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Occurrence of pests and stem rot on various oil crops

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Abstract. The purpose of this study was to find an oil crop with no serious problems with pests and diseases, making it suitable for organic farms.

The spring oilseed rape is the most important oil crop in Estonia. Winter turnip rape and winter oilseed rape are alternatives to spring rape.

In the present exploration the following were investigated: incidence of flea beetles, pollen beetles and cabbage seed weevils, and the number of blind stalks and infection of stem rot on spring oilseed rape, winter oilseed rape and winter turnip rape.

In winter oilseed rape and winter turnip rape trials no pesticides and fungicides were used during the growing period, but there was a variant of seed treatment by 'Rapcol' (phurathiocarb + matalaxil + fludioxonil) in comparison with the non-treated variant. Spring oilseed rape trials were treated by 'Rapcol' before sowing and sprayed by 'Fastac' (alpha-cypermethrin) at the beginning of flowering (stage of development - 61).

The following results were obtained: flea beetles appeared most on winter oilseed rape, least on winter turnip rape. Pollen beetles appeared most on spring oilseed rape, least on winter turnip rape. Most pods damaged by pollen beetles' larvae were found on winter oilseed rape, least on winter turnip rape. Damage by cabbage seed weevil was minimal in all the oil crop trials. Stem rot infection was high on spring oilseed rape, least on winter turnip rape.

By the results of exploration it can be concluded that winter turnip rape had the lowest infection by pests and disease and therefore has good potential for sustainable agriculture.

Key words: spring oilseed rape, winter oilseed rape, winter turnip rape, flea beetle, pollen beetle, cabbage seed weevil, stem rot

INTRODUCTION

Cultivation of oil crop has increased in Estonia: 2002 - 31600 ha; 2003 - 45500 ha; 2004 - 48100 ha (Põllumajanduse Ministeerium, 2004). Spring oilseed rape (*Brassica napus* L. *var. oleifera subvar. annua*) is the main crop cultivated; winter turnip rape (*Brassica rapa* L. *var. oleifera subvar. biennis*) and winter oilseed rape (*Brasica napus* L. *var. oleifera subvar. biennis*) are sometimes used as alternatives. Oil crops are attractive to a large number of insect species, both beneficial and pests (Winfered, 1986). Most of the pests damage generative organs of oil crops (Huges & Evans, 1999). European oilseed rape crops are hosts to a variety of insect pests. However, the most harmful are those which damage the reproductive parts of the plants, such as brassica pod midge, cabbage seed weevil and pollen beetle (Hughes & Evans, 1999). Pollen beetle and cabbage seed weevil are major inflorescense pests of oilseed rape in Europe, feeding in the flowering canopy and laying their eggs in the

buds and young pods respectively (Williams, 1980). In Estonia, the most common pests of oilseed rape are pollen beetles, cabbage seed weevils and flea beetles (Veromann et al., 2004, 2005).

A serious disease of oil crops is stem rot (*Sclerotinia sclerotiorum* Lib.). Stem rot infects numerous varieties of plants: cruciferous (*Cruciferae*), papilionaceous (*Papilionaceae*), solanaceous (*Solanaceae*), umbellates (*Umbelliferae*) and composites (*Compositae*) (Paul, 1988). Stem rot occurs worldwide and affects plants in all stages of growth, including seedlings, mature plants, and harvested products (Agrios, 1997). In oil crops more than 50% of the plants may be infected and a yield loss of more than 1000 kg/ha may occur in some years (Kaarli, 2004).

The objective of this study was to find an oil crop which has no serious problems with pests and diseases, and which is therefore suitable for organic farms, especially in the northern areas.

MATERIALS AND METHODS

Incidence of the following pests was investigated in the present research: flea beetles (*Phyllotreta spp*.), pollen beetles (*Meligethes spp*.) and cabbage seed weevils (*Ceutorrhynchus assimilis* Payk.). The scale of damage of pollen beetles larvae on pods and infection of stem rot on spring oilseed rape (varieties 'Quantum', 'Haydn', 'Siesta', 'Olga', 'Sponsor', 'Trend' and 'Licolly'), winter oilseed rape (varieties 'Silvia', 'Artus', 'Baldur', 'Banjo', 'Dexter', 'Libretto' and 'Pilot') and winter turnip rape (varieties 'Prisma', 'Largo', 'Credit', 'Salut', 'Tellus' and 'Helix') was estimated.

Observations were carried out in trial fields of the Jõgeva Plant Breeding Institute in 2004. The trial was established on 10 m² plots in three replications; 20 plants on each replication were analysed. Pests were collected in plastic containers by shaking. The primary raceme was shaken three times. Insects per plant were counted. Six countings, twice a week, started on 26 May (stage of development on spring oilseed rape -12, on winter oilseed rape and winter turnip rape - 65). For estimating the scale of damage by the pollen beetle, larvae on pods were counted on all the blind stalks of the whole plant (stage of development - 71).

Stem rot damage was evaluated on a 1 - 9 point scale (1 point = no damage; 9 points = maximum damage) before harvesting.

In winter oilseed rape and winter turnip rape trials, no pesticides and fungicides were used during the growing period, but there was a variant of seed treatment by 'Rapcol' (phurathiocarb + matalaxil + fludioxonil) in comparison with the non-treated variant. Spring oilseed rape was treated by 'Rapcol' before sowing and sprayed by 'Fastac' (alpha-cypermethrin) at the beginning of flowering (stage of development - 61).

The data were treated by statistical program R (http://www.r-project.org), where means and standard errors were calculated. Statistical comparisons were performed by the Student *t*-test ($P = 0.05$).

RESULTS

Incidence of flea beetles per 20 plants was the greatest on treated winter oilseed rape plants 5.3 ± 0.3 (on non-treated according 4.4 ± 1.1) (Table 1). Flea beetles were

not found on treated winter turnip rape - 0 ± 0 (per 20 plants);(on non-treated accordingly 0.2 ± 0.3). On spring oilseed rape fewer than 1 insect per 20 plants (0.9 ± 0.5 adults per 20 plants) was counted. Differences between treated and non-treated variants of winter oilseed rape(P = 0.45) and winter turnip rape (P = 0.17) were insignificant.

Table 1. Mean number with standard errors of flea beetles, pollen beetles and cabbage seed weevils (pest per 20 plants) on plots treated by 'Rapcol' and non-treated on different oil crops at JPBI trials in 2004.

Oil crop	Flea beetles		Pollen beetles		Cabbage seed weevils	
	treated	non-treated	treated	non-treated	treated	non-treated
Spring oilseed rape	0.9±0.5	x	12.6±11.6	x	0.1±0.2	x
Winter oilseed rape	5.3±0.3	4.4±1.1	10.6±0.7	10.8±0.3	1.0±0.2	1.5±0.1
Winter turnip rape	0±0	0.2±0.3	7.1±1.8	5.5±1.6	0.9±0.4	1.6±0.2

Infestations of pollen beetle on spring oilseed rape reached 12.6 ± 11.6 adults per 20 plants (Table 1). The number of pollen beetles on treated winter oilseed rape was less: average 10.6 ± 0.3 (on non-treated accordingly 10.8 ± 0.3) and the lowest on winter turnip rape: average on treated plants 7.1 ± 1.8 (on non-treated respectively 5.5 ± 1.6). Winter oilseed rape and winter turnip rape were not sprayed, as the number of pollen beetles remained below the recommended limit (20 pests per 20 plants). Regarding seed treatment, there were no significant differences between treated and non-treated variants of winter oilseed rape (P = 0.70) and winter turnip rape (P = 0.41).

Cabbage seed weevils were rare on all the oil crops. At most, only 1.6 ± 0.2 adults per 20 plants were found on non-treated winter turnip rape (on treated 0.9 ± 0.4 respectively) and 1.5 ± 0.1 on non-treated winter oilseed rape (on treated 1.0 ± 0.2 respectively) (Table 1).

Table 2. Average number of pods damaged by pollen beetles larvae (per 20 plants) treated with 'Rapcol' and non-treated plots, stem rot damage (1-9 point scale, where 9 is severe damage and 1, no damage) with standard errors on different oil crops at JPBI trials in 2004.

Oil crop	Pods damaged by pollen beetles larvs		Stem rot infection	
	treated	non-treated	treated	non-treated
Spring oilseed rape	59.6±42.2	x	7.2±1.0	x
Winter oilseed rape	172.0±3.5	201.5±19.1	1.7±0.6	1.5±0.7
Winter turnip rape	6.0±0.0	5.8±1.6	1.0±0.0	1.0±0.0

The largest number of pods damaged by pollen beetle larvae occurred on winter oilseed rape: on non-treated plants an average of 201.5 ± 19.1 damaged pods per 20 plants (23% of all the pods on 20 plants);, on treated winter oilseed rape plants 172.0 ±3.5 (20% of all the pods on 20 plants). Damaged pods were basically located on the lateral racemes and on bottom and top of primary inflorescence. This was followed by spring oilseed rape, 59.6 ± 42.2 damaged pods per 20 plants (7.7% of all the pods on 20 plants). Damaged pods were located on top of primary inflorescence. Winter turnip rape was attacked less: on treated plants 6.0 ± 0.0 pods per 20 plants - only 0.8% of all the pods on 20 plants) and on non-treated plants accordingly 5.8 ± 1.6 (0.7% of all the

pods on 20 plants) (Table 2. Differences between treated and non-treated variants of winter oilseed rape(P = 0.27) and winter turnip rape (P = 0.81) were insignificant.

It is probable that, in 2004, pollen beetles attacked winter oilseed rape twice: at the beginning and before the end of flowering. But further research is needed to determine why insects preferred winter oilseed rape buds for oviposit as opposed to winter turnip rape buds (flowering at nearly the same time as winter oilseed rape).

Stem rot infection in 2004 was especially strong on spring oilseed rape; disease control was not carried out and almost all the plants were infected (an average score of 7.2 ± 1.0 points) (9 points – severe damage) (Table 2). On winter oilseed rape infection was low: an average score on treated variants was only 1.7 ± 0.6 points (on non-treated variants 1.5 ± 0.7 points respectively). Infection by stem rot was not found in any of the winter turnip rape trials. There were insignificant differences between treated and non-treated variants of winter oilseed rape (P = 0.81).

CONCLUSION

From the results of exploration it can be concluded that winter turnip rape had the lowest infection by pests and disease and therefore has good potential for organic farming in Estonia.

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