I, peritrematal plate widest in middle part, with *gp* and *ip*, poststigmatal plate slender, ensiform, its tip extending to posterior level of coxa IV, with two pore-like structures; endopodal plate I–II set close to anterolateral corner of sternal shield, formed by two polygonal stick-like plates, endopodal III–IV strip-like with exopodal III–IV surrounding coxa IV, exopodal II–III formed by two platelets, internal platelet bar-shaped and external platelet subtriangular.

**Gnathosoma**

Epistome (Figure 6) arched with denticulated anterior margin; hypostomal groove with six rows of denticles, hypostomal setae

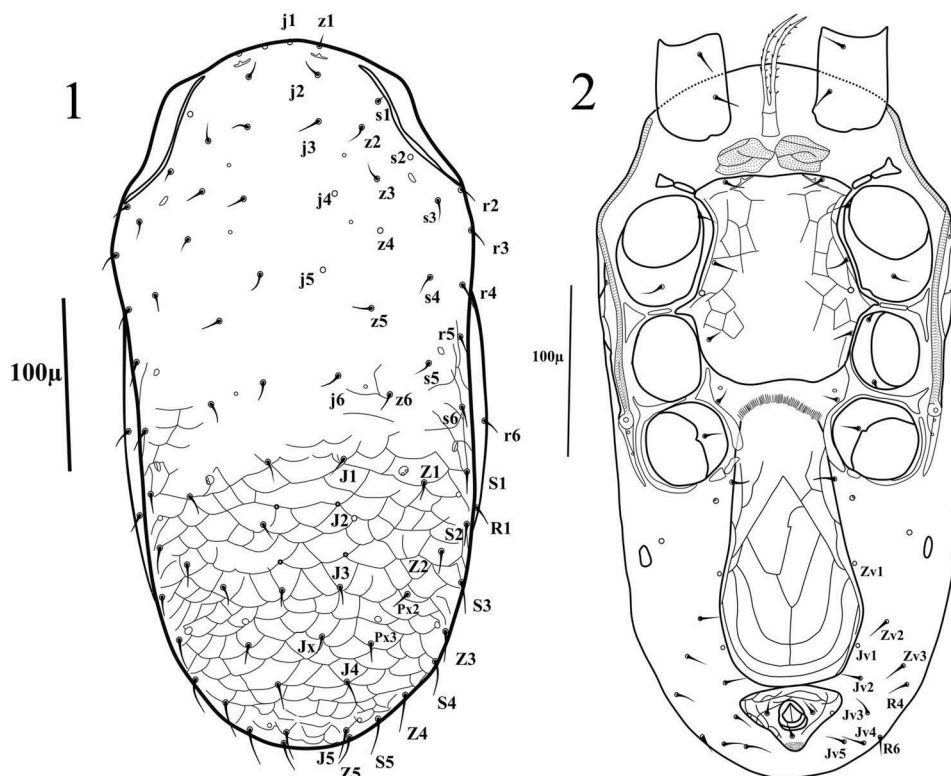
(Figure 3) simple, acicular, *h114*–*15*, *h2* 10–12, *h3* 12–14; palpal coxal setae 12–14; corniculi robust and horn-like; internal malae with barbed lateral margins; chelicerae (Figure 4) with small needle-like pilus dentilis, setaceous dorsal seta, arthrodial process; movable digit 50, with two teeth, and fixed digit 132, with six teeth in addition to terminal tooth; apotele (Figure 5) three-tined; palp chaetotaxy normal for laelapid mites, palp segment lengths: trochanter 27, femur 35–37, genu 25, tibia 25, tarsus 15.

**Legs**

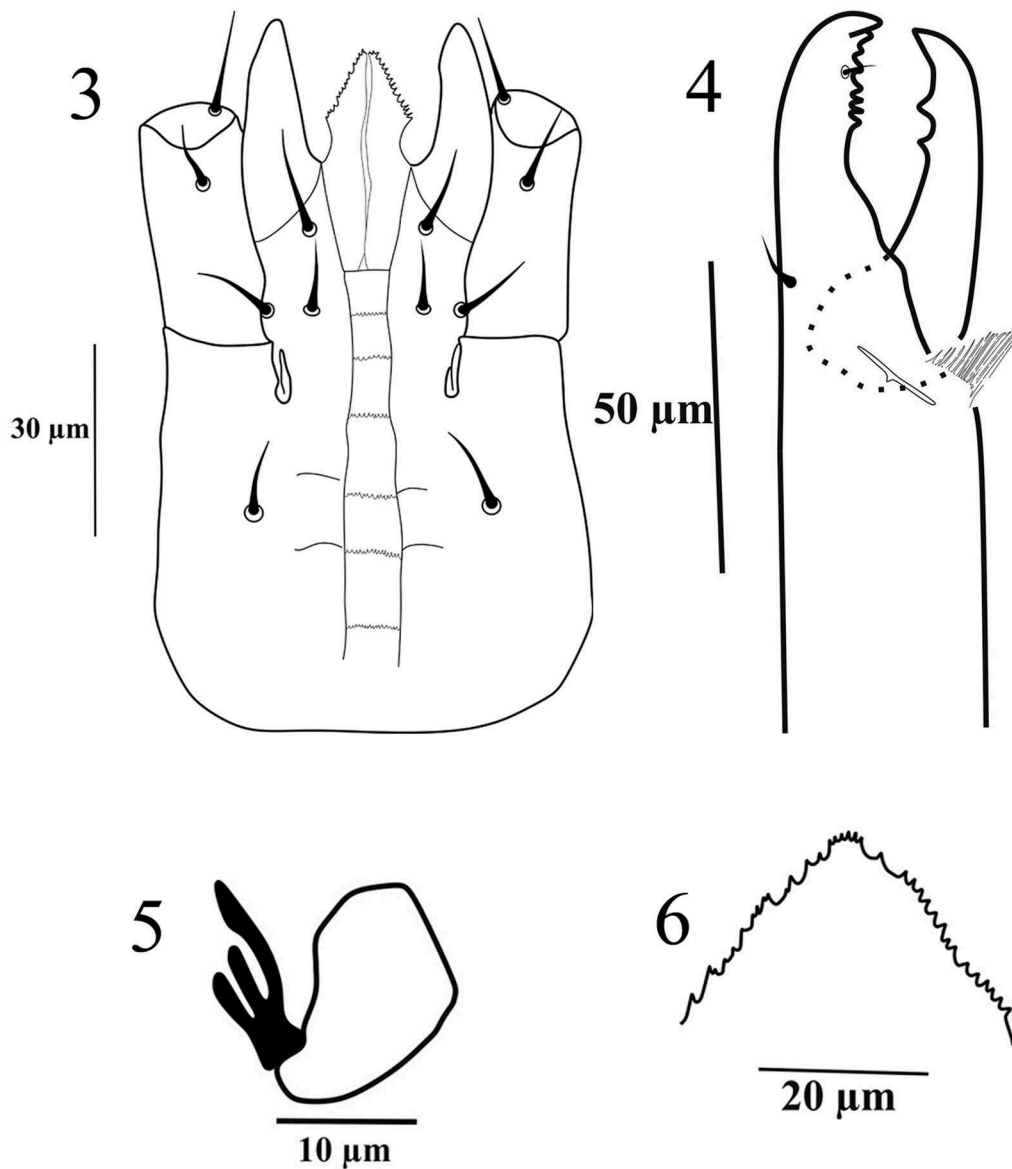
(Figures 7–10) Tarsi I–IV with claws and ambulacra; Leg I (Figure 7) 430–441, coxa 57–61, trochanter 32–35, femur 70–75, genu 67–68, tibia 77, tarsus 120–123 (98 + 22–98 + 25); Leg II (Figure 8) 331–340, coxa 24–25, trochanter 37–39, femur 67–69, genu 52–53, tibia 55, tarsus 94–97 (76 + 18–75 + 22); Leg III (Figure 9) 290–295, coxa 20–21, trochanter 40, femur 57–60, genu 40, tibia 40, tarsus 90–93 (70 + 20–70 + 23); Leg IV (Figure 10) 420–425, coxa 19–21, trochanter 60, femur 82–85, genu 62, tibia 68, tarsus 125 (100 + 25).

**Leg chaetotaxy**

Leg chaetotaxy normal for *Gaeolaelaps* (sensu Beaulieu 2009). Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/2 1/1 1, femur 2 2/1 3/3 2 (*ad2* and *pd2* very small and slightly thickened), genu 2 3/2 3/1 2, tibia 2 3/2 3/1 2 (*al2* and *av1* slightly thicker than other setae on segment); Leg II, coxa 0 0/1 0/1 0, trochanter 1 0/2 0/1 1 (*al* visibly thick, lanceolate), femur 2 3/1 2/2 1, genu 2 3/1 2/1 2 (*av* slightly thicker than other setae on segment), tibia 2 2/1 2/1 2 (*av* and *pv* slightly thicker than other setae on segment), tarsus 3 3/2 3/2 3+ *mv*, *md* (*mv*, *av2*, *pv2*, *md*, *av1*, *pv1*, *al1*, and *pl1* slightly thicker than other setae on segment); 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 2/1 1 (*pv* smaller and slightly thicker than other setae on segment), tibia 2 1/1 2/1 1 (*pv* smaller and slightly thicker than other setae on segment), tarsus 3 3/2 3/2 3+ *mv*, *md* (*mv*, *pd2*, *md*, *av1*, *pv1*, *al1*, and *pl1* slightly thicker than other setae on segment); Leg IV, coxa 0 0/1 0/0 0, trochanter 1 0/2 0/1 1, femur 1 2/1 1/0 1 (*ad2* slightly



Figures 1-2. *Gaeolaelaps urumiensis* sp. n.; 1, dorsal idiosoma; 2, ventral idiosoma.



Figures 3-6. *Gaeolaelaps urumiensis* sp. n.; 3, hypostome; 4, chelicera (lateral view); 5, apotele; 6, epistome.

thick and *pd* very small and slightly thick), genu 2 2/1 3/0 1 (*av* slightly thicker than other setae on segment), tibia 2 1/1 3/1 2 (*av* and *pv* slightly thicker than other setae on segment), tarsus 3 3/2 3/2 3+ *mv*, *md* (*mv*, *pd2*, *md*, *av2*, *pv2*, *md*, *av1*, *pv1*, *al1*, and *pl1* slightly thicker than other setae on segment).

#### Material examined

Holotype, female, soil, and litter, Urmia, West Azarbaijan province, Iran, 37° 19' 54" N, 44° 51' 57" E, 1695 m; 24/8/2016; coll. M. Kavianpour; paratype, two females, same data as holotype; holotype and paratype deposited in the Acarology Laboratory, Plant Protection Department, Agricultural College, Shahrekord University (APAS).

#### Insemination structures

Not seen.

#### Male

Unknown.

#### Etymology

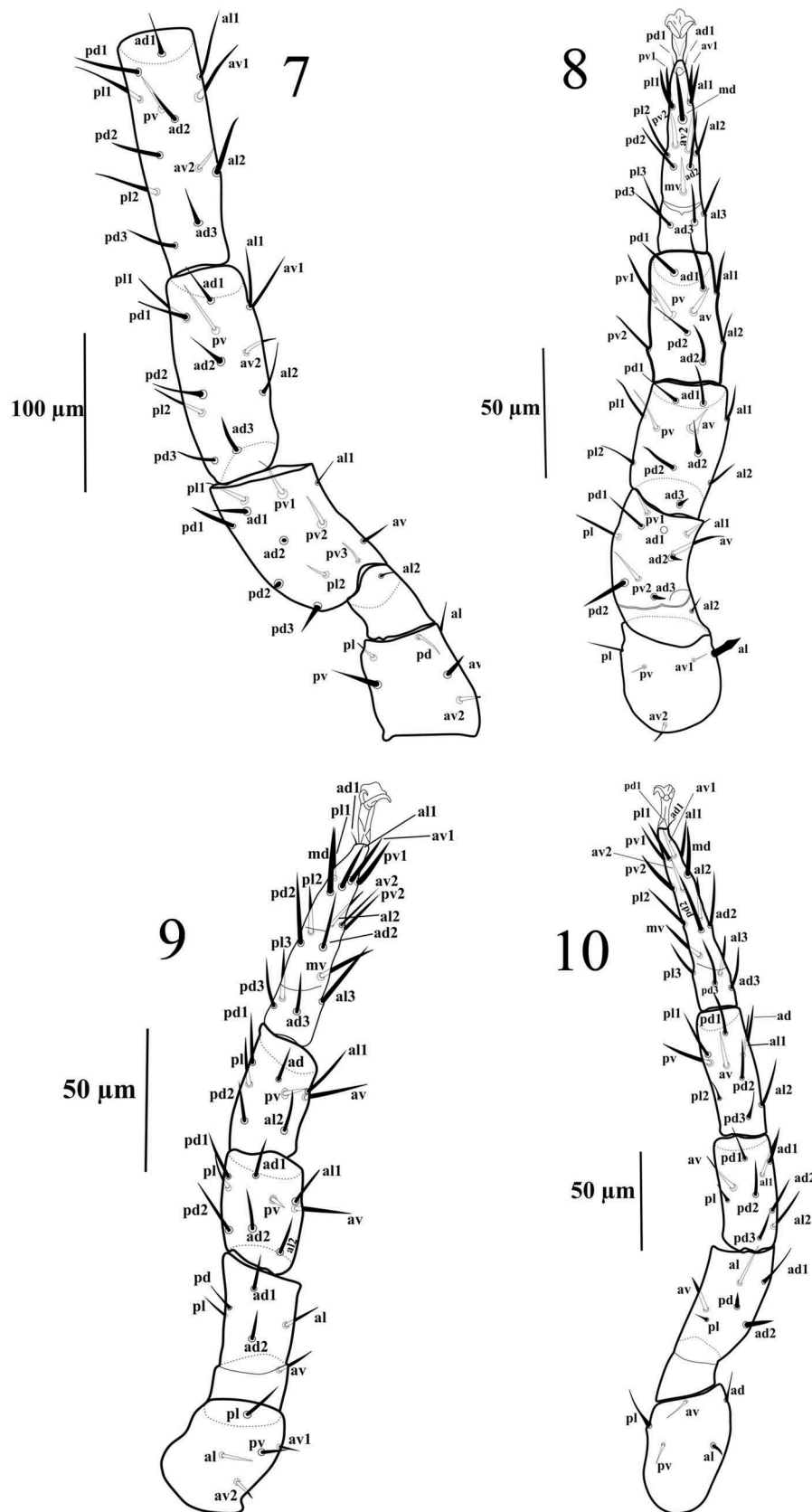
The species is named after the type locality Urmia, Iran.

#### Remarks

*Gaeolaelaps urumiensis* sp. n. appears close to *Gaeolaelaps izajiensis* Saeidi, Nemati and Khalili-Moghadam, 2016 in having similar body setae and ornamentation. It can be distinguished from *G. izajiensis* by having apotele three-tined (two tined in *G. izajiensis*); anal shield wider than long (37–45 long, 57–60 wide) while in *G. izajiensis* it is nearly as long as wide (54–60 long 54–56 wide) or slightly longer genital shield exactly adjacent to anal shield and does not overlap with anterior part of anal shield (abutting anal shield in *G. izajiensis*); poststigmatal plate slender, longish and ensiform, its tip extending to posterior level of coxa IV (extending to the middle part of coxae IV in *G. izajiensis*); fixed digit of chelicerae with six teeth (five teeth in *G. izajiensis*); internal malae with different shape and without median lobes (with median barbed extensions longer than fringed lateral lobes in the later); seta *al* on trochanter II thick, lanceolate (simple and acicular in *G. izajiensis*); without narrow elongate paragenital platelets adjacent to the epigynal shield (with one pair of narrow and slightly elongate paragenital platelets in *G. izajiensis*).

#### Discussion

Species of *Gaeolaelaps* often have a two-tined apotele, but a few species have a three-tined apotele: *Gaeolaelaps queenslandicus*



Figures 7-10. Legs of *Gaeolaelaps urumiensis* sp. n.; 7, leg I (dorso-lateral view); 8, leg II (dorso-medial view); 9, leg III (dorso-medial view); 10, leg IV (dorso-medial view).

(Womersley, 1956), *Gaeolaelaps bregetovae* (Shereef & Afifi, 1980), *Gaeolaelaps elongatus* (Hirschmann, 1969), and *Gaeolaelaps urumiensis* sp. n. are the five species with a three-tined apotele. Kazemi et al. (2014) stated that *Gaeolaelaps jondishapouri* has a three-tined apotele, but we re-examined the holotype and paratypes of *Gaeolaelaps jondishapouri* and could not see the tiny basal tine noted in Kazemi et al. (2014). *Cosmolaelaps angustiscutatus* (Willmann, 1951) is another significant species as it was until

recently placed in *Gaeolaelaps* (Nemati and Gwiazdowicz, 2016). This species is very similar to *G. elongatus* – so similar that Bregetova (1977) synonymized these species. Karg (1979) removed these species from synonymy by characters such as the denticles on the moveable digit and chaetotaxy of the opisthonorium. Further study of type specimens is required to test the possible synonymy of these species and also their generic placement.

## Key to the *Gaeolaelaps* (adult female) with three-tined apotele

1. Peritreme short, reaching to coxa II .....  
..... *Gaeolaelaps bregetovae* (Shereef & Afifi, 1980)  
– Peritreme long, reaching to coxa I ..... 2
2. Without spur-like or spine-like setae on femur II or tarsus II ..... 3  
– With spur-like or spine-like on femur II or tarsus II .....  
..... *Gaeolaelaps queenslandicus* (Womersley, 1956)
3. Dorsal shield attenuated caudally; genital shield not abutting  
anal shield ..... *Gaeolaelaps elongatus* (Hirschmann, 1969)  
– Dorsal shield not attenuated caudally; genital shield abutting  
anal shield ..... *Gaeolaelaps urumiensis* sp. n.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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