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FEATURES OF FORECASTING OF LEAF-EATING INSECTS DISTRIBUTION IN THE FORESTS OF ZHYTOMYR POLISSIA

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Abstract. Foliage damage by leaf-eating insects during mass reproduction causes deterioration of the sanitary state of forest and a decrease in its increment. Timely detection of pest foci allows reducing the cost of their elimination and preventing negative consequences for stands. The purpose of this study was to identify the species composition of leaf-eating insects on the territory of State Enterprise Zhytomyrske Forestry and the subcompartments with the greatest threat of foci development of the dominant species – *Tortrix viridana*, taking into account forest site conditions and stand structure. During the feeding period, the species composition of leaf-eating insects was identified, and after the end of oviposition, the density of *Tortrix viridana* egg masses was assessed on tree branches selected in subcompartments with different forest site conditions, age, the relative crop density, and proportion of oak in the stand composition. The database of forest inventory (Ukrderzhlisproekt) and the score assessment of the preferences of stands for foci development were used. Eleven species of leaf-eating insects from order *Lepidoptera* were identified, including 9 species from the family *Tortricidae*, of which *Tortrix viridana* dominated. The highest egg mass density of this pest was assessed in fresh dubrava conditions (D_2), in pure oak plantations aged 40-80 years with a low relative crop density. The average score of stand preference for *Tortrix viridana* was assessed by forest site conditions (2.93 and 2.88 for seed plantations and coppice forest, respectively), age (3.65), the relative density of stocking (2.6), and oak participation (3.3) in the State Enterprise Zhytomyrske Forestry. The list of subcompartments with a very high and high threat of an outbreak of *Tortrix viridana* has been established. A survey in these subcompartments would allow timely detection of pest population increase and prevent its development

Keywords: common oak, green oak leaf-roller, plot preference, forest site type, relative density of stocking, forest age

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INTRODUCTION

Common oak (*Quercus robur* L.) is distributed on about 27% of the forest fund of the State Forest Resources Agency of Ukraine, or 62% of the area of hardwood plantations [1]. In particular in Zhytomyr Oblast the share of oak plantations is about 14% [2]. Hundreds of species of insects feed on the leaves of oak trees, but only some of them are capable to increase their numbers hundreds of times every few years and completely devour the crowns of trees [3; 4]. These insects include mainly members of the order *Lepidoptera*, including the families *Tortricidae*, *Geometridae*, *Lymantriidae* and some others. Damage to 25% of the leaves has little effect on the condition and growth of plantings. At the same time, during outbreaks of mass reproduction, some trees can be completely eaten by larvae of leaf-eating insects 2-3 years in a row. This negatively affects the sanitary state of the forest and its increment [5-9], increases the susceptibility of trees to to colonisation with stem pests [10] and pathogens [11].

To reduce the time and money spent on identifying foci of mass reproduction of leaf-eating insects and the timely application (if necessary) of forest protection measures, it is very important to know in which plantations the threat of foci development is greatest, and to monitor it [12-14]. The prevalence of leaf-eating insects depends on the availability of food (trees of a certain species), favourable microclimatic conditions for the existence of both leaf-eating insects and entomophages, which regulate the number of these pests [15; 16].

The availability of attractive food for leaf-eating insects depends on the type of forest site types and the species composition, which is determined by silvicultural and forestry measures. Microclimatic conditions (lighting, temperature, humidity) are formed by a certain combination of relative crop density, age, composition of plantations. Microclimatic conditions are significantly affected by a sharp increase in lighting and heating due to changes in land categories of neighboring areas after fire, wind, economic measures, [15; 17]. Usually leaf-eating insects are attracted by illuminated and warm areas of plantations [18-24], and for entomophages – more shaded, with a variety of flowering plants [3; 19; 25]. For polyphagous insects, the species composition is less important than for monophages [4; 20; 26; 27], which is, in particular, the green oak-roller moth *Tortrix viridana* Linnaeus, 1758 (*Lepidoptera: Tortricidae*).

These data on the distribution of foci of leaf-eating and needle-eating insects in forest stands and research materials allowed V.L. Meshkova [19] to score the indicators on each species in terms of the risk of development of foci of mass reproduction of the most common pests. Accordingly, using the forest management database for each species, the type of forest site types, age, participation of oak in the composition, and relative density of plantations are evaluated by a score. This approach allows estimating the threat of outbreaks of certain pests in specific forest districts and forestry enterprises. This helps to establish a list of species and the area of plantations with very high and high risks of foci development [15]. The aforementioned approach is implemented in different regions of Ukraine, mainly for needle-eating insects in pine forests [18; 28]. In particular, with the use of digitised planting plans and appropriate software, the assessment of the threat of coniferous pests has been improved, taking into account changes in the land category of neighboring subcompartments [17].

At the same time, in deciduous plantations, the approach was tested in the Left-Bank Forest-Steppe [19]. According to studies of previous years [29], since the beginning of the 21st century there have been two outbreaks of mass reproduction of leaf-eating insects in the Zhytomyr Oblast, in 2002-2008 and 2010-2018. Moreover, in the forest fund of Zhytomyrske Forestry the maximum area of these insects during the last outbreak in 2013 reached 522 hectares. The following year it decreased almost twice, and since 2018 the populations of leaf-eating insects are depressed.

Thus, despite many studies of leaf-eating insects, the possibilities of using existing approaches to assess the threat of the spread of these pests in the forests of Zhytomyr Polissya remain unclear.

The *purpose* of the study was to identify the species composition of leaf-eating insects in the forests of Zhytomyrske Forestry SE and the subcompartments with the greatest threat of foci development of the most dominant species – green oak leaf-roller, taking into account forest site conditions and stand structure.

MATERIALS AND METHODS

The study was conducted in 2000 in the forest fund of State Enterprise Zhytomyrske Forestry. Given the publications [4; 19; 29] on the predominance among leaf-eating insects of species whose larvae feed in the spring – during the development of oak leaves, plantations were examined during the feeding period of the larvae. The surveys were carried out primarily in oak plantations, where the foci of mass reproduction of leaf-eating insects during the last outbreak were registered, as well as other plantations. Plantations were selected during the analysis of the Ukrderzhlisproekt database to cover the variety of types of forest growing conditions, age, relative density, and participation of common oak in the composition of forest stands.

Surveys of plantations were carried out along running lines [15]. As a part of the spring survey, in each subcompartment, 5 branches of oak were cut with a secateurs on a pole, and the number of growth shoots and caterpillars were estimated. Caterpillars were determined using identification guides [3; 30; 31], some individuals were fed leaves to form pupa and imago. The nomenclature of insect names was coordinated

with Fauna Europea [32]. The population density of caterpillars of each species was estimated as the number of individuals per 100 growth shoots. Since most species were very rare, these data were used only to determine the dominant species – green oak leaf-roller (*Tortrix viridana*).

After the flight of green oak leaf butterflies and their laying of eggs (from the second half of summer and autumn), the survey of plantations was conducted for the second time. During this examination, the egg mass density of this pest was determined [15]. For this purpose, 3 boughs at least 2 m long were selected from different parts of the crowns. The growth of the last year, secondary branches and shoots were cut off from each branch and only the central part was left. The number of eggs of *Tortrix viridana* on a segment of a bough 1 m long was counted. According to the obtained data on the egg mass density per 1 m of branch, the distribution of this pest in plantations was estimated depending on type of forest conditions, age, relative stand composition.

Forest site types were identified according to the edaphic grid of Alekseev-Pogrebnyak, which is built on the coordinates of trophic and humidity habitats [33]. Levels of threat of development of foci of *Tortrix viridana* were determined using the data of VO Ukrderzhlisproekt on the forest fund of Zhytomyrske Forestry. Using MS Excel filters, species in which the common oak is the main forest-forming species were selected. The area of plantations was calculated separately for each forest site type, for 10-year age classes of forest stands (⩽20 years, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80 and >80 years), for relative density intervals (⩽0.4; 0.5; 0.6; 0.7 and ⩾0.8) and for plantations with different parts of oak in the composition (⩽2 units, 3-5, 6, 7-8 and ⩾9 units). Each indicator was scored according to the method proposed by V.L. Meshkova [19] and the corresponding areas and their shares were calculated from the total area of oak plantations in the forest fund of Zhytomyrske Forestry.

Statistical analysis of the data consisted in determining the average values of the *Tortrix viridana* egg mass density, standard error and their comparison using the Student's t test [34]. The calculations were carried out using MS Excel software package.

RESULTS AND DISCUSSION

The findings of the survey of deciduous plantations of State Enterprise Zhytomyrske Forestry in the spring of 2020 indicate that damage caused by leaf-eating insects did not exceed 20%. During the examination, 11 species of leaf-eating insects from two families of the order *Lepidoptera* were identified. From the family *Tortricidae*, 9 species have been identified: *Tortrix viridana Linnaeus*, 1758 – green oak leaf-roller; *Pandemis cerasana* (Hübner, 1786) – barred fruit-tree tortrix; *Ptycholoma lecheana* (Linnaeus, 1758) – Leche's twist moth; *Archips podana* (Scopoli, 1763) – large fruit-tree tortrix; *Archips xylosteana* (Linnaeus, 1758) – variegated golden tortrix; *Archips crataegana* (Hübner, 1799) – brown oak tortrix; *Archips rosana* (Linnaeus, 1758) – rose tortrix; *Adoxophyes orana* (Fischer v. Röslerstamm, 1834) – summer fruit tortrix; *Aleimma loeflingiana* (Linnaeus, 1758) – yellow oak button. From the family *Geometridae*, 2 species were found: *Operophthera brumata* (Linnaeus, 1758) – winter moth; *Erannis defoliaria* (Clerck, 1759) – mottled umber. Most of the identified species are polyphagous and only *Tortrix viridana* L. is a monophage, which feeds only on the leaves of common oak. Caterpillars of this species were the most common – their average density was 0.7±0.12 specimens per 100 growth shoots, while the density of other species did not exceed 0.1±0.03 specimens per 100 growth shoots. The results of counting the caterpillars of leaf-eating insects during their feeding confirmed the expediency of counting the egg deposition of *Tortrix viridana* to determine the most attractive plantations for the pest outbreak.

The results of accounting for the egg deposition of *Tortrix viridana* carried out in the second half of 2000 revealed the peculiarities of their distribution by forest site type, age, crop density, and share of oak in the forest composition. Among the surveyed forest stands, the presence of egg depositions of *Tortrix viridana* was found only in three forest site types (FST) – fresh sudubrava (C_2), moist sudubrava (C_3) and fresh dubrava (D_2) (Fig. 1).

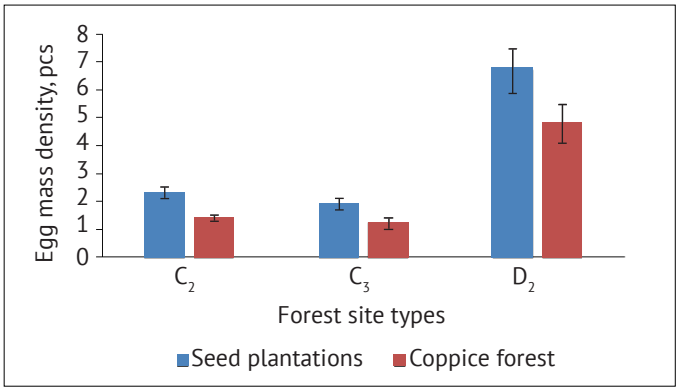

Figure 1. *Distribution of egg mass density (± standard error) of Tortrix viridana depending on the forest site type: C_2 – fresh sudubrava; C_3 – moist sudubrava; D_2 – fresh dubrava*

The egg mass density of *Tortrix viridana* in coppice stands of fresh dubrava was significantly higher than in coppice stands of fresh sudubrava ($t_{fact.}$= 5.3; $t_{0.01}$=2.73) and moist sudubrava ($t_{fact.}$= 5.8; $t_{0.01}$=2.73).The egg mass density in seed plantations of fresh dubrava was significantly higher than in seed plantations of fresh sudubrava ($t_{fact.}$= 4.8; $t_{0.01}$=2.76) and moist sudubrava ($t_{fact.}$= 4.9; $t_{0.01}$=2.76). The differences in the egg mass density between fresh and moist forest sites are not significant in both coppice stands ($t_{fact.}$=1.4; $t_{0.05}$=2.02) and in high forest ($t_{fact.}$= 0.9; $t_{0.05}$=2.02). In all forest site types, the egg mass density of *Tortrix viridana* was higher in coppice than in high forest. The differences are significant only in moist sudubrava: in fresh dubrava ($t_{fact.}$= 1.8; $t_{0.05}$=2.02), in fresh sudubrava ($t_{fact.}$= 1.8; $t_{0.05}$=2.02) and in moist sudubrava ($t_{fact.}$= 4.0; $t_{0.05}$=2.02).

Analysis of the distribution of the area of oak plantations in the forest fund of Zhytomyrske Forestry SE by forest site types (Table 1) shows the predominance of seed plantations. According to the forest site types, both seed and coppice oak plantations predominate in fresh sudubrava, moist sudubrava and fresh dubrava. In fresh dubrava, where the highest egg density of *Tortrix viridana* was found, only 7.88% and 0.54% of high and coppice oak plantations, respectively, are represented.

The calculation of area of oak plantations with a different level of threat of *Tortrix viridana* outbreak, given the forest site type and the origin of stands (seed and coppice), shows that at the largest area (71.1 and 89.7% of seed and coppice stands, respectively) the risk of pest outbreaks is average (score "3" [19]) (Table 2). The share of the area with a very high risk of *Tortrix viridana* outbreak in seed and coppice stands is 7.9 and 0.5%, respectively. The average weighted score of attractiveness for *Tortrix viridana* of forest site types of seed oak plantations – 2.93, and coppice forest – 2.88.

Table 1. *Distribution of the oak plantations area in Zhytomyrske Forestry SE by forest site types (FST)*

Forest site types (FST)	Area, ha		Share, %	
	seed plantations	coppice forest	seed plantations	coppice forest
B_2 – fresh subor	118.8	5.5	0.82	3.28
B_3 – moist subor	106.0	0.7	0.73	0.42
C_2 – fresh sudubrava	3192.9	30.6	22.01	18.24
C_3 – moist sudubrava	7120.2	119.9	49.09	71.45
C_4 – wet sudubrava	2.4	–	0.02	0.00
D_2 – fresh dubrava	1143.6	0.9	7.88	0.54
D_3 – moist dubrava	2821.0	10.2	19.45	6.08
D_4 – wet dubrava	0.9	–	0.01	0.00
Total	14505.8	167.8	100.00	100.00

Note: *Estimated on the basis of VO Ukrderzhlisproekt database as of January 1, 2019*

Table 2. *Distribution of stand area in different FST by attractiveness for Tortrix viridana*

Indicators	Threat of foci development, points*			
	0 – absent and 1 low	2 – low	3 – average	5 – very high
FST	C_4, D_4, B_2–B_3	D_3	C_2-C_3	D_2
	oak seed plantations			
Area	228.1	2821	10313.1	1143.6
Share, %	1.5	19.5	71.1	7.9
	oak coppice forest			
Area	6.2	10.2	150.5	0.9
Share, %	3.7	6.1	89.7	0.5

Note: * – *points according to [19]*

Analysis of egg mass density of *Tortrix viridana* by age of stands shows that the pest inhabits the stands at the age of 20 years, and only after 80 years the number of individuals decreases (Fig. 2).

A significant increase in the egg mass density of *Tortrix viridana* was observed in the age range of 31-40 years compared with the interval of 21-30 years ($t_{fact.}$ = 2.9; $t_{0.01}$ = 2.71) and in the age range of 41-50 years compared with interval of 31-40 years ($t_{fact.}$ = 4.7; $t_{0.01}$ = 2.71). A significant decrease in this indicator occurred at the age of over 80 years ($t_{fact.}$ = 6.2; $t_{0.01}$ = 2.71). Changes in the indicator within ten-year age intervals from 41 to 80 years are not significant ($t_{fact.}$ – 0.7-1.3; $t_{0.05}$ = 2.02).

The obtained data on the egg mass density of *Tortrix viridana* by age of stands do not differ from the literature [19]. Therefore, the distribution of the area of plantations by different ages was calculated according to the risk of pest outbreak (Table 3).

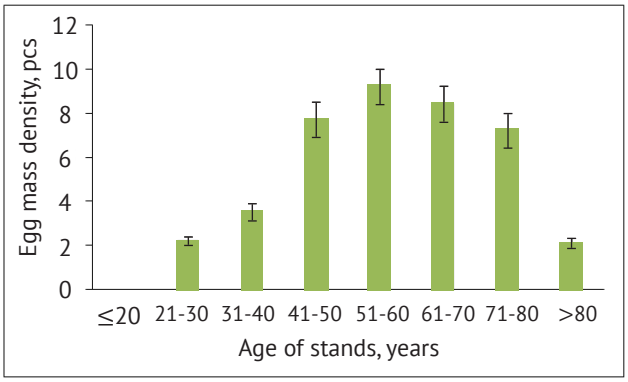

Figure 2. *Distribution of egg mass density (±standard error) of Tortrix viridana depending on age of stands*

Table 3. *Distribution of the area of plantations by different ages according to their attractiveness for Tortrix viridana*

Indicators	Threat of foci development, points*			
	0 – absent	2 – low	3 – average	5 – very high
Age, years	≤20	21-30 >80	31-40	41-80
Area	325.6	5877.2	283.1	8187.7
Share, %	2.2	40.1	1.9	55.8

Note: * – *points according to [19]*

According to the scoring of the attractiveness of oak stands by age, stands under 20 years of age are unsuitable for the development of *Tortrix viridana*. The area of such plantations is only 2.2%. Plantations with a low risk of *Tortrix viridana* outbreak – aged 21-30 years and over 80 years – account for 40.1% of the area.

Plantations with an average threat of *Tortrix viridana* outbreak (aged 31-40 years) grow on the area of 283.1 ha (1.9%). The most attractive for the pest outbreak are stands aged 41-80 years, occupying an area of 8187.7 ha (55.8% of the area of oak plantations) (Table 3). The average weighted score of attractiveness for *Tortrix viridana* by the age of oak stands of the forest fund of Zhytomyrske Forestry is 3.65.

Analysis of the distribution of egg mass density of *Tortrix viridana* by the relative crop density (Fig. 3) shows a decrease in the pest population as the relative crop density increases. Differences in the egg mass density are significant between areas with relative crop density up to 0.4 and 0.5 ($t_{fact.}$ = 2.8; $t_{0.01}$ = 2.71), 0.6 and 0.7 ($t_{fact.}$ = 6.5); $t_{0.01}$ = 2.71), 0.7 and 0.8 ($t_{fact.}$ = 6.0; $t_{0.01}$ = 2.71) and are not significant between sites with relative crop density of 0.5 and 0.6 ($t_{fact.}$ = 1.3; $t_{0.05}$ = 2.02).

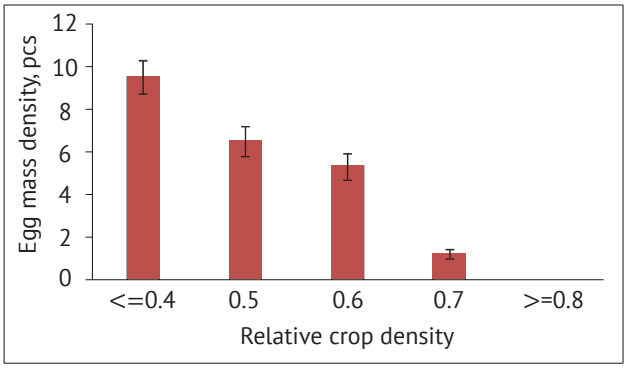

Figure 3. *Distribution of egg mass density (±standard error) of Tortrix viridana depending on relative crop density*

Distribution in plantings of phytophagous insects, in particular leaf-eating [4, 18], is largely determined by the relative crop density. The illumination of areas, rates and intensity of freezing, thawing, heating and cooling of soil, heating and cooling of air, ratio of terms and rates of development of trees, and composition of phytophagous and entomophagous insects depend on this indicator [19]. That is why the foci of mass reproduction of phytophages are most common in stands with lower relative crop density, as well as near suddenly illuminated areas as a result of windbreaks, fires, felling, construction, etc. [17].

Analysis of forest management data shows that among the oak plantations of Zhytomyrske Forestry, stands with a relative density of 0.7 (6648.6 ha, or 45.3%) prevail. Such plantations have a high risk of *Tortrix viridana* outbreak (Table. 4).

The area with less relative crop density, in which the risk of outbreak of leaf-eating insects is very high, is 15.8% of the area of oak plantations. In high-density stands (with a relative crop density of 0.8-1.0) there is no threat of pest outbreak. The average weighted score of attractiveness for *Tortrix viridana* in terms of the relative crop density of oak plantations of the forest fund of Zhytomyrske Forestry is 2.6.

As is well known [26; 35; 36], the resistance of plantations to insect damage is higher with greater biodiversity. According to V.L. Meshkova [19], plantations lose their attractiveness for *Tortrix viridana* even with the share of oak less than 7 units. According to the authors' study, the egg mass density of *Tortrix viridana* in the Zhytomyrske Forestry increased as the share of oak in the stands increased (Fig. 4).

***Table 4**. Distribution of area by the attractiveness of stands of different crop density for Tortrix viridana*

Indicators	Threat of foci development, points*		
	0 – absent	4 – high	5 – very high
Age, years	≥0.8	0.7	≤0.6
Area	5710.7	6648.6	2314.3
Share, %	38.9	45.3	15.8

***Note**: * – points according to [19]*

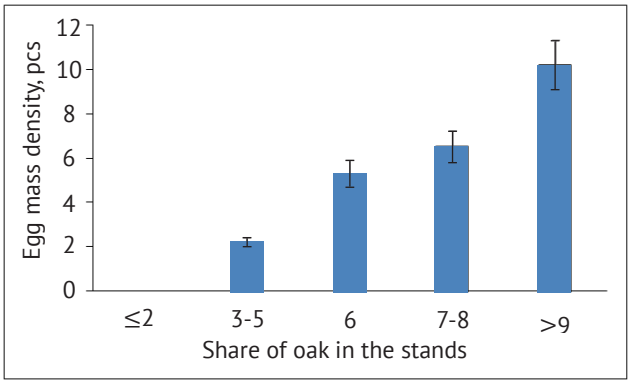

***Figure 4**. Distribution of egg mass density (±standard error) of Tortrix viridana depending on the share of oak in the stands*

Differences in the egg mass density are significant between areas with a consistent increase in the share of oak in the composition from 3 to 6 ($t_{fact.}$ = 4.9; $t_{0.01}$ = 2.71), from 7 to 9 ($t_{fact.}$ = 2.8; $t_{0.01}$ = 2.71) and are not significant between sections with relative crop density of 6 and 7 ($t_{fact.}$ = 1.3; $t_{0.05}$ = 2.02).

The analysis of forest management data shows that with the participation of oak in the composition of the oak plantations of the Zhytomyrske Forestry, stands with low threat of foci development prevail (Table 5). At the same time, plantations with an oak share of 7-8 (high threat) and 9-10 units (very high threat) are quite widely represented.

***Table 5**. Distribution of area of stands with different share of oak plantations on the attractiveness for Tortrix viridana*

Indicators	Threat of foci development, points*				
	0 – absent	2 – low	3 – average	4 – high	5 – very high
Share of oak in the composition, units	≤ 2	3-5	6	7-8	≥9
Area	55.9	5463.8	2323.4	3848.7	2981.8
Share, %	0.4	37.3	15.8	26.2	20.3

***Note**: * – points according to [19]*

The weighted average score of attractiveness for *Tortrix viridana* by the share of oak in the plantations of the forest fund of Zhytomyrske Forestry is 3.3.

The obtained data allow using forest management materials to determine the areas of forest where the pest outbreak is most probable, to calculate the area of potential foci, and to take the necessary measures to protect the forest in a timely manner.

Taking into account the forest site type, age, relative crop density and composition (see Tables 2-5), then, judging by the forest management database, in Zhytomyrske Forestry, the greatest risk of *Tortrix viridana* exists only in two divisions: Berezivske forestry, quarter 72 compartment 6 (1.3 ha) and Korabelne forestry quarter 61 compartment 1 (1 ha). Both plantations are located in FST D_2, have planting-stock age of 73 years, a relative crop density of 0.6 and 9 and 10 units of oak in the composition.

Taking into account areas with a very high and high risk of *Tortrix viridana*, adding compartments with a relative density of 0.7 and the share of oak in the composition of 7 and 8 units (see Tables 4, 5), the area of such plantations is 75 Ha.

Thus, oak plantations of Zhytomyrske Forestry are generally resistant to outbreaks of green oak leaf-roller and associated species of leaf-eating insects. At the same time, it is recommended to monitor the condition of plantations in areas with the highest risk of mass reproduction outbreaks.

CONCLUSIONS

1. Eleven species of leaf-eating insects from the order *Lepidoptera*, including 9 from the family *Tortricidae*, were found in the oak plantations of the State Enterprise Zhytomyrske Forestry. Among the insects, the green oak leaf-roller (*Tortrix viridana* L.) dominated.

2. The highest egg mass density of *Tortrix viridana* was determined in fresh dubrava (D_2), in plantations aged 50 to 80 years. The egg mass density increased as the share of oak in the plantations increased and the relative crop density decreased.

3. The attractiveness of oak plantations for *Tortrix viridana* by forest site type is 2.93 and 2.88 for seed and coppice stands, respectively, by age of stand – 3.65, the relative crop density and participation of oak in the composition – 2.6 and 3.3 points. That is, the risk of outbreaks is average.

4. The combination of the most favourable conditions for the mass reproduction of *Tortrix viridana*, such as forest site type, age of stand, relative crop density, and composition of plantations is determined only in two compartments with a total area of 2.3 hectares, and the area of high and very high risk is 75 hectares.

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ОСОБЛИВОСТІ ПРОГНОЗУВАННЯ ПОШИРЕННЯ КОМАХ-ЛИСТОГРИЗІВ У ЛІСАХ ЖИТОМИРСЬКОГО ПОЛІССЯ

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Анотація. Пошкодження листя комахами-листогризами під час масових розмножень спричиняє погіршення санітарного стану насаджень і зменшення їхнього приросту. Вчасне виявлення осередків шкідників дає змогу зменшити витрати на їхню ліквідацію та запобігти негативним наслідкам для насаджень. Метою досліджень було визначити видовий склад комах-листогризів у лісах ДП «Житомирське ЛГ» та ділянки з найбільшою загрозою формування осередків домінантного виду – зеленої дубової листовійки з урахуванням лісорослинних умов і структури насаджень. У період живлення комах-листогризів визначали їхній видовий склад, а після завершення відкладання яєць оцінювали щільність кладок яєць зеленої дубової листовійки на гілках дерев, відібраних у насадженнях із різними типом лісорослиннх умов, віком, відносною повнотою та часткою дуба у складі. Під час аналізу використано базу даних ВО «Укрдержліспроект» і балову оцінку принадності насаджень для формування осередків. Виявлено 11 видів комах-листогризів із ряду лускокрилих (*Lepidoptera*), зокрема 9 – з родини листовійки (*Tortricidae*), з яких домінувала зелена дубова листовійка *Tortrix viridana*. Найбільшу щільність її кладок яєць визначено у свіжій діброві (D_2), у чистих низькоповнотних насадженнях віком 40–80 років. Розраховано середній бал принадності насаджень ДП «Житомирське ЛГ» для цього шкідника за типом лісорослинних умов (2,93 та 2,88 для насіннєвих і порослевих деревостані відповідно), віком (3,65), відносною повнотою (2,6) та участю дуба у складі (3,3). Встановлено перелік ділянок і площу насаджень із дуже високою та високою загрозою формування осередків масового розмноження зеленої дубової листовійки. Проведення нагляду на цих ділянках дасть змогу вчасно виявити зростання чисельності шкідника та вжити заходів запобігання його розвитку

Ключові слова: дуб звичайний, зелена дубова листовійка, принадність насаджень, тип лісорослинних умов, повнота насаджень, вік насаджень