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INSECT SPECIES COMPOSITION ON EUROPEAN CHESTNUT (*Castanea sativa* Mill.) DURING FLOWERING IN SELECTED LOCALITIES IN SLOVAKIA

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ABSTRACT. *The European chestnut (Castanea sativa Mill.) belongs to first introduced tree species in Slovakia. Despite being not permanent element of the Slovak flora, a different scale of insect species is associated with this plant. The paper presents, for the first time, an investigation of the insect species linked with chestnut trees in Slovakia. The monitoring of insect species composition on chestnut during the phenological growth stage of flowering was carried out in June and July 2014. Trapping and monitoring of insects was accomplished during the blooming period of flowers (catkins) on selected chestnut individuals. The research was conducted on 5 Slovakian localities: Arboretum Mlyňany, Nitra, Modrý Kameň, Dolné Plachtince and Príbelce. We recorded 70 insect species in the selected localities. They belonged to five orders (Coleoptera, Hymenoptera, Diptera, Heteroptera and Lepidoptera) and 33 families. Beetles (order Coleoptera) were the most diverse insect group with 31 species. In terms of number of individuals, orders Hymenoptera (especially Apis mellifera Linnaeus 1758 and genus Bombus sp.) and Diptera were most abundant. The most abundant were groups of insects with chewing and sucking mouth parts.*

KEY WORDS: *chestnut, blooming, insect, species diversity, pollination.*

INTRODUCTION

Tree species from the family *Fagaceae,* to which the European chestnut (*Castanea sativa* Mill.) belongs, are known for their large biodiversity and

abundance of insect species. For various insect species parts of the tree, as leaves, flowers, fruits, nuts, bark, roots and wood, provide food, habitat, shelter, reproduction site, etc. The male flowers of chestnut are very aromatic and attractive for some insects, which collect pollen or feed on pollen. Insects are important pollinators of chestnut and significantly increase the quality and quantity of nuts and the total yield. In some cases, the presence of local population of some insect species are crucial for the reproduction of chestnut (Oliveira et al. 2001, Opler 1977). The most of flower-visiting adult insects belong to the bees, wasps, flies, butterflies, moths and certain beetles. They gain nutrition from floral nectar and pollen and a few from petal tissue. Occasionally, adults from other orders also feed on floral food (Krenn et al. 2005, Manino et al. 1991).

The harmful entomofauna on chestnut has already been studied in the conditions of Slovakia and belonging to the order of *Lepidoptera, Coleoptera*, *Hymenoptera* and *Diptera* (Juhásová et al. 2012). Insect pests, which damage chestnut shoots and leaves, are caterpillars of polyphagous species as *Tischeria ekebladella* (Bjerkander 1795), *Cydia splendana* (Hübner, 1799), *C. fagiglandana* (Zeller, 1841)*, Pammene fasciana* (Linnaeus, 1761), *Curculio elephas* (Gyllenhal, 1836) and monophagous gall wasp *Dryocosmus kuriphilus* Yasumatsu, 1951 (Juhásová et al. 2010; Pástor et al. 2017). Research on these harmful pests are needed for the correct management of chestnut trees (Ovcharov et al. 2007). Chestnut wood is attractive for other insect species such as *Trypodendron signatum* Fabricius, 1787, *Cerambyx* sp., *Rhagium* sp., *Plagionotus* sp. (Holecová 2012, Ovcharov et al. 2007). In old trees the life cycle of *Lucanus cervus* L. takes place (Chiari et al. 2014). Trunk feeders, such as *Synanthedon castaneae* (*Sesiidae*), have been reported as attacking the trunks of trees, preferably in bruised areas (Snow & Eichlin 1986). Moreover it is potential dispersal agent of the *Cryphonectria parasitica* hypovirulent fungal strain (Juhásová 1999). Other insects, particularly wood-boring beetles and solitary bees *(Apoidea)* are attracted to its fragrant white flowers, where they feed on pollen (Opler 1977).

Current data on insect species composition and diversity on *Castanea sativa* are too old or scarce in the scientific literature (Juhásová 1999, Juhásová et al. 2012). Moreover, they are often oriented only on Mediterranean countries and usually investigating the same economically important species (Giovanetti & Aronne 2011).. Therefore, this study would like to fill the missing research gap and to bring new data on insect species

composition on chestnut which may have ecological or beneficial importance in nature conservation. The main aim of the study is to present a summary of the investigations of the species composition during chestnut flowering period.

MATERIAL AND METHODS

The monitoring of entomofauna on chestnut was carried out in June and July 2014 in the phenological phase of flowering (10.06.2014 – 02.07.2014) in five localities: Arboretum Mlyňany (48°19'10" N, 18°22'07" E), Nitra (48°18'25" N, 18°5'11" E), Modrý Kameň (48°14' 24" N, 19° 19' 59" E), Plachtince (48°13'37" N, 19°17'32" E) and Príbelce (48°11'48" N, 19°15'42" E). These localities are situated in regions, where chestnut has its optimal growing conditions (Benčať 1960). The insects were collected with the help of a sweeping net directly from the flowering branches. After being collected, the samples were preserved in ethyl acetate and fixed in acetic acid (8 %). The identification of insect species was carried out with the help of following determination keys Emden (1954), Coe (1953), Fonseca (1968), Benson (1952), Eady and Quinlan (1963), Bense (1995), Warchalowski (1978), Mroczkowski (1954), Stebnicka (1978) and related websites (http://www.coleo-net.de/coleo/index.htm http://www.lepidoptera.cz/klic). The nomenclature of the taxa is given according to the Fauna Europaea Web Service (2014). The collected material was also evaluated in the frame of the Slovakian red list (Holecová et Franc 2001).

RESULTS

During our research we recorded 70 insect species (Table 1). They belong to five orders (*Coleoptera, Hymenoptera, Diptera, Heteroptera* and *Lepidoptera*) and 33 families (Fig.1, Fig. 2). The order *Coleoptera* was the most diverse (31 species). From this order the most abundant genus is *Anthremus* and species from the family *Cetoniidae*. The least diverse order was *Lepidoptera* represented only by 5 species. As regards to abundance and pollinating activity, orders as *Hymenoptera* (mostly *Apis mellifera* Linnaeus 1758, genus *Bombus sp.)* and *Diptera* were also significant. We observed insect pests from the family *Curculionidae* damaging the leaves, especially *Polydrusus impar* Gozis, 1882, *Polydrusus viridicinctus* Gyllenhal, 1836 and *Curculio glandium* Marsham, 1802, but we collected

Table 1. Checklist of insect species recorded on chestnut flowers (AM – Arboretum Mlyňany, PR – Príbelce, MK – Modrý Kameň, NR – Nitra, PL – Dolné Plachtince).

Order	Family	Taxon	Locality
Coleoptera	*Cerambycidae*	*Pachytodes erraticus* (Dalman 1817)	AM, PR, MK
		Stenurella bifasciata (Muller 1776)	AM, NR
		Clytus arietis (Linnaeus 1758)	PL
		Chlorophorus figuratus (Scopoli 1763)	PR
	Elateridae	*Adrastus rachifer* (Fourcroy 1785)	AM
		Limonius poneli Leseigneur & Mertlik, 2007	AM
		Agrypnus murinus (Linnaeus 1758)	PL
	Mordellidae	*Mordellistena humeralis* (Linnaeus 1758)	AM
		Mordellistena neuwaldeggiana (Panzer 1796)	AM
	Curculionidae	*Polydrusus impar* Gozis 1882	AM
		Anthonomus rubi (Herbst 1795)	AM
		Curculio glandium Marsham 1802	NR
		Polydrusus viridicinctus Gyllenhal, 1834	MK
	Nitidulidae	*Brassicogethes aeneus* (Fabricius 1775)	AM, NR
		Epuraea biguttata (Thunberg 1784)	NR
	Tenebrionidae	*Stenomax aeneus* (Scopoli 1763)	AM
	Scraptiidae	*Anaspis frontalis* (Linnaeus 1758)	AM, NR
	Oedemeridae	*Oedemera podagrariae* (Linnaeus 1767)	AM, PR, MK
	Cetoniidae	*Protaetia cuprea* (Fabricius 1775)	AM, NR
		Cetonia aurata (Linnaeus 1761)	AM, NR, PR, MK, PL
		Trichius sexualis Bedel 1906	NR
		Oxythyrea funesta (Poda 1761)	MK

Continued on the next page

Table 1. (continued).

Order	Family	Taxon	Locality
	Coccinellidae	*Adalia bipunctata* (Linnaeus 1758)	NR
		Calvia quatuordecimguttata Linnaeus 1758	MK
	Chrysomelidae	*Altica quercetorum* Foudras 1860	NR
	Cantharidae	*Cantharis pallida* Goeze 1777	NR
	Dermestidae	*Anthrenus verbasci* (Linnaeus 1767)	NR, MK
		Anthrenus scrophulariae (Linnaeus 1758)	NR
		Attagenus unicolor (Brahm 1791)	NR
	Cleridae	*Trichodes apiarius* (Linnaeus 1758)	MK
	Malachiidae	*Axinotarsus marginalis* (Laporte de Castelnau 1840)	MK
Hymenoptera	*Tenthredinidae*	*Athalia rosae* (Linnaeus 1758)	AM
	Apidae	*Apis mellifera* Linnaeus 1758	AM, NR, PR, MK, PL
		Bombus lapidarius (Linnaeus, 1758)	AM
		Bombus lucorum (Linnaeus, 1761)	MK
		Bombus terrestris (Linnaeus 1758)	PL
		Andrena tibialis (Kirby 1802)	AM, MK
		Andrena flavipes Panzer 1799	AM, NR
		Andrena vaga Panzer 1799	AM
		Andrena pandellei Perez 1903	NR
		Andrena proxima (Kirby 1802)	NR
		Andrena minutula (Kirby 1802)	NR
		Cephus pygmeus (Linnaeus 1767)	AM
	Cynipidae	*Cynips quercusfolii* Linnaeus 1758	NR
	Halictidae	*Lasioglossum sexstrigatum* (Schenck 1869)	NR
		Lasioglossum nitidulum (Fabricius 1804)	MK
	Formicidae	*Camponotus ligniperdus* (Latreille, 1802)	PR

Table 1. (continued).

Order	Family	Taxon	Locality
Heteroptera	*Miridae*	*Closterotomus biclavatus* (Herrich-Schäffer 1835)	AM
	Lygaeidae	*Orsillus depressus* (Mulsant & Rey 1852)	AM
		Kleidocerys resedae (Panzer 1797)	NR
	Coreidae	*Coriomeris affinis* (Herrich-Schäffer 1839)	AM
		Coreus marginatus (Linnaeus 1758)	PL
	Pentatomidae	*Palomena prasina* (Linnaeus 1761)	AM
		Graphosoma lineatum (Linnaeus 1758)	NR, MK, PL
Diptera	*Tachinidae*	*Tachina fera* (Linnaeus 1761)	AM
		Leskia aurea (Fallen 1820)	MK
	Calliphoridae	*Chrysomya albiceps* (Wiedemann 1819)	AM
	Syrphidae	*Melanostoma scalare* (Fabricius 1794)	AM
		Syritta pipiens (Linnaeus 1758)	AM
		Eupeodes luniger (Meigen 1822)	AM
		Episyrphus balteatus (De Geer 1776)	AM, NR, PR
		Sphaerophoria scripta (Linnaeus 1758)	AM
	Anthomyiidae	*Hylemya variata* (Fallen 1823)	NR
	Tephritidae	*Oxyna parietina* (Linnaeus 1758)	NR
	Muscidae	*Achanthiptera rohrelliformis* (Robineau-Desvoidy 1830)	PL
Lepidoptera	*Nymphalidae*	*Maniola jurtina* (Linnaeus 1758)	AM
		Aglais io (Linnaeus 1758)	PL
		Melanargia galathea (Linnaeus 1758)	PL
	Noctuidae	*Acontia trabealis* (Scopoli 1763)	MK
	Erebidae	*Amata phegea* (Linnaeus 1758)	PL

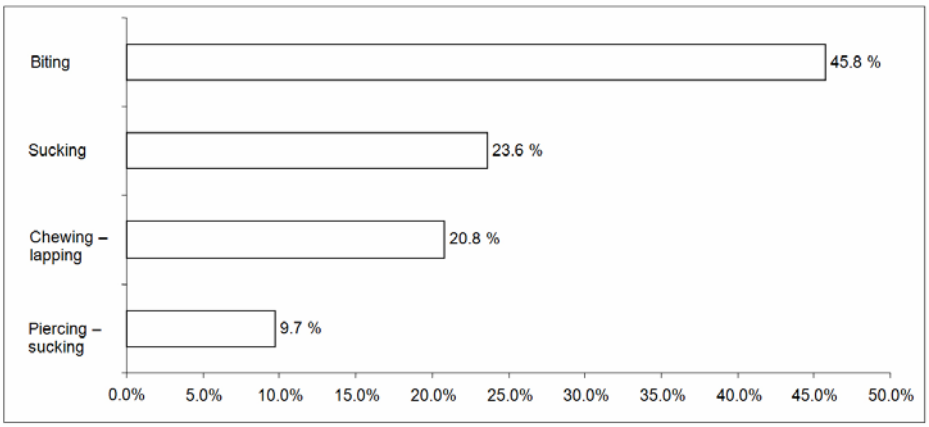

Figure 1. Percentual distribution of insect species into orders

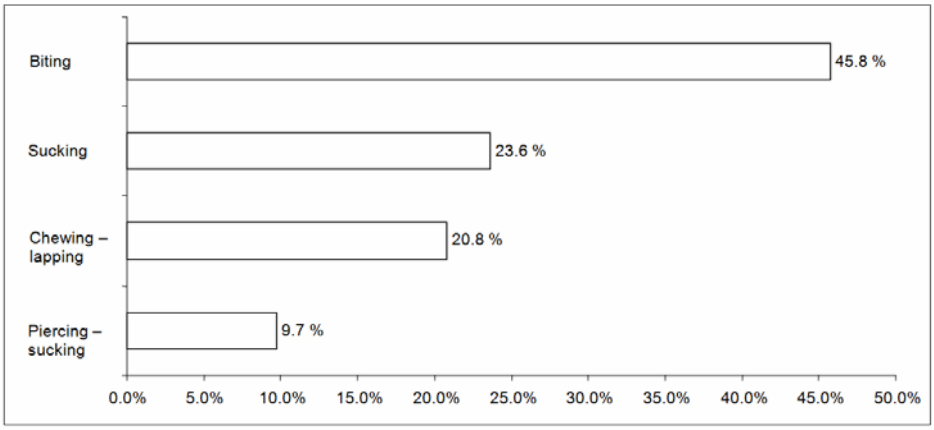

Figure 2. Percentual distribution of insect species according structure and function of mouthparts.

them from flowers. We also observed several polyphagous species (*Cerambycidae*). From the view of conservation biology we also recorded the following categories of insect species: (VU) vulnerable – *Potosia cuprea obscura* Andersch, 1797; (NT) near threatened – *Potosia cuprea metallica* Herbst, 1782 and (EN) endangered – *Trichius sexualis* Bedel 1906.

We divided the recorded species into 4 groups according to the structure and function of mouthparts (Fig. 2). The groups are the following ones: a)

biting b) sucking c) chewing – lapping d) piercing – sucking. The most abundant insect species were the ones with biting and sucking mouthparts.

DISCUSSION

Our findings are comparable to Manino et al. (1991) and Porsch (1950), who found similar pollinator species during their monitoring of different cultivars of European chestnut (*Castanea sativa* Miller), Japanese chestnut (*C. crenata* Sieb. et Zucc.), and their Euro-japanese hybrids in Italy and Germany, such as *Aglais io* Linnaeus, 1758, *Maniola jurtina* Linnaeus, 1758, *Melanargia galathea* Linnaeus, 1758, *Cetonia aurata* Linnaeus, 1761, *Chlorophorus* sp., *Bombus terrestris* Linnaeus, 1758, *Andrena* sp. Our findings were very similar: the honeybees resulted to be the most abundant insects species, followed by beetles. Honeybees tend to disregard chestnut blossoming if more attractive flowers are available (McKay et McGregor, 1974), which was not the case on our lacalities. Our findings are similar to Manino et al. (1991) that about the half of the insects observed on chestnut flowers was represented by honeybees.

Peverieri et al. (2017) investigated the insects species associated with sweet chestnut and listed more than 150 phytophagous insects species feeding on *Castanea* spp. He noticed that 62 % are native of East Asia, particularly China but also Japan and Korea, while the other 38 % live in North America (mainly USA). The majority belongs to the order *Lepidoptera* (46 %) followed in order of frequency by *Coleoptera* (26 %) and *Hemiptera* (13 %), while *Diptera*, *Heteroptera* and *Hymenoptera* are much less common. Peverieri et al. (2017) also mentioned, that defoliating insects are the most consistent trophic group (38 %), whereas the seed-feeders, the xylophagous, the sap-sucking and all the others are in order less represented being the first two categories respectively 22 % and 16% of the total, while the last two groups collected only 24 %.

When establishing new chestnut plantations, pollination requirements must not be overlooked, because chestnut is nearly completely self-sterile (Solignat et Chapa, 1975, McGregor, 1976). As regards the pollination process, flower morphology and pollen characteristics do not allow to affirm definitively whether the chestnut is anemophilous or entomophilous (Bergougnox et al., 1978). Chestnut represents significant terrestrial refuge and temporary habitat for numerous insect species, especially in the

blooming period and our ecological research has highlighted the considerable importance of *Castanea sativa* on insect biodiversity conservation.

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