

THE SPRUCE PROTECTION AGAINST THE PEST *IPS TYPOGRAPHUS* L.
(*COLEOPTERA, SCOLYTIDAE*) THROUGH STEM INJECTION WITH
BIOLOGIC INSECTICIDE NEEMAZAL –T/S

PROTEJAREA MOLIDULUI ÎMPOTRIVA DĂUNĂTORULUI *IPS*
TYPGRAPHUS L. (*COLEOPTERA, SCOLYTIDAE*) PRIN INJECTAREA
INSECTICIDULUI BIOLOGIC NEEMAZAL –T/S ÎN TULPINĂ

C. G. FORA*, K. F. LAUER**

*Agricultural and Veterinary University of the Banat, Timișoara, Romania

** Weihenstephan University, Freising, Germany

Corresponding author: Ciprian Fora, e-mail:foraciprian@yahoo.com

Abstract: The effectiveness of *NeemAzal-T/S* insecticide used against *Ips typographus* L. bark beetle was assessed by using the method based on solution injection with 4% concentration in spruce tree trunks. The method is nonpolluting both concerning the insecticide as well as the way of solution administration (the solution does not get in contact with the environment). The effectiveness on pest larva control was of 90% at 2-2.5 m trunk height, 87% at 4.5 – 5 m, 79% at 7 - 7.5 m, 82% at 9.5-10 m, 85% at 12 -12.5 m, 62% at 14.5- 15 m and 75% at 17- 17.5 m. Considering that none of the individuals managed to undergo pupa stage it has been assessed that the insecticide efficacy on pupae was of 100% for all samples. Nevertheless, such studies are still in their initial stage and are the first to be performed in the country the method is still requiring improvement. Our studies clearly demonstrate that spruce trees may be protected against *Ips typographus* L. beetle by means of such methods.

Rezumat: Eficacitatea insecticidului *NeemAzal-T/S* împotriva gândacului *Ips typographus* L. s-a determinat prin utilizarea metodei de injectare a soluției, în concentrație de 4%, în tulpina unor arbori de molid. Metoda este una nepoluantă atât din punct de vedere al insecticidului folosit, cât și din punct de vedere al modului de administrare al soluției (soluția nu ajunge în contact cu mediul înconjurător). Eficacitatea asupra larvelor dăunătorului a fost de 90% la 2-2,5 m înălțime a tulpinii, de 87% la 4,5-5 m, de 79% la 7-7,5 m, de 82% la 9,5-10 m, de 85% la 12-12,5 m, de 62% la 14,5-15 m și de 75% la 17-17,5 m. Deoarece nici un individ nu a reușit să se împușeze s-a apreciat că eficacitatea asupra pupelor a fost de 100% în toate probele analizate. Cu toate că sunt primele testări de acest gen efectuate în țară iar metoda trebuie îmbunătățită, eficacitatea obținută demonstrează că arborii de molid ar putea fi protejați împotriva gândacilor de scoarță prin acest procedeu.

Key words: *NeemAzal*, stem injection, *Ips typographus*, spruce protection,

Cuvinte cheie: *NeemAzal*, injectarea tulpinii, *Ips typographus*, protejarea molidului

INTRODUCTION

In India, the natives used very often leaves and seeds of *Azadirachta indica* in order to control plant aphides. Later, it has been observed that during locust invasions the leaves of the highly evaluated tree for researchers remained unattached. Therefore, in 1968 Butterworth and Morgan have managed to extract some active compounds from leaves and seeds of the previously mentioned species. The insecticide that has been obtained was termed *NeemAzal-T/S*, and comprises 12 active substances, the most important for pest control being by *Azadirachtin A* and *Azadirachtin 3:1*.

Both active substances that form the composition of the insecticide provides 70%-90% of the control effect. Among the remaining 10 active substances, two present control action and are known as *Salanin* and *Nimbin*, their effects being namely focused on reduction

of feeding. The rest of 8 active substances are less conspicuous (Schmutterer, Huber, 2004). In 1985, Kraus and Bilton have established the chemical structure of the control product ($C_{35}H_{44}O_{16}$).

Seeds of *Azadirachta indica* are regarded as an important source for obtaining of NeemAzal-T/S biological product, 1 g of seeds providing 2-11 mg of Azadirachtin. This compound can be also extracted from artificial callus (Schmutterer, Huber, 2004).

In Romania, in 2006, it has been tested for the first time the effect of the biological product NeemAzal-T/S on bark beetles (*Ips typographus*) in a spruce arboretum located in Nadrag-Padeş region, Timiş county, by injecting the biological control product into tree trunks. Unlike other chemical insecticides that generate sudden lethal effects on insects, the biological product has long term action and affects primarily the individuals that ingest treated food and later their progenies.

MATERIAL AND METHOD

The method based on injection of chemical insecticide into tree trunks in order to protect fructification of *Larix decidua* Mill. species against pests was tested by Olenici and Olenici in 1990-1991 and resulted to be successful and thus improved Readon method (1984). In our case, the protection against bark beetle *Ips typographus* L. was performed similarly by using the biological insecticides.

The experiment presented in the present paper was performed in a spruce arboretum with an average age of 100 years, located in management unit III Padeş, compartment 61 C (forest district Ana Lugojana) and being situated at 900 m altitude.

At first, we have been selected two spruce trees affected by destabilizing factors. The first spruce tree presented prominent drying signs (thinned crown) while in case of the second tree, the crown was feebly represented (approximately 15% of a normal crown) and showed also resinous signs. The resin leakage clearly indicated that pest insect tried to penetrate the bark but failed due to the presence of "resinous barrier".

At tree base, at approximately 40 cm above the ground, tree holes using a manual wood screw with slant angles of 45° against tree bark had been made. The hole depth was of approximately 2.5-3 cm while hole diameter measured 0.6 cm. The distance between two holes was of 1520 cm. In each tree hole, it has been inserted plastic tubes with diameter of 0.6 cm and 21 cm long. The tubes were closed using silicon at the end part that was penetrating the tree bark in order to hamper the solution leakage. By means of these tubes, it was futile to inject 100 ml of NeemAzal-T/S solution with concentrations of 4 % (figure 1). The method is based on capacity of systemic insecticide in order to perform translocation in all tree organs.



Figure 1. The stem injection with NeemAzal

After 7 weeks and 5 days from treatment performance, it has been assessed the insect progeny that should have presented the young adult phase. In such circumstances, it has been chosen the tree felling and tree cutting obtaining logs of 0.5 m long. Each tree trunk was cautiously and entirely peeled off and they served for estimating the number of perished and living individuals found in the galleries of each attack system. The effectiveness of treatment on larvae was calculated by considering the ratio between the number of dead individuals and total individuals submitted to studies.

$$E\% = (n / N) \times 100$$

where:

E% – the product effectiveness;
n – the number of dead individuals;
N – the number of analyzed individuals.

RESULTS AND DISCUSSIONS

The performed observation allowed us to conclude that feeding activity of female individuals that have got contact with the active compounds of the biological product was disturbed and thus mother galleries were shorter in comparison with other galleries eroded by other females on other trees for the same time period. The “anti-feeding” effect is not regarded as total but exerts its action while insect advances in feeding on treated bark. It has been observed that it is created a certain mislead of the females that have eroded typical mother galleries. Such galleries present sinuous shapes and rough edges (figure 2). Nevertheless, some females are making holes within mother galleries but they do not manage to lay eggs and even if they do, the eggs are insufficient. The mortality incidence for the egg stage is high (eggs present a milky white content). The reduced number of eggs laid by female insects may result from the fact that male adults fed also on treated bark at the time of eroding the gallery entrance and “nuptial chambers” and thus generating a low reproduction potential of male insects.

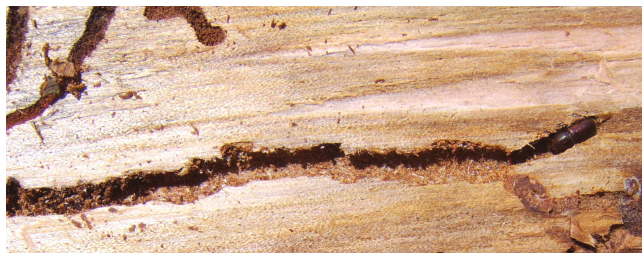


Figure 2. Female affected by NeemAzal

Larvae feeding on treated bark developed anemia, turned to yellowish and galleries made by these larvae are shorter. The digestive tract in the abdominal region starts blackening as a result of absorption process disturbance for the main nutritive elements (figure 3). Some larvae are prone to erode the pupal havens but due to a defective nourishing and some changes that appear in the digestive tract, they fail to accumulate the necessary energy for pupa development and thus subsequent death usually occurred. In 100% of the studied cases, larvae died before pupa formation, this indicating that insecticide takes action at the moment of pupa stage induction.

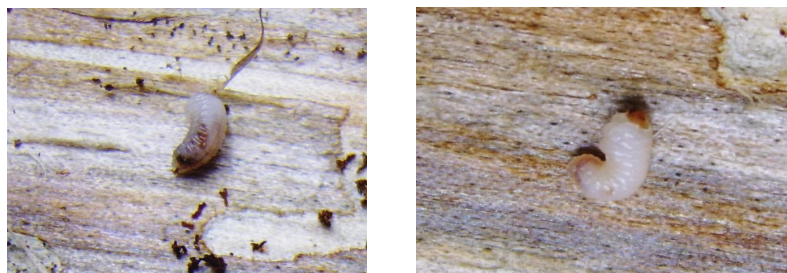


Figure 3. Affected larva of *Ips typographus* L. (left) and unaffected (right) of NeemAzal-T/S

The mortality occurring in pupa stage rises up to 62-90% (table 1) and for this reason the product is recommended to be used successfully on insect control. Moreover, though some larvae managed to erode “the pupal haven” these are unable to undergo the pupa stage. In addition, it could be stated that the lethal effect of the active substances on pupae is of 100%.

Eficacitatea tratamentului asupra larvelor de *Ips typographus* L.

Table 1

Sample no.	The number of analyzed larva	% mortality
1	42	90
2	134	87
3	120	79
4	158	82
5	100	85
6	87	62
7	93	75

In figure 4, it is presented the mortality percentage in terms of height for sample taking. The general tendency is represented by a slight decrease; the phenomena being explained by the fact that the spruce tree considered into our studies and on which observations have been made did not present a good vegetation state and thus the sap and active substances circulation could be obstructed.

Similar results were obtained in Canada and they led to the conclusion that the application of the control product based on Neem at the foot of the tree trunk in case of resinous species may have a significant diminishing effect on bark beetle population (Schmutterer, Huber, 2004).

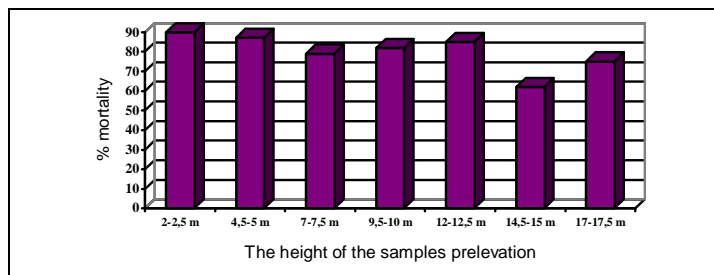


Figure 4. The repartition of the mortality on the height of the stem

The lethal effect was also observed on *Rhagium inquisitor* larvae that were feeding on treated bark at the base of the trees (figure 5).



Figure 5. Larva of *Rhagium inquisitor* L. affected of NeemAzal-T/S

In case of the second spruce tree considered in our study (MO₂), within the bark there have not been noticed any attack systems, this indicating that the tree was no longer preferred by the insect for egg laying due to strong resin presence either due to the repellent effect generated by NeemAzal-T/S solution. The repellent effect resulting from the application of Neem-based products has been observed by Pradhan et al., 1962.

CONCLUSIONS

The experiment developed in field conditions, using the injection of NeemAzal-T/S biological insecticide at the tree trunk base in order to control the bark beetle *Ips typographus* L., allowed us to conclude:

1. the „anti-feeding” effect is not being considered as complete and occurs mostly on adult parents as well as on larvae;
2. it has been observed a certain disorientation of the female individuals feeding on treated bark;
3. the number of eggs laid by the affected females is reduced while mortality in the egg stage is significant;
4. larvae feeding on treated bark developed anemia while mortality in this stage registered 62-90%;
5. lethal effect of the active substances on pupae is 100%;
6. performed determinations and observations are of extreme importance but method improvement is still required.

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