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ANALYSIS OF THE PREDICTION OF MASS REPRODUCTION OF STEM PESTS OF CONIFEROUS TREES OF POLISSYA AND FOREST-STEPPE

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Abstract

In Ukraine, in particular in Polissya, since 2012 and until that time, there is a looming increase in the number of stem pests. For the European fir *(Picea abies)* the dominant species is the bark beetle *(Ips typographus)*. For pine *(Pinus silvestris)* the top spot bark beetle *(Ips acuminatus*), hexagonal bark beetle - Stenograph *(Ips sexdentatus)* and small pineal loboid *(Blastophagus minor)* appear to be of paramount importance. One of the first steps in solving this problem in artificial ecosystems such as forests is the inventory of a harmful and useful fauna in order to detect the spatial distribution of organisms, the introduction of mechanisms for regulating their numbers, and particular attention is required for the forecast of massive reproduction of the harmful entomophage and the search for ways to stop the spread of these pests.

Keyword: prognosis, stem pests, temperature, precipitation, *Picea abies, Pinus silvestris, Ips typographus, Ips acuminatus, Ips sexdentatus, Blastophagus minor.*

Introduction

Preservation and rational use of natural resources, and especially biological diversity, is one of the main tasks of conservation of natural ecosystems.

One of the first steps in solving this problem in artificial ecosystems such as forests is the inventory of harmful and useful fauna, the detection of spatial distribution of organisms [13] and the introduction of mechanisms for regulating their numbers. The obtained data is an important component of the monitoring of forest bird infestation with the purpose of preventing their spread to new forest areas. In addition to the account and supervision, the prognosis [7] of the massive reproduction of stem pests in pine forests is of particular importance. It allows you to prematurely prepare for this type of pathology in the woods, strengthen surveillance of pests, carry out preventive measures and develop appropriate methods [1] of combating them.

In Ukraine, in particular in Polissya, since 2012 and to date there is a looming increase in the number of stem pests. For the European fir *(Picea abies)* the dominant species [6] is the bark beetle *(Ips typographus*). For pine *(Pinus silvestris),* the top spot bark beetle *(Ips acuminatus*), the six-tongue bark beetle - Stenograph *(Ips sexdentatus)* and the small pineal loboid *(Blastophagus minor)* are among the most prominent. It was established that the total forest-pathological condition of the forest plantations of Vinnytsia and Zhytomyr regions has deteriorated considerably, as evidenced by the area of complete sanitary cutting (hereinafter SSR). For example, in 2015, in the coniferous plantings of Zhytomyr region, the SSR was planted on an area of 2832.0 hectares, and in 2016 - 4828.0 hectares (increased by 70%). This is also evidenced by the results of reconnaissance and inpatient supervision, the area of affected plantations, the degree and nature of damage, population indicators of pests. For example, the area of cells of stem pests of Zhytomyr Polissya, according to the results of the reconnaissance forest-pathological survey in 2017, amounted to 18,173 hectares (compared to only 11 hectares in 2012).

The analysis of temperature data and precipitation since 2007 showed a high probability of massive proliferation of stem pests, the spread of which depends on changes in weather and climatic factors in the direction of temperature rise and precipitation reduction.

Methods

In order to predict the massive proliferation of stem pests of coniferous species, a correlation analysis of weather conditions [9] that can stimulate or limit the growth of the number of harmful insects is systematically carried out, and when drought is the root cause of weakening of plantations. In order to determine the real meteorological situation on the last years, data from the nearest meteorological stations are used, where the temperature and relative humidity, precipitation, humidity deficit were obtained. On their basis, corresponding charts were constructed, which were compared with long-term data. The bihydrothermal coefficient for GT was also calculated [11]. Farmers (BGTP), on the basis of which the ball is determined by the threat of mass reproduction for the next year.

The coefficient BGTP is calculated by the formula: k = (AS 10) / £ of daily average temperatures.

The coefficient is determined by the period of effective temperatures, that is, when the average daily temperature exceeds 10° C.

In agrometeorology, the generally accepted criterion for the selection of dry periods and their boundaries is the annual rainfall indicator [8]. The identification of an arid year or a particular period is considered to be the provision of atmospheric precipitation at a level less than 75% of the norm. Climatological surveys of forest management in Polissia have not been conducted in recent years. The influence of the temperature regime on the hydrology of forest soils is shown in studies [8], which showed that when the average temperature exceeded during vegetation at 1.1 ° C, more norms the total evaporation increased in 1.3-1.4 times,

and the total cost of moisture exceeded its income in the form of precipitation by 60-79%.

Results

During the survey of spruce and pine plantations, it has been established that they have recently functioned in cardinally modified forests, as evidenced by the analysis of the complex of characteristics of habitats and the actual state of vegetation.

There was a pronounced change in the hygrothes [12] in the direction of increasing dryness of forest vegetation conditions. In the forest biocenoses [5], arid natural conditions [4] were formed and steadily maintained, which became one of the negative reasons for the deterioration of their physiological state.

Thus, the outbreak of mass reproduction of bark beetles and, consequently, the weakening of dune stands due to changes in weather and climatic conditions over the last few years. As an example [3], the ratio of precipitation and active temperatures at the Meteorological Point Korosten (Zhytomyr region) is given. The straight line indicates the norms of rainfall and the sum of positive temperatures during the growing season for a given area.

The analysis of meteorological data convincingly suggests *(Fig. 1)* that underlying arid phenomena and forest pathologies initiated by them is a deficiency of atmospheric precipitation and an increase in the sum of active temperatures.

Meteorological observation point	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Belopillya	1	2	3	3	3	3	3	2	2	5	4	**3**
Khmilnik	1	1	1	3	2	4	3	2	2	5	3	**2**
Lipovec	2	2	2	3	3	3	4	2	2	5	3	**3**
Vinnytsya	1	2	2	4	2	4	4	2	2	5	4	**4**
Zhmerinka	1	2	0	3	1	4	3	2	3	4	3	**4**
Haysin	3	3	2	4	2	3	4	2	3	5	3	**3**
Mogilev Podolsky	2	4	0	3	2	4	4	2	2	5	4	**3**
Kryzhopil	2	3	1	4	2	4	4	2	3	5	3	**2**
Average mark of BGTP in Vinnytsya oblast	**2**	**2**	**1**	**3**	**2**	**4**	**4**	**2**	**2**	**5**	**3**	**3**
Ovruch	1	1	3	3	2	1	1	3	2	5	3	**3**
Olevsk	1	0	2	2	2	1	1	2	2	3	2	**2**
Korosten	1	2	3	3	2	2	2	3	2	4	3	**2**
Novograd Volynsky	2	1	3	3	1	1	1	1	2	3	4	**3**
Zhytomyr	2	1	3	3	2	3	3	2	2	4	3	**3**
The average mark of BGTP in Zhytomyr oblast	**1**	**1**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**4**	**3**	**3**

Figure 1. Points BHTP [7] (prediction) for stem pests in the area of DSLP "Vinnytsyalisozahyst" for 2007-2018 years: score 0 - calm level of risk; 1 point is a relatively quiet degree; 2-3 points - the degree of enhanced supervision; 4 - degree of threat locally; 5 - the highest degree of threat.

The above is the course of average points of the forecast of BHTP on stem pests in Vinnitsa and Zhytomyr regions. The first signs of drying pine plantations were detected in 2012, massively from 2014. Climatic conditions for the outbreak arose in 2008-2010 - from 1-2 points in 2007 to 3 points of the BGTP forecast for 2009. Favorable weather conditions in 2015, namely, high daily average air temperatures, insufficient and uneven rainfall, will trigger an alarming level of forecasting by 2016 (an average of 4-5 points).

Taking into account the above - in 2018, the forest-pathological situation will remain difficult, the area of the cells of stem pests and, accordingly, the area of the SSR will increase.

In the beginning of July 2012 *(Fig.* 2), in the area of Zhytomyr Polissya and Forest-Steppe, the area of reproduction of the bark of the typographer *(Ips typographus)* was found, which amounted to 0.5 hectares with up to 35% of the growing trees, despite their belonging to different categories of physiological condition. This indicated that the first phase of the outbreak (the increase in the number) of mass propagation of stem pests of coniferous species of trees came.

Since 2013, signs of drying of spruce and pine plantations have become massive as a result of the activity of stem pests. Even more favorable weather conditions for the outbreak of pine coniferous trees occurred in 2008-2010: from 1 point relative to the calm situation in 2007 to 3 points, which required intensified supervision according to the forecast of the BSGP in 2009 *(Fig. 3)*. Weather conditions in 2015 were characterized by high daily average air temperatures, insufficient and uneven rainfall. All this determined the level of forecasting as threatening for the next 2016, reaching 4-5 points.

The forecast was soon exhausted. The untimely conduct or absence of preventive measures for regulating the number of stem pests of coniferous forests only contributed to the expansion of their cells. Thus, in the spruce plantation of 104 quarter of 7 Khodorkovsky forestry, which was observed on the state enterprise

"Popilnyans'ke LH" by the end of August 2012, at the same cell area there were already 86% of trees in spruce forests of the 5th and 6th categories of the state. By the end of the growing season of the same year, the area of the invasive cell increased to 1.6 hectares, leaving only a few live spruce forests, not inhabited by a bark beetle typist *(Ips typographus*). In other adjacent spruce plantations of the same forestry, the current decay of spruce in the cells varied from 10 to 50-100%, which in the next 2013 led to the continuous drying of spruce stands of this forestry from the activity of the cell of the bark of the typographer.

The stated pheromone traps using pheromone "Ipsodor" at the end of April 2012 worked as attractants of the pest - at a high concentration of the bark of the typographer in the plantations, the number of caught individuals was small (from 49 to 216 pcs for 1 trap), and the area of damage increased rapidly.

Figure 2. Forecast for the development of stem-wood pests in the service area of DLSP "Vinnitsilysozahist" for 2010-2018.

Figure 3. The ratio of average points of BHTP (biogidrothermal indicator) for stem pests and cells of stem pests passed SSR (complete sanitary cutting) in Zhytomyr region for 2010-2018.

There was a decrease in the trapping of bark beetles in the period 2014-2016. Possible weather conditions could be due to this, as a result of which the spruce stands declined and lost their protective properties, and as a result, the food supply signal was stronger than the effect for pests from pheromone action; on the other hand, air in fir trees in the center of their distribution center was saturated with a high concentration of natural pheromone, resulting in beetles being disoriented.

During the ongoing reconnaissance forest-pathological surveys, it was found that coniferous plantations were disrupted as a result of the action of the cells of stem pests and were characterized by curtin and continuous drying of strong stands. Trees IV-VI status categories have been worked out by stem pests of the family of bark beetles.

Plants were in a state of active degradation, that is, those who lost their protective functions and belonged to the III class of biological stability. Localization of the cells and bringing them to the proper sanitary condition required urgent sanitation and sanitary measures in them.

Consider the magnitude of the problem and the level of threat on the example of the results of the reconnaissance forest-pathological survey of pine plantations belonging to the State Enterprise "Malynsky forestry", Zhytomyr region, Ukraine, in which there was a massive drying of pine forests as a result of the distribution of cells of secondary stem pests against the background of a complex of ecological and climatic factors . In conducting this forest-pathological survey on its territory in 2015, a clear correlation was established between the settlement of stem pests of forest stands and

the spread of ophiostomaceae *(Ophiostomaceae)* [2] in the interior of the leading tissues of wood, which was accompanied by a change in the color of the wood from natural to dark gray or blue. All the plots of dry land were characterized by the presence of deadwood trees of the V class category, which was about 60% of the total number, and trees belonging to category IV. The latter were characterized by yellowing and roasting of gills, and their crowns lost their needles and became more openwork. The initial stage of drying of trees was characterized by persistence.

The survey covered the area where reconnaissance surveys were conducted in past years. There were discovered 38 new cells of drying out, which occupied a total area of 9.7 hectares. During the forest-pathological survey, at the beginning of the vegetation period last year, centers of forest plantations invasive with stem pests in the total area of 6.9 hectares, including Malinsky forestry - 4.9 a, Ukraink forestry - 2.0 hectares were discovered. (Zhytomyr region, Ukraine), where during 2014 proper sanitary-sanitary measures (SSR) were carried out.

The revealed cells were characterized by curtin and group dryness and in most cases confined to the illuminated sections of the forest that were directly adjacent to the continuous sanitary felling, conducted in 2013-2014, to the edge, etc., and also partly located on raised sections of the relief, or near them, that is, in those places where there was a lack of moisture and which were easier to access for migrating pest colonies. The dominant species of pests were: the bark of vertex *(Ips acuminatus)* - the distribution area - the pine crown; Luboid pine small *(Blastophagus minor)* - distribution area - upper parts of the trunk and lower branches of the pine crown; bark beetle - *(Ips sexdentatus)* - the area of its spread - the middle and pleasing part of the trunks of pine trees.

Discussion

At an early diagnosis of settling of coniferous trees, stem pests are experiencing significant difficulties. Thus, the European spruce *(Picea abies)* is inhabited by the bark beetle typographer *(Ips typographus)* [10] by the so-called barrel type, when the epicenter of the beetle population is on the verge of living and dead knots, that is, at an altitude of 8-12 m. The crown of the trees at the time of the placement of the typographer is outwardly ordinary. To find out the beginning of the tree's population, you need to examine it from below on all sides. The sign of settling a spruce with a bark beetle is a rash from the bark of bark of flint, which is collected in crustal crust, on the root paws, often seen on leaves of grass and shrubs. Over time, rain and wind destroy traces of bark beetle. Additional features may be the individual beetles that can be seen on the tree trunk, the smelting on the fir tree, green but already dry needles, falling to the ground. This also applies to the early detection of stem pests of pine *(Pinus silvestris)* - vertebrate bark *(Ips acuminatus),* hexagonal bifurcation stenograp *(Ips sexdentatus)*. Small pine loboid *(Blastophagus minor)* manifests itself in pine plantations in the form of so-called "spiked" shoots during supplementary feeding of adult beetles. At the time of detection of the first signs of the activity of bark beetles (yellowing of needles, drunken flour), they already have time to pass half of their development period. From the time of the signaling and until the permit for felling, the beetles complete their development and populate other areas of forest plantations. Therefore, timely detection and elimination of freshly planted bark beetles is a very complicated, unproductive and at the same time a necessary process for controlling the stem pests of coniferous trees.

Conclusions and suggestions

Taking into account the above - from 2016 till now, the forest-pathological situation in the coniferous forests of Ukraine on the example of the Zhytomyr region remains difficult, and the area of the centers of forests affected by stem pests and, accordingly, the area of continuous sanitary felling significantly and rapidly increases. Therefore, forest protection of forests should be kept under intensive reconnaissance supervision of pine plantations with the purpose of timely identification and planning of appropriate sanitary measures.

Effective protection of valuable forest species from stem pests is possible only with the timely detection of cells at the initial stages of their mass reproduction. The volume and nature of recreational activities should be determined by the results of monitoring the state of plantations, which determine the number of stem pests, and also predict the beginning of their massive reproduction.

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INCREASING THE EFFICIENCY OF CREATING A MICROCLIMATE FARM IN THE CONDITIONS OF ACUTE CONTINENTAL CLIMATE

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ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ СОЗДАНИЯ МИКРОКЛИМАТА КОРОВНИКОВ В УСЛОВИЯХ РЕЗКО-КОНТИНЕНТАЛЬНОГО КЛИМАТА

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Abstract

The article writes about the main problems of animal husbandry associated with the microclimate in the Republic of Sakha (Yakutia). Requirements for the maintenance of highly productive animals. Deviation from the norms of microclimate parameters leads to a significant decrease in animal productivity. Studies of the microclimate in the barn in the winter showed that the temperature and humidity depend on the outdoor conditions, their values are unevenly distributed over the area of the room. The air temperature in the barn varies from 3 to 8.5 °, and the humidity in the room also has different values - from 40 to 85%. The main measures to eliminate the primary problems associated with the ventilation and heating of the building are identified.

Аннотация

В статье написано об основных проблемах животноводства связанные с микроклиматом в Республике Саха (Якутия). Требования, предъявляемые для содержания высокопродуктивных животных. Отклонение от норм параметров микроклимата приводит к существенному снижению продуктивности животных. Исследования состояния микроклимата в коровнике в зимний период показали, что температура и влажность воздуха зависят от условий наружного воздуха, их значения неравномерно распределены по площади помещения. Температура воздуха в коровнике варьируется от 3 до 8,5°, а влажность воздуха в помещении также имеет различные значения - от 40 до 85%. Выявлены основные мероприятия по устранению первостепенных проблем связанные с вентиляцией и отоплением здания.

Keywords: Microclomate, Farm.
Ключевые слова: микроклимат, коровник.

Основные проблемы животноводства в Якутии

Животноводство это важная часть жителей Республики Саха (Якутия). Но основной проблемой, которая мешает полноценному развитию, является ее климат. Резко-континентальный климат Якутии имеет свои особенности, характерные только для её территории. Зимой минимальная температура атмосферного воздуха достигает -55°С, а продолжительность варьируется от 250 до 270 суток.