EFFECT OF SOME HERBS ON POST-HARVEST PATHOGENS OF PEPPER
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Abstract
Dry biomass of Angelica archangelica Linn., Thymus vulgaris L. and Silphium perfoliatum L. were tested for
their effect on the growth of Alternaria alternata, Botrytis cinerea, Colletotrichum gloeosporioides and Rhizopus
nigricans. Thyme had the strongest effect on all fungi. The inhibition of C. gloeosporioides growth ranged from 56.2%
to 100%. The growth of other fungi was inhibited entirely. Angelica reduced significantly the growth of
C. gloeosporioides and R. nigricans but had no real effect on A. alternata and B. cinerea. Cup plant did not inhibit the
analyzed fungi and stimulated linear growth of A. alternata and C. gloeosporioides.

Key words: angelica, cup plant, thyme, post-harvest pathogens.

Introduction
Increasing competition in horticultural markets requires fruits and vegetables of highest quality. One of the
factors diminishing the value of fresh produce are residues of pesticides used before the harvest. There are many
biocides based on antagonistic bacteria and fungi which can be as effective as chemical fungicides (Harman and
Björkman, 1990). However, the public is concerned also about antibiotics residues as well. Therefore, many researchers
began investigations on the effect of natural substances on plant pathogens and found them effective (Motiejūnaitė and
Kaledienė, 2003). Cucchi and Guizzardi (1994) proved that oil extracts from various plants, including thyme, inhibited in vitro mycelial growth of Botrytis cinerea. Vapors of thyme and oregano oils showed strong antifungal activity against B. cinerea, Alternaria arborescens and Rhizopus stolonifer (Plotto et al., 2003). Before testing the abilities of active plant compounds it seems reasonable to check general abilities of plant biomass to inhibit the growth of pathogens. The aim of our work was to test the antifungal ability of dry mass of angelica, thyme and cup plant against some pathogens of pepper fruit.

Materials and Methods
Isolates of Alternaria alternata, Botrytis cinerea, Colletotrichum gloeosporioides and Rhizopus nigricans obtained
from diseased fruits of pepper were grown on PDA medium for 10 days. Grounded dry seeds of angelica and grounded
leaves of thyme and cup plant were added to PDA medium in 5% and 15% concentrations. Disks of fungal colonies
were placed in the center of Petri dishes filled with PDA with amendments or without them (as controls). 10 Petri dishes
were used for each experiment combination. The diameter of colonies was measured after 6, 10 and 14 days after
inoculation and compared to control colonies. All colonies were analyzed under the microscope. The disks from the
combinations where the growth of fungi was inhibited entirely were replaced into Petri dishes with PDA to check the
toxicity of amendment.

Results and Discussion
After 6 days, lower (5%) concentration of dry thyme reduced the growth of A. alternata by 76.5%,
C. gloeosporioides by 56.2%, B. cinerea and R. nigricans by 100%. After 10 days A. alternata was inhibited by 77.2%,
C. gloeosporioides by 82.3% and other pathogens by 100%. After two weeks the growth of all fungi was entirely
inhibited, except for A. alternata (82.8%). The higher concentration of thyme (15%) had a fungitoxic effect on all fungi
after 6 days except for C. gloeosporioides. This growth of this pathogen was reduced by 64% after 6 days and by 84.2%
after 10 days. Only after 14 days the growth of pathogen was inhibited by 100% (Tab.). The effect of thyme on all fungi
except C. gloeosporioides was fungitoxic. No conidia of C. gloeosporioides or A. alternata were observed when treated
with thyme.

Angelica inhibited B. cinerea by 13.5%, C. gloeosporioides by 64% and R. nigricans by 28.8% after 6 days. It
had no effect on A. alternata. After 10 days a slight inhibition was noticed for A. alternata (by 7%) and R. nigricans (by
17.7%) and stronger for C. gloeosporioides (70.1%). There was no effect on the growth of B. cinerea. After two weeks
the growth of A. alternata was inhibited by 5%, R. nigricans by 77.7% and C. gloeosporioides by 80.3%. No effect on
B. cinerea was noticed. At higher concentration angelica inhibited strongly only C. gloeosporioides and R. nigricans.
The colonies of B. cinerea were smaller by 5% after 6 days but no effect was observed after 10 and 14 days. At the time
of first and second observations angelica stimulated the growth of A. alternata by 10.8% and 1.7%, respectively and did
not affect the growth of pathogen after 14 days (Tab. 1). The sporulation of A. alternata and B. cinerea seemed to be
similar to that in control colonies.

Cup plant at 5% concentration stimulated the growth of A. alternata and C. gloeosporioides. At higher
concentration the herb inhibited only A. alternata (by 11.4%) after 14 days and stimulated this pathogen after 6 and
10 days and C. gloeosporioides from the beginning to the end of test. The growth of B. cinerea and R. nigricans with the
amendment of cup plant was the same as in control combination (Tab. 1). No differences in conidia production were
noticed.
Inhibition of the growth of fungi colonies (in %) by herbs amendments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>A. alternata</th>
<th>B. cinerea</th>
<th>C. gloeosporioides</th>
<th>R. nigricans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>10</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cup plant 5%</td>
<td>-18.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cup plant 15%</td>
<td>-51.3</td>
<td>-40.3</td>
<td>-5.0</td>
<td>0</td>
</tr>
<tr>
<td>Thyme 5%</td>
<td>76.5</td>
<td>77.2</td>
<td>82.3</td>
<td>100</td>
</tr>
<tr>
<td>Thyme 15%</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Angelica 5%</td>
<td>0</td>
<td>7.0</td>
<td>5.0</td>
<td>13.5</td>
</tr>
<tr>
<td>Angelica 15%</td>
<td>-10.8</td>
<td>-1.7</td>
<td>0</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Note: numbers marked with "—" stand for stimulating effect.

The tests confirmed the results of earlier investigations that proved a strong ability of thyme as an inhibitor of fungal growth (Wagner et al., 2003). Also other authors indicate the effectiveness of essential oils of thyme and oregano in plant protection both in vitro (Plotto et al., 2003) and in vivo (Paster et al., 1995). Even in a natural form thyme was able to inhibit or even kill tested fungi. Motiejūnaitė and Kalediënė (2003) achieved similar results testing green mass of this herb. As the effect of thyme was prolonged it seems that not only essential oil but also other components might be responsible for inhibiting fungi in our tests. Research of Saniewska (2002) proved that flavonoids can inhibit the growth of some plant pathogens. The fungitoxic effect of thyme suggests the possibility of developing a biocide based on this herb.

Angelica was not so effective but strongly inhibited the growth of storage pathogens: C. gloeosporioides and R. nigricans. The herb gives a very high yield and its production is cheap, so the investigations should continue on the activity of angelica and its components.

Cup plant, regarded as effective natural medicament for several human diseases (Kowalski, 2001) did not show inhibitory effect on tested pathogens. On the contrary, the amendment of this herb stimulated sometimes the fungi. Similar effect was observed by Motiejūnaitė and Kalediënė (2003) for a green mass of rosemary. The components of cup plant (Kowalski and Wolski, 2003) might serve as additional nutrients for some fungi.

References