Host plant specificity studies of the Western Corn rootworm - experiments in isolation cages

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Abstract/Summary

The studies expectedly resulted in beetles hatching only when maize after maize was grown. Two years after beetles have been inserted into closed cages larval damages (root eating and gooseneck symptoms) occurred in mono maize. All other variants/crops reproduced non or neglectible small numbers of descendants.

Introduction

Maize is one of the most profitable crops for Central European growers. Most farm enterprises are dependant on maize when they produce milk, beef or pork or when they maintain bio powerplants/biogas plants. Obligatory croprotations to halt the Western Corn Rottworm - Diabrotica virgifera virgifera might create substantial economic burdens to them.

Objective

1. Specify different commonly grown crops as potential host or enemy plants of Diabrotica virgifera virgifera
2. Study the role of crop rotation within the propagation of Diabrotica virgifera virgifera

Material and Methods - Experimental work with isolation cages to specify host and non host plants

In special designed well isolated cages each sized 2 m² and 2,5 m high maize was planted with 20 plants/cage – see pictures below. Defined numbers of female and mail beetles have been set free in 2009 into those cages. Descendant affiliated generations i.e. hatching of beetles have been regularly recorded.

Most common arable crops and plants were planted in these isolation cages in 2010 and subsequent years after maize:
1. Maize
2. Green rye – hibernal green cover between maize folled by maize
3. Field peas undersown in maize
4. Winter and spring cereals
5. Oil Seed Pumpkin
6. Miscanthus
7. Warm season grasses: barnyard grass - Echinochloa crus-galli, yellow foxtail - Setaria glauca

Results 2010 to 2012

The studies resulted as expected in beetles hatching only when maize after maize was grown (variants 1 to 3) and larval damages. All other variants reproduced non or neglectible small numbers of descendants.

Further results deriving from the isolation experiments 2010 – 2012:
- Spring cereals and oil pumpkin plants are not suitable as host plants - propagation of the corn rootworm is not possible
- Autumn planted hibernating winter rye have no suppressive effect on Western Corn Rootworm as maize follows maize in this variants
- Undersown fodder peas have no suppressive effect on Western Corn Rootworm when maize follows maize
- Miscanthus: although in literature elephant grass is discribed as a hostplant only very few beetles hatched in these experiments.
- Despite of artificial infestation of 15000 eggs/cage in spring only neglectible numbers of beetles could be found
- Warm season grassweeds: Echinochloa crus-galli, Setaria glauca, Setaria viridis only at high population density of Diabrotica can reproduce small proportion descendants.

No hatches of adults could be found until end of the season 2012.

Conclusions from the host plant studies in isolation cages - See table below

<table>
<thead>
<tr>
<th>Common arable crops tested in isolation cages</th>
<th>Suitability as hostplant</th>
<th>Estimated % risk in alternating croprotation with maize (maize = 100% )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring cereals – S. oat, S. wheat</td>
<td>-</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Maize</td>
<td>+ + +</td>
<td>100</td>
</tr>
<tr>
<td>Oilseed pumpkin</td>
<td>-</td>
<td>&lt; 1/ 15 – 20*</td>
</tr>
<tr>
<td>Fodder peas undersown in maize</td>
<td>+ + + (0) (no suppression by undersown fodder peas!)</td>
<td>100</td>
</tr>
<tr>
<td>Maize - winter rye - maize</td>
<td>+ + + (0) (no suppression by hibernating rye!)</td>
<td>100</td>
</tr>
<tr>
<td>Miscanthus – Elephant grass</td>
<td>(+)</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>Warm season Grassweeds: Echinochloa crus-galli, Setaria glauca, Setaria viridis</td>
<td>(+)</td>
<td>&lt; 10</td>
</tr>
</tbody>
</table>

When maize is less than 50 % within crop rotations the risk comes down to nearly zero. It also widely depends on the current infestation densities of Western Corn Rootworm in the respectiv area.

*Oil pumpkin is through its long period of flowering a strong attractant to Diabrotica which might lead into oviposition there although pumpkin is no hostplant.