

Fungal root endophytes of Northern Kazakhstan isolated from agricultural and non-agricultural crops

Научный руководитель – Kóvacs Gábor M

Akmetova Galiya Kursanovna

Postgraduate

Eötvös Loránd University, Будапешт, Hungary

E-mail: *galiya87@hotmail.com*

Endophytes are microorganisms that colonize plants without any visible symptoms of disease and might produce a plethora of secondary metabolites to prevent plants from various phytopathogens [4]. Root colonizing fungal endophytes, the so called dark septate endophytes (DSE) are world-wide common in both agronomical areas and natural habitats and can enhance the growth of host plants and provide resistance to plant diseases, drought stress and enhance plant performance [3, 5]. Hence, they may play important role in ecosystem functioning and can have major importance in agricultural applications. However, our knowledge on DSE communities is limited in Kazakhstan.

In this study, we aimed to identify the DSE community of different plant species agricultural and non-agricultural areas in the steppe zone of Northern Kazakhstan.

Roots were collected from the gramineous species barley (*Hordeum vulgare*), wheat (*Hordeum jubatum*), oat (*Avena sativa*), *Stipa capillata*, and also lentil (*Lens culinaris*, Fabaceae) and flax (*Linum usitatissimum*, Linaceae). The sampling was carried out in 2018-2019. The surface sterilization of plant roots was conducted by placing them in H₂O₂ for 90 sec, then 90 sec in ethanol 70% and twice washed in distilled H₂O [2]. Then, root pieces were placed onto PDA media and the hyphae growing out were subcultured [1]. For molecular identification, DNA isolation was carried out by NucleoSpin Plant II Kit and the internal transcribed spacer (ITS) region of the nrDNA was amplified and sequenced. In case of *Fusarium* species, the translation elongation factor 1-alpha (TEF). The sequences gained were compared with those of public databases, and phylogenetic analyses were used for identification of DSE species [6].

Altogether 605 isolates were collected from roots of different agricultural and non-agricultural plants in Northern Kazakhstan. The isolates represented *Fusarium* spp., *Alternaria* sp., *Bipolaris* sp., *Aspergillus* sp., *Nigrospora oryzae*, *Cladosporium* sp., *Talaromyces purpureogenus*, *Periconia macrospinosa*, *Acremonium* sp., *Crinipellis scabella*, *Microdochium bolleyi*, *Cadophora* sp., *Phaeosphaeria* sp., *Rhizoctonia* sp., *Epicoccum nigrum*, *Clonostachus rosea*, *Sarocladium strictum*, *Arthrinium arundinis*, *Slopeiomyces cylindrosporus*, *Chaetomium* sp. and *Darksidea* sp. The most common and widespread genus was *Fusarium*, which was represented by at least 15 species. Therefore, *Fusarium* species such as *F. redolens*, *F. culmorum* and *F. clavum* dominate the DSE community of the investigated plant species in Northern Kazakhstan. We found diverse fungal community in the sites and the major presence of DSEs in this area might be indicating an important function for the plants in defence mechanisms due to the severe climate of Northern Kazakhstan.

Thanks to my supervisors, Prof. Gábor M. Kovacs and Dr. Dániel G. Knapp at Eötvös Loránd University, Department of Plant Anatomy, Institute of Biology for their help and valuable comments.

This research was supported by the National Research, Development and Innovation Office, Hungary (NKFIH KH-130401), and the Stipendium Hungaricum Programme.

References

- 1) CBS Course of Mycology / Gams W., Hoekstra E.S., Aptroot A. (Eds.). Centraalbureau voor Schimmelcultures Baarn, Delft. 4th edition. 1998. P. 165.
- 2) Knapp D.G., Pintye A., Kovács G.M. The dark side is not fastidious - dark septate endophytic fungi of native and invasive plants of semiarid sandy areas // PLoS One. 2012. V. 7. No. 2. e32570. doi: 10.1371/journal.pone.0032570
- 3) Pan D., Mionetto A., Tiscornia S., Bettucci L. Endophytic bacteria from wheat grain as biocontrol agents of *Fusarium graminearum* and deoxynivalenol production in wheat // Mycotoxin Research. 2015. V. 31. No. 3. P. 137-143.
- 4) Song Y., Wu P., Li Y., Tong X., Zheng Y., Chen Z., Wang L., Xiang T. Effect of endophytic fungi on the host plant growth, expression of expansin gene and flavonoid content in *Tetrastigma hemsleyanum* Diels & Gilg ex Diels // Plant and Soil. 2017. V. 417. P. 393–402.
- 5) van Loon L.C., Bakker P.A.H.M., Pieterse C.M.J. Systemic resistance induced by rhizosphere bacteria // Annual Review of Phytopathology. 1998. V. 36. P. 453-483.
- 6) BLAST: https://blast.ncbi.nlm.nih.gov/Blast.cgi?PAGE_TYPE=BlastSearch