

THE INVASIVE ENTOMOFAUNA OF THE HOLOMETABOLA GROUP, SUPERORDER MECOPTEROIDEA FOR REPUBLIC OF MOLDOVA

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Abstract

The invasive entomofauna from the Holometabola group, Mecopteroidea supraorder for Republic of Moldova consists of 79 species from 3 orders (Lepidoptera, Hymenoptera and Diptera). These 79 species of insects were compared with the database of Fauna Europaea and for our country registered are 16 species (20.2%), but for 63 (79.7%) mentioned with the "absent" and "no data". In the mean time 18 species were recorded: Ostrinia nubilalis – 1932, Grapholitha molesta – 1968, Trichoptera tapetzella – 1969, Anarsia lineatella, Liriomyza trifolii, Plodia interpunctella – 1983, Sitotroga cerealella, Ephestia elutella, E.kuehniella, Pyralis fareinalis – 2003, Macrosaccus robiniella, Phyllonorycter platani – 2006, Aproceros leucopoda – 2008, Parectopa robiniella – 2009, Phyllonorycter issikii, Platygaster robiniae Obolodiplosis robiniae – 2011, Stigmella aceris – 2012. According periods penetration it was found that 1 species have entered the XVIII century, 4 in the XIX, 44 in the XX and 27 in the XXI. The registration in countries of interest is in: Bulgaria – 39 species; Poland – 18; Romania – 11; other countries —11.

Keywords: invazive entomofauna, Mecopteroidea, Republic of Moldova.

1. INTRODUCTION

In the Mecopteroidea supraorder with 6 orders, there are three which has invasive species of economic and ecological impact (Lepidoptera, Hymenoptera, Diptera), because all species of the order Lepidoptera in the larval stage are phytophagous; feed on plant organs during the growing season (Arctiidae, Yponomeutidae, Noctuidae – defoliants, Gracillariidae, Nepticulidae – leaf miners, Tortricidae – carpophages), the pests of grain and grain products (Gelechiidae, Tineidae), or have mixed regime: the defoliants and pests of grain and grain products (Pyrallidae), etc. (Alexinschi-Tecuci, 1932; Boguleanu, 1994; Timuş, 2000, 2001; Perju, 2001; Timuş and Mihailov, 2005; Marko, 2009; Neţoiu, 2009; Rakosy, 2009; Ureche, 2009; Derjanschi et al., 2010;).

From the order Hymenoptera some species present the economic impact: defoliants (Argidae, Tenthredinidae), other ecological as entomophagous (Aphelinidae, Braconidae, Encyrtidae, Formicidae, Platygasteridae, Sphecidae, Torymidae, Trichogrammatidae) (Timuş and Derjanschi, 2008).

The Diptera order, too, are very diverse as nutrient regime, namely: the leaf miners (Agromyzidae), carpophagous (Tephritidae), the gale from (Cecidomyiidae), the entomophagous predators (Phoridae), the destructors (Helomyzidae, Calliphoridae), etc. (Alexinschi, 1932; Arion, 1938; Derjanschi et al., 2012; Timuş, 2012, 2015 a, b).

Therefore, knowledge the invasive entomofauna from the superorder Mecopteroidea represents the same interest to entomologists and the Plant Protection, who are responsible for the entomofauna country of any kind to apply the appropriate decisions in the event of occurrence and the pest risk to plants (Moldovan, 1966; Busuioc, 2003; Nastase, 2007; Derjanschi et al., 2010; Timuş et al., 2010). The research was performed within the project 11.817.08.13F funded by Supreme Council for Sciences and Technological Development of Academy of Sciences of Moldova.

2. MATERIALS AND METHODS

Research the invasive entomofauna from the superorder Mecopteroidea was performed according to: a) analysis of the individual insect host-plants of agricultural land and the cultural landscapes (parks, squares, alleys, niches without control); b) literature in the archives and the libraries sectional "old book"; c) in the conjunction with databases of interest to the countries: Romania, Poland and Bulgaria. In the agricultural fields and the cultural landscapes, individuals specimens of insects harvested during the growing season were installed by the methods of collecting and their conservation (Croitoru et al., 2012).

3. RESULTS AND DISCUSSIONS

The species of insects from the supraorder Mecopteroidea with status alien for the fauna of the Republic of Moldova in total are 79 and part of 3 orders: Lepidoptera (44 or 55.6%), Hymenoptera (20 or 25.3%) and Diptera (15 or 18.9%) (Tables 1, 2 and Figure 1).

Table 1. The invazive entomofauna from Mecopteroidea superorder registered in countries of interest and Republic of Moldova

Order	Number of species	Romania		Bulgaria		Poland		Other country		FaEu / Republic of Moldova					
		total	%	total	%	total	%	total	%	present	%	absent	%	no date	%
Lepidoptera	44	11	25.0	20	45.4	7	15.9	6	13.6	7	15.9	0	0	37	84.0
Hymenoptera	20	0	0	9	45.0	8	40.0	3	15.0	9	45.0	8	40.0	3	15.0
Diptera	15	0	0	10	66.6	3	20.0	2	13.3	0	0	4	26.6	11	73.3
Total 3	79	11	13.9	39	49.3	18	22.7	11	13.9	16	20.2	12	15.1	51	64.5

From the chronological analysis the invasive entomofauna from the supraorder Mecopteroidea, observed that compared to species from the Hemimetabola and the Holometabola group (superorder Coleopteroidea), there were recorded much later or from the second half of XIX century. Exceptions are several species of ants (Hym., Formicidae), which began natural migration and continues to the present: *Monomorium pharaonis* registered the first center – 1780 (Poland) and the following – 1892; *Hypoconera punctatissima* – 1859 (Poland); *Linepithema humile* – 1992

(Bulgaria); *Lasius neglectus* – 1997 (Poland); *Paratrechina viridula* – 2008 (Macedonia). Continuing analysis of this order it was found that, while natural migration of phytophagous species, held and deliberate release of species that have obtained foreign status, but with positive role: *Aphelinus mali* (larvophagous parasitoid to the invasive species *Eriosoma lanigerum*), introduced in Poland in 1923; *Encarsia formosa* (larvophagous parasitoid to the invasive species *Trialeurodes vaporariorum*), introduced in Bulgaria in 1937; *Encarsia perniciosi* (larvophagous parasitoid to the invasive species *Diaspidiotus perniciosus*), introduced in the Poland in 1949; *Trichogramma dendrolimi* (oviphagus parasitoid of some the lepidopteran defoliators), introduced in Bulgaria in 1987.

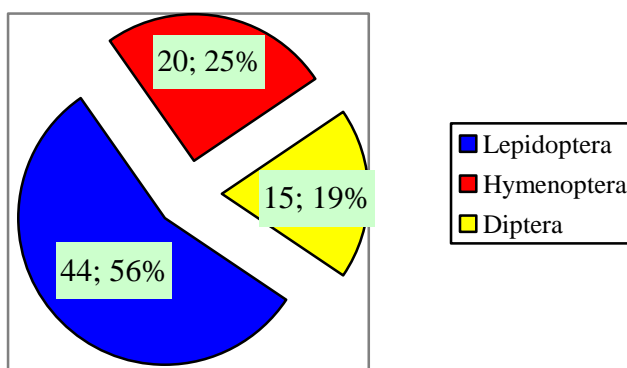


Figure 1. The invasive entomofauna from Mecopteroidea superorder

A single species of the larviphagous parasitoid (*Platygaster robiniae*, Platygasteridae) was spread naturally occurring will host insect invasive *Obolodiplosis robiniae* – the defoliant galigen on the acacia genus *Robinia*. About the braconids *Aphidius colemani*, *A.smithi* *Lysiphlebus testaceipes* – 2007-2008 (Bulgaria), do not know if it are controlled launched or natural migrated after insect host, so research in this area continues. In the Republic of Moldova in 2008 has been recorded the new species of Asian origin for Europe – *Aproceros leucopoda* (Hym., Argiidae) with the impact on elm at the species level *Cameraria ohridela*. The analysis Lepidoptera order was determined that dating began in the second half of XIX century, with species *Helicoverpa armigera*, *Trichophaga tapetzella* – 1863 (Bulgaria), *Pyralis farinalis* – 1896 (Bulgaria), then followed the first half of the XX century: *Sitotroga cerealella*, *Plodia interpunctella* – 1900 (Poland); *Achroia grisella*, *Ephestia elutella*, *Hypsopygia costalis* – 1903, *Ephestia kuehniella* – 1907, *Tineola bisselliella* – 1909 (Bulgaria); *Ostrinia nubilais* – 1920 (Poland); *Corcyra cephalonica* – 1930 (Bulgaria). As shown all species are pests of grain and grain products. The other species were recorded in the second half of the XX century and the beginning of the XXI century, most the defoliator (Arctiidae, Crambidae, Yponomeutidae), leaf miners (Gracilariidae, Nepticulidae), carpophagous (Tortricidae), pests of grain and grain products (Gelechiidae, Pyralidae, Tineidae), etc.

The invasive species from Diptera order were recorded among the last in the second half of the XX century and continue till now, and leading Diptera invasive recording is Bulgaria (10 or 66.6%) (Figure 2).

For comparison we can mention that insects of Mecopteroidea superorder entered on the mainland evident through four parts: north – Poland, 19 species (Lepidoptera: 8 or 18.1%; Hymenoptera 8 or 40.0%; Diptera 3 or 20.0%); south – Bulgaria, 38 species (Lepidoptera: 20 or 45.4% Hymenoptera

9 or 45.0%; Diptera 9 or 60.0%); west – Romania, 10 species (Lepidoptera: 10 or 22.7%) and east – Ukraine, 4 species (Lepidoptera 1 or 2.2%; Hymenoptera 2 or 10.0%; Diptera 1 or 6.6%), Figure 3.

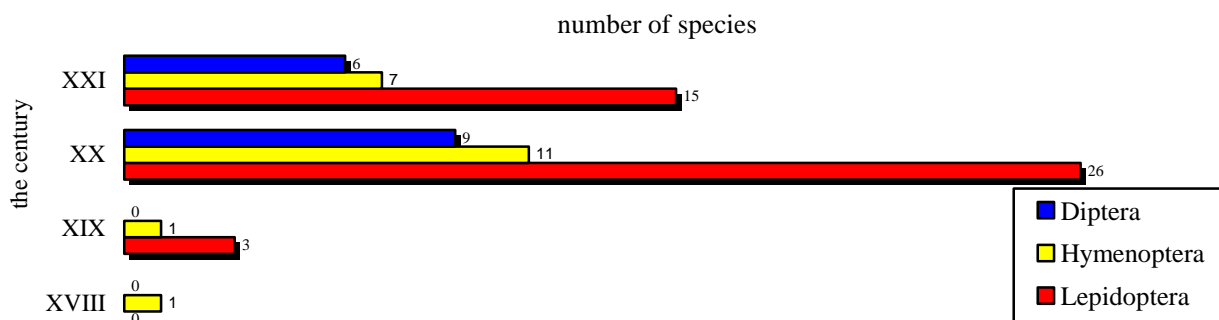


Figure 2. The chronological registration of the invasive entomofauna of Mecopteroidea superorder

The invasive entomofauna from the Holometabola group, Mecopteroidea superorder was corroborate with the database of Fauna Europaea and for the Republic of Moldova 63 species (79.7%) mentioned the "absent" and "no data". Meanwhile, of the 63 species of insects in our country already registered 18: 14 species of the Lepidoptera order (*Ostrinia nubilalis* – 1932; *Grapholitha molesta* – 1968; *Trichophaga tapetzella* – 1969; *Plodia interpunctella* – 1983; *Anarsia lineatella*, *Ephestia elutella*, *E.kuehniella*, *Pyralis farinalis*, *Sitotroga cerealella* – 2003; *Phyllonorycter platani*, *Macrosaccus robiniella* – 2006; *Parectopa robiniella* – 2009; *Phyllonorycter issikii* – 2011, *Stigmella aceris* – 2012); 2 species of the Hymenoptera order (*Aproceros leucopoda* – 2008, *Platygaster robiniae* – 2011) and 2 species of the Diptera order (*Liriomyza trifolii* – 1983, *Obolodiplosis robiniae* – 2011).

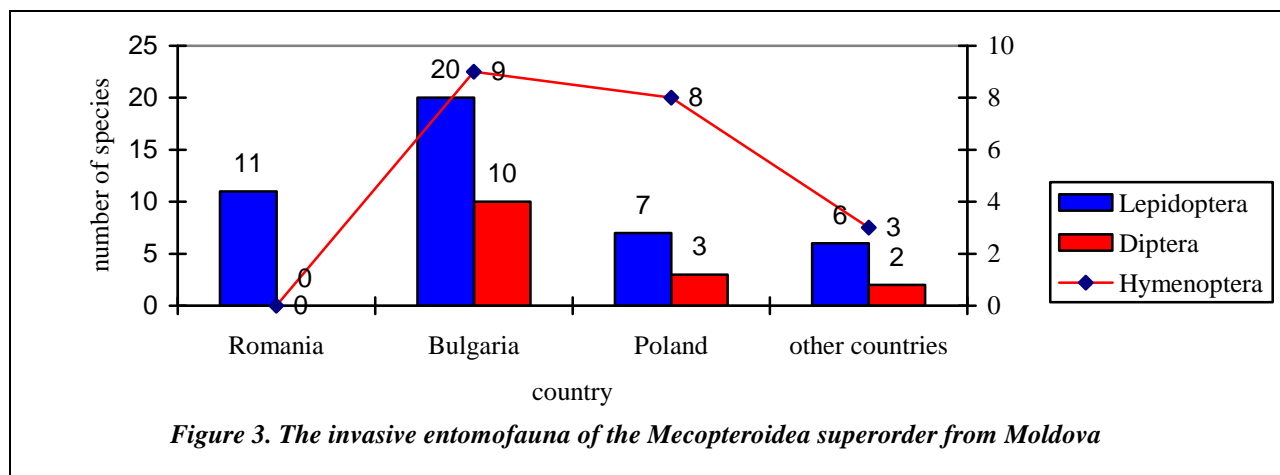


Figure 3. The invasive entomofauna of the Mecopteroidea superorder from Moldova

The *Grapholitha molesta* species were included in the list of quarantine pests (from 1937 in Romania and from 1948 in the Republic of Moldova), but has been excluded from the lists because finally adapted and became the usual pest. The *Tuta absoluta* species, currently with dual status (invasive and plant quarantine), was recorded in Romania in 2009, and the republic first time in 2011. The outbreak was eliminated entirely, because the insect has developed into a

private greenhouse near the capital, so it is considered that there is on the territory Moldova not available however, observations continue. The other 44 species requires research and publication of results in scientific articles European value, because most of these species are found in one of the countries of interest.

Table 2. The entomofauna invazive from the Holometabola group, Mecopteroidea supraorder

Family, genus, species / Order	1780-1789	1790-1799	1800-1809	1810-1819	1820-1829	1830-1839	1840-1849	1850-1859	1860-1869	1870-1879	1880-1889	1890-1899	1900-1909	1910-1919	1920-1929	1930-1939	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2014	
Lepidoptera																									
Arctiidae																									
1. <i>Hyphantria cunea</i> , 1773																									Ro
Crambidae																									
2. <i>Sclerocona acutella</i> , 1842																									Bg
Gelechiidae																									
3. <i>Anarsia lineatella</i> , 1839																									Md
4. <i>Sitotroga cerealella</i> , 1789													Po												
5. <i>Coleotechnites piceaella</i> , 1903																									Ro
6. <i>Scrobipalpa ocellatella</i> , 1858																									Ro
7. <i>Phthorimaea operculella</i> , 1873																									Ro
8. <i>Tuta absoluta</i> , 1917																									Ro
9. <i>Pectinophora gossypiella</i> , 1844																									Bg
Gracillariidae																									
10. <i>Caloptilia roscipennella</i> , 1796																									Bg
11. <i>Caloptilia azaleella</i> , 1913																									
12. <i>Cameraria ohridella</i> , 1986																									Bg
13. <i>Parectopa robiniella</i> , 1863																									Bg
14. <i>Macrosaccus robiniella</i> , 1859																									Po
15. <i>Phyllonorycter issikii</i> , 1963																									Po
16. <i>Phyllonorycter platani</i> , 1870																									Po
17. <i>Phyllonorycter leucographella</i> , 1850																									Ro
Nepticulidae																									
18. <i>Stigmella aceris</i> , 1857																			A						
19. <i>Stigmella prunetorum</i> , 1855																			A						
Noctuidae																									
20. <i>Helicoverpa armigera</i> , 1805																									Bg
21. <i>Sedina buetneri</i> , 1858																									Bg
Pyrallidae																									
22. <i>Achroia grisella</i> , 1794																									Bg
23. <i>Cadra calidella</i> , 1845																									Ro
24. <i>Cadra cautella</i> , 1863																									Bg
25. <i>Cadra figulilella</i> , 1871																									Bg
26. <i>Corcyra cephalonica</i> , 1866																									Bg
27. <i>Ectomyelois ceratoniae</i> ,																									Ro

miniers), Tortricidae family (carpophagouse), Gelechiidae, Pyralidae, Tineidae family (pests of grain and grain products), etc.

The invasive species from Diptera order were recorded among the last in the second half of the XX century and continue till now, and leading invasive recording is Bulgaria (10 or 66.6%).

Some species of nonnative Hymenoptera order were launched directed on the agricultural plantations as part of biological control of some phytophagous: *Aphelinus mali* / *Eriosoma lanigerum*; *Encarsia formosa* / *Trialeurodes vaporariorum*; *Encarsia perniciosi* / *Diaspidiotus perniciosus*; *Trichogramma dendrolimi* / lepidopteran defoliators. The parasitoid *Platygaster robiniae* / *Obolodiplosis robiniae*, in Europe was spread naturally.

After collating local database with the FaEu it was found that from 63 species "absent" and "no data", 18 were recorded: of the Lepidoptera order 14 species (*Ostrinia nubilalis*, *Grapholitha molesta*, *Trichophaga tapetzella*, *Plodia interpunctella*, *Anarsia lineatella*, *Ephestia elutella*, *E.kuehniella*, *Pyralis farinalis*, *Sitotroga cerealella*, *Phyllonorycter platani*, *Ph.issikii* *Macrosaccus robiniella*; *Parectopa robiniella*, *Stigmella aceris*), 2 of the Hymenoptera order (*Aproceros leucopoda*, *Platygaster robiniae*) and of the Diptera order 2 species (*Liriomyza trifolii*, *Obolodiplosis robiniae*). The species *Aproceros leucopoda* (Hym., Argiidae) of Asian origin. recent in Europe and with great impact on elm was registered in Republic of Moldova in the 2008 and continues to defoliation trees flat tire at present.

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