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Diversity of beetles (Coleoptera) in three types of orchards

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Abstract: In 2014 the research of epigeic beetles in three orchard sites by means of pitfall traps was carried out in the district Bánovce nad Bebravou (Western Slovakia). Overall, 220 beetle species (Coleoptera) were found. Beetles reached their greatest diversity in orchards that were abandoned. The beetle species diversity was lowest in the intensively managed orchards. Agricultural management affects the decreasing diversity of beetles and the further epigeic organisms.

Key words: Coleoptera, diversity, management, orchard habitats

Introduction

Orchards and meadows in these habitats rank among structural parts of the landscape. These habitats are human-made, providing various products, including fruits, grass, pasture areas and timber. They are especially typical for pastoral area of the 'Myjavská pahorkatina' hills, closed between ridges of Little ('Malé') and White ('Biele') Carpathians in Western Slovakia. Orchards, both operating and abandoned, also occur in the surroundings of Malá Lehota (the Žarnovica district), Látkovce (the Bánovce nad Bebravou district), Dolné Vestenice (the Prievidza district) and elsewhere. These secondary habitats have been mainly managed by haymaking, pasturing, but by chemical treatment as well. Nevertheless, orchard meadows may be significant habitats for the diversity of insects; which I am dealing with in this paper. Only a few published records on the insect communities of orchard habitats in Slovakia are accessible. Communities of diurnal butterflies of orchard meadows have been recently studied by Varga & Žarnovičan (2013). I have dealt with communities of beetles in similar anthropogenic habitats – wineyards in the Little Carpathians Mts (Majzlan 2010, 2011). Phytocenology and management of orchard meadows of the Myjavská pahorkatina hills were elaborated by Žarnovičan (2012), Žarnovičan, Labuda & Varga (2012). Beetle communities' significance of apple orchards in the surroundings of the Myjava town has been studied by Majzlan (2013).

Research of beetle comunities in agrocoenoses is usually carried out by simple methods of sampling. It is necessary to respect principles of biodiversity conservation in studied sites as well. Changes of the habitats and the landscape are usually studied in historical connection. If we don't know the past state, we can point out the recent knowledge only. One way or another, we create conditions for future monitoring of the changes of both habitats and landscape. Research of epigeic beetle fauna, even though is carrying out in one site only, provides relative sufficiency of information for evaluation of recent state and perhaps future trend as well. Changes and decreases of both cultural

and biological diversity exercise a serious influence on functions of the ecosystem. Some of these functions are provided by agricultural sector and orchards especially. The main intention of this study is to point out the significance of orchards for the diversity of beetles (and the further animals).

Studied territory

Apple orchards in the Látkovce village (Strážovské vrchy Mts) were chosen for exploration of the diversity of beetles (Coleoptera). The orchards are situated at the foot of the Strážovské vrchy Mts between villages Hradište and Uhrovec. This area has favourable climatic conditions therefore orchards have been established here already in the past. It is mostly situated at an altitude approximately 300 m, there are lower freezing temperatures and adequate humidity here. Brown soils on limestone are dominant. Formerly there were thermophilous oak forests (with *Quercus cerris* and *Quercus robur*) highly prevalent here. Remains of these forests occur in the surroundings of the Dolné Vestenice townlet. The site, where I have chosen three study plots, is managed by Pomi, co ltd. I would like to thank Mr. Cyprich and the owner of the company who were be so kind to allow my research activity.

Abandoned orchard (AO)

This apple orchard (fig. 1), had been established approximately 70 years ago. Recently it is overgrowth by an oak „forest“ or bush – a successional stage, which will be gradually approaching optimal, climax structure in the future. Similar thermophilous oak forests occus in the surroundings up to the Jankov vŕšok hill. Apple trees are gradually repressed by oaks, maples and hornbeams in this succession. Plants are represented by the following species:
Trees: *Carpinus betulus, Quercus petraea, Acer campestre, Acer pseudoplatanus, Carpinus betulus, Quercus cerris, Quercus petraea,*
Shrubs: *Crataegus monogyna, Ligustrum vulgare, Rosa canina* agg., *Salix caprea, Swida sanguinea, Crataegus monogyna, Frangula alnus, Ligustrum vulgare, Prunus spinosa, Rosa canina* agg., *Swida sanguinea*.
Herbs: *Achillea millefolium* agg., *Aegopodium podagraria, Agrimonia eupatoria, Agrostis capillaris, Alopecurus pratensis, Anthriscus sylvestris, Arrhenatherum elatius, Astragalus glycyphyllos, Betonica officinalis, Brachypodium sylvaticum* dom., *Bromus hordeaceus, Calamagrostis epigejos, Campanula patula, Campanula trachelium, Capsella bursa-pastoris, Carex muricata* agg., *Carex sylvatica, Carex pallescens, Carlina acaulis, Cichorium intybus, Cirsium arvense, Clematis vitalba, Clinopodium vulgare, Daucus carota, Dianthus armeria, Elytrigia repens, Fragaria vesca, Galium mollugo* agg., *Genista tinctoria, Geranium columbinum, Geum urbanum, Hieracium laevigatum, Holcus lanatus, Hypericum hirsutum, Hypericum perforatum, Jacea pratensis, Lathyrus tuberosus, Melilotus albus, Myosotis arvensis, Oenonthera biennis, Poa pratensis, Poa trivialis, Potentilla reptans, Prunella vugaris, Rubus fruticosus* agg., *Rumex crispus, Securigera varia, Stellaria media, Stenactis annua, Tithymalus esula, Torilis japonica, Trifolium pratense, Urtica dioica, Veronica chamaedrys, Veronica officinalis, Vicia hirsuta, Vicia tetrasperma.*
Coordinates of the site: 48° 42´ 12.54´´ S, 18° 20´ 55.14´´ V; 322 m a. s. l.

Fig. 1. Abandoned orchard with dense shrubby and herby vegetation (photo O. Majzlan May 1, 2014)

Movned orchard (MO)

This orchard (fig. 2) has been established during years 1955 – 1960. Apple trees were planted out in the distance 10 m. This orchard is neglected, trees are not cultivated and then apples are lesser quality. Undergrowth is cut twice a year by mowing machine. Seedlings of oaks are appearing among apple trees.
Trees: *Malus domestica*
Shrubs: *Rosa canina* agg.
Herbs: *Acetosa pratensis, Achillea millefolium* agg., *Aegopodium podagraria, Agrostis capillaris, Anthriscus sylvestris, Arrhenatherum elatius, Bromus hordeaceus, Campanula patula, Crepis biennis, Dactylis glomerata*, *Daucus carota, Festuca pratensis*, *Fragaria vesca, Galium mollugo* agg. dom., *Geum urbanum, Holcus lanatus, Hypericum perforatum, Jacea pratensis, Leontodon hispidus, Leucanthemum vulgare, Melilotus albus, Myosotis arvensis, Pastinaca sativa, Pimpinella saxifraga* agg., *Plantago lanceolata, Poa pratensis, Poa trivialis, Potentilla reptans, Prunella vugaris, Salvia pratensis, Securigera varia, Stenactis annua, Taraxacum* sect. *ruderalia, Tithymalus esula, Trifolium pratense, Trifolium repens, Veronica chamaedrys, Vicia hirsuta, Viola odorata.*
Coordinates of the site: 48° 42´ 22,80´´ S, 18° 20´ 1.68´´ V; 210 m a. s. l.

Fig. 2. Mowned orchard (photo O. Majzlan May 1, 2014)

Intensively managed orchard (IMO)

This orchard was laid out in 2005 especially by Mr. Cyprich. Apple trees are in rows – plantations, spacing 1 – 2 m. Tree tops are furnished with meshes, being protection from the hail (fig. 3). This culture is drop-irrigated, periodically mowned and sparged by herbicides Ganzo and Regran SL. Fertilizing is carrying out by nitrogeneous fertilizers Ducanit and Pulrea; the manure was applied in 2014. Glue catchers against the bark beetle *Xyleborus dispar* are also installed here using alcohol as an attractant. This beetle species is a pest of apple trees.
Tree: *Malus domestica.*
Herbs: *Achillea millefolium* agg., *Capsella bursa-pastoris, Convolvulus arvensis, Festuca pratensis* agg., *Geranium columbinum, Hypericum perforatum, Lathyrus pratensis, Lolium perence* dom., *Medicago lupulina, Myosotis arvensis, Plantago lanceolata, Plantago major* dom., *Poa trivialis, Prunella vulgaris, Taraxacum* sect., *Senecio vulgaris, Stellaria media, Sonchus oleraceus, Triofolium repens, Urtica dioica, Vicia tetrasperma.*
Coordinates of the site: 48° 42´ 6.12´´ S, 18° 20´ 52.68´´ V; 308 m a. s. l.

Material and methods

Pitfall traps were installed on May 2, 2014 in each of study plots for sampling; preserving solution was Fridex. Samples were extracted on May 21, June 18, July 23, August 8, August 11, September 13 and October 23, 2014. A part of prepared beetle material is deposed in The Slovak Museum of Nature Protection and Speleology (Liptovské múzeum ochrany prírody a jaskyniarstva).

Fig. 3. Intensively managed orchard (photo O. Majzlan May 1, 2014)

Results

The research of epigeic beetles has been carried out in 2014 in the site Látkovce. There were pitfall traps exposed in 3 study plots – orchards. Two hundred twenty species of beetles (Coleoptera) were documented in total. The highest diversity was proved in the mowned orchard (D 45). The lowest diversity (D 31) was documented in the intensively managed orchard (with application of fertilisers and pesticides).

Management interventions cause increasing of the crop of agricultural plants, but degradation of biodiversity simultaneously. Generally infrequent species *Alphitobius diaperinus* was dominant in this study plot. It lives especially in bird nests. Its occurrence may be connected with the manure applied as a fertiliser. Relation between phytophagous and zoophagous beetles may also reflect stability of the ecosystem. It was equiponderant in the study plot «abandoned orchard» (2.18). Zoophagous beetles were prevailing in the mowned orchard. In the intensively managed orchard there were pantophagous species (including mycetophagous, coprophagous, necrophagous, etc.) mostly prevailing.

Drusilla canaliculata was a dominant species in the abandoned orchard (13.8 %), the rest of the species were subdominant. The following four species were dominant in the mowned orchard: *Calathus fuscipes* 10.4 %, *Pseudoophonus rufipes* 9.5 %, *Sciaphilus asperatus* 6.1 % and *Otiorhynchus raucus* 5.6 %. In the intensively managed orchard only two species were eudominant: *Alphitobius diaperinus* 22.8 % and *Otiorhynchus ovatus* 21.3 %. These species shown the share 44 % from all sampled beetle individuals.

This phenomenon is typical for artificial habitats (town parks, cemeteries), having high diversity, but smaller species are prevailing and only a few species are eudominant.

The invasive species *Stelidota geminata* was documented in orchards as well. It originates from Northern America and Canada, it is a pest of strawberries there. The beetle feeds on decaying strawberries but also rapsberries. In Slovakia it appears in southern regions despite strawberries not have to occur everywhere. Perhaps it may feed on the further kinds of fruits (grape, plum, apple). Strong populations of this species were observed in the plum orchard (Majzlan 2013).

In the synusias of epigeic beetles I have documented several faunistically significant species, including *Alphitophagus bifasciatus, Typhaea haagi, Otiorhynchus sulcatus* and *Omiamima mollina.*

Dominant species of intensively managed orchard vas *Alphitobius diaperinus*. It occurs in bird nests especially. In the nests of the European roller (*Coracias garrulus*) it was a dominant species (Majzlan 2009). Its presence in the orchard may be connected with the manure used as a fertiliser. It was transported from some neat-house, where corn grains and decaying materials were probably occurred.

Table 1. Selected values of the beetle communities of studied apple orchards in Látkovce, 2014 (AO – abandoned orchard, MO – movned orchard, IMO – intensively managed orchard); Index of Diversity Margalef $D_i = S - 1 / \log N$ (S – Number of individuals, N – Number of species)

⬇ Values Type of Orchard ➡	AO	MO	IMO	Together
Number of individuals	317	608	661	1586
Number of species	96	122	88	
Diversity Margalef	38	45	31	
Zoophagous species	48	58	35	
Phytophagous species	22	42	18	
Pantophagous species	26	22	35	
Index zoo : phyto	2.18	1.38	1.94	

Conclusion

Research of epigeic beetles have been carried out in 2014 in the Látkovce site. The method of pitfall traps was applied. Generally 221 species of beetles (Coleoptera) were documented. The highest diversity was detected in the abandoned orchard which is out of the productive function; beeing in the process of succession. The lowest diversity was proved in the intensively managed orchard, of course. Management methods exercise an influence on the diversity of epigeic beetles and the further animals.

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Table 2. Review of beetles (Coleoptera) in 3 types of apple orchard in Látkovce, 2014 (AO – abandoned orchard, MO – movned orchard, IMO – intensively managed orchard)

⬇ **Family /** *Species* Site ➡	AO	MO	IMO	Trophic Category
Carabidae				
Abax parallelepipedus	1			zoophagous
Amara aenea (De Geer, 1774)	1	1	2	zoophagous
Amara eurynota (Panzer, 1797)	1		29	zoophagous
Amara ovata (Fabricius, 1792)		5		zoophagous
Anchomenus dorsalis (Pontoppidan, 1763)	1	6	15	zoophagous
Badister unipustulatus Bonelli, 1813	3			zoophagous
Bembidion varium (Olivier, 1795)		1		zoophagous
Bembidion properans (Stephens, 1828)	1			zoophagous
Brachinus crepitans (Linnaeus, 1758)		1		zoophagous
Calathus erratus (Sahlberg, 1827)	2	21	6	zoophagous
Calathus fuscipes (Goeze, 1777)	2	63		zoophagous
Calathus melanocephalus (Linnaeus, 1758)		6		zoophagous
Carabus coriaceus Linnaeus, 1758	1			zoophagous
Carabus scheidleri Panzer, 1799		6		zoophagous
Carabus violaceus Linnaeus, 1758	4	5		zoophagous
Harpalus modestus Dejean, 1829		6		zoophagous
Harpalus affinis (Schrank, 1781)		3		zoophagous
Harpalus latus (Linnaeus, 1758)	2	8		zoophagous

Harpalus rubripes (Duftschmid, 1812)	1	2	1	zoophagous
Harpalus tardus (Panzer, 1797)	1	1		zoophagous
Leistus ferrugineus (Linnaeus, 1758)		2	7	zoophagous
Licinus depressus (Paykull, 1790)	3	1		zoophagous
Nebria brevicollis (Fabricius, 1792)		2	1	zoophagous
Panagaeus bipustulatus (Fabricius, 1775)	3			zoophagous
Platynus assimilis (Paykull, 1790)			1	zoophagous
Pseudoophonus rufipes (De Geer, 1774)	2	58	16	zoophagous
Pterostichus melanarius (Illiger, 1798)		1		zoophagous
Pterostichus niger (Schaller, 1783)	10			zoophagous
Pterostichus ovoides (Sturm, 1828)	5			zoophagous
Syntomus foveatus (Fourcroy, 1785)		3		zoophagous
Synuchus vivalis (Illiger, 1798)	1	3		zoophagous
Trechus austriacus Dejean, 1831	4	3	19	zoophagous
Hydrophilidae				
Cercyon granarius Erichson, 1837			1	phytophagous
Cercyon melanocephalus (Linnaeus, 1758)		2		phytophagous
Cercyon quisquilius (Linnaeus, 1761)			1	phytophagous
Cercyon ustulatus (Preyssler, 1790)			1	phytophagous
Histeridae				
Paromalus flavicornis (Herbst, 1792)			1	zoophagous
Silphidae				
Silpha carinata Herbst, 1783		1		necrophagous
Xylodrepa quadripunctata (Linnaeus, 1761)	2			necrophagous
Leiodidae				
Agathidium nigrinum Sturm, 1807	1			mycetophagous
Anisotoma humeralis (Fabricius, 1792)	1			mycetophagous
Catops tristis (Panzer, 1794)	1			mycetophagous
Colenis immunda (Sturm, 1807)			1	mycetophagous
Hydnobius punctatus (Sturm, 1807)		1		mycetophagous
Leiodes polita (Marsham, 1802)			1	mycetophagous
Liocyrtusa minuta (Ahrens, 1812)	1		2	mycetophagous
Nargus brunneus (Sturm, 1839)	2		3	mycetophagous
Ptomaphagus sericatus (Chaudoir, 1845)	29			mycetophagous
Ptomaphagus subvillosus (Goeze, 1777)	2		1	mycetophagous
Scydmaneidae				
Euconnus pubicollis (Müll. Kunze, 1822)	4		1	zoophagous
Neuraphes carinatus (Mulsant, 1861)				zoophagous
Scydmaenus hellwigi (Herbst, 1792)		2		zoophagous
Scaphididae				
Scaphisoma agaricinum (Linnaeus, 1758)	1	1	1	mycetophagous
Staphylinidae				
Aleochara lata Gravenhorst, 1802	11			zoophagous
Aleochara ruficornis Gravenhorst, 1802	22			zoophagous
Aleochara tristis Gravenhorst, 1806	4	18	3	zoophagous
Atheta castanoptera (Mannerheim, 1830)		5	2	zoophagous
Atheta fungi (Gravenhorst, 1806)		2	2	zoophagous

Bledius baudii Fauvel, 1872		1		zoophagous
Bledius dissimilis Erichson, 1840		1		zoophagous
Carpelimus corticinus (Gravenhorst, 1806)			1	zoophagous
Carpelimus fuliginosus (Gravenhorst, 1802)	1			zoophagous
Drusilla canaliculata (Fabricius, 1787)	44	22	2	zoophagous
Falagria thoracica Curtis, 1833		12	5	zoophagous
Ocypus brunnipes Fabricius, 1781	5	10	2	zoophagous
Ocypus melanarius Heer, 1839	1	1		zoophagous
Ocypus mus Brullé, 1833		1		zoophagous
Ocypus nero semialatus J. Müller, 1904		2		zoophagous
Ocypus olens O. F. Müller, 1764	2			zoophagous
Ocypus tenebricosus Gravenhorst, 1846	1	2	1	zoophagous
Oligota granaria Erichson, 1837	1			zoophagous
Ontholestes murinus (Linnaeus, 1758)	2		1	zoophagous
Ontholestes tesselatus (Fourcroy, 1785)		1	5	zoophagous
Othius laeviusculus Stephens, 1833	1			zoophagous
Othius punctulatus (Goeze, 1777)		1		zoophagous
Paederus litoralis Gravenhorst, 1802		2		zoophagous
Paederus schoenherri Czwalina, 1899		1		zoophagous
Philonthus lepidus (Gravenhorst, 1802)		2	2	zoophagous
Philonthus splendens (Fabricius, 1792)	3			zoophagous
Philonthus varians (Paykull, 1789)		3		zoophagous
Platydracus fulvipes (Scopoli, 1763)		3		zoophagous
Platydracus chalcocephalus (Fabricius, 1801)	3			zoophagous
Platydracus stercorarius (Olivier, 1795)		3		zoophagous
Quedius cruentus (Olivier, 1795)			1	zoophagous
Rugilus erichsoni (Fauvel, 1867)	1			zoophagous
Staphylinus caesareus Cederjhlem, 1798		2		zoophagous
Staphylinus erythropterus Linnaeus, 1758			1	zoophagous
Tachyporus abdominalis (Fabricius, 1781)		1	2	zoophagous
Tachyporus solutus Erichson, 1839	4			zoophagous
Xantholinus linearis (Olivier, 1794)		1		zoophagous
Xantholinus longiventris Heer, 1839		1		zoophagous
Pselaphidae				
Brachygluta haematica (Reichenbach, 1816)		2		zoophagous
Bryaxis carinula Rey, 1888	3			zoophagous
Bythinus securiger (Reichenbach, 1817)	1			zoophagous
Pselaphus heisei Herbst, 1792	2			zoophagous
Trimium brevicorne (Reichenbach, 1816)	1			zoophagous
Clamibidae				
Clambus punctullum (Beck, 1817)	1			mycetophagous
Eucinetidae				
Eucinetus haemorrhoidalis (Germar, 1818)		1		zoophagous
Trogidae				
Trox hispidulus (Pontoppidan, 1763)			1	necrophagous
Trox scaber (Linnaeus, 1767)			2	necrophagous
Geotrupidae				

Odonteus armiger (Scopoli, 1772)	1			mycetophagous
Trypocopris vernalis (Linnaeus,1758)	5	2		coprophagous
Scarabaeidae				
Aphodius brevis Erichson, 1848			2	coprophagous
Aphodius corvinus Erichson, 1848			1	coprophagous
Aphodius fimetarius (Linnaeus, 1758)		1	3	coprophagous
Aphodius granarius (Linnaeus, 1767)			4	coprophagous
Aphodius prodromus (Brahm, 1790)			2	coprophagous
Aphodius sticticus (Panzer, 1798)	2			coprophagous
Cetonia aurata (Linnaeus, 1758)			2	saprophagous
Onthophagus coenobita (Herbst, 1783)	1			coprophagous
Onthophagus ovatus (Linnaeus, 1767)		32	8	coprophagous
Valgus hemipterus (Linnaeus, 1758)		1		saprophagous
Byrrhidae				
Byrrhus fasciatus (Forster, 1771)	1	2		phytophagous
Elateridae				
Agriotes acuminatus (Stephens, 1830)		4		zoophagous
Agriotes lineatus (Linnaeus, 1767)		5	1	zoophagous
Agrypnus murinus (Linnaeus, 1758)		2		phytophagous
Athous niger (Linnaeus, 1758)				phytophagous
Dalopius marginatus (Linnaeus, 1758)				phytophagous
Hemicrepidius hirtus (Herbst, 1784)		1	4	zoophagous
Lampyridae				
Lamprohiza splendidula (Linnaeus, 1767)	1			zoophagous
Cantharidae				
Cantharis rustica Fallén, 1807		2		zoophagous
Rhagonycha fulva (Scopoli, 1763)			5	zoophagous
Dermestidae				
Dermestes frischi Kugelann, 1792	1	1		necrophagous
Dermestes murinus Linnaeus, 1758				necrophagous
Anobiidae				
Ptinus pusillus Sturm, 1837	1			mycetophagous
Ptinus schlerethi Reitter, 1884		1		mycetophagous
Dasytidae				
Dasytes obscurus Gyllenhal, 1813	2			zoophagous
Malachiidae				
Charopus concolor (Fabricius, 1801)	1			zoophagous
Nitidulidae				
Epuraea laeviuscula (Gyllenhal, 1827)			1	mycetophagous
Epuraea oblonga (Herbst, 1793)		2		mycetophagous
Glischrochilus quadriguttatus (Fabricius, 1776)		1	1	saprophagous
Meligethes aeneus (Fabricius, 1775)	5		15	phytophagous
Stelidota geminata (Say, 1825)	5	1	20	mycetophagous
Rhizophagidae				
Monotoma bicolor Villa, 1835		2	4	mycetophagous
Monotoma brevicollis Aubé, 1837			6	mycetophagous

Rhizophagus bipustulatus (Fabricius, 1792)		2	1	zoophagous
Silvanidae				
Ahasverus advena (Waltl, 1832)			1	mycetophagous
Cryptophagidae				
Atomaria atricapilla Stephens, 1830			5	mycetophagous
Atomaria linearis Stephens, 1830			1	mycetophagous
Atomaria testacea Stephens, 1830		2	1	mycetophagous
Cryptophagus acutangulus Gyllenhal, 1828	2			mycetophagous
Cryptophagus affinis Sturm, 1845	1			mycetophagous
Cryptophagus lycoperdi (Scopoli, 1763)		1	2	mycetophagous
Cryptophagus pilosus Gyllenhal, 1828		3		mycetophagous
Episthemus globulus (Paykull, 1798)	1		3	mycetophagous
Coccinellidae				
Calvia decemguttata (Linnaeus, 1767)			1	zoophagous
Coccinella septempunctata Linnaeus, 1758		1	5	zoophagous
Hyperaspis campestris (Herbst, 1783)		2		zoophagous
Psyllobora vigintiduopunctata (Linnaeus, 1758)	5			zoophagous
Scymnus frontalis (Fabricius, 1787)	1			zoophagous
Corylophidae				
Corylophus casidoideus (Marsham, 1802)		4	5	mycetophagous
Sericoderus lateralis (Gyllenhal, 1827)	4			mycetophagous
Latridiidae				
Aridius nodifer (Westwood, 1839)	2	1	3	mycetophagous
Cartodere constricta (Gyllenhal, 1827)		3		mycetophagous
Corticaria elongata (Gyllenhal, 1827)		1	2	mycetophagous
Corticaria similata (Gyllenhal, 1807)		3		mycetophagous
Corticarina fuscula (Gyllenhal, 1827)		1		mycetophagous
Enicmus rugosus (Herbst, 1793)			5	mycetophagous
Enicmus transversus (Olivier, 1790)	5	2	1	mycetophagous
Latridius brevicollis (Thomson, 1868)	1			mycetophagous
Mycetophagidae				
Typhaea haagi Reitter, 1874			5	mycetophagous
Litargus connexus (Fourcroy, 1785)	1			mycetophagous
Anthicidae				
Anthicus antherinus (Linnaeus, 1761)	1			zoophagous
Hirticomus quadriguttatus (Rossi, 1792)		2	1	zoophagous
Omonadus floralis (Linnaeus, 1758)			1	zoophagous
Lagriidae				
Lagria hirta (Linnaeus, 1758)		2	2	zoophagous
Tenebrionidae				
Alphitophagus bifasciatus (Say, 1823)			2	mycetophagous
Eledona agaricola (Herbst, 1783)	1			mycetophagous
Alphitobius diaperinus (Panzer, 1797)			151	mycetophagous
Chrysomelidae				
Asiorestia ferruginea (Scopoli, 1763)		1		phytophagous
Cassida nobilis Linnaeus, 1758		1		phytophagous

Cryptocephalus bipunctatus (Linnaeus, 1758)	2			phytophagous
Galeruca pomonae (Scopoli, 1763)		1		phytophagous
Galeruca tanaceti (Linnaeus, 1758)		3		phytophagous
Chaetocnema concinna (Marsham, 1802)			1	phytophagous
Chrysolina sturmi (Westhoff, 1882)		1		phytophagous
Longitarsus atricillus (Linnaeus, 1761)		2		phytophagous
Longitarsus lycopi (Foudras, 1860)	3			phytophagous
Sphaeroderma testaceum (Fabricius, 1775)		1		phytophagous
Attelabidae				
Coenorhinus aequatus (Linnaeus, 1767)	1			phytophagous
Caenorhinus germanicus (Herbst, 1797)	4	1		phytophagous
Apionidae				
Apion virens Herbst, 1797		3		phytophagous
Apion aeneum (Fabricius, 1775)			1	phytophagous
Apion assimile Kirby, 1808	2			phytophagous
Apion nigritarse Kirby, 1808	5			phytophagous
Apion penetrans Germar, 1817		4		phytophagous
Apion trifolii (Linnaeus, 1768)	2	4	1	phytophagous
Curculionidae				
Acalles hypocrita Boheman, 1837	1			phytophagous
Alophus triguttatus (Fabricius, 1775)		3		phytophagous
Anthonomus rubi (Herbst, 1795)		2		phytophagous
Barynotus obscurus (Fabricius, 1775)		7		phytophagous
Barypeithes pellucidus (Boheman, 1843)	1	51		phytophagous
Brachysomus echinatus (Bonsdorff, 1785)			3	phytophagous
Trichosirocalus troglodytes (Fabricius, 1787)		1		phytophagous
Hypera arator (Linnaeus, 1758)		1		phytophagous
Lepyrus palustris (Scopoli, 1763)	2	2		phytophagous
Omiamima mollina (Boheman, 1834)		3		phytophagous
Otiorhynchus laevigatus (Fabricius, 1792)		8		phytophagous
Otiorhynchus ovatus (Linnaeus, 1758)	1	34	141	phytophagous
Otiorhynchus raucus (Fabricius, 1777)		12	1	phytophagous
Otiorhynchus sulcatus (Fabricius, 1775)			1	phytophagous
Phyllobius pyri (Linnaeus, 1758)			1	phytophagous
Phyllobius argentatus (Linnaeus, 1758)		1	1	phytophagous
Phyllobius oblongus (Linnaeus, 1758)	10	11	73	phytophagous
Phyllobius pyri (Linnaeus, 1758)			4	phytophagous
Phyllobius sinuatus (Fabricius, 1801)	12	5		phytophagous
Polydrusus pterygomalis Boheman, 1840	1			phytophagous
Polydrusus sericeus (Schaller, 1783)			2	phytophagous
Rhinoncus bruchoides (Herbst, 1784)				phytophagous
Sciaphilus asperatus (Bonsdorff, 1785)	4	37		phytophagous
Sitona lineatus (Linnaeus, 1758)			4	phytophagous
Sitophilus oryzae (Linnaeus, 1758)		1	3	phytophagous
Stomodes gyrosicollis (Boheman, 1843)		1	1	phytophagous
Tanymecus palliatus (Fabricius, 1787)	1			phytophagous
Trachyphloeus aristatus (Gyllenhal, 1827)			1	phytophagous

Trachyphloeus scabriculus (Linnaeus, 1771)	1			phytophagous
Scolytidae				
Hylastes angustatus (Herbst, 1793)	1			xylophagous
Scolytus carpini (Ratzeburg, 1837)	2			xylophagous
Scolytus mali (Bechstein, 1805)	2			xylophagous
Xyleborus dispar (Fabricius, 1792)			5	xylophagous
Xyleborus saxeseni (Ratzeburg, 1837)	1			xylophagous