PRESENCE DYNAMICS IN SELECTED WINTER OILSEED RAPE PESTS DURING THE SPRING PERIOD IN DIFFERENT CROPPING SYSTEMS*

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Apart from the main issues related to weeds, a key factor with respect to the organic growing of winter oil seed rape is the presence of pests. The number of winter oil seed rape pests has rapidly increased in the course of the past twenty years due to the expansion of cultivated land coupled with the prevailing use of conventional technology. We have monitored the presence of selected groups of winter oilseed rape pests in organic and conventional farming, in particular, the presence of stem weevils (*Ceutorhynchus napi* Gyll., *Ceutorhynchus pallidactylus* Mrsh.), cabbage flea beetles (*Phyllotreta* Stephens spp.), cabbage stem flea beetles (*Psylliodes chrysocephala* L.) and cabbage root flies (*Delia radicum* L.). With respect to stem weevils, we have monitored the presence of recently emerged larvae. We have noticed a significant differences in pest abundance between organically and conventionally grown plots. A very low level of stem weevil larval parasitisation by hymenopteran parasitoids was only recorded during one of the four monitored years (6.8% in organically and 16.7% in conventionally grown plots). A better understanding of pest peak abundance periods may contribute to the enhancement of integrated control systems.

organic oilseed rape; conventional oilseed rape; stem weevils; flea beetles; cabbage root fly; natural enemies

INTRODUCTION

Winter oilseed rape (OSR) represents the most important commodity of the oleaginous plant production of the Czech Republic. It is grown almost exclusively with the use of conventional farming technology and series of intensification inputs in the course of the growth period (in particular manufactured fertilizers and pesticides). In the Czech Republic, the organic farming technology has also been used to grow winter oilseed rape, but only in isolated instances. This is due to the demanding requirements associated with rape nutrition, and in particular its protection against damaging factors (i.e. weeds, diseases and pests).

In the conventional farming, pests are often eliminated by the preventive application of pesticides, regardless of the levels of nuisance caused, and with no respect for the unique bonds between the groups of 'pests' in the fields and their existing natural regulators. On the contrary, in organic farming, agronomists are greatly dependent on the operating of such bonds, given the minimal amount of controlling actions taken.

The aim of this study was to explore in experimental field conditions during a given time period the abundance of selected winter oilseed rape pests in two fundamentally different farming systems, i.e. conventional and organic farming. During the spring growth period of winter oilseed rape, we monitored the presence of adult pests outside their peak nuisance period (cabbage root flies, cabbage stem flea beetle). We monitored the presence of stem weevil larvae on pests with spring nuisance period and we concluded that these larvae could potentially be reduced in natural manner by larval hymenopteran parasitisation.

Our hypothesis was that the simultaneous comparison of both farming systems would reveal a higher pest density/variety in organic farming than in conventional farming. The data provided further information on both farming systems from a pest bionomics point of view, i.e.:

(1) knowledge of adult pest density peaks in the fields outside their nuisance period,

(2) more detailed information on the impact of hymenopteran parasitoids on the reduction of stem weevil larvae in the spring season.

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The uniqueness of this monitoring resided in the immediate vicinity of the two agrotechnical systems simultaneously monitored. They are indeed in close proximity of each other, on one piece of land, which has been already cultivated by using totally different technologies for a number of years.

MATERIAL AND METHODS

We monitored throughout the spring period of growth the presence of pests and their natural regulators in the research station for biological farming of Czech University of Life Sciences in Prague-Uhříněves during the years 2005–2008.

Growing technology

The individual growing technologies of both systems used in the specific years of experimentation are indicated in Tables 1 and 2. In the ecological farming system, a mixture of beans and peas harvested for green manure proved its worth as preceding crop. Regular soil loosening in alternate rows also contributed significantly to the enhancement of the nutritive condition and soil structure of the land. The crop was established by the well-tried technology of sowing in large rows (25 cm), with larger seeding quantity, and repeated line weeding (once or twice in the autumn and again once or twice in the spring). The conventional system was set up following cereal preceding crop with standard seeding quantities in inter-row interval of 12.5 cm, fertilised with industrial fertilisers at the level of 150 kg N/year and treated with herbicides, fungicides and insecticides, according to standard practice (Table 2). The crop of conventional rape amounted in average to 35 plants/m^2, whereas the crop of organic rape ranked in average at 45 plants/m^2.

Samples collecting

We monitored concurrently, at regular weekly intervals, the presence of pests and adult beneficial insects on an assortment located on the rape plots grown according to organic farming principles and on an assortment located on the rape plots grown with the use of standard conventional farming technologies (for growth stage of experimental plots see Appendix 1).

For the purpose of this monitoring, we used small and precisely delineated experimental plots (plots with harvest surface of 10 m^2) with a selection of varieties of winter oilseed rape. On the organic plots we used ten line varieties (including hybrids), and on the conventional plots 30 line varieties (including hybrids), in both cases. All varieties were species commonly grown in the environmental conditions of the Czech Republic. The only exceptions were the first year of the project (2005), when samples were only collected on the organic plots from two varieties (the line variety Aviso and the hybrid variety Baldur) and the year 2006, where we sowed on both sets of plots (organic and conventional) an identical complete selection of 34 varieties (line and hybrid varieties).

Pests and parasitoids collecting

Samples of adults were taken with a sweep net, in regular weekly intervals in the course of the spring period of growth (i.e. during the period of growth from the budding until approximately the beginning of green

Table 1. Survey of agronomical practices applied in the organic growing of winter oilseed rape in the years 2005–2008 (Experimental site of Uhříněves)

	Experimental year			
	2004/05	2005/06	2006/07	2007/08
Preceding crop	cow grass	beans + peas for green manure	beans + peas for green manure	cow grass
Ploughing	22.8.2004	20.8.2005	15.8.2006	14.8.2007
Presowing preparation	23–24.8.2004	23–28.8.2005	24–25.8.2006	23–25.8.2007
Sowing	24.8.2004	28.8.2005	25.8.0206	26.8.2007
Seeding dosage	1.2 MKS/ha	1.2 MKS/ha	1.2 MKS/ha	1.2 MKS/ha
Inter-row interval	12.5 cm, 25 cm	25 cm	25 cm	25 cm
Line weeding (Martínkova's thrust hoe)	3 × (5.10.2004; 5.4.2005, 21.4.2005)	3 × (21.9.2005; 12.10.2005; 20.4.2006)	2 × (20.9.2006; 28.3. 07)	2 × (8.10.2007; 10.4.2008)
Harvest	20.7.2005	20.7.2006	3.7.2007	20.7.2008
Number of days of growth	total from sowing – 330 days from 1.1.06 – 201 days	total from sowing – 326 days from 1.1.06 – 201 days	total from sowing – 313 days from 1.1.07 – 184 days	total from sowing – 329 days from 1.1.08 – 202 days

Table 2. Survey of agronomical practices applied in the conventional growing of wind oilseed rape in the years 2005–2008 (Experimental site of Uhříněves)

	Experimental year			
	2004/05	2005/06	2006/07	2007/08
Preceding crop	Winter wheat	Spring wheat	Peas + beans (green manure)	Peas + beans (green manure)
Ploughing	20.8.2004	20.8.2005	15.8.2006	13.8.2007
Soil preparation	23–25.8.2004	24–27.8.2005	19.–31.8.2006	25–26.8.2007
Sowing	27.8.2004	28.8.2005	1.9.2006	28.8.2007
Control – herbicidal	Herbicide: Gallera 29.9.2004, 6.4.2005 Graminicide: Gallant Super 6.9.2004, 6.10.2004	Herbicide: Butisan Star 31.8.2005 Graminicide: Gallant Super 22.10.2005	Butisan Star 2.9.2006 Galera – 10.10.2006 Graminicide: Galant Super 10.10.2006	Butisan Star 30.8.2007 Galera 2.10.2007, 13.4.2008
Fertilization	20.8.2004 ploughdown 30 kg N/ha with straw 22.3.2005 – 80 kg N/ha – Entec 26 13.4.2005 – 60 kg N/ha – Entec 26	20.8.2005 ploughdown 30 kg N/ha with straw 30.9.05 Campofort Retafos 24.3.2006 80 kg N/ha – LAV 27 18.4.06 60 kg N/ha – LAV 27	26.2.2007 40 kg N/ha – Entec 26 12.3.2007 – 40 kg N/ha – Entec 26 26 23.3.2007 – 60 kg N/ha – Entec 26	2.10.2007 – Campofort Retafos 18.2.08 – 40 kg N/ha + 20 kg S/ha; 7.3.2008 – 40 kg N/ha ha + 20 kg S/ha; 8.4.2008 – 60 kg N/ha ha + 20 kg S/ha (Entec 26)
Control – fungicidal	–	–	–	–
Control – insecticidal	Nurelle D – 6.4.2005 Decis EW 50– 2.5.2005	Nurelle D – 20.4.2005 Decis EW 50 – 2.5.2005	Nurelle D – 11.9.2006 Nurelle D – 3.4.2007	Nurelle D – 13.4.2008
Harvest	21.7.05	25.7.06	8.7.07	23.7.08
Number of days of growth	Total from sowing – 328 days from 1.1.2006 – 202 days	Total from sowing – 331 days from 1.1.2006 – 206 days	Total from sowing – 311 day from 1.1.2007 – 189 days	Total from sowing – 331 days from 1.1.2008 – 205 days

ripeness). Sweeping was performed by passing along the borders of the plots where the selected varieties were grown. In the first year (2005) sweeping was carried out four times 4 × 30 sweeps (corresponding to a field surface of 4 × 7.5 m^2), in the following harvest years (2006–2008) sweeping was carried out 4 × 20 shears (corresponding to a field surface of 4 × 5 m^2). Samples were killed in an ice box and afterwards analyzed in view of identifying the species represented and their abundance.

Pest larvae collecting

Larvae of pests emerged from the plants, in the course of their growth period, were captured with water traps. We used plastic boxes of similar dimensions (13.5 × 46.5 cm), whose capture surface was then recalculated on the basis of a 15.93 coefficient for a field surface of 1 m^2. We placed 4 water traps on the conventional rape plots and 4 water traps in the organic rape plots. In our reports, we indicated the density of larvae of the different varieties of pests per plot and when it was possible from a visibility point of view (as far as larvae of rape stem weevils are concerned) we added the proportion of these larvae carrying parasitoids. The presence of parasitoid eggs on adult larvae is disclosed by the presence of a characteristic black spot under the skin of the white yellow larvae.

RESULTS AND DISCUSSION

Stem weevils – rape and cabbage stem weevils (*Ceutorhynchus napi, Ceutorhynchus pallidactylus*)

It is very difficult to determine the density of stem weevils in a winter oilseed rape field. It is also very uneasy to identify the presence, and as the case may be, the impact of hymenopteran parasitoids on these populations. The number of adults captured with the sweep net provided very limited benchmarks per m^2 of field surface. During the period of 10^{th}–25^{th} April (years 2006–2008), we found 0.1–1 adults/per m^2 in the organic field and we did not manage to capture any adult in the conventional field.

The monitoring of newly hatched larvae that had emerged from the plants on a specific plot offered the best predicative ability. We could observe that on average, with respect to stem weevils, during the course of these four years, a significantly higher quantity of hatched larvae was recorded in the organic rape field than in the conventional field. Parasitism was only detected on these larvae in the year 2008 with a level of 16.7% with respect to conventional rape plots and 6.8% with respect to the organic rape plots. This corresponds only to an annual average of 2–4% for the four years monitored (Fig. 1).

A l f o r d (2003) lists the following species as the main representatives of hymenopteran parasitoids of stem weevils identified in Europe (including the Czech Republic): the species *Tersilochus fulvipes*, *T. moderator, T. obscurator* and *T. tripartitus* (Ichneumonidae: Tersilochinae). In Poland, parasitisation by chalcids *Stenomalina gracillis* (Chalcidoidea: Pteromalidae) was also determined.

The species *T. obscurator* is considered as the most significant hymenopteran parasitoid of stem weevils in Europe. J o u r d h e u i l (1960) indicates that the rate of parasitism of stem weevils with hymenopteran parasitoids in France was 35% in 1953 and 54% in 1956. Š e d i v ý (1983) mentioned that the rate of parasitism in the Czech Republic was 6% in 1951 and 69% in 1982. G ü n t h a r d t (1949) indicates that 35–75% of larvae in the ground hosted the parasitoid *T. tripartitus* in Switzerland in 1945, however, B ü c h i (1991) monitored in the same region in the period 1989–1996 and he identified the parasitisation rate only 0–20%. Other author (for example A l f o r d , 2003) indicate that the parasitisation rate of cabbage stem weevils in the southern Austria in the years 1996–2000 ranged between 40–80% (0–30% in Sweden in the year 1951, 2–52% in Germany in the years 1990–1997).

During the period 2005–2008 monitoring of parasitoids in the spring growth period of winter oilseed rape in Uhříněves, the only representatives of hymenopteran parasitoids associated with stem weevils, which were caught during the flowering of the plants, were *Stenomalina gracilis* (Hymenoptera: Pteromalidae).

Stem weevils parasitoids *T. fulvipes* a *T. obscurator* were most abundant at the beginning of the flowering period of the rape. The application of insecticides to control the oviposition of stem weevils and rape blossom beetles carried out at earlier stages provides in conventional farming a greater protection of these useful populations (L e h m a n n , 1965; N i t z s c h e , 1998).

One of the factors causing the very low level of parasitisation of stem weevil larvae might have been the soil tillage technology (i.e. regular ploughing), which was used in both farming systems. A l f o r d (2003) indicates that reduced soil tillage lowers the mortality of parasitoid larvae. In the fields with direct sowing without prior tillage, the quantity of parasitoids that emerged was twice as three times higher than in the fields ploughed in a standard manner (Table 3).

Cabbage flea beetles – cabbage stem flea beetle (*Psylliodes chrysocephala*) and cabbage flea beetles (*Phyllotreta sp.*) (Coleoptera: Chrysomelidae)

Adults of these species are most abundant in rape plants in September and October, when they damage the plant tissue and lay eggs in the soil close to the plants (A l f o r d , 2003). In the favourable conditions, they can however survive until the spring and continue with laying of eggs (A l f o r d , 2003). However, in the course of the spring growth period of rape, adults do not generally represent anymore any significant risk. The new generation emerges in the summer during the harvest time. Knowledge of increased adult density period during the spring period of growth may be however one of the factors taken into account when deciding on the appropriateness of using pest insecticide control in the spring.

The graphs show that the peak density was recorded as follows: with respect to cabbage stem flea beetle (*Psylliodes chrysocephala*) in May (around BBCH 65) (the BBCH-scale is a scale used to identify the phenological development stages of a plant), with respect to the cabbage flea beetle (*Phyllotreta* sp.) at the time of the flower bud formation (BBCH 55) and of maximal flowering (BBCH 65) (Figs 2 and 3).

A l f o r d (2003) indicates that cabbage stem flea beetle in its larval as well as adult stage can host larvae from several parasitoid species from the three

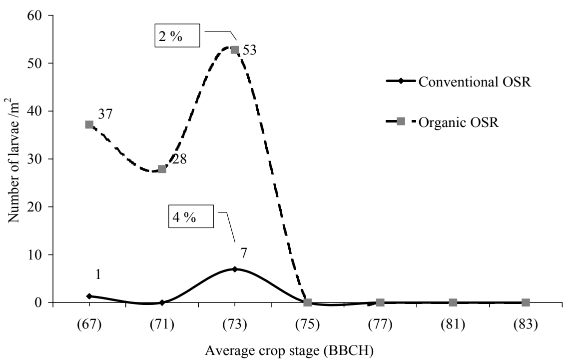

Fig. 1. Larvae of stem weevils in the course of the growth and % parasitisation by hymenopteran parasitoids. (Uhříněves, average of 2005–2008)

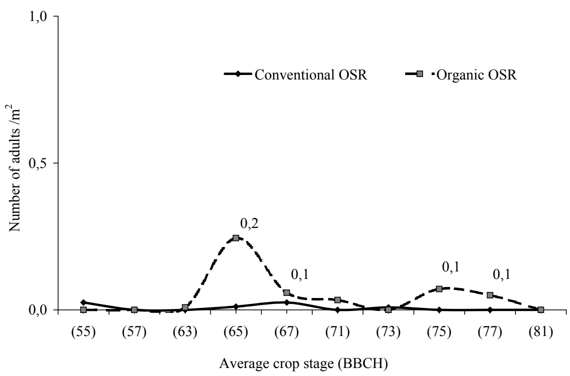

Fig. 2. Presence of cabbage stem flea beetle *Psylliodes chrysocephala* in OSR growth (Uhříněves, average of 2005–2008)

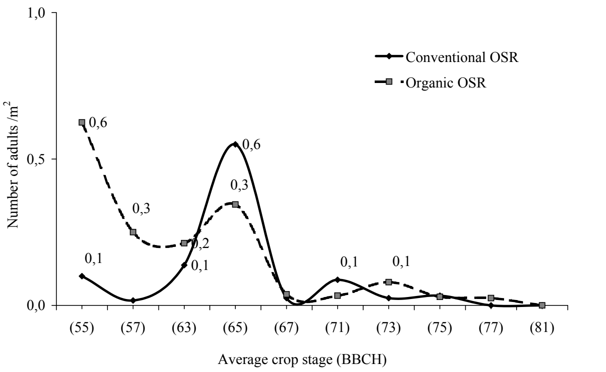

Fig. 3. Presence of adult of cabbage flea beetles (*Phyllotreta sp.*) in OSR growth (Uhříněves, average of 2005–2008)

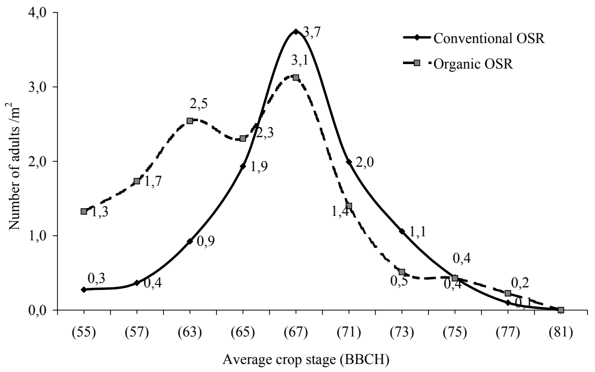

Fig. 4. Density of adult cabbage root flies in OSR growth (Uhříněves, average of 2005–2008)

hymenopteran families: Ichneumonidae, Braconidae and Pteromalidae, and adults can also host larvae from the family Braconidae. The rate of larvae parasitisation recorded in France varied between 30–61% (Jourdheuil, 1960), in Germany between 3–27% (Dosse, 1961). In the course of the spring growth period, we did not detect any species of hymenopteran parasitoids directly linked with mentioned pests (Table 3).

Cabbage root flies (*Delia radicum*)

Harmful abundance of cabbage root flies occurs in the autumn season, at the time of oviposition and larvae feeding. Alford (2003) indicates that the cabbage root fly has several generations within a year and rape plants are mainly endangered in dry areas with slow emergence.

On the average during our four-year monitoring, peak density of adult cabbage root flies clearly occurred at the end of the rape flowering cycle (BBCH 67), afterwards the number of adult cabbage root flies continuously diminish (Fig. 4).

During the slow increase of the population at the time of the flower bud formation until maximal flowering, a higher density of adult cabbage root flies was detected on the organically farmed winter oilseed rape field than on the conventional farmed winter oilseed rape field.

The main representatives of natural enemies of cabbage root flies are rove beetles *Aleochara* spp. (Coleoptera: Staphylinidae), whose endoparasitoid larvae feed on cabbage root flies (Finch, Collier, 2000). Adults can also be egg predators and/or predators of their young larvae (Langlet, Brunel, 1996). Their significant role in the reduction of the cabbage root fly population was not however confirmed (Finch et al., 1999).

Fig. 5 demonstrates the abundance of the population of larval and adult rove beetles (Coleoptera: Staphylinidae) in the winter oilseed rape plots monitored in Uhříněves.

Some of hymenopteran representatives from the superfamily Chalcidoidea (Hughes et al., 1959) and the family Ichneumonidae are also cabbage root fly parasitoids. They were responsible for 39% of the mortality of cabbage root flies (Langlet, Brunel, 1996).

In the course of the spring period of growth, we did not detect any hymenopteran parasitoids associated with the cabbage root fly (Table 3).

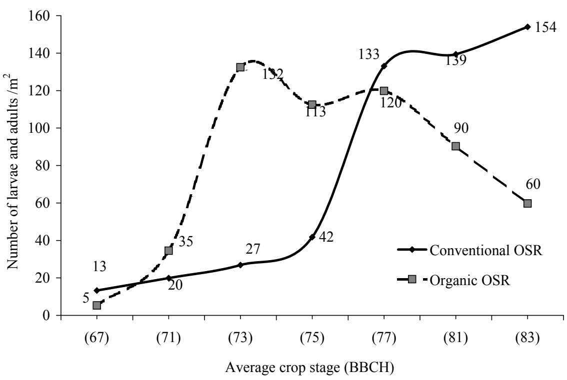

Fig. 5. Density of rove beetle larvae and their adults in OSR growth (Uhříněves, average of 2005–2008)

CONCLUSIONS

Results confirmed the premise that pests are generally more abundant in organically farmed winter oilseed rape fields.

With respect to stem weevils, we identified during the peak period of larvae dropping to the ground a very low rate of stem weevil parasitisation and such presence was only recorded in one of the four years monitored (2008: 6.8% in organically and 16.7% in conventionally grown plots). A slightly higher rate was recorded in the same periods on the organic farming field. We have generally observed that with respect to organic farming, the hypothesis of a significantly higher density and impact of stem weevil natural enemies on

Table 3. General survey of the most significant hymenopteran larval parasitoids hosted by rape pests detected on the monitored plots (Uhříněves, 2005–2008) (Association with pests according to A l f o r d , 2003)

Pests	Hymenopteran parasitoid		
	superfamily, family, subfamily	genus, species	relative adult density in the stands***
Rape blossom beetle	superfamily: Ichneumonoidea family: Ichneumonidae subfamily: Tersilochinae	*Tersilochus heterocerus* Thomson *Phradis morionellus (Holmgren*	●●●
		Aneuclis incidens (Thomson*)*	●
	superfamily: Proctotrupoidea family: Proctotrupidae	*Brachyhserphus Hellen* sp.	●●
Cabbage seed weevil	superfamily: Chalcidoidea family: Pteromalidae subfamily: Pteromalinae	*Trichomalus perfectus* (Walker) *Mesopolobus morys* (Walker)	●●●
		*Stenomalina gracilis**(Walker)	●●
		Halticoptera circulus (Walker)	●
		Cyrtogaster vulgaris (Walker)	
	superfamily: Ichneumonoidea family: Braconidae**	cca. 15 gen. spp.	●●●
	superfamily: Ichneumonoidea family: Braconidae** subfamily: Paxylomatinae	2 gen. spp.	●
	superfamily: Chalcidoidea family: Mymaridae subfamily: Mymarinae	1 gen. sp.	
		Polynema Halidaysp.	
Brassica pod midge	superfamily: Chalcidoidea family: Eulophidae	*Omphale* Halidaysp.	●●
		Tetrastichus Haliday spp. *(4)* *Entedon* Dalman *sp.* *Aprostocetus* Westwood sp. *Chrysocharis* Foerster sp. 3 next gen. sp.	●
	superfamily: Chalcidoidea family: Torymidae	*Pseudotorymus napi (*Amerling & Kirchner)	
	superfamily: Platygastroidea family: Platygastridae	*Platygaster* Latreille sp.	●●
		Inostemma Haliday sp. Platygastridae gen. sp.	●
	superfamily: Ceraphronoidea family: Ceraphronidae	Ceraphronidae gen. Sp	
Cabbage seed weevil + Brassica pod midge	superfamily: Chalcidoidea family: Eurytomidae	*Eurytoma* spp. (2)	
Aphid	superfamily: Cynipoidea family. Charipidae	Charipidae gen. Sp	
	family: Aphidiidae	Aphidiidae gen. sp.	
Other groups of parasitoids without direct association with specific pests	family: Braconidae subfamily: Paxylomatinae	Braconidae gen. spp.	
	family: Encyrtidae	*Copidosoma* sp. Encyrtidae gen. sp.	
	superfamily: Cynipoidea family: Figitidae	Figitidae gen. sp. (2)	
	family: Megaspilidae		
	family: Scelionidae		
	superfamily: Chalcidodoidea family: Pteromalidae	*Asaphes suspensus* (Nees)	
	superfamily: Ichneumonoidea family: Ichneumonidae	*Diaplazon ornatus*	

*species also associated with stem weevils (*C. napi, C. pallidactylus*), **genus also associated with rape blossom beetle (*Meligethes aeneus*), ***relative adult density in the stands in peak of their occurence: ●●● 1 – 2 adults/per m^2; ●● 0.1 – 1 adults/per m^2; ● less than 0.1 adults/per m^2

stem weevil larvae was not confirmed in the course of the growth of the rape crop. Apart from Chalcids *Stenomalina gracilis* (only secondarily associated with stem weevils according to published literature) no species representatives with direct association with these pests were identified.

In the course of the spring period of growth we recorded periods with significantly higher abundance of adult pests (mainly cabbage root flies and partially adult cabbage flea beetles). Their peak nuisance period is the autumn season and in practice direct controlling remains to a large extent very difficult. With respect to this group of pests we did not identify in the fields any association of representatives of stem weevil parasitoids.

In the course of the monitored years, we identified however a large population of rove beetles (up to 154 larvae and adults together per m^2), which may play a role in the reduction of cabbage root fly eggs and larvae.

It results from the above described monitoring that the colonisation of the field by the main groups of stem weevil parasitoids (mainly pests of generative organs) occur in the period around the month of May, which follows the usual period of application of pest control insecticides in conventional farming.

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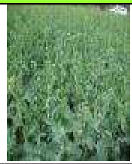
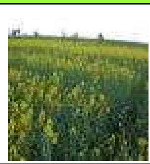
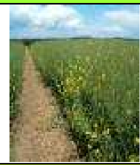
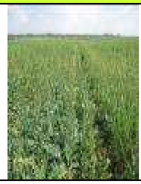
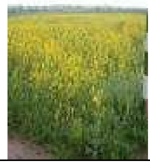
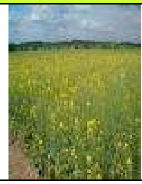
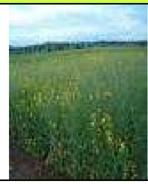
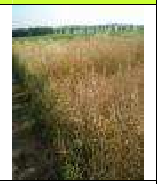
Appendix 1. Survey of the growth of the organic and conventional winter oil seed plots in the individual sampling years (Experimental site of Uhříněves)

Conventional OSR BBCH (ø)	**51-55**	**55-9**	**61-3**	**63-5**	**65-7**	**67-9**	**71-3**	**73-5**	**75-7**	**77-9**	**81-3**
											
Organic OSR BBCH (ø)	**55-57**	**57-9**	**63-5**	**65-7**	**67-9**	**71-3**	**73-5**	**75-7**	**77-9**	**81-3**	**83-5**
											
Ø BBCH	***55***	***57***	***63***	***65***	***67***	***71***	***73***	***75***	***77***	***81***	***83***
2005	-	-	11.5.	19.5.	26.5.	2.6.	14.6.	21.6.	28.6.	4.7.	12.7.
2006	25.4.	3.5.	10.5.	17.5.	24.5.	31.5.	7.6.	14.6.	23.6.	1.7.	10.7.
2007*	-	10.4.	17.4.	24.4.	30.4.	10.5.	18.5.	24.5.	31.5.	7.6.	13.6.
2008	24.4.	30.4.	7.5.	14.5.	23.5.	29.5.	4.6.	13.6.	20.6.	-	-
Range	***24-25.4***	***10.4-3.5***	***17.4-11.5***	***24.4-19.5***	***30.4-26.5***	***10.5-2.6***	***18.5-14.6***	***24.5-21.6***	***31.5-28.6***	***7.6-4.7***	***13.6-12.7***
In 2007 spring came exceptionally early. Growth in this year was 2 – 3 weeks ahead of schedule.											

Note: these data are development phase averages reached at the given time; sweep net catching was performed from the plots colonized by the selected species; due to the early arrival of spring, few-day growth differences can be noticed

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Dynamika výskytu vybraných škůdců ozimé řepky v období jarní vegetace v odlišných systémech pěstování

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Kromě hlavních problémů s pleveli je významným faktorem v ekologické pěstební technologii ozimé řepky i výskyt škůdců. Vlivem nárůstu osevních ploch a převažující konvenční technologie došlo i k velkému nárůstu škůdců ozimé řepky v posledních 20 letech. Byly sledovány výskyty vybraných skupin škůdců ozimé řepky v rámci ekologické a konvenční pěstební technologie, zejména stonkových krytonosců (*Ceutorhynchus napi*, *Ceutorhynchus pallidactylus*), dřepčíků (*Phyllotreta* spp.), dřepčíka olejkového (*Psylliodes chrysocephala*) a květilky zelné (*Delia radicum*). U stonkových krytonosců byl sledován výskyt nově vylíhnutých larev v porostu. Byl zjištěn významný rozdíl mezi výskytem škůdců na ekologické a konvenční ploše. Velmi nízká úroveň parazitizace larev stonkových krytonosců blanokřídlými parazitoidy byla zjištěna pouze v jednom ze 4 sledovaných ročníků. Přesné určení period maximálního výskytu škůdců může přispět k vylepšení systému integrované ochrany.

organický systém pěstování řepky; konvenční systém pěstování řepky; krytonosci; dřepčíci; květilka zelná; přirození nepřátelé

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