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MITES OF THE GENUS *PROCTOLAELAPS* BERLESE, 1923 (ACARI: MESOSTIGMATA: MELICHARIDAE) ASSOCIATED WITH BARK BEETLES IN ASIAN RUSSIA

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ABSTRACT: Six mite species of the genus *Proctolaelaps* Berlese, 1923 (Acari: Mesostigmata: Melicharidae) are recorded from bark beetles and in their galleries in Asian Russia. One of them, *Proctolaelaps dendroctoni* Lindquist and Hunter, 1965, is found for the first time in Palaearctic; its female is redescribed. *Proctolaelaps hystricoides* Lindquist and Hunter, 1965, *P. hystrix* (Vitzthum, 1923) and *P. scolyti* Evans (1958) are recorded for the first time in Russia. A key to females of the genus *Proctolaelaps,* associated with subcortical beetles, is provided.

KEY WORDS: Parasitiformes, Monogynaspida, Ascoidea, Scolytinae, systematics, new species, phoresy.

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INTRODUCTION

The mite family Melicharidae includes 11 genera and more than 200 species (Moraes *et al.* 2016). Melicharids are known from soil, litter, plants (i.e., their flowers and fruits), rotten wood, stored products, seaweeds, colonies of fruit flies, on cockroaches, beetles, moths, ants, bees, bumblebees and their nests, birds, small mammals and their nests, corps, and excrements (e.g., De Leon 1963; Westerboer 1963; Treat and Niederman 1967; Bregetova 1977; Fain *et al.* 1977; Karg 1985, 1988a; Hanekom *et al.* 1988; OConnor *et al.* 1991; Faraji 2011; Halliday 2001; Mašán *et al.* 2013; Moraes *et. al.* 2015, 2016).

Currently, the largest cosmopolitan melicharid genus *Proctolaelaps* Berlese, 1923 includes about 140 described species (Abo-Shnaf and Moraes 2016; Literakova *et al.* 2016; Moraes *et al.* 2016; Rueda-Ramírez *et al.* 2016). About 25 species of the genus *Proctolaelaps* are phoretic on beetles (cossonines, bark beetles, stag beetles, sap beetles, erotylids, scarab beetles, leaf beetles, silphids, and carabid beetles). These mites are especially common on subcortical beetles (Vitzthum 1923; Evans 1958; Samšiňák 1960; Hirschmann 1962, 1972; Costa 1963; Westerboer 1963; Lindquist and Hunter 1965; Ishikawa 1968; Lindquist 1971; Wisniewski 1980; Karg 1988b; Stone 1988; Mašán 1998; Ma *et al.* 2003; Gwiazdowicz 2007; personal observations).

Thirteen species of the genus *Proctolaelaps* have been reported from Russia: *P. arctorotundus* Nikolsky, 1984; *P. bickleyi* (Bram, 1956); *P. bombophilus* (Westerboer, 1963); *P. cossi* (Dugès, 1834); *P. fiseri* Samšiňák, 1960; *P. jueradeus* (Schweizer, 1949); *P. longisetosus* (Postner, 1963); *P. ornatus* (Postner, 1963); *P. parvanalis* (Thor, 1930); *P. pseudofiseri* Nikolsky, 1984; *P. pygmaeus* (Müller, 1859); *P. sibiriensis* (Davydova, 1988); *P. xyloteri* Samšiňák, 1960 (Bregetova 1977; Petrova 1982; Nikolsky 1984; Davydova and Nikolsky 1986; Andreev, 1988; Davydova 1988; Klimov 1998; Marchenko 2002, 2012, 2017; Maslov and Matusevich 2008; Makarova 2009, 2011, 2012; Khaustov *et al.* 2016).

During the study of mites, associated with bark beetles in Asian Russia (Siberia and the Far East), six species of the genus *Proctolaelaps* were recorded on bark beetles and in bark beetle galleries. The aims of this paper are the following: to present the new records of phoretic mites of the genus *Proctolaelaps*; to redescribe (with an extended set of measurements) a female of the poorly known species *Proctolaelaps dendroctoni* Lindquist and Hunter (1965); and to provide a key to the subcortical beetle-associated *Proctolaelaps* species.

MATERIAL AND METHODS

Bark beetles were collected from their galleries using an aspirator, after which they were placed into vials with 96% ethanol. The beetles, as well the mites obtained from the beetles and their galleries, were examined with the aid of the stereomicroscope Discovery V8 (Carl Zeiss, Germany). Most of the collected mites were mounted in a Hoyer's medium for the purposes of light-microscopy. The morphology of mites was studied with the help of the Axio Imager A2 (Carl Zeiss, Germany) compound microscope with the phase-contrast and the DIC objectives. Mikmed-1 Lomo microscope, equipped with a binocular head AU-12 and an ocular micrometer AM9-2, was also used.

SEM micrographs were taken with the aid of a JEOL–JSM-6510LV SEM microscope. The morphological terminology generally follows Evans and Till (1979). All pore-like structures, glandular openings (solenostomes), and poroids (lyrifissures) are designated as "pores". Dorsal and ventral setae were labelled according to the systems of Lindquist and Evans (1965), and Lindquist (1994). Palpal and leg chaetotaxy follows Evans (1963a, b, 1969). Lengths of shields were measured from the anterior to posterior shield margins along the midline. The length of the second cheliceral segment was measured from their base to the apex of the fixed digit. The length of legs was taken from the base of the coxa to the apex of the tarsus, excluding the ambulacrum. The measurements are given in micrometers (μm). The material is deposited in the Zoological Museum of Tyumen State University (Tyumen, Russia) and in the collections of the Department of Zoology in I.I. Mechnikov Odessa National University (Odessa, Ukraine).

SYSTEMATICS

Family Melicharidae

Genus *Proctolaelaps* Berlese, 1923

Type species: *Proctolaelaps productus* Berlese, 1923, by monotypy

PROCTOLAELAPS DENDROCTONI LINDQUIST AND HUNTER, 1965

Figs. 1–2, 3a, 4

Proctolaelaps dendroctoni Lindquist and Hunter, 1965, p. 25, Figs. 20–30.

The type series of *P. dendroctoni* includes specimens from the USA (Georgia, Louisiana and Texas). The mites were found in galleries of bark beetles *Dendroctonus frontalis* Zimmerman, 1868, *Ips avulsus* (Eichhoff, 1868), *I. calligraphus* (Germar, 1824) and on the adult *D. frontalis* (Lindquist and Hunter 1965). Kinn (1983) studied the life cycle of *P. dendroctoni* and quoted Wilson (1980), according to whom this mite species is usually phoretic on beetle associates of scolytids. This observation is especially applicable to the tenebrionid *Corticeus glaber* (LeConte, 1878)—a facultative predator of bark beetles. We have also recorded the phoresy of this species on *Corticeus* sp. (Fig. 4). This is a new record for the fauna of the Palearctic.

Diagnosis. Dorsal shield reticulate, smooth only in center of podonotal region. Female with 42 pairs of setae on dorsal shield. Length of setae in *J*-series does not exceed half distance to base of next posterior seta. Pre-sternal area without platelets. Sternal shield mainly reticulate, smooth posteriorly, pattern of lines in central part primarily transverse. Anus of middle size, located in central part of anal shield. Soft cuticle around of anal shield in female with 13 pairs of setae. Anterior margin of epistome narrowly rounded, denticulate. Deutosternum in female with 6 rows of denticles, rows 1–5 connected by lateral lines, anterior 4 rows each with 1–3 denticles, 5th row widened, with 3–5 denticles, 6th row free, widened, with 4–5 denticles, 7th row absent. Deutosternum in male with 1–2 unconnected denticles in area of 7th row. Corniculi asymmetrical. Fixed cheliceral digit in female with 5–7 teeth, movable digit with 2 teeth. Fixed cheliceral digit in male with 5–7 teeth, movable digit edentate, with only apical tooth. Leg chaetotactic formulae normal for genus, leg segments without macrosetae, some setae on tarsi II–IV thickened.

Redescription. Female (n=6; Figs. 1, 2, 3a, 4b).

Idiosomal dorsum (Figs. 1a, 4b). Dorsal shield oval; 370–395 long and 218–231 maximum width at *r5* level; smooth in central part of podonotal region, other surface reticulate, pattern of lines between setae *J2* and *J4* primarily transverse; holotrichous, with 42 pairs of setae (*j1–j6*, *z1–z6*, *s1–s6*, *r2–r6*, *J1–J5*, *Z1–Z5*, *S1–S5*, *R1–R4*) and 22 pairs of distinguishable pores. Soft cuticle with 2 pairs of setae of *UR*-series and setae *R5*. All dorsal setae simple, needle-like; measurements of some setae: *j1* 18–21, *j6* 12–14, *J5* 9–10, *Z5* 32–37, *S3* 20–21.

Idiosomal venter (Figs. 2a, 3a). Tritosternum with trapezoidal base, 11–12 long, 9–10 wide at base, laciniae pilose, fused for about half of total length (21–24), their free parts 24–29 long. Pre-sternal area transversely lineate, without evident platelets. Sternal shield fused with endopodal platelets of coxae I/II and coxae II/III; 82–86 long along midline, 122–130 wide at level of endopodal platelets of coxae I/II, 120–134 wide at level of endopodal platelets of coxae II/III, 78–82 wide in narrowest place at about mid-level of coxae II; with 3 pairs of setae (*st1–st3*; 19–21 long) and 2 pairs of pores (*iv1*, *iv2*), pore *iv1* positioned posteriad seta *st1*, pore *iv2* positioned between setae *st2* and *st3*; sternal shield rounded posteriorly; mainly reticulate, but smooth in posterior part, pattern of ornamentation lines in central area primarily transverse (Fig. 3a). Setae *st4* and pores *iv3* located on metasternal platelets, length *st4* 16–18. Epigynal shield reticulate; its anterior margin broadly rounded, overlap-

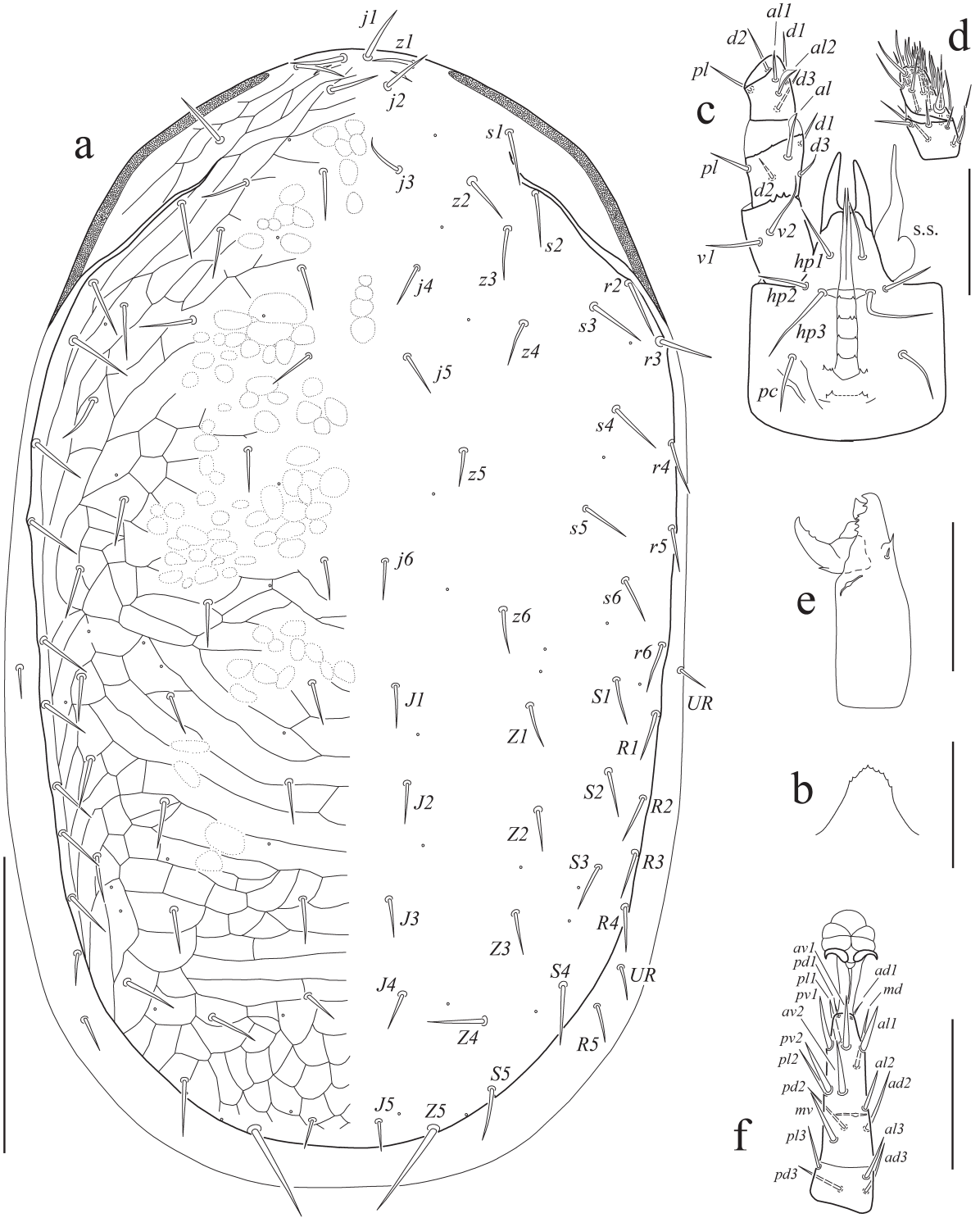

Fig. 1. *Proctolaelaps dendroctoni* Lindquist and Hunter, 1965, female: a—idiosoma, dorsal view; b—epistome; c—subcapitulum and palp (from trochanter to genu), ventral view; d—palptibia and palptarsus, dorsal view; e—chelicera, lateral view; f—tarsus II, ventral view. Scale bars 100 μm (a), 50 μm (b–f).

ping posterior sternal shield area, widened behind level of *st5* and convex posteriorly; 141–147 long, with greatest width of anterior part 78–80, greatest width of posterior part 71–78; bearing setae *st5*; length *st5* 16–17; genital pores placed off the shield. Postgenital platelets absent. Free endopodal plates strongly formed between coxae III and IV. Anal shield oval, with anterior margin rounded, slightly protuberant, posterior margin truncate; 67–71 long and 55–57 wide; reticulate; anus located in centre of shield, anal opening 21–23 long; cribrum well developed; one pair of pores present; length of

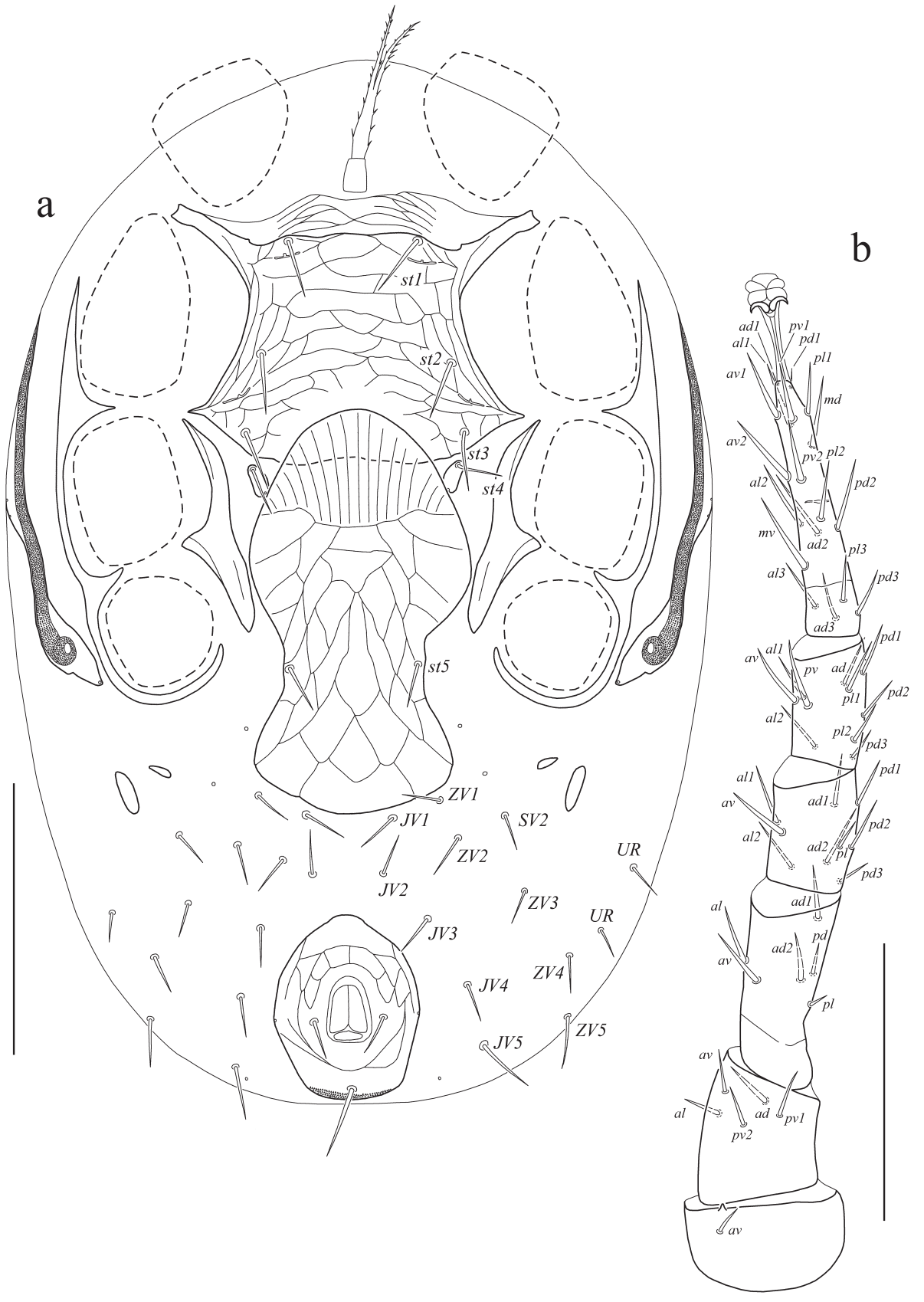

Fig. 2. *Proctolaelaps dendroctoni* Lindquist and Hunter, 1965, female: a—idiosoma, ventral view; b—leg IV, ventral view. Scale bars 100 μm.

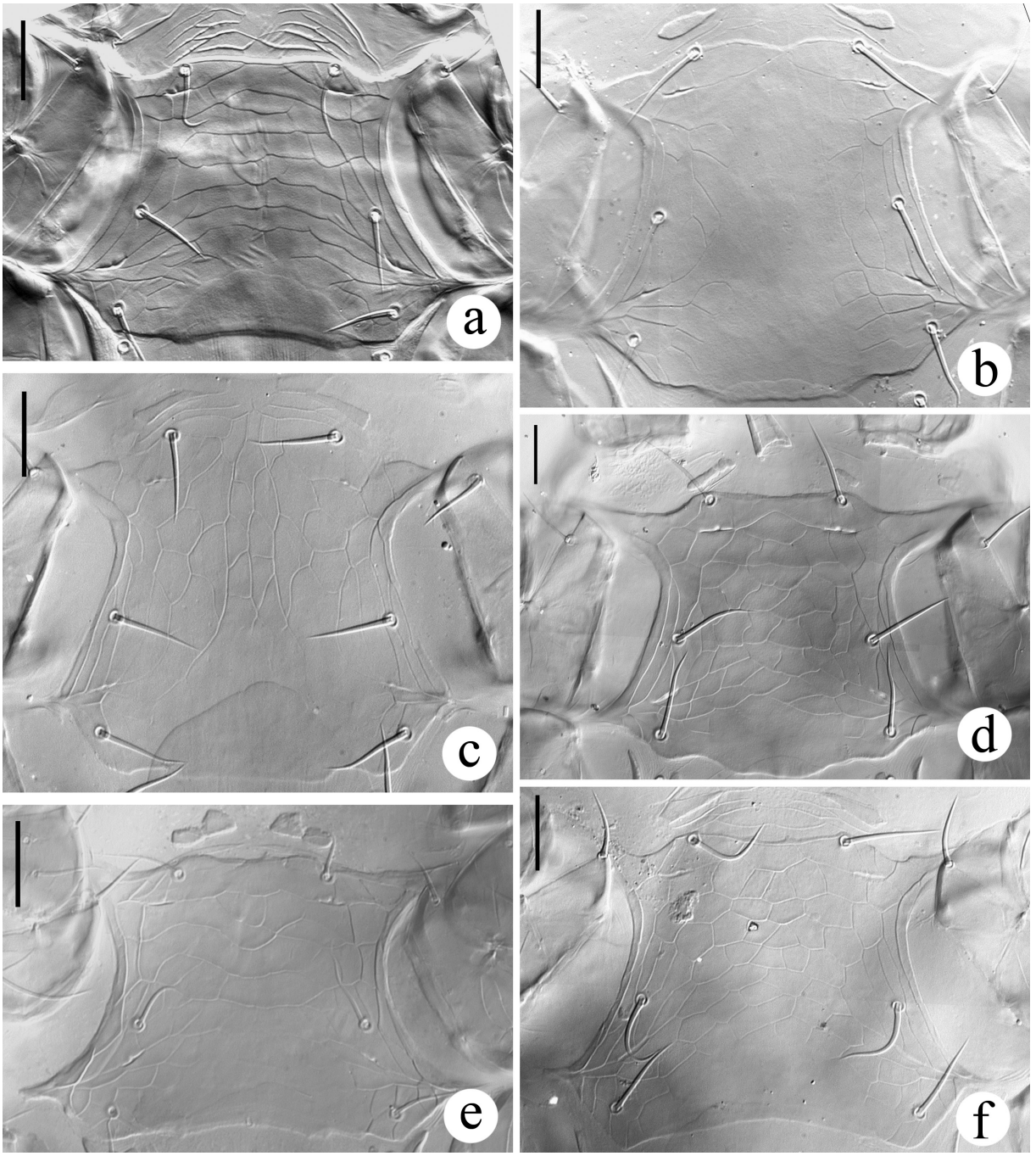

Fig. 3. Sternal shields of *Proctolaelaps* spp., females, DIC micrographs: a—*Proctolaelaps dendroctoni* Lindquist and Hunter, 1965; b—*P. fiseri* Samšiňák, 1960; c—*P. hystricoides* Lindquist and Hunter, 1965; d—*P. hystrix* (Vitzthum, 1923); e—*P. jueradeus* (Schweizer, 1949); f—*P. scolyti* Evans, 1958. Scale bars 25 μm.

para-anal setae 14–15, length of post-anal seta 23–26. Posetriad coxae IV 2 pairs of elongate metapodal platelets present; the larger platelet 14–18 long, 5–6 wide; the smaller platelet 7–8 long, 3–4 wide. Soft cuticle around of anal shield with, 13 pairs of setae (*JV1–JV5*, *ZV1–ZV5*, *SV2*, 2 setae of *UR*-series) and 2 pairs of distinguishable pores. All ventral setae simple; length of setae on soft cuticle (excluding *JV5*) 12–19, *JV5* 21–22. Exopodal platelets of coxae II–III, coxae III–IV and platelet enveloping coxa IV posteriorly fused. Peritrematal shields fused with dorsal shield at transversal level between setae *s1* and *s2*, free from exopodal strips, with 3 pairs of distinguishable pores; peritreme extending forward to level of *z1*. Spermathecal apparatus not distinguishable.

Gnathosoma (Figs. 1b–e). Anterior margin of epistome narrowly rounded, denticulate (Fig. 1b). Subcapitulum 77–81 wide at widest level. Deutosternum with 6 rows of denticles, rows 1–5 con-

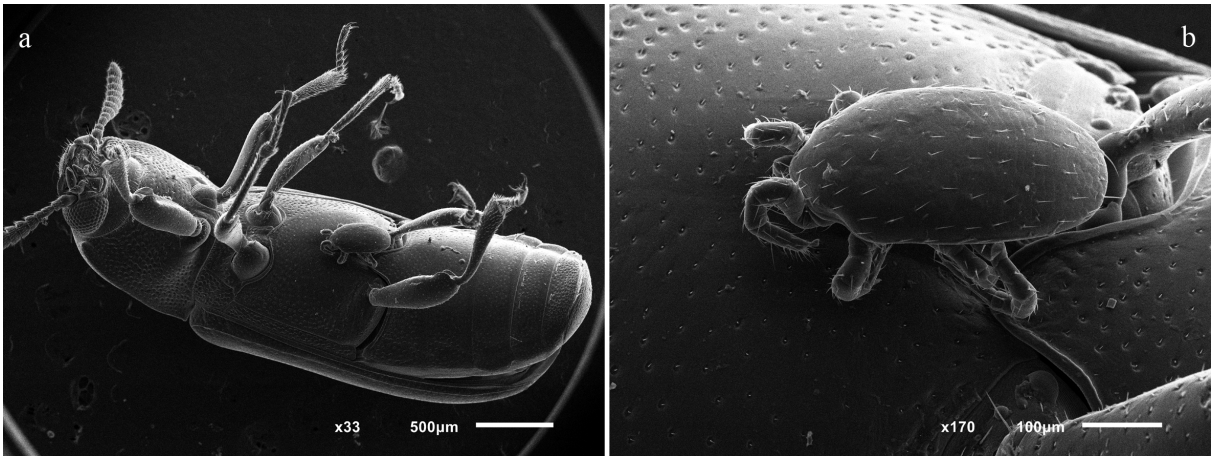

Fig. 4. *Proctolaelaps dendroctoni* Lindquist and Hunter, 1965, female on *Corticeus* sp., SEM micrographs: a—general view; b—detailed view.

nected; anterior 4 rows each with 1–3 denticles, 5th row widened, with 3–5 denticles, 6th row free, widened, with 4–5 denticles, on place of 7th row located fragments of concave line (Fig. 1c). Hypostome with 4 pairs of simple setae; palpcoxal seta (*pc*) 18–20, *hp1* 19–20, *hp2* 15–16, *hp3* 25–27. Corniculi entire, 29–34 long, 8–11 wide, asymmetrical (one always larger than other), horn-like, sclerotized; internal malae slender, shorter than corniculi; salivary styli broad narrowing distally. Palp length from trochanter to tarsus 109–113; setal formula: 2–5–6–15–16; palpfemoral seta *al* and palpgenual seta *al2* spatulate, palpgenual seta *al1* weakly spatulate, palptarsal apotele 2-tined, other setae simple (Figs. 1c, d). Second cheliceral segment length 72–74, movable digit length 28–30. Fixed cheliceral digit with 5–7 teeth and membranous lobe; movable digit with 2 teeth and ventral projection (Fig. 1e).

Legs (Figs. 1f, 2b). Lengths: I 290–302, II 244–256, III 256–269, IV 336–353. Leg chaetotactic formulae normal for genus: leg I: coxa 2, trochanter 6 (1 0/1 1/2 1), femur 12 (2 3/1 2/2 2), genu 13 (2 3/2 3/1 2), tibia 13 (2 3/2 3/1 2); leg II: coxa 2, trochanter 5 (1 0/1 0/2 1), femur 11 (2 3/1 2/2 1), genu 11 (2 3/1 2/1 2), tibia 10 (2 2/1 2/1 2), tarsus 18 (3 3/2 1/1 3/2 3); leg III: coxa 2, trochanter 5 (1 0/1 0/2 1), femur 6 (1 2/1 1/0 1), genu 9 (2 2/1 2/1 1), tibia 8 (2 1/1 2/1 1), tarsus 18 (3 3/2 1/1 3/2 3); leg IV: coxa 1, trochanter 5 (1 0/1 0/2 1), femur 6 (1 2/1 1/0 1), genu 9 (2 2/1 3/0 1), tibia 10 (2 1/1 3/1 2), tarsus 18 (3 3/2 1/1 3/2 3). Leg segments without macrosetae (Fig. 2b); all setae smooth; setae *al1*, *av1*, *av2*, *mv*, *pv1*, *pv2*, *pl1* on tarsi II–IV thickened, especially on tarsus II (Fig. 1f).

Material examined. One female, Russia, Primorsky Kray, 48°28′20.8″ N; 133°33′25.3″ E, 26 August 2016, on *Corticeus* sp. in galleries of *Ips acuminatus* (Gyllenhal, 1827) under bark of Korean pine (*Pinus koraiensis*), leg. A.A. Khaustov; 1 male, the same data, in galleries of *Ips acuminatus*.

Also, the species is registered in Crimea: 4 females, 3 males, Yalta, vicinity of Nikita settlement, 44°31′ N, 34°14′ E, 26 September 1998, in galleries of *Orthotomicus longicollis* (Gyllenhal, 1827) (Coleoptera: Curculionidae: Scolytinae) and *Rhagium inquisitor* (Linnaeus, 1758) (Coleoptera: Cerambycidae) under bark of Crimean pine (*Pinus nigra pallasiana*), leg. A.A. Khaustov; 3 females, same locality, 2 March 1996, on *Ips sexdentatus* (Börner, 1776) (Coleoptera: Curculionidae: Scolytinae); 2 females, same locality, 9 May 1996, on *Corticeus pini* (Panzer, 1799) (Coleoptera: Tenebrionidae).

PROCTOLAELAPS FISERI SAMŠIŇÁK, 1960

Fig. 3b

Proctolaelaps fišeri Samšiňák, 1960, p. 297, Figs. 1–3.

Proctolaelaps yinchuanensis Bai, Yin and Gu, 1993, p. 174, Figs. 1–5 (synonymy by Ma 2006).

This species is widely distributed in the Holarctic, where it is associated with various subcortical beetles, especially bark beetles (Samšiňák 1960; Westerboer 1963; Lindquist and Hunter 1965; Salmane 2007; Gwiazdowicz 2008; Hofstetter *et al.* 2015). In addition, it was recorded in European Russia in the galleries of *Hylastes opacus* Erichson, 1836, *Tomicus piniperda* (Linnaeus, 1758), *Ips typographus* Linnaeus, 1758, *Pityogenes chalcographus* (Linnaeus, 1761) (Andreev 1988; Maslov and Matusevich 2008) and in Western Siberia (Davydova and Nikolsky 1986). The errone-

ous identification of *P. fiseri* on *Pityogenes chalcographus* from Western Siberia by Khaustov *et al.* (2016) is corrected here to *Proctolaelaps hystricoides* Lindquist and Hunter, 1965.

Material examined. Four females, Russia, Tomsk Region, vicinity of Zavarzino settlement, 56°27′55.7″ N, 085°06′55.6″ E, 22 December 2014, on *Polygraphus proximus* Blandford, 1894 and in its galleries under bark of Siberian fir (*Abies sibirica*), leg. I.A. Kerchev; 7 females, Russia, Tomsk Region, Tomsk District, vicinity of Tomsk, 56°29′ N, 84°57′ E, 31 May–2 June 2016, on *Polygraphus proximus* and in its galleries under bark of Siberian fir, leg. A.A. Khaustov; 2 females, same data, ex *Tetropium* sp. (Coleoptera: Cerambycidae) under bark of Siberian pine (*Pinus sibirica*), leg. I.A. Kerchev; 1 female, Russia, Tyumen Region, Tyumen District, vicinity of Uspenka settlement, 57°04′ N, 65°04′ E, 14 June 2016, in galleries of *Ips typographus* under bark of Siberian spruce (*Picea obovata*), leg. A.A. Khaustov; 1 female, Russia, Khanty-Mansi Autonomous Okrug, Oktyabrsky District, vicinity of Oktyabrskoye, 62°27′ N, 66°04′ E, 11 August 2016, in galleries of *Hylurgops glabratus* (Zetterstedt, 1828) under bark of Siberian spruce, leg. A.A. Khaustov; 1 female, Russia, Primorsky Kray, 48°28′20.8″ N; 133°33′25.3″ E, 26 August 2016, in galleries of *Ips acuminatus* under bark of Korean pine (*Pinus koraiensis*), leg. A.A. Khaustov; 10 females, Russia, Primorsky Kray, vicinity of Lazo settlement, 43°30′ N, 133°34′ E, 26–28 August 2016, in galleries of *Polygraphus proximus* under bark of Khingan fir (*Abies nephrolepis*), leg. A.A. Khaustov; 2 females, Russia, Tyumen Region, Nizhnetavdinsky District, vicinity of Tyunevo settlement, 57°23′ N, 65°41′ E, 7 October 2016, in galleries of *Polygraphus subopacus* Thomson, 1871 under bark of Siberian spruce, leg. A.A. Khaustov; 4 females, Russia, Sakhalin Region, Sakhalin Island, Yuzhno-Sakhalinsk, 3 August 2017, in galleries of *Polygraphus proximus* under bark of Sakhalin fir (*Abies sachalinensis*), 46°54′40.3″ N; 142°46′03.9″ E, leg. A.A. Khaustov; 4 females, 1 male, Russia, Sakhalin Region, Kunashir Island, in galleries of *Polygraphus proximus* under bark of Sakhalin fir, 44°00′30.0″ N; 145°41′39.7″ E, 5 August 2017, leg. A.A. Khaustov; 6 females, 1 male, Russia, Sakhalin Region, Kunashir Island, in galleries of *Ips typographus japonicus* Niisima, 1909 under bark of Sakhalin spruce (*Picea glehnii*), 44°00′56.2″ N; 145°45′51.3″ E, 8 August 2017, leg. A.A. Khaustov; 4 females, Russia, Sakhalin Region, Sakhalin Island, in galleries of *Ips typographus* under bark of Sakhalin spruce, 46°47′04.9″ N; 142°23′13.0″ E, 13 August 2017, leg. A.A. Khaustov.

PROCTOLAELAPS HYSTRICOIDES LINDQUIST AND HUNTER, 1965

Fig. 3c

Proctolaelaps hystricoides Lindquist and Hunter, 1965, p. 22, Figs. 11–19.

Type series of *P. hystricoides* included specimens from Canada and the USA. The mites were found in galleries of many Scolytinae beetle species, under the bark of pines. Later, this species was recorded in soil samples from Iran (references in Kazemi and Rajaei 2013). Hadad Iraninezhad *et al.* (2001) reported this species in Iranian cotton fields. These mites also occur on bark beetles *Pityokteines* spp. that live on Silver fir (*Abies alba*) in Croatia (Pernek *et al.* 2008). This is a new record for the fauna of Russia.

Material examined. Two females, Russia, Tomsk Region, Tomsk District, vicinity of Tomsk, 56°29′ N, 84°57′ E, 31 May 2016, on *Polygraphus proximus* under bark of Siberian fir, leg. A.A. Khaustov; 2 females, same locality, 28 April 2017, in galleries of *Polygraphus proximus* under bark of Siberian fir, leg. A.A. Khaustov; 9 females, Russia, Tyumen Region, Tyumen District, vicinity of Uspenka settlement, 57°04′ N, 65°04′ E, 29 April–5 May 2016, on *Pityogenes chalcographus* under bark of Siberian spruce (*Picea obovata*), leg. A.A. Khaustov; 1 female, same locality, 5 June 2017, in alcohol sediments of tree traps together with *Ips typographus*; 6 females, Russia, Khanty-Mansi Autonomous Okrug, Oktyabrsky District, vicinity of Oktyabrskoye settlement, 62°27′ N, 66°04′ E, 11 August 2016, in galleries of *Hylurgops glabratus* under bark of Siberian spruce, leg. A.A. Khaustov; 1 female, Russia, Primorsky Kray, vicinity of Lazo settlement, 43°30′ N, 133°34′ E, 26 August 2016, in galleries of *Polygraphus proximus* under bark of Khingan fir, leg. A.A. Khaustov; 11 females, Russia, Primorsky Kray, Vladivostok city, 43°13′ N, 131°59′ E, 29 August 2016, in galleries of *Polygraphus proximus* under bark of Manchurian fir (*Abies holophylla*), leg. A.A. Khaustov; 6 females, 1 male, Altai Republic, 51°53′12.1″ N, 086°11′23.9″ E, in galleries of *Polygraphus proximus* under bark of Siberian fir, leg. A.A. Khaustov; 3 females, one male, Altai Republic, 52°00′13,4″ N, 086°33′04,9″ E, in galleries of *Polygraphus proximus* under bark of Siberian fir,

leg. A.A. Khaustov; 2 females, 1 male, Altai Republic, 51°18′53,9″ N, 085°40′25.0″ E, in galleries of *Ips subelongatus* Motchulsky, 1860 under bark of Siberian larch (*Larix sibirica*), leg. A.A. Khaustov; 4 females, 1 male, Russia, Sakhalin Region, Sakhalin Island, 46°51′59.2″ N, 142°52′42.7″ E, in galleries of *Ips subelongatus* under bark of Kuril larch (*Larix kurilensis*), leg. A.A. Khaustov.

PROCTOLAELAPS HYSTRIX (VITZTHUM, 1923)

Fig. 3d

Lasioseius (Lasioseius) hystrix Vitzthum, 1923, p. 105, Figs. 8, 9.

Proctolaelaps (*Proctolaelaps*) *hystrix*.—Evans, 1958, p. 200.

P. hystrix was described from Austria from the galleries of *Dendroctonus micans* (Kugelann, 1794) and *Hylastes ater* Paykull, 1800 (Coleoptera: Curculionidae: Scolytinae) (Vitzthum 1923). Currently, this species is known from Europe, North America and Australia (Lindquist and Hunter 1965; Halliday *et al.* 1998; Fend'a and Mašán 2003; Salmane 2005; Gwiazdowicz 2008; Chaires-Grijalva *et al.* 2016). This is a new record for the fauna of Russia.

Material examined. Twelve females, 1 male, Russia, Tyumen Region, vicinity of Omutinsky settlement, 56°35′11″ N, 67°42′55″ E, 18 August 2016, in galleries of *Dendroctonus micans* under bark of Scots pine (*Pinus silvestris*), leg. A.A. Khaustov.

PROCTOLAELAPS JUERADEUS (SCHWEIZER, 1949)

Fig. 3e

Lasioseius jüradeus Schweizer, 1949, p. 52, Fig. 30.

Proctolaelaps jüradeus.—Karg, 1971, p. 240.

Proctolaelaps (*Proctolaelaps*) *robustus* Evans, 1958, p. 203, Figs. 39–40 (synonymy by Bregetova, 1977).

This species is widely distributed in the Holarctic (including Russia). It is associated with soil and related substrates (Schweizer 1949; Evans 1958; Chant 1963; Westerboer 1963; Bregetova 1977; Karg 1993; Salmane 2001; Marchenko 2002, 2012; Gwiazdowicz 2008; Makarova 2012). Previously, *P. jueradeus* had never been reported as an associate of bark beetles.

Material examined. One female, Russia, Tyumen Region, Tyumen District, vicinity of Uspenka settlement, 57°04′ N, 65°04′ E, 22 May 2017, in alcohol sediments of tree traps together with *Ips typographus*, leg. A.A. Khaustov.

PROCTOLAELAPS SCOLYTI EVANS, 1958

Fig. 3f

Proctolaelaps (*Proctolaelaps*) *scolyti* Evans, 1958, p. 201, Figs. 36–38.

Proctolaelaps ulmi Hirschmann, 1962, p. 30, Fig. 13 (2).

Garmania (*Garmania*) *ulmi* Hirschmann, in Westerboer, 1963, p. 391, Figs. 231–238 (synonymy by Karg 1988).

This species is distributed in Europe, as well as Western and Central Asia. *P. scolyti* is mainly associated with bark beetles. The species has been recorded on sap beetles *Carpophilus hemipterus* (Linnaeus, 1758), as well as in soil, hollow trees, under bark, and in bird nests (Evans 1958; Westerboer 1963; Rybin 1983; Salmane 2005; Fend'a 2010; Çakmak *et al.* 2011). This is a new record for the fauna of Russia.

Material examined. Three females, Russia, Khanty-Mansi Autonomous Okrug, Oktyabrsky District, vicinity of Oktyabrskoye settlement, 62°27′ N, 66°04′ E, 11 August 2016, in galleries of *Scolytus ratzeburgi* Janson, 1856 under bark of Silver birch (*Betula pendula*), leg. A.A. Khaustov.

Key to females of *Proctolaelaps* associated with subcortical beetles

1. Anus small, length of anal shield exceeding length of anal opening by 3.5 or more times 2

— Anus large, length of anal shield exceeding length of anal opening by 2–3 times 6

2. Setae *j1–j5* not less than 2.5 times shorter than setae *J1–J4* [Western Palaearctic: Europe] ..... *P. xyloteri* Samšiňák, 1960; *P. kielczewskii* Wisniewski, 1980; *P. moseri* Wisniewski, 1980*

— Setae *j1–j5* similar in length to setae *J1–J4* 3

3. Pre-sternal area without platelets. Dorsal shield elongated-oval [Western Palaearctic: Europe] ..... *P. eccoptogasteris* (Vitzthum, 1923); *P. pruni* Karg, 1988**

— Pre-sternal area with 1 or 2 pairs of platelets. Dorsal shield oval 4

4. Pre-sternal area with 2 pairs of platelets (Fig. 3e). Epistomal margin denticulate. Fixed cheliceral digit with pilus dentilis [Holarctic] ..... *P. jueradeus* (Schweizer, 1949)

— Pre-sternal area with one pair of platelets. Epistomal margin smooth. Pilus dentilis absent 5

5. Length of anal shield exceeding length of anal opening by 3.5 times; anus located in central part of shield [Western Palaearctic: Europe]..... .....*P. cyllodi* Samšiňák, 1960

— Length of anal shield exceeding length of anal opening by 5 times; anus located in posterior part of shield [Western Palaearctic: Slovakia] ....*P. slovacus* Mašán, 1998

6. Epistome tri-ramous or bi-ramous 7

— Epistomal margin denticulate 10

7. Setae *j3–j5* short, 1.5–2 times shorter than setae *J2–J4*. Setae *Z5* curved, thickened. Post-anal seta very short, 2 times shorter than seta *JV5* [Australasia: Ausralia] .....*P. australis* Stone, 1988

— Setae *j3–j5* and *J2–J4* subequal in length. Setae *Z5* simple. Post-anal seta equal to or longer than seta *JV5* 8

8. Setae of *j-J*-series longer, seta *j4* as long as distance to seta *j5*, seta *J3* as long as distance to seta *J4* [Palaearctic; Nearctic; Australasia]..... .....*P. hystrix* (Vitzthum, 1923)

— Setae of *j-J*-series shorter, seta *j4* shorter than distance to seta *j5*, seta *J3* shorter than distance to seta *J4* 9

9. Sternal shield smooth in central part (Fig. 3b). Setae *st1* not close together, distance *st1–st1* longer than distance *st1–st2* [Holarctic] .... *P. fiseri* Samšiňák, 1960

— Sternal shield medially with longitudinal row of elongated cells (Fig. 3c). Setae *st1* close together, distance *st1–st1* shorter or equal to distance *st1–st2* [Holarctic] ....*P. hystricoides* Lindquist and Hunter, 1965

10. Dorsal setae shorter, length of setae *J1–J3* shorter than half distance to subsequent seta 11

— Dorsal setae longer, length of setae *J1–J3* subequal or equal distance to subsequent seta..... 13

11. Pre-sternal area with a pair of platelets. Subcapitular setae *pc* thickened basally [Nearctic; Northern Neotropics: Honduras]..... .....*P. subcorticalis* Lindquist, 1971

— Pre-sternal area without platelets (Fig. 3a). Subcapitular setae *pc* simple 12

12. Fixed cheliceral digit with 13 teeth, movable digit with 4 teeth. 7th row of hypostomal groove well developed, with 6 denticles. Epistomal margin with irregular dentate projections [Western Palaearctic: Europe] .....*P. brevipilis* (Westerboer, 1963)

— Fixed cheliceral digit with 5–7 teeth, movable digit with 2 teeth. 7th row of hypostomal groove absent. Epistomal margin with small uniform denticles [Holarctic]..... .....*P. dendroctoni* Lindquist and Hunter, 1965

13. Seta j6 reaching base of seta *J1* 14

— Seta j6 not reaching base of seta *J1* 18

14. Fixed cheliceral digit with 4 teeth and pilus dentilis; movable digit with 1 tooth [Palaearctic]. ..... *P. stammeri* (Westerboer, 1963)

— Fixed cheliceral digit with 7 or more teeth, pilus dentilis absent; movable digit with 2–3 teeth..... 15

15. Fixed cheliceral digit with 7 teeth. Anal shield long, almost reaching epigynal shield anteriorly; anal opening located mainly in posterior region of shield [Palaearctic] .... *P. longanalis* (Westerboer, 1963)

— Fixed cheliceral digit with about 20 teeth. Anal shield of normal length; anal opening located mainly in anterior region of shield..... 16

16. 1–4th rows of hypostomal groove each with 7–10 denticles. Epistomal margin with about 40 denticles [Western Palaearctic: Europe] .... *P. pini* Hirschmann, 1962

— 1–4th rows of hypostomal groove each with 1–4 denticles. Epistomal margin with about 10 denticles 17

17. Anterior margin of epistome semi-triangular, with closely disposed middle-sized denticles. Internal malae longer than corniculi [Western Palaearctic: Europe] .....*P. epuraeae* Hirschmann, 1962

— Anterior margin of epistome rounded, with sparsely spaced small denticles. Internal malae shorter than corniculi [Western Palaearctic: Europe, Asian Turkey]..... *P. rotundus* Hirschmann, 1962

18. Fixed cheliceral digit with about 25 teeth and dorsodistal pointed process; movable digit with 3–5 teeth. 1–4th rows of hypostomal groove each with about 10 denticles [Eastern Palaearctic: Japan] .....*P. nipponicus* Ishikawa, 1968

— Fixed cheliceral digit with about 15 teeth, dorsodistal process absent; movable digit with 2–3 teeth. 1–4th rows of hypostomal groove each with 0–3 denticles 19

19. Setae *j1*, *J4*, *Z3–Z5* subequal in length. 5th row of hypostomal groove medially smooth; 7th row absent. Internal malae shorter than corniculi [Neotropics: Chile] .....*P. ruehmi* Hirschmann, 1972

— Seta *Z5* 1.5–2 times as long as setae *j1*, *J4*, *Z3*, *Z4*. 5th row of hypostomal groove medially with 1 or several denticles; 7th row present. Internal malae longer than corniculi..... 20

20. Sternal shield medially smooth. Epigynal shield with pointed triangular anterior flap extending to level of setae *st2*. Epistomal margin triangu-

lar, denticulate. Postgenital platelets present [Cosmopolitan] ..... *P. bickleyi* (Bram, 1956)

— Sternal shield medially reticulate (Fig. 3f). Epigynal shield with rounded anterior flap extending to level of setae *st3*. Epistomal margin rounded, denticulate. Postgenital platelets absent [Palaearctic] ..... *P. scolyti* Evans, 1958

Notes:

*Gwiazdowicz (2007) suspected *P. kielczewskii* and *P. moseri* to be junior synonyms of *P. xyloteri*.

**Gwiazdowicz (2007) suspected *P. pruni* to be a junior synonym of *P. eccoptogasteris*.

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