Mesostigmata Mites (Acari: Parasitiformes) Associated with Beetles (Insecta: Coleoptera) in Latvia

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Abstract: Occasional studies of Mesostigmata mites (Acari: Parasitiformes) associated with beetles (Insecta: Coleoptera) in Latvia were made. In total, 36 Mesostigmata species were found to be associated with at least 38 beetle species. Preference or carrier specificity of some Mesostigmata (e.g. *Scamaphis equestris, Hypoaspis krameri, Stylochirus fimetarium, Poecilochirus* spp.) was stated. Parasitidae was the most frequent mite family observed, represented by 12 species in our studies. *Macrocheles glaber* was the most frequent mite species, recorded on 14 beetle species. Eleven Mesostigmata mite species were recorded on *Geotrupes stercorarius*. *Alliphis necrophilus* CHRISTIE, 1983 is recorded for the first time in fauna of Latvia. Differences in distribution of developmental stages of Mesostigmata on beetles was stated.

Key words: Acari, Mesostigmata, Coleoptera, phoresy, host specifity, Latvia, developmental stage.

Introduction

Mites are wingless arthropods, distribution of whose in space is problematic (Walter, Proctor 2000). Phoresy was first mentioned by Linnaeus for Acarina, but an exact definition of the phenomenon was given by Lesne in 1896 (Macchioni 2007). Phoresy is widely distributed among terrestrial and amphibious mites and comprises attachment of them to insects or other arthropods and strictly using them only by the means of transport for dispersal purposes. In this way mites are able to colonize new areas and ephemeral habitats using different ways and carriers (Macchioni 2007, Mašan 1994b, Schwarz, Müller 1992, Szymkowiak et al. 2007). Phoresy usually is defined by unsuitable conditions in the current habitat, e.g. lack of food, overcrowding, or as close symbiosis in mites and beetles. Mesostigmata are common host-riding associates, information on mite fauna and their relationships with beetles are still insufficiently investigated.

Occasional data on Mesostigmata associated with beetles in Latvia were published recently (Kontschán, Salmane 2008, Salmane 2005, 2007a, 2007b).

Hitherto, the fauna of Mesostigmata mites associated with beetles in Latvia was studied insufficiently, and the current paper is a first attempt to summarize available data.

Material and methods

Material was collected in different parts of Latvia, mainly mechanically; in some cases pit–fall traps were used. The most of presented material has been collected in Central and South regions of the country. Mesostigmata mites were located mainly on the ventral or dorsal side of the respective beetle. In case mites were found under the elytra, it is noted separately.

Mites were removed from the beetles by an entomological pin and preserved in the 70% ethanol during the field trip, and mounted on permanent slides in Berlese medium. Determination of Coleoptera was carried out using Leica S6D stereomicroscope, and mites - using Meiji or Olympus light stereomicroscopes. Mesostigmata were identified after the keys of N.Bregetova (1977), S.Kalúz et al. (2003), P.Mašan (1994a), and W.Karg (1993). Beetles were identified using identification keys of various authors.

Systematic list of mite species with

collecting locality information is presented. Hosts are arranged alphabetically by their families and genera in the list, as well as in the table 1.

Explanations and abbreviations used in the text: DN – deuteronypmh, DP – nature park, F – female, f. – forest, g. – garden, HPS – Hydroelectric Power Station, IB – Institute of Biology, University of Latvia, l. – lake, LEM – Latvian Ethnographical Open–Air Museum, M – male, m. – municipality, NBR – North Vidzeme Biosphere reserve, NP – National Park, pa. – park, p. – pond, r. – river, vill. – village or small settlement, * - new species to the fauna of Latvia. Some of the abbreviations employed are not standard English language abbreviations.

List of Mesostigmata species associated with beetles in Latvia

Microgyniidae TRÄGARDH, 1942
Microsejus truncicola TRÄGARDH, 1942
Material: *Dictyoptera aurora* (HERBST, 1784) (Lycidae) – (Salmane 2005).

Microgynium rectangulatum TRÄGARDH, 1942
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Diplogyniidae TRÄGARDH, 1941
Loboginoides spelaea WILLMANN, 1941
Material: *Uloma rufa* (PILLER, MITTERPACHER, 1783) (Tenebrionidae) – (Salmane 2005, 2007b).

Parasitidae OUDEMANS, 1901
Parasitus fimetorum BERLESE, 1903
Material: *Pterostichus nigrita nigrita* (PAYKULL, 1790) (Carabidae) – Limbaži m., Lēdurga dendrological pa., 11.05.2002 (2 DN), leg. I.Salmane; *Hister bissexstriatus* FABRICIUS, 1801 (Histeridae) – Ogre m., Ogre, Špakovska pa., 17.04.2004 (1 DN), leg. I.Salmane; Histeridae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., 07.07.2003 (1 F), leg. I.Salmane; *Platycerus caraboides caraboides* (LINNAEUS, 1758) (Lucanidae) – Ogre m., Ogre, Špakovska pa., 17.04.2004 (6 DN), leg. I.Salmane.

Parasitus lunaris BERLESE, 1906
Material: Silphidae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., 20.06.2003 (1 DN), leg. I.Salmane.

Parasitus fucorum (DEGEER, 1778)
Material: Coleoptera fam. indet. – (Lapiņa 1988, Salmane 2001).

Parasitus copridis COSTA, 1963
Material: *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – (Salmane 2005); Tukums m., Engure DP, near ornithological station at l. Engures, 10.09.2005 (2 DN), leg. I.Salmane; *Aphodius sordidus* (FABRICIUS, 1775) (Scarabaeidae) – Liepāja m., Pape DP, near l. Liepājas, meadow, horse dung, 17.06.2005 (1 DN), leg. D.Telnov.

Parasitus celer (C.L.KOCH, 1835)
Material: Carabidae gen. sp. – Gulbene m., Velēna surroundings, 20.08.1972 (2 DN), leg., det. I.Lapiņa; *Anoplotrupes stercorosus* (L.G.SCRIBA, 1791) (Geotrupidae) – Rīga m., Piejūras DP, between Garupe and Carnikava, coastal pine f., 08.10.2005 (1 DN), leg. I.Salmane; *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – Cēsis m., Gauja NP, Cēsis, mixed f. near Benča atteka (oxbow), 18.08.2004 (1 DN), coniferous f. near Meža kapi (graveyard), 18.08.2004 (2 DN), leg. I.Salmane; Limbaži m., near Meleki vill., coastal pine f., 21.08.2003 (1 DN), leg. I.Salmane; Ogre m., Ogre, Pārogre, near Rīga-Daugavpils highway, 04.05.2004 (4 DN), Špakovska pa., 15.10.2004 (3 DN), Ikšķile country territory between Ogres kapi (graveyard) and Lībieškalns, spruce f., 17.05.2009 (5 DN), Tome surroundings, coniferous f., 19.08-06.09.2009, (7 DN), leg. R.Spots; Rīga m., Jūrmala, Melluži, mixed f., 2.10.2004 (2 DN), leg. I.Salmane; Talsi m., Slītere NP, Kolkasrags (Kolka cape) coastal pine f., 01.08.2005 (1 DN), leg. I.Salmane; Tukums m., Engure DP, near ornithological station at l. Engures, 10.09.2005 (13 DN), leg. I.Salmane; *Geotrupes* sp. (Geotrupidae) – Ogre m., Ogre, mixed f., 14.08.1998 (27 DN), leg. I.Salmane; *Margarinotus* sp. (Histeridae) – Ogre m., Ogre, Pagasta iela 8, g., 23.05.2005 (1 DN), leg. I.Salmane; Histeridae gen. sp. – Rīga m., Gauja NP, Turaida, mixed f., 12.07.2003 (1 DN), leg. I.Salmane; Ogre m., Ogre, Špakovska pa., 01.05.2004 (1 DN), leg. I.Salmane; Pagasta iela 8, g., 11.06.2004 (6 DN), 19.06.2004 (1 F, 5 DN), leg. I.Salmane; *Aphodius sordidus*

(FABRICIUS, 1775) (Scarabaeidae) – Liepāja m., Pape DP, near l. Liepājas, meadow, horse dung, 17.06.2005 (1 DN), leg. D.Telnov; *Oiceoptoma thoracica thoracica* (LINNAEUS, 1758) (Silphidae) – Ogre m., Ogre, Pagasta iela 8, g., 15.06.2004 (12 DN), close to the Ogre city limit at Lašupes near r. Ogre, on grass, 25.07.2009 (3 DN), leg. I.Salmane; *Oryctes nasicornis nasicornis* (LINNAEUS, 1758) (Scarabaeidae) – Ogre m., Ogre, Pagasta iela 8, g., in compost, 6.07.2005 (2 DN), 18–19.07.2006 (5 DN), leg. I.Salmane.

Parasitus beta VOIGTS et OUDEMANS, 1904
Material: *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – (Salmane 2005).

Parasitus kraepelini BERLESE, 1903
Material: *Carabus cancellatus cancellatus* ILLIGER, 1798 (Carabidae) – Bauska m., near Mežotnes pilskalns (hillfort), broadleaved f., 04.05.2006 (1 F), leg. I.Salmane.

Parasitus lunulatus (J.MÜLLER, 1859)
Material: Coleoptera fam. indet. – Talsi m., Slītere NP, Kolka, Kolkasrags (Kolka cape), coastal pine f., 05.08.2004 (1 DN), leg. I.Salmane.

Poecilochirus necrophori VITZTHUM, 1930
Material: *Carabus cancellatus cancellatus* ILLIGER, 1798 (Carabidae) – Ogre m., Ogre, mixed f., 24.03.2002 (1 DN), 08.09.2002 (7 DN), Pagasta iela 8, g., 25.04.2002 (3 DN), 23.08.2004 (1 DN), 11.09.2004 (2 DN), leg. I.Salmane; *Carabus coriaceus coriaceus* LINNAEUS, 1758 (Carabidae) – Rīga m., Cekule vill., mixed f., 13.08.2002 (1 DN), leg. D.Telnov; *Carabus glabratus glabratus* PAYKULL, 1790 (Carabidae) – Cēsis m., Gauja NP, Skaļupes, mixed f., 11.07.2003 (7 DN), leg. I.Salmane; *Carabus hortensis hortensis* LINNAEUS, 1758 (Carabidae) – Ogre m., Ogre, Pārogre railway station surroundings, bushes, 14.08.2007 (2 DN), leg. I.Salmane; *Carabus nemoralis nemoralis* O.F.MÜLLER, 1764 (Carabidae) – Ogre m., Ogre, mixed f., 25.05.2001 (3 DN), 08.09.2002 (3 DN, under elytra), Pagasta iela 8, g., 12.08.2004 (1 DN), leg. I.Salmane; *Pterostichus nigrita nigrita* (PAYKULL, 1790) (Carabidae) – Rīga m., Cekule vill. surroundings, mixed f., 13.04.2002 (2 DN), leg. D.Telnov; Carabidae gen. sp. – Cēsis m., Taurene, Lodes muiža (manor), coniferous f., 26.06.1998 (1 DN), leg. I.Salmane; *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – Ogre m., Ogre, Pārogre, mixed f., 08.09.2002 (1 DN), Pagasta iela 8, g., 08.09.2002 (1 DN), leg. I.Salmane; Talsi m., Slītere NP, Kolkasrags (Kolka cape), coastal pine f., 06.08.2004 (1 DN), leg. I.Salmane; *Geotrupes* sp. (Geotrupidae) – Cēsis m., Taurene, Lodes muiža (manor) surroundings, coniferous f., 26.06.1998 (1 DN), leg. I.Salmane; *Nicrophorus vespillo* (LINNAEUS, 1758) (Silphidae) – Ogre m., Ogre, Pagasta 8, g., 24.06.2009 (5 DN), leg. I.Salmane; Rīga m., Gauja NP, Krimulda, Krimuldas pa., 09.08.2007 (14 DN), leg. I.Salmane; *Oiceoptoma thoracica thoracica* (LINNAEUS, 1758) (Silphidae) – Cēsis m., Cēsis, coniferous f. near Meža kapi (graveyard), 18.08.2004 (11 DN), leg. I.Salmane; *Silpha tristis* ILLIGER, 1798 (Silphidae) – Ogre m., Ogre, Pārogre, bushes near r. Ogre, 30.06.2003 (1 DN), leg. I.Salmane; Rīga m., Piejūras DP, Saulkrasti, deciduous f., 31.07.2003 (3 DN), leg. I. Salmane, Rīga m., Dzidriņas, Dārza iela 10, g., compost, 02.09.2009 (3 DN), leg. D.Telnov; *Nicrophorus* sp. (Silphidae) – Jelgava m., Zaļenieki surroundings, agricultural field, 20.07.1972 (46 DN), leg., det. I.Lapiņa; Rīga m., near Nītaure, spruce f., on dead *Microtus* sp., 01.08.2003 (5 DN), leg. I.Salmane.

Poecilochirus subterraneus (J.MÜLLER, 1860)
Material: *Oiceoptoma thoracica thoracica* (LINNAEUS, 1758) (Silphidae) – Cēsis m., Cēsis, coniferous f. near Meža kapi (graveyard), 18.08.2004 (1 DN), leg. I.Salmane; *Nicrophorus* sp. (Silphidae) – Rīga m., near r. Mergupe close to the pension "Nītaure", spruce f., on dead *Microtus* sp., 01.08.2003 (2 DN), leg. I.Salmane.

Poecilochirus davydovae HYATT, 1980
Material: *Nicrophorus vespillo* (LINNAEUS, 1758) (Silphidae) – (Salmane 2007a); *Oiceoptoma thoracica thoracica* (LINNAEUS, 1758) (Silphidae) – (Salmane 2007a); *Nicrophorus* sp. (Silphidae) – (Salmane 2007a).

Poecilochirus sp.
Material: *Oryctes nasicornis nasicornis* (LINNAEUS, 1758) (Scarabaeidae) – Ogre m., Ogre, Pagasta iela 8, compost, 19.07.2005 (1 DN), leg. I. Salmane.

Schizosthetus simulatrix ATHIAS–HENRIOT, 1982
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Ameroseiidae BERLESE, 1919 sensu EVANS, 1961
Ameroseius longitrichus HIRSCHMANN, 1963
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Aceosejidae BAKER et WHARTON, 1952
Proctolaelaps fiseri SAMŠINAK, 1860
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2006, 2007b).

Proctolaelaps bickleyi (BRAM, 1956)
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Cheiroseius necorniger (OUDEMANS, 1903)
Material: *Oiceoptoma thoracica thoracica* (LINNAEUS, 1758) (Silphidae) – Cēsis m., Cēsis, coniferous f. near Meža kapi (graveyard), 18.08.2004 (1 DN), leg. I.Salmane.

Rhodacaridae OUDEMANS, 1902
Dendrolaelaps disetosimilis HIRSCHMANN, 1860
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Dendrolaelaps uncinatus HIRSCHMANN, 1860
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Dendrolaelaps sp.
Material: *Platycerus caprea* (DEGEER, 1774) (Lucanidae) – Rīga m., Piejūras DP, Lilaste, near l. Ziemeļu Garezers, coastal pine f., 27.08.2005 (11 DN), leg. I.Salmane.

Insectolaelaps armatus (HIRSCHMANN, 1960)
Material: *Rhagium inquisitor* (Cerambycidae) – (Salmane 2007b); *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Multidendrolaelaps hexaspinosus HIRSCHMANN, 1860
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae), (Salmane 2007b).

Macrochelidae VITZTHUM, 1930
Macrocheles glaber (J.MÜLLER, 1860)
Material: Carabidae gen. sp. – Ogre m., Zilie kalni (hills), spruce f., 19.10.1997 (12 F), leg. I.Salmane; *Anoplotrupes stercorosus* (L.G.SCRIBA, 1791) (Geotrupidae) – Rīga m., Piejūras DP, between Garupe and Carnikava, coastal pine f., 8.10.2005 (2 F), leg. I.Salmane; Talsi m., Slītere NP, Kolka surroundings, bushes near p. Zēņu, 22.07.2002 (3 F), leg. I.Salmane; Valmiera m., Mazsalaca, pine f. near Skaņais kalns (hill), 23.08.2005 (5 F), leg. I.Salmane; *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – Alūksne m., Māriņkalns, mixed f., 09.08.2003 (3 F), leg. I.Salmane; Cēsis m., Cēsis, Pārgauja, mixed f., 18.07.2004 (6 F), near Benča atteka (oxbow), mixed f., 18.08.2004 (8 F), coniferous f. near Meža kapi (graveyard), 18.08.2004 (29 F), mixed f. near Cīrulīšu klintis (cliffs), 19.09.2004 (2 F), leg. I.Salmane; Limbaži m., coastal pine f. near Meleki, 21.08.2003 (8 F), leg. I.Salmane; Ogre m., Ogre, Ogres sala, bushes, 24.08.2002 (17 F), Pārogre, near Rīga - Daugavpils highway, 04.05.2004 (1 F), Špakovska pa., 15.10.2004 (2 F), Ikšķile municipal territory, Zilie kalni, spruce f., 19.10.2009 (2 F), leg. I.Salmane, Tome surroundings, coniferous f., 19.08-06.09.2009 (28 DN), leg. R.Spots; Rīga m., Cekule vill. surroundings, mixed f., 13.08.2002 (55 F), Jūrmala, Melluži, mixed f., 02.10.2004 (3 F), Rīga, LEM, meadow, horse dung, 19.08.2004 (8 F), leg. I.Salmane; Talsi m., Slītere NP, Slītere vill., deciduous f. near Slītere bāka (light house), 09.07.2004 (2 F), broadleaved f., 13.06.2007 (3 F), Kolkasrags (Kolka cape), coastal pine f., 05.08.2004 (40 F), 06.08.2004 (3 F), 01.08.2005 (12 F), 12.06.2007 (2 F), 28–29.08.2008 (29 F), leg. I.Salmane, 26-27.09.2009 (4 F), leg. R.Spots; Tukums m., near the ornithological station at l. Engures, 11.09.2004 (4 F), 10.09.2005 (14 F), leg. I.Salmane; Valmiera m., Mazsalaca, pine f. near Skaņais kalns (hill), 09.07.2008 (2 F), leg.

I.Salmane; *Geotrupes* sp. (Geotrupidae) – Cēsis m., Taurene, coniferous f. near Lodes muiža (manor), 26.09.1998 (1 F), leg. I.Salmane; Ogre m., Zilie kalni (hills), spruce f., 19.10.1997 (12 F), Ogre, Pārogre, mixed f., 14.08.1998 (4 F), leg. I.Salmane; Rīga m., Ropaži, mixed f., 09.09.1998 (2 F), Cekule vill., mixed f., 13.08.2002 (55), leg. I.Salmane; Histeridae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., 07.07.2003 (9 F), 11.06.2004 (22 F), 19.06.2004 (2 F), leg. I.Salmane; *Aphodius fossor* (LINNAEUS, 1758) (Scarabaeidae) – Ogre m., Ogre, Pārogre, mixed f., 26.07.2001 (3 F), leg. I.Salmane; *Aphodius sordidus* (FABRICIUS, 1775) (Scarabaeidae) – Liepāja m., near l. Liepājas, meadow, horse dung, 17.06.2005 (4 F), leg. D.Telnov; *Oryctes nasicornis nasicornis* (LINNAEUS, 1758) (Scarabaeidae) – Ogre m., Ogre, Pagasta iela 8, g., compost, 18.07.2006 (2 F), leg. I.Salmane; Scarabaeidae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., 25.05.2001 (2 F), 29.06.2003 (2 F), leg. I.Salmane; Talsi m., Slītere NP, Kolkasrags (Kolka cape), coastal pine f., 17.07.2001 (4 F), 22.07.2003 (8 F), Kolka surroundings, bushes near p. Zēņu, 19.07.2003 (3 F), 23.07.2003 (1 F), leg. I.Salmane; Valmiera m., Mazsalaca, pine f. near Skaņais kalns (hill), 30.08.2000 (5 F), 26.08.2003 (1 F), leg. I.Salmane; *Trypodendron laeve* EGGERS, 1939 (Scolytidae) – Ogre m., Ogre, Pagasta iela 8, g., 23.09.2007 (1 F), leg. I.Salmane; *Nicrophorus vespillo* (LINNAEUS, 1758) (Silphidae) – Ogre m., Ogre, Pārogre, mixed f., 08.09.2002 (2 F), leg. I.Salmane; *Nicrophorus vespilloides* HERBST, 1783 (Silphidae) – Cēsis m., Taurene, deciduous f. near Lodes muiža (manor), 15.06.2001 (28 F), leg. I.Salmane; *Oiceoptoma thoracica thoracica* (LINNAEUS, 1758) (Silphidae) – Ogre m., Ogre, Pagasta iela 8, g., 15.06.2004 (69 F), Lašupes surroundings, close to the city limit near r. Ogre, on grass, 25.07.2009 (2 F), leg. I.Salmane; Silphidae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., 20.06.2003 (1 F), leg. I.Salmane.

Macrocheles perglaber FILIPPONI et PEGAZZANO, 1962
Material: *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – (Salmane 2005).

Ologamasidae RYKE, 1962
Stylochirus fimetarium (J.MÜLLER, 1859) [according to Mašan, Kalúz, 2001]
Material: *Carabus cancellatus cancellatus* ILLIGER, 1798 (Carabidae) – Ogre m., Ogre, Pārogre, mixed f., 24.03.2002 (7 DN), 08.09.2002 (1 DN), leg. I.Salmane; Rīga m., Cekule vill. surroundings, mixed f., 13.08.2002 (14 DN), leg. D.Telnov; *Carabus coriaceus coriaceus* LINNAEUS, 1758 (Carabidae) – Cēsis m., Gauja NP, Skaļupes, mixed f., 11.07.2003 (3 DN), leg. I.Salmane; Rīga m., Cekule vill. surroundings, mixed f., 13.08.2002 (1 DN), leg. D.Telnov; *Carabus glabratus glabratus* PAYKULL, 1790 (Carabidae) – Cēsis m., Gauja NP, Skaļupes, mixed f., 11.07.2003 (3 DN), near r. Mergupe, close to Nītaure, mixed f., 01.08.2003 (1 DN), leg. I.Salmane; *Carabus nemoralis nemoralis* O.F.MÜLLER, 1764 (Carabidae) – Bauska m., near Mežotnes pilskalns (hillfort), broadleaved f., 4.05.2006 (4 F), leg. I.Salmane; Ogre m., Ogre, Pārogre, mixed f., 08.09.2002 (10 DN), on road in Pārogre railway station surroundings, 27.07.2009 (2 DN); leg. I.Salmane; *Cychrus caraboides* (LINNAEUS, 1758) (Carabidae) – Rīga m., Cekule vill. surroundings, pine/birch f., 13.04.2002 (1 DN), leg. D.Telnov, Gauja NP, Sigulda, mixed f. near r. Gauja, 06.08.2002 (9 DN), leg. I.Salmane; *Pterostichus aethiops* (PANZER, 1796) (Carabidae) – Rīga m., Piejūras DP, between Garupe and Carnikava, coastal pine f., 8.10.2005 (1 DN), leg. I.Salmane; *Pterostichus niger niger* (SCHALLER, 1783) (Carabidae) – Liepāja m., Embūte surroundings, Embūte DP, broadleaved f., on beetles under stone, 18.07.2009 (6 DN), leg. D.Telnov; Limbaži m., Lēdurga, dendrological pa., 11.05.2003 (1 DN), leg. I.Salmane; Ogre m., Ogre, Pārogre, mixed f., 24.03.2002 (10 DN), 08.09.2002 (2 DN, under elytra), leg. I.Salmane; Rīga m., Carnikava surroundings, 20.04.2002 (1 DN), leg. D.Telnov; *Pterostichus nigrita* (PAYKULL, 1790) (Carabidae) – Ogre m., Ogre, Pārogre, mixed f., 08.09.2002 (29 DN), leg. I.Salmane; Rīga m., Cekule vill. surroundings, mixed f., 13.08.2002 (2 DN), leg. D.Telnov, Gauja NP, Sigulda, mixed f. near r. Gauja, 06.08.2002 (5 DN), Gauja vill. surroundings, coastal pine f., 05.09.2002 (10 DN, under elytra), leg. I.Salmane; *Pterostichus*

oblongopunctatus oblongopunctatus (FABRICIUS, 1787) (Carabidae) – Rīga m., Gauja NP, Sigulda, mixed f. near r. Gauja, 06.08.2002 (1 DN), Piejūras DP, Lilaste, mixed f. near l. Ziemeļu Garezers, 05.09.2002 (2 DN), leg. I.Salmane; Carabidae gen. sp. – Ogre m., Zilie kalni (hills), spruce f., 19.10.1997 (11 DN), leg. I.Salmane; *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – Alūksne m., Māriņkalns, mixed f., 09.08.2003 (2 DN), leg. I.Salmane; Cēsis m., Cēsis, Pārgauja, mixed f., 18.07.2004 (1 DN), leg. I.Salmane; Ogre m., Ogre, Špakovska pa., 15.10.2004 (4 DN, under elytra), leg. I.Salmane; Tukums m., ornithological station near l. Engures, 11.09.2004 (3 DN), leg. I.Salmane.

Stylochirus physogastris KARG, 1971 [sensu Mašan, Kalúz, 2001]
Material: Carabidae gen. sp. – Ogre m., Ogre, Pārogre, mixed f., 05.07.2003 (1 DN), leg. I.Salmane.

Laelaptidae BERLESE, 1892
Hypoaspis krameri (G.CANESTRINI et R.CANESTRINI, 1881)
Material: *Oryctes nasicornis nasicornis* (LINNAEUS, 1758) (Scarabaeidae) – Ogre m., Ogre, Pagasta iela 8, g., compost, 6.07.2005 (9 F), 18.07.2006 (2 F), leg. I.Salmane; Rīga m., Langstiņi vill., g., 09.06.1997 (15 F), leg. V.Melecis, Olaine, compost, 05.08.1998 (10 F), Salaspils, territory of IB, 17.07.2004 (10 F), leg. I.Salmane; Talsi m., Slītere NP, Kolka surroundings, sawdust, 20.07.2001 (24 F), leg. I.Salmane.

Hypoaspis lubricoides KARG, 1971
Material: *Hylurgops palliatus* (GYLLENHAL, 1813) (Scolytidae) – (Salmane 2007b).

Eviphidae BERLESE, 1913
Scarabaspis inexpectatus OUDEMANS, 1903
Material: *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – (Salmane 2005); *Aphodius fossor* (LINNAEUS, 1758) (Scarabaeidae) – Rīga m., Tumšupe vill. env., along the road to Garkalne, meadow, cow dung, 24.05.2003 (3 F, 1 DN), leg. D.Telnov; *Aphodius sordidus* (FABRICIUS, 1775) (Scarabaeidae) – Liepāja m., near l. Liepājas, meadow, horse dung, 17.06.2005 (4 DN), leg. D.Telnov.

Alliphis halleri (G.CANESTRINI et R.CANESTRINI, 1881)
Material: Carabidae gen. sp. – Ogre m., Zilie kalni (hills), spruce f., 19.10.1997 (1 F), leg. I.Salmane; Coleoptera fam. indet. – (Lapiņa 1988, Salmane 2001); *Anoplotrupes stercorosus* (L.G.SCRIBA, 1791) (Geotrupidae) – Rīga m., Piejūras DP, between Garupe and Carnikava, coastal pine f., 8.10.2005 (3 F), leg. I.Salmane; Talsi m., Slītere NP, Kolka, bushes near p. Zēņu, 22.07.2002 (1 F), leg. I.Salmane; Carabidae gen. sp. – Ogre m., Zilie kalni (hills), spruce f., 19.10.1997 (1), leg. I.Salmane; *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – Cēsis m., Cēsis, Pārgauja, mixed f., 18.07.2004 (1 F), Benča atteka (oxbow), mixed f., 18.08.2004 (2 F), coniferous f., 18.08.2004 (3 F), leg. I.Salmane; Limbaži m., coastal pine f. near Meleki, 21.08.2003 (11 F), leg. I.Salmane; Rīga m., Cekule vill. surroundings, mixed f., 13.08.2002 (25 F, 9 M, 9 DN), Rīga, LEM, horse dung, 19.08.2004 (3 F, under elytra), leg. I.Salmane; Talsi m., Slītere NP, Kolkasrags (Kolka cape), coastal pine f., 06.08.2004 (5 F), 1.08.2005 (1 F), leg. I.Salmane; Tukums m., ornithological station near l. Engures, 11.09.2004 (5), 10.09.2005 (15 F), leg. I.Salmane; *Geotrupes* sp. (Geotrupidae) – Rīga m., Cekule vill. surroundings, mixed f., 13.08.2002 (58), leg. D.Telnov, Ropaži, pine f., 09.09.1998 (8 F, 1 M), leg. I.Salmane; Histeridae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., 07.07.2003 (1 DN), leg. I.Salmane; Rīga m., Gauja NP, Turaida, mixed f., 12.07.2003 (2 DN), leg. I.Salmane; Scarabaeidae gen. sp. – Talsi m., Slītere NP, Kolkasrags (Kolka cape), coastal pine f., 18.07.2003 (1 M, 2 DN), 22.07.2003 (3 DN), Kolka surroundings, grassland near p. Zēņu, 19.07.2003 (2 F, 3 M, 6 DN), bushes near p. Zēņu, 23.07.2003 (2 DN), leg. I.Salmane; Valmiera m., Mazsalaca, pine f. near Skaņais kalns (hill), 30.08.2000 (4 F, 1 DN), leg. I.Salmane.

**Alliphis necrophilus* CHRISTIE, 1983
Material: *Aphodius prodromus* (BRAHM, 1790) (Scarabaeidae) – Rīga, central railway terminal, train platform, 22.04.2009 (1 F), leg. I.Salmane.

Scamaphis equestris (BERLESE, 1911)
Material: *Geotrupes stercorarius* (LINNAEUS, 1758) (Geotrupidae) – (Salmane 2005).

Trematuridae BERLESE, 1917 (KARG, 1989)
Trichouropoda ovalis (C.L.KOCH, 1839)
Material: Histeridae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., compost, 11.06.2004, leg. I.Salmane.

Uropodidae KRÄMER, 1881
Uropoda ocellata KONTSCHÁN et SALMANE, 2008
Material: Histeridae gen. sp. – (Kontschán, Salmane 2008).

Uropodina spp.
Material: *Pterostichus nigrita nigrita* (PAYKULL, 1790) (Carabidae) – Limbaži m., Lēdurga, dendrological pa., 11.05.2003, leg. I.Salmane; Cantharidae gen. sp. – Cēsis m., near l. Talejas, 7.06.2003, leg. I.Salmane; Curculionidae gen. sp. – Cēsis m., Taurene surroundings near Lodes muiža (manor), meadow, 10.06.1998, leg. I.Salmane; *Prosternon tessellatum* (LINNAEUS, 1758) (Elateridae) – Rīga m., Lilaste, near l. Garezers, deciduous f., 4.06.2006, leg. I.Salmane; Elateridae gen. sp. – Ogre m., Ogre, Pārogre, mixed f., 18.05.2003, leg. I.Salmane; *Atholus corvinus* (GERMAR, 1817) (Histeridae) – Rīga m., Salaspils, National Botanical garden, 30.04.2002, leg. D.Telnov; *Hister unicolor* LINNAEUS, 1758 (Histeridae) – Ogre m., Vērene vill. surroundings, cow dung, 24.05.2003, leg. D.Telnov; Histeridae gen. sp. – Cēsis m., Taurene surroundings near Lodes muiža (manor), cow dung, 6.06.2003, leg. I.Salmane; Ogre m., Ogre, Pagasta iela 8, g., compost, 04.05.2003, 25.05–1.06.2003, leg. I.Salmane; *Aphodius fimetarius* (LINNAEUS, 1758) (Scarabaeidae) – Cēsis m., Taurene surroundings near Lodes muiža (manor), cow dung, 06.06.2003, leg. I.Salmane; Rīga m., Cekule vill. surroundings, 10.05.2003, leg. D.Telnov; *Aphodius prodromus* (BRAHM, 1790) (Scarabaeidae) – Ogre m., Ogre, Pagasta iela 8, sidewalk, 02.05.2008, leg. I.Salmane; *Onthophagus nuchicornis* (LINNAEUS, 1758) (Scarabaeidae) – Ogre m., Ogre, Pagasta iela 8, g., 23.09.2007, leg. I.Salmane; *Oryctes nasicornis nasicornis* (LINNAEUS, 1758) (Scarabaeidae) – Ogre m., Ogre, Pagasta iela 8, g., compost, 18.07.2006, leg. I.Salmane; Scarabaeidae gen. sp. – Ogre m., Ogre, Ogres sala, bushes, 06.05.2003, leg. I.Salmane; *Trypodendron laeve* EGGERS, 1939 (Scolytidae) – Ogre m., Ogre, Pagasta iela 8, g., 23.09.2007, leg. I.Salmane; Scolytidae gen. sp. – Ogre m., Ogre, Pagasta iela 8, g., 28.04.2007, leg. I.Salmane; *Ocypus ophthalmicus ophthalmicus* (SCOPOLI, 1763) (Staphylinidae) – Ogre m., Ogre, Pagasta iela 8, g., 25.05.2003, leg. I.Salmane.

Discussion

Thirty eight species were identified among the collected beetles; the rest of them determined to the genus or family level (Table 1). Of the mites, 36 Mesostigmata species were identified, of them Parasitidae - 12 species, Eviphidae - 4, Ologamasidae - 2, Microgyniidae - 2, Macrochelidae - 2 species, and the rest of families represented by single species each. Deuteronymphs of the genera *Poecilochirus* and some of *Dendrolaelaps*, as well as material of suborder Uropodina (with exception of *Trichouropada ovalis* and *Uropoda ocellata*) was not identified to the species level. Species of the genus *Iphidosoma* BERLESE, 1892 after P. Mašan, S. Kalúz (2001) are synonymies of the genus *Stylochirus* G.CANESTRIN et R.CANESTRINI, 1882 and are placed in the family Ologamasidae RYKE, 1962 (after N. Bregetova 1977, P. Mašan, pers. comm.).

The most diverse mite fauna was found on Scarabaeidae and Geotrupidae beetles: 14 mite species were recorded, with 6 species dominating (Table 1). High number of species (16) was recorded from *Geotrupes* sensu lato beetles in Slovakia (Mašan 1994b). On Scarabaeidae and Geotrupidae beetles mainly mites of the families Parasitidae, Macrochelidae, Eviphidae and Uropodina were found (Table 1). Similar observations were made in Japan (Takaku et al. 1994), where the most abundant mite fauna (Macrochelidae, Evipihidae) was found on Scarabaeidae beetles. Development of those mites – trophical or reproductive, or both – in some way are related

to the animal dung. Unfortunately, Uropodina material was not identified, and it is impossible to comment species diversity of this group now. Still, the most numerously in our investigation they were found on *Aphodius* spp. (Scarabaeidae).

Among investigated Scarabaeidae and Geotrupidae beetles, the most diverse fauna of mites (10 species) was recorded on *Geotrupes stercorarius*, which is the commonest species of Geotrupidae family in the Baltic region. Of mesostigmatids 61,7 % was *Macrocheles glaber*, 21,7 % - *Alliphis halleri* and 7,8 % - *Parasitus celer*. *M. glaber* was also the most numerously found on Scarabaeidae beetles during investigations made in Russia and Slovakia (Makarova 1995, Mašan 1995). It was recorded on 14 beetle species, mainly on Scarabaeidae, Geotrupidae and Silphidae. Such kind of distribution of this mite is related to its life history strategy. As known, beside of many other small invertebrates, *Macrocheles* mites are the main predators of dipteran eggs and larvae, which are abundantly presented as in animal excrements, as well as on dead animal corpses, and which are the main concurrents of Scarabaeidae and Silphidae beetle larvae for food resources and development of new beetle generations (Krantz 1983, Niogret et al. 2006, 2007, M.M.H.Wallace et al.1979). *M. glaber* has a World-wide distribution and phoretic habit on beetles (Niogret et al. 2006). Mite species *P. celer* was recorded on Scarabaeidae beetles also in Germany and Hungary (Karg, Rossner 1999).

Three Mesostigmata species were found on *Oryctes nasicornis*. Of them 88,6 % was *Hypoaspis krameri*, 8,9 % - *Parasitus celer* and 2,5 % - *Macrocheles glaber*. *H. krameri* is a well known and specific phoretic mite associate of the genus *Oryctes* and stag-beetles (Lucanidae) in Europe (Bregetova 1977, Karg 1993), development of which is closely related to the developmental substrate of beetle larvae.

Eight mite species were recorded on Carabidae beetles (Table 1). Prevalence of *Poecilochirus necrophori* and *Stylochirus fimetarius* on them was obvious. Similar results are shown in the investigations carried out by L. Lundquist (1991) in southern Sweden. We recorded *S. fimetarius* also on *Geotrupes stercorarius* in three cases, but otherwise it was quite specific to carabid beetles – it was recorded on 10 Carabidae species. In addition, on *Pterostichus niger* and *Cychrus caraboides* *S. fimetarius* was found in 100 % of mite specimens found on this beetle. On *Pterostichus nigrita* it was 81,0 % of mite specimen number, and on *Carabus nemoralis* and *Carabus cancellatus* 69,6 % and 59,5 %, respectively. Investigations made in Japan (Takaku et al. 1994) reviled two mite species on Carabidae, one identical to our *S. fimetarius* (distributed in Europe and Asia Minor (Bregetova 1977, Karg 1993)), and other one - *Poecilochirus carabi* (distributed in Palaearctic (Bregetova 1977, Karg 1993)). As it is confirmed by other investigations, *S. fimetarius* is a phoretic species mainly on Carabidae beetles (Makarova 1995).

Eight mite species were recorded on Silphidae species. *Poecilochirus necrophori*, *P. subterraneus*, and *P. davydovae* are typical symbionts, because these are well-known relationships and interdependence among *Nicrophorus* beetles and *Poecilochirus* mites (Schwarz, Koulianos 1998, Schwarz, Müller 1992, Springett 1968). On *Nicrophorus vespillo* beetles *P. necrophori* was 73,1 % of recorded mites and *P. davydovae* 12,2 %. On *Oiceoptoma thoracica* were recorded five mite species; 72 % of them were *M. glaber*, 15 % *Parasitus celer* and 11 % *P. necrophori*. The last species was recorded on 13 beetle species, mainly Silphidae and Carabidae.

Eight mite species were found on Histeridae beetles. The Uropodina mites were the dominating, of them only *Trichouropada ovalis* was identified to the species level. *Uropoda ocellata* was recently described as new for science species from Histeridae gen. sp. beetle collected in Central Latvia (Kontschán, Salmane 2008).

According to results of our investigations, some recorded mesostigmatid species were found carrier specific: *Scamaphis equestris* was restricted to *G. stercorarius*. It was found on other species of genus *Geotrupes* as well (Haitlinger 1990, Hyatt 1956, Mašan 1994b). *Hypoaspis krameri* was restricted to *Oryctes nasicornis*. *Scarabaspis inexpectatus* was recorded only on Scarabaeidae and Geotrupidae beetles. *Stylochirus fimetarius* was collected mainly from ground-beetles (Carabidae), and

Poecilochirus subterraneus and *P. davydovae* only from Silphidae beetles.

Occurrence of *Microsejus truncicola, Microgynium rectangulatum*, and *Loboginoides spelaea* mites is restricted to wood-related beetles. These species are common inhabitants of decaying wood and also are recorded on wood inhabiting beetles (Bregetova 1977).

Species *Alliphis necrophilus* (Eviphidae) was recorded for the first time in Latvia and was found phoretic on *Aphodius prodromus* (Geotrupidae). Hitherto, this species was collected from *Nicrophorus* beetles only (Mašan 1994a, 1999, Takaku et al. 1994).

Parasitus lunaris, *Parasitus lunulatus*, *Parasitus kraepelini* and *Cheiroseius necorniger* were recorded on the beetles accidentally and in low numbers.

Specific occurrence of various developmental stages of Mesostigmata mites on beetles was stated. Phoretic deuteronymphs, females and males were stated within families Eviphidae, Aceosejidae, Rhodacaridae and *Schizosthetus simulatrix* (Parasitidae). The similar data for family Eviphidae were found by P.Mašan (1999). Only adult phoretic stages were found for Ameroseiidae, Laelaptidae and Macrochelidae, in addition, only females were recorded of two last families. The similar observations were made by L.Lundquist (1998) and P.Mašan (1999). Dispersal of *Macrocheles* mites is accomplished by the females (Evans et al. 1961). For many phoretic Mesostigmata species their feeding habits are unknown, still it is assumed, that many of them during their travel on beetle are not feeding. There are records of *Macrocheles glaber* females, which may feed on scraps of food adhering to the setae in the region of mouthparts of the beetle (Evans et al. 1961). Of Parasitidae (with exception of *Schizosthetus simulatrix*), Ologamasidae and Uropodina as phoretic were recorded deuteronymphs and in some cases also phoretic females. *Parasitus* (Parasitidae), Uropodidae and *Trichouropoda* (Uropodina) usually have phoretic deuteronymphs (Evans et al. 1961, Krantz 1978). As well as deuteronymphs of the genus *Poecilochirus* usually are phoretic; they develop in brood chambers of *Nicrophorus* beetle's larvae and attaches to the adult beetles (Schwarz 1991, Springett 1968). Observations have been made on deuteronymphs of *Poecilochirus* mites having adaptations of chelicera, possibly, for stealing of food from mandibles of its host carrion beetle (Silphidae) (Lindquist 1975).

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Table 1. Occurrence of Mesostigmata mites on beetles in Latvia.

	Coleopteran species																																												
Mite species	*Anoplotrupes stercorosus*	*Geotrupes stercorarius*	*Geotrupes* sp.	*Onthophagus nuchicornis*	*Aphodius fossor*	*A. sordidus*	*A. fimetarius*	*A. prodromus*	*Oryctes n. nasicornis*	Scarabaeidae gen. sp.	*Carabus c. cancellatus*	*C. c. coriaceus*	*C. g. glabratus*	*C. h. hortensis*	*C. n. nemoralis*	*Cychrus caraboides*	*Pterostichus aethiops*	*P. n. niger*	*P. n. nigrita*	*P. o. oblongopunctatus*	Carabidae gen. sp.	*Nicrophorus vespilloides*	*N. vespello*	*N.* sp.	*Oiceoptoma t. thoracica*	*Silpha tristis*	Silphidae gen. sp.	*Atholus corvinus*	*Hister bissexstriatus*	*H. unicolor*	Histeridae gen. sp.	*Prosternon tessellatum*	Elateridae gen. sp.	*Hylurgops palliatus*	*Trypodendron laeve*	Scolytidae gen. sp.	Cantharidae gen. sp.	*Platycerus caprea*	*Platycerus c. caraboides*	*Dyctioptera aurora*	*Uloma rufa*	*Ocypus. o. ophthalmicus*	*Rhagium inquisitor*	Curculionidae gen. sp.	Coleoptera fam. indet.
P. celer	x	x	x			x			x																x						x														x
P. copridis		x	x			x																									x														x
P. beta		x																																											
P. lunaris																											x																		
P. kraepelini											x																																		
P. lunulatus																																													x
P. fucorum																																													x
P. fimetorum																			x										x		x							x	x						
P. subterrancus																								x	x																				
P. necrophori		x	x								x	x	x	x	x				x		x		x	x	x	x																			
P. davydovae																							x	x	x																				
Poecilochirus sp.									x																																				
S. simulatrix																																		x											
M. glaber	x	x	x		x	x			x	x											x	x	x		x		x				x				x										
M. perglaber		x																																											
S. physogastris																					x																								
S. fimetarius		x									x	x	x		x	x	x	x	x	x	x																								
S. inexpectatus		x			x	x				x																																			
S. equestris		x																																											
A. halleri	x	x	x							x											x										x														x
A. necrophilus								x																																					
D. disetosimilis																																		x											
D. uncinatus																																		x											
I. armatus																																		x									x		
M. hexaspinosus																																		x											

Table 1 (continued)

Dendrolaelaps sp.										x								
H. krameri			x															
H. lubricoides								x										
M. truncicola												x						
M. rectangulatum								x										
L. spelaea													x					
C. necorniger					x													
P. fiseri								x										
P. bickleyi								x										
A. longitrichus								x										
Uropodina sp.		x x x x x		x		x x x	x x	x x	x					x		x	x	
U. ocellata						x												
T. ovalis						x												