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Microfungi as a part of biodiversity observed in Ukraine (exemplified on anamorphic ascomycota)

Diversity of all representatives from Fungi kingdom could be predicted from about 30,000 to 45,000 species for Ukraine, applying Prof. Hawksworth's estimation rate for some European countries [1]. Microscopic fungi of various taxonomic groups are among the most numerous and least known of these organisms. Their detection and monitoring usually are not easy, recognition and identification are problematical and involve careful microscopic observations. The number of expected plant pathogenic anamorphic fungi which are members of Ascomycota is not less than 5,000–6,000 species in Ukraine.

Anamorphic ascomycota, which are the conidial fungi, have different level of host specificity and are influenced by various environmental factors. There is an assumption that such biological interactions correlate with characteristics of plant communities and can help in:

1) the estimation of disorders of ecosystem functioning;
2) search for new producers of various metabolites which are known in Plant kingdom or not;
3) revealing new threats for ecosystem functioning;
4) development of new technologies for high crops growing, protection against diseases and biodegradation of organic substrates.

What are the sources for diversity of such conidial fungi in Ukraine?

Location in south-east Europe, temperate with some features of continentality climate and some sub-meridional climatic areas on south are the main determinant factors of fungal inhabitant number and diversity. Besides, the other factor is changes of vegetation from the north to the south of the country, according four main natural zones: broadleaf forests, forest-steppes, steppes and Mediterranean; high mountains of the Carpathians and the Crimean ones.

Habitats loss and fragmentation are pervasive threats to the whole Earth's biodiversity and it exists in Ukraine. It is supposed that assemblage of organisms on nature protected territories can represent primary biodiversity of the country. Thus, the study of such areas is the main task of researchers. Existing variety of protected nature areas in Ukraine covers about 4,95 % of country's territory, so their preservation and investigation are the main long-term goals. Last decades fluctuations in climatic factors have led to drier and hotter summer seasons in forest and forest-steppe zones, provoking the migration and invasions of new and rare species of fungi. Environment fluctuations and natural changes in populations define preservation of most adapted anamorphic ascomycota, general decrease of

epiphytotics in stable ecosystems and fast spread of fungi previously not known in Ukraine.

Current study of the fungi from the Right Bank Polissya demonstrated and supported above conclusions. Analyzed numerous data on the fungi of the class Dothideomycetes were summarized from collection of the KW fungarium, regional lists of fungi, various publications and the data of our study in the region from 1998, 2018–2021 years.

Ascomycota of the class Dothideomycetes are represented there by 534 species of 125 genera of hemibiotrophic and saprotrophic fungi that are pathogens affecting plants and other fungi, litter decomposers and soil fungi. It was established that the most characteristic fungi of the Right Bank Polissya region are species of the orders Pleosporales (219 species of 61 genera), Mycosphaerellales (166 species of 27 genera) and Botryosphaeriales (99 species of 10 genera). Most common and widespread among them were *Camarosporium pseudoacaciae*, *Diplodia mutila*, *Leptosphaeria ogilviensis*, *Microdiplodia coryli*, *Microsphaeropsis olivascens*, *Phyllosticta cruenta*, *Pseudocercospora opuli*, *Ramularia coccinea*, *R. grevilleana*, *Septoria aegopodii*, *S. oenotherae*, *S. polygonorum*, *S. pyricola*, *S. scabiosicola*, *S. trientalis*, *Sphaerulina westendorpii*, as well as *Cladosporium herbarum* from the order Cladosporiales and *Coleroa robertiani* from Venturiales. It was found that in recent years the development of some hemibiotrophic fungi has acquired the character of epiphytotics due to environment synanthropization, increase in average annual temperatures and droughts in the region. These were anamorphic ascomycota of *Botryosphaeria visci* (on mistletoe), *Cercospora armoraciae* (on horseradish), *Pseudocercospora opuli* (on viburnum), *Ramularia urticae* (on nettles), *Septoria chelidonii* (on celandine), *Sphaerulina gei* (on gravilats) and *Wilsonomyces carpophilus* (on plums, peaches and cherry). The study has revealed that 16 % of the species are rare, have been collected only once in Ukraine and Polissya, and observed mainly in 1950–1970s years. Besides, a number of other interesting and rare fungi that had never been recorded before in the region and migrated from south and east, were found for the first time: *Cladosporium galii*, *Ramularia crepidis*, *R. cupulariae*, *R. gnaphalii*, *R. heraclei*, *R. lysimachiae*, *R. simplex*, *Rhabdospora visci*, *Septoria callae*, *S. lycopi*, *S. tabacina* [2–5]. Recent collection of *R. crepidis* described in the USA is only the second for Ukraine since the 1950s, as well as *C. galii*, described from Poland, and *R. gnaphalii*, which was previously recorded only in the Kyiv region.

The study revealed specificity of these fungi distribution in the nature reserves and national nature parks of the Right Bank Polissia. Carried out analysis of Dothideomycetes species diversity in biotopes has demonstrated that the most common habitats of these fungi are: mesotrophic grass biotopes (especially mesophytic meadows for pastures), shrubs (especially, deciduous shrubs, blackberry thickets, floodplains and swampy shrubs) and the Central European hornbeam-oak forests, acidophilic oak

and birch forests, eutrophic black alder forests, acidophilic and neutrophilic pine forests. Last collections in the protected nature areas of Polissya resulted in the identification of nine phytopathogenic fungi species from different classes, new to the territory of Ukraine: *Asteroma solidaginis*, *Colletotrichum acutatum*, *Neoramularia bidentis*, *Phomopsis vaccinii*, *Plasmopara peucedani*, *Ramularia libanotidis*, *Septoria balloticola*, *S. dysentericae* and *S. hydrocotyles*, in 2018–2021 years [2–6].

At the same time, shortages for fungal diversity assess and further isolation of fungi *in vitro* are still problematic due to low data availability, problems of observation (are the species is rare or just rarely recorded), lack of long-term monitoring in the same territory. Thus, further development of assessment methods, much more attention to fungi ecophysiology and study areas with high habitats diversity would assist in improvement the fungal diversity observations and revealing new species.

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