

Contribution to knowledge of two rare saproxylic beetles (Coleoptera) from Eastern Bohemia (Czech Republic)

Príspevek k poznání dvou vzácných saproxylických brouků z východních Čech

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Abstract. Superfamily Tenebrionoidea includes many saproxylic species. Our contribution deals with two mycetophagous species, which are rare in central Europe. *Mycetophagus fulvicollis* is a member of typical saproxylic family Mycetophagidae. This fungus beetle lives under the bark of dead broadleaved trees and is considered a relict of continuous forests. The darkling beetle *Platydema violaceum* is a member of subfamily Diaperinae, which includes many mycetophagous beetles. Both beetles live under the bark of trees infested by fungi, both are red-listed in many European countries. These saproxylic beetles are probably distributed only in landscape mosaic of people low-impact land use almost within continuous forest stands. There are many studies, that presented the relationship between beetles and wood-decaying fungi, but only a few that presented attraction of beetles to mycelia.

Keywords: Ecological preferences, *Mycetophagus fulvicollis*, Mycetophagidae, mycetophagous beetles, *Platydema violaceum*, primary and secondary biotopes, red-listed beetles, relict species, Tenebrionidae

INTRODUCTION

Saproxylic beetles are among one of the most recently studied groups. Many studies dealt with this group of beetles and not a few dealt with conservation status of saproxylic beetles (Hedgren and Weslien 2008). Studying the preferences of rare subcorticolous beetles is difficult and exacting for statistical analyses (Siitonen and Saaristo 2000). Most of experiments are designed with non-invasive methods like different kinds of traps (e.g. window traps or extraction cylinders) (Økland 1996). But most of these trapping methods do not describe ecological preferences of species. Window traps are very useful for monitoring or records of some amazing species (Čížek and Hauck 2006), but describe only flightable community of studied area. Some more biotope-specific traps like photoeclector-based traps, extraction cylinders or trunk-window traps only catch migrating or emerged adults (e.g., Majzlan 2002).

Studying of ecological preferences of subcorticolous or wood-living beetles cannot be done in the field without invasive methods, like peeling the bark or sifting wood debris. One of the crucial moments in knowledge of ecological preferences is to find environment for development of larvae. Because preferences of adults and their development stages could differ (e.g., floricolous beetles).

The large quantities of different kinds of dead wood are essential for survival of saproxylic beetles (Speight 1989). There are also many another factors, which influenced occurrence of some biotope-specific species.

More than half of the insect species breeding on fungi appeared to be monophagous, non-monophagous species of beetles frequently used hosts that are closely related to each other. Authors indicated that the rarity of some fungivorous species might therefore be due to weak ability to colonize distant patches and also indicated that some species of this group could be indicators (Jonsell and Nordlander 2002, 2004, 2006). Many studies dealt with fungivorous beetles, but not so many with beetles that are feeding not in bodies of fungi, but on mycelium.

Johansson et al. (2006) told that sporocarps of polypores are known to emit volatiles attracting fungivorous beetles, but it is unknown whether some beetles are also attracted to odours from the mycelia. Some species did discriminate between volatiles emitted by different polypore species and also between volatiles emitted by the sporocarps and mycelia from the same species. Only *Dryocoetes autographus* (Ratzeburg, 1837) was attracted to *Fomitopsis rosea* (Alb. & Schwein.) P. Karst. mycelium.

The superfamily Tenebrionoidea include 30 families (Lawrence and Newton 1995), about 20 are represented in central Europe (Hůrka 2005). Family Mycetophagidae is in central Europe represented by 17 species, most of them are mycetophagous feeding on fruiting bodies of tree fungi or mycelia under the bark. In Czech Republic six species are red-listed (Jelínek 2005). Almost saproxylic subfamily Diaperinae includes in central Europe 26 species, two species in genus *Platydema* Laporte de Castelnau & Brullé, 1831, both red-listed (Novák 2005) and distributed in Czech Republic (Novák 2007). Both are feeding on mycelia of wood-decaying fungi.

METHODS

Sampling method

We use invasive methods for this study, so we try to minimize negative intervention to biotopes. Sample strip was on random place of stem (max to 2,5 m height) approximately 0,1 m². We recorded presence and number of species (adults and larvae) if they were recognizable, recorded the parameters of wood (diameter at breast height, height of snag, bark thickness, orientation, sun exposure, substrate moisture, stage of bark peeling, bast color, mycelium stage of Basidiomycetes, species and number of fruiting bodies of presented fungi, presence of other beetles and indicating invertebrates), and some parameters of stand (e.g., water character, stand structure).

Study area

Our research was based on random searching of interesting biotopes for rare species (main part of our research was based on sampling of associated saproxylics within genus *Cucujus* Fabricius, 1775) in eastern Polabí lowland (Pardubice Region: Czech Republic). Most of these investigated biotopes were fragments of non-intensive land use area.

Study species

Platydema violaceum (Fabricius, 1790) (Coleoptera: Tenebrionidae: Diaperinae) is distributed in whole central Europe. Its occurrence is in scattered distribution pattern (Novák 2007). The first faunistic record from Bohemia was from Obříství u Mělníka (Picka 1978). To 1980's was probably distributed only in the warmest parts of Polabí (Elbe river env.). Recently is this thermophilic beetle probably in temporal expansion considering of some natural factors. Mapping of occurrence of this beetle in Czech Republic takes place with another species on BioLib (www.biolib.cz) (Horák 2008). This obligate mycetophagous and saproxylic darkling beetle occurs under the bark of withered and dead broadleaf trees infested by fungi, mainly in beech and oak, and partly in birch, limes and elders (Roubal 1936, Hůrka 2005).

Mycetophagus fulvicollis Fabricius, 1792 (Coleoptera: Mycetophagidae: Mycetophaginae) is distributed in whole central Europe (Průdek 2005). Whole fungus beetles (Mycetophagidae) are recently represented in Czech Republic by 15 species. This rare obligate mycetophagous and saproxylic beetle is indicated as stenotopic relict of undisturbed forest habitats (Průdek 1996). Vogt (1967) observed this species from rotten wood attacked by fungi more than from fruiting bodies. Schlaghamerský (2000) described this species as typical forest species and partly zoophagous.

Notes of occurrence of these beetles in Eastern Bohemia are in Mertlík (2007) and Mikát (2007).

Grid mapping

Quadrinumber code of localities was established on the standard grid map (Novák 1989), which is identical with the Central European grid system. The grid cells (g.c.) are 10 minutes of eastern longitude by 6 minutes of northern latitude, which corresponds with an area of 11,1 x 12,0 km.

RESULTS

Platydema violaceum

We observed the darkling beetle *P. violaceum* in two localities. The first locality was Radhošť, near bridge over river Loučná (g.c. 6062) on October 25, 2006. We found five gregarious adults under the bark of standing dead poplar hybrid (*Populus xcanadensis*) infested by bracket fungi *Phellinus populicola* Niemelä, 1975. We

recorded one imago of *Cucujus cinnaberinus* (Scopoli, 1763) and some adults of *Phosphuga atrata* (Linnaeus, 1758) with *P. violaceum* in sample strip. Parameters of dead wood were: the diameter at breast height was 82,8 cm – high dimension dead wood; beetles were 1 m above ground; bark thickness was 2,8 cm; height of tree was approximately 12 m; the distance from river was 0,5 m; northern exposition of sample strip; structure of stand was in line; high gradient of sun exposure; we found more than 11 fruiting bodies of mentioned fungus; bark peeling was good; underbark substrate stage was relatively wet; colour of bast was brown black; mycelium was living and fructified; enough dead branches and more than 11 limbs (>1m); bark coverage was 60%.

Next locality was in Uhersko, in former pheasantry (g.c. 6062) also on October 25, 2006. We found one adult under the bark of poplar hybrid snag infested by bracket fungi *Phellinus populicola*. We recorded eight larvae of *C. cinnaberinus* and five larvae of genus *Pyrochroa* Geoffroy. Parameters of dead wood were: diameter at breast height was 47,8 cm; Beetle was 1,2 m above ground; bark thickness of sample strip was 0,20 cm; height of snag was 3 m; distance from stream was 50 m; southern exposition of sample strip; structure of stand was in group; medium gradient of sun exposure; we found 1 dead fruiting body of mentioned fungi; good stage of bark peeling; underbark substrate stage was dry; bast colour was brown black; we found no mycelium; bark coverage was 50%.

Mycetophagus fulvicollis

We found *M. fulvicollis* only on one locality in Sruby, near swamps of Sruby (g.c. 6063) on August 27, 2008 and second observation was on September 11, 2008. Tens of adults and one larva of Mycetophagidae were under the bark and in woody debris of birch snag infested by mycelium of *Fomes fomentarius* (L. ex. Fr.) Kickx. We also recorded one dead adult of fungus beetle *Litargus connexus* (Foucroy, 1785) and many larvae of Dermestidae. Parameters of dead wood were: 18,3 cm diameter at breast height; beetles and larvae were approximately 1,3 m above ground on the top of snag; bark thickness was 0,3 cm; height of snag was 1,4 m; distance from swamp was 150 m; sample strip was around whole snag circuit; group structure of stand and medium gradient of sun exposure; no fruiting body of fungi; good stage of bark peeling; underbark substrate stage was dry and bast was totally crumble; bark coverage was 90%.

DISCUSSION

Platydema violaceum

We found *P. violaceum* in typical secondary biotope – under the bark of poplar hybrid (in middle stage of decay) from 1960's. One was in riparian stand probably with no continuity of tree stand to the past. These line stands were planted as erosion control measures and expeditious source of timber. The second stand was typical ligniculture (silviculture with short rotation period), which were frequently planted in Czech Republic. These lignicultures are almost in open canopy, high gradient of sun-exposure, and had to be expeditious source of timber in future.

Quite interesting is record from hybrid poplars. We found no development stages, gregarious adults were probably ready to overwinter. Dry environment and no mycelium in the second record are illustrative. In the first record was interesting gregarious concentration of adults. Crawson and Elis (1968) described this behaviour in adults and larvae of *Dendrophagus crenatus* (Paykull, 1799). Beetles of *P. violaceum* were concentrated near fruiting body of bracket fungi and medium wet environment, which not corresponded with typical overwintering strategy. *P. populicola* is a bracket fungus, which is parasite of poplars. This fungus infested trees through lesion after breaked limbs or buttress damage, this fungus caused white type of rot (Černý 1989).

The record is probably the easternmost in Bohemia. The first mentioned tree was cut down and removed from locality in winter 2006. The snag from the second locality was near protected area Bažantnice v Uhersku and lost the bark. *P. violaceum* was not found again till this time.

Both records were situated into close-to-nature area of meandered river Loučná and its floodplain. This area is one of the most maintained environment areas in Eastern Bohemia. Landscape is mosaic of people low-impact land use, continuous forest stands, meandered river, swamps and pastures. In this area there are distributed many redlisted species – strong population of *C. cinnaberinus*, another beetles are *Cetonischema aeruginosa* (Drury, 1770), *Oxythyrea funesta* (Poda, 1761), *Osmoderma barnabita* Motschulsky, 1845, *Trichius fasciatus* (Linnaeus, 1758), *Tropinota hirta* (Poda, 1761), *Agrilus ater* (Linnaeus, 1767), *A. suvorovi populneus* (Schaefer, 1946), *Cicindela campestris* Linnaeus, 1758, *Carabus scheidleri* Panzer, 1799, *Ampedus nigerrimus* (Lacordaire, 1835), *Endomychus coccineus* (Linnaeus, 1758), *Acalles fallax* (Boheman, 1844), *Onyxacalles pyrenaicus* (Boheman, 1844)

Rutera hypocrita (Boheman, 1837); and also vertebrates (birds – *Columba oenas*, *Pernis apivorus*, *Riparia riparia*, mammals – *Lutra lutra*, *Pipistrellus pipistrellus*, fishes – *Lapetra planeri*, reptiles – *Lacerta agilis* or

amphibians – *Bombina bombina* etc.) and vascular plants (e.g. *Arum maculatum*, *Centaurium pulchellum*, *Thalictrum lucidum*) (Lemberk 2008a, Pelikán 2008, Šafářová 2008, Jar. Jelínek and M. Mikát, pers. comm. and our pers. observ.).

This area is now jeopardized by construction of highway and flood control precautions.

Mycetophagus fulvicollis

This beetle occurs in birch dominated stand mixed with aspens and old branched oaks. This stand is probably continuous forest stand more before than second half of 18th century. This was based on old Josef's maps of Bohemia from 1764-1768 and validate by František's maps from 1819-1858 and verify in the field with presented and dominated autochthonous tree species (sensu Boukal 2008). This stand was probably sometimes disturbed, e.g. by construction of railway and occasional fires, but never was deforested. This remnant is near great complex of east bohemian forests and is connected with swamp, wet meadows (former pastures). This area was probably pasture ground, the swamp grows from pond that dissolved after construction of railway. Whole area is now island inside AgroEnvi landscape and intensive managed forests. Many redlisted species are also distributed in this area – butterflies *Phengaris teleius* (Bergsträsser, 1779), *P. nausithous* (Bergsträsser, 1779), *Argynnis adippe* (Denis & Schiffermüller, 1775); beetles *Cassida murraea* Linnaeus, 1767, *Coraeus elatus* (Fabricius, 1787), *Oxythyrea funesta* (Poda, 1761); vertebrates (reptiles – *Lacerta vivipara*, amphibians – *Hyla arborea*, *Bombina bombina* etc.) and vascular plants (e.g. *Iris sibirica*, *Gentiana pneumonanthe* (today is extinct), *Thalictrum lucidum*, *Epipactis palustris*, *Orchis morio*, *Carex davalliana*, *Laserpitium pruthenicum*, *Silaum silaus*) (Horák et al. 2008, Lemberk 2008b, L. Bureš and L. Šafářová pers. comm. and our pers. observ.).

This locality is jeopardized by construction of highway branch.

We found many adults and larvae in dead birch snag. Under the bark, there were dry environment and woody debris, in the rest of the wood were many small holes from galleries of another insect. Near snag lies rest of tree and on this log were three dying bodies of *F. fomentarius*. Under the bark of this log was wet environment and *M. fulvicollis* absented. We found only two larvae of elaterids (Elaterinae) and earthworms. *F. fomentarius* is a bracket fungus, which is saproparasite of many tree species (mostly beeches, birches and poplars). This fungus infested trees through lesion after breaked limbs or buttress damage, and caused also white type of rot (Černý 1989). Fruiting bodies of *F. fomentarius* are biotopes for threatened beetle species (e.g., Hågvar 1999).

CONCLUSIONS

Both these species are charismatic invertebrate candidates as an umbrella species for the protection of natural habitats with large quantities of dead wood and it's neighbouring. Both are vulnerable in Czech Republic (Jelínek 2005, Novák 2005) and redlisted in many other countries or Europe (Jäch 1994, Geiser 1998, Rassi et al. 2001, Gärdenfors 2005).

P. violaceum occurs most in floodplain forests in warmer areas and its neighbours. We found *P. violaceum* in non-continuous tree stands in floodplain biotope with quantities of dead wood within landscape of people low-impact land use. There are only a few undisturbed forests in floodplains in central Europe. The floodplain of river Loučná is relatively fair area, but with large areas of poplar hybrid solitaires, alleys and stands. Many native tree species are still presented here. *M. fulvicollis* is indicated as relict of undisturbed forest habitats. We found *M. fulvicollis* in continuous open canopy forest stand, exactly remnant of former pasture woodland, sometimes probably disturbed (e.g. by fire). Interesting was high abundance of adults in relatively low diameter snag. Whole localities are nowadays jeopardize by construction of highways and flood control precautions.

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SOUHRN

Platydema violaceum a *Mycetophagus fulvicollis* jsou nápadní a dobře poznatelní brouci, kteří by mohli patřit mezi deštníkové druhy pro ochranu přírodě blízkých stanovišť s množstvím mrtvého dřeva. Oba druhy jsou uvedeny v červeném seznamu ČR jako ohrožené, a jsou také na červených seznamech většiny Evropských zemí. Kromě toho byla na stanovištích a v jejich nejbližším okolí zaznamenána vysoká druhová pestrost dalších ohrožených druhů organismů.

P. violaceum se vyskytuje většinou v lužních lesích teplejších oblastí a v jejich nejbližším okolí. My jsme našli tento druh v nekontinuálních porostech na lužních stanovištích s množstvím mrtvého dřeva v lokalitách, které jsou součástí území, ve kterém se zachovala místa šetrně obhospodařovaná. Ve střední Evropě jsou již jen zbytky málo narušených lužních stanovišť. Okolí řeky Loučné se vyznačuje relativní zachovalostí krajinného rázu a druhovou bohatostí fauny a flóry. Vyskytují se zde i četné výsadby hybridních topolů, které jsou zdrojem velkého množství mrtvého dřeva. Stále se zde vyskytuje řada původních druhů dřevin.

M. fulvicollis je uváděn jako relikv málo narušených lesních stanovišť. My jsme tento druh našli v kontinuálním zbytku remízovitého charakteru. S velkou pravděpodobností jde o zbytek porostu, který byl dříve pasen dobyt看em a místy vypálen požárem z blízké železnice. Zajímavá byla početnost dospělců v poměrně malém březovém pahýlu.

Studované lokality jsou v současné době vážně ohroženy stavbou rychlostní silnice a jejich přivaděčů, a také protipovodňovými opatřeními. Zřejmě nevyhnutelný je v budoucnu zánik velmi cenných přírodních lokalit.

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PICTURE ATACHEMENT



Adult of *Mycetophagus fulvicollis*.



A birch snag – microhabitat of *Mycetophagus fulvicollis*.



The swamps of Sruby is an area of meadows, shrubs, former pastures, swamps and forest remnant near great complex of east bohemian forests.



An interior of forest remnant with swamp and dead wood.



Western part of swamps in the winter.



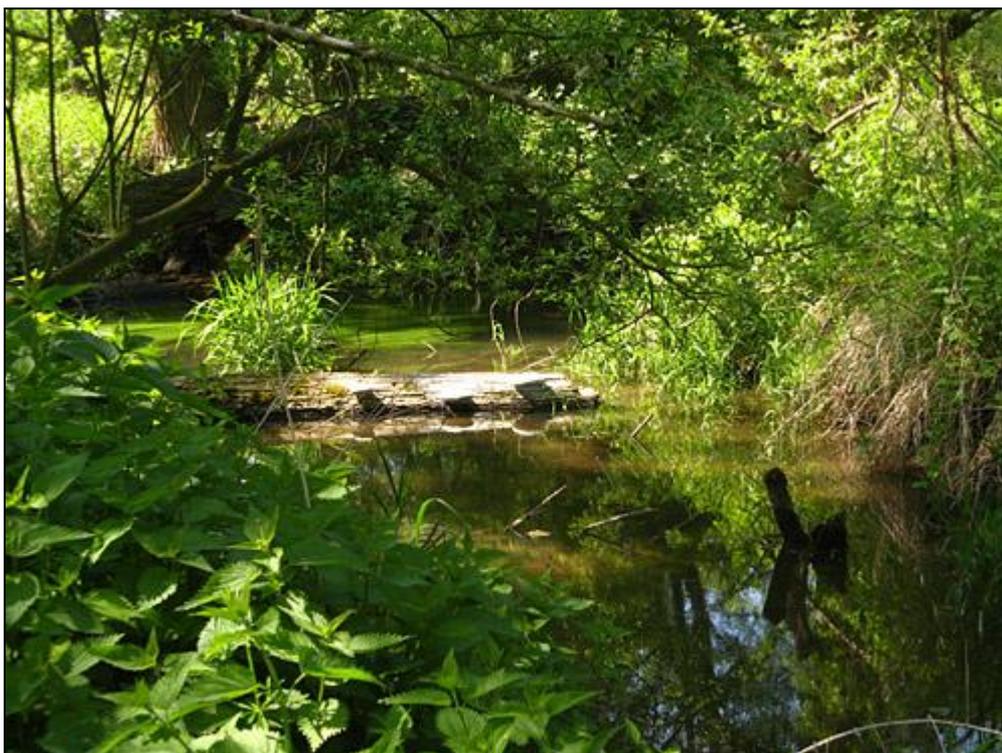
Quantities of dead wood with dead fruiting bodies of fungi provide habitat for many saproxylic species.



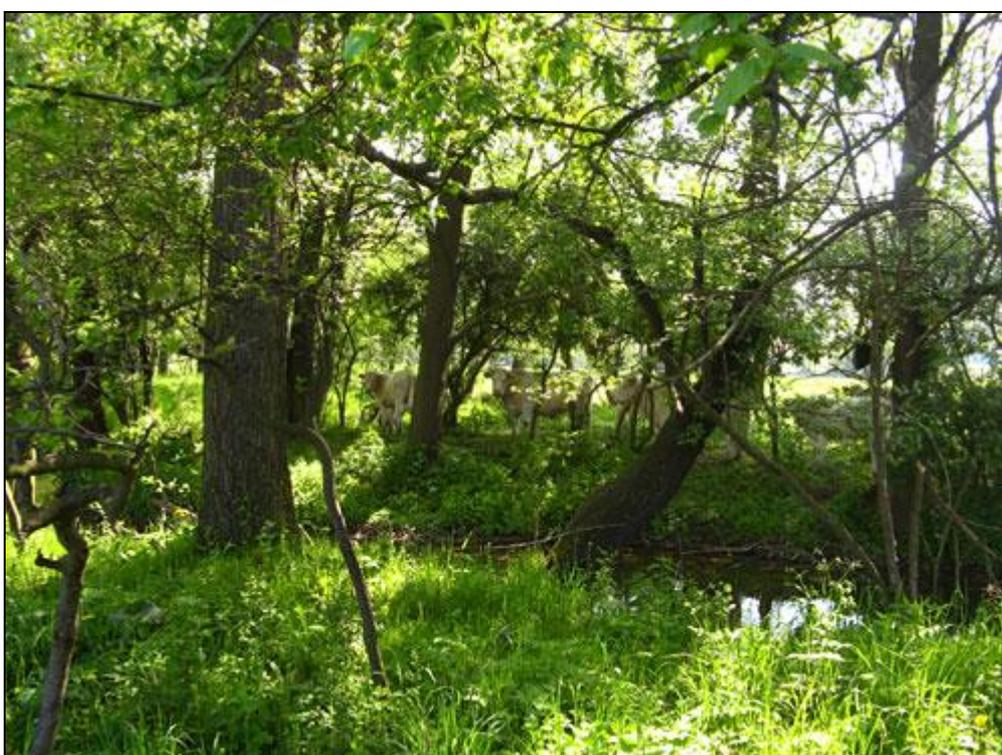
Adult of *Platydema violaceum* (author S. Krejčík, www.meloidae.com).



Dead poplar stem – microhabitat of *Platydema violaceum*.



Meandered river Loučná provides large scale of habitats.



In surrounding of Loučná is still presented pasture of horses and cows.



Dead wood of poplar hybrids simulate vanishing microhabitats of soft-wooded and broadleaved trees.