

1. SUMMARY

„Evaluation of azadirachtin preparations in reducing the number of tomato leaf miner (*Tuta absoluta* Meyrick) in the cultivation of selected tomato varieties (*Solanum lycopersicum* L.)”

This study evaluated the effectiveness of three biological formulations containing azadirachtin – Dr. Anand Neem (DAN), NeemAzal-T/S (NA), and Neem Oil (ON) – in controlling the larval population of the tomato leaf miner (*Tuta absoluta*) on two tomato cultivars: Adonis (pink-fruited) and Krakus (red-fruited). Azadirachtin, extracted from the neem tree *Azadirachta indica*, is known for its insecticidal properties. Based on the hypothesis that azadirachtin can effectively reduce *T. absoluta* populations in protected tomato cultivation, three formulations containing 0.025%, 1%, and 5% of the active ingredient were employed. The multifactorial study, conducted between 2022 and 2024, included both laboratory and greenhouse experiments.

In greenhouse tunnel conditions, the DAN formulation (with the highest azadirachtin concentration) proved to be the most effective-significantly reducing pest infestation, lowering larval activity, and inducing high larval mortality. Neem Oil showed the lowest efficacy, failing to suppress larval feeding and providing insufficient plant protection. Following ON application, the development of a subsequent pest generation was observed.

NeemAzal exhibited intermediate effects – suppressing larval activity with a delayed lethal outcome. A correlation was found between the efficacy of the formulations and the larval developmental stage, with the highest mortality recorded at the L2 stage. The mode of action of the individual formulations varied and was dependent on the concentration of the active substance: DAN acted rapidly and directly, NA acted systemically and over time, whereas ON did not interrupt the pest's developmental cycle. All three formulations also demonstrated repellent and antifeedant properties. The Adonis cultivar was more susceptible to infestation and damage than Krakus, likely due to its more delicate leaf structure.

Laboratory analyses confirmed the dependence of formulation efficacy on both concentration and duration of action. Higher concentrations clearly inhibited feeding, while lower concentrations could initially stimulate it. After just 24 hours, the efficacy of most formulations decreased, indicating the need for more frequent applications under field conditions.

Although statistical analyses did not show significant differences between cultivars, Adonis leaves attracted more larvae, which may be attributed to differences in chemical

composition or trichome structure. Higher concentrations of the active substance also increased the deterrence index – a metric for repellent efficacy.

Chlorophyll fluorescence assessment enabled the evaluation of the physiological impact of larval feeding and formulation application on plant health. Fv/Fm parameters did not show significant differences from the control, suggesting a localized stress response or the plants' ability to compensate for damage. Greater stress was observed in Adonis after NeemAzal-T/S application and in Krakus following Neem Oil treatment. Formulations with higher azadirachtin content effectively reduced feeding-induced stress, particularly in Krakus.

FTIR spectral analysis revealed chemical composition changes in the leaves caused by larval feeding and DAN application – specifically, a decrease in polysaccharide content and an increase in protein levels, especially in Adonis. These alterations indicate activation of plant defense mechanisms and confirm the utility of FTIR spectroscopy as a tool for early detection of biotic stress.

Final Conclusions:

- **Most effective formulation:** Dr. Anand Neem (DAN) – strong and rapid lethal effect.
- **Least effective:** Neem Oil (ON) – ineffective in disrupting the pest's developmental cycle.
- **Cultivar susceptibility:** Adonis was more prone to larval feeding; the Krakus cultivar is recommended due to its higher resistance.
- **Recommendations:** Rotational use of azadirachtin-based products and frequent applications are advised to maintain efficacy.

The study confirms that neem-based products can effectively reduce *Tuta absoluta* populations and offer an environmentally friendly alternative to chemical insecticides in integrated tomato pest management. This approach ensures effective pest control while supporting environmental protection.

Key words: tomato cultivation under cover, azadirachtin, *Tuta absoluta*.

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