

Species composition of Cicada (Auchenorrhyncha) communities on the surrounding vegetation of apple orchards in Hungary

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BLEICHER K., MARKÓ V. & OROSZ A.: *Species composition of Cicada (Auchenorrhyncha) communities on the surrounding vegetation of apple orchards in Hungary.*

Abstract: Species richness and composition of cicada (Auchenorrhyncha) assemblages were investigated in differently treated (conventional, IPM, organic and abandoned) apple orchards and their surroundings in Hungary in years 1999 and 2000. In the present paper - as part of a larger survey - data on cicada species found on the surrounding vegetation of the investigated apple orchards are given. In two investigated areas (Nyírtura and Szigetcsép) three Malaise traps were placed. One inside of the apple orchard, one in the adjacent woodland and one between the apple orchard and the woodland (named edge). In Vámosmikola two Malaise traps were placed inside of the apple orchard, one in the adjacent woodland and two in the edge. Altogether 10 146 individuals had been collected in the open, bushy edges and woodlands adjacent to apple orchards, belonging to 109 species. The species richness of cicadas varied between 47 and 67. The species occurring with high relative abundance, in decreasing order, were the following: *Eupteryx calcarata*, *Kybos virgator*, *Empoasca decipiens*, *Eupteryx cyclops*, *Eupteryx atropunctata*, *Ribautiana tenerrima*, *Edwardsiana rosae*, *Eupteryx stachydearum*, *Kybos populi*, *Edwardsiana crataegi* and *Edwardsiana lamellaris*.

Keywords: cicada, Auchenorrhyncha, apple, edge, surrounding vegetation, species richness, composition

Introduction

Species richness and composition of cicada (Auchenorrhyncha) assemblages were investigated in differently treated (conventional, IPM, organic and abandoned) apple orchards in Hungary in years 1999 and 2000 (BLEICHER et al 2006). In the present paper - as part of this survey - data of cicada species found on the surrounding vegetation of the investigated apple orchards are given.

Number of species collected during faunal surveys of Hungarian natural ecosystems varied between 67 and 226 (OROSZ 1981, 1983, 1996, 1997, 1999, 2002). GYÖRFFY (1980, 1987, 1993), GYÖRFFY and KINCSEK (1987-1988), GYÖRFFY and SZÖNYI (1989), and GYÖRFFY and ABDAI (1996) reported between 38 and 183 species from different grassland areas. As a result of nearly ten year long complex ecological studies in grasslands by GALLÉ and others (1985) almost 200 cicada species had been found. The cicada assemblages in the semi-natural vegetation adjacent to agricultural fields have not been studied until now in Hungary. The results of the present investigation give additional data to the knowledge of the Hungarian Auchenorrhyncha fauna.

Material and methods

The samples were collected by Malaise traps in the surroundings of three apple orchards in Hungary in years 1999 and 2000. In two investigated areas (Nyírtura and Szigetcsép) three Malaise traps were placed. One inside of the apple orchard, one in the adjacent woodland and one between the apple orchard and the woodland in the open, bushy edge vegetation (named edge). In Vámosmikola two Malaise traps were placed inside of the apple orchard, one in the adjacent woodland and two in the edge.

In the present paper data of cicada species found in the surrounding vegetation are given. The faunal list of cicada species collected in the apple orchards is given by BLEICHER et al (2006). Malaise traps (TOWNES 1972) resembled a tent with four open sides and four fine, white mesh panels below a conical mesh top (size of the panels: 2 m high, 1.25 m wide, total area of the four panels: 10 m²). The traps between the adjacent woodland and the orchard were placed at 20-25 m distance from the edge of the orchard. The traps were continuously operated from late April or early May to October and were emptied three times a week.

The orchards located in different environments: there was a lowland area with flooded forest (Szigetcsép), a lowland area with agricultural fields (Nyírtura), and a hilly area with forests (Vámosmikola). The exact geographical co-ordinates of the orchards were as follows: Vámosmikola (Lat. 47° 58.4' N, Long. 18° 49.3' E) (two neighbouring, conventionally treated apple orchards), Szigetcsép (Lat. 47.0° 15.0' N, Long. 18° 58.3' E) (conventionally treated apple and pear orchards), Nyírtura (Lat. 48° 0.2' N, Long. 21° 49.5' E) (organic apple orchard). The resolution of geographic coordinate distribution is about 0.1 min in latitude and longitude. That means about 130 m and 200 m of accuracy in the E-W and N-S directions, respectively.

The apple orchard in Szigetcsép was situated near by the river Danube. The vegetation of the woody area, which surrounded the orchard, was composed of *Populus* and *Salix* species, mainly *P. tremula* and *S. alba*, rarely *P. alba*, mainly with *Sambucus nigra* and *Rubus caesius* in the shrub layer. There were also other fruit orchards in the surrounding: pear, apricot, peach, cherry and sour cherry. The orchard in Nyírtura was surrounded by a plantation of *Populus x canadensis*. The orchard in Vámosmikola was surrounded by forests with *Quercus* species, mixed with *Robinia pseudoacacia*.

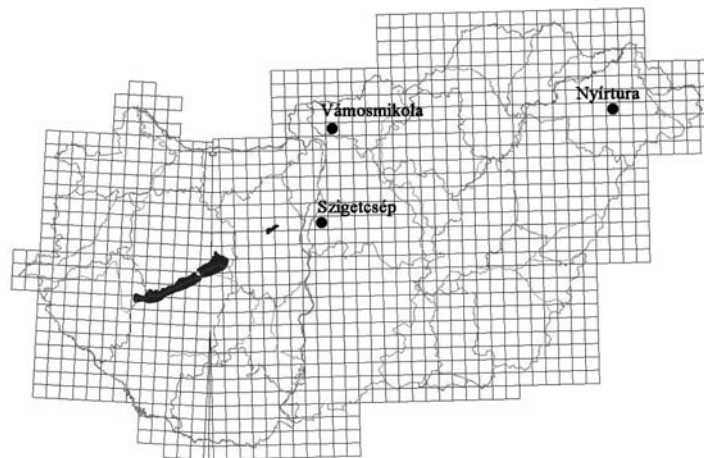


Figure 1. The investigated areas on UTM map

In the conventionally treated orchards - in Szigetcsép and Vámosmikola - broad-spectrum insecticides: mainly organophosphorous insecticides and some pyrethroids, organochlorine and carbamate compounds were used. In organic orchard - in Nyírtura - only "green" pesticides were used containing copper and sulphur. In abandoned orchards were not used any pesticides.

The localities of the investigated areas are shown on UTM map in Fig. 1.

The commonness of the cicada species in the surroundings of the orchards was approached in three ways: (1) by counting the proportion of individuals of a species in the total catch of the areas; (2) by calculating the sum of the scores, where the seven most abundant species collected in one area were placed in decreasing order, and the dominant species, with highest relative abundance scored 7, the second one 6 etc. The scores from different orchards were summarized by species. (3) Thirdly, the presence or absence of the species in the surrounding of the orchards was investigated.

The identification of the collected cicadas based on the works of OSSIANNILSSON (1978, 1981, 1983) and RIBAUT (1936, 1952). The males were identified on species and most of the female individuals on genus level. In Table 1 the data identified on genus level are shown only, if male individuals belonging to that genus have not been collected in the investigated orchard. The scientific names of the cicadas in present paper follow the nomenclature compiled by HOLZINGER et al. (1997).

Results and discussion

Altogether 10 146 individuals belonging to 109 species had been found in the Malaise traps in the surrounding of three investigated apple orchards. The list of the collected cicada species is shown in Table 1.

The number of collected specimens in the three investigated areas and the total species richness are given in Table 2. The species richness varied between 47 and 67. The average species richness was 57. The relative abundance values and total scores of species are shown in Table 2. The most common species in the investigated areas, in decreasing order of their relative abundance (%) in the total catch were the followings: *Eupteryx calcarata* (37.5 %), *Kybos virgator* (11 %), *Empoasca decipiens* (11 %), *Eupteryx cyclops* (11 %), *Eupteryx atropunctata* (5.5 %), *Ribautiana tenerrima* (4.8 %), *Edwardsiana rosae* (2.3 %), *Eupteryx stachydearum* (1.8 %), *Kybos populi* (1.5 %), *Edwardsiana crataegi* (1.3 %) and *Edwardsiana lamellaris* (1.1%). These 11 species comprised 90 % of the total catch.

The species, which dominated the cicada assemblages in the three habitats (with the total scores) collected by Malaise traps, were: *Eupteryx calcarata* (17), *Empoasca decipiens* (17), *Kybos virgator* (8), *Eupteryx atropunctata* (8), *Kybos populi* (8), *Eupteryx cyclops* (6), *Edwardsiana crataegi* (5), *Ribautiana tenerrima* (4), *Empoasca solani* (3), *Cicadella viridis* (3), *Edwardsiana rosae* (2) and *Hephathus nanus* (2).

The species *Eupteryx calcarata*, *Edwardsiana crataegi*, *Kybos virgator*, *Empoasca decipiens*, *Edwardsiana rosae*, *Kybos populi*, *Eupteryx atropunctata*, *Eupteryx cyclops*, *Ribautiana tenerrima*, *Eupteryx stachydearum*, *Empoasca solani* and *Cicadella viridis* were found in all three areas (Table 1).

It can be concluded, that during our study in the surroundings of apple orchards, the most frequently found species were *Eupteryx calcarata*, *Kybos virgator*, *Empoasca decipiens*, *Eupteryx cyclops*, *Eupteryx atropunctata*, *Ribautiana tenerrima*, *Edwardsiana rosae*, *Kybos populi* and *Edwardsiana crataegi*.

Table 1. List of cicada species collected in the surroundings of the apple orchards, and years of collection.

	Nyírtura 1999 - 2000 ORG	Szigetcsép 1999 - 2000 CON	Vámosmikola 1999 - 2000 CON, IPM
Cercopidae			
<i>Aphrophora alni</i> (Fallén, 1805)		1999	1999, 2000
<i>Aphrophora salicina</i> (Goeze, 1778)		1999	
<i>Cercopis sanguinolenta</i> (Scopoli, 1763)		1999, 2000	
<i>Lepyronia coleoptrata</i> (Linnaeus, 1758)	1999		
<i>Neophilaenus lineatus</i> (Linnaeus, 1758)	1999		1999, 2000
<i>Philaenus spumarius</i> (Linnaeus, 1758)	1999, 2000		1999, 2000
Cicadellidae			
<i>Aguriahana stellulata</i> (Burmeister, 1841)			1999
<i>Alebra albostriella</i> (Fallén, 1826)			1999, 2000
<i>Alebra neglecta</i> Wagner, 1940			2000
<i>Allygidius atomarius</i> (Fabricius, 1794)		1999	
<i>Allygidius furcatus</i> (Ferrari, 1882)		1999	
<i>Allygidius abbreviatus</i> (Letierry, 1878)			2000
<i>Allygus modestus</i> Scott, 1876	1999		
<i>Allygus</i> sp.	1999		
<i>Alnetoidia alneti</i> (Dahlbom, 1850)		2000	1999, 2000
<i>Anaceratagallia ribauti</i> Ossiannilsson, 1938	1999		2000
<i>Anaceratagallia</i> sp.	2000	2000	
<i>Anaceratagallia venosa</i> (Fourcroy, 1785)			2000
<i>Anoplotettix horvathi</i> Metcalf, 1955		1999	
<i>Aphrodes bicincta</i> (Schrank, 1776)	1999	2000	1999, 2000
<i>Arboridia parvula</i> (Boheman, 1845)		1999, 2000	1999
<i>Arboridia velata</i> (Ribaut, 1952)			2000
<i>Balclutha punctata</i> (Fabricius, 1775)	1999		2000
<i>Balclutha rhenana</i> Wagner, 1939	1999	1999	1999
<i>Chlorita paolii</i> (Ossiannilsson, 1939)			1999
<i>Chlorita viridula</i> (Fallén, 1806)			1999, 2000
<i>Cicadella viridis</i> (Linnaeus, 1758)	1999, 2000	1999	2000
<i>Cicadula placida</i> (Horváth, 1897)		1999, 2000	1999, 2000
<i>Cicadula quadrinotata</i> (Fabricius, 1794)		1999	
<i>Cicadula quinquenotata</i> (Boheman, 1845)			1999
<i>Doratura stylata</i> (Boheman, 1847)	1999		
<i>Edwardsiana avellanae</i> (Edwards, 1888)	1999		
<i>Edwardsiana candidula</i> (Kirschbaum, 1868)		1999, 2000	
<i>Edwardsiana crataegi</i> (Douglas, 1876)	1999, 2000	1999, 2000	1999, 2000
<i>Edwardsiana diversa</i> Edwards, 1914			1999, 2000
<i>Edwardsiana fraterculus</i> Edwards, 1908			2000
<i>Edwardsiana lamellaris</i> Ribaut, 1931			1999, 2000
<i>Edwardsiana plebeja</i> (Edwards, 1914)			1999
<i>Edwardsiana prunicola</i> (Edwards, 1914)			1999, 2000
<i>Edwardsiana rosae</i> (Linnaeus, 1758)	1999, 2000	1999	1999, 2000
<i>Edwardsiana stehliki</i> Lauterer, 1958	1999		
<i>Emelyanoviana mollicula</i> (Boheman, 1845)	2000	1999	1999, 2000
<i>Empoasca decipiens</i> Paoli, 1930	1999, 2000	1999, 2000	1999, 2000
<i>Empoasca rufescens</i> (Melichar, 1896)	1999		

Table 1. List of cicada species collected in the surroundings of the apple orchards, and years of collection.

	Nyírtura	Szigetcsép	Vámosmikola
	1999 - 2000 ORG	1999 - 2000 CON	1999 - 2000 CON, IPM
<i>Empoasca solani</i> (Curtis, 1846)	1999, 2000	1999, 2000	1999, 2000
<i>Empoasca vitis</i> (Göthe, 1875)		1999, 2000	1999, 2000
<i>Eupteryx atropunctata</i> (Goeze, 1778)	1999, 2000	1999, 2000	1999, 2000
<i>Eupteryx aurata</i> (Linnaeus, 1758)			1999
<i>Eupteryx calcarata</i> Ossiannilsson, 1936	1999, 2000	1999, 2000	1999, 2000
<i>Eupteryx collina</i> (Flor, 1861)		1999	1999, 2000
<i>Eupteryx cyclops</i> Matsumura, 1906	2000	2000	1999, 2000
<i>Eupteryx immaculatifrons</i> (Kirschbaum, 1868)			1999, 2000
<i>Eupteryx notata</i> Curtis, 1837			2000
<i>Eupteryx stachydearum</i> (Hardy, 1850)	2000	1999	1999, 2000
<i>Eupteryx urticae</i> (Fabricius, 1803)			1999, 2000
<i>Eupteryx vittata</i> Linnaeus, 1758	1999, 2000	1999, 2000	1999, 2000
<i>Eurhadina concinna</i> (Germar, 1831)			2000
<i>Eurhadina kirschbaumi</i> Wagner, 1937			1999, 2000
<i>Eurhadina pulchella</i> (Fallén, 1806)			1999, 2000
<i>Euscelidius schenkii</i> (Kirschbaum, 1868)	1999	1999	
<i>Euscelidius variegatus</i> (Kirschbaum, 1858)			2000
<i>Fieberiella florii</i> (Stal, 1864)		1999	
<i>Forcipata citrinella</i> (Zetterstedt, 1828)	1999, 2000	1999	
<i>Hephathus nanus</i> (Herrich-Schäffer, 1835)	1999, 2000		
<i>Idiocerus</i> sp.			2000
<i>Idiocerus stigmaticallis</i> Lewis, 1834		1999	
<i>Japananus hyalinus</i> (Osborn, 1900)	1999		1999, 2000
<i>Kyboasca bipunctata</i> (Oshanin, 1871)		1999	1999
<i>Kyboasca butleri</i> (Edwards, 1908)	1999		
<i>Kybos populi</i> Edwards, 1908	1999, 2000	1999, 2000	2000
<i>Kybos virgator</i> (Ribaut, 1933)	2000	1999, 2000	1999, 2000
<i>Macropsis fuscula</i> (Zetterstedt, 1828)			2000
<i>Macropsis infuscata</i> (J.Sahlberg, 1871)		2000	
<i>Macrosteles frontalis</i> (Scott, 1875)	2000	1999	
<i>Macrosteles laevis</i> (Ribaut, 1927)	1999, 2000	1999	
<i>Macrosteles sexnotatus</i> (Fallén, 1806)		1999	2000
<i>Macrosteles variatus</i> (Fallén, 1806)		1999	2000
<i>Metalimnus formosus</i> (Boheman, 1845)			2000
<i>Micantulina stigmatipennis</i> (Mulsant & Rey, 1855)			2000
<i>Mocydia crocea</i> (Herrich-Schäffer, 1837)	1999	1999, 2000	2000
<i>Mocydiopsis attenuata</i> (Germar, 1821)			1999
<i>Mocuellus metrius</i> (Flor, 1861)			2000
<i>Ossiannilssonola callosa</i> (Then, 1886)			1999, 2000
<i>Phlogotettix cyclops</i> (Mulsant & Rey, 1855)	2000	1999, 2000	2000
<i>Psammotettix alienus</i> (Dahlbom, 1850)	1999, 2000		2000
<i>Psammotettix</i> sp.		1999, 2000	
<i>Rhoananus hypochlorus</i> (Fieber, 1896)		1999	
<i>Rhytidodus decimusquartus</i> (Schrank, 1776)	2000		
<i>Ribautiana ognevi</i> (Zachvatkin, 1948)		1999	
<i>Ribautiana scalaris</i> (Ribaut, 1931)			1999, 2000
<i>Ribautiana tenerima</i> (Herrich-Schäffer, 1834)	1999, 2000	1999, 2000	1999, 2000
<i>Speudotettix subfuscus</i> (Fallén, 1806)	1999		1999
<i>Streptanus aemulans</i> (Kirschbaum, 1868)		1999	2000

Table 1. List of cicada species collected in the surroundings of the apple orchards, and years of collection.

	Nyírtura	Szigetcsép	Vámosmikola
	1999 - 2000	1999 - 2000	1999 - 2000
	ORG	CON	CON, IPM
<i>Typhlocyba quercus</i> (Fabricius, 1777)			1999, 2000
<i>Ulopa reticulata</i> (Fabricius, 1794)	1999		
<i>Zygina flammigera</i> (Fourcroy, 1785)	1999, 2000		
<i>Zygina nivea</i> (Mulsant & Rey, 1855)		1999	
<i>Zygina tithide</i> Ferrari, 1882		1999	
<i>Zyginidia pullula</i> (Boheman, 1845)	1999, 2000	1999, 2000	1999, 2000
Cixiidae			
<i>Cixius cunicularius</i> (Linnaeus, 1767)	2000	1999	
<i>Cixius distinguendus</i> Kirschbaum, 1868	2000	1999	2000
<i>Cixius nervosus</i> (Linnaeus, 1758)	1999	1999	1999, 2000
<i>Reptalus cuspidatus</i> (Fieber, 1876)		1999	
<i>Tachycixius pilosus</i> (Olivier, 1791)			1999, 2000
Delphacidae			
<i>Delphax crassicornis</i> (Panzer, 1796)			1999
<i>Dicranotropis hamata</i> (Boheman, 1947)		2000	2000
<i>Javesella pellucida</i> (Fabricius, 1794)	1999		1999, 2000
<i>Laodelphax striatellus</i> (Fallén, 1826)	1999	1999, 2000	1999, 2000
<i>Stenocranus minutus</i> (Fabricius, 1787)			2000
Dictyopharidae			
<i>Dictyophara europaea</i> (Linnaeus, 1767)	2000		
Membracidae			
<i>Centrotus cornutus</i> (Linnaeus, 1758)			2000
<i>Stictocephala bisonia</i> Kopp & Yonke, 1977	2000	1999	1999

Explication: the Malaise traps were operated in the surrounding of CON – conventional, IPM – Integrated Pest Management, ORG – organic apple orchards.

These species are common and widespread in the Hungarian fauna. *Eupteryx calcarata* and *Eupteryx cyclops* feed on nettle species (*Urtica* and *Ballota* species) (RIBAUT 1936; OSSIANNILLSSON 1981; SCHIEMENZ 1990). *Eupteryx atropunctata* is a widespread, polyphagous species occurring on wide range of herbs (OSSIANNILLSSON 1981; SCHIEMENZ 1990). *Kybos virgator* and *Kybos populi* feed on *Salix* and *Populus* species (OSSIANNILLSSON 1981; SÁRINGER 1989; SCHIEMENZ 1990). *Empoasca decipiens* is a polyphagous species occurring both on herbaceous and woody plants, including fruit trees (SCHIEMENZ 1990, ALFORD 1992). *Ribautiana tenerrima* feeds on various trees and bushes, mainly on *Rubus*, *Rosa* and *Ribes* species (RIBAUT, 1936; WAGNER and FRANZ 1961; ALFORD 1992; SCHIEMENZ 1990). *Edwardsiana rosae* and *Edwardsiana crataegi* are both known as common on *Rosaceae* plants, including fruit trees, especially apple (OSSIANNILLSSON 1981; ALFORD 1992, SÁRINGER 1989).

Some of the collected species are rare in Hungary, or interesting in respect of faunal research: *Rhoanamus hypochlorus*, a species typical in lowland meadows and pastures,

Table 2. Relative abundance (%) and total scores of the most abundant cicada species collected in the surroundings of the apple orchards (edge and forest); with the number of males and species richness. Relative abundance values, lower than 2 % were marked with*

species	Nyírtura	Szigetcsép	Vámosmikola	Total score
	1999-2000 <i>Populus canadensis</i> plantation and its margin	1999-2000 Flooded forest area and its margin	1999-2000 Oak forests with <i>Robinia</i> <i>pseudoacacia</i> and its margin	
<i>Eupteryx calcarata</i> Ossiannilsson, 1936	65	3.6	38.7	17
<i>Empoasca decipiens</i> Paoli, 1930	14.9	18.1	7.6	17
<i>Kybos virgator</i> (Ribaut, 1933)	*	49.2	3.2	8
<i>Eupteryx atropunctata</i> (Goeze, 1778)	*	5.7	7.1	8
<i>Kybos populi</i> Edwards, 1908	2.5	5.3	*	8
<i>Eupteryx cyclops</i> Matsumura, 1906	*	*	16.9	6
<i>Edwardsiana crataegi</i> (Douglas, 1876)	6.2	*	*	5
<i>Ribautiana tenerrima</i> (Herrich-Schäffer, 1834)	*	*	7.3	4
<i>Empoasca solani</i> (Curtis, 1846)	*	3.2	*	3
<i>Cicadella viridis</i> (Linnaeus, 1758)	*	*	*	3
<i>Edwardsiana rosae</i> (Linnaeus, 1758)	*	*	3.3	2
<i>Hephathus nanus</i> (Herrich-Schäffer, 1835)	*			2
<i>Laodelphax striatellus</i> (Fallén, 1826)	*	2.1	*	1
<i>Eupteryx stachydearum</i> (Hardy, 1850)	*	*	2.6	0
<i>Edwardsiana lamellaris</i> Ribaut, 1931			*	0
<i>Japananus hyalinus</i> (Osborn, 1900)	*		*	0
<i>Eupteryx collina</i> (Flor, 1861)		*	*	0
<i>Eurhadina kirschbaumi</i> Wagner, 1937			*	0
<i>Eupteryx vittata</i> Linnaeus, 1758	*	*	*	0
<i>Philaenus spumarius</i> (Linnaeus, 1758)	*		*	0
<i>Alebra albostrigata</i> (Fallén, 1826)			*	0
<i>Emelyanoviana mollicula</i> (Boheman, 1845)	*	*	*	0
<i>Eurhadina pulchella</i> (Fallén, 1806)			*	0
<i>Edwardsiana diversa</i> Edwards, 1914			*	0
<i>Phlogotettix cyclops</i> (Mulsant & Rey, 1855)	*	*		0
Number of males	1663	1521	5073	
Number of species	47	57	67	

Metalimnus formosus, which is typical in moist meadows, on *Phragmites communis* and *Carex* spp. *Mocuellus metrius* also occurs in moist, marshy meadows (WAGNER and FRANZ 1961). The species *Ossiannilssonola callosa* is extremely rare in Hungary, it is common in northern countries or highlands. *Phlogotettix cyclops* is also rare in Hungary.

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