

Key pests and their parasitoids on spring and winter oilseed rape in Estonia

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The pests and their hymenopterous parasitoids present in a spring and a winter oilseed rape crop in Estonia were studied. *Meligethes aeneus* was the most abundant pest in both crops. Other crucifer-specialist pests included: *Ceutorhynchus assimilis*, *C. pallidactylus*, *C. rapae*, *C. floralis*, *C. pleurostigma* and *Phyllotreta* spp., but their abundance was low. Four species of parasitoids of *M. aeneus* larvae (*Diospilus capito*, *Phradis morionellus*, *P. interstitialis* and *Tersilochus heterocerus*) and three of *C. assimilis* larvae (*Mesopolobus morys*, *Stenomalina gracilis* and *Trichomalus perfectus*) were also found.

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1. Introduction

The expansion of area of oilseed rape (*Brassica napus* L.) grown in Europe has resulted in an increase in the number of pests (Büchi 1996, Cook *et al.* 1999, Hokkanen 2000). In Estonia, the area sown to the crop has increased greatly over the last decade, with 50,400 hectares grown in 2004 (Statistics Board 2005).

The major pests of winter oilseed rape in Europe are *Meligethes aeneus* (Fabricius) (Coleoptera, Nitidulidae), *Ceutorhynchus assimilis* (Paykull), *C. pallidactylus* (Marsham), *C. napi* Gyllenhal (Coleoptera, Curculionidae), *Dasineura brassicae* (Winnertz) (Diptera, Cecidomyiidae) and *Psylliodes chrysocephala* (Linnaeus) (Coleoptera, Chrysomelidae) (Alford *et al.* 2003, Williams 2004). Flea beetles (*Phyllotreta* spp. Coleoptera, Chrysomelidae) are also important, par-

ticularly on spring oilseed rape (Alford *et al.* 2003). All of these pest species are attacked by hymenopterous parasitoids, notably from the families Braconidae, Ichneumonidae, and Pteromalidae that attack the larvae, and these are being exploited for bio-control in integrated pest management strategies (Williams *et al.* 2003a). For example, *M. aeneus* is attacked by nine species of parasitoids (Nilsson 2003). Of these *Phradis morionellus* (Holmgren) (Hymenoptera, Ichneumonidae) and *Diospilus capito* (Nees) (Hymenoptera, Braconidae) are the most important, and in Switzerland, over 60% of larvae have been reported parasitized (Billqvist & Ekblom 2001a). *Ceutorhynchus assimilis* is attacked by over 30 species of parasitoids (Williams 2003), of which *Trichomalus perfectus* (Walker) (Hymenoptera, Pteromalidae) is the most widespread, abundant and important (Williams 2003). The most impor-

tant parasitoids of *C. pallidactylus* are *Tersilochus obscurator* Aubert, *T. tripartitus* Brischke, *T. exilis* Holmgren (Hymenoptera, Ichneumonidae), and *Stibeutes curvispina* (Thomson) (Hymenoptera, Ichneumonidae) (Ulber 2003, Barari *et al.* 2004).

In Estonia, knowledge of rape pests and of their hymenopterous parasitoids is fragmentary and largely confined to the description of species. The aim of this study was to identify the key pests and their parasitoids on winter and spring rape in Estonia and to compare the species composition on the two crops. This information is essential to underpin the development of economically-viable and ecologically-sustainable rape cultivation technologies.

2. Material and methods

The winter rape crop sampled was the variety “Hansen”, grown at Puki Farm, Tartu County in 2001/2. The study field (4 ha) was approximately rectangular, bordered to the north by winter wheat, to the east by natural meadow and to the south and west by gravel road. The previous crop was clover. The spring rape crop sampled was the variety “Quantum” grown at Pilsu Farm, Tartu County in 2003. It followed winter wheat. The study field (4 ha) was rectangular and bordered to the north by an asphalt road, with a 10 m strip of barley between the road and the rape, to the south by winter wheat, to the west by grassland and to the east by barley. The soil was loamy in both fields (average pH KCl 6.15).

Insects were sampled using yellow water traps (210 × 310 × 90 mm). Yellow water traps have been used extensively to sample pests and their parasitoids in oilseed rape (Williams *et al.* 2003b). Yellow is the most effective colour for trapping them. Traps placed at the top of the canopy are particularly effective for sampling insects that fly within the upper canopy e.g. the inflorescence pest *M. aeneus* and *C. assimilis* and their parasitoids, but not as effective for stem-mining pests and their parasitoids, which fly lower in the canopy. Ten traps were placed in the winter rape in the beginning of flower (BBCH 61-62 of Meier (2001)) on 8.V.2002, and on the spring rape at BBCH 0 (14.V.2003), just after sowing. They

were positioned at the top of the crop canopy and raised weekly to keep pace with crop growth. Insects were collected from them once a week until harvest. The samples were sorted, phytophagous crucifer-specialist insects and all hymenopterous parasitoids were separated and stored in 70% ethanol at -18°C, for later identification and counting of key species.

3. Results and discussion

3.1. Winter rape 2002

Only two of the most important of the European pests were caught in the traps, *M. aeneus* and *C. assimilis*, of which the former was the more abundant (Table 1). *Meligethes viridescens* and *C. floralis* were also relatively abundant. Two species of *Phyllotreta* (*P. armoraciae* and *P. nemorum*) were caught in low numbers, and only one specimen of *C. rapae* Gyllenhal was caught. Although *Phyllotreta* species are important pests of cruciferous plants, they do not usually cause much damage to winter rape, appearing when plants are well established and have already formed bud rosettes. The relatively large numbers of *C. floralis* caught were unexpected, as this species is not widespread or abundant on cultivated crucifers preferring wild cruciferous plants (Metspalu & Hiiesaar 2002). It was the earliest pest to arrive appearing at mid-flowering (BBCH 65-66). *Meligethes* spp. and *C. assimilis* were first caught at the end of flowering, and remained the dominant species thereafter, with greatest numbers during pod development (BBCH 71-72).

Although the numbers of *M. aeneus* were large, they arrived when the plants were mostly past the bud stage suitable for oviposition. Although *C. assimilis* was also abundant in the traps, no larval damage to the pods was found, suggesting that the synchrony of this species with crop growth was poor, and that it arrived at a sexually-immature stage or when the crop was unsuitable for egg-laying. This species was therefore not an important pest of winter rape that year.

Yellow water trap catches contained hymenopterous parasitoids from six superfamilies and from 16 families. However, the numbers of those

Table 1. Total numbers of crucifer-specialist insects and their parasitoids caught in yellow water traps (N=10) in 2002–2003 on winter and spring rape at Puki and Pilsu Farm, Tartu County, respectively.

Pest/Parasitoid	Winter oilseed rape	Spring oilseed rape
<i>Meligethes aeneus</i> (Coleoptera, Nitidulidae)	1,118	2,246
<i>Diospilus capito</i> (Hymenoptera, Braconidae)	0	7
<i>Phradis morionellus</i> (Hymenoptera, Ichneumonidae)	1	64
<i>Phradis interstitialis</i> (Hymenoptera, Ichneumonidae)	0	26
<i>Tersilochus heterocerus</i> (Hymenoptera, Ichneumonidae)	0	1
<i>Meligethes viridescens</i> (Coleoptera, Nitidulidae)	290	64
<i>Ceutorhynchus assimilis</i> (Coleoptera, Curculionidae)	649	67
<i>Trichomalus perfectus</i> (Hymenoptera, Pteromalidae)	1	3
<i>Mesopolobus morys</i> (Hymenoptera, Pteromalidae)	1	1
<i>Stenomalina gracilis</i> (Hymenoptera, Pteromalidae)	1	0
<i>Ceutorhynchus floralis</i> (Coleoptera, Curculionidae)	251	6
<i>Ceutorhynchus rapae</i> (Coleoptera, Curculionidae)	1	100
<i>Ceutorhynchus pallidactylus</i> (Coleoptera, Curculionidae)	0	1
<i>Tersilochus tripartitus</i> (Hymenoptera, Ichneumonidae)	0	4
<i>Phyllotreta</i> spp. (Coleoptera, Chrysomelidae)	4	101

that attack the pests of oilseed rape were very low with only one specimen of each of four species, namely, *P. morionellus*, which attacks *M. aeneus* larvae and *T. perfectus*, *M. morys* and *S. gracilis* (Hymenoptera, Pteromalidae) which attack *C. assimilis* larvae (Table 1) caught. This paucity of parasitoids in the crop is surprising. *Phradis morionellus* is recognised as an abundant and effective regulator of its host in Scandinavia (Billqvist & Ekbohm 2001a). In the Uppland region of Sweden, parasitism levels of 56% by *P. morionellus* and 29% by *D. capito* in *M. aeneus* larvae have been reported (Billqvist & Ekbohm 2001a,b). Herrström (1964) found, at one location in Sweden, 100% parasitism of *C. assimilis* larvae with *M. morys* as the dominant parasitoid.

3.2. Spring oilseed rape 2003

As on winter rape, the most abundant pest species was *M. aeneus* (Table 1). The first were caught on the crop at the two-leaf stage, although more commonly they arrive later when flower buds are present (Nilsson 1988). Their numbers increased steadily to a maximum at first flower (BBCH 59-60) and then decreased again as flowering finished. A new increase in numbers occurred as

pod were beginning to ripen (BBCH 80-81), indicating emergence of the new generation from the soil. Few *C. assimilis* were caught. Probably by the time spring rape had reached the young pod growth stage suitable for egg-laying by this weevil, it had already laid its eggs on other suitable cruciferous plants. *Ceutorhynchus rapae* was relatively numerous; this species is not considered to be a pest of oilseed rape, feeding mainly on cabbage, radish and turnip. A few *C. floralis* were also caught.

Of parasitoids of *M. aeneus*, *P. morionellus*, *P. interstitialis*, *D. capito* and *T. heterocerus* were caught on spring rape. Both *Phradis* spp. were caught during flowering when host larvae were abundant in the flowers. *Diospilus capito*, a multivoltine braconid endoparasitoid, appeared in catches as pods began to ripen (BBCH 80-81) and as the new generation of *M. aeneus* emerged. *Diospilus capito*, *P. morionellus*, *P. interstitialis* and *T. heterocerus* have all been recorded in Finland (Hokkanen 1989), at the northern distribution limit of oilseed rape cultivation. Of the parasitoids of *C. assimilis*, only a few *M. morys*, and *T. perfectus* were caught. A few *T. tripartitus*, a solitary, univoltine, ichneumonoid endoparasitoid of *P. chrysocephala* and *C. pallidactylus* were also caught.

3.3. Comparison of the species composition on spring and winter oilseed rape

The species spectrum of the oligophagous pests of winter and spring rape was similar (Table 1), but their flight phenologies differed. The most abundant pest on both crops was *M. aeneus*, with twice as many caught on spring rape as on winter rape. Similar results were obtained by Šedivý and Vašek (2002). *Meligethes viridescens* was numerous on winter rape but not on spring rape. Conversely, the numbers of *C. assimilis* caught on winter rape were 10-fold those on spring rape. They emerged in spring and used the winter rape for maturation feeding. *Ceutorhynchus floralis* was more abundant on winter than on spring rape. According to the literature, this species is an early spring species, which passes through its development cycle on spring weeds. Both *C. rapae* and *Phyllotreta* spp., represented only by a few individuals on winter rape, were more abundant on spring rape.

There are several reasons for the differences in incidence of pests on spring and winter rape. One important reason is that the phenological development of the crop may be asynchronous with the development of the pests. This can be influenced greatly by weather conditions of the year. For example, in a dry and warm spring, winter rape may complete flowering too early to provide flower buds for *M. aeneus* oviposition. Similarly, for *C. assimilis*, winter rape may be past its optimal growth stage for oviposition by the time the pest arrives on the crop. Further, hibernating insects may be killed by severe winter conditions so that emerging populations may be too small to damage the crop. The diversity and abundance of parasitoids, like that of their hosts was greater on spring than on winter rape.

4. Conclusions

From this study, we conclude that, in Estonia in 2003, *M. aeneus* was the only key pest and only on spring oilseed rape. Other studies have also shown that winter rape is less vulnerable than spring rape, partly due to earlier flowering, partly due to a longer growth season to compensate for attacks (Tarang *et al.* 2004). Other pests of impor-

tance in other European rape-growing areas do not yet appear to have reached pest status in Estonia, where the crop is relatively new, although many potential pests are present. They may be surviving on wild relatives of *Brassica* crops and may adapt in time to synchronise their life cycles with that of oilseed rape. Parasitoids of key pest species were present, albeit in low numbers. However, their abundance may increase as the abundance of pests increases with implications for their value in the development of pest management strategies incorporating bio-control.

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