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The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

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A NEW EVIPHIDID MITE GENUS
(PARASITIFORMES; MESOSTIGMATA; EVIPHIDIDAE)
ASSOCIATED WITH THE DUNG BEETLE
SCARABAEOUS TRANSCASPIUS STOLFA (COLEOPTERA; SCARABAEIDAE)
IN TURKMENISTAN

by Olga L. MAKAROVA*

EVIPHIDIDAE
NEW GENUS
DUNG BEETLES
SCARABAEOUS PHORESY

SUMMARY: A new eviphidid mite, Cryptoseius petrovae gen. et sp. nov., was found under elytra of the beetle Scarabaesus transcaspius Stolfa from Turkmenistan. Descriptions of the female, male and deutonymph are given. The new genus displays a significant superficial resemblance to Scamaphis Karg (Eviphididae) and Coleolaelaps Berlese (Laelapidae), also associated with large scarabaeid beetles. A new combination, Coleolaelaps anoxiae comb. n. (Laelapidae) for Pelethiphis anoxiae Koyumdjjeva, 1977 (Eviphididae), is suggested.

EVIPHIDIDAE
NOUVEAU GENRE
SCARABAEOUS PHORESY

RESUMÉ: Un nouvel eviphidide, Cryptoseius petrovae n. gen., nov. sp., s'est révélé sous les élytres de Scarabaesus transcaspius Stolfa, au Turkmenistan. On donne les descriptions de la femelle, du mâle et de la deutonymph. Le nouveau genre présente une ressemblance superficielle significative avec Scamaphis Karg (Eviphididae) et Coleolaelaps Berlese (Laelapidae), eux aussi associés à de grands coléoptères scarabaeides. Pour Pelethiphis anoxiae Koyumdjjeva, 1977 (Eviphididae), une combinaison nouvelle, Coleolaelaps anoxiae comb. n. (Laelapidae), est suggérée.

Gamasid mites of the family Eviphididae occupy various substrates and biotopes, but most are associated with discrete temporary habitats, such as vertebrate droppings, nests and carrion, as well as sea debris. Many species are stenobiontic and occupation of the proper substrate is facilitated by phoresy on appropriate arthropods.

Phoretic specificity among eviphidid species varies. For example, Crassicheles holsaticus (Willmann) has been found phoretic both on different dipterans and on staphylinid beetles. Some species of Alliphis Halbert and Scarabaspis Womersley, which live in droppings, may be distributed by any coprophilous scarabaeid beetles. Crassicheles concentricus Karg can be found on many different small dipterans. On the contrary, Scamaphis equestris (Berlese) and Alliphis necrophilus Christie are evidently associated with beetles of particular genera (respectively Geotrupes Latreille and Nicrophorus F.), whereas phoresy of Pelethiphis gurei (Costa), Pelethiphis opacus Koyumdjjeva and Eviphis pterophilus Berlese is apparently species specific.

During a study of mites occurring on different species of Scarabaeus, several new eviphidid species were found, including a representative of a new, morphologically unusual genus, Cryptoseius gen. n., which is described below. It was found only on Scarabaeus transcaspius Stolfa, collected at two loca-

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tions in Turkmenistan in different years. It is worth noting that *Scarabaeus transcaspius* is also characterized by significant morphological and ecological specificity, being considered as the species most adapted to the conditions of sandy deserts among *Scarabaeus* L. (Kabakov, 1980).

The description presented below is based on material collected by the coleopterologists T. A. Chernyakhovskaya and K. V. Makarov. All measurements are given in micrometers. The setal designations follow those of Lindquist & Evans (1965) and Lindquist (1995) for the idiosoma, and those of Evans (1963) for the legs. Setal homologies were established regarding the disposition in relation to location of pores and the variations in setal arrangements. The holotype and part of the paratypes series are deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg. Other paratypes are in the author’s collection.

**Cryptoseius gen. nov.**

Type species: *Cryptoseius petrovae* sp. nov. Monotypic.

*Diagnosis.* Idiosoma of adults elongate-oval, slightly convex; sclerites of body and extremities yellow. Dorsal shield reduced, not covering whole body, with incomplete set of setae. Setae s2, r2, r3 inserted anterodorsally on shield elements which are fused with peritrematic extremities; main part of shield bears 20 pairs of smooth setae of various lengths. Setae j1 small, not standing out against background of other frontal setae. Female sternum shield well sclerotized, bearing three pairs of setae and three pairs of pores; first pair of pores oval, oriented transversally, located behind setae St1. Metasternal setae free on integument. Peritremes strongly shortened rather broad; peritrematic shields rudimentary; exopodal shields lost. Tectum triangular, with dentate margin, not pilose. Hypognathal groove narrow, with 8 rows of denticles. Labrum, supralabral process and internal mala of hypostome strongly developed, apically pointed. Female chela small, gracile, with some sharp denticles as illustrated (Fig. A 6). Male d.m. tube-like, spermatodactyl canal extends inside digit. Palpal apotele two-tined. Chaetotactic formula for legs I, II, III, IV respectively: femora (2-3/1, 2/3-2) (2-3/1, 2/2-1) (1-3/2-1) (1-2/1, 1/1-1); genua (1-3/2, 2/1-2) (2-3/1, 2/1-2) (1-2/1, 2/1-1) (1-2/1, 2/1-1); tibiae (1-3/2, 2/1-2) (2-2/1, 2/1-2) (1-1/1, 2/1-1) (1-1/1, 2/1-1). Femur and tarsus II in male each supplied with a small, roundish apophysis of setal origin. Sexual dimorphism not sharply expressed. Deutonymphs resemble adults. Females, males and deutonymphs phoretic. Associated with lamellicorn Scarabaeeidae.

At present, the new genus is placed in the subfamily Eviphidinae Berlese (*sensu* Evans, 1957). The differential diagnosis given here is rather formal because of the necessity to clarify the subfamily structure of Eviphidiidae in general (Makarova, 1996a) and to revise some compounded taxa (e.g. *Peletiphis* Berlese and *Alliphis* Halbert). It is given in comparison with genera of the subfamily Eviphidinae recognized by Evens & Till (1979) and Mašán (1993), excluding *Iphidosoma* Berlese, Rhodacaridae (*Kethley*, 1983).

* Differential diagnosis.* The degree of the reduction of the dorsal shield and its setal set in both females and males, the chaetotactic pattern of femur and genu IV (Fig. A 3), as well as the tectal structure are unique in Eviphidiidae. In contrast to most Eviphidiidae (except *Scamaphis equestris*), the peritreme is shortened and the peritrematic shield is rudimentary. As distinct from *Scamaphis* Karg, which shares with the new genus some other marked characteristics (the elongated form of the body, the reduction of the dorsal shield and its setal set, the broad shortened peritremes, etc.), *Cryptoseius* gen. n. shows a different orientation of the first sternal pores (perpendicular to the body axis), a narrow hypognathal groove, possessing 8 rows of denticles, and strong expressed cheliceral sexual dimorphism; in the female the third sternal pores are situated on the sternal shield, the setae Mst are inserted on the integument, and the opisthosomal cuticle has only 4 pairs of setae (larval pattern); in the male the leg apophyses are only of setal origin, present on the femur and tarsus II (in *Scamaphis* in addition to the enlarged setae on tarsi II–IV, there is a large cuticular process on trochanter IV).

**Etymology.** The generic name applies to the localization of the mite during phoresy—under the elytra of beetles.
FIG. A: Cryptoseius petrovae gen. sp. n., female.
1. — Dorsum of idiosoma. 2. — Venter of idiosoma. 2a. — Variant of posterior margin structure of sternal shield. 3. — Femur and genu IV.
4. — Hypostome. 5. — Telotarsus IV with ambulacrum. 6. — Chelicera. Scales: 1 & 2 = 100 μm; 3–6 = 50 μm.
Cryptoseius petrovae sp. n.

Material: Holotype: female—Turkmenistan, Amu-Darya R., 110 km lower Chardzhou, Nargyz Isl. (Amu-Darya Reserve), under elytra of Scarabaeus transcaspius Stolfa, 16 June 1988 (T. A. Chernyakhovskaya); paratypes: 17 females, 6 males, 6 deutonymphs, same locality and data, 2 females, 1 male—Turkmenistan, East Kara-Kum, env. Repetek railway station (Repetek Biosphere Reserve), under elytra of Scarabaeus transcaspius, 9 June 1989 (K. V. Makarov).

Description: Medium-sized, elongate mites. Sclerites of body and extremities yellow in adults. Dorsal shield not covering entire body, leaving broad pleurae. Reticulate ornamentation of shields poorly developed; they are very slightly granulated.

Female. Dorsum (Fig. A 1): Anterolateral parts of dorsal shield separated from its main part and fused with peritrematic extremities. Main part of dorsal shield (496–568 x 264–304) commonly with 20 pairs of smooth, heteromorphic setae. Dorsal chaetotaxy unstable, often asymmetrical; certain setae may be absent (for example, seta J4 asymmetrically lost in one in four females), doubled, or have migrated on shield and behind it. Setal length varies greatly. Setae z3, z6, s1, s3, r4, r6, J2, J3, Z1, Z2, S1, S3, R2 and R4 always absent. Anterolateral shield elements bear setae s2, r2, r3 (24–72). Shortest setae on dorsal shield are z5, J1, J4, J5, Z3, Z4 (9–17), z1 16–22 and J1-2 (21–40). Most dorsal macrosetae range from 94–176, including setae z6 and Z5 inserted on soft cuticle, which are conspicuously longer than r5 (35–68), R1 (28–56), R3 (28–50) and R5 (46–74).

Venter (Fig. A 2): Tritosternum with massive base (length 28–40) and pilose laciniae (84–108). Paesternal region weakly sclerotized. All setae on ventral surface hair-like distally. Sternum normally developed, fused with endocoxal shields, with 3 pairs of setae and 3 pairs of oval pores; form of posterior margin of sternal shield variable (Fig. B 2a); reticulation on its wrinkled surface only visible anteriorly. Metasternal setae free on integument; St1, St2 (30–42) always shorter than St3 and Mst (40–58). Genital shield widened and rounded posteriorly, bearing a pair of setae (48–66), its anterior hyaline extension roundish, not extending to sternal shield margin. Solenostomes situated posteriorly in acetabula of coxae III. Metapodal shields irregularly oval. Opisthogastric cuticle with only 4 pairs of setae, JV1 and JV2 (40–58) always longer than ZV2 (32–48) and JV5 (20–24). Anal shield pear-shaped, twice longer than broad (117 x 64), its granulation developed mainly laterally, pores (2 pairs) hardly visible, crotibrum very extensive, perianal setae 28–40. Peritremes rather broad (width 14–16), strongly shortened, reaching only midlevel of coxae II; peritrematic shields narrow.

Gnathosoma: Tectum triangular (Fig. B 6a, b), with dentate margin, highly variable. Hypognathal groove (Fig. A 4) narrow (width 7–9), with 8 rows of denticles (1–4 in a row). Hypostomastic setae needle-like, CI 24–28, C3 32–38, C2, C4 14–21. Corniculi triangular, 37–40 x 13–15, with lateral cutters containing salivary styli. Internal malea of hyposome long, reaching midlevel of genu of palp, fringed laterally. Labrum well developed, almost reaching level of palp apex, pilose; supralabral process narrow, long, sharply pointed. Setae al of palp femur and genu needle-like. Chelicera small, delicate (Fig. A 6), length of chela 56–61; d.f. with two teeth of different size, its tip split, pilus dentilis short, setiform; d.m. with one large tooth and one small subapical denticle.

Legs: All legs shorter than dorsal shield (I 382–420, II 374–394, III 370–406, IV 462–516); length of tarsus I 104–108, tarsus IV 140–160. Chaetotactic formula legs I, II, III, IV, respectively: femora (2-3/1, 2-3/2) (2-3/1, 2-2/1) (1-3/2-1) (1-2/1, 1/1-1); genua (1-3/2, 2-1/2) (2-3/1, 2-1/2) (1-2/1, 2-1/1) (1-2/1, 2-1/1); tibiae (1-3/2, 2-1/2) (2-2/1, 2-1/2) (1-1/1, 2-1/1) (1-1/1, 2-1/1). Unlike the general type of leg chaetotaxy in Eviphididae (Evans, 1963), femur III in this species bears additional spiniform setae v2, femur IV and genu IV with additional spiniform setae pv (Fig. A 3).

External spurs on distal margins of coxae II–IV larger than internal ones. Most leg setae thickened, some dorsal ones on femora and genua I–IV are macrosetae as shown in Fig. B 2,5. Femora I–II with 2 macrosetae (ad1, pd1), femora III–IV with 1 macrosetae (ad1). Genu I with 2–4 macrosetae (always pd1, pd2, sometimes ad1, ad2), genua II–IV with 2 macrosetae (genu II with pd1, pd2; genua III–IV with ad1, pd1). Length of longest leg macroseta (pd1 on the
FIG. B: Cryptoseius petrovae gen. sp. n.

1–5: Male; 6: Female; 7: Deutonymph. 1. — Venter of idiosoma. 2. — Trochanter, femur, genu and tibia I. 3. — Supralabral process. 4 a, b. — Chelicera in different positions. 5. — Leg II without coxa. 6 a, b. — Variants of tectum form. 7. — Idiosoma. Scales: 1, 5 & 7 = 100 μm; 2–4 & 6 = 50 μm.
femur II) 72–100. One of the subapical ventral setae on tarsi II–IV modified into strongly sclerotized, apically tridentate blade, evidently used as support (Fig. 1, 5). All leg claws weak.

**MALE. DORSUM:** Main part of dorsal shield 456–480 × 256–282. Dorsal chaetotaxy generally as in female, but most of those setae inserted on soft cuticle much shorter (r5, R1, R3 12–20).

Venter (Fig. B 1): Tritosternum short (16–20), laciniae 72–80. On sternogenital shield, setae St1–3 (20–27) always shorter than St4–5 (24–38); opisthogastric cuticle with 4 pairs of setae; JV1, JV2 (22–34) always longer than ZV2 (19–21) and JV5 (13–18); perianal setae 22–30. Left and right peritremes of different length in some individuals.

Gnathosoma: Tectum as in female. Deutosternal groove broadens anteriorly. Labrum consisting of two laminae; wide pellicle-like blade lies under long narrow one (as in female). Subcheliceral plate narrows sharply in supralabral process (Fig. B 3). Chela length 52–54; d.f toothless, with beak-like tip (Fig. B 4); d.m. larger than d.f., cylindrical, bearing one tooth; tip of spermatodactyl blade-like, its canal extending inside digit.

Legs: Legs much shorter than in female; length of tarsus I 76–88, tarsus IV 98–116; set of setae the same, but many ventral setae very strong (Fig. B 2, 5). Femoral macrosetae as in female. Genua I–IV with 4 macrosetae (ad1, ad2, pd1, pd2). Longest leg macroseta (ad1) situated on femur IV, 92–100. Femur and tarsus II each bear a small roundish apophysis of setal origin (Fig. B 5). Specialized supporting seta on tarsi II–IV strongly swollen basally; long hair-like setae situated ventrally near it (Fig. B 5a).

**DEUTONYMPH. DORSUM:** (Fig. B 7): Dorsal shield weakly sclerotized, 440–450 × 240–250, bearing 21 pairs of setae (S2 on shield margin, r2 and r3 on integument). Only 3 pairs lateral setae (s4, s5, S2) long (up to 80), all dorsocentral setae small.

Venter (Fig. B 7): All shields poorly sclerotized. Tritosternum as in female. Sternal shield bears 4 pairs of setae and 3 pairs of pores, st5 on integument, opisthogastric cuticle with 4 pairs of setae. Length of most setae on ventral surface 20–23, only JV5 (8–9). With rounded peritreme fragment in front of peritreme proper in most deutonymphs, situated at level of border between coxae I and II.

Gnathosoma: generally as in female. Length of d.m. 40–44.

Legs: Specialized three-tined setae on tarsi II–IV, as in female.

**Etymology:** The species is named in honour of the prominent Russian acarologist Dr Adelaida D. Petrova-Nikitina.

**DISCUSSION**

Phoretic specificity of mesostigmatic mites often is associated with their development in the nests of insects or on their larvae in soil and other substrates (Costa, 1969, 1971; Costa & Hunter, 1971; Samišák, 1991; Athias-Binche, 1991, etc.). The close cohabitation with insects, considering also the similar peculiarities of the mouth apparatus organization (strongly developed pointed mouth appendages—labrum, supralabral process, malae), shown by some entomophilous representatives of different gamasid families (Macrochelidae, Laelapidae, Eviphididae, Pachylaelapidae), may often be accompanied by direct trophic relations with the brood of hosts. But the nutrition of these mites has practically never been studied. There is some information (Costa, 1966, 1969) showing that the feeding on saprobiontic nematodes is insufficient for the full development (Neopodocinum caputmedusae (Berlese) and Pelethiphis guri (Costa)), or for normal reproduction (Pachylaelaps hispani Berlese) of mites intimately associated with the beetle Copris lunaris L. At the same time, laelapid mites of the genus Coleolaelaps Berlese, which possess a similar mouth apparatus, are considered to feed on skin exudates of the larvae of scarabacids beetle subfamily Melolonthinae (Vitzthum, 1940–1943). The same diet was proven for mites of the laelapid genus Dinogamasus Kramer, in which development is related to the brood of carpenter bees (Scaife, 1952, cited in Costa, 1969; Madel, 1975, cited in Scherf, 1975).

The collecting of mites from large scarabaeids and burying beetles often results in the discovery of new species, including sibling species (Costa, 1967; Müller & Schwarz, 1990; Athias-Binche, Schwarz & Meierhofer, 1993; Brown & Wilson, 1992; Makarova, 1996b, etc.). The species richness
of these mites is evidently due to the isolation of the underground beetle nests and differences in the ecological niches of the hosts. Despite this, strict one-host preferences may not come into existence (COSTA, 1971; COSTA & ALLSOPP, 1979, 1981; KRANTZ & MELLOT, 1972; KRANTZ, 1991; MAKAROVA, 1995, etc.). It is important to notice that even in case of highly specific association, the nutrition of the mites may be not related directly to their hosts (NEUMANN, 1943; COSTA, 1964, 1967; KRANTZ & MELLOT, 1972; KRANTZ & ROYCE, 1994).

Cryptoseius gen. n. displays a significant superficial resemblance to Scamaphis Karg, associated with the beetles of the genus Geotrupes (HYATT, 1990; HALTLINGER, 1990, 1993; MAŠÁN, 1994; new data). This similarity is expressed in the elongated form of the body, reduction of dorsal shield and its setal set, the heterogeneity of dorsal shield setae (lengthened marginal setae and shortened dorsocentral ones), the broad shortened peritremes, the strongly developed mouth processes and sensilla on the palptarsus, and the spine-like setae on the legs. These external similarities could be considered as parallelisms, due to a similar mode of life.

In different combinations, most of these morphological features also appear in entomophilous gamasids of other families (HUNTER & ROSARIO, 1988), such as representatives of the genera Dinogamasus Kramer, Coleolaelaps Berlese, Hypoaspis Canestrini s. str., Dynastasps Costa (Laelaptidae), some species of Neopodocinum Berlese (Macrochelidae), Cosmetolaelaps Womersley, Paradoxiphis Berlese, etc., which coexist with large insects that take care of their brood. These circumstances probably explain the description of Coleolaelaps anoxiae (KOYUMDIEVA, 1977) comb. n. (Laelaptidae) as a member of Pelethiphis (Eviophididae).

It is noteworthy that the morphological instability of characters in the new species parallels the individual variability displayed by representatives of other gamasid families (Paradoxiphis, Coleolaelaps) associated with large scarabaeids (COSTA & HUNTER, 1971; COSTA & ALLSOPP, 1979).

At present, a discussion about the relations of Cryptoseius gen. n. with others genera of Eviophididae would be untimely (see diagnosis). The plesiomorphic condition of the leg chaetotaxy, tectum and sternal porotaxy suggests a rather archaic character of the new genus.

Acknowledgements

The author is most grateful to Dr E. E. LINDQUIST, who kindly provided comments and corrections to the manuscript, particularly concerning setal designations, to Dr A. D. PETROVA-NIKITINA and Dr A. B. BABENKO for stimulating discussions, to Dr A. V. TOLSTIKOV for improving the first English version of the paper, as well as to Mrs T. A. CHERNYAKHOVS-KAYA and Dr K. V. MAKAROV for providing material for study. The work was supported by the “Biodiversity” Programme, established by the Russian Government, and the Russian Foundation for Basic Research.

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