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# INVESTIGATION ON THE EFFECT OF "PANATECHNOLOGY" PRODUCTS ON SOME APHIDS IN ORCHARDS

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## Abstract

The products of the *Panatechnology* series are completely natural, obtained by finely grinding rock meal and adding other natural ingredients. They can be applied as complex foliar and soil fertilizers and as agents increasing the natural immunity of plants. The aim of the investigation was to determine the potential effect of these products on some aphids in apple and peach orchards. The study was conducted in 2022 and 2023 in conventional orchards of apples and peaches, in the experimental fields of the Agricultural University – Plovdiv. Several leaf treatments were carried out with products from the *Panamin* and *Panatop* series (Immuno Save; Panamin Suspension, etc.) as a comprehensive program to improve plant resistance and growth during the spring period. The experiments have shown that *Panamin* and *Panatop* immunostimulants can reduce the rate of attack of some aphids on apple and peach trees to some extent but cannot completely prevent the danger of these pests, especially in a year suitable for their development.

**Keywords:** aphids, apple, Panamin, Panatop, peach

## INTRODUCTION

Silicon is known to enhance the crop resistance to biotic and abiotic stresses through physical and allelochemical mechanisms (Abas Shah et al, 2019). Silicon-treated leaves of plants have a significantly more hardened upper cuticle layer – a "double cuticle layer" and significantly more hardened, and thickened trichomes. These factors have a deterrent effect on pests with fine piercing-sucking mouth parts, which perceive them as an unfavorable environment for feeding, oviposition and reproduction (Keeping et al, 2009). However, the accumulated evidence suggests that cell silicification is not the only underlying mechanism of Si-induced resistance against herbivores, biochemical changes are also involved (Reynolds et al, 2016).

The products of the *Panamin* and *Panatop* series are completely natural obtained by finely grinding rock meals and adding other natural ingredients. Some of them have high silicon content. They can be applied as complex foliar and soil fertilizers and as agents increasing the natural immunity of plants. They provide good plant protection against abiotic and biotic stress and increase immunity. This justifies testing the products of the *Panamin* and *Panatop* series as potential treatment against insect pests with piercing-sucking mouth parts (Panamin. 2021a; 2021b)

The most significant pests with piercing-sucking mouth parts in the region of Plovdiv on apple and peach are some species of aphids (*Hemiptera: Aphididae*): Green citrus aphid (*Aphis spiraecola* Patch.), Rosy apple aphid (*Dysaphis plantaginea* Pas), Green peach aphid (*Myzus persicae* Sulzer), *Mealy plum aphid* (*Hyalopterus pruni* Geoffroy) and several species of the genus *Brachycaudus*. Aphid infestation in orchards varies with weather conditions (Grigorov et al, 2004; Andreev et al 2007; 2009; 2013; Vasilev & Andreev, 2015;

Andreev & Vasilev, 2017).

The control on these pests in orchards is usually carried out by repeated treatments with broad-spectrum systemic insecticides, which kill all the beneficial insects in the agrocenosis and disrupt the processes of natural regulation of other groups of pests as well, thus leading to a general pollution of the environment.

The preliminary in-vitro tests showed that the *Panamin* and *Panatop* products (Panamin Suspension and Panatop Immuno Save, with high content of silicon) have a strong contact insecticidal action against the green apple aphid (*Aphis pom* De Geer) (Ganchev, 2022).

The aim of the investigation was to determine the potential effect of some of the *Panatechnology* products with high content of silicon on aphids - pests in apple and peach orchards in field conditions.

## MATERIALS AND METHODS

The study was conducted in 2022 and 2023 in conventional orchards of apples and peaches, in the experimental fields of the Agricultural University – Plovdiv. In 2022, in the apple orchard of the department of Entomology, having an area of 0.4 ha (8 rows, variety Granny Smith), nine foliar treatments were carried out with four *Panamin* and *Panatop* products, from the beginning of April until the second half of July. The products were used in 0,5% concentration, alone and in combination, as shown in Table 1 according to the scheme - 2 rows treated; 2 rows untreated (control area). Two of them - *Panamin Suspension* and *Panatop Immuno Save* are with high content of silicon. The working concentration, the number and the date of treatments were recommended by the manufacturer as a technology for a better yield quantity and quality.

**Table 1.** *Panamin* and *Panatop* products used for the experiment in 2022

| No. Variant ⇓ Date ⇒ | 04.04. | 12.04. | 09.05. | 19.05. | 31.05. | 14.06. | 21.06. | 28.06. | 19.07. |
|---|---|---|---|---|---|---|---|---|---|
| 1. Standard Biostimulant | + | | + | | | | + | | |
| 2. Panatop B 11% | | + | + | | | | | | |
| 3. Panamin Suspension | | + | | | | | | | |
| 4. Panatop Alga Max | | | + | | | | + | | |
| 5. Panatop Immuno Save | | | | + | + | + | | + | + |

**Table 2.** *Panamin* and *Panatop* products used for the experiment in 2023

| No. Variant ⇓ Date ⇒ | 23.03. | 24.04. | 16.05. | 19.05. | 22.05. | 31.05. | 15.06. | 22.06. |
|---|---|---|---|---|---|---|---|---|
| 1. Panamin Suspension | + | + | | | | | + | |
| 2. Panatop Immuno Save | | | + | | + | + | | + |
| 3. Protect DSC | | | | + | | | | |

A similar scheme was applied in 2023 in the apple (variety Granny Smith) and peach (variety UFO 4) orchards of the department of Horticulture, but only 3 *Panatechnology* products were used with 8 treatments (Table 2).

Observations were made every 10 days on the skeletal branches of 10 trees randomly chosen in each treated and untreated row. The aphid colonies that appeared during the reporting period were observed. The attack rate on the shoots was recorded. Species that were found at low densities or occurred only once are not represented in the results. Aphid species were identified by morphological characters and type of damage. The Green citrus aphid, which is very similar to the green apple aphid, was identified by the number of lateral tubercles (Blackman & Eastop, 2004).

In 2023, due to the high population density of aphids in the experimental fields, a treatment with the chemical insecticide Mospilan 20SG (acetamiprid) was carried out in early April. That is why, it was possible to observe only aphids with colonies developed late.

## RESULTS AND DISCUSSION

The Green citrus aphid is a facultatively migrating species with a large range of hosts. It is found in apple orchards from the second half of April and may be present throughout the growing season. Typically, the number of colonies on shoot tips increases until June when the highest density is observed. After this period, the number of colonies gradually decreases to the termination of the active growth of the shoots when their tips become woody. In late summer and autumn, colonies are usually found only on the shoots or else the species disappears completely from the orchards (Andreev et al, 2009).

From the second half of May it was clearly visible that the attack on the shoots in the treated plots was weaker by 5 to 10% compared to the untreated ones (Figure 1). The first two treatments had no effect because they were carried out at a time when colonies of this species were not yet present in the orchard. No effect was observed from the third treatment either. The reduced attack resulted from the fourth and subsequent treatments with Panatop Immuno Save - a product with high silicon content. However, in the beginning of June the attack on the shoots in both plots exceeded the Economic Injury Level (EIL = 15% infested shoots). The subsequent decrease in the infestation rate is normal for the annual trend in the population dynamics of the pest.

All the products used are immunostimulants and are applied in a scheme that is expected to increase the quantity and quality of the yield. High silicon products were expected to have an additional effect on aphids, and they really had. We assume that the reduced rate of infestation caused by the Green citrus aphid was a result of the treatment with *Panatop Immuno Save*, but to enhance the effect it was necessary to apply the product in the initial periods of the pest multiplication - the first half of May. It was not possible to evaluate the effect of the other product with high content of silicon *Panamin Suspension*, which was applied earlier in combination with *Panatop B 11%*.

The Rose apple aphid is a migratory species with apple as a main host and secondary hosts - the species of the genus *Plantago* (plantain). It usually appears in orchards a little earlier than the Green citrus aphid. As with other species of migratory aphids, in the beginning of the growing season the population density and the infestation rate on the shoots increase, while from the end of May - the beginning of June, the number of colonies decreases due to migration to the summer host. This species is considered more dangerous because when feeding the aphid colonies cause a significantly greater damage by holding the growth and causing malformations of the tips of the shoots. Therefore, the Economic Injury Level has a significantly lower value (EIL = 5% attacked shoots) (Andreev et al, 2013).

In 2022, the colonies of the species appeared in the first half of April and were found until the third decade of June, while the density followed the standard population dynamics (Figure 2).

The year 2022 was favorable for the development of aphids during the spring period. It is noteworthy that a reduced attack effect was observed even after the second treatment with the *Panamin Suspension + Panatop B 11%* combination applied in the second decade of April against the colonies in the initial stage of their formation. The difference continued until mid-May and increased towards the end of the month after the application of *Panatop Immuno Save*. However, it should be noted that despite the reduced infestation rate, the EIL values were exceeded in the treated plot.

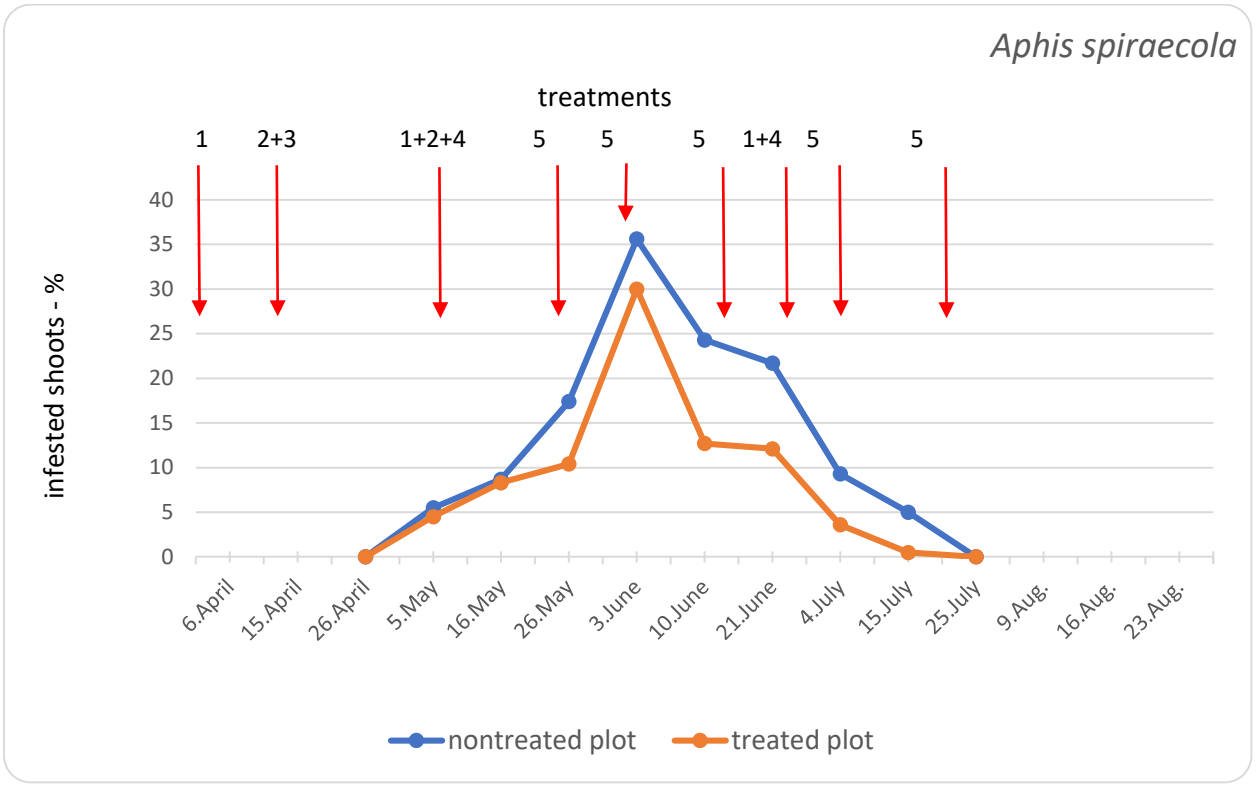


**Figure 1.** Green citrus aphid infestation rate on apple shoots in 2022 in the conventional orchard of the department of Entomology at the Agricultural University – Plovdiv.

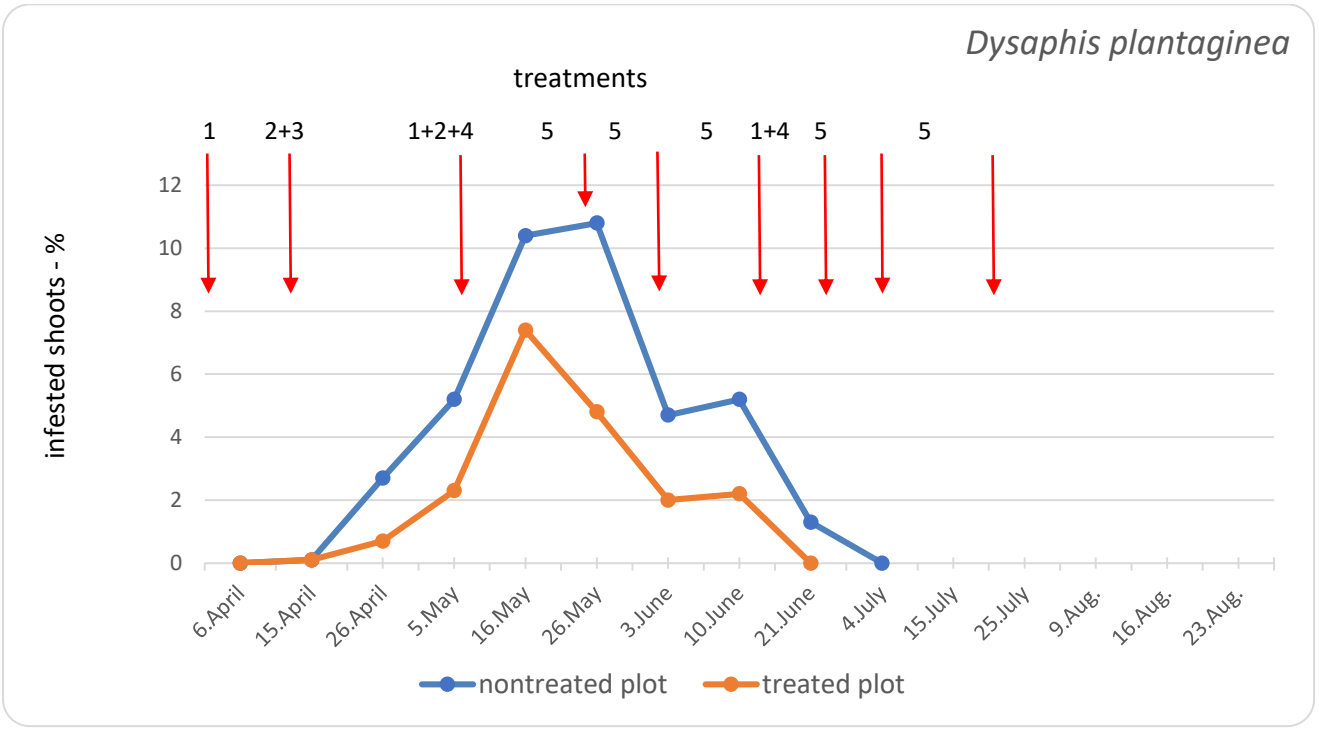


**Figure 2.** Rosy apple aphid infestation rate on apple shoots in 2022 in the conventional orchard of the department of Entomology at the Agricultural University - Plovdiv

The second year (2023) had a cool and rainy spring and was also very suitable for the development of aphid colonies. Unfortunately, an early treatment with Mospillan 20SG stopped the development of most species and for our experiments we could only observe aphids that colonize shoots in a slightly later period – after the insecticide action had ended. For this reason, the *Panatop Immuno Save* product, which was expected to reduce both colony growth and infestation rates, was applied later - from mid-May. In just over a month 4 treatments with this product were carried out, and two treatments with other products were added to the scheme - *Panamin Suspension* (another product with high content of silicon) and *Protect DSC*, which had another effect.

In the apple orchard we encountered only the Green citrus aphid. The first small colonies of this species were observed in early May in the treated plot (Figure 3). Since the middle of the month, there has been a steady trend of increasing the rate of infestation on the shoots. It can be assumed that the treatments carried out in the second half of May slowed this process down slightly, but only two treatments were carried out in June, one of which with another product and the density of the aphid exceeded the economic injury level at the beginning of June. The infestation rate was greater in the treated plot, while in the untreated plot it remained at a lower level. The difference between the two variants could be a coincidence, caused by other factors, but it showed us that when aphids have optimal conditions for development, the products with silicon in the applied concentration are not able to prevent the mass infestation. It can be assumed that at a higher concentration the effect of these products will be better.

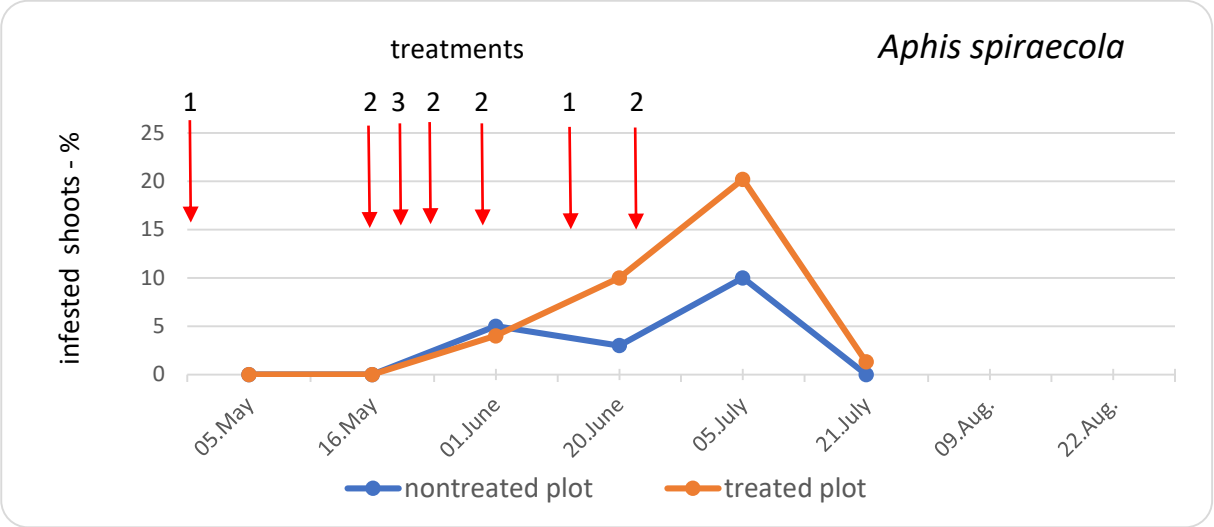


**Figure 3.** Green citrus aphid infestation rate on apple shoots in 2023 in the conventional orchard of the department of Horticulture at the Agricultural University – Plovdiv.

The same treatment scheme applied in a peach orchard showed a very good result in suppressing the attack by the Peach curl aphid (*Brachycaudus schwartzi* Börner). The experiment showed that the *Panatechnology* products significantly slowed down the growth of the colonies and permanently reduced the number of infested shoots in the treated area (Fig. 4). In the control plot, after its appearance in mid-May, the aphid multiplied progressively, and the infested shoots exceeded twice the economic injury level (EIL=5%).

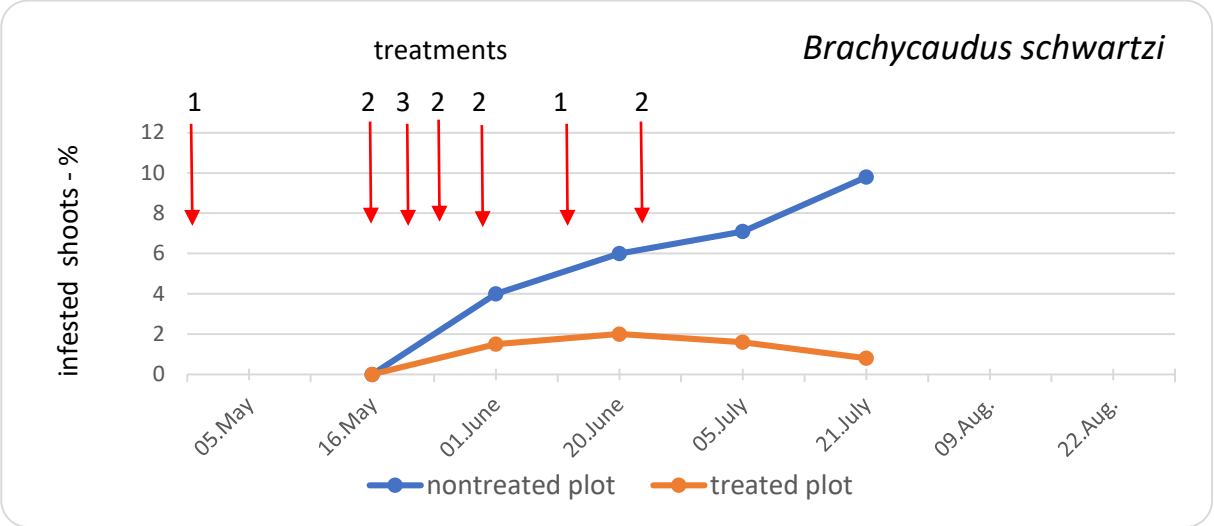


**Figure 4.** Peach curl aphid infestation rate on peach shoots in 2023 in the conventional orchard of the department of Horticulture at the Agricultural University – Plovdiv.

This species attacks only the peach and infests all shoots, not only those that have active growth. The species prefers higher temperatures and appears in orchards later compared to other aphids, and the rate of infestation rises at temperatures above $30^0$C until harvest. This makes the pest very difficult to control with chemical insecticides (Vasilev & Andreev, 2015). The possibility of reducing the attack of this aphid below the economic injury level by using *Panatechnology* products with high content of silicon will be of importance to fruit growers in Bulgaria, as it will eliminate the need of using toxic chemical insecticides during harvest.

Such experiments were being conducted for the first time under field conditions. They have shown very promising results and should be continued and extended.

## CONCLUSION

The first experiments under field conditions with the products of *Panatechnology*, with high silicon content, at a concentration of 0.5%, showed that they could partially reduce to some extent the attack of some aphids on apples and peach, but it cannot completely prevent the danger coming from these pests, especially in years favorable for their development.

To improve the insecticidal effect, it is necessary to synchronize the application of such products with the phenological development of the aphids.

The use of natural immunostimulants with high content of silicon could reduce the use of chemical insecticides or at least reduce the number of treatments.

## ACKNOWLEDGMENTS

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