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DISEASES CAUSED BY *CLADOSPORIUM* AND *ALTERNARIA* SPP. IN FOREST NURSERIES OF BELARUS

At the moment, due to the stressful conditions, the cases of plant diseases, caused by facultative parasites, which are often inhabiting the soils, that are rich in dead plant substrates, become more common. They are able to parasitize plants with poorly developed, broken integumentary tissues. In order to assess the structure of phytopathogenic organisms surveys were conducted in 40 forest nurseries of Belarus. During these surveys samples of infected plants were collected and a molecular-genetic identification of pathogens in planting material of coniferous species was carried out. The surveys showed, that the most common diseases of seedlings in forest nurseries of Belarus are caused by *Cladosporium* and *Alternaria* spp. 33 cases of infected by fungi of the genus *Cladosporium* and 28 cases by fungi of the genus *Alternaria* plants were revealed in the surveyed forest nurseries in Belarus in total. Other diseases, which also were often detected, are: caused by *Phoma* spp., *Epicoccum nigrum*, *Fusarium* spp., *Sphaeropsis sapinea*. Species composition of pathogens, affected species of trees are described. Researches compiled a list of forestry enterprises were pathogens was found. Authors described the main symptoms of diseases caused by *Cladosporium* and *Alternaria* spp. and analyzed the conditions for the occurrence of epiphytoties.

Key words: forest nurseries, forest pathology inspection, molecular genetic identification, diseases of seedlings, *Cladosporium*, *Alternaria* spp.

Introduction. In the situation of plants periodic mass weakening under the influence of stressful factors there are numerous cases of plants affection by facultative parasites, which live more often in soil on the dead vegetative substratum, but are capable to parasitize on plants with poorly developed, defective external protective tissues, with weakened immunity. Considerable number of facultative parasites are part of such genus as *Cladosporium* and *Alternaria*, causing cladosporiosis and blackspot of plants.

Cladosporium fungi are often present in air, soil, on food stuffs, textile, leaves, needles and other substrata.

More than ten species of *Cladosporium* genus are capable to germinate on crops. They cause mould, blotch and rot of various parts of plants: cereals, legumes, tomatoes, cucumber, etc. [1].

Cladosporium genus fungi are also harmful on forest wood species. They are capable to affect seeds of deciduous and coniferous species, reducing their sowing qualities. Seeds become covered by a dark-olive film and small velvet tussocks (consisting of mycelium and spores of a fungus) which in mass acquire dark colour, in this connection the mould is often called black [2]. *C. herbarum* fungus is most often mentioned in literature, it is also capable to affect seedlings of coniferous species, causing appearance of dark-olive mould [1]. Symptoms of seedlings cladosporiosis are: needles darkening, and then getting an olive tincture, and appearance on tissues surface of brown-olive mycelium. Representatives of *Cladosporium* genus are capable to cause appearance of mould, sapwood colour and wood browning of stored timber [2].

Species of *Alternaria* (for example, *A. enuissima* and *A. alternata*) come to light on a very wide phytogenous substrata spectrum [3]. Blackspots of agricultural plants are presented, basically, by appearance of mould and rot on fruits, seeds and root crops, by mottled leaves, by young growth lodging [1].

On forest tree species fungi of *Alternaria* genus cause the seeds black mold, young growth and seedlings lodging, and also blue stain of stored wood [2].

Main part. Phytopathological inspections of 40 forest nurseries located in Brest, Vitebsk, Gomel, Grodno and Minsk SPFA, were carried out by us within 2011–2014 within the limits of SSTP "Forests of Belarus – productivity, resistance, effective utilization". Samples of plants with diseases symptoms were delivered into the laboratory, where the affected tissues were analyzed with the help of molecular-genetic methods [4].

The researches show (Fig. 1) that almost in every second of the inspected forest nurseries there is phomosis of planting stock, caused by fungi of *Phoma* genus. Symptoms and conditions of this disease emergence were described by us earlier.

Cladosporiosis and blackspot also widely come to light on planting stock of tree species (they are found in every third or even every second inspected nursery). In addition to the above-stated diseases, epicoccosis (causative agent is *Epicoccum nigrum*), fusariosis (*Fusarium* spp.), diplodiosis (*Sphaeropsis sapinea*), etc. are widely met.

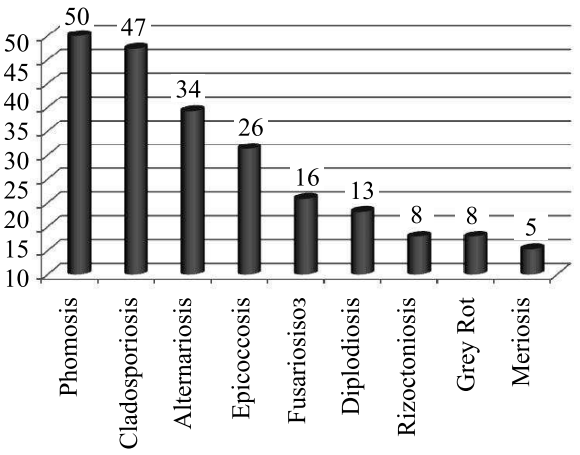

Fig. 1. Diseases occurrence frequency of the planting stock of coniferous species (in % to the quantity of the inspected nurseries)

As cladosporiosis and blackspot causative agents are not species-specific in relation to feeding plants, so in the same nursery the same causative agent was often found on several plots. Therefore we analyzed the disease occurrence frequency in the forest nurseries, expressed in the total number of the revealed cases of plants affection (Fig. 2).

In total 33 cases of plants affection by cladosporiosis and 28 cases – by blackspot were found in the inspected forest nurseries of Belarus that permits to consider these diseases as the most widespread on the planting stock of coniferous tree species. Species composition of fungi found in tissues of the affected plants is shown in the Table.

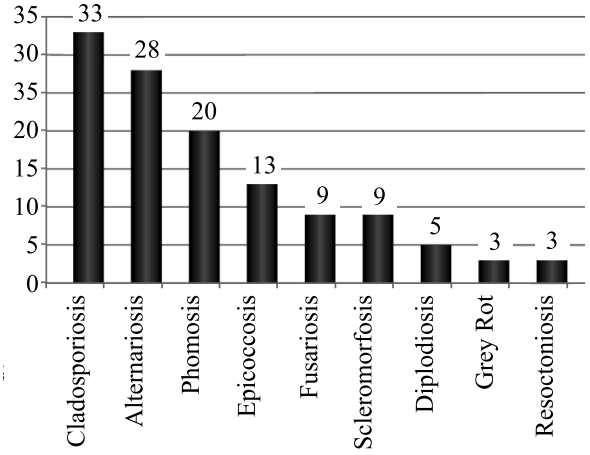

Fig. 2. Number of the revealed cases of the coniferous species planting stock affection by diseases

Planting stock blackspots in the forest nurseries of Belarus are caused mainly by *Alternaria alternate* fungus. Also we came across numerous cases of plants affection by other species from this genus, which now have no taxonomic description.

Species composition of fungi of *Cladosporium* and *Alternaria* genus, found in forest nurseries of Belarus in 2011–2014 using molecular genetic methods

Fungus species	Tree species	Timber enterprise (or other organization)
C. herbarum (Pers.) Link.	*Pinus sylvestris* L.	Borisovsky, Smolevichsky, Korenevsky EBM
	Picea abies (L.) Karst.	Vilejsky, Starobinsky, Mogilevsky, Smolevichsky, Chaussky
	Thuja orientalis L.	Volkovyssky
C. cladosporoides (Fresen.) G.A. de Vries	*Pinus sylvestris* L.	Baranovichsky, Vileisky, Octiabrsky
	Picea abies (L.) Karst.	Chaussky
	Larix decidua Mill.	Borisovsky
Other species of *Cladosporium*, which have no taxonomic description	*Pinus sylvestris* L.	Baranovichsky, Borisovsky, Glussky, Kletsky, Logoisky, Mogilevsky, Molodechnensky, Starobinsky, Miloshevichsky, Zhlobinsky
	Picea abies (L.) Karst.	Vileisky, Kletsky, Logoisky, Molodechnensky, Smolevichsky, Starobinsky, Chaussky, Novogrudsky, Dvinsky EBM
Alternaria alternata (Fr.) Keissl.	*Pinus sylvestris* L.	Svetlogorsky, Kletsky, Logoisky, Molodechnensky, Korenevsky EFB
	Picea abies (L.) Karst.	Goretsky, Vileisky, Kletsky, Logoisky
Other species of *Alternaria*, which have no taxonomic description	*Pinus sylvestris* L.	Borisovsky, Starobinsky, Belynichsky, Octiabrsky, Glussky, Novogrudsky, Dvinsky EBM, CBG of NAS of Belarus
	Picea abies (L.) Karst.	Vileisky, Bykhovsky, Goretsky, Chaussky, Novogrudsky, Shchuchinsky, Dvinsky EBM
	Larix decidua Mill.	Borisovsky, Vileisky (2 species), Kletsky

Conclusion. On the planting stock of coniferous tree plants cladosporiosis is met most often (it is found almost in every second nursery) and blackspot (is found in every third nursery).

Cladosporiosis causative agents of coniferous plants are mainly species: *C. herbarum* and *C. cladosporoides*, several species of fungi of this genus are also found which have no description in modern taxonomy of fungi.

The blackspot causative agent of woody plants is mainly *A. alternata* fungus, however and in this case we found several speciesof *Alternaria* genus non-described in taxonomy.

Cladosporiosis and blackspot causative agents are facultative parasites, therefore the basis of prophylaxis of diseases loci development in the forest nurseries will be strict observance of cultivation agrotechnology of planting stock of tree species and plants treating with system fungicides.

References

1. Dobrozrakova T. L. *Laboratornye zanyatiya po fitopatologii* [Laboratory studies on Phytopathology]. Moscow; Leningrad, Gosudarstvennoe izdatel'stvo sel'skohozyaystvennoy literatury Publ., 1958. 224 p.

2. Fedorov N. I. *Lesnaya fitopatologiya* [Forest Phytopathology]. Minsk, BGTU Publ., 2004. 462 p.

3. Fedorovich M. N., Poliksenova V. D. Griby roda *Alternaria* Nees. v Belarusi. *Vestnik BGU* [Bulletin of the Belarusian State University], series 2, Chemistry. Biology. Geography, 2012, no. 1, pp. 54−57 (in Russian).

4. Padutov V. E., Baranov O. Yu., Voropaev E. M. *Metody molekulyarno-geneticheskogo analiza* [Methods of molecular genetic analysis]. Minsk, Yunipol Publ., 2007. 176 p.

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