

ALTERNATIVE METHODS FOR SLUG AND ARION CONTROL IN WINTER RAPESEED (*BRASSICA NAPUS* L.)

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In the Czech Republic were accepted minimalization growing systems at the larger area in comparison with Western Europe. These systems together with climate changes intensified danger of many diseases and pests. Feared pests of field crops become e.g. slugs and arions, which are common pests in the gardens of the Czech Republic. Occurrence of slugs and arions is especially dangerous in humid climate, when efficiency of permitted limacides (i.e. granulates) decreases. For these reasons we focused on different preparations and methods. Experiments proved, that insecticide Marshal 25 EC (carbosulfan) in comparison with limacide Vanish Slug Pellets (metaldehyde) achieves the same results but its efficiency in more humid conditions becomes higher. We found out that Marshal 25 EC also has a side effect on *Ceutorhynchus pleurostigma*, *Athalia rosae* and on genera *Phyllotreta* and *Psylliodes*. The best statistically confirmative and ecologically suitable method of protection against slugs and arions becomes spread of calcium oxide (CaO) on soil surface, which besides limacide effect also has a positive agrochemical effect.

winter rapeseed; slugs; arions; protection; limacides; CaO

INTRODUCTION

In the Czech Republic minimizing growing systems, (the so-called without ploughing or with a limited soil cultivation) have reached a larger area in comparison with West European countries (Ditrich, 2001). Of course, there are many negative features. Diseases and pest invasion, which the traditional technology strongly eliminated (Štranc et al., 2003b; Vob, 1997).

In the last two years there was an abnormal precipitation sum and higher mean temperatures, which were alternated by heavy rains (Table 1).

Strong precipitations, together with unsuitable minimizing technologies (insufficiently buried plant remains etc.) are suitable for slugs development. In the autumn the slowly growing stands of winter crops (mainly oilseed rape) have fine and frail tissues (Štranc, Vašák, 2001). According to Briner and Frank (1998) *Brassica napus* belongs to the most palatable plants for slugs from 78 studied plants. Slugs are the common pests in fields and gardens at the present time. In the last period they destroy not only oilseed rape and vegetables, but cause great damage to cereals and many other crops.

The most dangerous in CR with different tasks for environmental condition are *Deroceras reticulatum* and *Arion lusitanicus*. According to Frank (1998a, b) *Deroceras reticulatum* and *Arion lusitanicus* are the most common slugs in Europe.

Deroceras reticulatum has a typical net drawing on its body (Plachká et al., 1997). It is about 3 cm long and so it gives it an opportunity to hide and overwinter in the field. *Arion lusitanicus* is substantially higher, 8–12 cm long. It is the highest individual in slug species. Adults are different in the shade of orange-brown colour scale (Horsák, Dvořák, 2002). Due to its greatness it cannot be hidden in the field and therefore it is not so dangerous in emerging rapeseed plants. It therefore exists at the field edges, 15–40 m into the field area according to the meteorological conditions.

MATERIAL AND METHODS

Experiments were established in the area of Vroutek (the Louny district) in 2001 on the luvial soil, after the period of stand destruction caused by slugs. On the new

Table 1. Meteorological conditions in the studied localities

	Mean year temperature (°C)	Sum year's precipitations (mm)	Mean August temperature (°C)	Mean September temperature (°C)	Precipitations sum in August (mm)	Precipitations sum in September (mm)
Long-time mean	8.98	415.3	18.20	14.23	66.8	37.1
2001	9.57	464.9	19.96	12.88	44.8	56.3
2002	10.25	675.1	20.37	13.81	158.2	64.5

Long-time mean 1961–2000

Table 2. Experimental variants, preparation doses, application method and effective compound

Variant	Preparation	Doses per 1 ha	Application method	Quantity effective compound in the preparation
1	Check	300 l	spraying	H ₂ O only
2	Marshal 25 EC	3.0 l	spraying	250 g/l carbosulfan
3	Vanish Slug Pellets	5.0 kg	spreading	4% metaldehyde
4	Unburnt lime remnants	2.0 t	spreading	49% CaO + 8% MgO

sown stand from 31. 8. 2001 a new experiment was established on 4. 9. 2001. The evaluation of the experiment was finished on 25. 9. 2001. Previous crop – oats and peas mixture, 412 m above the sea level.

In 2002 the experiments were established in Královské Údolí (the Louny district) on brown soil. The sowing of the experiment was established on 27. 8. 2002 started on 28. 8. 2002. The evaluation of the experiment was finished on 28. 9. 2002. The previous crop – winter barley, 395 m sea level.

All limacide applications were preemergent in 2001 and 2002.

The established variants had a circle shape and the protection ring was 2,5 m wide. The inner part of the circle was not treated, for the information if the slugs can be prevented, coming from different wild fallows. The area outside the circles was not treated (outer check) – Fig. 1.

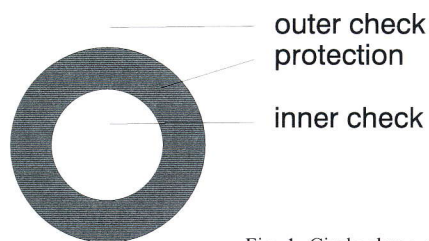


Fig. 1. Circle shape of established variants

RESULTS AND DISCUSSION

Mean value was counted from the inner and outer check (Fig. 1), for there was no significant difference.

The both localities were 10 km distant from one another in both years and with similar meteorological con-

ditions (Table 1). According to Štranc, Vašák (2001) and Štranc et al. (2003b), the effective time of limacides in rainy and very wet weather was lower and short time. Precipitations in Vroutek area (2001) in September were 56 mm, at the normal 37 mm. So this month could be classified as a moist one. There were 26 rainy days in September. The experiment established in 2001 was extremely invaded by slugs of the genus *Deroceras*. It was enabled by the rainy and cold weather in September. The total loss of leaves and plants even in the best variant No. 4 (application unburnt lime remnants – CaO on the surface of soil) was 90% against 100% of destroyed check variant (Table 3). It is evident that the slug damage is not fully liquidated by limacide treatment, just subdued.

In 2002 the occurrence of slugs was lower in Vroutek in comparison with 2001. Due to the extreme precipitations at the period of starting rapeseed growth (28. 8.–12. 9. 2002 ca 70 mm) the slug damage was yet high. The total loss of plants and leaves on the experimental variant with unburnt lime remnants was only 17% in comparison with 88% of the check variant (Table 4). The results from 2002 prove the high efficiency of studied limacide treatments at the medium invasion of slugs.

The most efficient method of treatment in both years was the variant 4 with unburnt lime remnants (2 t per ha) applied on the soil surface. In this variant most plants survived and the total loss of plants and leaves was the lowest. The unburnt lime remnants were also active as a fertilizer to the most suitable crop in crop rotations (which are very narrow at the present time).

The effectiveness of studied limacide protections was proved also by statistical evaluation of results (Tukey 95%, Tables 3 and 4).

Table 3. Experimental results and their statistical evaluation (Tukey 95% test) from Vroutek, 2001

Variant	Preparation	Sowing rate per m ²	Evaluation – on 25. 9. 2001				
			Vital plants per m ²		% of damaged vital plants per m ²	Total loss of plants and leaves in %	
1	Check	60	0	A	100	100	A
2	Marshal 25 EC	60	15	B	61	90	B
3	Vanish Slug Pellets	60	18	B	77	93	B
4	Unburnt lime remnants	60	20	B	69	90	B
P-value			0.000		0.003		
Min. statistical difference			5.44		6.36		

Note: Method of analysis of variance, significance level 95% ($n = 3$). Means given under different letters (A, B) – give significant differences ($\alpha = 0.05$ – Tukey). For example – the mean A differs significantly from B, but not significantly from AB.

Table 4. Experimental results and their statistical evaluation according to Tukey 95% from the area Královské Údolí in 2002

Variant	Preparation	Sowing rate per m ²	Evaluation – on 28. 9. 2002				
			Vital plants per m ²		% of damaged vital plants per m ²	Total loss of plants and leaves in %	
1	Check	70	17	A	52	88	A
2	Marshal 25 EC	70	59	B	13	27	BC
3	Vanish Slug Pellets	70	53	B	13	34	B
4	Unburned lime remnants	70	61	B	5	17	C
P-value			0.000		0.000		
Min. statistical difference			12.45		10.56		

Note: Method of analysis of variance, significance level 95% ($n = 4$). Means given under different letters (A, B, C) – give significant differences ($\alpha = 0.05$ – Tukey). For example – the mean A differs significantly from B, BC, C etc., but not significantly from AB.

CONCLUSIONS

1. The results show statistically significant positive effect of limacide treatments. The basic agrotechnical methods as crop rotations, soil preparations before sowing etc. must not be neglected (Štranc et al., 2003a).
2. The occurrence of slugs is quite dangerous in wet weather, when the effectiveness of limacides (mainly granulates) is decreasing (Štranc et al., 2003b).
3. The preparation Marshal 25 EC reaches, in comparison with Vanish Slug Pellets, similar results with the advantage of its higher effectiveness in wetter conditions, according to the small plot experiments from 2001, 2002. This compound has an adjacent positive effect for cabbage gall weevil (*Ceutorhynchus pleurostigma*), turnip sawfly (*Athalia rosae*) and flea beetles of the genus *Phyllotreta* and *Psylliodes* and connected mycotic diseases.
4. The best and in a sense of ecological method in the protection against slugs can be considered the spreading of unburnt lime remnants on the soil surface, which are also agrochemically effective.

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Alternativní metody hubení slimáčků a plzáků v řepce ozimé (*Brassica napus* L.).

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V České republice se na větší ploše než v západní Evropě ujaly minimalizační pěstitelské systémy, které společně se změnami klimatu vystupňovaly tlak řady chorob a škůdců. Obávanými škůdci polních plodin se stávají např. slimáčci a plzáci, kteří jsou v ČR běžnými škůdci zahrad.

Výskyt slimáčků a plzáků je zvláště nebezpečný za vlhkého počasí, při kterém se účinnost povolených limacidů (zejména granulátů) snižuje. Z těchto důvodů jsme se zaměřili na jiné přípravky a metody. Pokusy prokázaly, že insekticid Marshal 25 EC (carbosulfan) ve srovnání s limacidem Vanish Slug Pellets (metaldehyde) dosahuje stejných výsledků s tou výhodou, že jeho účinnost ve vlhčích podmínkách je vyšší. Zjistili jsme, že Marshal 25 EC má mimoto vedlejší efekt na krytonosce zelného (*Ceutorhynchus pleurostigma*), pilatku řepkovou (*Athalia rosae*) a dřepčiky (rodu *Phyllotreta* a *Psylliodes*). Jako nejlepší statisticky průkaznou a ekologicky vhodnou metodu ochrany proti slimáčkům a plzákům hodnotíme rozhoz vápenných nedohasků (CaO) na povrch půdy, které vedle limacidního účinku vykazují i pozitivní agrochemický efekt.

řepka ozimá; slimáčci; plzáci; ochrana; limacidy; vápnění; CaO

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