AFCP Blog

Oilseed Rape:
biopesticides for cabbage stem flea beetle

Dr Claire Price recently completed her PhD on 'Investigating biopesticides for the control of cabbage stem flea beetle (*Psylliodes chrysocephala*)' based at Harper Adams University, supervised by Tom Pope. Earlier this week, Claire joined an AFCP webinar to explain more about her research.

Claire's work was jointly funded by the Agriculture and Horticulture Development Board (AHDB), Certis Belchim and five AgriFood Charities Partnership (AFCP) members: Chadacre Agricultural Trust, Clan Trust, the Felix Thornley Cobbold Agricultural Trust, The Morley Agricultural Foundation, and Perry Foundation. The project also involved collaborations from the University of Warwick.

Figure 1: Cabbage stem flea beetle (CSFB) (Photos by Claire Price)

Oilseed rape (OSR) is an important break crop in UK agricultural crop rotations. The European Union banned the use of neonicotinoid insecticides, initially though a five year moratorium on use in 2013 followed by a permanent ban on use from 2019.

The lifecycle of *Psylliodes chrysocephala* (cabbage stem flea beetle, CSFB) is closely interlinked with the life cycle of oilseed rape and can damage the crop when the CSFB is in both its larval and its adult phase. The chemical control of CSFB in oilseed rape after the neonicotinoid seed treatments were banned became reliant on pyrethroid insecticides. However, there is known resistance to this group of insecticides which is also known to be harmful to non-target organisms. Thus, biopesticides could provide an additional option within an Integrated Pest Management (IPM) approach.

Claire conducted a range of laboratory experiments looking at a range of biopesticide options including entomopathogenic bacteria, entomopathogenic fungi, entomopathogenic nematodes (EPN), the botanical insecticide azadirachtin and fatty acids. Two fatty acid commercial products were tested; these work by damaging the cuticle of insects, in this case CSFB, and causing death by metabolic disturbance (*Figure 2*). Both fatty acids tested were effective in killing the CSFB in laboratory conditions.

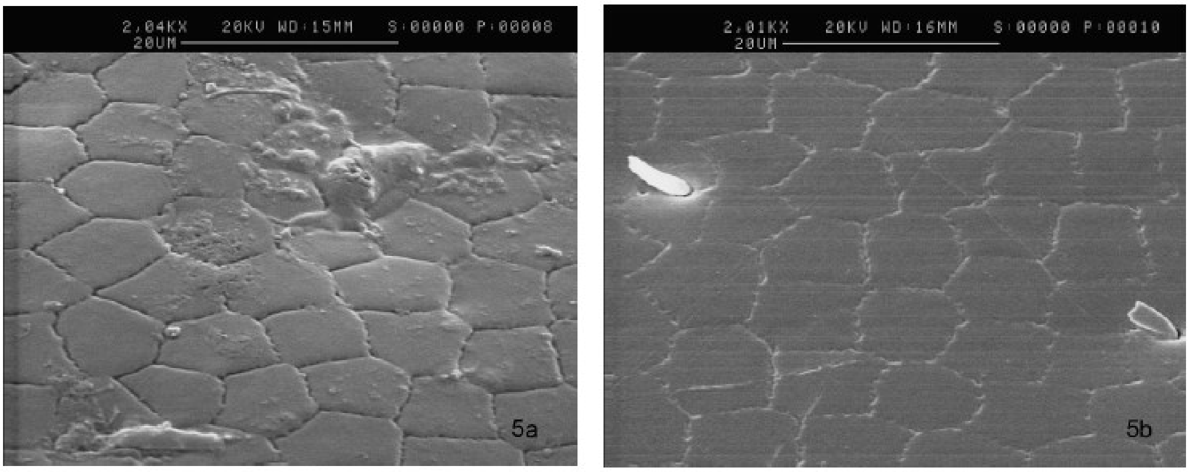

Figure 2: Cabbage stem flea beetle (Psylliodes chrysocephala) *elytra cuticle observed through a scanning electron microscope, (x2000) after treatment with (a) fatty acids and (b) water (Photos by Claire Price).*

A range of commercialised species of EPN were tested on adult CSFBs, though most of these are commercialised against the larval stage of other insect pest species. Two species were found to be effective in lab conditions.

The entomopathogenic fungus *Beauveria bassiana* strain GHA was effective at killing CSFB adults in lab conditions when double the field dose recommended for soft-bodied insects was applied.

This research project also sought to look at the effects in field conditions. In the field, the fatty acids would clearly be applied to the crop and not directly to the CSFB. In order to be effective on CSFB, the products need to be wet, thus lab testing looked at increasing the drying time and increase the spread of fatty acids with adjuvants. The adjuvants were effective on their own at increasing the spread but when in combination with the fatty acids they did not seem to increase the spread. Other adjuvants aimed at protecting the EPN from lethal UV radiation and desiccation were combined with two EPN species in the lab to test their compatibility. The results from the adjuvants varied by species but overall, the adjuvants showed no toxicity to the EPN so these adjuvants could potentially be used to improve EPN survival in the field.

The field trial looked at 12 different treatments including three controls (water, untreated, and a conventional pyrethroid insecticide, lambda-cyhalothrin), focussing on the leaf damage from adult CSFB on a range of assessment dates, and on larval numbers in the plants. Only the fatty acid product FLiPPER, when combined with the pyrethroid lambda-cyhalothrin (Hallmark with Zeon technology), and lambda-cyhalothrin by itself, significantly reduced CSFB adult leaf damage compared to the water treatment and untreated plots. No difference was seen in larval damage across the treatments.

Claire has shown a keen interest in the farming press discussions around CSFB management and thus conducted a sentiment analysis looking at changes before and after the neonicotinoid seed treatments bans. This showed an increased interest in topics related to oilseed rape and CSFB control, with two peaks after the initial moratorium in 2013 and after the permanent ban in 2019. Additionally, it showed an increased use of terms related to cultural control methods, while the use of terms related to conventional control methods decreased. However, Claire feels there is further scope to increase the awareness of biopesticides, parasitoids and predators, and their potential benefit, amongst the farming press as they are not very commonly included within articles and not widely used within the industry.

Overall, the research showed that entomopathogenic nematodes (EPN), an entomopathogenic fungus and fatty acids could form part of IPM approaches for the management of CSFB in oilseed rape in the future. Further testing on these biopesticides is needed to refine application methods, the assessment methods, timing of treatment applications and formulation of the biopesticides. Assessing the impact on non-target organisms is also a research priority.

During the discussion in the webinar, it was also noted that the costs and benefits of using biopesticides needs to be considered. Whilst some work has shown dramatically higher costs for use of biopesticides in comparison with pyrethroids, a comparison should also be drawn against the neonicotinoids which were previously used with success.