The endophytic mycobiome of spring and winter wheat (*Triticum aestivum* L.) forms cultivated in ecological, conventional and control conditions

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ENDOPHYTES IN WHEAT

• Wheat are crucial for global food production, due to their application as important nourishment for humans and livestock animals.

• Endophytes occurrence in plants may ensure various benefits:
  → oppose pathogen development,
  → promote host growth,
  → enhance host defence against abiotic stresses.

• Exploring the ecological role of endophytes and understanding the complex interaction between them and host wheat, may lead to improve wheat tolerance for biotic and abiotic stresses.
AIM OF THE STUDY

The aim of the study was to isolate and molecular characterize the fungal communities colonizing endosphere of different wheat organs (leaves, stems, kernels, roots) and to compare the obtained mycobiome structures of winter and spring wheat forms cultivated in field (conventional and organic farming) and in control conditions.
5 WINTER WHEAT FORMS
(Legenda, Bamberka, Ostroga, Arkadia, Euforia)

5 SPRING WHEAT FORMS
(Rusałka, Rospuda, Bombona, Arabella, Kandela)

GROWING CONDITIONS:

1. CONVENTIONAL
   (FIELD)

2. ORGANIC
   (FIELD)

3. CONTROL
   (GREENHOUSE)
METHODS

I. SAMPLE COLLECTION AT LATE MILK STAGE

II. SURFACE STERILIZATION

(70% ETHANOL, 0.5% ACTIVE CHLORINE)

III. ISOLATION OF ENDOGENOUS FUNGI

PARTS OF THE PLANT ORGANS WERE PLACED ON PDA MEDIUM AND INCUBATED

IV. MOLECULAR IDENTIFICATION

• DNA ISOLATION FROM PURE CULTURE
• SANGER SEQUENCING OF : ITS1 - 5.8 - ITS2; SSU, LSU REGIONS, tef1, RBP1, CaM, tub2 and act genes fragments
• nBLAST ALIGNMENT
RESULTS

NUMBER OF OBTAINED ISOLATES

- CONVENTIONAL: 430
- ORGANIC: 149
- CONTROL: 225

DIVERSITY OF FUNGAL ENDOPHYTES IN DISTINCT GROWTH CONDITIONS

<table>
<thead>
<tr>
<th>Growth Conditions</th>
<th>Number of Identified Fungal Species</th>
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<tbody>
<tr>
<td>CONVENTIONAL</td>
<td>43</td>
</tr>
<tr>
<td>ORGANIC</td>
<td>26</td>
</tr>
<tr>
<td>CONTROL</td>
<td>22</td>
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</tbody>
</table>
COMPOSITION OF ENDOPHYTIC FUNGI IN WHEAT

GROWTH CONDITIONS

CONVENTIONAL
ORGANIC
CONTROL

Penicillium olsonii
Aspergillus sp.
Mellea sp.
Geomyces penicillus
Gliocnide sp.
Stemphylium vesicarium
Setosphaeria pedicellata
Sarcocladium sp.
Phoma sp.
Trichoderma koningii
Phoma pomorum
Pentonia macrospina
Penicillium crustoseum
Penicillium aculeatius
Penicillium digitatum
Rhizoctonia sp.
Neosartorya sp.
Microdochium bolleyi
Fusarium proliferatium
Fusarium solani
Fusarium roseum
Fusariumavenaceum
Cladosporium sp.
Cladosporium cladosporioides
Cadophora sp.
Backonia sp.
Arthrinium sp.
Anthea co-gnesis flocculosa
Alternaria infactoria
Alternaria alternata
Chrysosporium sderotigenum

Cibostachys candelabrum
Meyerozyma sp.
Leptosporangium leptobacterium
Engyodontium aubum
Gibberella sp.
Setosphaeria terestris
Sarcocladium strictum
Rhizoctonia solani
Trichoderma viride
Trichoderma hamatum
Phoma euryrema
Penicillium sp.
Penicillium chrysogenum
Penicillium amphiphilus
Penicillium expansum
Nigrospora sartarii
Moesziomyces sp.
Isaria farinosa
Fusarium sp.
Fusarium redolens
Fusarium avaporum
Epipactis sp.
Cladosporium albidum
Chaetomium sp.
Bipolaris sorokiniana
Aureobasidium pullulans
Anthea co-gnesis sp.
Alternaria sp.
Alternaria conjuncta
Achrolobasidya sp.
Chrysosporium pseudoenderdarium
DISTRIBUTION OF THE ENDOGENOUS FUNGI IN DIFFERENT PLANT ORGANS

**MOST FREQUENT:**
Setophoma terrestris, Setophphaeria pedicellata, Fusarium oxysporum, Periconia macrospinosa, Microdochium bolleyi, Fusarium sp.

**MOST FREQUENT:**
Alternaria sp., Penicillium sp., Sarocladium strictum, Cladosporium sp., Anthracocystis flocculosa

**MOST FREQUENT:**
Alternaria sp., Sarocladium strictum, Penicillium sp., Anthracocystis sp., Aureobasidium pullulans
FUNGAL DIVERSITY OF WINTER AND SPRING WHEAT ENDOSPHERE IN CONVENTIONAL CONDITIONS
FUNGAL DIVERSITY OF WINTER AND SPRING WHEAT ENDOSPHERE IN ORGANIC FARMING
Fungal Diversity of Winter and Spring Wheat Endosphere in Control Conditions
The highest number of endogenous fungi species were observed in wheat cultivated in conventional, field conditions (43), contrary in organic, field and in control conditions the 26 and 22 taxa were identified, respectively.

The endophytic mycobiome structure of wheat from field conditions have similar species composition, moreover the above and bellow ground parts of this plant present distinct structure of endogenous fungal community.

In wheat cultivated in field conditions the highest number of fungal endophytes were identified in roots (25 and 15 in conventional and organic farming, respectively), whereas in plants from control conditions the kernels where the most diverse (14).

Sarocladium sp. and Penicillium sp. were mostly observed in analysed cultivars and organs from wheat cultivated in control conditions. Clonostachys candelabrum, Geomyces pannorum, Engyodontium album, Nigrospora gorlenkoana, Chrysosporium pseudomerdarium and Phlebia sp. were observed only in single cultivars.

The genotype of the host plant has a lower effect on the mycobiom structure of the wheat endosphere. The main differences were observed between winter and spring wheat forms in organic cultivation.