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**INFECTIOUS DISEASES OF OAK BRANCHES AND TRUNK IN BELARUS**

The article presents data on the most common infectious diseases of the oak branches and trunk in the republic. The conducted studies have shown that every year there is a whole range of plant pathogenic fungi that causes diseases of different oak organs in the oak forests. Tumor-like transverse cancerous growth, canker and vascular diseases are the most common infectious diseases of the oak branches and trunk.

**Introduction.** English oak (*Quercus robur* L.) is one of the most valuable tree species naturally growing in forests of Belarus. It is an edifier plant of not only oak phytocenosis, but also of all broad-leaved forests where a species acts as a constant component, in the southwest part of republic the durmast oak (*Q. petraea* Liebl) mingles with it.

Oak, as none other species, is subject to recurrent depressions which show themselves in decrease of a radial growth and dimensions ratio change of the summerwood and latewood, in loss of a crown part and in drying of the prevailing layer trees. The phenomena of depression of hard-deciduous forests as they were called by K. B. Lositsky [1], repeat themselves periodically and are different according to both coverage width and damage level.

The factors causing weakening and drying of oak forests, both in our republic and abroad are various. However, the original cause of oak forests weakening, according to many authors [2–3], are mostly periodically repeating extreme weather conditions, groundwater level change, violation of a hydrological mode. Depressions in oak growth and development worsen if negative climatic factors are combined with biotic ones: repeated oak defoliation by leaf-eating insects and the subsequent development of fungi diseases.

**Main part.** The aim of our work was to determine the most widespread infectious diseases of oak branches and trunk on the territory of Belarus.

Objects of the field researches were pure and mixed oak stands growing on the territory of RB in different geobotanical subzones. The research technique consisted in reconnaissance and detailed inspection of oak stands, in revealing the species composition of agents of disease of branches and trunk.

Data of the reconnaissance inspections were specified by laying in the most typical areas of an allotment of temporary plots where the type of the agent of disease and damage level of plants [4] were identified.

Overall plots should be not less than 2% of the inspected area. Plots in forest cultures were laid in the form of bands located along rows.

On the basis of the received data the diseases prevalence was determined:

$$P = \frac{n}{N} \cdot 100\%,$$

where  $P$  – disease prevalence, %;  $n$  – total number of damaged (sick) trees;  $N$  – total number of recorded trees.

As a result of our phytopathologic inspections of the species *Quercus* L. it was found out that oak condition is influenced by a complex of biological factors, from infectious diseases attacking branches and trunks of the growing oak trees it is necessary to point out the tumor-like transverse cancerous growth, necrosis and vascular mycosis. In the conditions of Belarus the given oak diseases have chronic character and grow on one tree for many years, gradually weakening them.

First isolated symptoms of oak affection by the tumor-like cancerous growth were registered in trees of the I age-class. Thus on the shoots with thickness from 2 to 3 cm the annular oval bulgings were formed which with time grew up and turned into typical affects, characteristic to cancerous diseases. Spread of this disease is closely connected to the development of insects damaging branches and young trunks of oak. A specific character of this disease is formation of a cross-crack with irregular borders baring wood. In the places of attack the trunk is deformed. Cancerous ulcers are found more often in the lower part of the trunk. Ring state of the ulcer on the trunk basically depends on pathogen development time on the tree. With the years affection of oak forests by this disease increases and reaches up to 20–25% from total trees quantity on the plot.

According to our data, invariable companions of oak forests of the II and higher age-classes are necrosis diseases of branches. They mainly progress on subbranches which die off in a tree crown, forwarding their faster degradation and natural trunk pruning. About 10 systematically different kinds of fungi [5] can be found on oak branches which die off. *Clithris quercina* and *Vuilleminiacomedens* are found more often among them. The first of them basically develops on branches with a smooth bark and is presented in young trees while the second one prefers to affect thicker branches and has economic meaning in middle-aged and ripening timber stands. Both of

them cause a die-off of branches and white fibrous rot of wood.

In middle-aged, ripening and mature oak forests the willemine necrosis and wood-destroying fungi of *Stereum* type at strong development cause die-off up to one third of the crown subbranches. Only in rare cases, as a rule, in a combination with other causes, the drying of all crown is observed. So, in ripening and mature oak forests of the state closed wood «Priluksky», the drying of not less than one third of a crown lower part because of necrosis diseases is registered at 20–25% of trees.

In all age categories of oak plantings, according to our observations, the greatest danger is represented by the vascular mycosis caused by *Ceratocystis* type fungi and by others pathogens. Young oak trees (10–15 years) are affected by disease more often in the acute form leading to the trees death during one vegetation period [6]. But in the conditions of Belarus the disease chronic form prevails, and it is observed more often in floodplain ripening, mature and overripe oak forests. The chronic form is well traced at visual examinations according to the disease external evidence. Oak affect external evidence by the vascular mycosis on mature trees appear in the middle or in the end of summer, at that there is yellowing and defoliation on separate branches of sick trees as a result of the disease active development of in the spring-and-summer season. The bark on such branches loses its turgor, wood is dehydrated. In the spring on the affected trees a partial or full die-off of separate branches becomes evident, buds on them open with delay or do not develop at all. The formed leaves on slightly affected branches have reduced dimensions. The subsequent stages of disease are characterized by the crown openwork structure, top-drying, formation of water shoots on the trunk and by gradual tree drying in the course of several years.

Growing brown of wood elements during all the period of pathogen presence (branches, trunk, root, shoots) serves as the inner symptom of the oak affection by vascular mycosis. On the longitudinal section of branches and trunk the water conductive elements (large vessels) in the areas affected by the fungus become brown with different shades and look like dash lines-strands. Dark continuous or broken rings or semicircles are visible on the cross section of the affected tree. It is the affect result by the fungus toxins causing die-off of alive parenchyma cells, formation of gum-like materials and thyllis which occlude vessels openings [5]. To receive more exact data about presence and dimensions of the inner affect it is desirable to carry out the analysis of the cut down test trees. Especially as it is rather difficult to determine the drying reason of mature trees branches which are very high. According to several authors

data, vascular mycosis against the total weakening of oak plantings can progress symptom-free, and the agent of disease in such conditions does not show pathogen properties. Often trees with slight and average degree of affect (with branches drying from 10 to 50%), the next years after a drought gradually restore the crown at the expense of water shoots and can preserve viability for many years. In such cases, according to a number of authors, the branches drying can have not infectious character connected to breach of water supply of growing trees. It is pointed out that the insignificant separation of superficial root systems from a capillary fringe of subsoil waters leads to weakening in particular of ripening and mature stands.

Vascular mycosis was detected by us in all examined middle-aged, ripening, mature and overripe oak forests of the republic. With increase of age the area of oak plantings with symptoms of vascular mycosis and the intensity of its development increases gradually, and in the ripe timber stands it is on average 36% of the examined area.

The majority of the examined plantings are affected by vascular mycosis slightly and to average degree and only 8–24% of the examined trees have symptoms of strong affection when more than 75% of branches in a crown have dried out from the disease. Thus the quantity of strongly weakened and drying trees essentially increases (2–3 times) in old-age and overripe oak forests in comparison with middle-aged ones [6].

Vascular mycosis affection has the most frequent occurrence in flood plain incomplete timber stands, and also in weakened pure and mixed old-age plantings. One of the causes of high affection of the oak forests by vascular mycosis are trunk pests which are the main fungus infection carriers [7].

**Conclusion.** A whole complex of plant pathogenic fungi and bacteria causing diseases of different oak organ is annually in force in oak forests of the republic.

First symptoms of the oak affection by tumor-like transverse cancerous growth in plants of the I age-class, with age increase the trees affection by the given disease increases.

*Clithrisquercina* and *Vuilleminiacomedens* are most often met among necrosis diseases. Clithris-bark necrosis develops on branches with a smooth bark and is presented in young plants, villemine necrosis affects thicker branches and has economic meaning in middle-aged and ripening timber stands.

Vascular mycosis caused by *Ceratocystis* type fungi and others pathogens, occurs in different age-classes. With age increase of oak plantings the intensity of its development increases. The mycosis affection has the most frequent occurrence in flood plain incomplete timber stands, and also in weakened pure and mixed old-age plantings.

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