Biol. Stud. 2024; 18(1): 111–124 • doi: https://doi.org/10.30970/sbi.1801.757
www.http://publications.lnu.edu.ua/journals/index.php/biology

UDC: 582.728.4(477.42)

CURRENT STATUS OF THE DISTRIBUTION OF EUROPEAN MISTLETOE (*VISCUM ALBUM* L.) IN ZHYTOMYR POLISSIA

Olena Zhytova*, *Lyudmyla Kotyuk*, *Olena Andreieva
Polissia National University, 7 Stary Blvd., Zhytomyr 10008, Ukraine

Zhytova, O., Kotyuk, L., & Andreieva, O. (2024). Current status of the distribution of European mistletoe (*Viscum album* L.) in Zhytomyr Polissia. *Studia Biologica*, 18(1), 111–124. doi:10.30970/sbi.1801.757

Background. European mistletoe (*Viscum album* L.) is a hemiparasitic, autotrophic plant, which is an integral part of natural and urbanized ecosystems of Ukraine, in particular Zhytomyr Polissia. *V. album* is considered to be an aboriginal species which is largely responsible for the deterioration of the sanitary condition of woody plants. In particular, it causes their premature drying, a sharp decrease in the intensity of growth and yield of fruit. This study pursues the following goals: 1) to identify the species of trees affected by *V. album* and which ones it prefers in the conditions of Zhytomyr Polissia; 2) to study the biology of the development of *V. album* in the conditions of the region; 3) analysis of the degree of damage to trees by *V. album* using the coefficient of complex assessment.

Materials and Methods. The reconnaissance method was used to determine the distribution of *V. album*, the type of damage and the intensity of damage to tree plantations and the degree of tree damage by mistletoe was determined using the coefficient of comprehensive damage assessment (C_{cda}).

Results and Discussion. It was found that out of the total number of affected trees, *B. pendula* (27.13 %), *R. pseudoacacia* (17.04 %) and *P. tremula* (11.13 %) were the most commonly infested by *V. album* in the region. At the same time, 46 % of the trees are slightly damaged, 31 % are moderately damaged and 23 % are insignificantly damaged. It was found that without human intervention, the number of populations and the number of *V. album* tend to increase.

Conclusions. On the territory of Zhytomyr Polissia, *V. album* has entered the category of invasive plants. *V. album* was detected on 20 tree species, of which the number of trees affected by *V. album* reached 41.54 % of the total number of the examined trees. The vast majority of *V. album* populations (61 %) are growing. The largest numbers of *V. album* shrubs were recorded on trees aged 60–80 and 80–100 years, accounting for 23 % and 25.13 % of the total number of trees infested by *V. album*, respectively.

Keywords: *Viscum album* L., hemiparasitic plant, distribution, trees, degree of damage

INTRODUCTION

In recent years, a rapid spread of European mistletoe (*Viscum album* L.) has been observed throughout Ukraine, especially in the region, while the extent of its impact on green areas is reaching the scale of an ecological disaster (Rybalka & Vergeles, 2017). According to Yu. O. Bilonozhko *et al.* (2019), the existing trend of the increase in *V. album* distribution range is due to the change in climatic conditions towards warming, as well as frequent forest fires. The problem of the spread of this hemiparasitic plant is not new for Ukraine; a significant number of European countries have faced it (Lech *et al.*, 2020; Muche *et al.*, 2022). However, it remains relevant for the future, as the uncontrolled mass invasion of tree plantations by the hemi-parasite *V. album* continues, which cannot but cause concern among scientists and foresters. This hemiparasitic plant not only deteriorates the aesthetic appearance of woody plants, but is also the cause of the deterioration of the sanitary condition, in particular the premature drying of tree plantations, a sharp decrease in the growth rate and yield of fruit, which in general is a significant ecological threat (Rybalka, 2016; Wood, 2004).

Recently, there has been a debate in scientific publications about the usefulness or harmfulness of *V. album* for tree and shrub plantations (Ivchenko *et al.*, 2014; Bondar *et al.*, 2020). A number of authors (Ivchenko *et al.*, 2014; Melo *et al.*, 2023) hold an opinion that *V. album*, thanks to its evergreen leaves, can be used as a decorative element of the landscape for park zones or for woody plants on sides of roads, since the harmfulness of this hemiparasitic plant is insignificant. Besides, *V. album* is known as a medicinal plant and is currently used in medicine (Ostermann *et al.*, 2020; Biegel *et al.*, 2022; Walas *et al.*, 2022).

Despite the existing information (Ivchenko, 2016; Wood, 2004) on the usefulness of *V. album*, the results of numerous studies (Matusyak, 2019; Rybalka, 2016; Muche *et al.*, 2022) testify to its harmfulness for tree plantations. According to A. I. Ivchenko *et al.* (2014), mistletoe belongs to the category of active invasive plants, affecting urban plantations, old parks with valuable dendroflora, and protective strips along the roads.

In summary, there is a need for further accumulation of data on the ecological and biological characteristics of *V. album*, taking into account the regional aspect, in order to limit its invasiveness. In particular, the questions of the increasing intensity of the invasion of *V. album* plantations, the reasons for its spread, the implementation of preventive measures to reduce the negative impact of the hemiparasitic plant on natural and artificial biotopes remain relevant. In addition, regardless of the existing mass of

scientific information on *V. album*, it is still necessary to study the species composition of host trees, the extent of their damage by the hemiparasitic plant in the conditions of Zhytomyr Polissia, taking into account the appearance of many species of introduced woody plants in the region.

MATERIALS AND METHODS

The research was carried out in 2021–2023 on the territory of Zhytomyr Polissia within its administrative boundaries (**Fig. 1**).

Fig. 1. Map-scheme of the research region of *Viscum album*

A total of 1,360 trees were surveyed. The detection of mistletoe-infested trees and the extent of their distribution was carried out during the forest pathological inventory. The distribution of *V. album*, the type of damage and the intensity of damage caused by the hemiparasite to tree plantations in the green zones of the region were determined by the reconnaissance method. These studies were conducted by means of visual inspection along the edges of roads, squares, parks, forest edges and populated areas of the region. During the survey, the number of mistletoe plants and their age were determined. The type of damage was determined as follows: single – individual trees infested by mistletoe; group (curtain) – when 3 to 10 trees are infested by mistletoe; solid – when all trees of a certain species or age group are infested by the hemiparasite.

When studying the development of europian mistletoe, we measured (n = 5) the length of its shoots and the diameter of the *V. album* shrub on the silver birch (*Betula pendula* Roth.).

The degree of damage to woody plants was determined by the coefficient of complex damage assessment (C_{cda}) using a 7-point scale of *V. album* crown infestation and damage to trunks and skeletal branches, based on which trees are classified as very severely, severely, moderately, slightly and insignificantly damaged by the hemiparasitic

plant (Shlapak *et al.*, 2013). The coefficient of complex damage assessment of woody plants by *V. album* was determined by the formula

$$C_{cda} = Dc + Dt + Dsb,$$

where C_{cda} is the coefficient of complex damage assessment, Dc is crown damage, Dt is stem damage, Dsb is skeletal branch damage.

Based on the calculation of the sum of the scores, the degree of plant damage was determined: 12–14 points (very severely damaged); 10–11 points (severely damaged); 7–9 points (moderately damaged); 3–6 points (slightly damaged); 1–2 points (insignificantly damaged). By transferring the data from the seven-point scales into the formula (Shlapak *et al.*, 2013), we obtained a comprehensive assessment of the damage to the plants studied.

Statistical data processing was performed using the Statistica 5.0 computer program.

RESULTS AND DISCUSSION

The European mistletoe (*Viscum album* L.), a hemiparasitic plant of the Santalaceae family, is an autotroph capable of synthesising organic substances due to the presence of an autonomous chlorophyll-bearing system. Apart from the negative effects on its host, this plant can also be beneficial by providing the host with its own assimilates protecting it from fungal diseases and animal pests (Zuber, 2004; Baltazár *et al.*, 2015).

Viscum album is a species with an extensive Euro-Asian range, coinciding with the distribution of deciduous forests (Thomas *et al.*, 2023). This hemiparasitic plant is an integral part of natural ecosystems and the urbanised environment of Zhytomyr Polissia.

Among hemiparasitic plants, European mistletoe stands out for its rather aggressive action and broad selective ability (Gnatyuk & Kavun, 2016; Schröder *et al.*, 2023). It is characterised by a unique resistance to external factors and diseases (Pishchalenko *et al.*, 2020). *V. album* has the ability to quickly adapt to the highly altered environment of large cities, which is why it is considered a synanthropic species (Bilonozhko, 2019; Szmidla *et al.*, 2019). The combined list of *V. album* host trees includes 452 species. The hemiparasite has been found on 22 tree species in the USA and 384 species in Europe, of which 190 species are introduced (Zuber, 2004; Rybalka & Vergeles, 2017).

In the territory of Zhytomyr Polissia, *V. album* colonises deciduous species, preferring soft trees with a thin layer of bark. The hemiparasitic plant is a thick green hemispherical shrub that grows in the crowns and branches of trees. *V. album* shrubs of different size and age can be found on one tree.

Under the conditions of the region, *V. album* can reach a diameter of 100 150 cm. The stems are bare, cylindrical, green-barked or brownish-green in the lower part, unjointed, easily broken at the nodes. The shoots are woody, dichotomously branched with thickening at the nodes (**Fig. 2*A*$_1$**). The leaves are sessile, elliptic, with clearly visible 5–6 longitudinal veins, yellow-green, overwintering (**Fig. 2*A*$_2$**). According to the results of our research, the length of the leaves of *V. album* (n = 15) parasitic on silver birch (*Betula pendula*) is 39.11±3.04 mm, the width – 7.37±0.55 mm, and the fruit diameter – 6.37±0.4 mm (**Table 1**).

The plant is dioecious. The flowers of *V. album* are unisexual, inconspicuous, yellowish-green with a simple three- or four-part perianth, clustered in groups of three (rarely 5–6) at the end of the shoots in the branches of the stem. The hemiparasitic plant

flowers in spring, at the end of April. The fruit is a juicy, glossy, sticky, white or yellowish, false berry with one or more seeds (**Fig. 2*B*, *C***). The fruits of *V. album* ripen mainly in September; in some years they were recorded in October.

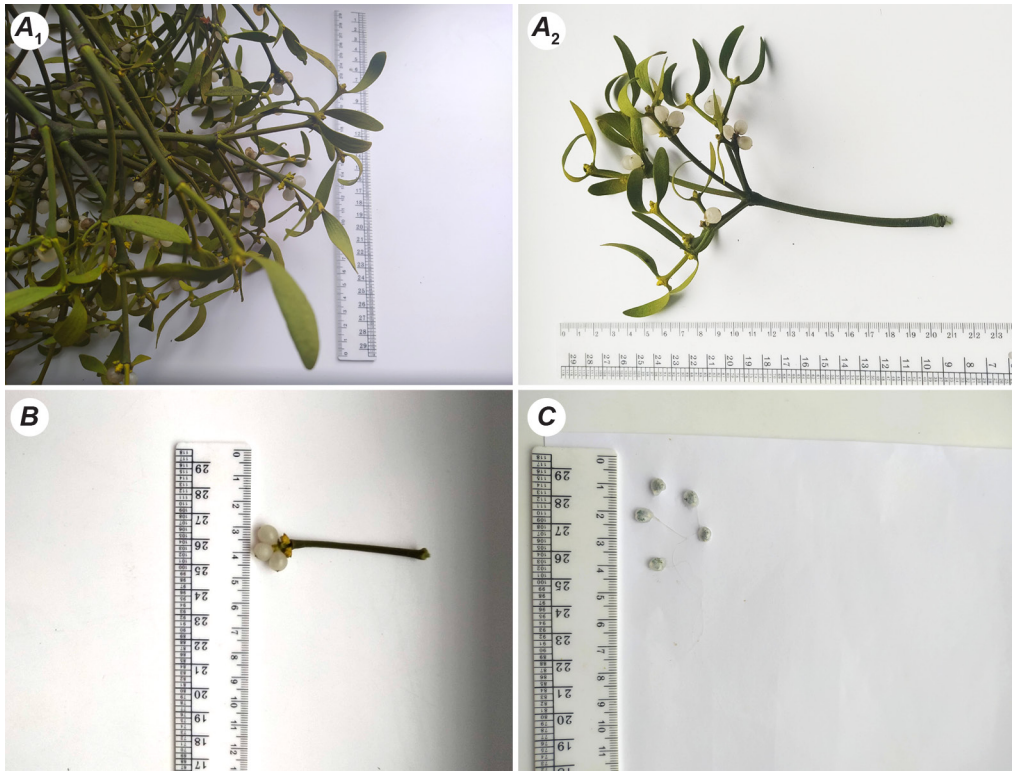

Fig. 2. Shoots (***A***), fruits (***B***) and seeds (***C***) of *Viscum album* on *Betula pendula*

Table 1. **Morphometric characteristics of *Viscum album* growing on the host plant *Betula pendula*, mm**

Research year	Leaf length	Leaf width	Fruit diameter
2020	38.8±2.55	7.1±0.62	6.2±0.39
2021	39.0±2.34	7.2±0.57	6.3±0.43
2022	39.52±4.24	7.82±0.47	6.62±0.37
Average	39.11±3.04	7.37±0.55	6.37±0.40

Fruits do not drop in winter. Seeds have flat and convex edges. In *V. album*, the root system is reduced and forms sucking roots (haustoria) that provide mineral nutrition to the hemiparasite.

The parasitism of flowering plants is a unique ecological adaptation that has evolved from an independent function to an increasing dependence on other higher plants. The development of *V. album* starts with the germination of the seeds in May, and the first stages of development of *V. album* are quite slow. Stems and shoots only

start to develop after a few years. Our observations showed that in the first year after seed germination, the shoot grows to a length of 7.6±0.62 cm. The following year, the shoot branches out and can reach a length of19.0±0.98 cm, forming a spherical shape.

In the third year, a normal shrub of *V. album* is formed with a diameter of up to 27.6±1.18 cm. Later, new buds appear on the so-called "root system" of the hemiparasitic plant, which sprout outwards and develop into new shrubs of European mistletoe. *V. album* can live for almost 45 years (Zuber, 2004; Baltazár *et al.*, 2015). The spread of *V. album* is endozoochorous. According to the results of our observations and literature data (Taran *et al.*, 2008; Ivchenko *et al.*, 2014; Walas, 2022), under the current conditions of climatic disturbance, the spread of mistletoe is facilitated not only by various species of blackbirds, but also by synanthropic birds – members of the Corvidae family. Birds enjoy mistletoe berries, which are an important source of food in winter and until the end of April.

The widespread distribution of *V. album* was noted after a visual survey of various biotopes of Zhytomyr Polissia for damage to trees by *V. album*. It was found that the spread of *V. album* causes significant damage to the dendroflora of the settlements in the region, resulting in a decrease in their aesthetics and phytomelioration function, as well as accelerating the processes of ageing and dying of tree species (**Fig. 3**).

The current situation with the intensive spread of *V. album*, taking into account the constant increase in the range of this hemiparasitic plant, is, in our opinion, caused by favourable conditions for the development of the population of *V. album*, due to the weakening of rural plantations in the settlements of the region, associated with significant anthropogenic changes, which is confirmed by studies of other authors (Rybalka *et al.*, 2012; Muche *et al.*, 2022). An increase in gasification and atmospheric dust, particularly in large settlements, contributes to the frequent occurrence of *V. album* on some deciduous tree species.

Fig. 3. Black locust (*Robinia pseudoacacia*) infested by *Viscum album*

The size, age and location of *V. album* on trees are quite variable. It is known (Bilonozhko, 2019; Kavun *et al.*, 2021) that this hemiparasite is able to colonise a fairly wide range of deciduous tree species, with a preference for alien and introduced species.

Our studies indicate a significant distribution of *V. album* in the region on a fairly broad list of woody plant species. An analysis of the species composition of trees infested

by *V. album* shows that this hemiparasite most frequently infests plants of the genus *Robinia* L., *Populus* L., *Betula* L., *Salix* Host., *Tilia* L. Europian mistletoe was found on 20 tree species, namely pedunculate oak (*Quercus robur* L.), black poplar (*Populus nigra* L.), pyramidal poplar (*Populus nigra* f. *italica* (Munchh.) A. Andersen), white poplar (*Populus alba* L.), black locust (*Robinia pseudoacacia* L.), silver birch *(Betula pendula* Roth.), Norway maple (*Acer platanoides* L.), field maple (*Acer campestre* L.), small-leaved linden (*Tilia cordata* Mill.), rowan (*Sorbus aucuparia* L. Sorbus), common ash (*Fraxinus excelsior* L.), white willow (*Salix alba* L.), eastern crack-willow (*Salix fragilis* L.), common aspen (*Populus tremula* L.), apricot (*Prunus armeniaca* L.), common hornbeam (*Carpinus betulus* L.), domestic apple (*Malus domestica* Suckow (Borkh.)), cherry plum (*Prunus cerasifera* Ehrh.), common hawthorn (*Crataegus monogyna* Jacq.), walnut (*Juglans regia* L.). In species such as hornbeam, domestic apple, hawthorn, walnut and cherry plum, mistletoe infestation is in its early stages.

In the course of observations on the territory of Korosten district of Zhytomyr region, we noted isolated cases of invasion of Scots pine (*Pinus sylvestris* L.) by pine mistletoe (*Viscum album* ssp. *austriacum* (Wiesb.) Vollm.), which is considered to be a subspecies of *V. album*. In Zhytomyr Polissia, O. O. Orlov and co-authors (2023) found pine mistletoe in the Polissky Nature Reserve on an area of about 120 ha (Orlov *et al.*, 2023; Orlov *et al.*, 2023).

The number of trees affected by *V. album* reached 42.28 % of the total number of trees surveyed. A detailed analysis of the nature and extent of tree damage by *V. album* was carried out on 13 species of woody plants (**Fig. 4**).

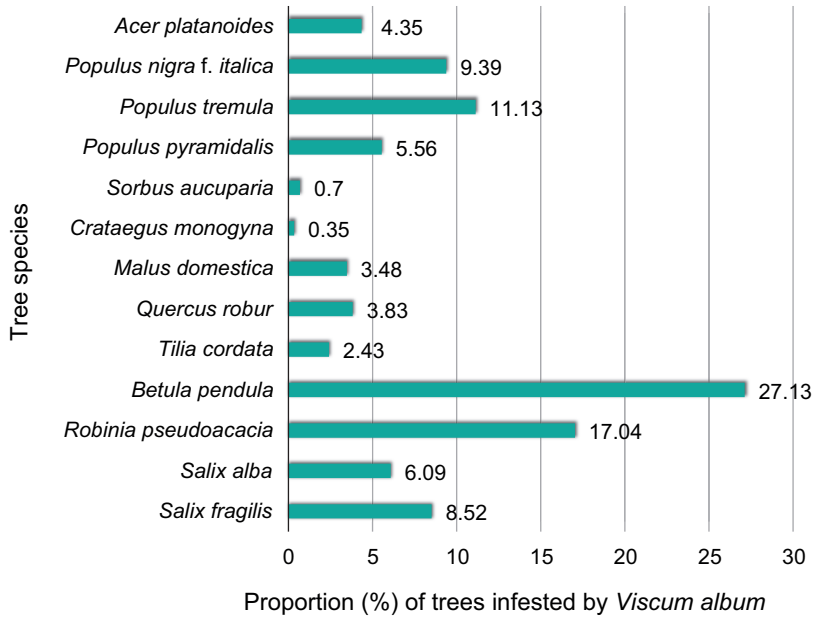

Fig. 4. The proportion of *Viscum album* infestation of certain species of trees as a percentage of the total number of trees affected

It was found that *V. album* affected different tree species in different ways. *B. pendula* (27.13 %), *R. pseudoacacia* (17.04 %) and *P. tremula* (11.13 %) had the highest

percentage of *V. album* infested trees in relation to the total number of infested trees in the region. *S. aucuparia* and *C. monogyna* make up the smallest proportions of trees affected by Europian mistletoe. For the first time in the region, damage to apricot (*Prunus armeniaca*) with single bushes of *V. album* was recorded.

According to the results of a comprehensive assessment of the degree of damage caused by *V. album* to various species of woody plants, 46 % of trees experienced slight damage, 31 % were moderately damaged, and 23 % showed an insignificant degree of harm (**Table 2**).

Table 2. **Degree of damage to trees by *Viscum album***

No.	Species	N (total number of examined trees)	n (affected)	C_{cda}	
				category	degree of damage, average score
1	*Salix fragilis*	112	49	moderately damaged	7
2	*Salix alba*	101	35	moderately damaged	8
3	*Robinia pseudoacacia*	110	98	moderately damaged	8
4	*Betula pendula*	358	156	moderately damaged	9
5	*Tilia cordata*	72	14	slightly damaged	4
6	*Quercus robur*	102	22	slightly damaged	3
7	*Malus domestica*	68	20	insignificantly damaged	2
8	*Crataegus monogyna*	19	2	insignificantly damaged	2
9	*Sorbus aucuparia*	20	4	insignificantly damaged	2
10	*Populus pyramidalis*	86	32	slightly damaged	6
11	*Populus tremula*	108	64	slightly damaged	4
12	*Populus nigra* f. *italica*	122	54	slightly damaged	4
13	*Acer platanoides*	82	25	slightly damaged	3
Total		1360	575	–	2,3,4,6,7,8,9

S. fragilis, *S. alba*, *R. pseudoacacia* and *B. pendula* show an moderate degree of damage by *V. album*, while *M. domestica*, *C. monogyna* and *S. aucuparia* are slightly affected, indicating the selectivity of this hemiparasite for certain tree species. Trees with severe and very severe damage were not identified. According to the data obtained, *V. album* was recorded in mature and over-mature stands. The maximum number of mistletoe bushes was found in the upper part of the trees, indicating their preference for light.

The largest number of *V. album* shrubs (up to 60 specimens) was recorded on old trees that reached an age of 80–100 years, their share among the affected trees being

25.13 %. In the age group of 60–80 years, the number of infested trees is slightly lower, reaching 23 % of the total number of trees affected by *V. album* (**Fig. 5)**. Young trees are extremely rarely infested by this hemiparasite.

The obtained data indicate a decrease in the resistance of trees to *V. album* infestation with age, which is due to their ecological and biological characteristics, a decrease in resistance to infestion and the growing conditions of tree plantations. It has been found that the weight of *V. album* on old trees is quite significant and this contributes to the fragility of dry old branches of woody plants caused by the penetration of pathogenic organisms into plant tissues.

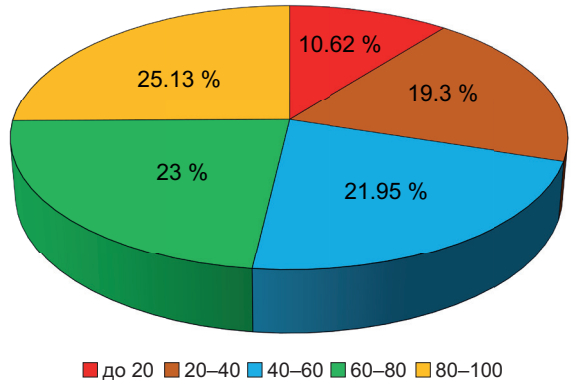

Fig. 5. Distribution of trees affected by *Viscum album* by age group

Compared to young wood, old wood is more susceptible to splitting when infested by *V. album*. It was found that the growth conditions of tree plantations indirectly influence the spread of *V. album*. Trees close to water bodies, regardless of their species composition (maple, willow, poplar), are more likely to be infested by this hemiparasite than trees that grow farther away from water bodies (**Table 3**).

Table 3. **Damage to trees by *Viscum album* depending on growing conditions**

Species	Examined, psc.		Affected, psc.		% affected	
	on flat interfluve	close to water bodies	on flat interfluve	close to water bodies	on flat interfluve	close to water bodies
Acer platanoides	44	38	10	15	23	40
Betula pendula	256	102	70	86	27.34	84.31
Populus alba	28	20	5	11	17.86	55
Salix fragilis	58	80	14	35	24.14	43.47

Most commonly, *V. album* infests solitary trees, alley plantations and “forest” trees lining the banks of rivers, ponds, parks, etc. The observed species and biocenosis dependency requires the inclusion of mistletoe-resistant trees in landscape compositions, e.g. Jeffery pine (*Pinus jeffreyi* Balf.), western yellow pine (*Pinus ponderosa* Douglas ex C. Lawson), western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), etc. It

is also possible to create clusters of conifer plantations, which are less affected by *V. album* (Taran *et al.*, 2008).

The analysis of the studies shows that the roadsides of motorways, alley plantations with the predominance of *B. pendula*, *R. pseudoacacia* are characterised by intensive damage by *V. album* (**Fig. 6**).

Fig. 6. Infestation of trees by *Viscum album* along motorways

Deciduous trees such as *B. pendula*, *R. pseudoacacia* and *P. nigra* show the most severe damage.

CONCLUSIONS

1. Twenty tree species affected by *V. album* were found in the green areas of Zhytomyr Polissia. Of the 1,360 trees examined, 575 trees were affected by *V. album*, i.e. 42.28 %.
2. Europian mistletoe (*Viscum album* L.) is an hemiparasitic shrub with a life cycle of 4–6 years. In modern conditions, according to the observations of the mode of development and reproduction of *V. album*, it was established that it blooms at the end of March–April, the fruits ripen in autumn, mainly in September–October.
3. Under the conditions of the region, *B. pendula* (27.13 %), *R. pseudoacacia* (17.04 %) and *P. tremula* (11.13 %) of the total number of infested trees show the greatest tendency to be affected by a hemiparasitic plant.
4. *S. aucuparia* (0.69 %) and *C. monogyna* (0.35 %) were the most resistant to damage, indicating the selectivity of this hemiparasite for certain tree species.
5. According to the coefficient of comprehensive damage assessment to different species of woody plants caused by *V. album*, the largest proportion, 46 %, are slightly affected trees, 31 % are moderately affected and 23 % are trees with an insignificant degree of damage.
6. *V. album* was recorded in mature and over-mature stands. The largest number of *V. album* bushes was recorded on old trees, which are 80–100 years old, and their share in the affected trees was 25.13 %.

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Animal Rights: This article does not contain any studies with animal subjects performed by any of the authors.

AUTHOR CONTRIBUTIONS

Conceptualization, [O.Zh.]; methodology [O.Zh.]; formal analysis [O.Zh.; L.K.;O.A.]; investigation [O.Zh.; L.K.]; resources [O.Zh.; L.K.]; data curation [O.Zh.; L.K.] writing – original draft preparation [O.Zh.]; writing review and editing [O.Zh.; L.K.]; visualization [O.Zh.]; supervision [O.Zh.; L.K.; O.A.]; project administration [O.Zh.]; funding acquisition [-].

All authors have read and agreed to the published version of the manuscript.

REFERENCES

Baltazár, T., Pejchal, M., & Varga, I. (2013). Evaluation of European mistletoe (*Viscum album* L.) infection in the Castle Park in Lednice. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 61(6), 1565–1574. doi:10.11118/actaun201361061565
Crossref ● Google Scholar

Biegel, U., Mevissen, M., Schuller, S., Ruess, K., Christen, O., Ayrle, H., Koch, C., & Walkenhorst, M. (2022). *Viscum album* L., a therapeutic option for neoplastic diseases in companion animals? A systematic review. *Complementary Medicine Research*, 29(6), 465–482. doi:10.1159/000525035
Crossref ● PubMed ● Google Scholar

Bilonozhko, Yu. O., Ponomarenko, L. O., Rabokon, A. M., Postovoitova, A. S., Kalafat, L. O., Privalikhin, S. M., Blum, Y. B., & Pirko, Ya. V. (2019). Distribution of mistletoe (*Viscum album* L.), which parasitizes different woody plants species, in Kyiv and its genetic characteristics. *Faktori Eksperimental'noi Evolucii Organizmiv*, 25, 106–110. doi:10.7124/feeo.v25.1148 (In Ukrainian)
Crossref ● Google Scholar

Bondar, O., Isachenko, O., Mashkov, O., & Nazarenko, V. (2020). Ecological danger of mistletoe plant spread in Kyiv region and counteraction to its spread. *Ecological Sciences*, 32(5), 45–50. doi:10.32846/2306-9716/2020.eco.5-32.7 (In Ukrainian)
Crossref ● Google Scholar

Gnatyuk, O., & Kavun, E. (2016). Osoblyvosti rozpovsiudzhennia omely biloi v parkovykh i rekreatsiinykh zonakh Lisostepu ta Polissia [Peculiarities of the distribution of white mistletoe in the park and recreation areas of the Forest Steppe and Polissia]. *Visnyk Zhytomyrskoho natsionalnoho ahroekolohichnoho universytetu*, 2(56), 1, 183–192. Retrieved from http://ir.polissiauniver.edu.ua/handle/123456789/7613 (In Ukrainian)
Google Scholar

Ivchenko, A. I., Bozhok, O. P., Paczura, I. M., Kolyada, L. B., Bozhok, V. O., & Ivchenko, A. I. (2014). Osoblyvosti orhanizatsii rezultatyvnoi borotby z omeloiu biloiu [On the issue of an organization of effective fight against white mistletoe]. Scientific Bullettine of UNFU, 24(5), 12–18. Retrieved from https://nv.nltu.edu.ua/Archive/2014/24_5/4.pdf (In Ukrainian)
Google Scholar

Kavun, E. M., Berezovskiy, I. V., & Panko, V. V. (2021). Invasive cycle and assessment of the depth of invasion of representatives of dendroflora of Ukraine in the some ecosystems by european mistletoe (*Víscum álbum* L.). *Biology and Ecology*, 7(2), 27–36. doi:10.33989/2021.7.2.261543 (In Ukrainian)
Crossref ● Google Scholar

Klymenko, M. O., Boshchevska, I. M., Klymenko, L. V., Turchyna K. P., & Mikhalchuk, M. A. (2020). Ecological features of white mistletoe spreading on the territory of Rivne. *Bulletin National University of Water and Environmental Engineering*, 2(90), 38–49. Retrieved from https://visnyk.nuwm.edu.ua/index.php/agri/article/view/1119 (In Ukrainian)
Google Scholar

Lech, P., Żółciak, A., & Hildebrand, R. (2020). Occurrence of European mistletoe (*Viscum album* L.) on forest trees in Poland and its dynamics of spread in the period 2008–2018. Forests, 11(1), 83. doi:10.3390/f11010083
Crossref ● Google Scholar

Matusiak, M. V. (2019). Biological and environmental characteristics of distribution of *Viscum album* in the conditions of Vinnytsa. *Scientific Bulletin of UNFU*, 29(8), 66–69. doi:10.36930/40290810 (In Ukrainian)
Crossref ● Google Scholar

Melo, M. N. O., Batista, J. V. da C., Peñaloza, E. M. C., Oliveira, A. P., Garrett, R., Baumgartner, S., & Holandino, C. (2023). A scoping review of genus *Viscum*: biological and chemical aspects of alcoholic extracts. *Plants*, 12(9), 1811. doi:10.3390/plants12091811
Crossref ● PubMed ● PMC ● Google Scholar

Muche, M., Muasya, A. M., & Tsegay, B. A. (2022). Biology and resource acquisition of mistletoes, and the defense responses of host plants. *Ecological Processes*, 11(1), 24. doi:10.1186/s13717-021-00355-9
Crossref ● Google Scholar

Orlov, O. O., Zhukovskyi, O. V., Borodavka, V. O., Borodavka, O. B., Shevchuk, V. V., Mateychyk, V. I., & Arvat, L. S. (2023). Pine mistletoe (*Viscum album* ssp. *austriacum* (Wiesb.) Vollm.) in pine forests of Ukraine: current state of the problem. *Forestry and Forest Melioration*, 142, 124–135. doi:10.33220/1026-3365.142.2023.124 (In Ukrainian)
Crossref

Orlov, O., Danylyk, I., Zhukovskyi, O., Budzhak, V., Fedoniuk, T., Borodavka, V., & Borodavka, O. (2023). *Viscum album* subsp. *austriacum* (Santalaceae r. Br.) in Volyn Polissia and Zhytomyr Polissia (Ukraine): current distribution, ecology and prediction of future spread. *Studia Biologica*, 17(3), 139–166. doi:10.30970/sbi.1703.722
Crossref ● Google Scholar

Ostermann, T., Appelbaum, S., Poier, D., Boehm, K., Raak, C., & Büssing, A. (2020). A systematic review and meta-analysis on the survival of cancer patients treated with a fermented *Viscum album* L. extract (Iscador): an update of findings. *Complementary Medicine Research*, 27(4), 260–271. doi:10.1159/000505202
Crossref ● PubMed ● Google Scholar

Pishchalenko, M. A. Barabolya, O. V., & Chaika, T. A. (2020). The influence of biotope dendroflora species composition of the town of Poltava on mistletoe (*Viscum album* L.) spreading. *Bulletin of Poltava State Agrarian Academy*, 2, 99–109. doi:10.31210/visnyk2020.02.12 (In Ukrainian)
Crossref ● Google Scholar

Rybalka, I. O., & Vergeles, Yu. I. (2017). Infestation of urban trees by the white mistletoe (*Viscum album* L.) as an environmental safety problem in urban forestry. *Municipal Economy of Cities*, 134, 122–130. Retrieved from http://eprints.kname.edu.ua/46092/1/5008-9948-1-SM.pdf (In Ukrainian)
Google Scholar

Schröder, L., Rupp, O., Senkler, M., Rugen, N., Hohnjec, N., Goesmann, A., Küster, H., & Braun, H.-P. (2023). The *Viscum album* Gene Space database. *Frontiers in Plant Science*, 14, 1193122. doi:10.3389/fpls.2023.1193122
Crossref ● PubMed ● PMC ● Google Scholar

Shlapak, V. P., Kozak, N. I., Tereshchenko, Y. F., Vitenko, V. A., & Muzyka, G. I. (2013). Vyznachennia stupenia urazhennia omeloiu biloiu (*Viscum album* L.) derevnykh roslyn parku "Pionerskyi" v misti Uman [Determination of damage degree the arboreal plants by mistletoe

white (*Viscum album* L.)]. *Scientific Bulletin of UNFU*, 23(6), 324–328. Retrieved from https://nv.nltu.edu.ua/archive/2013/23_6/66.pdf (In Ukrainian)
Google Scholar

Szmidla, H., Tkaczyk, M., Plewa, R., Tarwacki, G., & Sierota, Z. (2019). Impact of common mistletoe (*Viscum album* L.) on Scots pine forests – a call for action. *Forests*, 10(10), 847. doi:10.3390/f10100847
Crossref ● Google Scholar

Taran, N. Y., Svyetlova, N. B., Baczmanova, L. M., Ulynecz, V. Z., & Ganchurin, V. V. (2008). Biologiya rozvytku *Viscum album* L. ta ekologichnyj monitoryng yiyi poshyrennya v lisoparkovyx biocenozax [Development biology of *Viscum album* L. and ecological monitoring of it spreading in forest and park biocenoses]. *Ukrainian Botanical Journal*, 65(2), 242–251. Retrieved from http://dspace.nbuv.gov.ua/bitstream/handle/123456789/9777/8-Taran.pdf?sequence=1 (In Ukrainian)
Google Scholar

Thomas, P. A., Dering, M., Giertych, M. J., Iszkuło, G., Tomaszewski, D., & Briggs, J. (2023) Biological flora of Britain and Ireland: *Viscum album*. *Journal of Ecology*. 111, 701–739. doi:10.1111/1365-2745.14036
Crossref ● Google Scholar

Walas, Ł., Kędziora, W., Ksepko, M., Rabska, M., Tomaszewski, D., Thomas, P. A., Wójcik, R., & Iszkuło, G. (2022). The future of *Viscum album* L. in Europe will be shaped by temperature and host availability. *Scientific Reports*, 12(1). doi:10.1038/s41598-022-21532-6
Crossref ● PubMed ● PMC ● Google Scholar

Wood, B. W., & Reilly, C. C. (2004). Control of mistletoe in pecan trees. *HortScience*, 39(1), 110–114. doi:10.21273/hortsci.39.1.110
Crossref ● Google Scholar

Zuber, D. (2004). Biological flora of Central Europe: *Viscum album* L. *Flora – Morphology, Distribution, Functional Ecology of Plants*, 199(3), 181–203. doi:10.1078/0367-2530-00147
Crossref ● Google Scholar

СУЧАСНИЙ СТАН ПОШИРЕННЯ ОМЕЛИ БІЛОЇ (*VISCUM ALBUM* L.) В УМОВАХ ЖИТОМИРСЬКОГО ПОЛІССЯ

Олена Житова, Людмила Котюк, Олена Андреєва

Поліський національний університет, Старий бульв., 7, Житомир 10002, Україна

Вступ. Омела біла (*Viscum album* L.) – рослина-напівпаразит, автотроф, аборигенний, який є невід`ємним компонентом природних і урбанізованих екосистем України, зокрема, Житомирського Полісся. *V. album* спричинює погіршення санітарного стану дерев'янистих рослин, зумовлюючи їхнє передчасне всихання, а також різке зниження інтенсивності росту і врожайності плодових дерев. Мета дослідження: 1) визначити види дерев, які уражує *V. album* і яким віддає перевагу в умовах Житомирського Полісся; 2) вивчити біологію розвитку *V. album* в умовах регіону; 3) проаналізувати характер і ступінь ураження дерев рослинами *V. album*; 4) визначити ступінь ураження дерев *V. album* за коефіцієнтом комплексної оцінки і встановити приблизний вік *V. album* за популяційно-демографічним коефіцієнтом.

Матеріали і методи. Для визначення поширення *V. album* характер пошкодження й інтенсивність ураження нею деревних насаджень здійснювали рекогносцирувальним методом. Ступінь ураження дерев омелою визначали за коефіцієнтом комплексної оцінки ($К_{копо}$).

Результати й обговорення. Виявлено, що найбільш зараженими *V. album* на території регіону є *B. pendula* (27,13 % від загальної кількості уражених дерев), *R. pseudoacacia* (17,04 %) і *P. tremula* (11,13 %). Водночас 46 % становлять малоуражені дерева, 31 % – середньоуражені та 23 % – дерева з незначним ураженням. З'ясовано, що без втручання людини кількість популяцій і чисельність *V. album* має тенденцію до зростання.

Висновки. На території Житомирського Полісся *V. album* увійшла в розряд інвазивних рослин. *V. album* виявлено на 20 видах дерев, із них уражені *V. album* сягають 41,54 % від загальної кількості досліджених дерев. Переважна більшість популяцій *V. album* (61 %) за динамікою розвитку має зростаючий характер. Найбільшу кількість кущиків *V. album* було зафіксовано на деревах, вік яких сягає 60–80 років і 80–100 років, частка яких від загальної кількості уражених *V. album* дерев становить 23 % і 25,13 %, відповідно.

Ключові слова: *Viscum album* L., рослина-напівпаразит, поширення, дерева, ступінь ураження

Received / Одержано 26 December, 2023 | Revision / Доопрацьовано 18 January, 2024 | Accepted / Прийнято 20 March, 2024 | Published / Опубліковано 27 March, 2024