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THREE NEW UNUSUAL BEETLE-ASSOCIATED SPECIES OF THE GENUS *GAEOLAELAPS* (ACARI, MESOSTIGMATA, LAELAPIDAE) FROM UKRAINE

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Three New Unusual Beetle-Associated Species of the Genus *Gaeolaelaps* (Acari, Mesostigmata, Laelapidae) from Ukraine. Trach, V. A. — Three new species of mesostigmatic mites from Ukraine are described: *Gaeolaelaps heteroceri* Trach, sp. n. associated with *Heterocerus* sp. (Coleoptera, Heteroceridae) from Odessa, Mykolaiv and Kherson Regions; *G. khaustovi* Trach, sp. n., associated with *Bembidion* sp. (Coleoptera, Carabidae) from Crimea; *G. sevastianovi* Trach, sp. n. associated with *Heterocerus* sp. (Coleoptera, Heteroceridae) from Lugansk Region. These three species are characterised by a number of unique characters: very short peritremes and peritrematal shields, elongated dorsal shield, abnormal for Laelapidae leg chaetotaxy. A key to the species of *Gaeolaelaps* with extra short peritremes is presented.

K e y w o r d s: Mesostigmata, Laelapidae, *Gaeolaelaps*, Ukraine, beetles, Coleoptera.

Introduction

The family Laelapidae is the most morphologically and ecologically diverse family of mesostigmatic mites that are free living or associated with arthropods, mammals, or birds (Lindquist et al., 2009; Kazemi et al., 2014). Worldwide, this family comprises about 90 genera and 1300 species (Beaulieu et al., 2011).

A large cosmopolitic genus *Gaeolaelaps* Evans et Till, 1966 (Acari, Mesostigmata, Laelapidae) includes over 100 described species (Walter, Moser, 2010; Kazemi et al., 2014). Halliday and Lindquist (2007) provided nomenclatural remarks on the use of the generic name *Gaeolaelaps*, and Beaulieu (2009) provided the detailed review of this genus. Later, the concept of the genus was revised by Kazemi, Rajaei and Beaulieu (Kazemi et al., 2014).

Most *Gaeolaelaps* species were described from soil and litter, but some species were collected from nests of vertebrates and from arthropods (or their nests), including mygalomorph spiders, millipedes, cockroaches, termites, carabid, passalid, cerambycid, scarabaeid beetles and ants (Hyatt, 1964; Bregetova, 1977; Rosario, 1981; Arutunian, 1993; Karg, 1993; Strong, Halliday, 1994; Fain et al., 1995; Strong, 1995; Mašán, 1998; Beaulieu, 2009; Sklyar, 2012; Trach, 2012; Jonarchi, Babaeian, 2014).

During a study of mesostigmatic mites associated with beetles in Ukraine, three undescribed species of *Gaeolaelaps* were found on heterocerid and carabid beetles.

Material and methods

Host beetles were collected by hand (Odessa, Mykolaiv, Kherson Regions, Crimea) and by using an ultraviolet lamp (Lugansk Region) and transferred into vials containing 70 % ethyl alcohol. Mites collected from beetles were cleared in lactic acid and slide-mounted in Hoyer's medium. Morphology of mites was studied with the aid of a compound microscope, a Mikmed-1 Lomo equipped with binocular head AU-12, ocular micrometer AM9-2, camera lucida RA-7U 4,2 and DCM900 digital camera. The morphological nomenclature generally follows Evans and Till (1965). Measurements are given in micrometers (mkm) for the holotype and paratypes (in parentheses, minimum to maximum). Lengths of dorsal, sternal, epigynal and anal shields were taken from the anterior to posterior shield margins along the midline. The length of the second cheliceral segment was measured from the base to the apex of the fixed digit. Leg length was taken from the base of the coxa to the apex of the tarsus, excluding the ambulacrum (stalk, claws and pulvillus).

Abbreviations are as follows: MZ — collections of the Museum of Zoology, I. I. Mechnikov Odessa National University, Odessa, Ukraine; DZ — collections of Department of Zoology I. I. Mechnikov Odessa National University, Odessa, Ukraine.

Results and discussion

Gaeolaelaps heteroceri Trach, **sp. n.** (fig. 1, *1–6*; 2, *1–4*)

Material. **Holotype** ♀, slide N 11–06–2013/01, Ukraine, Odessa Region, Kominternovsky District, vicinity of Koshary (46°39′ N, 31°10′ E), lower reaches of the Tiligul estuary (liman), shore of salt lake, under elytra of *Heterocerus* sp. (Coleoptera, Heteroceridae), 11.06.2013 (V. A. Trach). Paratypes: 15 ♀, 1 ♂, same data; 1 ♀, Ukraine, Mykolaiv Region, Berezansky District, vicinity of Koblevo (46°39′ N, 31°11′ E), lower reaches of the Tiligul estuary (liman), shore of salt lake, under elytra of *Heterocerus* sp., 18.05.2001 (V. A. Trach); 5 ♀, Ukraine, Kherson Region, Skadovsky District, Dzharylhach Island (46°02′ N, 32°56′ E), shore of salt puddle, under elytra of *Heterocerus* sp., 14.08.2014 (V. A. Trach). The holotype and paratype are deposited in MZ, other paratypes in DZ.

Description. Female (n = 6). Dorsum (fig. 1, *1*). Body large, strongly swollen in most specimens. Dorsal shield elongate oval (length / width ratios of 1.8–2.1), tapering posteriorly from setae *r4*, reticulate throughout, 319 (311–349) in length, maximum width 160 (155–185) at level of setae *r3–r4*. Shield with 39 pairs of simple slightly curved setae (*j1–6*, *z1–6*, *s1–6*, *r2–5*, *J1–5*, *Z1–5*, *S1–5*, *px2–3*), setae *Jx* absent. Setae *j1* 21 (21–23), other setae 25–40 (23–46) long. Dorsal shield with about 11 pairs of pore-like structures. Dorsal soft cuticle with 7 (6–8) pairs of simple setae, 23–29 (21–24) long.

Venter (fig. 1, *2*). Tritosternum with a wide base, 15 (13–15) long, 15 (15–17) wide at base, 6 (5–6) wide at apex, with two plumose laciniae, length free for 48 (44–55) and fused basally for 6 (4–6). Presternal area lightly punctate, with a few transverse lines. Sternal shield 105 (103–120) long, minimum width between coxae II 76 (74–80), maximum width at the anterior part of the shield — 90 (90–107) and posteriorly of the coxae II — 122 (111–124), posterior margin rounded. Sternal shield bearing three pairs of setae 25–27 (23–34) long and two pairs of lyrifissures. Weak sculpture lines developed on the lateral margins of the shield. Setae *st4* (25 (25–27)) and lyrifissures *iv3* located on soft cuticle. Epigynal shield narrow, reticulated, with simple setae *st5* (23 (21–25)). Shield 122 (111–132) in length, maximum width — 50 (46–63), the vertex of the epigynal shield rounded. T-shaped endopodal platelets located near coxae IV. Two pairs of paragenital platelets are located near the epigynal shield. Anal shield subtriangular, 57 (55–59) long, 50 (46–53) wide, cribrum well developed, narrowly extending laterally to level of preanal setae; anus located slightly anterior to mid-level of shield. Length of preanal setae — 21 (21–23), postanal seta — 24 (23–27). Soft cuticle with seven pairs of simple setae (*JV1–5*, *ZV1–2*), 23–32 (23–32) long. Exopodal platelets between coxae III–IV and parapodal platelets fused with peritrematal shields. Peritrematal shields very short, extending to posterior level of coxae II, 111 (109–120) long. Peritremes very short, reaching only to middle level of coxae III, 44 (44–48) long, 7 (7–8) wide near the middle. Spermathecal structures are indiscernible.

Gnathosoma (fig. 1, *3–5*). Tectum (fig. 1, *3*) weakly sclerotised, with some weak denticles. Subcapitulum (fig. 1, *4*) with 5–7 (5 in one paratype, 6 in holotype and seventeen paratypes and 7 in three paratypes) rows of deutosternal denticles. Rows with 4–8 (4–11) denticles. Subcapitulum 80 (76–88) in width. Corniculi horn-like. Hypostomal setae simple, length of setae *pc* — 19 (19–23), *hp1* — 19 (17–25), *hp2* — 15 (13–17), *hp3* — 23 (19–23). Palps 118 (109–122) long, seta *al* on femur, setae *al1* and *al2* on genu thickened. Palptarsal apotele slender, two-tined. Chaetotaxy of palps normal: 2–5–6–14–15. Several setae on palpal tibia and on palpal tarsus blunt-ended. Second cheliceral segment 92 (90–95) in length, with fringed arthrodial corona, fixed digit of chelicerae with two teeth and pilus dentilis (fig. 1, *5*). Movable digit of chelicerae with two uniform large teeth, 48 (42–48) long.

Legs (fig. 2, *1–4*). Legs thickened and stocky. Length of legs: I — 315 (315–328), II — 260 (248–269), III — 218 (214–239), IV — 290 (286–302). Claws I–IV well developed. Chaetotaxy of some segments abnormal for *Gaeolaelaps* and Laelapidae. Leg I chaetotaxy (from coxa to tibia): 2–**5**–**12**(2–3/1–2/**2**–2)–13(2–3/2–3/1–2)–13(2–3/2–3/1–2). Leg II–IV

chaetotaxy (from coxa to tarsus): II — 2–5–**9**(**1**–**2**/1–2/2–1)–11(2–3/1–2/1–2)–10(2–2/1–2/1–2)–18(3–3/3–1/1–2/2–3); III — 2–5–6(1–2/1–1/0–1)–9(2–2/1–2/1–1)–8(2–1/1–2/1–1)–18(3–3/3–1/1–2/2–3); IV — 1–5–6(1–2/1–1/0–1)–9(2–2/1–3/0–1)–10(2–1/1–3/1–2)–18(3–3/3–1/1–2/2–3). Tarsus I with numerous setae. All leg setae simple, smooth, some slightly thickened.

Fig. 1. *Gaeolaelaps heteroceri* Trach, sp. n., ♀: *1* — idiosoma, dorsal view; *2* — idiosoma, ventral view; *3* — tectum; *4* — subcapitulum and palp; *5* — chelicera; ♂: *6* — chelicera.

M a l e. Idiosoma of single male specimen was damaged during the slide-mounting process.

Gnathosoma as in female. Second cheliceral segment 75 in length, fixed digit as in female (fig. 1, *6*). Movable digit with one tooth; spermatodactyl relatively large.

Legs (including chaetotaxy) as in female.

D i f f e r e n t i a l d i a g n o s i s. *G. heteroceri* Trach, sp. n. differs from all congeners by the following combination of characters:

— dorsal shield with 39 pairs of simple setae;

— very short peritremes (reaching only to middle level of coxae III);

— abnormal leg chaetotaxy: trochanter I with only five setae (*ad* is lacking), femur I with only 12 setae (one *pv* seta is lacking), femur II with only nine setae (one *al* seta and one *ad* seta are lacking).

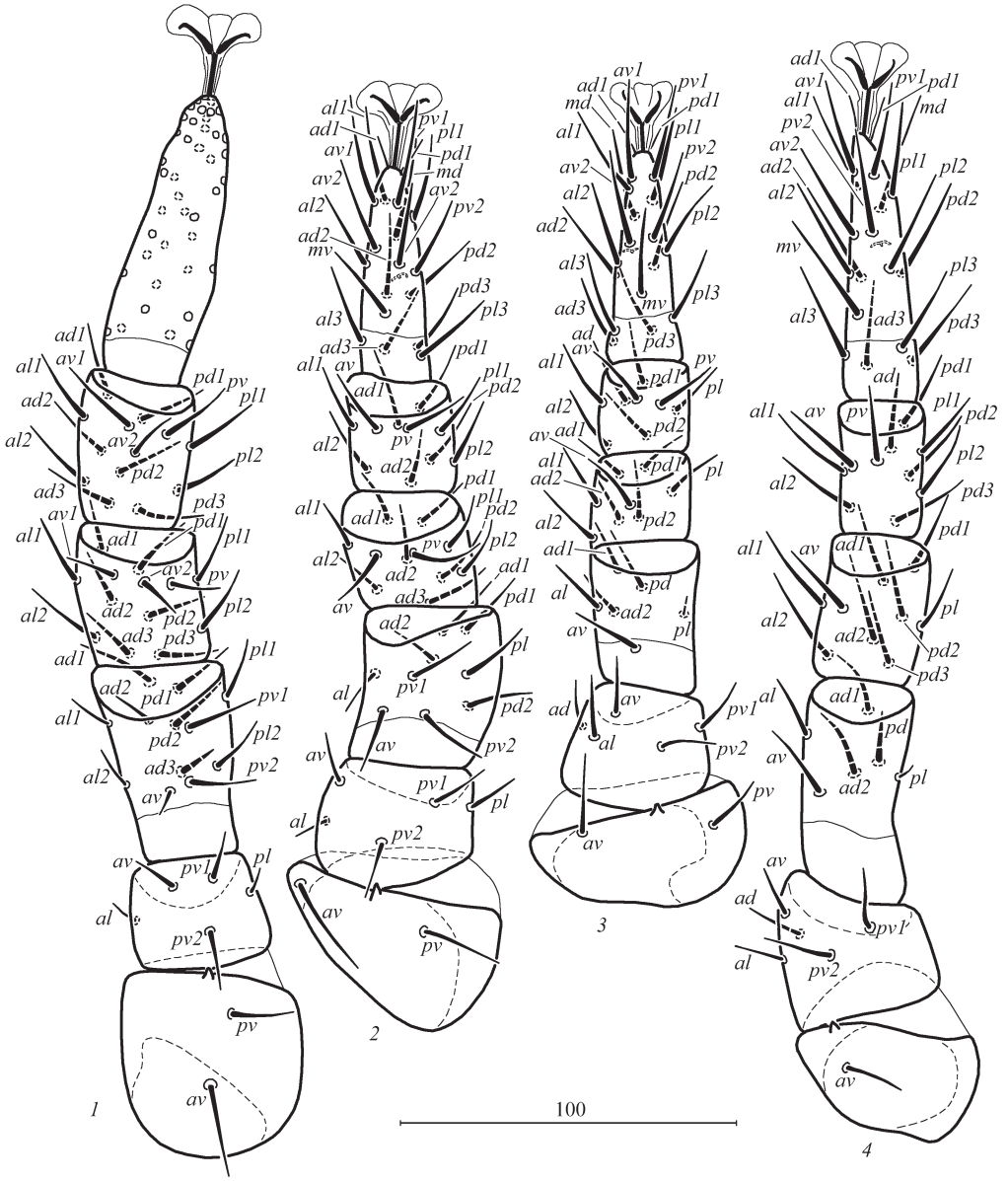

Fig. 2. *Gaeolaelaps heteroceri* Trach, sp. n., ♀: *1–4* — legs I–IV, respectively.

By the very short peritremes, shape of dorsal shield, number pairs of setae on the dorsal shield, *G. heteroceri* Trach, sp. n. is similar to *G. carabidophilus* Trach, 2012. It differs by the shape of peritrematal shields (in *G. heteroceri* Trach, sp. n. extending to posterior level of coxae II; in *G. carabidophilus* fused with dorsal shield near setae *z1*), by characteristics of the sternal shield (in *G. heteroceri* Trach, sp. n. maximum width of the shield at the anterior part and shield bearing only two pairs of lyrifissures; in *G. carabidophilus* maximum width of the shield at posterior part and sternal shield bearing three pairs of lyrifissures), by shape of the fixed digit of the chelicera (two digits in *G. heteroceri* Trach, sp. n. and four to six in *G. carabidophilus*), by chaetotaxy of dorsal soft cuticle (normal in *G. heteroceri* Trach, sp. n. and hypertrichous in *G. carabidophilus*), by leg chaetotaxy (abnormal in *G. heteroceri* Trach, sp. n. and normal in *G. carabidophilus*).

By the presence only 39 pairs of simple setae on the dorsal shield (and always without setae *Px*) and presence only two pairs of lyrifissures on the sternal shield, *G. heteroceri* Trach, sp. n. is similar to *G. aculeifer* (Canestrini, 1884); *G. farajii* Nemati et Mohseni, 2013; *G. heselhausi* (Oudemans, 1912); *G. isodentis* (Karg, 1989); *G. matinikus* (Rosario, 1981); *G. mossadeghi* Kavianpour et Nemati, 2014; *G. nolli* (Karg, 1962); *G. orbiculatus* Nemati et Mohseni, 2013; *G. sclerotarsus* (Costa, 1968); *G. similisetae* (Karg, 1965); *G. tenuisetus* (Rosario, 1981); *G. transversanalis* (Karg, 2000) and other. From all species, *G. heteroceri* Trach, sp. n. differs by very short peritremes (reaching only to middle level of coxae III; in other *Gaeolaelaps* species peritremes normal or rare reaches to middle or to anterior margin of coxae II) and abnormal leg chaetotaxy (leg chaetotaxy in most *Gaeolaelaps* not described).

From *G. rhizotrogi* (Mašán, 1998) and *G. dubininae* (Sklyar, 2012) (incompletely described from a single female specimen, probably a synonym of *G. rhizotrogi*), *G. heteroceri* Trach, sp. n. differs by shorter peritrematal shields, shape of dorsal (elongate oval in *G. heteroceri* Trach, sp. n., obovate in *G. dubininae* and *G. rhizotrogi*), sternal, epigynal shields,shape of the fixed and movable digits of the chelicera and other characters.

Biology. Adults and larvae of Heteroceridae construct tunnels in wet sand at the edges of streams, rivers, lakes and ponds, and in brackish mud flats. There is no agreement among authors regarding the feeding habits (Vanin et al., 2005). Mites (22 females, 1 male, 8 deutonymphs, 6 protonymphs, 1 larva and about 20 eggs) were found under elytra of about 15 specimens of *Heterocerus* sp. on the shores of salt lake and salt puddle. The intensity of invasion (phoresy) of beetles (for females only) stood from 1 to 3. Most of females (19) were strongly swollen. The relationships — between *G. heteroceri* Trach, sp. n. with their hosts is not clear. Based on the some morphological characters (for example strong chelate-dentate chelicerae), parasitism (at least in an obligate form) for *G. heteroceri* Trach, sp. n. and other arthropod-associated *Gaeolaelaps* species can probably be ruled out and predation of small invertebrates in the nests of their arthropod hosts is more likely (Kazemi et al., 2014). Probably *G. heteroceri* Trach, sp. n. associated with Heteroceridae that live along the shores of salt lakes and ponds.

Etymology. The name of the new species refers to the genus name of its host beetle, *Heterocerus*.

Gaeolaelaps khaustovi Trach, **sp. n.** (fig. 3, *1–7*; 5, *1*)

Material. **Holotype** ♀, slide N 22–04–2001, Ukraine, Crimea, Yalta City Municipality, vicinity of Sovetskoe, Canyon Uch-Kosh (44°32′ N, 34°12′ E), under elytra of *Bembidion* sp. (Coleoptera, Carabidae), 22.04.2001 (A. A. Khaustov). Paratype, ♀, same data. The holotype and paratype are deposited in MZ.

Description. Female (n = 2). Dorsum (fig. 3, *1*). Body large, strongly swollen. Dorsal shield greatly elongate (length / width ratios of 2.8–2.9), tapering posteriorly from setae *r4*, reticulate throughout, 416 (441) in length, maximum width 147 (155) at level of setae *r4*. Shield

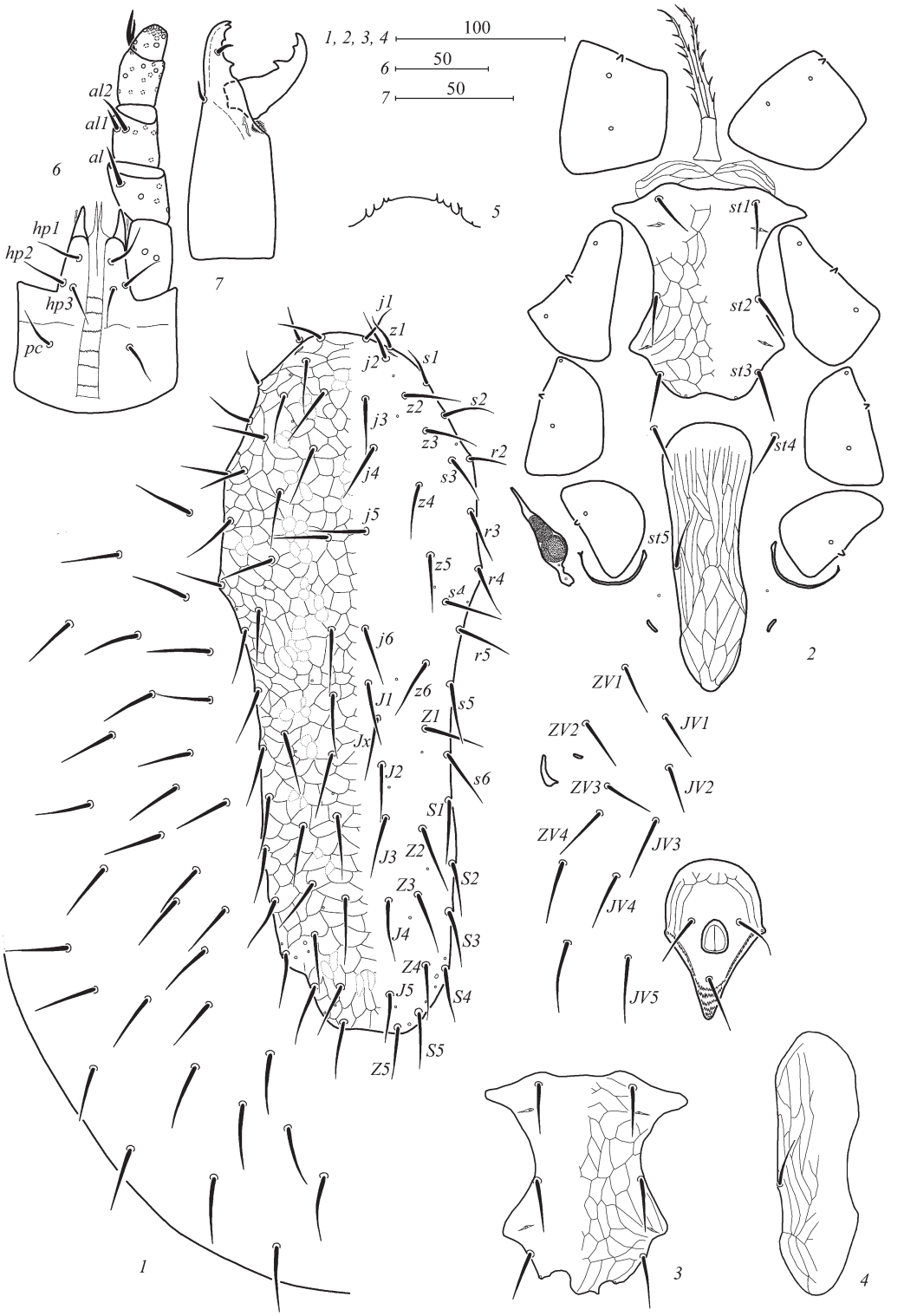

Fig. 3. *Gaeolaelaps khaustovi* Trach, sp. n., ♀: *1* — idiosoma, dorsal view; *2* — idiosoma, ventral view; *3* — tectum; *4* — subcapitulum and palp; *5* — chelicera; *6* — sternal shield of paratype; *7* — epigynal shield of paratype.

with 37 pairs of simple setae (*j1–6*, *z1–6*, *s1–6*, *r2–5*, *J1–5*, *Z1–5*, *S1–5*) and one unpaired medial *Jx* seta, setae *Px2–3* absent (in holotype one seta *z6* is lost). Setae *j1*, *z1*, *s1* 19–23 (19–23), other setae 27–38 (23–38) long. Dorsal shield with about 17 pairs of pore-like structures. Dorsal soft cuticle hypertrichous, with 32 (32–33) pairs of simple setae, 29–42 (32–46) long.

Venter (fig. 3, *2*). Tritosternum with a narrow base, 23 (21) long, 15 (15) wide at base, 8 (8) wide at apex, with two free plumose laciniae, 69 (74) long. Presternal area lightly punctate, with a few transverse lines. Sternal shield 95 (109) long, minimum width between coxae II 55 (53), maximum width at the anterior part of the shield — 80 (88) and posteriorly of the coxae II — 69 (67), posterior margin of the sternal shield of variable shape (fig. 3, *2*, *3*). Sternal shield bearing three pairs of setae 25–27 (25–27) long and three pairs of lyrifissures, *iv3* located on the posterior margin of the shield. Weak reticulate sculpture developed on most of the surface of shield. Setae *st4* (27 (25–27)) located on soft cuticle. Epigynal shield narrow, of slightly variable shape, reticulated, with unpaired seta *st5* (25 (25)). Shield 149 (153) in length, maximum width — 38 (46) (fig. 3, *2*, *4*). Second seta *st5* on soft cuticle near the epigynal shield is absent. Pair of paragenital platelets is located near the epigynal shield. Opisthosomatic venter with two pairs of metapodal platelets: smaller inner 6 (8) x 3 (3) and larger external 17 (21) x 6 (6). Anal shield elongate-subtriangular, 88 (95) long, 53 (53) wide, bearing pair of pores, cribrum well developed, narrowly extending laterally to level of preanal setae; anus located in the center of shield. Length of preanal setae — 27 (27), postanal seta — 29 (34). Soft cuticle with eleven pairs of simple setae (*JV1–5*, *ZV1–5*, *UR*), 32–42 (32–44) long. Parapodal platelets free, thin. Peritrematal shields free, very short, pointed anteriorly, extending to posterior level of coxae III, 65–67 long. Peritremes very short, reaching only to anterior level of coxae IV, 29 (32) long. Spermathecal structures are indiscernible.

Gnathosoma (fig. 3, *5–7*). Tectum (fig. 3, *5*) with smooth front edge and denticulate margins. Subcapitulum (fig. 3, *6*) with six rows of deutosternal denticles. Rows with 8–12 denticles. Subcapitulum 90 in width. Corniculi horn-like. Hypostomal setae simple, length of setae *pc* — 27, *hp1* — 25, *hp2* — 23, *hp3* — 25. Palps 149 long, seta *al* on femur, setae *al1* and *al2* on genu thickened. Palptarsal apotele slender, two-tined. Chaetotaxy of palps normal: 2–5–6–14–15. Several setae on palpal tibia and on palpal tarsus blunt-ended. Second cheliceral segment 101 in length, with fringed arthrodial corona, fixed digit of chelicerae with three teeth and pilus dentilis (fig. 3, *7*). Movable digit of chelicerae with two different teeth: larger proximal and smaller distal, 42 long.

Legs (fig. 5, *1*). Legs slender. Length of legs: I — 483, II — 395, III — 311, IV— 445. Claws I–IV well developed. Leg chaetotaxy normal for *Gaeolaelaps* and Laelapidae. Leg I chaetotaxy (from coxa to tibia): 2–6–13(2–3/1–2/3–2)–13(2–3/2–3/1–2)–13(2–3/2–3/1–2). Leg II–IV chaetotaxy (from coxa to tarsus): II — 2–5–11(2–3/1–2/2–1)–11(2–3/1–2/1–2)–10(2–2/1–2/1–2)–18(3–3/3–1/1–2/2–3); III — 2–5–6(1–2/1–1/0–1)–9(2–2/1–2/1–1)–8(2–1/1–2/1–1)–18(3–3/3–1/1–2/2–3); IV — 1–5–6(1–2/1–1/0–1)–9(2–2/1–3/0–1)–10(2–1/1–3/1–2)–18(3–3/3–1/1–2/2–3). Tarsus I with numerous setae. All leg setae simple, smooth. On tarsi IV most setae slightly thickened (fig. 5, *1*).

D i f f e r e n t i a l d i a g n o s i s. *G. khaustovi* Trach, sp. n. differs from all congeners by the following combination of characters:

— greatly elongate dorsal shield;

— 37 pairs of simple setae and one unpaired medial seta on the dorsal shield;

— dorsal soft cuticle hypertrichous;

— sternal shield with three pairs of lyrifissures;

— very short peritremes (reaching to anterior level of coxae IV).

By the short peritremes, *G. khaustovi* Trach, sp. n. is similar to *G. carabidophilus*, *G. dubininae*, *G. heteroceri* Trach, sp. n. and *G. rhizotrogi*. *G. khaustovi* Trach, sp. n. is very similar to *G. carabidophilus* in the shape of sternal and epigynal shields, presence three pairs of lyrifissures on the sternal shield and presence more than nine pairs setae

on opisthogastric cuticle. *G. khaustovi* Trach, sp. n. differs from *G. carabidophilus* by the shape of dorsal shield (greatly elongate in *G. khaustovi*, Trach, sp. n. and elongate oval in *G. carabidophilus*), number of setae on the dorsal shield (37 pairs and one unpaired medial seta in *G. khaustovi* Trach, sp. n., and 39 pairs setae in *G. carabidophilus*), short peritrematal shields (extending to posterior level of coxae III in *G. khaustovi* Trach, sp. n. and fused with dorsal shield near setae *z1* in *G. carabidophilus*), shape of the fixed digit of the chelicera, shape of the metapodal platelets.

From *G. dubininae* and *G. rhizotrogi*, *G. khaustovi* Trach, sp. n. differs by shape of dorsal, sternal and epigynal shields, by presence one unpaired medial seta on the dorsal shield, short peritrematal shields and other characters. From *G. heteroceri* Trach, sp. n., *G. khaustovi* Trach, sp. n. differs by shape of dorsal, sternal, epigynal shields and tectum, by presence 37 pairs and one unpaired medial seta on the dorsal shield (39 pairs in *heteroceri* Trach, sp. n.), hypertrichous dorsal soft cuticle, shorter peritrematal shields, shape of the fixed digit of the chelicera and other characters.

By the hypertrichous dorsal soft cuticle, *G. khaustovi* Trach, sp. n. is similar to *G. angustiscutatus* (Willmann, 1951), *G. carabidophilus* Trach, 2012, *G. dubininae*, *G. elongatus* Hirschmann, Bernhard, Greim et Götz, 1966 and *G. millipedus* Rosario, 1981. *G. khaustovi* Trach, sp. n. can be readily distinguished from *G. angustiscutatus*, *G. elongatus*, *G. millipedus* by shape of the dorsal shields, number setae on soft dorsal cuticle (32–33 pairs in *G. khaustovi* Trach, sp. n., about 20 in *G. angustiscutatus* and *G. millipedus*, about 10 in *G. elongatus*), shape of sternal and epigynal shields and short peritremes. A comparison with *G. carabidophilus* and *G. dubininae* has been given above.

By the presence 37 pairs and one unpaired medial seta on the dorsal shield *G. khaustovi* Trach sp. n. is similar to *G. magkadikitus* Rosario, 1981; *G. schusteri* (Hirschmann, 1966) and *G. theodori* (Costa, 1974). In *G. schusteri* and *G. theodori* seta *Jx* located between setae *J3* and *J4* (in *G. khaustovi* Trach, sp. n. and *G. magkadikitus* — between *J1* and *J2*). In addition, *G. khaustovi* Trach, sp. n., *G. schusteri* and *G. theodori* have sternal shield with three pairs of lyrifissures. *G. khaustovi* Trach, sp. n. easily distinguished from these species by having dorsal soft cuticle hypertrichous and very short peritremes.

Biology. Most *Bembidion* are strongly hygrophilous and live close to water, some are confined to running waters, other to shores of lakes, ponds, or the sea. Most species are primarily scavengers, but many also take living prey such as small arthropods (Lindroth, 1985). Only two females without eggs were found under elytra on the one specimen of *Bembidion* sp. The feeding biology of *G. khaustovi* Trach, sp. n. is unknown.

Etymology. This species is named in honour of Dr. A. A. Khaustov in recognition of his contributions to the study of the beetle-associated mites, and who collected the type specimens.

Gaeolaelaps sevastianovi Trach, **sp. n.** (fig. 4, *1–4*; 5, *2–5*)

Material. **Holotype** ♀, slide N 29–07–2010, Ukraine, Lugansk Region, Melovskoj District, vicinity of Krinichnoe, near Cherepaha river (49°18′ N 40°05′ E), under elytra of *Heterocerus* sp. (Coleoptera, Heteroceridae), 29.07.2010 (V. A. Trach). Paratypes, 2 ♀, same data. The holotype and paratypes are deposited in MZ.

Description. Female (n = 3). Dorsum (fig. 4, *1*). Body large, strongly swollen. Dorsal shield elongate oval (length / width ratios of 1.6–1.8), tapering posteriorly from setae *r5*, weakly reticulate throughout, 269 (273–277) in length, maximum width 164 (155–164) at level of setae *r4*. Shield with 37 pairs of simple setae (*j1–6*, *z1–6*, *s1–6*, *r2–5*, *J1–5*, *Z1–5*, *S1–5*), setae *Px2–3* and *Jx* absent. Setae *j1* and *z1* 21–23 (19–23), other setae 32–44 (32–48) long. Dorsal shield with about 10 pairs of pore-like structures. Dorsal soft cuticle with three pairs of simple setae, 25–32 (25–34) long.

Venter (fig. 4, *2*). Tritosternum with a wide base, 11 (11) long, 13 (13) wide at base, 6 (6) wide at apex, with two plumose laciniae, length free for 42 (38–42) and fused basally

for 4 (4). Presternal area lightly punctate, with a few transverse lines. Sternal shield 105 (105–109) long, minimum width between coxae II 69 (71–74), maximum width at the anterior part of the shield — 76 (78–80) and posteriorly of the coxae II — 99 (99–105), posterior margin rounded. Sternal shield bearing three pairs of setae 25–29 (25–29) long and two pairs of lyrifissures. Weak reticulate sculpture developed on edges of shield. Setae *st4* (27 (27)) and lyrifissures *iv3* located on soft cuticle. Epigynal shield wide, weakly reticulated, with simple setae *st5* (25 (25–27)). Shield 78 (78–80) in length, maximum width — 42 (42–46). Pair of paragenital platelets is located near the epigynal shield. Anal shield subtriangular, 48 (44–46) long, 46 (46) wide, cribrum well developed, narrowly extending laterally to level of preanal setae; anus located slightly anterior to mid-level

Fig. 4. *Gaeolaelaps sevastianovi* Trach, sp. n., ♀: *1* — idiosoma, dorsal view; *2* — idiosoma, ventral view; *3* — subcapitulum and palp; *4* — chelicera.

of shield. Length of preanal setae — 19–21 (19–21), postanal seta — 21 (21). Soft cuticle with seven pairs of simple setae (*JV1–5*, *ZV1–2*), 21–25 (21–25) long. Parapodal platelets thin, fused with peritrematal shields. Peritrematal shields very short, extending to posterior level of coxae III, 46 (44–48) long. Peritremes very short, reaching only to anterior level of coxae IV, 21 (21–23) long, 13 (13) wide near the middle. Spermathecal structures are indiscernible.

Gnathosoma (fig. 4, *3–4*). Tectum not discernible. Subcapitulum (fig. 4, *3*) with 6–7 (6 in holotype, 7 in two paratypes) rows of deutosternal denticles. Rows with 10–15 denticles. Subcapitulum 80 (80–84) in width. Corniculi horn-like. Hypostomal setae simple, length of setae *pc* — 15 (15), *hp1* — 21 (19–21), *hp2* — 19 (17–19), *hp3* — 19 (19–21). Palps 103 (101–103) long, seta *al* on femur, setae *al1* and *al2* on genu thickened. Palptarsal apotele slender, two-tined. Chaetotaxy of palps normal: 2–5–6–14–15. Several setae on palpal tibia and on palpal tarsus blunt-ended. Second cheliceral segment 74 (71–74) in length, with fringed arthrodial corona, fixed digit of chelicerae with two teeth and pilus dentilis (fig. 3, *4*). Movable digit of chelicerae with two large uniform teeth, 32 (32) long.

Legs (fig. 5, *2–5*). Legs thickened and stocky. Length of legs: I — 273–277 (269–277), II — 218–223 (210–218), III — 193–197 (189–193), IV — 239–244 (244–252). Claws I–IV well developed. Chaetotaxy of some segments abnormal for *Gaeolaelaps* and Laelapidae. Leg I chaetotaxy (from coxa to tibia): 2–**5**–**12**(2–3/1–2/**2**–2)–13(2–3/2–3/1–2)–13(2–3/2–3/1–2). Leg II–IV chaetotaxy (from coxa to tarsus): II — 2–5–**9**(**1**–**2**/1–2/2–1)–11(2–3/1–2/1–2)–10(2–2/1–2/1–2)–18(3–3/3–1/1–2/2–3); III — 2–5–6(1–2/1–1/0–1)–**8**(2–2/1–2/**0**–1)–8(2–1/1–2/1–1)–18(3–3/3–1/1–2/2–3); IV — 1–5–6(1–2/1–1/0–1)–**8**(2–2/1–3/0–**0**)–**9**(2–1/1–3/1–**1**)–18(3–3/3–1/1–2/2–3). Tarsus I with numerous setae. All leg setae simple, smooth, some slightly thickened.

Differential diagnosis. *G. sevastianovi* Trach, sp. n. differs from all congeners by the following combination of characters:

— 37 pairs of simple setae the dorsal shield;

— very short peritremes (reaching to anterior level of coxae IV);

— abnormal leg chaetotaxy: trochanter I with only five setae (*ad* is lacking), femur I with only 12 setae (one *pv* seta is lacking), femur II with only nine setae (one *al* seta and one *ad* seta are lacking), genua III with only eight setae (*pv* is lacking), genua IV with only eight setae (*pl* is lacking), tibia IV with only nine setae (one *pl* is lacking).

By the short peritremes, *G. sevastianovi* Trach, sp. n. is similar to *G. carabidophilus*, *G. dubininae*, *G. heteroceri* Trach, sp. n., *G. khaustovi* Trach, sp. n. and *G. rhizotrogi*.

G. sevastianovi Trach, sp. n. differs from *G. khaustovi* Trach, sp. n. by the shape of dorsal shield (elongate oval in *G. sevastianovi* Trach, sp. n., greatly elongate in *G. khaustovi* Trach, sp. n.), number of setae on the dorsal shield (37 pairs in *G. sevastianovi* Trach, sp. n., 37 pairs and one unpaired medial seta in *G. khaustovi* Trach, sp. n.), chaetom of dorsal soft cuticle (normal in *G. sevastianovi* Trach, sp. n., hypertrichous in *G. khaustovi* Trach, sp. n.), shape of sternal, epigynal, anal and peritrematal shields, number of pairs of lyrifissures on sternal shield (two in *G. sevastianovi* Trach, sp. n., three in *G. khaustovi* Trach, sp. n.), leg chaetotaxy (abnormal in *G. sevastianovi* Trach, sp. n., normal in *G. khaustovi* Trach, sp. n.) and other characters.

From *G. carabidophilus*, *G. sevastianovi* Trach, sp. n. primarily differs by number of setae on the dorsal shield (37 pairs in *G. sevastianovi* Trach, sp. n., 39 pairs in *G. carabidophilus*), chaetom of dorsal soft cuticle (normal in *G. sevastianovi* Trach, sp. n., hypertrichous in *G. carabidophilus*), shape of sternal, epigynal and peritrematal shields, number of pairs of lyrifissures on sternal shield (two in *G. sevastianovi* Trach, sp. n., three in *G. carabidophilus*), leg chaetotaxy (abnormal in *G. sevastianovi* Trach, sp. n., normal in *G. carabidophilus*).

G. sevastianovi Trach, sp. n. differs from *G. dubininae* and *G. rhizotrogi* by the shape of dorsal shield (elongate oval in *G. sevastianovi* Trach, sp. n., obovate in *G. dubininae* and *G. rhizotrogi*), shape of sternal and peritrematal shields and other characters.

From *G. heteroceri* Trach, sp. n., *G. sevastianovi* Trach, sp. n. primarily differs by number of setae on the dorsal shield (37 pairs in *G. sevastianovi* Trach, sp. n., 39 pairs in *G. heteroceri* Trach, sp. n.), shape of epigynal and peritrematal shields, shorter peritremes and leg chaetotaxy.

By the presence only 37 pairs on the dorsal shield and presence only two pairs of lyrifissures on the sternal shield *G. sevastianovi* Trach, sp. n. is similar to *G. ahangarani* Kazemi et Beaulieu, 2014; *G. angustiscutatus* Willmann, 1951; *G. barbarae* (Strong, 1995); *G. genitotortus* Sklyar, 2012; *G. invictianus* Walter et Moser, 2010; *G. paraculeifer* Rosario, 1981; *G. passalus* Rosario, 1981; *G. praesternalis* Willmann, 1949; *G. queenslandicus* (Womersley, 1956); *G. rarosae* Rosario, 1981; *G. verticis* (Karg, 1979) and *G. vertisimilis* (Karg, 1994).

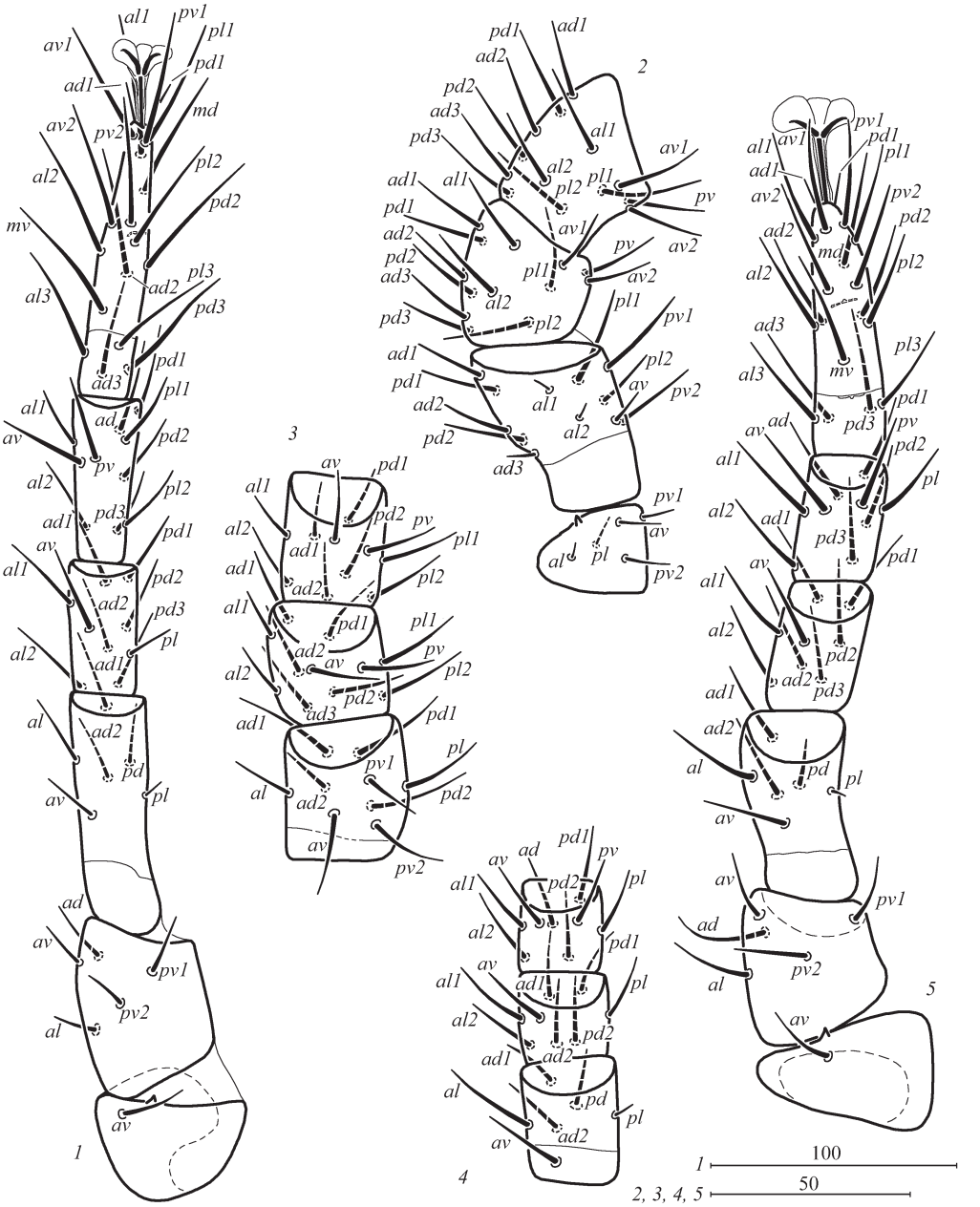

Fig. 5. *Gaeolaelaps khaustovi* Trach, sp. n. (*1*) and *G. sevastianovi* Trach, sp. n. (*2–5*), ♀: *1* — leg IV; *2* — leg I (from trochanter to tibia); *3* — leg II (from femur to tibia); *4* — leg III (from femur to tibia); *5* — leg IV.

From all species, *G. sevastianovi* Trach, sp. n. differs by very short peritremes and abnormal leg chaetotaxy.

Biology. Only three females without eggs were found under elytra on the one specimen of *Heterocerus* sp. (about 20 specimens of *Heterocerus* sp. were examined from same locality). The feeding biology of *G. sevastianovi* Trach, sp. n. is unknown. Probably *G. sevastianovi* Trach, sp. n. is associated with Heteroceridae that live along the shores of fresh waters.

Etymology. This species is named in honour of my teacher, Professor V. D. Sevastianov, who devoted many years to training acarologists in I. I. Mechnikov Odessa National University.

Conclusion

The arthropod-associated *Gaeolaelaps* often exhibit more or less unique departures from soil-inhabiting *Gaeolaelaps* species (Faraji, Halliday, 2009; Walter, Moser, 2010; Trach, 2012; Kazemi et al., 2014). Despite the number of unique characters (elongated dorsal shield, dorsal and ventral hypertrichy, sternal shield with three pairs of lyrifissures, very short peritremes, abnormal chaetotaxy of some leg segments) all three new species belong to the genus *Gaeolaelaps* (following the concept of genus as defined by Beaulieu (2009), Kazemi, Rajaei and Beaulieu (Kazemi et al., 2014)), because are characterised by the chaetotaxy of dorsal and ventral shields, shapes of sternal and epyginal shields normal for genus, six rows (in most specimens) of deutosternal denticles, well-developed chelate-dentate chelicerae, normal for *Gaeolaelaps* leg setation (on most leg segments) and other characters.

At present, the very short peritremes (reaching only to anterior level of coxa III or shorter) known only in beetle-associated *Gaeolaelaps* (*G. carabidophilus*, *G. dubininae*, *G. heteroceri* Trach, sp. n., *G. khaustovi* Trach, sp. n., *G. rhizotrogi*, *G. sevastianovi* Trach, sp. n.). In addition, the short peritremes are common in some arthropod-associated genera of Laelapidae: *Jacobsonia* Berlese, 1910; *Myrmozercon* Berlese, 1902; *Narceolaelaps* Kethley, 1978; *Scissuralaelaps* Womersley, 1945; *Suracarus* Flechtmann, 2005 (Kethley, 1978; Fain, 1992, 1994; Flechtmann, 2005; Shaw, Seeman, 2009 et al.).

It is also noteworthy that beetle-associated *Gaeolaelaps* with very short peritremes (excluding *G. dubininae* and *G. rhizotrogi*) characterised by more or less elongate dorsal shield tapering posteriorly at level of setae *r4*. *Gaeolaelaps* species associated with carabid beetles have hypertrichous dorsal soft cuticle and normal leg chaetotaxy (not descibed in *G. dubininae*), in contrast, mites associated with heterocerid beetles have abnormal leg chaetotaxy and normal dorsal soft cuticle chaetotaxy.

Evans (1965) noted the abnormal for Laelapidae (as in *G. heteroceri* Trach, sp. n. and *G. sevastianovi* Trach, sp. n.) chaetotaxy of the trochanter I (1–**0**/1–0/2–1) and chaetotaxy of the femur I (2–3/1–2/**2**–2) in *Dermanyssus alaudae* (Schrank, 1781), and chaetotaxy of the femur II (**1**–**2**/1–2/2–1) in *Ophionyssus natricis* (Gervais, 1844) and *O. sauracum* (Oudemans, 1901). At present, both genera belong to other families of superfamily Dermanyssoidea (Lindquist et al., 2009; Beaulieu et al., 2011). Only one ventral seta present on the genua III (as in *G. sevastianovi* Trach, sp. n.) in some specimens of *G. variabilis* (Faraji et Halliday, 2009), but cases of the abnormal chaetotaxy on genua IV (2–2/1–3/0–**0**) and tibia IV (2–1/1–3/1–**1**), as in *G. sevastianovi* Trach, sp. n., in the published data about chaetotaxy of Laelapidae we not found (Evans, 1963; Evans, Till, 1965; Strong, Halliday, 2008; Beaulieu, 2011 et al.). Moreover, the leg chaetotaxy of about 10 soil-inhabiting *Gaeolaelaps* species was studied. All species were characterised by normal for *Gaeolaelaps* leg chaetotaxy and only one undetermined species had on genua IV additional seta *pv* (2–2/1–3/**1**–0).

Key to the species of *Gaeolaelaps* with extra short peritremes (females)

1. Dorsal soft cuticle hypertrichous (with more than 30 pairs of setae); sternal shield with three pairs of lyrifissures. 2
— Dorsal soft cuticle non hypertrichous (with less than 15 pairs of setae); sternal shield with two pairs of lyrifissures. 3
2. Peritrematal shields long, extending to level of coxae I; dorsal shield with 39 pairs of setae (Px2–3 present). ..... *G. carabidophilus* Trach, 2012
— Peritrematal shields very short (extending to posterior level of coxae III); dorsal shield with 37 pairs of setae and one unpaired medial seta Jx. ..... *G. khaustovi* Trach, sp. n.
3. Dorsal shield elongate oval, sharply tapering posteriorly from setae r4. 4
— Dorsal shield obovate, not sharply tapering posteriorly from setae r4. .... *G. rhizotrogi* (Mašán, 1998) and *G. dubininae* (Sklyar, 2012)
4. Dorsal shield with 39 pairs of setae (Px2–3 present); epigynal shield strongly tapering anteriorly of setae st5; peritremes short (length / width ratios ≈ 5.5–7). ..... *G. heteroceri* Trach, sp. n.
— Dorsal shield with 37 pairs of setae (Px2–3 absent); epigynal shield slightly tapering anteriorly of setae st5; peritremes very short (length / width ratios ≈ 2). ..... *G. sevastianovi* Trach, sp. n.

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