



Insecticide resistance status in UK oilseed rape crops

Summary

- This publication by the Insecticide Resistance Action Group (IRAG) summarises the resistance status of pest insects of UK oilseed rape (OSR) crops
- The peach–potato aphid (*Myzus persicae*) and mealy cabbage aphid (*Brevicoryne brassicae*) are the main aphid pests of OSR
- This information applies primarily to the peach–potato aphid, as this aphid is associated with significant insecticide resistance issues
- Peach–potato aphids with high levels of resistance to pyrethroids, and some carbamates, now predominate across the UK
- Available insecticides in OSR effective against peach–potato aphid include those containing the active ingredients thiacloprid, pymetrozine or acetamiprid
- There is no evidence of insecticide resistance in mealy cabbage aphids, which can be controlled by several effective insecticides, including pyrethroids
- Resistance to pyrethroid insecticides has also been detected in populations of pollen beetle (*Meligethes* spp.), cabbage stem flea beetle (*Psylliodes chrysocephala*) and diamond-back moth (*Plutella xylostella*)
- To minimise the risk of insecticide resistance appearing and spreading, insecticide use should be minimised through the use of thresholds and IPM programmes, products should be used at their full label rate and modes of action (MoA) should be alternated in the spray programme
- This publication should be used in conjunction with IRAG’s ‘Insecticide resistance and its management’ publication
- All IRAG publications can accessed via the dedicated web page – ahdb.org.uk/knowledge-library/IRAG
- Approved chemical names or the name of the chemical group they belong to are used throughout this document. The names of products registered in the UK that contain these insecticides are available at secure.pesticides.gov.uk/pestreg/ProdSearch.asp

Resistance status of pests of oilseed rape crops

Brassica crops may be infested by numerous insect species. Most of them are occasional pests. Some, however, are frequent and damaging and require control measures on a regular basis. Repeated and widespread use of some insecticides has selected for populations of pest insects that are resistant to them, resulting in control failures (Table 1). The most notable resistance in the UK is to the pyrethroid class of insecticides, where several species are now classified as being resistant.

Table 1. Pests of oilseed rape crops where resistance to insecticides has been identified (X)

		Pyrethroids	Organo-phosphates	Carbamates
Aphids	Peach–potato aphid	X	X	X
Beetles	Cabbage stem flea beetle	X		
	Pollen beetle	X		
Moths and butterflies	Diamond-back moth	X		

Resistance status of aphid pests of oilseed rape crops

The peach–potato aphid and mealy cabbage aphid are the main aphid pests of OSR. The peach–potato aphid is most important in the autumn as a vector of Turnip yellows virus (TuYV). It can also cause direct feeding damage but only if infestations are severe. Mealy cabbage aphid can cause damage through direct feeding and is primarily a problem in spring and summer.

The various mechanisms of resistance in peach–potato aphids have been monitored for many years (see the ‘Insecticide resistance and its management’ publication for details).

Aphids with high esterase (conferring variable resistance to a number of insecticide groups, particularly organophosphates), MACE (conferring strong resistance to pirimicarb) and kdr (conferring moderate resistance to pyrethroids) were widely distributed on potato crops in eastern England in 1996. MACE and esterase resistance then appeared to decline to low levels by 2000, possibly because peach–potato aphids carrying these resistance mechanisms suffer greater mortality during times of stress (eg during colder winters).

MACE aphids resurged in central and eastern Scotland in 2001, however, and have since spread to the rest of the UK. These more recent changes are due to new forms of peach–potato aphid that carry both MACE and an alternative form of kdr called ‘super-kdr’. These aphids appear to be better adapted to the current UK environment. At present, peach–potato aphids with high levels of resistance to pyrethroids and some carbamates predominate across the UK.

There is no evidence of strong resistance to neonicotinoids in peach–potato aphid populations in the UK. As a result, this chemistry, which includes foliar applications of thiacloprid, has an important role to play in aphid management in OSR. This has been especially true since 2013, when the European Commission introduced restrictions that prevented the use of thiamethoxam and clothianidin seed treatments in OSR (now being extended to all field crops).

Peach–potato aphids that carry strong neonicotinoid resistance (conferred by a combination of a metabolic mechanism and a target site mechanism) are now common in some peach growing regions of southern mainland Europe and have spread to Greece and North Africa, on peach as well as on other crops. This situation is being monitored carefully in the UK and guidelines will be updated if the situation changes.

The maximum number of applications of any neonicotinoid-containing product (see Table 2) is a statutory restriction introduced by CRD, in collaboration with IRAG, as a pro-active resistance management measure. Such restrictions take account of exposure of peach–potato aphids to neonicotinoid sprays when they are not the intended target of the spray (e.g. pollen beetle sprays in spring).

Ongoing resistance screening work has also found no evidence of resistance to pymetrozine in peach–potato aphid in the UK. There is also no evidence of insecticide resistance in the mealy cabbage aphid.

Insecticide resistance status of other pests of oilseed rape crops

Resistance to pyrethroid insecticides has been detected in populations of pollen beetle and cabbage stem flea beetle (CSFB) and diamond-back moth in the UK. Pyrethroid resistance in pollen beetle was first detected in the UK in 2006 and is now common in the East and South East. Pyrethroid resistance in CSFB was first detected in the UK in 2014. It is now common in the East and South East but it is also present in the North East, the Midlands, the West and the South. Pyrethroids will provide poor control where resistance frequency is high. The diamond-back moth is a migrant species and, although small numbers may overwinter in the UK, there are regular influxes of moths from continental Europe during the summer. Diamond-back moths, tested recently in the UK (2016–2017), are resistant to pyrethroid insecticides but not to insecticides from other chemical groups.

Current insecticide options for aphid control

There are several modes of action (MoA) approved for use within OSR crops. The active ingredients available for aphid control in OSR, the MoA, spray restrictions and notes on resistance that would impact on the level of control achieved, are detailed in Table 2. Further information on the MoA classification scheme can be found at irac-online.org/modes-of-action

Thiacloprid and pymetrozine are likely to prove most effective against peach–potato aphid, irrespective of their resistance status.

Treatment efficacy should be monitored at a suitable time after application (this will be dependent on the active ingredients used but generally should be done after three days; pymetrozine will take longer to kill aphids).

Table 2. Aphicides available for professional use on OSR in the UK (as at June 2018), along with the mode of action (MoA), restrictions on use and notes on current UK resistance. For several of the active ingredients, more than one product is available.

Mode of action (chemical group)	Active ingredient(s)	Maximum permitted number of applications [†]	Peach–potato aphid resistance status in UK
3a (pyrethroids)	Deltamethrin	No limit	Strong resistance widespread
3a (pyrethroids)	Etofenprox	1	Strong resistance widespread
3a (pyrethroids)	Lambda-cyhalothrin	No limit	Strong resistance widespread
3a (pyrethroids)	Tau-fluvalinate	No limit	Strong resistance widespread
4a (neonicotinoids)	Acetamiprid	1	No resistance
4a (neonicotinoids)	Thiacloprid	1 ^{††}	No resistance
9B (pyridine azomethine derivatives)	Pymetrozine	1 up to GS59	No resistance
29 (chordotonal organ modulators)	Flonicamid	1 up to GS18	No resistance

[†] Where there is 'no limit' specified for the maximum permitted number of applications, the dose is expressed as a maximum individual and maximum total dose.

^{††} One application permitted in autumn for peach–potato aphid control, with an additional application permitted in spring for pollen beetle control (neonicotinoid restrictions limit total number of any neonicotinoid containing product to two applications on OSR).

Current insecticide options for pollen beetle and CSFB control

There are four MoA approved for use against pollen beetle; pyrethroids (alpha-cypermethrin, beta-cyfluthrin, cypermethrin, deltamethrin, etofenprox, lambda-cyhalothrin, tau-fluvalinate and zeta-cypermethrin), oxadiazines (indoxacarb), pyridine azomethine derivatives (pymetrozine) and neonicotinoids (e.g. thiacloprid). Where pyrethroid resistance is present, the most effective insecticides will be indoxacarb, pymetrozine and thiacloprid. If more than one treatment is required, avoid using the same MoA again.

Only pyrethroids are approved for use against CSFB. Where resistance is present, pyrethroids are unlikely to provide effective control. If a pyrethroid application is not effective, and this cannot be explained by factors such as poor spray coverage, then it is likely that the population is resistant. In such cases, do not apply further pyrethroids, as this will continue to select for resistance and harm natural enemies.

A number of natural enemies are known to attack CSFB in the autumn, especially the egg and larval stages. Using pyrethroids against resistant populations, therefore, may result in higher larval populations than would otherwise have occurred.

Further information

cereals.ahdb.org.uk/aphids

Many principles of insecticide resistance management are common across crops and pest targets. These are detailed in IRAG's 'Insecticide resistance and its management' publication.

All IRAG publications can be accessed via ahdb.org.uk/knowledge-library/IRAG

Additional information on integrated pest management methods can be found in AHDB Cereals & Oilseeds Research Review No 86 (2016): A review of pest management in cereals and oilseed rape in the UK: cereals.ahdb.org.uk/media/1100127/rr86.pdf

ahdb.org.uk/knowledge-library/encyclopaedia-of-pests-and-natural-enemies