Winter oilseed rape protection against Brassica pod midge (*Dasineura brassicae Winn.*) in Czech Republic

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Abstract:
Nowadays, Brassica pod midge belongs to most important oilseed rape pests in Czech Republic. The small plot trials were carried out at four localities – Uhříněves, Humpolec, Opava and Nechanice. Different registered insecticides, insecticides actually tested in registration trials and also non-traditional insecticides. There is a suggestion, that only one insecticide application seems as strongly insufficient, therefore, the effective protection could be ensured only by system of sprayings. In booth experimental years the best results were achieved with applications first at the end of flower or later. This fact is in contrast with heretofore recommended term of application. The application term is probably of greater importance than choice of insecticides with the same attributes. It has been found that *D. brassicae* lays her eggs much longer time in case of outstanding warm weather, than expected. The increase of efficiency by tank-mix application of fungicides together with insecticides was not proved. The combined application of botanical insecticide based on azadirachtin with Greemax significantly increased the efficiency. This combination is in contrary to others safe for bees. The application of Nurelle D (0,6 l/ha) 3 – 5 days before flower increased efficiency of subsequent protection.

Introduction

Brassica pod midge (*Dasineura brassicae* Winn.) is well known oilseed rape pest in CR for a long time, however, never has caused such of great damages like in 2001 – 2003. The total damages caused during this period were estimated on 20 – 40 %. On the begin of 90. th. years of 20. th. century, already 10 – 15 % of damaged siliques on the field margins was considered as a strong infestation. Nowadays, such level of damage is considered as usual and almost unimportant. Cold weather during the spring 2004 decreased *D. brassicae* population in comparison to previous years. The bionomics of *D. brassicae* and manner of silique injury within correlation with seed weevil (*Ceutorhynchus assimilis* Payk.) has been described for a long time (Miller, 1956), but our observations from recent years indicates changes in behaviour and harmfulness in comparison to literary sources. *D. brassicae* has a lot of identical features with the next representatives of Cecidomyidae family. The adults are 1 – 2 mm small, characterized by markedly long legs, which represents reliable identification attribute for field specialists, who differentiate *D. brassicae* in oilseed rape from next similar species of Diptera or Hymenoptera insect (Skuhravý,1960). In recent years, the control of this pest has caused many problems to the growers. Common used and recommended treatments proved a low efficiency.

Material and methods

During 2002 - 2004, Department of crop protection (CUAP) in cooperation with Union of oilseeds growers and processors and some insecticide producers and distributors have carried out precise small trial plots (size of trial plot – 10 m^2, 3 repetitions in 2003, 4 rep. in 2004) at four localities – Uhříněves, Humpolec, Opava and Nechanice. Each trial plot was separated from another by zero variant plot (10 m^2), which perfectly isolated main trial plots.

The aim was to test efficiency of registered insecticides, insecticides actually tested in registration trials and also non-traditional insecticides. After our observations there is a suggestion, that only one insecticide application seems as strongly insufficient, therefore the effective protection could be ensured only by system of sprayings.

Table 1: Overview of trial variants in 2003.

Variant	Treatments	Dose	Term of treatment	Effective compound
1.	Control	-	-	-
2.	Decis EW 50	0,15 l/ha	full flower	deltamethrin
3.	Mospilan 20 SP	120 g /ha	full flower	acetamiprid
4.	Mospilan 20 SP	120 g /ha	end of flower	acetamiprid
5.	Calypso 480 SC	0,2 l/ha	full flower	thiacloprid
6.	Proteus	0.6 l/ha	full flower	thiacloprid +
7.	Spodnam DC	1,25 l/ha	full flower 2 treatments after 7 days	pinolene
8.	Neem Oil	1,5 l/ha	full flower	azadirachtin
9.	Frutapon 7E	4%	full flower (3 repetitions after 4 days)	oil

The number of trial variants was considerably extended in the spring 2004 (Table 2).

Table 2: Overview of trial variants in 2004.

Variant	Treatments	Dose	Term of treatment	Effective compound
1.	Control	-	-	
2.	Karate Zeon 5 CS + Mospilan 20 SP	0,15 l/ha 0.120 kg/ha	full flower (tank mix)	lambda cyhalothrin - acetamiprid
3..	Karate Zeon 5 CS + Mospilan 20 SP + Frutapon 7E	0,15 l/ha 0.120 kg/ha 2%	full flower (tank mix)	lambda cyhalothrin - acetamiprid olej
4.	Mospilan 20 SP Mospilan 20 SP	0.150 kg/ha 0.120 kg/ha	end of flower (after 3 weeks)	acetamiprid acetamiprid
5.	Mospilan 20 SP	0.180 kg/ha	end of flower	acetamiprid

6.	Calypso 480 SC	0.2 l/ha	full flower	thiacloprid
7.	Calypso 480 SC	0.2 l/ha	end of flower	thiacloprid
8.	Proteus	0.6 l/ha	full flower	thiacloprid + deltamethrin
9.	Calypso 480 SC + Horizon	0.2 l/ha 1 l /ha	full flower (tank mix)	thiacloprid tebuconazole
10.	Greemax + NeemOil	40 ml 1,5 l/ha	end of flower (tankmix)	nepesticidní látka azadirachtin
11.	Greemax + Calypso	40 ml 0,2 l/ha	full flower (tan kmix)	nepesticidní látka thiacloprid
12.	Greemax + Calypso	40 ml 0.15l/ha	full flower (tank mix)	nepesticidní látka thiacloprid
13.	Karate Zeon 5 CS	0,15 l/ha	full flower	lambda - cyhalothrin
14.	Karate Zeon 5 CS + Amistar	0,15 l/ha 1l/ha	full flower (tank mix)	lambda - cyhalothrin azoxystrobin
15.	Karate Zeon 5 CS + Alto Combi 420 SC	0,15 l/ha 0,5 l/ha	full flower (tankmix)	lambda - cyhalothrin carbendazim cyproconazole

Decis EW 50 and Karate Zeon 5 CS are the registered pyrethroids, most common used in agricultural practice. Recently registered Mospilan 20 SP and Calypso 480 SC were used in two different terms of application as well as in different combinations.

This insecticides are lately most used against *D. brassicae* in CR. The combined insecticide Proteus is already at the begin of registration trials in CR. By Spodnam DC wasn´t expected direct insecticide effectiveness, but strengthening (sealing) of siliques.

Botanical insecticide with effective compound azadirachtin was examined in second experimental year combined with „carrier“ Greemax, which has markedly improved penetration into plants. By application of oil based preparations was presumed mechanical killing of tiny adults on surface of oil emulsion or possibly it´s repellent effect on the plants.

Considering their high application costs, this preparations were excluded after first experimental year. The combinations of insecticides in tank-mix with fungicides were also examined, because of coincident term of treatment against *D. brassicae* and *S. sclerotiorum*. The application dose of water was 400 l/ha.

The number of damaged siliques was evaluated in area of 1 m^2 from each plot, always in mid of June according to stage of growth. According to occurence of second generation of *D. brassicae* in 2003, the locality Uhříněves was evaluated twice. The trials were also yield evaluated and results converted for standard 12 % of moisture. Finally, the result were statistically evaluated using the analysis of variance.

The complete insecticide treatment against stem weevils and pollen beetles was carried out at some localities using repeated spraying of Nurelle D (0,6 l/ha). Last treatment was carried out 3 days before flowering. The last treatment with Nurelle D was purposely skipped at some localities. The treatments of each trial plot was performed using precise back sprayer.

The plants were not importantly damaged by another species of pest. There were no fungal diseases in 2003, in 2004 was detected the steady occurence of *Sclerotinia* and *Phoma*. The occurence of *D. brassicae* was extraordinary high in 2003, in 2004 lower but still much exceeding the threshold of harmfullness.

Results

Results from 2003

From lots of results was choosen typical file from locality Uhříněves.

Table 3: Results from locality Uhříněves

	Variant	Number of damaged siliques (20.5.2003)	Number of damaged siliques (17.6.2003)	Increase of damage (Nr. of siliques)	Increase of damage (%)	Yield (t/ha)
1.	**Control**	1713	1831	118	6,9	4,19
2.	**Decis EW 50**	1340	1691	351	26,2	4,19
3.	**Mospilan 20 SP (full flower)**	1310	1362	52	4,0	4,18
4.	**Mospilan 20 SP (end of flower)**	**763**	**961**	**198**	**26,0**	**4,54**
5.	**Calypso 480 SC**	967	1219	252	26,1	4,25
6.	**Proteus**	**458**	**1030**	**572**	**124,9**	**4,65**
7.	**Spodnam DC**	1432	1704	272	19,0	4,28
8.	**Neem Oil**	1614	1770	156	9,7	4,16
9.	**Frutapon 7E**	**480**	**728**	**248**	**51,7**	**4,62**

The result in Table 3 are divided into two parts. The yield was positively affected by treatments in variants Nr. 4, 6 and 9. The rest of treatments in comparison to control variant didn´t affect the yield practically. The number of damaged siliques by effective treatments was significantly lower after first application however, during next 3 weeks has increased much faster than by uneffective treatments. The complete results from all localities are summarized in the next Table Nr. 4.

Table 4: Summarized results from all localities.

	Variant	Locality		
		Praha	**Humpolec**	**Opava**
1.	Control			
2.	Decis EW 50	uneffective	effective	uneffective
3.	Mospilan 20 SP –full flower	uneffective	uneffective	effective
4.	Mospilan 20 SP-end of flower	**excellent**	**excellent**	**excellent**
5.	Calypso 480 SC	effective	effective	effective
6.	Proteus	**excellent**	effective	**excellent**
7.	Spodnam DC	effective	**excellent**	effective

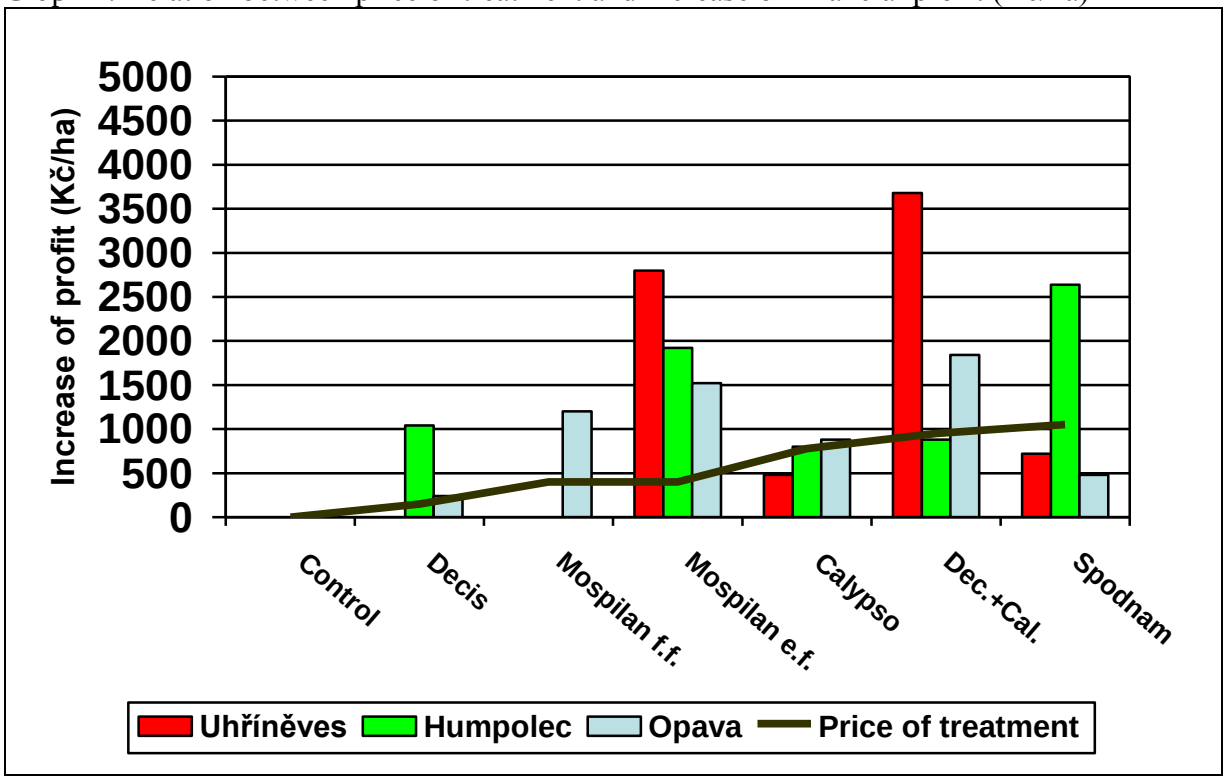
8.	Frutapon 7E	**excellent**	**excellent**	non-evaluated

Table 5: Increase of yield in comparison with control variant (%)

	Variant	**Locality**		
		Praha	**Humpolec**	**Opava**
1.	**Kontrola**			
2.	**Decis EW 50**	0	6	8
3.	**Mospilan 20 SP –full flower**	**0**	**0**	**40**
4.	**Mospilan 20 SP-end of flower**	**8**	**11**	**51**
5.	**Calypso 480 SC**	**2**	**4**	**30**
6.	**Proteus**	**11**	**5**	**62**
7.	**Spodnam DC**	**2**	**15**	**16**
8.	**Frutapon 7E**	10	**14**	*non-evaluated*

It is necessary to mention, that relatively very high increase of yield at locality Opava was caused by high damage of control variant and extremely low yields. The more decisive results for practical use are the values from localities Uhříněves and Humpolec. The yield level was more than 4 t/ha at Uhříněves and 2 – 2,5 t/ha at locality Humpolec. Nevertheless, the economical recoverability of treatment is most important factor for farmers. In Graph 1 is shown the relation between price of treatment (without application costs) and increase of financial profit (Kč/ha) considering the price of rapeseed – 8000 Kč/ha.

Graph 1: Relation between price of treatment and increase of financial profit (Kč/ha)



Statistical evaluation

Statistical evaluation of number of damaged siliques, 1. assessment, locality Uhříněves, arranged in descending order – Control variant most damaged, Proteus variant least damaged.

Source of variability	Df	Sum of Squares	Mean Square	F-ratio	++
variant	8	592076.667	74009.583	33.47	++
repetition	2	11630.889	5815.444	2.63	..
residual	16	35379.111	2211.194		
Total	26	639086.667			

		0,01	0,05
1.	Control ..... Standard	A.	A.
8.	Azadirachtin...	AB.	AB.
7.	Spodnam.....	AB.	BC.
2.	Decis.....	B.	C.
3.	Mospilan (f.f.)	B.	CD.
5.	Calypso.....	C.	D.
4.	Mospilan (e.f.)	CD	DE.
9.	Frutapon.....	D	E
6.	Proteus	D	E

Statistical evaluation of number of damaged siliques, 2. assessment, locality Uhříněves, arranged in descending order – Control variant most damaged, Frutapon variant least damaged.

Source of variability	Df	Sum of Squares	Mean Square	F-ratio	++
variant	8	434966.519	54370.815	15.62	++
repetition	2	38950.296	19475.148	5.60	+.
residual	16	55679.704	3479.981		
Total	26	529596.519			

		0,01	0,05
1.	Control ..... Standard	A	A.
8.	Azadirachtin...	AB.	A.
7.	Spodnam.....	AB	A.
2.	Decis.....	AB	A.
3.	Mospilan (f.f.)	BC	B.
5.	Calypso.....	C	BC.
6.	Proteus	CD	CD
4.	Mospilan (e.f.)	CD	CD
9.	Frutapon.....	D	D

Statistical evaluation of yield, locality Uhříněves.

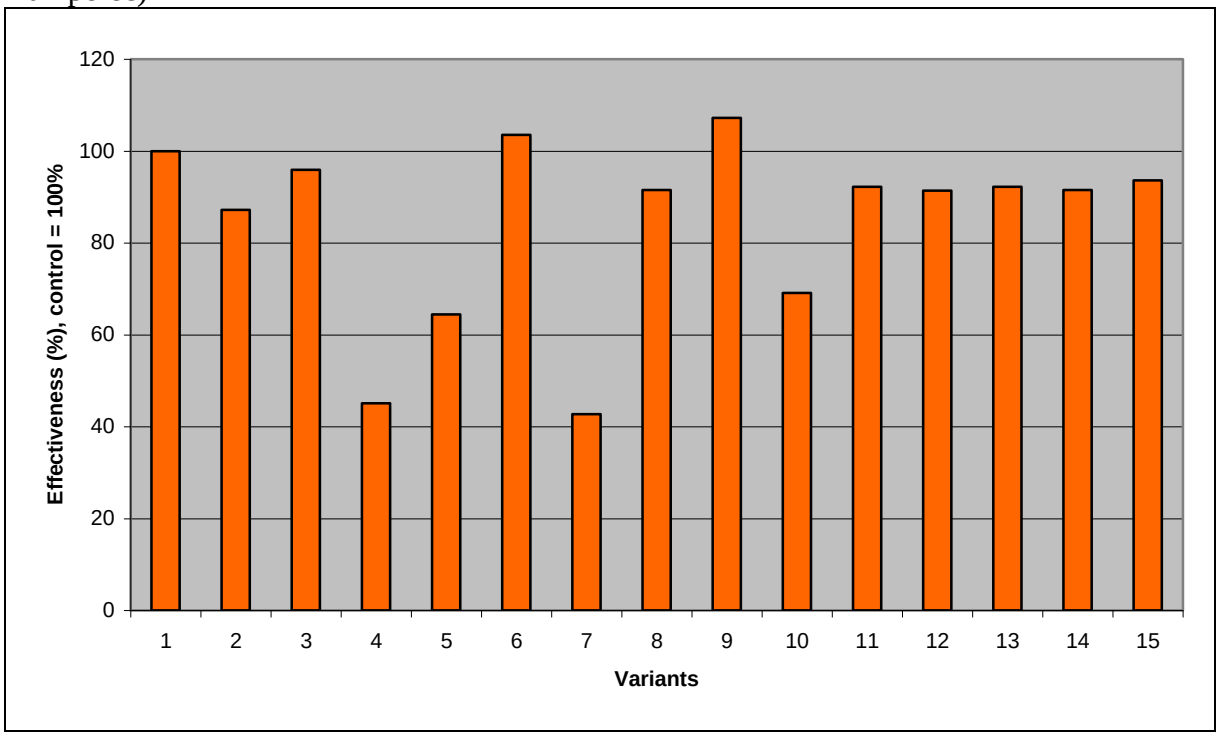
Source of variability	Df	Sum of Squares	Mean Square	F-ratio	++
variant	8	1.156	0.145	4.04	++
repetition	2	0.304	0.152	4.25	+.
residual	16	0.573	0.036		
Total	26	2.033			

			Yield	0,01	0,05
6.	Proteus		4.65	A.	A.
9.	Frutapon.....		4.62	AB.	A.
4.	Mospilan (e.f.)		4.54	ABC.	AB.
7.	Spodnam.....		4.28	ABCD	BC
5.	Calypso.....		4.22	ABCD	BC
2.	Decis.....		4.19	BCD	C
1.	Kontrola.....	Standard	4.19	BCD	C
3.	Mospilan (f.f.)		4.18	CD	C
8.	Azadirachtin...		4.16	D	C

Results from 2004

Results from experimental year 2004 are preliminary for now, because of non-finished evaluation in term of closure.

Graph 2: Effectiveness of treatments against *D. brasssicae* (average of localities Nechanice + Humpolec)



For variants overview see Table 2

Discussion

In booth experimental years, the best results were achieved by treatments at the end of flower or later. This fact is in contrast with so far recommended term for application. The impact of application term is probably very important and has probably greater importance than choice of insecticides with the same attributes. For illustration could be used comparison of variants 6. and 7. or 3. and 4. in year 2004.
Thereby have our experiments particularly responded to inconsistent results published by preparations Mospilan or Calypso, where timely and usual application proved as less efficient (in this term have occured mainly adults and eggs in the growth), but later - when larvae prevail in the growth, the effectivenes markedly increased. Calypso preparation has probably longer residual effect.
By all effective preparations is necessary to consider next application, to prevent significant increase in damage of siliques at the end of May. It has been found that *D. brassicae* lays her eggs much longer time in case of outstanding warm weather, than expected (Kazda, Baranyk, 2003). The increase of efficiency by tank-mix application of fungicides together with insecticides was not proved. The pyrethroid treatments either separately or combined was not proved as efficient in booth years, the differences among variants were non-significant.
The high doses of mineral oil were proved as useful, but they are very expensive and uneconomical.
The addition of oil at economically tolerable level into another preparations was not effective.
The combined application of botanical insecticide based on azadirachtin with Greemax significantly increases efficiency. This combination is contrary to others safe for bees. The application of Nurelle D (0,6 l/ha) 3 – 5 days before flower has increased efficiency of subsequent protection.

Conclusions

Based on our observations, there is possible to recommend following system of protection against pests during spring period – only registered preparations are used:
1. Early spring application of Nurelle D (or Talstar) against stem weevils (*C napi, C. pallidactylus*).
2. Application of Nurelle D approx. 5 day before flower against stem weevils, pollen beetles (*M. aeneus*) and pests of siliques (*C. assimilis, D. brassicae*). By this application is necessary to keep protection of bees!
3. Application of pyrethroids at beginning of flower against pollen beetles – only in case of their occurence.
4. Application at the end of flower (Mospilan 20 SP or Calypso 480 SC) against larvae of *D. brassicae.*
Based on our experiences, pretermission of some treatment term leads to general reduction in efficiency.

The presented system of protection is relatively expensive – approx. 1500 Kč/ha without application costs. Considering the price of rapeseed at 7500 Kč/ha, the only 200 kg/ha of yield increase would repay the price of treatments. Even by the price of rapeseed at only 6000 Kč/ha, the treatment costs are already recovered by 250 kg/ha of yield increase. Such of yield increases by current level of pests in oilseed rape are guaranteed almost every time – based on values from the 2003 year.

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