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Evaluation of intercropping and other methods for controlling *Tetranychus urticae* Koch on tomato plants in Dakahlia Governorate

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Abstract
Tomato (*Solanum lycopersicon*), one of the most widely grown vegetable crops in Egypt. Egypt is the world's fifth largest producer which produces about 8 million tons of tomatoes per year. The two spotted spider mite *Tetranychus urticae* Koch, considered one of the main pests for tomato plants. Three experiments were done during the season of 2025 at ElGodaieda district, Dakahlyia Governorate to evaluate the effect of intercropping, plant extract, Acaricide and the efficiency of the predatory mite, *Phytoseiulus persimilis* in controlling *T. urticae* infesting tomato plants.
Obtained results showed that intercropping with onion was the most effective method with reduction percentage of (66.83%) followed by cabbage and been with (24.55% & 14.47%), respectively. The efficacy of plant extract (Neem) and the Acaricide (Cormite), were (57.11% & 94.80%), reduction percentage respectively.
The third trail was releasing of predatory mite, *P. persimilis* with a rate of 15- 20 mite per plant. The population of *T. urticae* reduced by (81.28%) after three weeks of the release.

Keywords: Intercropping, plant extract, acaricides, biological control

Introduction
Tomato plants stand out as a major crop in Egypt, which considered a significant global producer duo to the availability of the ideal conditions for growing high quality tomatoes. In Agricultural sector and food industry, tomato production has a crucial role, supporting both internal consumption and international export.
The two spotted spider mite *Tetranychus urticae* Koch, considered as a highly destructive pest which has a significant economic impact on tomato plants worldwide. (Migeon *et al*., 2010 & Boubou *et al*., 2012) [2]. Due to *T. urticae* about 10-50 % of tomato production losses worldwide. (Yigezu *et al*., 2022) [16].
Chemical acaricides remain the traditionally main way for controlling *T. urticae*. However, it has developed a resistance to almost all classes of acaricides due to their intensive and repeated use. Furthermore, it has a huge impact on environment, public health and animals which are not their intended targets. And so, the research efforts are increasingly focused on founding alternative methods and strategies against *T. urticae*. (Hata *et al*., 2016) [6],(Mulugeta *et al*., 2020) [12],(Rocha *et al*., 2020) [13].
Therefore, the present study aims to throw light on some alternative methods for controlling *T. urticae* on tomato plants including intercropping, plant extract, acaricide and releasing specialized predatory mite.

Materials and Methods
An area of two qirat (350 m^2), was used for this study this area was 25m long, 14m wide divided into 42 rows there were seven treatment plots with six rows for each treatment with a (3.m length, 2.3m breadth) and 50 m^2 for each treatment, plots were separated by 1.5- 1m.

The first experiment
In three plots, cabbage, beans and onions were sown in between the tomato rows as an extra- plant population. Tomato seedlings were moved to experimental field after 40 days when they had about 3 to 4 true leaves. All the recommended management techniques for all crops were applied. After two weeks from transplantation, the two spotted spider mite population was counted using a hand lenses, early in the morning. Six plants from the middle rows of tomatoes were chosen and tagged for data collection. Three leaves from each plant were collected and evaluated for the number of *T. urticae* every week. (Tadele, 2016) [14], (Hata *et al*., 2016) [6].
The amount of infestation damage level was determined by counting the number of areas that were yellowing, browning and crumbling caused by mites. Then these areas were scored on a scale of 1 -5, with (0) representing no damage, (2) representing little damage, (3) representing (20-50%) damage, (4) representing serious damage (50-75%) and (5) representing sever damage (>75%). The level of infestation or damage noted according to (Mackenzie *et al*., 1993) [10].

The second experiment
In two plots by using a sprayer the following compounds were sprayed to evaluate their effect on *T, urticae*:-
1. Neem extract (Azadirachtin 40%), the application rate was (50 ml/ 10 L water).
2. Cormite (1.8 % EC), the application rate was (40ml/ 100L water).

Obtained from Agricultural Company in Egypt.
The motile stages of *T. urticae*, were counted directly before spraying and after 3, 7, 14 and 21 days of spraying in order to assess the effectiveness of the tested materials:
% PR = (C – T) / C X 100
Were C, control; T, treatments; and %PR, present of population reduction. (Henderson and Tilton, 1955) [8].

The third experiment
In the last plot the predatory mite, *Phytoseiulus persimilis*, were used in controlling *T. urticae.*

The predatory mite were mass produced on common bean plants (*Phaseolus vulgaris* L.) and then released in the plot by 15- 20 individual / plant, when infestation level reach 3-5 mite / plant. The motile stages of *T. urticae*, were counted weekly for three successive weeks. (Heikal *et al*., 2003) [9]; (Taha *et al*., 2002) [15].

Data analysis

The percent population reduction (%PR) was calculated as follows. (Henderson and Tilton, 1955) [8].

Result and Discussion

1. The effect of intercropping on population abundance and infestation level of *T. urticae* on tomato plants in Dakahlyia Governorate during 2025 season

The result revealed that intercrops showed a highly effect on the population of *T. urticae* the effective result in reduction percentage and infestation level was in the intercrop with onion followed by cabbage then been as shown in table (1).

The intercropping tomatoes and onion dramatically decreased the number of mites and their infestation level, (204 & 1.50), as compared to the control (tomato alone) were, (615 & 3.94).

Data also illustrated that intercrop tomatoes and beans exhibit the lowest effect with a reduction percentage of only (14.47%), and high infestation level (3.12).

It well known that aromatic plants contain a naturally volatile compounds that emit a strong scent, capable of deter pests from eating their host when it grown as an intercrop this results agree with the study of (Ab0-shanab *et al*., 2019), who found that when intercropping tomato with coriander was the most effective way to reduce the number of *T. urticae* on tomatoes. (Hata *et al*., 2019) [7] examined the effect of aromatic plants on *T. urticae* on strawberry.

Table 1: Effect of intercropping on population abundance and infestation level of *T. urticae* Koch on tomato plants

Treatments	No. mite / Treatment	Reduction %	Infestation level
Control (Tomato alone)	615	---------	3.94
Tomato + cabbage	464	24.55	2.86
Tomato + bean	526	14.47	3.12
Tomato + onion	204	66.83	1.50

2. Effect of neem extract and cormite on the reduction percentage and infestation level of *T. urticae* on tomato plants in Dakahlyia Governorate during 2025 season

Data in table (2) cleared that tomato treated with cormite had the lowest infestation level (0.63), and the highest mean reduction percentage (94.80%), while neem extract had moderate effect with mean reduction percentage of (57.11%), and (2.65), infestation level. These results are agreed with those obtained by (Hassan *et al*., 2005) [5]; (Gaber *et al*., 2004) [4].

Table 2: Effect of neem extract and cormite on population abundance and infestation level of T. urticae Koch on tomato plants

Treatments & application rate	No. mite / Treatment	Reduction percentage after								Mean Reduction %	Infestation level
		3 days		7 days		14 days		21 days			
		No.	%	No.	%	No.	%	No.	%		
Neem extract 50ml / 10 L water	411	152	63.02	164	60.09	188	54.25	201	51.09	57.11	2.65
Cormite 1.8 % EC 40ml / 100 L water	396	61	84.66	18	95.45	0	100	3	99.24	94.80	0.63
Control (Tomato alone)	418	441	-------	462	------	490	------	615	------	-------	3.94

3. The efficiency of the predatory mite *P. persimilis* on the population abundance and infestation level of T. *urticae* on tomato plants in Dakahlyia Governorate during 2025 season

The obtained results in table (3) showed that the population of *T. urticae* was (438) individual before releasing the predatory mite and the total number in the control area was, (418) individual.

As cleared in table (3) the population of *T. urticae* slightly decreased after releasing the predatory mite for one week, the average number of mites were, (387) with a reduction percentage of (11.64%).

The average number of mites and reduction percentage for *T. urticae* start gradually increased to reach (122 & 72.15%) and (82 & 81.28%), after two and three weeks of release respectively. Also the infestation level was the lowest in all treatments was, (0.33%). These results agreed those found by (Taha *et al*., 2001); (Heikal *et al*., 2003) [9]; (Fouzy *et al*., 2006).

Table 3: Efficiency of the predatory mite *P. persimilis* on the population abundance and infestation level of *T. urticae* on tomato plants

Treatments	No. mite / Treatment	Reduction percentage after						Mean Reduction %	Infestation level
		1 week		2 weeks		3 weeks			
		No.	%	No.	%	No.	%		
Control (Tomato alone)	418	462	-------	490	------	615	-------	--------	3.94
Tomato + *P. persimilis*	438	387	11.64	122	72.15	82	81.28	55.02	0.33

Conclusion

The foregoing results proved that intercropping could be a good strategy against *T. urticae*, also proved the effectiveness of using the predatory mite as a safe alternative way from acaricides that gave excellent results for controlling *T. urticae*. Thus, the two most promising management strategies for integrated control of the two spotted spider mite *Tetranychus urticae* Koch, on tomatoes

are tomato onion intercropping and the release of the predatory mite *Phytoseiulus persimilis*, in tomato fields with a rate of 15 – 20 mite / plant.

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