



Resistance testing of Diamondback moth 2019

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Diamondback moth in vegetable brassicas



- Damages all kinds of vegetable brassicas including rucola/rocket in all developmental stages of the crop
- Feeding damage and presence of larvae or pupae in or on the crop when selling it are the main problems
- In flowering brassicas, larvae and pupae in the heads makes the product unsellable
- In head cabbage, the problem is both feeding damage and presence of the pathogen in the heads



Even small infestations make the crop unsellable and because of this, effective control is extremely important

Foto: Stina Andersson

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Diamondback moth

- Most of them don't spend the winter in Sweden, but can have several generations here during the summer and autumn
- Migrates and arrives here with warm winds from the south or east
- Previously, it was a sporadic problem, but for the past 10 years there has been major occurrence every year - coming from the east
 - Can be resistant or tolerant to insecticides already when arriving
 - As they migrate here, the resistance partly varies from year to year











Diamondback moth

The problem is that they are so many and that we all have different stages of development in the field at the same time. This makes it difficult to control them growers and advisers often talk about resistance, but many times it is difficulties with the control that are interpreted as resistance.







In 2019, we had an extremely large migration. The Swedish Board of Agriculture chose to do a resistance testing of the first generation of larvae in Sweden.







Products tested

Product	Active substance	Standard dose	Product class	IRAC MoA
Beta-Baythroid SC 025	beta-cyfluthrin, 25 g/L	0,5 L/ha	pyrethroids	3A
Fastac 50	alpha-cypermethrin, 50 g/L	0,3 L/ha	pyrethroids	3A
Mavrik	tau-fluvalinate, 240 g/L	0,3 L/ha	pyrethroids	3A
Steward 30 WG high/low	indoxacarb, by weight 30 %	0,085 kg/ha (high dose) 0,066 kg/ha (low dose)	oxadiazines	22A
Movento SC 100	spirotetramat , 100 g/L	0,75 L/ha	tetronic and tetramic acid derivatives	23
Conserve	spinosad, 120 g/L	0,8 L/ha	spinosyns	5
NeemAzal-T/S	azadirachtin A, 9,8 g/L	3 L/ha	-	-
Dipel DF	Bacillus thurigiensis kurstaki ABTS-351 2	1 kg/ha	microbial disruptors of insect midgut membranes	11
Turex 50 WP	Bacillus thuringiensis kurstaki/aizawai GC-91	1 kg/ha	microbial disruptors of insect midgut membranes	11



The testing followed **IRAC Susceptibility Test Method No. 018**

- Diamondback moth larvae from the 1st generation in Sweden were collected in an untreated cabbage field
- Whole, non-infested cabbage leaves were dipped for 10 seconds in the test-liquid or in water (untreated)
- All products were tested in half, standard and double dose and four replicates were used
- Treated surface-dry leaves were put in containers and 5 larvae (L2) were put on each leaf (40 larvae per treatment) with a fine pointed brush
 - Containers were stored in 23-24°C, ~60% RH and with 16 hours daylight (not in direct sunlight)

Mortality was assessed after 72, 96 and 120 hours

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120 h after water treatment (untreated)







All products - standard dose





All products - standard dose





Pyrethroids - standard dose







96 h after alpha-cypermethrin (Fastac)





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Does the dose matter?



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Does the dose matter?

There is <u>no</u> significant difference between the three different doses for: indoxacarb high and low spiroteramat tau-fluvalinate spinosad *Bacillus thurigiensis kurstaki Bacillus thurigiensis kurstaki/aizawai*

azadirachtin: half dose has a significant lower efficacy than standard and double dose

<u>beta-cyfluthrin</u>: significant difference between half and double dose, no difference between standard dose and the other doses

alpha-cypermethrin: significant difference between all doses





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Efficacy of Fastac on Diamondback moth





Summary 1



- Small Diamondback larvae (L2) were quite easy to control in 2019. All tested products except beta-cyfluthrin (Beta-Baythroid) had a good efficacy 120 hours after treatment
- Dipel (*B.t.*), Turex (*B.t.*) and spinosad (Conserve) showed excellent efficacy already at the first assessment and there was little or no feeding damage after 72 hours
- Azadirachtin (NeemAzal) had a high efficacy after 72 hours and after 120 hours, 95% of the larvare had died
- Indoxacarb (Steward) had moderate effect after 72 hours but after 120 hours all tested doses showed more than 95% effect. There was no feeding damage on cabbage leaves after Steward treatment. The assessment at 72 hours after treatment could have been made differently
 - Spirotetramat (Movento) had surprisingly good efficacy after 120 hours! Since it has a systemic effect, it would be interesting to take a closer look at it in a growing crop where it may show to be even more useful



Summary 2



- The only products of concern was the pyrethroids. <u>Alpha-cypermethrin</u> (Fastac) showed a good efficacy, but surviving larvae were completely unaffected by the treatment. <u>Tau-fluvalinate</u> (Mavrik) and <u>beta-cyfluthrin</u> (Beta-Baythroid) had quite low efficacy at the first assessment but after 120 hours tau-fluvalinate was as good as alpha-cypermethrin. Also surviving larvae on leaves treated with tau-fluvalinate and beta-cyfluthrin were unaffected by the treatments
- The recommendation to growers after this testing is not to use pyrethroids against Diamondback moth
- The problems that growers and advisers experience with Diamondback moths are probably not due to the poor effect of other insecticides but to the fact that
 - 1. the larvae are too large at the time of control
 - . it's difficult to get a good spread of the product on the parts of the plant where the larvae are present
 - 3. there are too many developmental stages of Diamondback moth in the field at the same time which makes it difficult to see the effect in the field

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Thanks for the attention! Questions?



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