

ON DIFFERENT MODES OF ACTION OF NEEMAZAL T/S IN CABBAGE BUTTERFLY

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The influence of NeemAzal T/S 0.05% and 0.1% water emulsions in III instar cabbage butterfly caterpillars was studied. NeeamAzal T/S had a deterring effect for feeding which was stronger when a higher concentration was used. The poisoning of caterpillars via food was also quicker in case of 0.1% concentration and 100% caterpillars were killed during 4 days. NeemAzal T/S caused high mortality of caterpillars also in a contact .

Key words: *NeemAzal T/S, cabbage butterfly , deterrence, mortality.*

During the last ten years new interest has arisen in natural botanical insecticides. They are environmentally less harmful than syntethical pesticides and acting in many insects in different ways (Schmutterer, 1990,1992; Bergen,1994; Metspalu, Hiiesaar, 1994; Luik,1997; Metspalu et al.,1997). Among natural pesticides the compounds from neem (*Azadirachta indica* A. Juss) have a number of properties useful for insect pest management. These include repellence, feeding and oviposition deterrence, insect growth regulator activity, low mammalian toxicity and low persistence in the environment (Schmutterer, 1990; Koul, 1992; Hiiesaar et al.,2000). Neem is also less toxic to nonphytophagous insect species than many conventional insecticides, including pest natural enemies and insects-pollinators (Hoelmer et al., 1990;McCloskey et al.1993; Nauman et al., 1994a,b). Some experiments are made with neem for forest pest management. The neem seed extracts had a systemic influence on bark beetle *Dendroctonus ponderosae*. The lodgepole pines treated with neem were less attacked by *D. ponderosae* and the mortality of larvae was increased on applied trees (Naumann et al., 1994a). In weevils *Hylobius pales* the application of pine logs with neem extract significantly inhibited feeding during 24 h (Salom et al., 1994).

The German firm Trifolio is producing a commercialised neem preparation – NeemAzal, containing active compound triterpenoid azadirachtin – the secondary metabolite of the neem tree. The influence of the commercial preparation on insect is not only depending on the main acting compound but also on additives, which can modify the mode of action. Therefore it is important to test the preparation in different pests while different species in different developmental stages can respond differently. The results of tests with NeemAzal-T (5% azadirachtin content) and NeemAzal-T/S (1% azdirachtin) showed that the plant compound – azadirachtin – inhibited the maturation feeding of the pine weevil *Hylobius abietis* both in laboratory and forest conditions. In forest conditions the inhibition was long lasting if higher concentrations treatments of conifer seedlings were used (Luik,2000; Luik et al., 2001). In laboratory conditions NeemAzal T/S caused the high mortality of mite *Tetranychus urticae* and some insects- *Aphis gossypii* and *Thrips tabaci* (Hiiesaar et al.,2000). The aim of present study was to explain the influence of NeemAzal T/S to the feeding behaviour and toxicity via food and in contact in cabbage butterfly *Pieris brassicae* III instar caterpillars.

Material and methods

The eggs of cabbage butterfly were collected from the field and incubated in petri dishes at laboratory conditions. Newly hatched caterpillars were fed with fresh cabbage leaves. If caterpillars reached III instar the experiments with them were started. The NeemAzal T/S water emulsions in two concentrations 0.05% and 0.1% were tested.

Choice feeding tests and the following development observation in caterpillars.

Pieces of cabbage leaves with the area of 400 mm² were used in choice feeding tests. For treatment with the Neem/Azal T/S emulsion the pieces were dipped into 0.05% or 0.1% emulsion for 2 seconds. Later leaf pieces were dried for 15 minutes on filter paper and put together with the untreated control piece to petri dish. A treated (0.05% or 0.1%) and an untreated pieces of cabbage leaf were placed in moistened paper sleeves (to prevent drying of leaf pieces) within a petri dish. One III instar caterpillar, starved for 8 h was placed in each dish (100x15 mm). The petri dishes were exposed in a laboratory at natural light conditions in temperature + 20±1 °C. All the dishes were numbered and during three days after every 24h the eaten leaf area was measured in dishes. In both variant (0.05% and 0.1%) of the choice feeding test 35-40 caterpillars were used. On these data the average leaf area eaten by caterpillars was calculated. For the estimation residual influence of NeemAzal after 3 days choice feeding test all the caterpillars of the experiment were fed with fresh untreated cabbage leaves and the mortality of caterpillars during the following development was fixed. For the establishment of the rate of natural mortality the 30 caterpillars were continuously reared in the same conditions at the laboratory and their mortality was registered. They were also used as control variant for other tests.

Estimation of NeemAzal T/S influence on caterpillars via food. The III instar caterpillars were fed with the cabbage leaves treated with NeemAzal T/S 0.05% or 0.1%. The caterpillars were reared in 1-l glass jars, where food was changed and excrements removed every day. The leaves were dipped into the corresponding emulsion and dried on filter paper and after that placed into a glass jar. In both concentration variants 40 caterpillars were reared in the laboratory conditions and their mortality was fixed during their development.

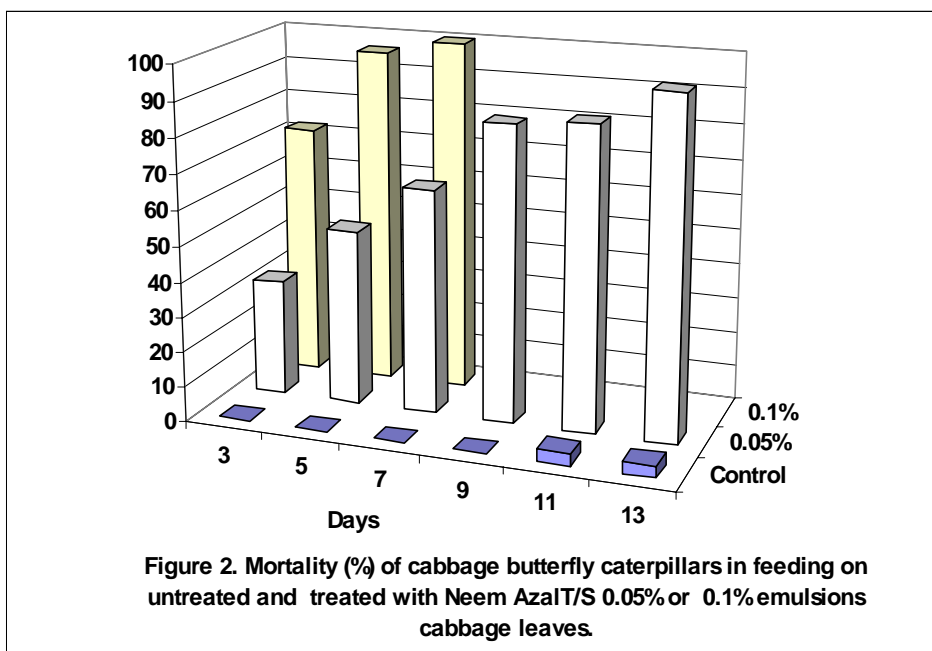
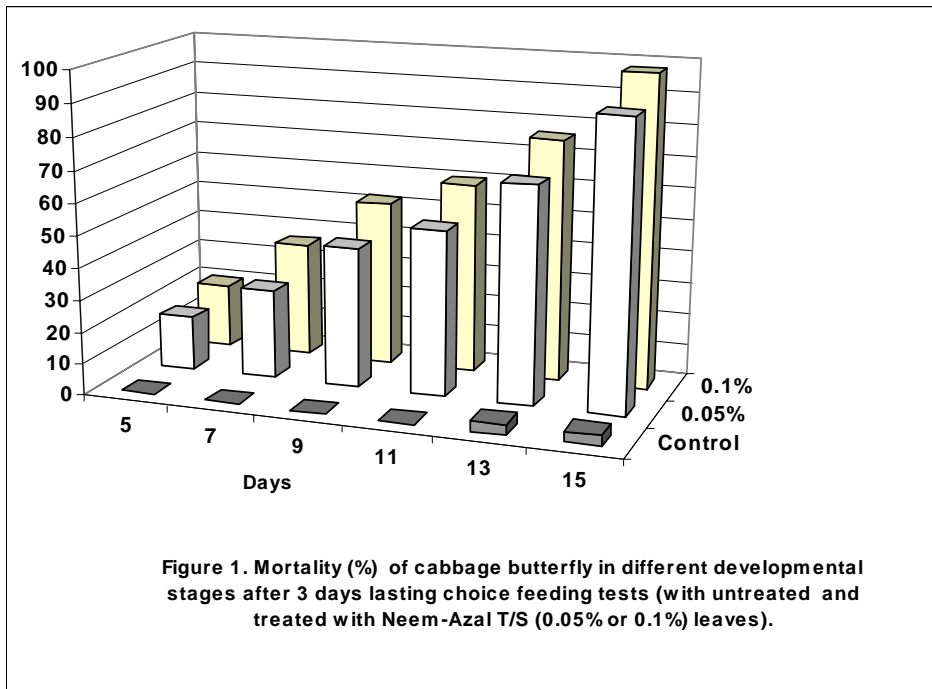
Estimation of NeemAzal T/S contact influence on caterpillars . Thirty III instar caterpillars were dipped for 2 seconds into 0.05% or 0.1% NeemAzal emulsion. After drying they were fed continuously with fresh cabbage leaves in laboratory conditions in glass jars and their mortality was fixed. In both variants 40 caterpillars were used.

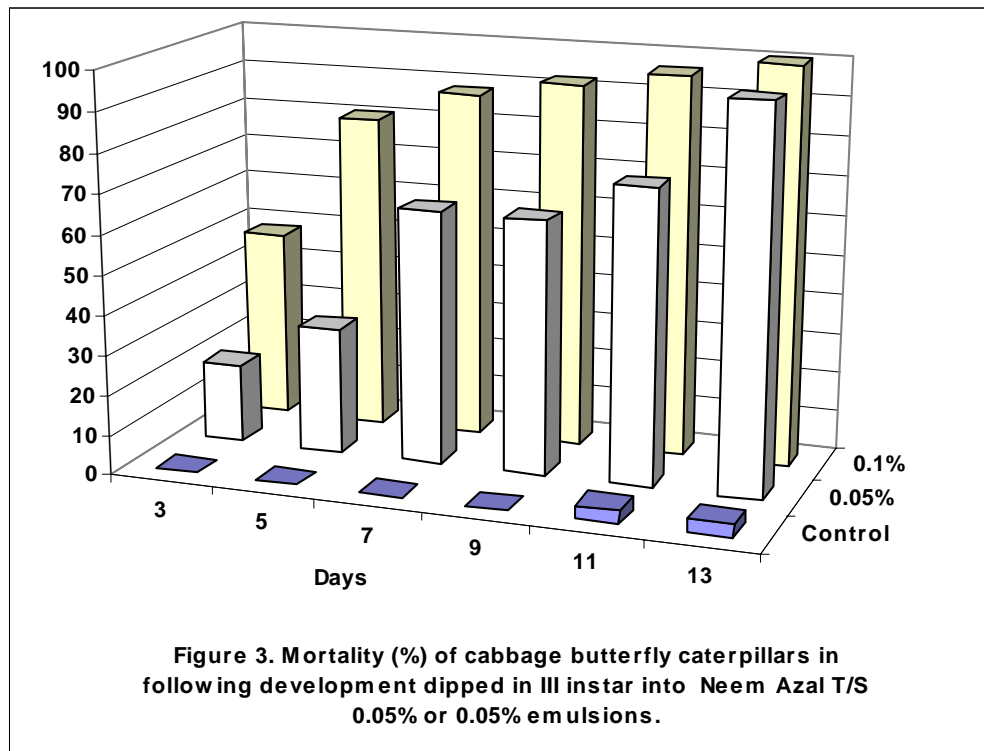
Results

During the first 24 h in the choice feeding test the caterpillars did not touch the leaves treated with NeemAzal T/S in both concentrations (Tabel 1). They were eating only untreated control leaves. On the second day caterpillars obviously got used to the odours and slightly started to feed also on treated leaves. On the third day when $\frac{3}{4}$ part of control leaves were eaten the caterpillars really started to eat leaves treated with 0.05% NeemAzal emulsion. In the leaf treated with a higher concentration of NeemAzal it still deterred feeding of the caterpillars quite strongly.

Table 1. Feeding area of the III instars caterpillars of the cabbage butterfly on untreated control and treated cabbage leaves with NeemAzal T/S 0.05% or 0.1% emulsions.

Days	0.05%		0.1%	
	Control leaf	Treated leaf	Control leaf	Treated leaf
I	132.8± 8.8	0	144. 8±15	0
II	312.6±.31.3	1.0± 0.3	317.2±32.3	0.1±0.02
III	323.1± 30.5	73.2±10.1	318.8±30.0	0.5±0.2





It is possible to conclude that the deterring influence of feeding of the NeemAzal on cabbage butterfly is depending on concentration.

After the choice feeding test during which the caterpillars were three days exposed in NeemAzal odours the mortality of caterpillars increased in the following development (Figure 1). Mortality of caterpillars was higher if caterpillars were exposed in stronger odours of NeemAzal.

Consequently, the residual effect of NeemAzal odours expressed in further development in specimens and they were killed if not earlier then in the pupal stage (13- 15 days of development).

When caterpillars were fed with poisoned by NeemAzal then in the case of a higher concentration all the caterpillars were perished during 7 days (Figure 2). In using 0.05% emulsion half the test insects were killed at the same time, others were killed, if not earlier, then in pupal stage after 13 days development.

The contact influence of NeemAzal appeared in high mortality on the seventh day after dipping caterpillars into emulsions (Figure 3). When the concentration was lower, the mortality rate was higher than 50%. When the concentration was higher the mortality rate was higher than 80%. On the 13-th day after dipping all specimens treated with 0.1% emulsion were perished . In the case of a lower concentration they totally perished a bit later in the pupal stage.

There is possible to conclude that tested NeemAzal water emulsion in concentrations 0.05% and 0.1% had a deterring influence on feeding in the III instar cabbage butterfly caterpillars and the inhibition effect was stronger in the case of a higher concentration. The residual effect of NeemAzal appeared in the following rearing of caterpillars of the choice feeding test. The main part of this test population perished during 13 days. That is explicable with the influence of NeemAzal odours. NeemAzal

T/S 0.05% and 0.1% caused high mortality in caterpillars both via food as in contact . Higher concentration influenced the caterpillars more quickly.

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