Species composition and resistance to fungicides of Russian potato and tomato 
early blight pathogens

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Distribution of potato and tomato early blight in Russia

Disease severity: high, moderate, low.
Collecting blighted samples

Samples with typical symptoms were used for isolation
190 isolates from 7 locations were tested
Composition of species
Location of the sequenced region and positions of primers ITS 5 and ITS 4

<table>
<thead>
<tr>
<th>Name of primer</th>
<th>Sequence</th>
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<tbody>
<tr>
<td>Forward primer ITS 5 (White et al, 1990)</td>
<td>5’ – GGAAGTAAAAAGTCGTAACAAGG</td>
</tr>
<tr>
<td>Reverse primer ITS 4 (White et al, 1990)</td>
<td>5’ – TCCTCCGCTTATTGATATGC</td>
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Sequence of this region allows to identify the small-spore species, A. solani, A. tomatophila, A. infectoria.
ITS 5 – ITS 4 regions of 33 strains were sequenced.
List of the identified species:

*Alternaria solani* Sorauer

*A. infectoria* E.G. Simmons

**Group of small – spore species**

After morphological investigation this group was devoted to 3 species:

*A. alternata* (Fr.) Keissl.
*A. infectoria* E.G. Simmons
*A. tenuissima* (Kunze) Wiltshire
Comparison of ITS 4 – ITS 5 regions of A. alternata and A. solani
Comparison of ITS 4 – ITS 5 regions of A. alternata and A. infectoria
Location of the sequenced region and positions of primers ITS 5 and MR

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<td>5’ – GACCTTTGCTGATAGAGAGTG</td>
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Pare of primers ITS 5 – MR allow to distinguish species with small spores from A. solani and A. infectoria
Application of primers ITS 5 and MR for Alternaria species identification

190 Alternaria sp. strains were tested.
Identification of species

Isolation in pure culture

Extraction of DNA (CTAB method)

PCR with pare of primers ITS 5 - MR

Small-spore group

Not small-spore group

Morphological identification

Sequencing
Species of Alternaria in different regions

S – A. solani, I – A. infectoria, G – group of small spore species
Resistance to fungicides
Testing of the resistance to fungicides

**Alternaria solani**

**Alternaria alternata**

**EC$_{50}$** – concentration of the fungicide in agar media twice decreasing the growth rate of the colony. Concentrations 0,1; 1; 10; 100; 1000 mkg/ml were used for testing.
There were no highly resistant *A. solani* strains to mancozeb in all tested field populations.
There were no differences in resistance of *A. solani* and small spore species to chlorothalonil. Highly resistant strains were found in all tested field populations.
Resistance to fludioxonil

Small spore species

All tested strains were very sensitive to fludioxonil.
Resistance to difenoconazole

Small spore species

EC$_{50}$ range

A. solani

EC$_{50}$ range

All tested strains were very sensitive to difenoconazole
Conclusions

Species with small spores (morphologically identified as A. alternata, A. tenuissima, and A. arborescens) were found in all tested populations,

A. solani was found in Astrakhan region, Mari-El, and Far East,

A. infectoria was found only one strain in Kostroma region.

All tested strains were highly sensitive to fludioxonil and difenokonazole

All tested A. solani strains were sensitive to mankozeb, but there was many resistant strains between small-spored Alternaria.

Majority of strains were resistant to chlorothalonil.
Thank you for your attention!