MICROMYCETOUS FUNGI ASSOCIATED WITH CHESTNUT (*Castanea sativa*) IN NATURAL FOREST ECOSYSTEMS OF TURKEY

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МИКРОМИЦЕТНЫЕ ГРИБЫ, АССОЦИИРОВАННЫЕ С КАШТАНОМ (*Castanea sativa*) В ЕСТЕСТВЕННЫХ ЛЕСНЫХ ЭКОСИСТЕМАХ ТУРЦИИ

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В результате полевых и лабораторных исследований и литературных данных, на различных органах каштана обыкновенного (*Castanea sativa*) выявлены 33 вида микромицетов. Все 33 вида относятся к отделу Ascomycota. По числу порядков, семейств, родов и видов наиболее богат класс Sordariomycetes (58% от всех сумчатых). Другой класс Dothideomycetes представлен 8 видами (24%) из 7 родов, 5 семейств, 5 порядков. Класс Leotiomycetes составляет 9% от всех сумчатых. Выявленные микромицеты представлены паразитными, патогенными и сапротрофными видами.

High generic and species diversity of higher plants, especially of flower plants, are characteristic of Turkey. Vascular plants are represented by more than 11000 species and subspecies which belong to 1223 genera and 173 families in Turkey. About 3000 of the taxa are endemic. This diversity wealth of higher plants have been caused microfungi diversity growing on them. Vascular plants of our country have been investigated enough and eleven volumes of Turkey flora were published (Davis 1965 – 1985; 1988; Güner et al., 2000). If Turkey's higher plants have been studied very well, the mycobiota is not examined as extensively and the most studies deal with macrofungi, mostly agaricoid ones. First data on microfungi was recorded by Bremer et al. (1947, 1948, 1952). Some fragmental dones about micromycetes were given by Karel (1958), Göbelez (1963, 1967), Öner and Ekmekci (1974), Öner et al. (1984), Tamer et al (1990), Güven and Tamer (1993), Karakaya (1998) etc. The investigations on micromycetes were started by us in different areas (especially forest ecosysytems) of Turkey orderly (Hüseyinov and Selçuk 2000, 2001; Hüseyin and Selçuk 2002, 2003, 2004) Hüseyin et al. 2005, 2006; Hüseyin and Selçuk 2007; Selçuk et al. 2009, 2010, 2012; Hüseyin et al., 2013; Selçuk and Hüseyin 2014; Hüseyin et al. 2014; Selçuk and Ekici 2014; Selçuk et al. 2014; Hüseyin and Selçuk 2014; Vasighzadeh et al. 2014; Hüseyin et al. 2015; Selçuk et al. 2015).

The chestnut (*Castanea sativa* Miller) is generally spread in the northern Anatolia and constitutes mixed forests with other forest species (*Fagus orientalis*, *Quercus petrea*, *Q. robur*, *Carpinus betulus*, *Tilia tomentosa*, *Populus tremula*, and others). Shrub layers in these forests have been composed of *Prunus laurocerasus*, *Corylus avellana*, *Cornus mas*, *mespilus germanica*, *Sorbus torminalis*, *Rhododendron ponticum*, *Buxus sempervirens* and *Ilex aquifolium*, etc. On the other hand, Turkey is a second, after China all among the world country according to chestnut produce.

Material collected on Chestnut trees from different natural forests ecosystems of Turkey by authors of this presentation. For the identification of fungi species numerous literatüre sources were employed (Byzova et al. 1967, 1968, 1970; Merezhko, 1980; Sutton, 1980; Dennis, 1981; Smitskaya et al., 1986; Ellis and Ellis, 1987; Nag Raj, 1993; Mel'nik, 1997, 2000).

The systematic status of identified species and the authors names of microfungi are arranged following Index fungorum (accessed 2015 March).

At the result of our mycological researches thirty-three micromycetes species have been found on chestnut trees of natural forest ecosystems in Turkey up to now. These species belong to four classes, thirteen orders, twenty families, and thirty genera of Ascomycota. The most of revealed species belong to Sordariomycetes classes (nineteen species or 58% of total). Hypocreomycetidae, Sordariomycetidae, Xylariomycetidae and Incertae sedis represented six species, respectively. Eight species have been found from classes Dothideomycetes, including four from the order Capnodiales. Leotiomycetes and Incertae sedis classes represented by three by three species. The most species represented by Mycosphaerellaceae family. These microfungi and their substrate are given below as a table.

Table – Species composition and substrate confinement of identified micromycetes on *Castanea sativa*

Species	Substrate confinement
Arthopyrenia punctiformis A. Massal.	Bark of dead branches
Camarosporium castaneae Woron.	Bark of dead branches
Ceratocystis castaneae (Vanine & Solovjev) C. Moreau	Dead wood
Ceratophorum helicosporium (Sacc.) Sacc.	Living leaves
Coryneum modonium (Sacc.) Griffon & Maubl.	Bark of dead branches
Cosmospora viridescens (C. Booth) Gräfenhan & Seifert	Bark of dead branches
Cryphonectria parasitica (Murrill) M.E. Barr	Trunk and thick branches
Cryptodiaporthe castanea (Tul. & C. Tul.) Wehm.	Bark of dead branches
Cylindrium clandestinum (Corda) Sacc.	Falling leaves
Cylindrocarpon castaneae Schischkina & Tsanava	Fruits
Cylindrosporium castaneae (Lév.) Krenner	Living leaves
Cytospora leucosperma (Pers.) Fr.	Dead branches
Dendrodochium rubellum Sacc.	Wind fallen trees
Diatrype disciformis (Hoffm.) Fr.	Bark of dead branches
Diatrype stigma (Hoffm.) Fr.	Bark of dead branches
Diatrypella pulvinata Nitschke	Bark of dead branches
Erysiphe alphitoides (Griffon & Maubl.) U. Braun & S. Takam.	Living leaves
Hydrometrospora symmetrica J. Gönczöl & Révay	Bark of dead branches
Melanconium castaneae Salvi	Bark of dead branches
Monochaetia flagellata (Earle) Sacc. & D. Sacc.	Living leaves
Monochaetia monochaeta (Desm.) Allesch.	Living leaves
Mycosphaerella maculiformis (Pers.) J. Schröt.	Wintered leaves
Mycosphaerella punctiformis (Pers.) Starbäck	Wintered leaves
Nectria peziza (Tode) Fr.	Dead branches
Pestalotiopsis versicolor (Speg.) Steyaert	Living leaves
Phomatospora dinemasporium J. Webster	Wood
Phomopsis castaneae Woron.	Fruit
Phyllactinia guttata (Wallr.) Lév.	Living leaves
Septoria gilletiana Sacc.	Living leaves
Stromatoseptoria castaneicola (Desm.) Quaedvl., Verkley & Crous	Living leaves
Taeniolella breviuscula (Berk. & M.A. Curtis) S. Hughes	Wood
Teratosperma uniappendiculatum Matsush.	Wood
Triposporium elegans Corda	Wood

Interesting and rare species are *Ceratophorum helicosporium*, *Monochaetia flagellata*, *M. monochaeta* and *Teratosperma uniappendiculatum*. On the other hand, *Ceratocystis castaneae*, *Cryphonectria parasitica*, *Diatrype disciformis* and *Diatrypella pulvinata* are widespread species. *Cylindrosporium castaneae*, *Erysiphe alphitoides*, *Phyllactinia guttata*, *Septoria gilletiana*, and *Stromatoseptoria castaneicola* parasites or pathogenes on leaves of Chestnut. The damage caused by these parasites and pathogens are not significant, but in some years they contribute to premature defoliation. *Arthopyrenia punctiformis*, *Camarosporium castaneae*, *Coryneum modonium*, *Cryptodiaporthe castanea*, *Diatrypella pulvinata*, *Taeniolella breviuscula*, and *Triposporium elegans* are saprobic species on dead branches and wood of *Castanea sativa*. *Cryphonectria parasitica* has got an economic importance among all parasites species on forestry. *C. parasitica* recorded in Turkey in 1967, firstly. This fungus caused bark cancer of chestnut trees. Bark cancer spread more widely in Aydın, Balıkesir, Bursa, Düzce, İstanbul, Kocaeli, Rize, Sakarya, Trabzon and some other provinces of Turkey. 30% of chestnut trees are infected by *C. parasitica*. Trees of all ages are subject to decline except for seedlings. Shoots and thin branches are not infected by the fungus. It has been shown that the decline starts on the top of tree. The first symptoms are seen in May. Leaves on declining trees become red, and then dry and fall down; but the leaves may stay on the tree witouth change in their colour. Some time later, dry branches start to be seen. At first, 1–2 year old branches decline one by one, then the decline afflicts more thick branches. In the end, all the branches are partly declined and the crown appears sparse and meshy. Then the crown and all the tree and roots decline too. The tree decline occurs in May and partly in August, branches in an

ill crown suddenly show fading of their leaves and soon decline. Lately, declined chestnut trees has seen often that the symptoms of cancer don't appear. On transverse and longitudinal cuts of the wood, vascular bundles stopped with a foaming or glue like matter can be seen. All these symptoms are similar to oak tree tracheomycosis or holland elm disease that caused by *Ceratocystis* species, except *C. castanea*. From trees with these symptoms have been isolated *Graphium* sp. Species of the *Graphium* genus without teleomorph are not known on the chestnut. *Graphium album* (Corda) Sacc., *G. rigidum* (Pers.) Sacc., and *G. rubrum* Rumbold are known on Fagaceae species. These were recorded on wood decaying in the ground. The fungus we isolated from the chestnut is closer to *G. rigidum*, but differ from that because of its morphologic peculiarity. It is known that the teleomorph of a fungus the genus *Graphium* Corda is a species belonging to the genus *Ceratocystis*. *Ceratocystis* species don't known on the tree that except *C. castanea*. This fungus is the reason for blueness of wood. In our opinion, the reason of chestnut declining is *Ceratocystis* fungus apart from *Cryphonectria parasitica*. Probably, this *Ceratocystis* species is a new, but some additional works are needed.

ФИТОПАТОГЕННЫЕ ГРИБЫ ФИЛЛОСФЕРЫ ХВОЙНЫХ НА ТЕРРИТОРИИ СРЕДНЕЙ СИБИРИ

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PHYTOPATHOGENIC FUNGI OF CONIFEROUS PHYLLOSPHERE ON THE MIDDLE SIBERIA TERRITORY

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The territory of Middle Siberia has a considerable supply of coniferous forest. Very often pathogenic fungi are a reason of needle cost and of needle blight. The study of species diversity of needle pathogenic fungi was realized in forest nurseries and natural forests. 19 different diseases were diagnosed. Pathogenic agents are members of three groups: Ascomycota, Basidiomycota (order Uredinales) and Fungi imperfecti.

В процессе индивидуального развития древесные виды постоянно подвергаются воздействию абиотических и биотических факторов окружающей среды. Одним из важнейших факторов, определяющих состояние лесов, являются фитопатогенные грибы, являющиеся причиной различных заболеваний корневой системы, стволов, листового аппарата и семян деревьев. Наши исследования посвящены изучению видового состава грибов, вызывающих заболевания хвои на территории лесных питомников, искусственных насаждений и естественных лесов Средней Сибири. Патогены филлосферы вызывают гибель и осыпание хвои, что особенно опасно для сеянцев, самосева и подроста. Взрослые деревья, в случае незначительного поражения, играют роль источника инфекций, а при массовом повреждении кроны становятся более уязвимыми к воздействию неблагоприятных факторов, что сказывается на здоровье лесов в целом. Развиваясь в тканях хвоинок и вызывая их гибель, грибы в процессе своей жизнедеятельности становятся неотъемлемой частью эпифитных микробных сообществ филлосферы и взаимодействуют не только с хозяином, но и с микроорганизмами-сапротрофами. Рассматривая дерево, как систему «эпифитные микроорганизмы – растение-хозяин – патоген» наше внимание сконцентрировалось на сопряженном развитии этих компонентов через взаимодействие фитопатогенов, банальных эпифитов и летучих соединений растений.

Проведено исследование видового разнообразия фитопатогенных микромицетов хвои в лесопитомниках, искусственных насаждениях и естественных лесах 22 лесничеств Средней Сибири и в заповеднике «Столбы».

Материалом исследования служила хвоя следующих растений: сосны обыкновенной (*Pinus sylvestris* L.), сосны кедровой сибирской, (*P. sibirica* (Du Tour)), ели сибирской (*Picea obovata* Ldb.), лиственницы сибирской (*Larix sibirica* Ldb.), пихты сибирской (*Abies sibirica* Ldb.), можжевельника обыкновенного (*Juniperus communis* L.), можжевельника казацкого (*J. sabina* L.).

Идентифицирован 21 вид грибов, вызывающих 19 заболеваний хвои на территории Средней Сибири (таб. 1). Все диагностированные повреждения листового аппарата хвойных условно