

REVIEW OF SPECIES FROM CATEGORY OF FILOPHAGOUS INSECT RELEVANT FOR DECIDUOUS FORESTS OF ROMANIA

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Abstract. *Phyllophagous insects that feed on the leaves of trees and shrubs in deciduous forests cause qualitative and quantitative damage to these natural ecosystems, true sources of oxygen. The current study aims to be an update of the information on the range of important pests in Romanian deciduous forests with continental extrapolation. An evaluation of the existing database (mainly from electronic sources but also from the physical bibliography) clearly shows that most of the pest species that are currently a problem for all deciduous forests in any area of the country belong to the orders Hemiptera (10) and Lepidoptera (8). Besides these, other categories of Coleoptera (2), Diptera (2), Orthoptera and Hymenoptera (1) were quantified. Stink bugs, aphids, tingids and cycads constituted the Hemiptera group with 41.66% of the total pests and Lepidoptera (which includes both moths and large butterflies) represented 33.33%. The remaining 25.31% is composed of leaf beetles, mining flies, bush-crickets and sawflies. All of these have the ability, both individually and together, to cause tree loss and to spread and infest new areas. Updating databases and initiating periodic monitoring activities in all forests, regardless of region, are ways of raising awareness of potential economic losses and, first of all, that they lead to the weakening of the main oxygen-producing sources.*

Keywords: *filophagous insects, deciduous forests, harmful range.*

INTRODUCTION

In deciduous forests, there are various species of insects that depreciate the quality and quantity of the trees. In the specialized literature there are numerous publications and also opinions about the harmful range for forests in Romania. Thus, according to some authors (FRATIAN, 1984; NETOIU ET AL., 2006; NETOIU ET AL., 2018; SIMIONESCU ET AL., 2012; DOMBI ET AL., 2013; OLENICI AND DUDUMAN, 2016; RADAC ET AL. 2017; HULUJAN ET AL., 2017; BALACENOIU ET AL., 2020; VIRTEIU AND GROZEA, 2023) insects from the following genera are present: Dasineura, Tortrix, Eopineus, Aproceros, Lymantria, Corythucha, Macrosaccus, Cydalima, Hyphantria, Prociphilus, Phyllonorycter, Phyllaphis, Obolodiplosis, Lygaeus, Stereonichus, Cameraria, Parectopa, Megastigmus, Melasoma, Operophtera, Metcalfa, Nezara and Halyomorpha. According to KONIG (1998), many genera belong to Lepidoptera species. These species are also mentioned by foreign authors in their publications (THEOBALD, 1929; AUGUSTIN ET AL., 1993; FORSTER AND GRODZKI, 1999; ZUBRIK ET AL., 2007; KOLLÁR AND DONOVAL, 2013; HANCOCK ET AL., 2019).

Over time, some species that were present a few decades ago (ARSENESCU ET AL., 1966) disappeared or decreased in number, while others increased in frequency and new ones appeared (GROZEA ET AL., 2012; GOGAN AND GROZEA, 2013; BUNESCU AND FLORIAN, 2016; VLAD AND GROZEA, 2016; GUGEA AND VÎRTEIU, 2017; DE MICHELE AND GROZEA, 2018). But some of the insects have maintained their importance and population level (RETEVOI, 2018).

The diversity of species that affect the trees in the natural mixed deciduous forests is a subject not discussed much, on the one hand due to the classification as protected ecosystems and on the other hand because phytosanitary treatments cannot be applied. However, their periodic evaluation is necessary considering that harmful insects (especially phyllophagous ones) can affect the quality of life of the trees through early defoliation. That's why through this work we wanted to see which are the species brought to the attention of specialists through

their publications so that we can try in the future to monitor and know what we are looking for in a deciduous forest in western Romania.

MATERIAL AND METHODS

The study was carried out by analyzing the electronic and physical sources from the USVT Library or the discipline of Entomology, between September and October, 2023. The electronic ones were searched through the Google engine, mostly being websites of professional journals or institutes of regulations in the field of plant protection, so verified sources. These were made up of full-length articles, newsletters and online books. A total of 153 sources were consulted (121 online, 32 physical). The obtained data were centralized addressing aspects of species identification, systematic classification, the first reporting at the level of Europe and the first reporting in Romania. Data processing did not require complex statistics, but the simplistic tabular and graphic approach (much more suitable for this type of study).

RESULTS AND DISCUSSION

From all the analyzed sources, we found that 24 species of insects (out of over 200) are or can be considered main phyllophagous insects and can be problems for deciduous forests in Romania. These species are taken together, as the range present at a given moment, and which together become real problems for deciduous forests in different regions of the country (with small exceptions, in the warmer areas, S, S-and S-E being predominant stinky bugs).

The division by category of the representative species shows that most were identified from the order Hemiptera (10 species) and Lepidoptera (8 species). From the Coleoptera and Diptera orders, 2 species each were identified, and from the Hymenoptera and Orthoptera orders, only 1 species was identified each (Figure 1).

Among the 15 families, the most representative families were Gracillariidae (4), Aphididae and Pentatomidae with 3 species each, Tingidae and Cecidomyiidae (2 species each). The other 10 families (see Figure 2) each had 1 representative species.

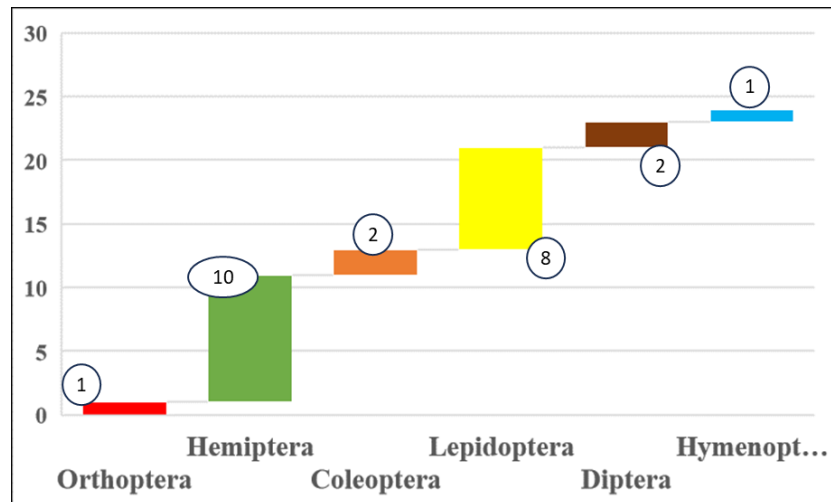


Figure 1. The share of insect species by category from the relevant harmful range of deciduous forests in Romania

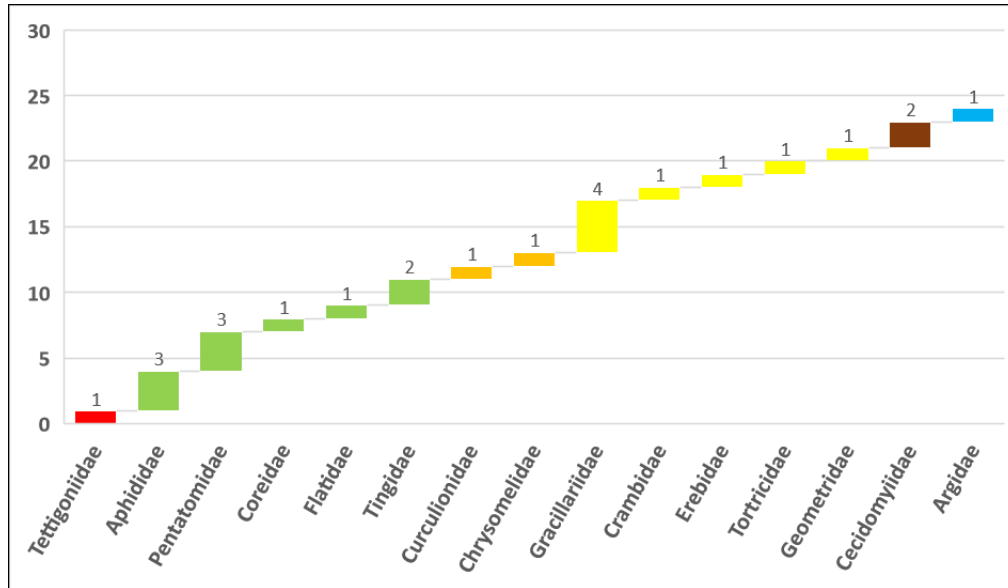


Figure 2. The share of insect species by category from the relevant harmful range of deciduous forests in Romania

A detailed study of the species can be found in Table 1, where data about the universal scientific name (Latin), the classification in the essential systematic units for recognition (family, order) as well as the year and the author of the first report (if the information was available) in Europe and Romania are also described.

From the set of analysed articles, we extracted that the Hemiptera composed of aphids, stink bugs, tingids and cicadas had a weight of 41.66% of the total number of pests mentioned in the specialized literature. Lepidoptera represented by moths and large butterflies had a weight of 33.33% and coleoptera through leaf beetles, mining flies, bush crickets and flies had a weight of 25.31%.

Table 1

Identification (in the electronic and physical/bibliographic system) of the most relevant species of phyllophagous insects from deciduous forests in Romania

Latin name	The popular name	Family	Order	First detection in Europe*	First detected in Romania**
<i>Tettigonia viridissima</i>	Great green bush-cricket	Tettigoniidae	Orthoptera	England, 1970	Unknown, 1981
<i>Prociphilus fraxinifolii</i>	Leafcurl ash aphid)	Aphididae	Hemiptera	Hungary, 2003	Oltenia, 2018 (NETOIU ET AL., 2018)
<i>Phyllaphis fagi</i>	Woolly beech aphid	Aphididae	Hemiptera	Great Britain, 1929	Present, unknown (mentioned by CHIRA ET AL., 2005)
<i>Periphyllus lyropictus</i>	The Norway maple aphid	Aphididae	Hemiptera	Uncertainly	Timișoara, (VIRTEIU SI GROZEA, 2023)

<i>Rhaphigaster nebulosa</i>	Mottled Shieldbug	Pentatomidae	Hemiptera	Holland, 2002	Gorj, 2016 (OLENICI ET AL., 2016)
<i>Halyomorpha halys</i>	Brown marmorated stink bug	Pentatomidae	Hemiptera	Switzerland, 2004	Bucharest, 2014, (MACAVEI ET AL., 2015)
<i>Nezara viridula</i>	Southern green stink bug	Pentatomidae	Hemiptera	Italy, 1998	Timișoara, 2010 (GROZEA ET AL., 2012)
<i>Leptoglossus occidentalis</i>	Western conifer seed bug	Coreidae	Hemiptera	Italy, 1999	Câmpulung Moldovenesc, 2016; Dumbravita-Timis, 2019 (OLENICI SI DUDUMAN, 2006; GROZEA SI MUNTEAN, 2019)
<i>Metcalfa pruinosa</i>	Citrus flatid planthopper	Flatidae	Hemiptera	Italy, 1979	Constanta, 2009 (PREDA AND SPOLKA, 2009)
<i>Corythucha arcuata</i>	Oak lace bug	Tingidae	Hemiptera	Italy, 1964	Arad, 2016 (RADAC ET AL. 2017)
<i>Corythucha ciliata</i>	Sycamore lace bug	Tingidae	Hemiptera	Croatia, 1970	Craiova, 1990 (KIS, 1990)
<i>Orchestes fagi</i>	Beech leaf-miner beetle	Curculionidae	Coleoptera	Switzerland, 2008	Bacau, 1964 (ARSENESCU ET AL., 1966)
<i>Melasoma populi</i>	Red poplar leaf beetle	Chrysomelidae	Coleoptera	Unknown (probably France, 1990)	Măgura, 2003 (UNGUREANU ET AL. 2008)
<i>Parectopa robinella</i>	The locust digitate leafminer	Gracillariidae	Lepidoptera	Italy, 1970	Mehedinti, 1989 (NEȚOIU, 2006)
<i>Phyllonorycter robinella</i>	Leaf blotch miner moth	Gracillariidae	Lepidoptera	Switzerland, 1983	Hemeiș, 2002 (URECHE, 2006)
<i>Phyllonorycter issikii</i>	Lime leafminer	Gracillariidae	Lepidoptera	Italy, 2002	Podu Ilioaie, 2002 (URECHE, 2006)
<i>Cameraria ohridella</i>	Horse-chestnut leaf miner	Gracillariidae	Lepidoptera	Macedonia, 1985	Lovrin, 1996 (SANDRU, 1998)
<i>Cydalima perspectalis</i>	Box tree moth	Crambidae	Lepidoptera	Germany, 2007	Bucuresti, SZEKELY, 2011
<i>Lymantria dispar</i>	Gypsy moth	Erebidae	Lepidoptera	Germany, 1987	MARINESCU, 1937
<i>Tortrix viridana</i>	European oak leafroller	Tortricidae	Lepidoptera	Germany, 1920	Cotroceanca, 1950, 1970 (FRATIAN, 1984)
<i>Operophtera brumata</i>	Winter moth	Geometridae	Lepidoptera	United Kingdom, 1949	Unknown, probably in period of (1960-1970)
<i>Obolodiplosis robiniae</i>	Locust gall midge	Cecidomyiidae	Diptera	Italy, 2003	București, 2007 (BALINT, 2010)
<i>Dasineura gledithchiae</i>	Honeylocust podgall midge	Cecidomyiidae	Diptera	Italy, 2002	Present, unknown, probably Bucharest, 2019 (OLENICI ET AL., 2020)
<i>Aproceros leucopoda</i>	Zig-zag sawfly	Argidae	Hymenoptera	Hungary, Poland, 2003	Banat, Moldova, 2006 (BLANK, 2010)

*some information related to the first detection in Europe is not provided in the electronic system, but neither is the physical bibliographic system, so the status was mentioned as -unknown; ***some information related to the first detection in Romania is not provided so the status was mentioned as the same like previously mentioning, as -unknown

Depending on the information found, we made a universal assessment (adapted, following the evaluation methodology of FORSTER ET AL., 1999) of the frequency of attack on leaves in the crown of a tree, using Scale 0-5, where 0 = no damage to leaves/crown, 1 = 0,1-

1% of leaves/crown are affected by pest, 2= 2-5% of leaves/crown affected by pest, 3= 6-25% of leaves/crown affected by pest, 4=26-75% of leaves/crown affected by pest, and 5= more than 75% of the leaves/crown are affected by the pest. So, we found the following (Table 2): the species of *Metcalfa p.*, *Corythucha a.* and *Cameraria o.* had a score (grade) of 3 while the others had grades of 0, 1 and 2.

Table 2

Identification (in the electronic and physical/bibliographic system) of the most relevant species of phyllophagous insects from deciduous forests in Romania

Pest	Damaged percent (%) of leaves/crown	Rating scale (0-5)*
<i>Tettigonia v.</i>	0.1	1
<i>Prociphilus f.</i>	1.0	1
<i>Phyllaphis f.</i>	2.5	2
<i>Periphyllus l.</i>	0.2	1
<i>Rhaphigaster n.</i>	0.3	1
<i>Halyomorpha h.</i>	0.1	1
<i>Nezara v.</i>	0.1	1
<i>Leptoglossus o.</i>	0.3	1
<i>Metcalfa p.</i>	5.1	3
<i>Corythucha a.</i>	5.0	2
<i>Corythucha c.</i>	4.2	1
<i>Orchestes f.</i>	2.1	2
<i>Melasoma p.</i>	1.8	2
<i>Parectopa r.</i>	2.8	2
<i>Phyllonorycter r.</i>	1.4	2
<i>Phyllonorycter i.</i>	1.4	2
<i>Cameraria o.</i>	5.6	3
<i>Cydalima p.</i>	0.2	1
<i>Lymantria d.</i>	4.3	2
<i>Tortrix v.</i>	2.2	2
<i>Operophtera b.</i>	1.6	2
<i>Obolodiplosis r.</i>	1.5	2
<i>Dasineura g.</i>	0.3	1
<i>Aproceros l.</i>	0.2	1

* according to the evaluation scale from 0 to 5

CONCLUSIONS

The results of the study clearly show that the most frequent phyllophagous insects in deciduous forests in Romania are primarily Hemiptera and Lepidoptera. These and others can also cause defoliation of trees but can spread and infest new areas. The verification and upgrading of continuous information associated with the initiation of periodic forest monitoring activities can reduce the risk of economic losses and awareness of the potential losses of the limitation of the main sources of oxygen.

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