IRAC Insecticide Resistance Action Committee
eConnection

About This Issue

This is a single topic IRAC eConnection to advise on the potential resistance situation developing with pyrethroid insecticides against the cabbage stem flea beetle in Europe. We provide some background on the reports of reduced performance of the pyrethroid insecticides, the implications, and propose some pest management guidelines to reduce the chance of further resistance developing.

Cabbage stem flea beetle (CSFB), *Psylliodes chrysocephala* - Resistance on the move

The cabbage stem flea beetle (*Psylliodes chrysocephala*) is an important European pest of winter oilseed rape, attacking plants from their emergence to the shooting stage. Pyrethroid insecticides have been heavily relied upon for the control of this pest for 30 years, with very few alternative modes of action available. However a second cornerstone and mode of action for its sustainable control included seed treatment applications by neonicotinoid insecticides, which were recently restricted by the EU by banning their use in flowering and bee-attractive crops like oilseed rape.

Cabbage stem flea beetle, *Psylliodes chrysocephala*
Photograph © Bayer CropScience

In recent years, there has been an increase in the number of reports of the reduced performance of pyrethroid insecticides against this pest in Germany, Denmark and the United Kingdom. The first confirmed case of reduced pyrethroid susceptibility in cabbage stem flea beetle was reported in northern Germany during 2008.(1) Subsequent studies have confirmed that the reduced susceptibility is associated with a *kdr* (L1014F) target site resistance mutation, which is also common in other pyrethroid resistant insect species.(2) Although the L1014F mutation has been demonstrated to only have a limited impact on the efficacy of pyrethroids in this species (10-20 fold reduction in activity), its association with the reduced performance of pyrethroids in the field suggests that under less than ideal conditions, the resistance could affect residual activity and result in a significant loss in beetle control.

In 2014 the Insecticide Resistance Action Committee (IRAC) started a collaborative program to monitoring the frequency and distribution of the L1014F *kdr* mutation in populations of cabbage stem flea beetles across Europe. In addition the survey also monitored for the presence and frequency of the M918T *super-kdr* mutation. The M918T mutation is commonly associated with high levels of pyrethroid resistance in other insects, but has not yet been detected in cabbage stem flea beetle.

The first results indicate a low frequency of the L1014F mutation in Eastern Europe (Czech Republic & Poland) where there have been no significant complaints of reduced performance of pyrethroids. However, in northern & eastern Germany, France and the United Kingdom the mutation is present in high frequencies. The regions of high mutation frequency also correspond with the areas of the UK and Germany where observations of reduced pyrethroid activity have been reported. The M918T *super-kdr* mutation was not found in any of the populations tested in Europe.

Due to the lack of any alternative modes of action in many European countries and the relatively low impact of the L1014F mutation as the only reported resistance mechanism yet on pyrethroid field efficacy against cabbage stem flea beetle, the use of pyrethroid insecticides remains the main option for the control of this pest. Recently neonicotinoid seed treatments provided an additional tool for resistance management purposes in terms of early season protection of young seedlings from flea beetle attack. Their recent ban is likely to have strong implications for oilseed rape production and without any doubt increases pyrethroid selection pressure and possibly facilitates the emergence of additional resistance mechanisms. To optimize pyrethroid activity and reduce the chances of further resistance development for the time being, the following insecticide use guidelines are recommended by IRAC.

Cabbage Stem Flea Beetle - Pest Management Guidelines

- In some cases the early sowing of oil seed rape allows the plants to sufficiently develop so that they are less susceptible to adult and larval damage. Higher seeding density may compensate for plant loss due to stem flea beetle attack.
- Where possible rotate insecticides with different mode of action (IRAC mode of action classification groups). In regions where only one mode of action is available, the use of insecticides should be strictly minimized to reduce the risk of resistance development.
- Always follow insecticide use guidelines, as outlined by the manufacturer. Always use the recommended label rates and water volumes (minimum 200L/ha).
- Only apply insecticides in accordance with regionally defined pest thresholds.
- Yellow water traps buried in the soil between plants can be used to detect the beginning of adult infestations in autumn. Larvae assessments can be conducted by dissecting leafstalks or stems and counting the number of larvae or galleries.
- The effectiveness of insecticides applied against adult beetles can be optimized by making applications late in the afternoon, as during this time adult beetles can often be found on the upper part of the plant and are therefore more vulnerable to contact insecticides.

Pyrethroid resistance monitoring should be continued in order to follow the spread of resistance and to detect new emerging resistance mechanisms likely to be facilitated by increased selection pressure.

References

1. Heimbach U, Müller A, Incidence of pyrethroid-resistant oilseed rape pests in Germany, Pest Management Science 69 (2013) 209–216.

2. Zimmer CT, Müller A, Heimbach U, Nauen R, Target-site resistance to pyrethroid insecticides in German populations of the cabbage stem flea beetle, *Psylliodes chrysocephala*, Pesticide Biochemistry and Physiology 108 (2014) 1-7.

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Subscription: Free via the IRAC website.

Editor: Alan Porter, IRAC Coordinator.

IRAC website: www.irac-online.org

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