

Insecticide Resistance Action Group

Minutes of the 43rd meeting held at Warwick Crop Centre

Wednesday, 12th November 2019

Hosted by Rebecca Hilton



Bean, Chris (Zantra)
Cartwright, Paul (AICC)
Collier, Rosemary (Warwick Crop Centre: Chair)
Collins, Larissa (Fera)
Cowgill, Sue (AHDB)
Denholm, Ian (University of Hertfordshire)
Evans, Andy (SRUC)
Foster, Steve (Rothamsted Research)
Hilton, Rebecca (Corteva Agriscience)
Jones, Gareth (FMC)
Mattock, Sue (CRD)
Mortlock, Philip (BASF)
Morris, Reuben (Frontier)
Nicholls, Caroline (Defra)
Pope, Tom (HAU)
Laurence, Power (Certis)
Sisson, Adrian (Belchim)
Stevens, Mark (BBRO)
Wallwork, Chris (Agrii)
Ward, Melanie (Adama)
White, Sacha (ADAS: Secretary)

1. Welcome

IRAG welcomes Melanie Ward, attending in place of Andy Bailey, and Paul Cartwright, AICC's new representative.

2. Apologies for absence

Bailey, Andrew (Adama)
Newbert, Max (Syngenta)
Parsons, Chris (Bayer CropScience)
Shaw, Bethan (EMR)
Slater, Russell (IRAC/Syngenta)

3. Minutes of last meeting

Minutes agreed.

Action: RC to email group to ask if everyone is happy for CN to stay as a member following her move to Defra.

- Done. Agreed for CN to join as Defra representative.

Action: RC to contact Toby Bruce to find out more about the government enquiry that has come as a result of his presentation.

- RC spoke to Toby Bruce. Outcome undecided
- *Action: RC to speak to Toby Bruce again.*

Action: Members to email additional updates to the IRAG IRM guidance documents taking into account recent withdrawals of some insecticides to Sacha White.

- Done. Uploaded to website.

Action: RC to circulate updated constitution to the group and to put onto the IRAG website.

- Done. Constitution agreed.
- *Action: SW to send SC member list. SC to add constitution and member list to website.*

Action: RS to circulate slides of his presentation to the group.

- Done.

Action: SM to circulate links to documents mentioned in her presentation and that she would welcome any comments on these.

- Done

Action: SF to circulate slides from his presentation to the group.

- Done

Action: RC to email group asking for nominations for the role of Secretary.

- Done. BS has offered to take on the role of Secretary. Agreed by group. SW thanked for his work in role.

Action: SW to handover to BS.

4. Feedback from IRAC

RS unable to attend and had no update for the meeting.

5. Regulatory Issues

SM gave the following update:

MoA labelling

- CRD have had informal discussions with Crop Protection Association (CPA) regarding adding MoA information to product labels (in line with Crop Life International recommendation). There is a requirement for these to be

introduced but a light touch approach will be taken to enforcement. CRD's deadline is in line with Crop Life's deadline, which is 2023. CRD will continue to raise the profile of the exercise with industry and provide updates. It is an important policy as part of the Sustainable Use Directive and is an obvious way of providing information on MoA.

- CW asked which mechanism would be used in circumstances in which a change of labelling is needed e.g. change in the MoA classification. SM responded that this would likely occur at the next relabelling, which usually occurs in a six-month cycle.
- CW noted that it is important not to penalise authorisation holders through the process. SM said that the wording would be kept broad to avoid this.

Loss of actives paper

- Paper is ongoing. Aims to be able to share at the next meeting. Will review 2008-18 and identify actives and MoA lost.
- Paper will be useful for the ECP as it will illustrate why Article 53 requests are coming through and the challenges facing growers.
- Approx. six MoA have been lost. These have been replaced with other MoA but these have often been highly selective.
- Won't be published in a journal but a summary of the report will be made available on the web. IRAG, CRD or ECP could host. CW commented that it would be good for it to be hosted by ECP.
- CW noted that it would be good to note where losses are due to either regulation at the EU level, UK level, crop level or due to insecticide resistance. SM said that withdrawn actives will be illustrated but is unable to differentiate this on an individual active by active basis.
- CRD are not experts in elements such as individual products of choice, especially in regard to EAMUs (where efficacy not considered).
- Impact on IPM also described, including changes to alternative non-chemical methods, e.g. availability of MoA in potatoes allowed unrealistic rotations.

6. Update on research

Work at Rothamsted Research

SF provided an update on PS2720 project – 'Monitoring and managing insecticide resistance in UK Pests'. Project funding ends this year so further funding needed.

Myzus persicae (peach-potato aphid):

- Pirimicarb resistance remains, likely due to linkage with super kdr.
- Still no high neonicotinoid resistance (Nic-R⁺⁺) in UK, although it is spreading north in continental Europe. Nic-R⁺⁺ confers some cross-resistance to sulfoxaflor.
- MS notes that Nic-R⁺⁺ it has been detected in Belgium, where derogation for neonicotinoid seed treatments was in place. In the UK, the only effective

insecticide approved for use in sugar beet is a single application of flonicamid. Observation that in 2019 the greatest incidence of beet yellows virus occurred where early applications of pyrethroids occurred for thrips control, likely due to the removal of natural enemies.

- No resistance to pymetrozine, flonicamid, spirotetramat, cyantraniliprole or sulfoxaflor.
- SF plans to replace pymetrozine testing with acetamiprid as pymetrozine has been lost.

Nasonovia ribisnigri (currant-lettuce aphid)

- Pymetrozine is fast-acting. All died when treated with this insecticide.
- Spirotetramat: 56% of aphids initially survived but died several days later. This Time Lag is a new observation. Will repeat assay. This subsequently showed a similar finding suggesting that there may have been selection for lettuce aphids that are able to survive longer after treatment with spirotetramat but they are still die before they can reproduce. This situation needs to be monitored as it may be a pre-cursor to the evolution of resistance.

Cereals

- *Sitobion avenae* (grain aphid)
 - 3 samples received in 2019. 2 were pyrethroid susceptible in 5 hour coated-glass vial assays. One sample was midway between susceptible and moderately resistant. No evidence that greater resistance has developed beyond that conferred by heterozygous *kdr* resistance.
- New project
 - AHDB-funded project began in the autumn monitoring shifts in pyrethroid sensitivity in cereal aphids, *S. avenae* and *Rhopalosiphum padi*.
- BYDV testing
 - Rothamsted have developed a PCR test able to detect BYDV in aphids. AHDB-funding is allowing testing to occur at several suction traps. AE asks if there's a reason for the lack of testing at a Scottish suction trap. SC explains this is due to logistical reasons but would like to include Scottish sites in the future.
 - Two assays are available; one able to distinguish between MAV and PAV, the other able to distinguish between BYDV (MAV/PAV) and CYDV (RPV). CW asks whether the data can be checked for a correlation between resistance status of the vector and the virus. MS says that this has been checked previously.
 - Results from 2018 show considerable geographic variation in the frequency of *R. padi* infected with BYDV. Ranged from 0% (Rothamsted) to 21% (Writtle). Initial results from 2019 again show geographic variation in frequency (approx. 5% at Brooms Barn to approx. 22% at Newcastle).
 - Large variation in relative frequency of BYDV and RPV (CYDV) also found.

- Frequency of *R. padi* infected with BYDV also increased over time, peaking in August/September.
- *Metopolophium dirhodum* (rose-grain aphid)
 - 1 sample received in 2019. Susceptible to pyrethroids. No evidence of resistance to pyrethroids in this species.

Psylliodes chrysocephala (Cabbage stem flea beetle; CSFB)

- Caitlin Willis is a new PhD student at Rothamsted, studying the spread of pyrethroid resistance in CSFB. 2019 resistance survey found only 3 pyrethroid susceptible populations out of many samples from across the UK. No geographic trend to the resistance was apparent. Adjacent fields could have very different levels of resistance. Overall, a significantly higher frequency of resistance was found compared to 2018.
- Bioassay is a glass vial assay using a field rate of lambda-cyhalothrin (equivalent to 7.5 g ai/ha). CSFB is given an opportunity to recover to assess metabolic-based resistance.
- Suspects that metabolic resistance is the most common in the UK, unlike in mainland Europe. Pre-treated some with the metabolic-inhibitor, PBO, and none survived. P450 enzymes are thought to be involved but will be investigated further.
- Super-kdr has been found at a low frequency but has not increased much so suspects there's a fitness cost. Samples will be checked for kdr/super-kdr.
- Lumiposa seed treatments (cyantraniliprole) are authorised in some countries (not UK) but manufacturers don't claim it provides full protection from CSFB. SF now has a baseline for this active. SF can also use a leaf dip assay, which may be more relevant for other insecticides.
- Simon Kightley (NIAB) has data on 2019 OSR losses to CSFB.

Plutella xylostella (Diamond back moth; DBM)

- 1 sample collected from Scotland in 2019. Found to be resistant to lambda-cyhalothrin (Hallmark) in leaf dip bioassays (72 h endpoint). All previous samples (7 total) were found to be resistant, containing either kdr or super-kdr. Indicates that pyrethroids are unlikely to provide effective control.
- Cyantraniliprole (Benevia) (applied as leaf dip bioassays (96 h endpoint)) worked, as in previous years, though one individual survived at the lower dose. Control achieved with field rate.
- Spinosad (Conserve) (applied as leaf dip bioassays (72 h endpoint)) worked, as in previous years, at all doses.
- No control was seen when Spruzit was applied in a leaf dip bioassay (72 h endpoint).
- The European biotype may be at lower risk of developing resistance to other MoAs than other biotypes.

Crioceris asparagi (Asparagus beetle)

- Six samples tested in glass vial assays against adults. No baseline exists at present due to a lack of a susceptible strain. Four samples were less susceptible at field rate in 2019. Concerning and an indication of pyrethroid resistance.
- Cypermethrin most commonly used against the pest. SF plans to use cypermethrin in future bioassays.
- RC found higher survival in one sample in the SceptrePlus project. Growers target adults to minimise egg laying.

Cavariella aegopodii (Willow carrot aphid)

- Two samples received. Response tested to lambda-cyhalothrin (against adults) in glass vial assays (5h endpoint). No susceptible baseline exists due to a lack of a susceptible strain.
- Compared with susceptible baselines of other aphid species, there appears to be lower susceptibility. Question is whether this indicates resistance or simply an inherently lower susceptibility in this species. Difficult to compare with field performance as pyrethroids are not primarily used against the pest and so performance isn't monitored.
- LC suggests this could indicate resistance as a grower has reported a reduction in control.
- SF plans to use PBO to test for metabolic resistance.

Work at Warwick Crop Centre (WCC)

RC gave the following update on research underway at Warwick Crop Centre.

SceptrePlus:

- >240 products evaluated (insecticides, herbicides and fungicides) against many pests.
- Good control of *M. persicae*, *C. aegopodii*, *Brevicoryne brassicae*, *Pemphigus bursarius* and *Nasonovia ribisnigri* with single applications of several chemical insecticides.
- Control with two sprays of bioinsecticides generally less good but some are promising. These are mainly plant extract-based products. MoA of these need further investigation.
- Next steps include development of a matrix of product efficacy and persistence (in some cases) against different species, and review of impact on non-target species to inform IPM strategies.
- Lettuce root aphid (*P. bursarius*)
 - Growing methods have changed so need to understand how important it is with new cultivation methods.

- Range of treatments investigated, including spray, phyto drip at sowing and pre-plant drench.
- No treatments found to be clearly effective. A challenging pest to target.
- *N. ribisnigri*
 - Previously found some promising treatments but only assessed with two replicates.
- Phyto drips for control of brassica aphids.
 - Important to replace neonicotinoid seed treatments.
 - Several effective for early inoculations.
 - At least one effective for all inoculations.
 - No phytotox recorded.
- Bean seed fly (*Delia platura*)
 - Only seed treatment effective but future in doubt. No in-furrow treatments were effective.

Carrot aphids:

- Project aims to understand which species are primarily responsible for transmitting viruses and timings of infections. Led by Adrian Fox. Involves *Cavariella* species and *Myzus*. Carrot red-leaf virus appears to be associated with *C. aegopodii*. This fits with the phenology of the pest.

Migrant moths:

- Monitoring silver Y moth and DBM migrants from 2017-2019. Used:
 1. Brassica grower pheromone traps.
 2. Citizen science. Involves summarising this data and disseminating on WCC web page. Has proved very effective.
- Little migrant DBM activity until mid-June. Some silver Y moth activity seen from June to September. Growers were alerted.

Push-pull cabbage root fly (CRF)

- Approach involves applying chemical to 'repel' and growing Chinese cabbage as a trap crop. Spatial deployment of trap crop is important. Also looking at a *Metarhizium* EPF biocontrol.

Work at ADAS (SW)

SW gave an update on ADAS research.

CSFB

- Updated on results from the AHDB-funded CSFB IPM project. Defoliation of WOSR in the winter is effective at reducing larval numbers in the crop. Demonstrated in plot trials and on a field scale. Impacts on yield less conclusive, with no significant reductions in yield in one year but significant reductions due to defoliation in the second year of work.

BYDV

- Introducing new AHDB-funded BYDV project. Two primary objectives; optimising monitoring and improving decision making through the development of decision support systems.

Work at Fera (LC)

LC gave an update on Fera research.

- Crop monitoring found that aphid numbers peaked in the Midlands in 2016. Primarily *C. aegopodii*.
- Ladybird numbers peaked in the midlands in 2018.
- Glasshouse potato, willow-carrot and peach-potato aphid numbers have increased since 2014.
- CSFB larvae numbers have increased since 2013, with the greatest increases in the South-West, the South-East and the East of England.

7. What constitutes resistance and how to measure it? (RC)

- What is the message to convey to growers (RC)?
- Loss of expected level of control that is continuous (TP).
- IRM is a matter of managing expectation. One spray will often no longer provide adequate control (AS).
- What is resistance without baseline data (SF)? In absence of baselines one could monitor non-crop populations (ID). LC points out that this didn't work for *C. aegopodii*.
- Label information could be improved regarding timing and susceptible stages. CRD consider this during the assessment but there is room for improvement (SM).
- Increasing concentrations as an insecticide resistance management strategy will only work up to a point due to physico-chemical limitations (ID).
- The definition of an insecticide is not to kill a pest but to reduce damage (TP).
- Modern insecticides rarely achieve consistent >90-100% mortality due to need to justify dose and the higher standards of risk assessment is reflected in supported doses (SM). ID adds that % not controlled is space for resistance selection.
- Modern insecticides also often less broad spectrum and against only specific stages (SM).
- Resistance may be indicated where products no longer give effective control when used according to the authorised label recommendations (SM)

8. IRAG resistance matrix (RC)

- CW circulated an updated matrix. Only updated the list of pests and AI, not crops and MoA. Not ready to be uploaded in current form.
- Should yellow coding be changed? Currently indicates that resistance has been found in other countries and is suspected in the UK. Should it be separated? (CW). Published version ought to contain only confirmed cases of resistance.
- If this is going to be available to UK growers then it needs to be relevant to the UK (SM). SF feels it ought to focus on the UK. SM notes that an EPPO database of resistance cases for weeds, diseases, and insects is being developed.

Action: SW to contact RS about similar European-wide database.

9. IRAG output

- IRAG resistance guidance needs updating annually.
- SM asks whether seasonal messages regarding new resistance should be disseminated. These could be disseminated through AHDB (SC).

Action: Add agenda item for this in each meeting.

10. AOB

- CW highlights a new CEH study (Powney *et al.*, 2019) that found a major decline in bee and hoverfly species in the UK since 1980. Crop pollinators were the only group to increase. Biggest declines among species associated with uplands.
Action: SW to share paper.
- GDPR states that contact details cannot be shared without permission (SM).
Action: Add a line to constitution stating that details of membership (name and affiliation) are made available online. Emails are also available online for Chair and Secretary.
Action: SW to confirm with members that they are content for emails to be without using BCC to aid in discussion. All members present were fine with this.
- CW noted that in the previous meeting RS said that the role of IRAC is to “communicate information and educate on resistance to insecticides and insect-resistant traits” and asks whether crop “traits” in terms of resistance/tolerance should form part of the IRAG remit, as such traits need to be protected against resistance breaking biotypes. Gives the example of *N. ribisnigri* overcoming resistance in lettuce. There is an issue regarding whether the group has the relevant expertise. SM suggest we invite breeders for specific meetings. ID notes that IRAC is largely focussed on transgenic crops, and that the mechanisms of crop resistance/tolerance are poorly understood.

Action: Group to invite relevant speakers when necessary. Potential speakers include Defra and Rothamsted.

- SC raises opportunity to contribute to funding of new IRM project, which aims to validate recent modelling work. Model findings challenge current guidance. Taking a consortium approach to funding the work and have a part-formed consortium. Flagging here for additional funders. SM notes that CRD value the importance of the proposed work as it will help understand the importance of insecticide mixtures in IRM.

11. Date and venue of next meeting

AHDB offered to host at Stoneleigh, Warwickshire in April 2020. Meeting since cancelled due to COVID-19 pandemic.