Resistance of pollen beetles (*Brassicogethes aeneus*) to insecticides complicates control of cabbage stem weevils (*Ceutorhynchus pallidactylus*) in winter oilseed rape crops

Marek Seidenglanz\(^1\), Jaroslav Šafář\(^1\), Pavel Kolařík\(^2\), Eva Hrudová\(^3\), Jiří Havel\(^4\), Ján Táncik\(^5\), Peter Bokor\(^5\), František Kocourek\(^6\), Nikoleta Rubil\(^7\), Jakub Beránek\(^8\), Martina Sojneková\(^8\)

\(^1\)Agritec Plant Research Ltd., Czech Republic; \(^2\)Agriculture Research Ltd, Czech Republic, \(^3\)Mendel University in Brno, Czech Republic, \(^4\)OSEVA Development and Research Ltd., Czech Republic, \(^5\)Slovak University of Agriculture in Nitra, Slovakia, \(^6\)Crop Research Institute, Czech Republic, \(^7\)University of Zagreb, Faculty of Agriculture, Croatia; \(^8\)Central Institute for Supervising and Testing in Agriculture, Czech Republic.
CZ (SK) populations of pollen beetles are resistant to pyrethroids
Relationships between $LC_{50}$, registered dose, lab. effectiveness of the registered dose and the resistance degree assigned to the individual populations according to IRAC guidelines

Is it possible to recommend pyrethroids (at least those which are registered in higher rates) to farmers to apply them against stem weevils and pollen beetles?
Susceptibility of CZ pollen beetles to thiacloprid

**Are neonicotinoids good alternative for pyrethroids? On the base of our results NO – but that is in strong conflict with respected papers**


Does the wide distribution of resistant populations of pollen beetles in CZ:

- complicate controlling stem weevils in crops?
- pose other threat to pollen beetle’s (+ stem weevil’s and flea beetle’s) parasitoids in crops?

Stem weevils = more species in CZ: *C. pallidactylus; C. napi; C. sulcicolis; C. picitarsis*

Importance of *C. pallidactylus* and *C. napi* differs according to regions and seasons
Recurrent problems in control of stem weevils in CZ:

1) Many sprays have been purposeless every year

- some reliable and simple prediction system for adult abundances leaving the hibernation sites and migrating to rape stands is needed (systems based on knowledge of the effects of simply available meteo factors recorded in some periods during the winter on inducing mortality in populations of hibernating adults*)

- monitoring of fly activity with usage of yellow water traps (to be valuable more than usually recommended 3 traps per field are needed = high consumption of time - farmers need service)

Adults are not distributed uniformly in crops. Distribution is random or in some cases individuals are significantly aggregated into clusters (patches and gaps). The locations, shapes and acreages of the patches (and gaps) changed in the course of crop colonization.

Recurrent problems in control of stem weevils in CZ:

2) Many applications against stem weevils have incorrect timing (insecticides are usually applied too early = first spring application is usually rash)

- to detect the start of egg-laying period is possible (a field only for monitoring purposes – sufficient number of yellow water traps placed in time - dissecting females from the traps)

- prediction of total length of the egg-laying period is not possible; it can be lengthy process – especially in the case of C. pallidactylus (effect of climate change (will) play a role*)

When do the spring insect pests start to lay eggs and how long *C. pallidactylus* can continue with the activity (locality Sumperk, CZ, 2017) – WHEN, WHAT to spray? What is the main target? HOW many sprays?

In some years it is not possible to control stem weevils and pollen beetles with one spray even if the method based on dissecting *C. pallidactylus* females is used (delayed application).
The effects of insecticides on stem weevils substantially differ especially in the years when egg-laying period is lengthy. Second spring spray influences the final level of stem damage.

- Especially for the second spring application the active ingredients which are highly effective against both pollen beetles (not pyrethroids; neonicotinoids?) and stem weevils are required.
- The new alternatives (indoxacarb; pymetrozine?) seem to be less effective against stem weevils.

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>C. napi</th>
<th>C. pallidactylus</th>
<th>B. aeneus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab. contact effect. of registered dose (25 g a.i./ha; %)</td>
<td>63.38</td>
<td>68.26</td>
<td>100</td>
</tr>
<tr>
<td>Mean LC$_{50}$ (g a.i./ha)</td>
<td>14.28</td>
<td>15.64</td>
<td>&lt; 0.20</td>
</tr>
<tr>
<td>Mean LC$_{90}$ (g a.i./ha)</td>
<td>75.35</td>
<td>73.56</td>
<td>&lt; 0.94</td>
</tr>
</tbody>
</table>
There is a one real consequence of this in the Czech Republic:

More repeated applications of organophosphates (chlorpyrifos-ethyl or chlorpyrifos-methyl) every year
That is not what we need: the situation privileges insecticides with long term negative effects on parasitoids populations.*

Conclusions:

Does the wide distribution of resistant populations of pollen beetles in CZ:

- complicate controlling stem weevils in crops? **YES**
- pose other threat to pollen beetle’s (+ stem weevil’s and flea beetle’s) parasitoids in crops? **YES**