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Mites (Acarina) associated with species of *Trox* (Coleoptera: Scarabaeidae)

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Abstract. Twelve mite species [*Macrocheles penicilliger* (Berlese), *Macrocheles* sp., *Uroseius infirmus* (Berlese), *Uroseius* sp., *Uropoda orbicularis* (Müller), *Cerratoma szekessyi* Mahunka, *Bakerdania decumana* Krczal, *Schwiebea nova* (Oudemans), *Schwiebea* sp., *Cisellipsopus microsporus* Fain & Mahunka, *Rhopalanoetus* sp. and *Listrophorus* sp.] representing six families (Macrochelidae, Uropodidae, Pygmephoridae, Acaridae, Histiostomatidae and Listrophoridae) were found to be phoretic on four species of the scarabaeid genus *Trox* F. [*T. sabulosus* (L.), *T. scaber* (L.), *T. hispidus* (Pontoppidan) and *T. cadaverinus* Illiger]. Phoresy was observed for the first time in the following mite species: *Listrophorus* sp., *Cisellipsopus microsporus*, *Bakerdania decumana* and *Uroseius infirmus*. *Uropoda orbicularis* and *Schwiebea nova* are identified here as phoretic upon species of *Trox* for the first time.

INTRODUCTION

The genus *Trox* F. is a cosmopolitan genus, represented mostly in the Palaearctic, Ethiopian and Australasian regions. The adults and larvae are necrophagous or saprophagous. In Central Europe they occur mostly under mammal or bird cadavers, on the saponified remains of bones, skin, hair or feathers, in excrement of birds and carnivores, in bird or mammal nests and in the decaying substrate of tree hollows. In comparison with other scarabaeids, on which many phoretic mites have been found and studied (e.g., Costa, 1963; Koyumdieva, 1981; Haitlinger, 1987, 1990), knowledge of the mites associates of the genus *Trox* is partial only. Sixl (1971) found phoresy of females of *Macrocheles penicilliger* (Berlese) and of deutonymphs of two species of *Uroseius* Berlese on *Trox scaber* (L.) in Austria. Phoresy of *M. penicilliger* on *T. scaber* was observed also by Evans & Browning (1956) in England. Fain & Philips (1978, 1983) described new mite species from the trogines, viz. *Troxocoptes minutus* Fain & Philips (Acaridae) from Thailand and *Suidasia australiensis* Fain & Philips (Saproglyphidae) from Australia.

MATERIAL AND METHODS

The examined material of mites was obtained from *Trox sabulosus* (L.), *T. scaber* (L.), *T. hispidus* (Pontoppidan), and *T. cadaverinus* Illiger during 1989–1992. The beetles (about 150 individuals) were collected individually under cadavers (*T. sabulosus* and *T. cadaverinus*) or extracted from the nests of *Milvus migrans* (Boddeart) (Falconiformes: Accipiteridae), *Bubo bubo* (L.), *Asio otus* (L.) (Strigiformes: Strigidae), *Corvus frugilegus* L., *Pica pica* (L.) (Passeriformes: Corvidae) and *Sturnus vulgaris* L. (Passeriformes: Sturnidae) (*T. scaber*, *T. hispidus* and *T. cadaverinus*) by means of a Tullgren apparatus. All collections (see below) were performed in southwest Slovakia (see Fig. 1).

Fig. 1: Collection sites of phoretic mites in Slovakia: 1 – Hubina, 2 – Malé Leváre, 3 – Jakubov, 4 – Bratislava, 5 – Podunajské Biskupice, 6 – Dunajská Lužná, 7 – Šamorín, 8 – Kráľovičove Kračany.

RESULTS AND DISCUSSION

A total of 12 mite species, representing six families were found to be phoretic on four species of the genus *Trox*.

Mesostigmata

Family Macrochelidae

Macrocheles penicilliger (Berlese, 1904)

A cosmopolitan species occurring mostly in bird nests, but found also in soil and on several decaying substrates (litter, excrement of bats). Its phoretic activity is known on *Trox scaber* (L.) (Evans & Browning, 1956; Sixl, 1971) in Europe and on the scarabaeid *Dichotomius carolinus* in North America (Krantz, 1988). In Slovakia, it was found in large numbers in nests of the water fowls *Anas strepera* L., *Neta rufina* (Pallas) and *Larus ridibundus* L. (Ambros et al., 1992), and less frequently in the nests of the passerines *Riparia riparia* (L.), *Luscinia svecica* (L.) and *Parus major* L.

MATERIAL: 9♀♀ – 21.vii.1992, Jakubov (Záhorská nížina lowland) on *Trox sabulosus* in decaying felt.

Macrocheles sp.

A species differing from all known congeners in Europe by chaetotaxy of the dorsal shield. On the basis of the internal setae on the dorsum it belongs to the species group of *M. lagodekhensis* Bregetova & Koroleva, according to Krauss (1970).

MATERIAL: 3♀♀ – 22.iv.1992, Jakubov, on *Trox sabulosus* found in decaying felt, 1♀ – 6.v.1992, Podunajské Biskupice (Podunajská nížina lowland), on *T. sabulosus* found on remains of a roe cadaver, 40♀♀ – 21.vii.1992, Jakubov, on *T. sabulosus* found in decaying felt.

Family Uropodidae

Uroseius infirmus (Berlese, 1887)

A species living in soil or litter in deciduous or mixed forests. Phoresy by the deutonymphs of two unidentified species of the genus *Uroseius* Berlese on *Trox scaber* was observed by Sixl (1971). Phoresy by *Uroseius* species on flies [*U. acuminatus* (C.L. Koch) and *U. cylindricus* (Berlese)] is known, as is this affinity of the genus to ants in nests of the latter (*U. koehleri* Wisniewski and *U. myrmecophilus* Wisniewski) (Karg, 1989).

MATERIAL: 1 DN – 22.iv.1992, Jakubov, on *Trox sabulosus* found in decaying felt, 4 DN – 21.vii.1992, Jakubov, on *T. sabulosus*, 19 DN – 16.viii.1991, Malé Leváre (Záhorská nížina lowland) on *T. scaber* found in the nest of *Milvus migrans*, 1 DN – 3.viii.1992, Dunajská Lužná (Podunajská nížina lowland), on *T. scaber* from the nest of *Asio otus*.

Uroseius sp.

MATERIAL: 25 DN – 16.viii.1991, Malé Leváre, on *Trox scaber* found in the nests of *Milvus migrans*, 28 DN – 29.vi.1989, Bratislava, on *T. hispidus* found in a nest of *Sturnus vulgaris*.

Uropoda orbicularis (Müller, 1776)

According to Bregetova et al. (1977), this species lives in decaying plant substances, in manure, compost soil and in moss. Karg (1989) recorded *U. orbicularis* on scarabaeids of the genera *Aphodius* and *Copris*, and on some histerids. It is distributed widely and abundant in Europe.

MATERIAL: 1 DN – 29.v.1989, Bratislava, on *Trox hispidus* found in nest of *Sturnus vulgaris*.

Prostigmata

Family Pygmephoridae

Cerratoma szekessyi Mahunka, 1970

A species whose ecological relations and bionomy are little known. It was described originally from mammalian nests of *Microtus* sp. Phoresy by *C. szekessyi* was observed by Kalúz (1992) on the dung beetle *Geotrupes vernalis* (L.) in Slovakian Karst.

MATERIAL: 1♀ – 16.viii.1991, Malé Leváre, on *Trox scaber* found in the nests of *Milvus migrans*.

Bakerdania decumana Krczal, 1969

Until now, this species has been known only from the old decaying wood and this represents the first evidence of phoresy on insects.

MATERIAL: 2♀♀ – 20.x.1992, Jakubov, on *Trox sabulosus* found in decaying felt.

Astigmata

Family Acaridae

Schwiebea nova (Oudemans, 1905)

The adult of *S. nova* occurs abundantly in forest soils and in various decaying substances. Deutonymphs (hypopi) show characteristic phoretic behaviour, e.g., Scheucher (1957) found them on the beetles *Dorcus parallelopipedus* (L.), *Dictyoptera aurora* (Herbst), *Cis boleti* (Scopoli), *Hylobius abietis* (L.) and *Poecilus cupreus* (L.), on the ant *Lasius fuliginosus* (Latreille) and on the chilopod *Lithobius forficatus* Koch. Zakhvatkin (1941) found the mite on *Hylobius abietis* (L.) and on *Crabro solenius* (L.) (Hymenoptera). In the former Czechoslovakia, Samšiňák (1957) recorded it from *Bolitophagus reticulatus* (L.) and Mašán (unpublished) on the beetles *Endomychus coccineus* (L.), *Scaphidium quadrimaculatum* Olivier and *Rhagium mordax* DeGeer.

MATERIAL: 4 DN – 16.viii.1991, Malé Leváre, on *Trox scaber* found in the nest of *Milvus migrans*.

Schwiebea sp.

MATERIAL: 8 DN – 22.iv.1992, Jakubov, on *Trox sabulosus* found in decaying felt.

Cisellipsopus microsporus Fain & Mahunka, 1990

C. microsporus was recently described on the basis of five hypopi taken from Barber's traps in Hungary. The present study is the first evidence of phoresy on insects.

MATERIAL: 43 DN – 5.iv.1989, Kráľovičove Kračany, on *Trox scaber* found in nests of *Corvus frugilegus*, 2 DN – 16.viii.1991, Malé Leváre, on *T. scaber* found in nests of *Milvus migrans*.

Family Histiostomatidae

Rhopalanoetus sp.

Up to the present time, only one species of *Rhopalanoetus* – *R. fimetarius* (Canestrini & Berlese) – was known from Europe. Its deutonymphs are very abundant on the coprophilous scarabaeids of the genus *Geotrupes*, *Copris*, *Oniticellus* and *Aphodius* (Scheucher, 1957; Mahunka, 1970; Haitlinger, 1987).

MATERIAL: 6 DN – 6.vii.1990, Šamorín (Podunajská nížina lowland), on *Trox scaber* found in a nest of *Pica pica*, 4 DN – 7.vii.1991, Hubina (Považský Inovec mountains), on *T. cadaverinus* found in a nest of *Bubo bubo*, 15 DN – 16.viii.1991, Malé Leváre, on *T. scaber* found in a nest of *Milvus migrans*.

Family Listrophoridae

Listrophorus sp.

Representatives of the cosmopolitan genus *Listrophorus* Pagenstecher are fur parasites of several mammal species. Phoresy or other relationships with arthropods have not been observed in the genus, despite the fact that many parasitic mites employ phoresy (Philips & Fain, 1991; Fain & Beaucornu, 1972).

MATERIAL: 1 ♀, 2 N – 16.vii.1991, Malé Leváre, on *Trox scaber* found in a nest of *Milvus migrans*.

The mite species recorded in this study may be classified, according to their frequency on the representatives of the genus *Trox*, into two groups. The first group is represented by those species which are not found typically on insects (one or two records at most), and whose phoretic relationship is occasional and non-specific. This group includes species with low phoretic activity, which use phoresy only exceptionally (i.e., *Listrophorus* sp., *Bakerdania decumana* and *Cerratoma szekessyi*), and characteristically phoretic species which, however, use trogine scarabaeids as secondary or occasional phoretic hosts only (i.e., *Schwiebea nova* and *Uropoda orbicularis*). The second group is represented by those species found more or less regularly and, at the same time, abundantly, on more individuals and in more localities (i.e., *Rhopalanoetus* sp., *Macrocheles* sp., *Uroseius infirmus*, *Uroseius* sp. and *Cisellipsopus microsporus*). It is probable that these species have specific phoretic relationships with beetles of the genus *Trox*.

The mites observed on *Trox* species were attached most frequently to the setae around the mouth parts (i.e., *Listrophorus* sp., *B. decumana* and *C. szekessyi*), to furrows on the pleural parts of the elytra (i.e., *Uroseius* sp., *C. microsporus* and *S. nova*) and on the flat abdominal sternites (i.e., *Macrocheles* sp., *Uroseius* sp., *Schwiebea* sp. and *C. microsporus*). *Rhopalanoetus* sp. was found attached over the entire body surface, with some deutonymphs even invading the space under the elytra.

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