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Evaluation of the effectiveness of some acaricides in the control of the two-spotted spider mite (*Tetranychus urticae* Koch) on squash crops under high plastic tunnels

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ABSTRACT

The two-spotted spider mite (*Tetranychus urticae* Koch) is an important pest present in squash crops under high plastic tunnels and in the field, that can reduce yield quantitatively and depreciating it qualitatively. The attack is frequent in dry and hot years, reaching a maximum development in the months of July-August. On the leaves, following the attack, depigmentations appear followed by their drying. The experiment done in 2023, aimed to evaluate the effectiveness of two products based on Neem oil (Oleorgan) and hexythiazox (Nissorun 10 WP) for controlling the pest on squash crops. The 'Perfect' cultivar and the 'Lorea' hybrid were used as biological material. The yield on variants and replicates was recorded, being between 12.30 and 22.58 t/ha. Based on the obtained results, the efficacy (%) was calculated and was between 64.4 and 96.0%.

Keywords*:* hexythiazox, neem oil, squash, two-spotted spider mite

INTRODUCTION

Squash is a vegetable species with a high nutritional value, essential for the metabolism and vitality of the human body because it contains various vitamins, sugar, starch, fats, proteins and minerals such as calcium, magnesium, potassium, sodium, phosphorus, and iron (Abdallah *et al*., 2018). The squash crop can be established both in the open field and in protected spaces, being attacked by several phytophagous species of pests (Abdallah *et al.,* 2012). Among them, the two-spotted spider mite (*Tetranychus urticae* Koch), is present on leaves, stems and branches, reducing yield quantitatively and depreciating it qualitatively (Abdallah *et al.,* 2018). It is a worldwide, ubiquitous and economically important agricultural pest that feeds on a wide range of host plant species throughout the world (Shukla, 2018).
The two-spotted spider mite (*Tetranychus urticae* Koch) is one of the most important pests of the Cucurbitaceae family, which can attack more than 200 species (Shen *et al.,* 2021). It is a member of the family *Tetranychidae* which includes many harmful species of plant-feeding mites (Farouk and Osman, 2011; Shukla, 2018). The pest is adapted to various environmental conditions and protected spaces are ideal for its development, where it can have a generation in a week (Düzgünes and Çobanoglu, 1983; Shoorooei *et al*., 2012).
Attack of the pest is frequent in dry and warm years. Located on the underside of the leaves, it is recognized by the drying of the tissues between the veins, which become like the parchment. Larvae and phytophagous adults absorb the sap from the tissues by

stinging, the affected areas showing depigmentations. In the field, the attack reaches its maximum evolution in July-August (Şovărel *et al*., 2020).
In recent years, pesticides based on plant extracts are increasingly used to combat mites. Azadirachtin, one of the most active constituents of neem oil, acts as a feeding inhibitor and limits the growth of insects and mites. Neem extract is also a powerful repellent, that stops or inhibits feeding, growth regulator and oviposition deterrent affecting more than 200 pest species (Yanar *et al.,* 2011).
The experiment aimed to evaluate the effectiveness of the products Oleorgan (40% saponified Neem oil) and Nissorun 10 WP (hexytiazox 10%) in controlling the two-spotted spider mite in squash crops under high plastic tunnel.

MATERIALS AND METHODS

The experience established at RIFVG Vidra, in 2023, aimed to test the effectiveness of two control products, one biological based on neem oil 40% (Oleorgan) and one chemical, hexythiazox 10% (Nissorun 10 WP). The biological material was represented by a Romanian cultivar ('Perfect') and a hybrid ('Lorea') of squash. The plant density was 9 333 plants/ha and the planting was made on May 17 and three variants (V1. Oleorgan, V2. Nissorun 10 WP and V3. Untreated control) were placed in 4 repetitions and 5 treatments were applied at intervals of 7 days. On May 24, the first attack of the pest was registered. Dynamic observations were made on 3 noted plants, evaluating the infested areas on a surface of at least 50 cm^2 (25 discs of 1.5 cm in diameter were cut) according to EPPO standard PP1/037(2), recording the number of eggs, nymphs and alive adults separately.
During the experience, ten harvests were made and the average number of fruits per plant, average weight and length of fruits, yield per plant and yield per hectare were calculated. The obtained data were processed statistically by the variance analysis method, using the ANOVA program. Based on the obtained results, the efficacy (%) was calculated.

RESULTS AND DISCUSSIONS

Following the treatments applied in squash crop (fig. 1), to the 'Perfect' cultivar, it was found that for all stages of the pest, the variants with the 2 products were significantly different from the untreated control variant (table 1, 2 and 3). The Oleorgan product had an efficacy between 86.3 and 92.0% (91.1% for the egg stage, 92.0% for the nymph stage and 86.3% for the adult stage). The efficacy of the Nissorun 10 WP product was 94.8% for the egg stage, 94.4% for the nymph stage and 95.3% for the adult stage of the pest.

Figure 1. Squash crops under high plastic tunnel

In the control of adults of the common red spider, a lower mean value is observed in the variant Oleorgan compared to the variant Nissorun 10 WP (table 3).

Table 1. The number of eggs and efficacy (%) at the 'Perfect' squash cultivar

Variants	The number of eggs (average value)			Signification	E %
	Average value	Difference from untreated control	% compared to the untreated control		
V1. Oleorgan	26.3	-268.2	8.9	***	91.1
V2. Nissorun 10 WP	15.2	-279.2	5.2	***	94.8
V3. Untreated control	294.5	-	100.0	-	-

LD 5% = 11.8; LD 1%= 17.2; LD 0,1% = 25.8

Table 2. The number of nymphs and efficacy (%) at the 'Perfect' cultivar

Variants	The number of nymphs (average value)			Signification	E %
	Average value	Difference from untreated control	% compared to the untreated control		
V1. Oleorgan	9.2	-106.7	7.9	***	92.0
V2. Nissorun 10 WP	6.5	-109.5	5.6	***	94.4
V3. Untreated control	116.0	-	100.0	-	-

LD 5% = 9.9; LD 1%= 14.6; LD 0.1% = 22.6

Table 3. The number of adults and efficacy (%) at the 'Perfect' cultivar

Variants	The number of adults (average value)			Signification	E %
	Average value	Difference from untreated control	% compared to the untreated control		
V1. Oleorgan	16.0	-100.7	13.7	***	86.3
V2. Nissorun 10 WP	5.5	-111.2	4.7	***	95.3
V3. Untreated control	116.7	-	100.0	-	-

LD 5% = 14.1; LD 1%= 20.3; LD 0,1% = 29.8

At the Lorea hybrid, significantly different results were recorded in the variants with treatments compared to the untreated control variant (tables 4, 5 and 6).

Table 4. The number of eggs and efficacy (%) at the 'Lorea' squash hybrid

Variants	The number of eggs (average value)			Signification	E %
	Average value	Difference from untreated control	% compared to the untreated control		
V1. Oleorgan	71.5	-129.5	35.6	***	64.4
V2. Nissorun 10 WP	14.2	-186.7	7.1	***	92.9
V3. Untreated control	201.0	-	100.0	-	-

LD 5% = 14.1; LD 1%= 20.3; LD 0,1% = 29.9

The efficacy of the Oleorgan product was between 64.4 and 83.3%, and the product Nissorun 10 WP had an efficacy between 92.9 and 96.0%. The highest efficacy of Nissorun 10 WP was recorded at the nymph stage of the pest (96,0%; table 5) and the lowest at the adult stage (90,1%; table 6).

Table 5. The number of nymphs and the efficacy (%) at the 'Lorea' squash hybrid

Variants	The number of nymphs (average value)			Signification	E %
	Average value	Difference from untreated control	% compared to the untreated control		
V1. Oleorgan	18.0	-89.5	16.7	***	83.3
V2. Nissorun 10 WP	4.2	-103.2	3.9	***	96.0
V3. Untreated control	107.5	-	100.0	-	-

LD 5% = 9.2; LD 1%= 13.2; LD 0,1% = 19.4

Table 6. The number of adults and the efficacy (%) at the 'Lorea' squash hybrid

Variants	The number of adults (average value)			Signification	E %
	Average value	Difference from untreated control	% compared to the untreated control		
V1. Oleorgan	27.2	-70.7	27.8	***	72.2
V2. Nissorun 10 WP	9.7	-88.2	9.9	***	90.1
V3. Untreated control	98.0	-	100.0	-	-

LD 5% = 10.8; LD 1%= 15.5; LD 0,1% = 22.7

At the product Oleorgan variant, the best efficacy in controlling egg stage of the *T. urticae* pest was recorded at the 'Perfect' cultivar squash (91,1%) compared to 'Lorea' squash hybrid (64.4%; fig. 2). In the same squash cultivar, the highest efficacy was recorded for the variant with Nissorun 10 WP (94.8%).

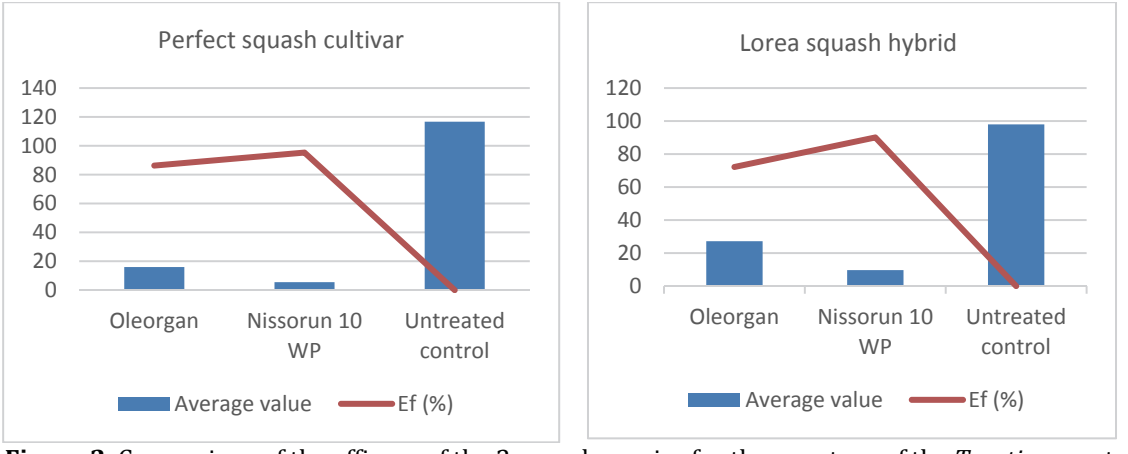

Figure 2. Comparison of the efficacy of the 2 squash species for the egg stage of the *T. urticae* pest

For the control of the nymph stage, the Oleorgan product registered an efficacy of 92% in the 'Perfect' *cv.* in comparison with the 'Lorea' hybrid where the efficacy was 83.3% (fig.

3). The Nissorun 10 WP product registered the best efficacy at the 'Lorea' hybrid (96,0%) and 94.4% at the 'Perfect' squash cultivar.

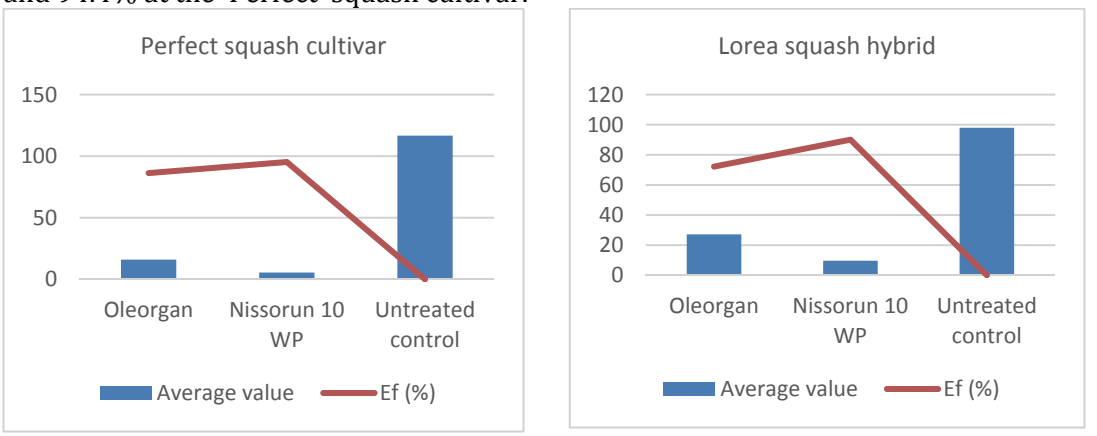

Figure 3. Comparison of the efficacy of the 2 squash species for the nymph stage of the *T. urticae* pest

Comparing the 2 species of squash, for the control of the adults of the pest, in the 'Perfect' *cv.* the efficacy of the Oleorgan product was 86.3% and in the 'Lorea' hybrid it was 72.2%. The Nissorun product registered a higher efficacy in the 'Perfect' *cv.* (95.3%) compared to the 'Lorea' hybrid (90.1%; fig. 4).

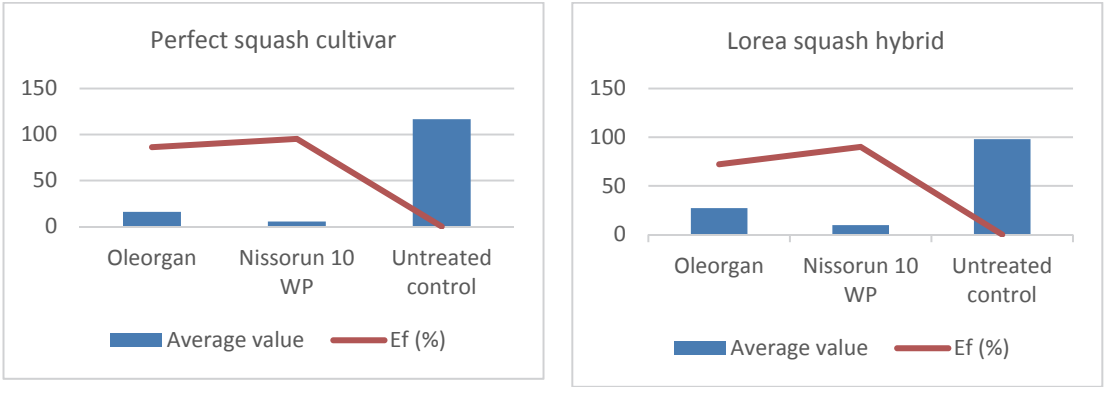

Figure 4. Comparison of the efficacy of the 2 squash species for the adult stage of the *T. urticae* pest

Regarding the yield, in the 'Perfect 'cultivar the highest yield was obtained in the variant with Nissorun 10 WP (22.58 t/ha; table 7) and was significantly different from the untreated control 16.05 t/ha.

Table 7. The yield obtained at the 'Perfect' squash cultivar

Variants	Average number of fruits /plant	Average weight/ fruit (kg)	Fruit length (cm)	Yield /plant (kg)	Yield (t/ha)	% compared to the untreated control	Difference from untreated control (t/ha)	Signification
1. Oleorgan	9.12	0.240	22.62	2.19	20.44	127.35	4.39	***
2. Nissorun 10 WP	10.52	0.230	23.07	2.42	22.58	140.69	6.53	***
3.Untreated control	7.82	0.220	22.53	1.72	16.05	100.00	-	-

LD 5% = 0.96; LD 1% = 1.38 ; LD 0.1% = 2.03

In the 'Lorea' hybrid at the variant with Nissorun 10 WP was recorded 19.13 t/ha (table 8), being significantly different from the untreated control (12.30 t/ha). The variant with Oleorgan product (15.40 t/ha) was different from the untreated control.

Table 8. The yield obtained at the 'Lorea' squash hybrid

Variants	Average number of fruits /plant	Average weight/ fruit (kg)	Fruit length (cm)	Yield /plant (kg)	Yield (t/ha)	% compared to the untreated control	Difference from untreated control (t/ha)	Signification
1.Oleorgan	8.25	0.200	21.24	1.65	15.40	125.20	3.10	***
2. Nissorun 10 WP	9.80	0.210	20.93	2.05	19.13	155.53	6.83	***
3.Untreated control	6.50	0.200	20.89	1.30	12.30	100.00	-	-

LD 5% = 0.93; LD 1% = 1.35 ; LD 0.1% = 1.98

CONCLUSIONS

- Following the experiments carried out, it was found that both control products are effective in combating the *Tetranychus urticae* pest, the 'Perfect' cultivar being less sensitive to the pest's attack.
- For the Oleorgan product, at the 'Perfect' cultivar, an average effectiveness of 89.8% was recorded, and for the Nissorun 10 WP product 94.8%.
- At the 'Lorea' hybrid, the average effectiveness was 73.3% for the Oleorgan product and 93.0% for the Nissorun 10 WP product.
- The highest yield was recorded for the 'Perfect' cultivar, at the variant with the product Nissorun 10 WP 22.58 t/ha.

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REFERENCES

1. Abdallah A.A., Abdel-Halim M.H., Ghallab M.M. and Azzam, H.G. (2018). Susceptibility of three squash cultivars to the two spotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae) infestation in relation to phyto-chemical components of the leaves. Egypt. J. Plant Prot. Res. Inst. 1 (2): 153-167.
2. Abdallah A.A., El-Saiedy E.M.A. El-Fatih M.M. and Shoula, M.E. (2012). Effect of some biological and biochemical control agents against certain squash pests. Archives Of Phytopathology And Plant Protection, 45:1, 73-82, DOI: 10.1080/03235401003633816.
3. Düzgünes Z. and Çobanoglu S., (1983). The life history and tables *Tetranychus urticae* Koch and *Tetranychus cinnabarinus* (Boisduval) (Acarina: Tetyranychidae) under the various temperatures and humidities. Plant Protection Bulletin 23(4): 171-187.
4. Shen N., Li Y., Leviticus K., Chang X-L, Tang T., Cui L., Han Z-J. And Zhao C-Q. (2021). Effect of broflanilide on the phytophagous mite *Tetranychus urticae* and the predatory mite *Typhlodromips swirskii*. Pest Manag Sci, 77: 2964-2970.
5. Shoorooei M., Nasertorabi M., Soleimani A., Moghbeli E., Madadkhah E and Moghbeli H. (2012). Screening of some cucumber accessions to two-spotted spider mite (*Tetranychus urticae*). International Research Journal of Applied and Basic Sciences, Vol. 3 (8), 1580-1584.
6. Shukla A. (2018). Evaluation of hexythiazox 5.45 EC against red spider mites (*Tetranychus urticae*) on okra. Journal of Entomology and Zoology Studies, 6(2): 43-46.
7. Şovărel G., Costache M., Cenuşă E. And Hogea S. (2020). Bolile şi dăunătorii culturilor de legume din spaţii protejate şi câmp. Recunoaştere şi combatere. Editura PIM, Iaşi, pp. 127-128.
8. Yanar D., Kadioglu I. and Gokce A. (2011) Ovicidal activity of different plant extracts on two-spotted spider mite (*Tetranychus urticae* Koch) (Acari: Tetranychidae). Scientific Research and Essays vol. 6 (14), pp. 3041-3044. DOI: 10.5897/SRE11.535.