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Population Indicators of Sawflies and Concomitant Species of Needle-Eating Species in the Stands of the Prytiasmyn Ridge

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Abstract. Due to the consequences of climate change, namely a decrease in the groundwater level, there is a massive weakening of Scots pine stands in the forests of Ukraine. Against the background of dynamic weakening of trees, annual warm winters, the establishment of warm, sunny, and dry weather in spring contribute to the spread of needle-eating pests, especially sawflies. The purpose of this study was to clarify the species composition and biological features of certain species of needle-eating insects of the Prytiasmyn Ridge and the degree of threat to plantings from needle-eating insects, namely from sawflies and related species. At the stage of reconnaissance survey of pine stands, the method of qualitative and quantitative assessment of sawflies and related species of needle-eating insects was tested. During the survey of plantings of the Prytiasmyn Ridge, Defoliating insects of the following species were found: *Acantholyda erythrocephala*, *Acantholyda posticalis*, *Dendrolimus pini*, *Panolis flammea*, *Sphinx pinastri* isolated, most pine stands predominate in number *Diprion pini* and its concomitant species *Gilpinia frutetorum* and *Gilpinia virens*. The provides results of observations on the population of *Diprion pini* and concomitant species *Gilpinia frutetorum* and *Gilpinia virens* in pine stands with determination of distribution, phenological and biological features. As a result of the survey of stands inhabited by needle-eating insects, it was established in which phase of the outbreak the pest population is, to which categories the breeding centres and biological features of *Diprion pini* and related species under these conditions belong. The population indicators of the common pine sawfly *Diprion pini* and concomitant species in the stands of the Prytiasmyn ridge of the Cherkasy Oblast were evaluated. It was found that the number of these species is increasing, e.g., in 2021 the average number of viable cocoons of *Diprion pini* females was 21%, and the density of cocoons in the detritus (or forest floor) was 0.53 units·m^{-2} compared to the indicators of 2020 of 12% and 0.19 units·m^{-2}, respectively. Similarly, the number of concomitant species *Gilpinia frutetorum* and *Gilpinia virens* is increasing, the average density of cocoons in the detritus (or forest floor) of which was 1.39 units·m^{-2} in 2020, and 1.87 units·m^{-2} in 2021. As a result of the reconnaissance and detailed surveys, foci of the needle-eating insect complex were found with a total area of 128.0 ha, the determined defoliation rate of the crown was from 30% to 50%. The obtained accounting data allow assessing the potential for the reproduction of populations of Defoliating insects and indicate the need for further monitoring observations in the pine stands of the Prytiasmyn ridge

Keywords: phytophagous insects, viable cocoons, defoliation, *Diprion pini*, *Gilpinia frutetorum*, *Gilpinia virens*

Introduction

Recently, starting from 2000, global climate changes have been observed, under which organisms of all trophic levels (plants, phytophages, entomophages) have experienced a violation of the synchronicity of their development, survival, harmfulness, fertility, and range boundaries have changed [1]. On the territory of Ukraine, mass reproduction and cyclical increases in numbers are inherent in insects, mainly from *Lepidoptera* and *Hymenoptera* orders [2; 3]. The most common phytophagous insects of conifers are the pine tree lappet *Dendrolimus pini* L., the red pine sawfly *Neodiprion sertifer* Geoff., and common pine sawfly *Diprion pini* L. [4-6]. The average annual area of centres of mass

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reproduction of pine sawflies in Ukraine exceeds 14 thousand ha and is almost a third of the area of all centres of needle-eating insects [4]. Needle-eating insects cause considerable damage to pine stands, significantly reducing their productivity and protective functions.

The focus of mass reproduction is the area of the plantation, where damage to the crowns of more than 30% and a considerable density of populations of harmful insects is predicted. Mass reproduction of needle-eating insects under favourable conditions is most often observed in well-lit and well-warmed areas of plantations [3; 7]. However, even in favourable years for the common pine sawfly (with a lower temperature threshold of 10.8°C and a sum of effective temperatures of 116.5°C) [4], centres of its mass reproduction do not occur everywhere, but in the most attractive stands, which are determined by the type of forest vegetation conditions, the composition of the tree stand, the age, and completeness of the plantations. Notably, the areas of the cells of defoliating insects can significantly increase due to "cortical drying" [1].

The area of centres of mass reproduction of sawflies and derived (associated) species is determined by the structure of the forest fund, and therefore, Prytiasmyn forests are artificially created by plantations of Scots pine on moisture-deficient, non-grassy sands. The pine forests of Cherkasy Oblast are the object of both global, climate change-related, and local scientific research devoted to the study of the ecological state of the region's forest biogeocoenoses, the characteristics of the grass cover, the dynamics of productive moisture reserves during the growing season, and the development of phytophagous insect populations [6].

Pine sawflies (*Hymenoptera, Symphyta, Diprionidae*) are the most common insects of pine forests in Europe, in particular in Austria, Finland, Estonia, Germany, the Czech Republic [4], especially the monovoltine pine sawfly *Neodiprion sertifer* Geoff. and the common pine sawfly *Diprion pini* L., which develops in one or two generations per year depending on the temperature conditions, namely: the average monthly temperature in May within 15°C and July 18-25°C [2; 4; 8]. Defoliant insects are one of the dominant factors affecting tree growth in temperate and boreal forests, but the impact of climate change on the periodicity and frequency of outbreaks of mass reproduction of these insects is still understudied [1; 4; 7]. V.L. Meshkova et al. [4] performed a graphic analysis of the dynamics of *Diprion pini* L. foci based on individual levels of threat, and it was found that the interval between outbreaks was reduced to three to six years, when the interval between maxima was from 4 to 11 years and an average of 9 years, respectively [2; 7; 9]. Research has established that trees damaged by pine sawflies dry out by 80% or more without the involvement of trunk pests and, due to the fall of the most weakened trees damaged by pine sawflies, the growth of the rest of the trees accelerates [1; 3; 10].

The presence of natural enemies can slightly adjust the number of sawflies and associated species; these include parasitoids (families *Chalcidoidea, Ichneumonidae, Tachinidae*) and predators (birds, small mammals, insects of the families *Elateridae* and *Carabidae*) [10; 11]. According to studies, the influence of a complex of natural enemies on the death of *Diprion pini* L. cocoons is stable, but by the end of the study period (the end of the growing season), the intensity of defoliation slowly decreases, the annual mortality of cocoons from natural enemies ranges from 66% to 80% due to damage by Ichneumonidae and small mammals [10; 11]. Therefore, the combination of best stand characteristics, abiotic factors of the environment and regulation by natural enemies can lead to population fluctuations, and therefore, detailed information on abiotic and biotic regulatory factors is necessary, as well as monitoring of coniferous sawflies and associated species considering changes in climatic conditions.

The purpose of this study was to establish the species affiliation of the "companion" species of sawflies, to identify the specific features of their biology, seasonal development and the degree of threat to plantations according to the corresponding population indicators.

Materials and Methods

Reconnaissance survey of pine plantations of the Prytiasmyn ridge is performed every year on the entire area of forest massifs, these works include an examination of pathogen contamination of natural and artificial forest plantations, as well as on-site inspection of leaves for the warning signs indicating the occurrence of pathogens and phytophagous insects. Surveys are conducted annually, usually in autumn, and they form the basis for drawing up a plan of forest protection measures and sanitary felling for the next year [12; 13]. A detailed (stationary) survey was carried out in 2020 and 2021 in the stands of the Prytiasmyn ridge, which stretches along a strip about 50 km long and 1.5-2.5 km wide along the left bank of the Tiasmyn River, where there are best forest ecological conditions for the reproduction of sawflies (or associated species) and in cells. Table 1 presents the terms of conducting records of needle-eating insects [4; 12].

Table 1. Accounting stages and units of measurement

Species		Accounting stages, accounting time, units of measurement
Needle-eating insects	*Dendrolimus pini*	caterpillar (wintering stage), November, 1 m^2 of litter; caterpillar, April, quantity on 1 tree
	Diprion pini	cocoon (eonymph, pronymph), October, March 1 m^2 of litter
	Neodiprion sertifer	cocoon (eonymph, pronymph), October, March 1 m^2 of litter

When surveying centres of mass reproduction of pine sawflies, a spring count of cocoons in the litter was carried out, setting up test areas in plantations with different degrees of crown eating, counts were carried out on samples (sites or accounting trees). The total number of samples in the cell was at least 20, in forest areas with homogeneous plantations, samples were placed evenly along the planned routes, in quarters with heterogeneous plantations, samples were placed in large sections. To record the insects in the litter, samples of 1 m^2 (2×0.5 m) were laid under the trees with the smaller side adjacent to the tree, and the larger side along the radius of the crown projection, the top layer of the litter was discarded, then carefully examined, removing the rest of the litter in layers, and then

soil to a depth of 5-8 cm. All insects (at different stages of development), individually alive, affected by diseases and damaged by parasites or predators were selected and counted [12; 13].

When recording, it is important to be able to distinguish healthy pupae (cocoons) from those affected by parasites and pathogens. A healthy pupa makes vigorous abdominal movements when squeezed from the sides. When leaving the imago pupa, they open diagonally with large lids from the head to the middle of the front side of the abdomen. When the parasites leave the pupae, they leave round holes of diverse sizes in the walls. Pupae with signs of damage by bacterial pathogens contain a brown liquid with a sharp unpleasant smell, with signs of mycosis damage – hard and covered with fungal mycelium [4; 12; 13]. The cocoons of sawflies are opened with a round lid on the entire width of the cocoon from the end when they fly out, the parasitised cocoons when they fly are left in the walls, as well as in the end, the holes are always smaller. When damaged by entomophages and predators (rodents), holes of irregular shape are formed on cocoons and pupae [12; 13].

The species composition of overwintering pests was determined, isolating the cocoons of the common pine sawfly and related species. When examining the cocoons of the common pine sawfly, the following were selected: whole cocoons without any holes; damaged by entomophages (wireworms, turuns, etc.), which have one or more holes of irregular shape and different sizes on the surface, and are empty inside or with larva remains; damaged by mouse-like rodents, which have an elongated hole of arbitrary shape, depressed on the sides, and empty inside; the cocoons hatched by the birds have a membrane bent to the sides in the form of a triangular patch at the place of damage; parasitised cocoons have regular round holes, but unlike the cocoons from which adult sawflies emerged, they are much smaller.

Whole cocoons were analysed to identify the sex index (the ratio of females to males). For this, whole cocoons were divided by size, larger cocoons measuring 9-10 mm were assigned to females, and smaller ones (7-8 mm) – to males, the number of females was divided by the number of males, while finding the ratio between females and males in the wintering population of sawflies (♀:♂).

The average density of cocoons (p) at the size of the accounting plot of 1 m^2 (2×0.5 m) was calculated according to the following formula:

$$\rho = \frac{n\ (\text{cocoons})}{n\ (\text{accounting areas})} \qquad (1)$$

The threat of 100% eating of plantations by *Diprion pini* L. larvae in terms of the number of viable ones per 1 m^2 is 13 female cocoons per 1 m^2.

Externally intact female and male cocoons were analysed for diapause, parasite infestation, and disease damage by dissecting the cocoons and carefully examining hibernating individuals with binoculars and a magnifying glass, a total of 471 cocoons were analysed in 2020 and 726 cocoons in 2021. When infected with fungal diseases inside the cocoon, the larva is mummified and hard, the tissue is filled with white, red, green, pink, mycelium. If affected by bacterial diseases, the hibernating larvae in the cocoon have an unpleasant smell, are black, filled with a black or red liquid. Viral diseases are diagnosed through microscopic analysis, visually – in the cocoon, the larva is liquefied and transformed into a cloudy, odourless liquid.

Spring surveys were performed by surrounding model trees and collecting larvae of sawflies and associated species on a total area of 128 ha. The larvae feeding in the crown were collected by rounding and the state of defoliation was determined approximately. The collected larvae were subsequently divided by species and age, age was determined by the width of the head capsule (Table 2) [12].

Table 2. The width of the head capsule of larvae of different ages, mm

Age	I	II	III	IV	V	VI
Head capsule width, mm	0.5	0.8	1.1	1.4	1.8	2.2

The question of determining the age of larvae in the study of population indicators is important because without an accurate determination of age it is difficult to signal the timing of the development of defoliant insects and to prescribe appropriate control measures.

Results and Discussion

During the survey of experimental plantations, a complex of defoliant insects was discovered, which included 8 species from 6 genera and 5 families (Table 3). During the inspection of the forest, the following species were found: the red-headed *Acantholyda erythrocephala* and the pine star *Acantholyda posticalis* saw-weavers, the pine silkworm *Dendrolimus pini*, the pine weevil *Panolis flammea*, the pine weevil *Sphinx pinastri*, the common pine sawyer *Diprion pini* and its derived species – shrub gilpinia *Gilpinia frutetorum* and greenish gilpinia *Gilpinia virens* with different frequency of occurrence. Larvae of sawflies damage pine plantations of various ages, including undergrowth and open forest crops, which, in case of a rapid increase in numbers, leads to substantial loss of needles, deterioration of the sanitary condition of plantations, loss of growth and death of individual trees. Apart from common (*Diprion pini* L.) and red (*Neodiprion sertifer* Geoffr.) pine sawflies, there are so-called "combined" species in pine forests that damage needles at the same time as these species [9].

Table 3. Distribution of needle-eating insects in the plantations under study

Family	Genus	Species	Frequency of occurrence
Pamphiliidae	*Acantholyda*	*Acantholyda erythrocephala*	Isolated
		Acantholyda posticalis	Isolated
Lasiocampidae	*Dendrolimus*	*Dendrolimus pini*	Isolated
Noctuidae	*Panolis*	*Panolis flammea*	Isolated
Sphingidae	*Sphinx*	*Sphinx pinastri*	Isolated
Diprionidae	*Diprion*	*Diprion pini*	Crowded
	Gilpinia	*Gilpinia frutetorum*	Crowded
		Gilpinia virens	Crowded

Notably, the species complex of defoliant insects in this region is typical for stands dominated by Scots pine [1; 3; 7], associated species of sawflies, namely *Gilpinia frutetorum* and *Gilpinia virens*, form stable centres in favourable years [9]. The obtained data are consistent with studies of needle-eating insects on the territory of Ukraine, namely in Zhytomyr [1; 3] and Luhansk Oblast [7], Kyiv and Chernihiv Polissia and Forest Steppe [6], but the listed species occur unevenly across the entire area of plantations. As the data in the Table 4 suggests, the dominant species are the larvae of *Diprion pini*, *Gilpinia frutetorum* and *Gilpinia virens*, the caterpillars of *Sphinx pinastri* and *Dendrolimus pini* were found singly.

When surveying the nests of the common pine sawfly, a considerable increase in the number of "accompanying" species of pine sawflies was noted in different regions [3; 7; 9]. In connection with the lack of data on the biological characteristics, distribution and development of these species, it is difficult to appoint and promptly perform forest protection measures.

Table 4. The survey results obtained from the model trees

Location		Area, ha	Seq. No.	Species		
Quarter	Section			*Sphinx pinastri*	*Dendrolimus pini*	*Diprion pini* and derived types
22	1	14.7	1	0	1	51
21	2	7.2	1	0	0	47
20	4	16.7	1	0	1	43
			2	0	0	39
20	5	7.4	1	0	1	94
18	3	1	1	0	0	103
10	11	6	1	0	0	0
9	8	10.8	1	0	0	46
9	7	9.0	1	0	0	3
8	5	37.3	1	0	0	26
			2	0	0	17
8	13	3.8	1	2	1	151
7	5	14.1	1	0	1	23
Total		128.0		2	6	643

A total of 643 larvae of sawflies were collected, the main part of which was larvae of the shrub gilpinia, about 75%, and the rest – 25% of the larvae of the greenish gilpinia. *Gilpinia* cocoons and larvae were ubiquitous in the stands under study. In contrast to the common pine sawfly, larvae of shrub gilpinia live alone and are a typical "companion" species in sawfly populations [14-16].

According to the timing of feeding, needle-eating sawflies are divided into two groups. Larvae of the Group I species feed in the spring and cause damage at the same time as the red pine sawfly (from the end of April to mid-June) [9; 16], did not occur in the plantations under study. Larvae of the Group II species feed simultaneously with the common pine sawfly (spring generation in June, autumn generation in August-September), namely *Gilpinia frutetorum*, and *G. virens* [16]. Unlike needle-eating sawflies, larvae of *Gilpinia frutetorum* and *Gilpinia virens* are solitary, and are a typical "companion" species in sawfly populations. Larvae of greenish gilpinia occur singly everywhere and never reproduce en masse [9].

An analysis of the age structure of *Gilpinia frutetorum* and *Gilpinia virens* larvae was carried out (Table 5), as a result of which the predominance of II-III age class larvae was established. Notably, in the stands under study, larvae, and cocoons of *Diprion pini* and associated species were found ubiquitously (Table 6).

Table 5. Analysis of the age structure of the larvae of greenish and shrub gilpinia

Phytophage insect	I		2		III		IV		V	
	pcs.	%	pcs.	%	pcs.	%	pcs.	%	pcs.	%
Gilpinia virens	26	16	90	56	45	28	0	0	0	0
Gilpinia frutetorum	92	19	202	42	159	33	29	6	0	0

Table 6. Average population indicators of common *Diprion pini*

Number of embedded samples	Viable cocoons		Damage caused by entomophages, pcs./%	Affected by mycoses, pcs./%	Dead, pcs./%
	Females, pcs./%	Males, pcs./%			
2020					
150	7/12	5/9	27/45	18/31	2/3
2021					
150	20/21	14/15	27/30	23/25	8/9

The analysis of collected cocoons with a distribution by viability and sex, considering the number of affected, damaged and dead, allowed establishing that the number of cocoons of the common pine sawfly and related species increased in 2021, compared to 2020, due to a sharp increase in the proportion of females in the population (Fig. 1).

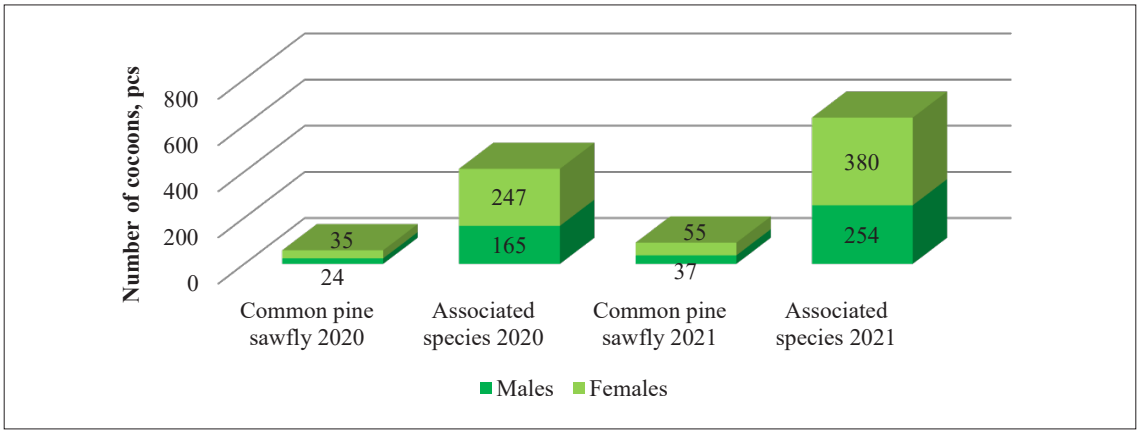

Figure 1. Distribution of cocoons of pine sawflies and related species by sex, pcs.

Among the *Diprion pini* cocoons collected in 2020-2021, no more than 20% of the cocoons were intact. Among the 59 intact cocoons examined in 2020 (by external signs), only 12 were found to be viable, i.e., contained living aeonymphs, when in 2021, 34 viable cocoons were found among 92 cocoons. Analysing the obtained data, the average number of viable cocoons of common pine sawfly females was 12% in 2020, and 21% in 2021, respectively, so this indicates favourable conditions for the development of the population and the potential for increasing the number in the future. The average density of cocoons in the test plots in the litter was 0.19 pcs·m^{-2} in 2020, and 0.53 pcs·m^{-2} in 2021. Mostly, the cocoons of the common pine sawfly were damaged by entomophages – 45% and 30%, the share of cocoons affected by mycoses was 31% and 25%, the share of dead cocoons – 3% and 9%, respectively.

During the study, the population indicators of accompanying species were analysed by year: viable cocoons of females of derived species (shrub gilpinia and green gilpinia) in 2020 – 13%, in 2021 – 11%, respectively (Table 7, Fig. 2). From all the test plots that were planted in the plantations in 2021, 634 intact cocoons of related species of the pine sawfly, namely greenish and shrub gilpinia, and 412 cocoons in 2020 were found, of which the proportion of viable ones was 117 and 86 cocoons, respectively.

Table 7. Population indicators of derived species *Gilpinia frutetorum* and *Gilpinia virens*

Number of embedded samples	Viable cocoons		Damage caused by entomophages pcs./%	Affected by mycoses pcs./%	Dead, pcs./%
	Females, pcs./%	Males, pcs./%			
2020					
150	52/13	34/8	193/47	88/21	45/11
2021					
150	70/11	47/7	379/60	126/20	12/2

Figure 2. Collected cocoons of *Diprion pini* and related species

The average density of cocoons in the litter on the trial plots was 1.39 pcs·m^{-2} in 2020, and 1.87 pcs·m^{-2} in 2021.

As can be seen from the above data, the majority of cocoons of the derived species of shrub gilpinia and greenish gilpinia are damaged by entomophages – 47% and 60%, the share of cocoons affected by mycoses is 21% and 20%, the dead are 2% and 11%, respectively, in 2020 and 2021.

During the research, the level of defoliation of the pine plantations was measured (Fig. 3). According to the conducted reconnaissance and detailed surveys, teh study established the presence in the plantations of the Prytiasmyn ridge of centres of the complex of needle-eating insects with a total area of 128.0 ha, the determined average defoliation rate of the crown was from 30% to 50%. Therefore, further study of the biology of the "companion" species of sawflies will allow establishing the regularities of their relationships in complex centres and determining the degree of danger for pine plantations.

Figure 3. Defoliation of the surveyed forest stands

According to the classical scheme of A.I. Ilyinsky (1952), outbreaks of mass reproduction of needle-eating insects form seven generations of phytophagous insects, which develop in four phases [12]. In the first (initial) phase, the population size rapidly increases by 2-4 times (compared to the population size index before the outbreak), in the second phase (population growth), centres of mass reproduction are formed, in the third phase (the outbreak itself) – the number of individuals in the population increases, and in the fourth (crisis phase) – it sharply decreases. According to the results of the conducted forest pathology survey, it was established that the population of *Diprion pini* and related species *Gilpinia frutetorum* and *Gilpinia virens* is on the verge of a tangible threat of damage to the plantations of the Prytiasmyn ridge and the centre is in the second phase of development – the phase of population growth. Therefore, it is currently expedient to carry out exterminating measures to reduce the population and its spread.

Conclusions

In 2020-2021, a complex of defoliant insects was found in the stands of Prytiasmyn pine forests, which includes 8 species from 6 genera and 5 families. The biological features of the species that may have economic value, namely the red-headed *Acantholyda erythrocephala* and the pine-star *Acantholyda posticalis* saw-weavers were specified, the pine silkworm *Dendrolimus pini*, the pine weevil *Panolis flammea*, the pine weevil *Sphinx pinastri*, the common pine sawfly *Diprion pini* and related species – the shrub gilpinia *Gilpinia frutetorum* and the greenish gilpinia *Gilpinia virens*. In the conditions of the Prytiasmyn ridge, all identified species of insects occurred, but sawflies and their associated species dominated. Population densities of all needle-eating insects' species were low, but cocoon densities of both common and associated pine sawfly species increased in 2021 compared to 2020. Among the factors regulating populations of pine sawflies, the leading role was played by entomophages, which damaged the majority of cocoons of related species and sawflies, and mycosis.

Considering the fact that the stands of the Prytiasmyn ridge are considerably weakened, defoliation of needles in the cell is already above average in the vast majority, and the feeding of pests will continue throughout September-October, damage to needles can lead to a sharp increase in the defoliation rate and a considerable weakening and deterioration of the sanitary condition in the pine stands. Further study of the biology of associated species of pine sawflies will reveal patterns of their interaction in complex centres and determine the degree of danger for pine plantations.

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Популяційні показники пильщиків та супутніх видів комах-хвоєгризів насаджень Притясминської гряди

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Анотація. У звя'зку з наслідками кліматичних змін, а саме пониженням рівня ґрунтових вод, у лісових масивах України спостерігається масове ослаблення насаджень сосни звичайної. На фоні динамічного ослаблення дерев, щорічних теплих зим, встановлення теплої, сонячної та сухої погоди навесні сприяють розвитку та поширенню хвоєгризучих шкідників, особливо пильщиків. Метою досліджень було уточнення видового складу та біологічних особливостей окремих видів комах-хвоєлистогризів Притясминської гряди та ступеня загрози насадженням від хвоєгризів, зокрема, від пильщиків та супутніх видів. На етапі рекогносцирувального обстеження соснових насаджень, було здійснено апробацію методики якісної та кількісної оцінки пильщиків та супутніх видів комах-хвоєгризів. Під час обстеження насаджень Притясминської гряди виявлено комах-дефоліантів наступних видів: *Acantholyda erythrocephala*, *Acantholyda posticalis*, *Dendrolimus pini*, *Panolis flammea*, *Sphinx pinastri поодиноко*, в більшості соснових насаджень переважають за чисельністю *Diprion pini* та його супутні види *Gilpinia frutetorum* та *Gilpinia virens*. Наведені результати спостережень за популяцією *Diprion pini* та супутніх видів гільпінії чагарникової *Gilpinia frutetorum* та гільпінії зеленуватої *Gilpinia virens* у соснових насадженнях з визначенням поширення, фенологічних і біологічних особливостей. У результаті обстеження насаджень, заселених хвоєгризучими комахами, встановлювали у якій фазі спалаху перебуває популяція шкідника, до яких категорій належать осередки розмноження та біологічні особливості *Diprion pini* та супутніх видів у даних умовах. Оцінено популяційні показники звичайного соснового пильщика *Diprion pini* та супутніх видів у насадженнях Притясминської гряди Черкаської області. Визначено, що чисельність зазначених видів зростає, так, у 2021 році середня кількість життєздатних коконів самиць *Diprion pini* становить 21 %, а щільність коконів у підстилці – 0,53 шт·м$^{-2}$ за показників 2020 року 12 % та 0,19 шт·м$^{-2}$ відповідно. Аналогічно зростає чисельність супутніх видів *Gilpinia frutetorum* та *Gilpinia virens*, середня щільність коконів у підстилці яких становила у 2020 році 1,39 шт·м$^{-2}$, а у 2021 році – 1,87 шт·м$^{-2}$. За наслідками проведених рекогносцирувальних та детальних обстежень виявлено осередки комплексу комах-хвоєгризів загальною площею 128,0 га, окомірно встановлений показник дефоліації крони становив від 30 % до 50 %. Отримані облікові дані дозволяють оцінити потенційні можливості розмноження популяцій комах-дефоліантів та свідчать про необхідність проведення подальших моніторингових спостережень в соснових насадженнях Притясминської гряди

Ключові слова: комахи-фітофаги, життєздатні кокони, дефоліація, *Diprion pini*, *Gilpinia frutetorum*, *Gilpinia virens*