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Cabbage seed weevil (*Ceutorhynchus assimilis* Payk.) and its parasitoids in oilseed rape crops in Estonia

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Abstract: Besides pollen beetles, the cabbage seed weevil is the second most numerous crucifer-specialist in Estonian oilseed rape crops. The occurrence of cabbage seed weevil and its hymenopterous parasitoids was studied in standard and integrated cropping systems in winter and spring oilseed rape crops in 2004–2005. Cabbage seed weevil is more synchronized with winter oilseed rape and its abundance was greater in winter than in spring. The average pod damage was 9.9% in winter and only 1.2% in the spring crop. In winter oilseed rape, the population of *C. assimilis* was more numerous in the integrated than in the standard cropping system. Three parasitoids of seed weevil – *Trichomalus perfectus*, *Stenomalina gracilis*, *Mesopolobus morys* – were caught with yellow water traps but their abundance was low. The larval parasitism rate was higher in the integrated cropping system (22.2%) than in the standard cropping system (9.7%). *Trichomalus perfectus* was the dominant species emerging from *C. assimilis* larvae.

Key words: *Ceutorhynchus assimilis***,** oilseed rape, parasitoids, insecticide, cropping system

INTRODUCTION

In Estonia the area of oilseed rape has rapidly increased during the last decade; it provides good preconditions for population growth of crucifer-specialist insects. Spring oilseed rape is prevailing and *Meligethes aeneus* (Fab.) became the most dangerous pest in this crop (Veromann et al., 2006a). But the production area of winter oilseed rape is also expanding. Cabbage seed weevil (*Ceutorhynchus assimilis* Payk.) is one of the major pests of oilseed rape in Europe, reducing yield of infested pods by about 18% (Alford et al., 2003; Williams, 2004). The management of the pests of oilseed rape relies on chemical pesticides. Along with the pests, insecticides also kill their natural enemies, which can substantially reduce beetle populations (Murchie et al., 1997). *Ceutorhynchus assimilis* is host to 34 species of parasitoids: *Stenomalina gracilis* (Walker), *Mesopolobus morys* (Walker) and *Trichomalus perfectus* (Walker) are most common (Williams, 2003), and capable of controlling more than 70% (Alford et al., 1995) of the seed weevil population. Therefore the conservation and enhancement of parasitoids is essential to develop alternative strategies for managing the pests (Williams, 2004). The aim of this study was to establish the occurrence of cabbage seed weevil and its parasitoids in standard and integrated cropping systems in winter and spring oilseed rape in Estonia.

MATERIALS AND METHODS

Studies were carried out in 2004 and 2005 in Pilsu Farm, Tartu County, Estonia. Standard (STN – plough, insecticide) and integrated (ICM – non-inversion tillage, no insecticide) management systems were used. In 2004 the winter oilseed rape was treated with insecticide Fastac (0.15 l/ha) when 80% of pods had reached final size, at GS 78; spring rape was not treated with insecticide that year. In 2005 the insecticide Karate (0.16 l/ha) was applied to spring oilseed rape at full flowering stage (GS 65) and to winter rape when 60% of pods were full length (GS 76). Oilseed rape growth stages (GS) follow Lancashire et al. (1991).

Insects were sampled in weekly intervals using yellow water traps (210 x 310 x 90 mm) from green bud stage until the pods began to ripen. Traps were positioned on a metal pole at crop canopy height within the crop, 15 m from different edges. In 2004, four, and in 2005, six traps were placed within each plot.

To estimate seed weevil damage and parasitization rates, five plants from five randomly chosen places were collected from each plot at GS 80 when the pods reached full size. The pods per plant were counted and incubated in emergence traps in laboratory conditions. Three weeks later exit holes on pods and emerged parasitoids were counted and the percentage of larval parasitism and damaged pods was calculated.

RESULTS AND DISCUSSION

Ceutorhynchus assimilis started to colonise winter oilseed rape during flowering at GS 63–66 and its abundance increased during the pods' developing stage at GS 68–72 (Fig. 1). This period is the most suitable time for egg-laying for *C. assimilis* (Alford et al., 2003; Williams, 2004). The peak of weevils was at GS 78–80, when most of the pods had reached final size. This growth stage is already past the appropriate time for egg-laying and seed weevils were probably attracted to the yellow colour of the traps. Seed weevil was more numerous in the integrated than in the standard cropping system, but the difference was not statistically significant.

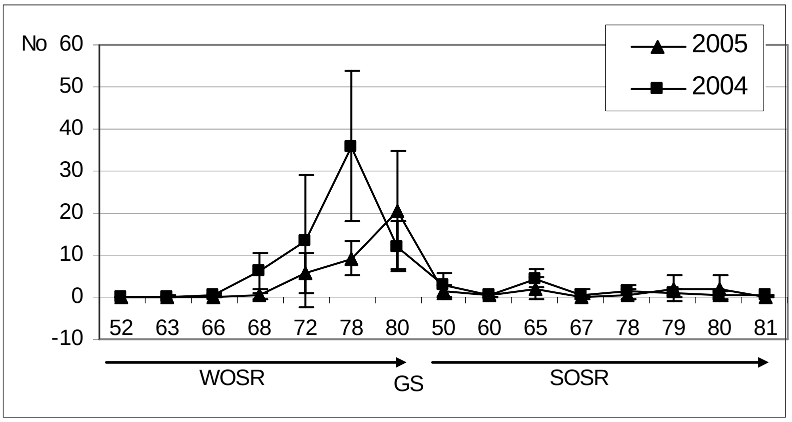

Fig. 1. Abundance of *Ceutorhynchus assimilis* per yellow water trap caught at different growth stages (GS) of winter (WOSR) and spring (SOSR) oilseed rape fields in Pilsu Farm, Tartu County, Estonia, in 2004 and 2005 (bars are showing St.Dev).

In spring oilseed rape, the population of *C. assimilis* was significantly lower than in the winter crop ($\chi^2 = 37.38$, $df = 1$, $P < 0.0001$). Peak population coincided with full flowering. However, at the pod-developing stage, very few weevils were present in the crop. Insecticide application in 2005 reduced the number of weevils 2.5 times. Similarly, in our previous studies (Veromann, et al., 2006a; Veromann, et al., 2006b), seed weevils did not reach pest status in spring oilseed rape.

The infestation of pods in the winter crop was lower in the standard than in the integrated cropping system (Fig. 2). In the latter system, the greater number of damaged pods was related to the greater abundance of *C. assimilis*. Hiiesaar et al. (2003) reported that damage caused by *C. assimilis* is not substantial, but in our study, up to 10.7% of winter rape pods were damaged. In spring oilseed rape the infestation of pods was small: an average 0.7% and 1.7% pods were damaged in STN and ICM, respectively.

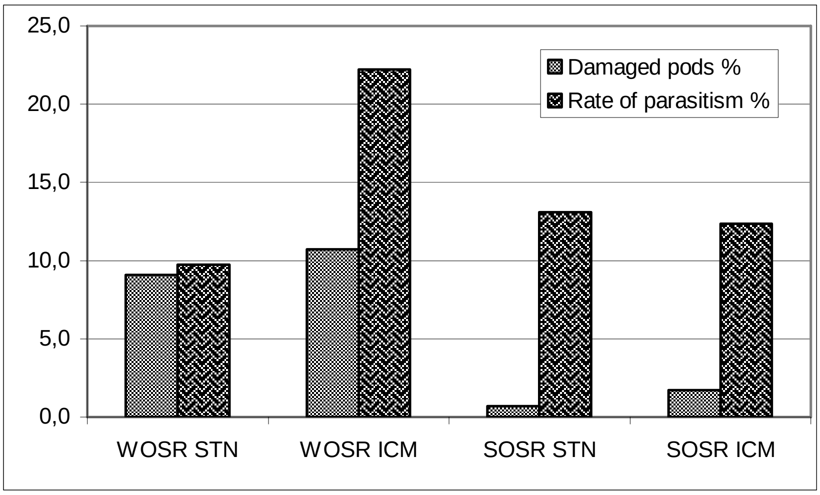

Fig. 2. Mean percentage of damaged pods and parasitisation rate of larvae per year in spring (SOSR) and winter (WOSR) oilseed rape in standard (STN) and integrated (ICM) cropping systems in Pilsu Farm, Tartu County, Estonia, 2004–2005.

During the study, three species of *C. asimilis* larval ectoparasitoids – *Trichomalus perfectus, Stenomalina gracilis, Mesopolobus morys* were caught with yellow water traps, but their number was low (one specimen per trap) in both crops. Their abundance was higher in 2005 than in 2004. *Trichomalus perfectus* was the dominant species. The peak of this parasitoid is 2–4 weeks after the host arrives in the crop. The new generation mates on emergence and leaves the crop before harvest; only females overwinter (Williams, 2003).

In winter oilseed rape the parasitism of *C. assimils* larvae was greater in the integrated cropping system and reached 22.2% (Fig. 2). In the standard system the insecticide treatment coincided with the peak of seed weevil parasitoids and probably killed half of them (Alford et al., 1995; Murchie et al., 1997). In the spring crop the application of insecticide was at the flowering stage and had no detrimental effect on seed weevils’ parasitoids. Unfortunately, other non-target beneficial insects are active in the crop during flowering and may be harmed (Walters et al., 2003).

Trichomalus perfectus was the dominant species in both crops, accounting for 64.8% of emerged ectoparasitoids of *C. assimilis* larvae. From emerged parasitoids 28.6% were *M. morys* and only 6.6% were *S. gracilis*. In the UK, 99% of ectoparasitoids were *T. perfectus* in winter oilseed rape and in the spring crop almost half were *M. morys* (Williams, 2003).

CONCLUSIONS

In Estonian conditions *Ceutorhynchus assimilis* is phenologically synchronised with winter oilseed rape, where reproduction mainly takes place. The weevil population was more numerous in the integrated than in the standard cropping system. Seed weevil parasitoids were showing a tendency to increase in number.

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REFERENCES

Alford, D.V., Nilsson, C. & Ulber, B. 2003. Insect pest of oilseed rape crops. In Alford D.V (ed.): *Biocontrol of oilseed rape pests.* Blackwell Science, Oxford, pp. 9–41.

Alford, D.V., Murchie, A. & Williams, I.H. 1995. Observations on the impact of standard insecticide treatment on *Trichomalus perfectus*, a parasitoid of seed weevil on winter oilseed rape in the UK. 1995. *Bulletin IOBC/wprs* **18**(4), 122–126.

Hiiesaar, K., Metspalu, L., Lääniste, P., Jõgar, K., Kuusik, A. & Jõudu, J. 2003. Insects on winter oilseed rape studied by different catching methods. *Agronomy Research* **1**, 17–23.

Lancashire, P.D., Bleiholder, H., Boom, T. van D., Langelüddeke, P., Strauss, P., Weber, E. & Witzenberger, A. 1991. A uniform decimal code for stages of crops and weeds. *Annals Appl. Biology* **119**, 561–601.

Murchie, A.K., Williams, I.H. & Alford, D.V. 1997. Effects of commercial insecticide treatment to winter oilseed rape on parasitism of *Ceutorhynchus assimilis* Paykull (Coleoptera: Curculionidae) by *Trichomalus perfectus* (Walker) (Hymenoptera: Pteromalidae). *Crop Protection* **16**(3), 199–202.

Veromann, E., Luik, A. & Kevväi, R. 2006a. Oilseed rape pests and their parasitoids in Estonia. *Bulletin IOBC/wprs*, in press.

Veromann, E., Luik, A., Metspalu, L., & Williams, I.H. 2006b. Key pests and their parasitoids on spring and winter oilseed rape in Estonia. *Entomol. Fennica* **17** (in press).

Williams, I.H. 2003. Parasitoids of cabbage seed weevil. In Alford, D.V (ed.): *Biocontrol of oilseed rape pests.* Blackwell Science, Oxford, pp. 97–112.

Williams, I.H. 2004. Advances in Insect Pest Management in Europe. In Horowitz, A.R. & Ishaaya, I. (eds.): *Insect Pest Management*. Springer-Verlag, Berlin, pp. 181–208.

Walters, K.F.A., Young, J.E.B., Kromp, B. & Cox, P.D. 2003. Management of oilseed rape pests. In Alford, D.V (ed.): *Biocontrol of oilseed rape pests.* Blackwell Science, Oxford, pp. 43–71.