INVITED ARTICLE

INSECTICIDE RESISTANCE STATUS IN LUCERNE FLEA

Leo McGrane and Dr Aston Arthur (cesar)

TAKE HOME MESSAGES

- Lucerne flea have been flagged as a pest at high risk of evolving resistance to commonly used insecticides such as organophosphates and neonicotinoids.
- A recent study found the screened populations of lucerne flea have not yet evolved resistance to omethoate or imidacloprid.
- Longevity of insecticide use requires a disciplined approach to pest management, incorporating good Integrated Pest Management principles.

BACKGROUND

Lucerne flea (*Sminthurus viridis*) can be found in most grain crops and pastures in southern Australia. Crops such as lucerne and clover are particularly susceptible to feeding damage. Growers have faced difficulties managing this pest when numbers are high. In part, this is due to their natural tolerance to synthetic pyrethroid insecticides. Further, there are increasing concerns about pest species developing resistance to insecticides, particularly very common species like lucerne flea, which can be subjected to regular insecticide selection pressure even though it might not always be the primary target.

Figure 1. Lucerne flea *Sminthurus viridis*. Source: cesar.

AIM

To screen lucerne flea field populations for resistance to omethoate and imidacloprid.

METHOD

To determine resistance status of lucerne flea in major cropping areas, cesar screened nine lucerne flea field populations in 2018 for resistance to omethoate and imidacloprid – two widely used insecticides in grain crops. Eight of these populations were collected from areas with a history of insecticide usage (in Victoria, NSW and Western Australia). One population sourced from Victoria had no history of insecticide usage. This population was used as a 'sensitive' control to which all other populations could be compared.

Once the samples were collected, researchers performed bioassays to establish the baseline sensitivity of each population to omethoate and imidacloprid. This involved adding a specific insecticide solution into a vial, introducing adult lucerne fleas into the vial and scoring how many died over a number of hours. This is performed for different concentrations of insecticide until we have a complete picture of what concentrations cause mortality, providing a useful method of identifying resistance. For instance, if one population had evolved resistance, we would expect to see those lucerne flea survive at a higher concentration of insecticide. A schematic of how this works can be seen below. As an example of how strong resistance can become in a population, in previous bioassays for another pest – the redlegged earth mite (*Halotydeus destructor*), resistant populations were found to have approximately 200,000 times the resistance of a population susceptible to synthetic pyrethroids.

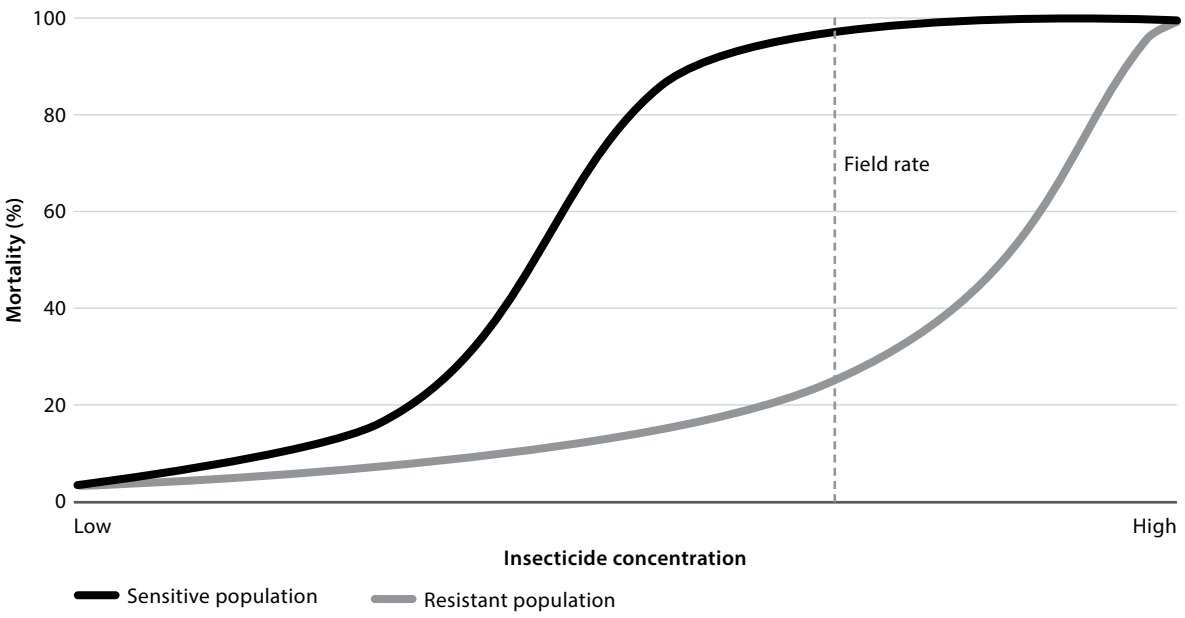

Figure 1. Schematic showing how insecticide resistance is determined using a bioassay.

RESULTS AND INTERPRETATION

The bioassay results indicated no resistance to either omethoate or imidacloprid in field populations of lucerne flea. There were some slight differences detected between the populations, but in all cases where a difference was detected, the control population exhibited a higher LD_{50} value. It is important to note that although no evidence of organophosphate or neonicotinoid resistance was found, there is significant selection pressure for resistance evolution placed on lucerne flea in Australia from frequent use of insecticides.

A 2019 GRDC report on Insecticide Resistance in the Southern Region, produced by cesar in collaboration with SARDI and the Birchip Cropping Group, lists lucerne flea as a pest that has a high risk of evolving insecticide resistance.

COMMERCIAL PRACTICE

Research by cesar indicates lucerne flea has not yet evolved resistance to insecticides. This is good news for growers who find lucerne flea in numbers that may warrant a spray treatment.

To minimise the selection pressure placed on this pest and the risk of resistance evolving, some basic ground rules can be followed. These include:

- Avoid synthetic pyrethroids, due to lucerne flea's natural tolerance.
- Be mindful of using organophosphates, neonicotinoids and other insecticides when trying to control pests. Non-target effects can increase selection pressure on commonly found species, such as lucerne flea, and may lead to the evolution of resistance.
- Spray insecticides at the correct label rate and ensure the next insecticide used on that area is from a different Mode of Action group.
- Report suspected new cases of insecticide resistance to cesar on (03) 9349 4723.

REFERENCES/FURTHER READING

Pest Note: Red legged earth mite, Updated April 2019, cesar, http://cesaraustralia.com/sustainable-agriculture/pestnotes/insect/Redlegged-earth-mite

McDonald G., Umina P., Lye J., Maino J., Perry K. and Baker G., 2019, GRDC, *Insecticide resistance in the southern region: current status, future risk and best management practices*, https://grdc.com.au/resources-and-publications/all-publications/publications/2019/insecticide-resistance-in-the-southern-region-current-status,-future-risk-and-best-management-practices

Umina P., Arthur A., Binns M. and Maino J., 2019, *A method to investigate neonicotinoid resistance in mites*. Experimental and Applied Acarology, Vol 79: pp 345-357.

ACKNOWLEDGEMENTS

This work was led by Dr Aston Arthur (cesar), with financial support from the GRDC. WA collections of lucerne flea were made by WA Department of Primary Industries and Regional Development. Project partners are CSIRO, the University of Melbourne, and the WA Department of Primary Industries and Regional Development. GRDC Project Code: UM00057