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Influence of NeemAzal-T/S on *Mamestra brassicae* L.

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The aim of this study was to explore the effects of the botanical insecticide NeemAzal-T/S on *Mamestra brassicae*, known an important cabbage pest. The experiments were carried out in the experimental garden of the Estonian University of Life Sciences in the summer of 2006. During the experiment the effect of different concentrations and treating methods of the preparation (0.03 % and 0.3 % solution spraying and 0.3 % solution watering) were monitored.

During the observation period *M. brassicae* were found in lower numbers from treated plants than from untreated plants. A comparison of treated variants with control revealed statistically significant differences in the number of *M. brassicae*. There were no significant differences between the treated variants. Seasonal dynamics of *M. brassicae* showed that the population peak was in the beginning of July and after that the number of pests started to decrease. Spraying the cabbage with NeemAzal-T/S 0.3 % solution decreased the inhabitation by cabbage moth. The effect was not as clear in the other treatments. NeemAzal-T/S acted on cabbage moth females as a weak repellent and oviposition deterrent. According to our results, 0.3 % concentration of NeemAzal-T/S was most effective against cabbage moth and spraying was found to be more effective than watering.

Key words: biopesticide, *Mamestra brassicae*, oviposition preference.

Introduction. Cabbage moth, *Mamestra brassicae* L. is a highly polyphagous species, particularly associated with cruciferous crops (Bretherton et al., 1979), but also feeding on a wide range of other plant species (Turnock, Carl, 1995). In Estonia *M. brassicae* is one of the most significant pests of cruciferous crops, but is also widely known pest throughout North West Europe. In various climatic zones cabbage moth can produce a number of generations during summer; in Estonia it is mainly a univoltine species, hibernating as diapausing pupae in the soil. Under our conditions synthetic insecticides are dominant in plant protection strategies against cabbage moth and botanical insecticides are not very common in practice.

Botanical insecticides are useful and desirable tools in most pest management programs because they can be effective and often complement the actions of natural enemies (Ascher, 1993; Schmutterer, 1995). The main advantages of using bioinsecticide

are reduced toxicity to humans, rapid and complete degradation in the environment, low risk for resistance and selective properties for non-target organisms, including natural enemies of pest and insects-pollinators (Hoelmer et al., 1990; McCloskey et al., 1993; Nauman et al., 1994; Schmutterer, 1995).

Botanical insecticides are less harmful than synthetic ones and affect many insects in different ways (Schmutterer, 1995; Villanueva-Jiménez et al., 2000; Metspalu et al., 2001; Durmusoglu et al., 2003). Among natural pesticides the compounds from neem tree (*Azadirachta indica* A. Juss, *Meliaceae*) have a number of properties useful for insect pest management. Neem extracts are widely used around the world either singly in Integrated Pest Management or in conjunction with synthetic pesticides (for review see Mordue (Luntz), Nisbet, 2000). Neem-based insecticides containing different compounds have been reported to control more than 400 species of insects, including important pests, such as leafminers, aphids and whiteflies (Isman, 1999; Walter, 1999). Azadirachtin, a steroid-like tetranortriterpenoid derived from neem trees, is a strong anti-feedant, repellent, growth regulator, molting inhibitor, sterilant and oviposition deterrent for a wide variety of phytophagous insects (Koul, 1992; Schmutterer, 1995; Mordue (Luntz), 2004). Azadirachtin has also shown direct detrimental and histopatological effects on most insect tissues, e. g. muscles, body fat, and gut epithelial cells (Mordue (Luntz), 2004).

The action of neem depends on the pest species, the time of application, treating methods and the concentration used. It is also important to determine the efficacy of neem in different regions of the world. One preparation may act differently with different populations. The aim of this study was to elucidate the actions and efficiency of different concentrations of commercial botanical insecticide NeemAzal-T/S on the cabbage moth, *Mamestra brassicae*, under field conditions in Estonia.

Object, methods and conditions. The experiments were carried out in the experimental garden of the Estonian University of Life Sciences in the summer of 2006. In the present experiments NeemAzal-T/S (1 % Azadirachtin) (from Trifolio-M GmbH, Germany), was used. There were four variants: two different concentrations of NeemAzal-T/S – 0.03 % and 0.3 % were used for spraying and 0.3 % concentration of Neem Azal T/S was used for watering of testing plots.

White cabbage (*Brassica oleracea* (L.) var. *capitata* f. *alba*) plants were grown from seed, kept in glasshouse until they reached the 3 true leaf stage. In mid-May plants were replanted to the experimental field. Each variant consisted of 9 plants per plot (three rows of three plants spaced at 70 cm intervals). All variants had three replications. To prevent larvae from leaving the plots, a 20 cm wide strip of dill (*Anethum graveolens* L.), which is not a food plant of *M. brassicae* larvae, was sown around each plot. Larvae of *M. brassicae* on all the plots were sampled at 7-day intervals from 4 July to 12 September. Eggs and larvae were removed from plants by hand picking, to avoid repeated counting. The first spraying and watering with NeemAzal-T/S was made after the first counting (4 July) of *M. brassicae* eggs and larvae. The treatments were applied at weekly intervals during the entire observing period.

Tests were performed using the statistic package StatSoft ver. 7, Inc./USA. Data have been presented as mean ± standard error. Statistical comparisons were performed with repeated measures ANOVA by the Ficher LSD test. All means were considered significantly different at the $p < 0.05$ level.

Results. A comparison of treated variants with control revealed statistically significant differences in the number of *M. brassicae* larvae (ANOVA $F_{3,18}$ =12.30; df = 3; $p < 0.05$; LSD test $p < 0.05$). The number of *M. brassicae* was reliably lower in all treated variant ($p < 0.05$) (Fig. 1) during the whole observation period. Our results showed that butterflies preferred the untreated plants as the site for oviposition, 37.8 % of caterpillars counted during the whole observation period were gathered from this variant.

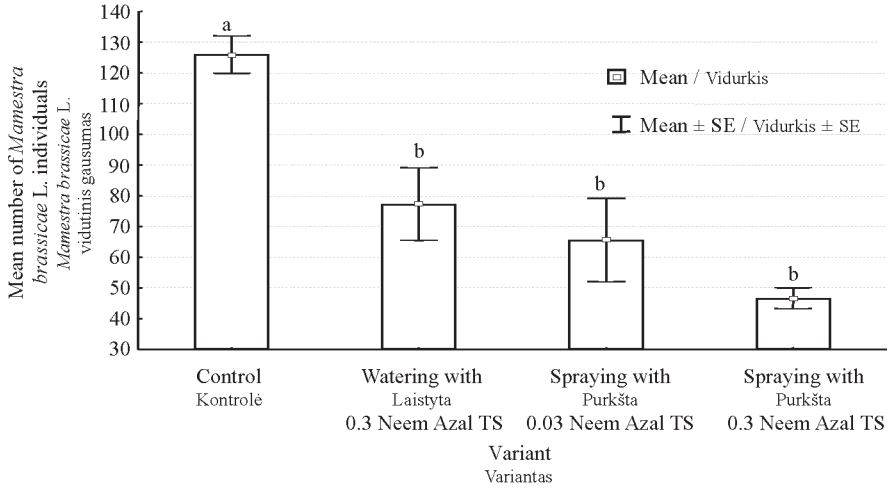

Fig. 1. Mean number of cabbage moth (*Mamestra brassicae* L.) individuals on NeemAzal-T/S treated variants. Columns with different letters are significantly different (Ficher LSD test $p < 0.05$).

1 pav. Kopūstinio pelėdgalvio (*Mamestra brassicae* L.) vidutinis gausumas nimazaliu apdorotuose variantuose. Stulpeliai pažymėti skirtingomis raidėmis patikimai skiriasi (Fišerio testas, kai $p < 0,05$).

Statistical analysis of the results indicated that there were no significant differences between the treated variants (LSD test, $p > 0.05$), although there existed a considerable tendency in the direction of lower number of *M. brassicae* in the variant treated with 0.3 % neem. The comparison of the differently treated variants revealed that the cabbage moth selected least the plots sprayed with 0.3 % neem preparation (16.7 %), followed by sprayed with 0.03 % neem (21.2 %) as the site for oviposition and the third choice was watered variant (24.3 %).

The first observation before treatments revealed high infestation of cabbage moth in all variants; there were no significant differences between variants (Fig. 2). One week after treatments (11.07) the number larvae fall drastically in all treated variants; the lowest number of larvae was found on plots sprayed with 0.3 % neem preparation. Comparison of number of *M. brassicae* in all test variants revealed significant difference with control ($p = 0.02$), but there were no differences between treatments ($p > 0.05$; Fig. 2).

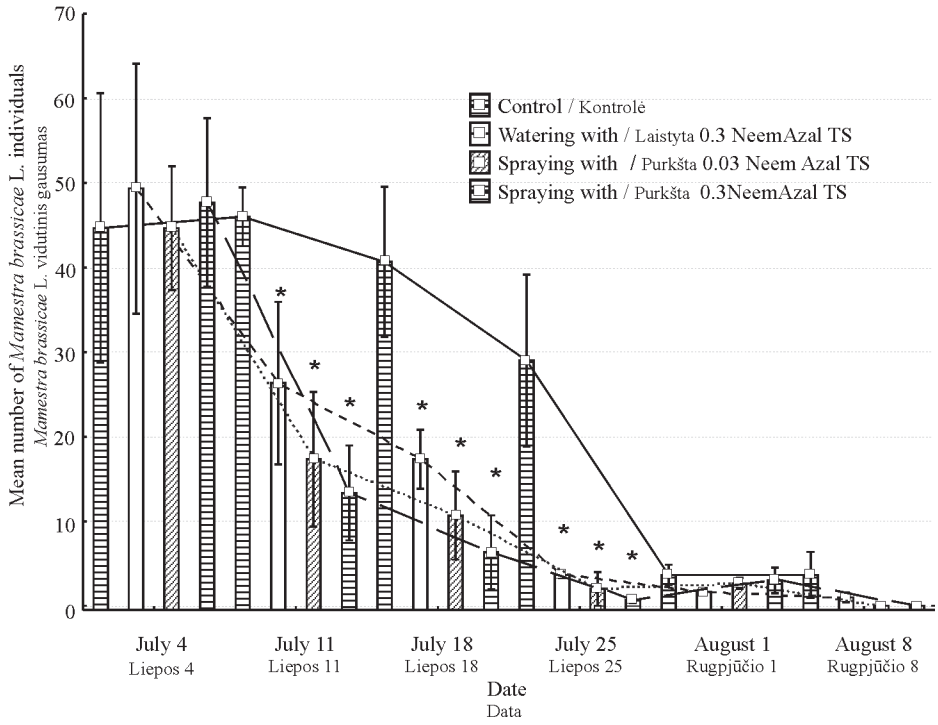

Fig. 2. Seasonal abundance of *Mamestra brassicae* on differently NeemAzal-T/S treated variants (mean ± SE). Columns with asterisks are significantly different from control (Tukey test $p < 0.05$).

2 pav. *Mamestra brassicae* sezoninis gausumas skirtingai nimazaliu apdorotuose variantuose (vidurkis ± SE). Stulpeliai, pažymėti žvaigždutėmis, patikimai skiriasi nuo kontrolinio varianto (Tukey testas $p < 0,05$).

Only few larvae were found at the third observation (18.07) on 0.3 % sprayed variant; somewhat more – on sprayed with 0.03 %, followed by watered variant. In control the number of pest was declined slightly. The same trend continued in all variants till the end of observations.

Discussion. Cabbage moth mainly selects an oviposition site by odour cue, whereas the search process is, to some extent, influenced by visual cues (Rojas et al., 2000). Data from literature reveal that neem is useful as an ovipositional repellent for polyphagous pests (Larew, 1990; Liu, Stansly, 1995). According to Metspalu et al., (2001) results NeemAzal-T/S had a repellent effect on the adults of large white butterfly (*Pieris brassicae*). Similar results were found in Facknath (1998) – different neem preparations had a repellent effect on *Plutella xylostella* adults. Meadow et al., (2001) found a repellent effect of neem on oviposition of turnip root fly (*Delia floralis*) and cabbage moth. Our data showed that cabbage moth oviposition was reduced on cabbage treated with NeemAzal-T/S in comparisson with control. Probably the neem-treating misinformed the *M. brassicae* adults and they did not find the plants or they were not able to lay the eggs. Especially decreased the inhabitation by the

cabbage moth in variant with 0.3 % concentration. Similarly to our observations, the repellent effect of neem extracts against *M. brassicae* oviposition was found in a study by Seljasen and Meadow (2006). Naumann and Isman (1995) found a similar reduction in oviposition by the noctuid moth *Spodoptera litura* on neem-treated plants. Neem-based insecticides deter oviposition by some other lepidopteran, and some homopteran, coleopteran and dipteran pests (Saxena, 1989; Schmutterer, 1995; Butler et al., 1991; Singh, Singh, 1998; Akey, Henneberry, 1999).

The present research showed that direct contact with the Neem Azal T/S decreased *M. brassicae* egg survival and larvae that fed on neem treated leaves had lower survivorship. During the observation we found both dead egg clusters and larvae from neem-treated plants. According to Liang et al. (2003) results Agroneem, Ecozin and Neemix had lethal effects on the diamondback moth larvae, and neem oil reduced egg hatching and larval survival in larvae of *Helicoverpa armigera* (Ma et al., 2000).

Our tests showed that the lower number of *M. brassicae* on neem treated plants; that could have resulted from direct toxicity of the neem extract. Respectively to Mancebo et al. (2002) data, Azatin, neem seed extract containing 3 % azadirachtin, has been reported to cause quick direct toxicity in the mahogany shootborer, *Hypsipyla grandella* larvae.

According to our results, 0.3 % concentration of NeemAzal-T/S was most effective against cabbage moth and spraying was found to be more effective than watering. Systemic transport of neem in plants and controlling effects are also documented for the cabbage pest *P. brassica* (Osman, Port, 1990) and *Plutella xylostella* (Wendorf, Shüler, 1992). Our results confirm previous statements.

Conclusion. From our results it can be concluded that under our conditions it is possible to control M. brassicae with NeemAzal-T/S.

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Nimazalio T/S poveikis *Mamestra brassicae* L.

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Santrauka

Tyrimo tikslas buvo ištirti botaninio insekticido nimazalio T/S poveikį žalingam kopūstų kenkėjui *Mamestra brassicae*. Tyrimai buvo atlikti Estijos gamtos mokslų universiteto ekspermentiniame darže 2006 m. vasarą. Buvo tirtas preparato skirtingų koncentracijų ir apdorojimo būdų (0,03 % ir 0,3 % tirpalo purškimo ir 0,3 % tirpalo laistymo) poveikis.

Stebėjimo metu mažiau *M. brassicae* buvo ant apdorotų augalų nei ant neapdorotų. Variantų palyginimas parodė patikimus *M. brassicae* skirtumus tarp apdorotų variantų ir kontrolės. Tarp apdorotų variantų patikimų skirtumų nerasta. Sezoninis *M. brassicae* kitimas rodo, kad gausiausiai šių kenkėjų buvo liepos pradžioje, po to jų skaičius pradėjo mažėti. Purškiant kenkėjus nimazalio T/S 0,3 % tirpalu sumažėjo kopūstinių pelėdgalvių gyvenimo trukmė. Poveikis kituose variantuose nebuvo ryškus. Nimazalis T/S veikė kopūstinių pelėdgalvių pateles kaip silpnas repelentas ir šiek tiek atbaidydavo nuo kiaušinių dėjimo. Remiantis mūsų rezultatais, 0,3 % nimazalio T/S koncentracija buvo efektyviausia nuo kopūstinių pelėdgalvių ir purškimas buvo efektyvesnis nei laistymas.

Reikšminiai žodžiai: biopesticidas, kiaušinių dėjimo pirmenybė, *Mamestra brassicae*.