Differences in Flight Activity of Pests on Winter and Spring Oilseed Rape

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Abstract

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For 6 years the flight activity of pests on winter and spring oilseed rape was studied from spring till harvest, using yellow traps. In all years the flight intensity was higher in winter rape than in spring rape. The dominant insect pests of winter oilseed rape were *Ceutorhynchus obstrictus*, *C. napi*, *C. pallidactylus*, *Dasineura brassicae*, *Meligethes aeneus*, *Phyllotreta atra* and *Ph. nigripes*; subdominant were *Athalia rosae*, *Brevicoryne brassicae* and *Psylliodes chrysocephala*. In spring rape the dominant species were *Brevicoryne brassicae, Ceutorhynchus obstrictus, Dasineura brassicae, Meligethes aeneus, Phyllotreta atra* and *Ph. nigripes;* subdominant were *Athalia rosae, Ceutorhynchus napi, C. pallidactylus* and *Psylliodes chrysocephala. Dasineura brassicae* was not evaluated from trap catches. The damage by *D. brassicae* is higher to pods on axillary branches than on the main inflorescence. The occurrence of pests on spring rape was tied to a unsuitable phenophase of the plants at the time of flight activity and to the suitability of food. Winter rape requires a higher intensity of chemical treatment against pests than spring rape.

Keywords: winter oilseed rape; spring oilseed rape; pests; yellow trap; flight activity; variability

In the Czech Republic, two forms of oilseed rape are cultivated, winter and spring rape. In the past six years (1996–2001), winter rape was cultivated on an average of 370 000 ha, while spring rape occupied an average of 20–30 000 ha, i.e. approximately 5.3 to 11.5% of the total area of oilseed rape. Spring rape is grown chiefly in regions favourable for early sowing. Otherwise it is sown as a supplementary crop when stands of winter rape were destroyed by frost, are patchy or thin. The two forms of oilseed rape are, therefore, often grown on the same agricultural enterprise. This creates variously favourable conditions for the occurrence of some insect pests and requires a different approach to control measures. While the species spectrum of the oligophagous pests of winter and spring oilseed rape is much the same, their activity and economic importance are considerably different.

Yellow traps have been used by many authors to study the flight activity of insect pests on winter rape, their bionomics, monitoring of their occurrence, and investigations on their rational control. However, data are still scarce concerning the differences in flight activity of the pests on winter and spring oilseed rape. On this aspect there are valuable papers by NILSSON (1988) on the different flight activity of the pollen beetle [*Meligethes aeneus* (Fab.)] on winter and spring rape, and by AXELSEN (1992) on the different occurrence of the brassica pod midge (*Dasineura brassicae* Linn.) on the two forms of oilseed rape. ALFORD (2000) reports the pollen beetle and the cabbage aphid [*Brevicoryne brassicae* (Linn.)] as insect pests frequently damaging spring rape. In England, the cabbage seed pod weevil (*Ceutorhynchus obstrictus* Marsham = *assimilis*), the cabbage stem weevil (*C. pallidactylus*), the brassica pod midge (*D. brassicae*) and slugs are occasional or local pests of spring rape.

The present study was aimed at studying, during 6 years at one locality, the variation in flight activity of insects pests in stands of winter and spring rape, and at evaluating their different economic importance in the two forms of oilseed rape.

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MATERIAL AND METHODS

The experiments were carried out annually during 1996–2001 between March and harvest of oilseed rape at Prague-Ruzyně, central Bohemia (50° 06' N, 14° 16' E, annual mean temperature 7.9°C, precipitation 472.3 mm). In the area of the study, oilseed rape constituted 5% in the array of crops. Winter rape cv. Lirajet and spring rape cv. Golda were used for the experiments. During the years of the study, winter rape was invariably sown between 15 and 20 August; the date of sowing of spring rape varied, depending on conditions suitable for soil preparation, and ranged from 30 March (2001) to 17 April (1996). The time of sowing spring rape was influenced, above all, by excessive rainfall or cold spring weather that delayed germination and emergence (in 1996, 2000 and 2001). The density of the stands varied between 40 and 50 plants per m^2. Two separate experimental plots were 100 by 100 m in size, and fields with winter and spring oilseed rape were 100 to 200 m apart. No chemical control measures were taken in the plots.

The flight activity of the insect pests was evaluated by the catches in yellow traps installed inside the rape stands. During the growing season their position was changed so that the bottom of the dishes was above the tops of the rape plants. Yellow dishes 28 cm in diameter, filled to one third of their volume with water to which 0.01% of the detergent Agral was added, were painted grey on the outside. Three traps were placed inside each experimental plot, at 10 m from the front edge, 10 m from the rear edge and in the center of the stand. The occurrence of adults of insect pests in the dishes was checked daily from 1 March of each year in winter rape, and from 2 d after sowing spring rape. On the basis of observations made in earlier years (ŠEDIVÝ 1993) the traps were checked during the morning hours, before the onset of flight activity. The occurrence of *D. brassicae* was evaluated by determining the infestation of the pods of winter and spring rape on three times 10 plants of the equal grow. The onset of flight activity of the dominant insect pests was also estimated by using the sums of effective temperatures required for flight activity (LÁSKA & KOCOUREK 1991; ŠEDIVÝ & KOCOUREK 1994). Data on air temperature and precipitation were obtained from a meteorological station close to the experimental plots.

RESULTS

Flight activity

During the 6 years of observing the flight activity, 23 078 adults of the dominant insect pests were captured in the yellow traps. On average, 57.5% of that total were captured in winter rape and 42.5% in spring rape. The most frequent insects, with 54.9% of the total, were the flea beetles *Phyllotreta atra* (Fab.) and *Ph. nigripes* (Fab.). Their flight activity in winter rape stands was twice that in spring rape. Another very frequent pest was the cabbage seed pod weevil, *Ceutorhynchus obstrictus*, and its flight activity in winter rape was 4.8 times higher than in spring rape. Adults of the pollen beetle, *Meligethes aeneus*, made up an average of 14.5% of the total catch. As a rule, the number captured in winter rape was 1.5 times higher than that in spring rape. The average frequency of the stem weevil, *Ceutorhynchus napi* (Gyll.), in winter rape was 8.7%, which was twice that of the cabbage stem weevil, *C. pallidactylus* (Marsham). The flight activity of these two weevil species on spring rape was low. The flight activity of *C. pallidactylus* on spring rape was 1.6 times higher than that of *C. napi*. The percentage of *Athalia rosae* (Linn.) of the total flight activity was a mere 0.8%, and it was 1.7 times higher on spring rape than on winter rape (Fig. 1). The frequencies of the species varied considerably from year to year (Table 1).

Table 1. Variation in frequency (%) of adult insect pests in the total catch during 1996–2001

Species	Oilseed rape	
	winter	spring
Athalia rosae	0.1–2.4	1.3–3.8
Ceutorhynchus obstrictus	1.2–45.5	2.6–20.8
Ceutorhynchus napi	4.4–24.9	0–3.5
Ceutorhynchus pallidactylus	2.4–11.3	0–4.2
Meligethes aeneus	4.0–18.0	8.4–34.4
Phyllotreta spp.	16.0–84.0	42.0–79.8

High flight activity of the dominant pests was correlated with their noxious occurrence on winter or spring rape. In 1998 there was a distinct peak in flight activity. It was chiefly caused by the increased abundance of flea beetles, *Phyllotreta* spp., whose numbers caught in the traps tripled from one year to the next in both rape forms. The year 2001 was unfavourable for the germination of spring rape but, despite their lower flight activity, the flea beetles already destroyed most emerging plants. High flight activity of *M. aeneus* on winter rape was observed in 1997, 1998 and 2000. On spring rape, this was only observed in 1998 when the flight activity of the subsequent generation coincided with the pre-flowering phenophase of the rape. Adult *M. aeneus* destroyed all rape buds during their maturation feeding. In that year the flight activity of the pollen beetle was 1.6 times higher on spring than on winter rape. Low flight activity of *A. rosae* was observed during most of the 6 experimental years, and none in 1999 and 2000 (Fig. 2).

Of the group of weevil pests, *Ceutorhynchus obstrictus* showed the highest flight activity. The numbers cap-

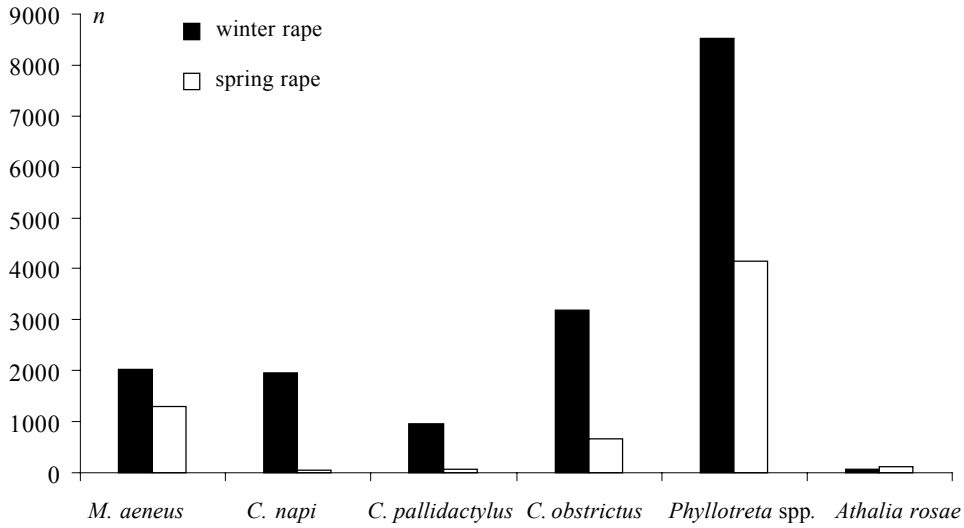
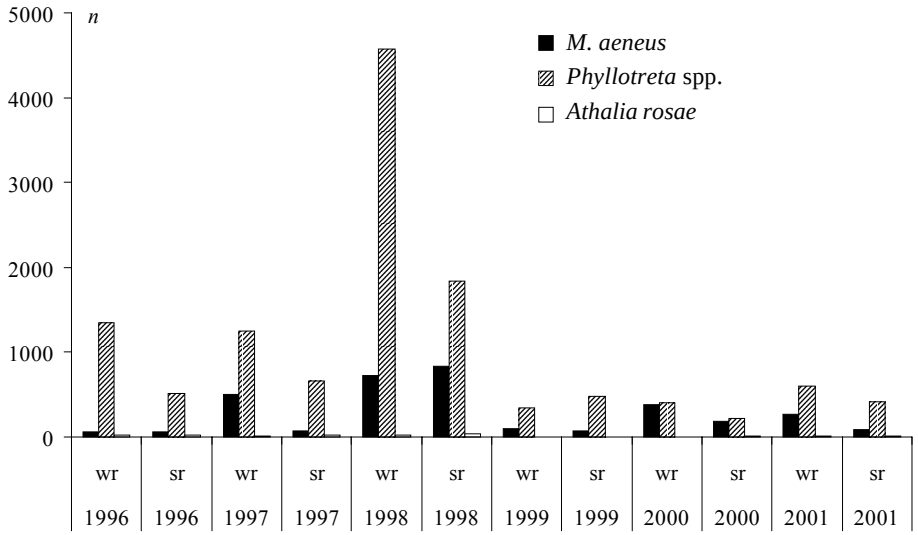


Fig. 1. Numbers of pests captured in yellow traps in plots of winter and spring oilseed rape during 1996–2001

tured of this species increased rapidly from 1997 on, reached a peak in winter rape in 2000, and then dropped again markedly the following year. Its flight activity showed two peaks. The first peak was observed at the same time as the occurrence of adults in the traps. The females had ripe ova in their ovaries. The second peak was observed in late May and early June. The period of the second dispersion in winter rape took place at temperature sums of 613 ± 24°C. During the years of the study, the flight intensity of *C. napi* on winter rape increased from 1996 to 2000 and dropped markedly in 2001. After mid-March, the females of this weevil species had ripe ova in their ovaries. No differentiated ova were found in the ovarioles of females captured in the second half of May and early June. In 1997 and 1998 the flight activity followed a bimodal curve. The first peak was observed in mid-March to early April. The second peak occurred in late April and the first half of May. In spring rape there were only occasional catches in late March and early April. No damage to the rape plants was seen. No flights in spring rape stands were observed in 1999 and 2000. The flight activity of *C. pallidactylus* followed much the same tendency as that of *C. obstrictus* during the 6 years. The number of adults caught in winter rape increased from 1997 on, dropped drastically in 1999, attained a peak in 2000, and dropped to a minimum in 2001. In spring rape stands the occurrence of the cabbage stem weevil was low. Its larvae were found in only one of 30 stems. No flight activity of this species in spring rape was observed in 1999 and 2000 (Fig. 3).

The degree of variation in the intensity of flight activity in winter and spring rape was evaluated from the ratio between the highest and lowest total catch in the traps during the 6 years of study. The highest:lowest total catch



wr – winter rape
sr – spring rape

Fig. 2. Flight intensity of *Phyllotreta* spp., *Meligethes aeneus* and *Athalia rosae* during 1996–2001

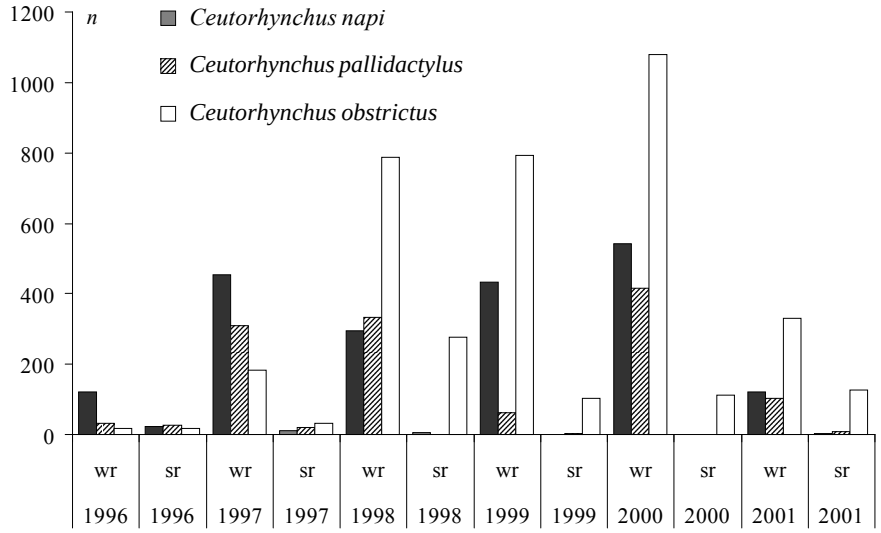


Fig. 3. Flight intensity of *Ceutorhynchus* spp. during 1996–2001

wr– winter rape
sr – spring rape

ratio were: for *A. rosae* in winter rape 29:1, in spring rape 7.6:1; for *C. napi* in winter rape 4.5:1, in spring rape 23:1; for *C. obstrictus* in winter rape 56.8:1, in spring rape 16:1; for *C. pallidactylus* in winter rape 10:1, in spring rape 29:1; for *M. aeneus* in winter rape 11.3:1, in spring rape 12.6:1; for *Phyllotreta atra* and *Ph. nigripes* in winter rape 13:1, in spring rape 8.1:1. The greatest ratio between highest:lowest catch of adults was observed in winter rape for *C. obstrictus*, the least for *C. napi*. In spring rape the greatest ratio was found for *C. pallidactylus*, the least for *A. rosae*.

The flight activity of pests in winter and spring rape was also evaluated for the number of days during which each species was found in the traps. Flight activity lasted longest in *M. aeneus* and *Phyllotreta* spp.; with the former it averaged 65 d in winter rape and 45 d in spring rape, and with the latter 61 d in winter rape and 50 d in spring rape. Flight activity was shortest in *A. rosae* in both winter and spring rape (Fig. 4). In all species shown in Fig. 4 the duration of flight activity may be partly biased by the fact that in years that favour the development of a pest the data also include part of the next generation.

Notes on selected species

Brevicoryne brassicae (Linn.)

The flight activity of the cabbage aphid was recorded in all years of the study by the yellow traps placed in winter rape stands. In 1996, 1997 and 2001 it occurred in mid-May at flowering of the rape and amounted to 31 and 40 aphids per three traps per day. The top flowers and pods of some inflorescences were slightly damaged. In 1998, increased flight activity of the aphids was observed in May, the highest number being 42 aphids per three

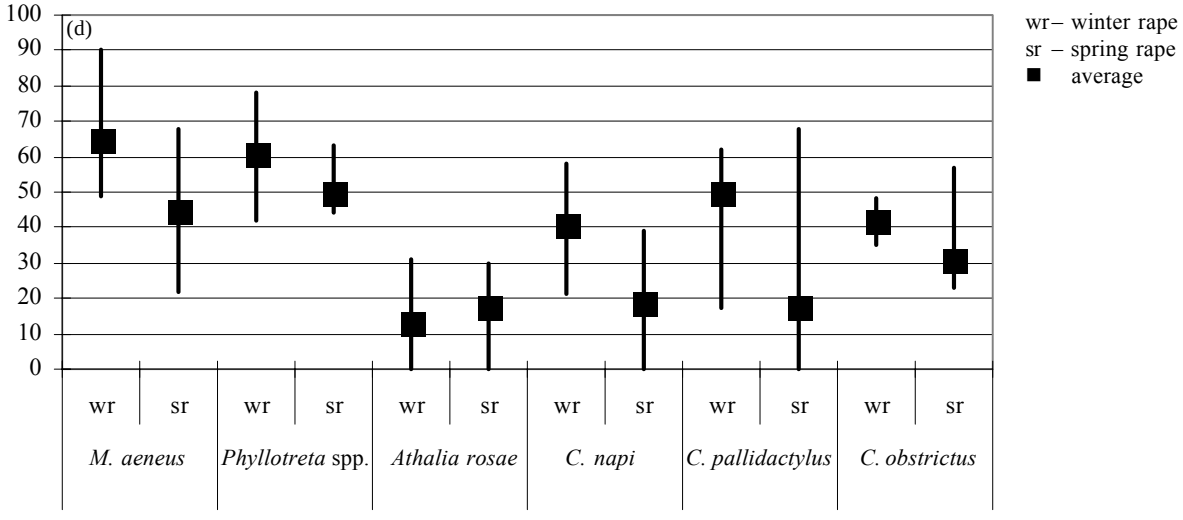


Fig. 4. Duration of flight activity of insect pests of winter and spring oilseed rape during 1996–2001

traps per day. As a result, pods of the major inflorescences were heavily damaged on plants at the edges of the stand up to a depth of 5 m, where on average 28–30% of the plants were affected. In 2000, heavy flight activity was observed towards the end of flowering. It culminated on 15 May, with a catch of 60 aphids per three traps per day. The inflorescences were heavily damaged and losses occurred as a result. The duration of flight activity varied from 2 to 35 days, the 6-year average was 12 days.

Spring rape stands were infested by the cabbage aphid in 3 of the 6 years. In 1996, flight activity was observed on 20 June, amounting to 60 aphids per three traps per day. The aphids damaged the tops of inflorescences, but caused no economic losses. In 2000 and 2001, spring rape stands were heavily damaged in the period between the onset of flowering and the end of pod development. In 2000 the peak of flight activity occurred on 12 June, amounting to 21 aphids per three traps per day. In 2001 the peak happened as early as 15 May, with 33 aphids per three traps per day. In both these years two thirds of the pods were damaged and the yield of the rape cv. Golda decreased to 0.9 t/ha. Flight activity was observed from 4 to 40 days, the 6-year average was 31 days.

Dasineura brassicae Winn.

The catches of brassica pod midges in the yellow traps were irregular as their bottoms were higher than the tops of the rape plants, while the midges stayed on the inflorescences below them. For that reason the degree of damage to the pods of winter and spring rape cultivars was evaluated rather than the flight activity of the midge. On average, the winter rape cv. Lirajet showed 44.7% damaged pods on the main inflorescences and 55.3% on axillary stems, while spring rape cv. Golda had 46.4% damaged pods on the main inflorescences and 53.6% on the axillary stems. The damage to pods was different in plots of winter rape cultivars that were 300 to 500 m distant from the experimental ones. On average, cv. Falcon showed 62.5% damaged pods on the main inflorescences and 37.4% on the axillary stems, while on cv. Stela these values were 60.5% and 39.5%, resp.

Psylliodes chrysocephala (Linn.)

During spring, cabbage stem flea beetles were found more frequently in traps placed in winter rape than in those in spring rape. In winter rape the first adults were captured on 9 March 1997, in spring rape on 14 April 1996. The infestation of winter rape with these pests was not evaluated. No damage was observed on spring rape plants.

DISCUSSION

During the 6 years of the study, marked differences were observed in the flight activity of insect pests in winter and spring rape stands. They were caused by variation in the population dynamics of the particular pest species, variable weather conditions, and different suitability of winter and spring rape plants for the development of the pests. According to DEBOUZIE and BALLANGER (1993) the flight activity of *C. napi* is also affected by the distance between experimental plots and those on which winter rape was grown the previous year. In our experience, this observation applies to all rape pests that spend the whole year on arable land. The flight activity of most pests was highest in 1998 because conditions in that year were most favourable for their development. The lowest flight activity was observed in 2000 and 2001 when conditions were unfavourable for emergence and development of spring rape, which negatively influenced the intensity of flight activity. The year 1996 was unfavourable for both winter and spring rape pests.

The different frequency of insect pests in winter and spring rape crops also tends to characterise the different suitability of the two rape forms for their development. The sporadic flight activity of *C. napi* and *C. pallidactylus* in spring rape and the slight damage to plants indicate that this rape form is unsuitable for the development of these weevils. The differences in flight activity may also be due to the differences in the growth habit of spring and winter rape. According to KASA and KONDRA (1986), spring rape plants have a short ground rosette phenophase and rapid stem elongation. Such plants are unsuitable for the oviposition of *C. pallidactylus* that lays eggs in the leaves of oilseed rape plants and whose larvae develop in their stems (PILORGÉ *et al.* 1997). Another reason for the different occurrence of insect pests in winter and spring rape crops lies in the suitability of a particular phenophase for their feeding and development. *M. aeneus* will only damage spring rape plants in those years in which bud formation coincides with high flight activity of adults of the subsequent generation. Similarly, spring rape crops were more heavily damaged by cabbage aphids, *B. brassicae*, in years when the plants were at a stage shortly before the flowers started to expand and while gregarious flight activity of the aphids took place. At that time the winter rape plants had already finished flowering. The spring rape cv. Golda was more damaged by *D. brassicae* on axillary stems than the early cultivars of winter rape because when it finished flowering it offered a phenophase more suitable for oviposition than did the early winter rape cultivars. The greater occurrence of *A. rosae* in spring than in winter rape crops was also due to the more suitable phenophase for oviposition and development in the former.

Sums of effective air temperatures that cause gregarious flight activity of insect pests in winter rape cannot be used to time measures for the protection of spring rape crops since there is a difference in the periods of their mass flight activities.

Winter rape crops require a higher intensity of chemical pest control than those of spring rape. Under the conditions of the present study, seven regular or potential insect pest species in winter rape were determined. In agricultural practice, winter rape crops are regularly treated to control *C. napi*, *C. pallidactylus* and *M. aeneus*. In our spring rape plots, six potential insect pest species were determined. However, out on farms the spring rape crops are treated only in years of noxious occurrence of *Phyllotreta* spp. and *B. brassicae*.

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Souhrn

ŠEDIVÝ J., VAŠÁK J. (2002): **Rozdíly v letové aktivitě škůdců ozimé a jarní řepky**. Plant Protect. Sci., **38**: 138–144.

Aktivita přeletu škůdců v porostech ozimé a jarní řepky byla sledována pomocí žlutých misek šest let. Ve všech letech byla intenzita přeletu škůdců vyšší v ozimé řepce než v jarní řepce. Dominantními škůdci na ozimé řepce byli bejlomorka kapustová, blýskáček řepkový, dřepčík černý, dřepčík černonohý, krytonosec čtyřzubý, krytonosec řepkový a krytonosec šešulový. Subdominantními škůdci byli dřepčík řepkový, mšice zelná, pilatka řepková. V jarní řepce byli dominantními škůdci bejlomorka kapustová, blýskáček řepkový, dřepčík černý, dřepčík černonohý, mšice zelná. Subdominantními škůdci na jarní řepce byli dřepčík řepkový, krytonosec čtyřzubý, krytonosec řepkový, pilatka řepková. Výskyt bejlomorky kapustové nebyl hodnocen ve žlutých miskách. Škodlivost bejlomorky byla vyšší na bočných stoncích rostliny než na hlavním květenství. Výskyty škůdců na jarní řepce byly omezovány nevhodnou fenofází rostlin a dostupností vhodné potravy v období přeletu škůdců. V praxi ozimá řepka vyžaduje vyšší intenzitu chemické ochrany proti škůdcům než jarní řepka.

Klíčová slova: ozimá řepka; jarní řepka; škůdci; žluté misky; letová aktivita; proměnlivost

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