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Release of the predacious mite, *Amblyseius swirskii* for controlling the population density of tenuipalpid mites, on pomegranate in the field

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Abstract

The effect of releasing of predacious mite *Amblyseius swirskii* Athias-Henriot in different levels for reducing the population density of tenuipalpid mites, (*Tenuipalpus punicae* Pritchard & Baker and *Tenuipalpus granati* Sayed) on pomegranate seedlings were studied. The results showed that, the highest rate of reduction of the double release and high level was after seven weeks after release with percentage 91.82% reduction. The highest rate of reduction of the double release and low level was after five weeks after release with percentage 86.27% reduction. The highest rate of reduction of the single release and high level was after three weeks after release with percentage 85.10% reduction. The highest rate of reduction of the single release low level was after three weeks after release with percentage 76.96% reduction. The mean of all levels was (56.03 and 75.81) and (78.51 and 82.62) for single and double release at low and high releasing, respectively. This confirms the success of using the predacious mite *A. swirskii* for controlling the population density of phytophagous mites on pomegranate orchards.

Keywords: biological control, *Amblyseius swirskii*, *Tenuipalpus punicae*, pomegranate, releasing.

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1. Introduction

Pomegranate (*Punica granatum* L.) is considered one of the important fruit crops grown in Egypt. Its cultivation extends from north to south, where 85,415 acres in the 2016 season, of which 26,9070 tons were produced (Abd Rabou, 1998; Anonymus, 2018; Mesbah, 2008) and the present time it is being cultivated in The newly reclaimed lands, especially in the reclaimed north, are believed to be of great benefit to human health and activities, as they contain antibiotics for many parasites, microbes, and so on (Arzu *et al*., 2012). Family Tenuipalpidae, is one of the most important families of phytophagous mites that infect fruit trees in Egypt and the world, including pomegranate trees (Jeppson *et al*., 1975). The family Phytoseiidae are widely used due to their potential as biological control agents for phytophagous mites and more pest on different crops (Arthurs *et al*., 2009; Heikal *et al*., 2004). Jeppson *et al*. (1975), Toroitich *et al*. (2009), and Migeon and Dorkeld (2017) reported that, the biological control is one of the methods of pest control used and means the optimal use of living organisms (natural enemies) in the environment to reduce the damage of pests, including phytophagous mites. addition to its environmentally safe and long-term promising to eliminate the danger of these pests, and reliance on them can eliminate the danger posed using pesticides (Bailey *et al*., 2009; Birişik *et al*., 2014; Özcan and Koçoğlu, 2021; Sanda and Sunusi, 2014; Uygun *et al*., 2010). Therefore, a great care is given to develop alternative, from here it focused guidance to stopping the spread of these pests which cause significant losses in the fruit trees under study in Assiut governorate, Egypt, and thus designed plan for studying the effect of using predacious mite *Amblyseius swirskii* Athias-Henriot for reducing population density of phytophagous mites on pomegranate seedlings on open field.

2. Materials and methods

The experiment was designed on pomegranate tree at the farm of faculty of Agriculture, Al-Azhar University, Assiut, Egypt.

2.1 Source of predators

Amblyseius swirskii Athias-Henriot (Phytoseiidae) was collected from leaves of pomegranate trees at the farm of Faculty of Agriculture, Al-Azhar University, Assiut, Egypt as mobile individuals.

2.2 The phytoseiid mite cultures

A stock culture from *A. swirskii* was established by placing a copulated female of predacious mite together with suitable number of prey of *Tetranychus urticae* Koch on mulberry leaves situated upside down on cotton wool soaked in water in a 9 cm diameter Petri–dish and left to deposit eggs. The edges of the leaf were also lined with a wet cotton barrier. Old leaves were changed by fresh one when needed (5–7 days), few drops of water were added daily to the petri–dish and the culture was kept in room temperature.

2.3 Mass rearing of the phytoseiid mite

A stock culture of *T. urticae* was made to use in the multiplication of the predator by changing the predator on the incomplete stages as prey who made the predator grow and multiply and thus increase its numbers. This work was repeated several times until we got large number of the predacious mite *A. swirskii* to be use in field biological control experiments under this study.

2.4 Release of the predatory mites for biological control of tenuipalpid mites at open field

Predacious mite *A. swirskii* prepared for release process were left in refrigerator at 10°C for 5 minutes to release on seedling of pomegranate before sunset. Fifteen seedlings similar size and age of pomegranate were chosen for this experiment at the Farm of Faculty of Agriculture, Al-Azhar University, Assiut governorate, Egypt. The seedlings were divided into 5 groups each of 3 seedlings. Twelve seedlings of treatments were applied for releasing the predatory mite, *A. swirskii* and divided into 4 groups and 3 seedlings were as control (without predators) as follow:

- single releasing
  - 100 individuals /seedling.
  - 200 individuals / seedling.
- Double releasing
  - 100 individuals / seedling and re-release again after 15 days.
  - 200 individuals /seedling and re-release again after 15 days.
- Group of pomegranate trees a control **(**without predators according to Ebrahim (2016)).

Discs were made of mulberry leaves situated upside down on cotton wool soaked in water in a 9 cm diameter Petri–dish and the predator were placed on them in the specified numbers using very fine brush and then saved it in a plastic box and transport it from the laboratory to the field directly and then placed these discs in perforated small bags, then the bags were placed in a suitable place in each tree. Randomized samples of 25 leaves/tree were collected just before every release and then weekly, where the first sample was considered as the pre-count and the second one as the first post-count and this was repeated with the subsequent samples according to Ebrahim (2016).

2.5 The percentages of reduction in open field

Percentages of reduction of the mite's population in felid were calculated according to the equation of Henderson and Tilton (1955):

$$\text{Percent Reduction} = 1 - \frac{\text{Treatment after} \times \text{control before}}{\text{Treatment before} \times \text{control after}} \times 100$$

3. Results

This study was carried out in the farm of the Faculty of Agriculture, Al-Azhar University, Assiut, Egypt on a group of similar size and age seedlings of pomegranate; the objective of this study is to find the most convenient release

level of the predacious mite, *Amblyseius swirskii* for controlling the population of tenuipalpid mites (*Tenuipalpus punicae* and *Tenuipalpus granati*) on pomegranate trees. The releasing levels of the predacious mite, *A. swirskii* were with single, double releases at low releasing treatment (100 individuals/seedling) and the second for high releasing treatment (200 individuals/seedling); and their effect were presented in Table (1).

Table (1): The numbers and reduction percentages of tenuipalpid mites on pomegranate seedlings affected by different levels of releasing of *Amblyseius swirskii* at the field.

Treatment	Number of phytophagous mites / 25 leaves and % reduction after release								Control
	Single releasing				Double releasing				
	100 individuals/ seedling		200 individuals/ seedling		100 individuals/ seedling		200 individuals/ seedling		
	Number of phytophagous mites	Reduction (%)	Number of phytophagous mites	Reduction (%)	Number of phytophagous mites	Reduction (%)	Number of phytophagous mites	Reduction (%)	
Before release	99.00	-	143.00	-	113.67	-	185.00	-	155.33
After 1 week	87.67	48.86	117.00	52.76	101.00	48.69	154.33	51.83	269.00
After 2 weeks *	92.00	71.05	99.33	78.36	106.00	70.95	134.00	77.44	498.67
After 3 weeks	101.33	76.96	94.67	85.10	111.00	78.02	130.00	84.18	690.00
After 4 weeks	89.00	64.23	71.67	80.06	53.00	81.45	55.00	88.17	390.33
After 5 weeks	76.67	65.47	50.00	84.41	35.00	86.27	43.67	89.47	348.33
After 6 weeks	64.00	67.29	46.67	83.49	38.33	82.94	35.67	90.24	307.00
After 7 weeks	60.33	63.12	41.33	82.51	26.00	86.16	25.00	91.82	256.67
After 8 weeks	56.00	57.69	53.00	72.28	38.67	74.55	36.00	85.44	207.67
After 9 weeks	34.67	49.94	30.00	70.01	25.33	68.15	29.33	77.34	108.67
After 10 weeks	53.67	51.04	31.33	80.21	25.00	80.14	34.00	83.40	172.00
After 11 weeks	50.00	62.76	30.00	84.53	28.67	81.40	29.33	88.31	210.67
After 12 weeks	57.33	63.29	43.67	80.64	36.33	79.74	45.00	84.58	245.00
After 13 weeks	75.00	53.06	55.00	76.17	44.00	76.01	65.33	78.12	250.67
After 14 weeks	75.00	31.05	33.67	78.57	37.00	70.38	40.00	80.32	170.67
After 15 weeks	43.67	51.06	21.33	83.45	26.00	74.62	24.00	85.61	140.00
After 16 weeks	17.00	53.75	10.33	80.54	15.00	64.46	17.00	75.25	57.67
After 17 weeks	10.00	56.42	5.33	83.92	4.67	82.27	5.00	88.34	36.00
After 18 weeks	9.00	47.05	5.00	79.64	4.33	77.81	4.67	85.30	26.67
After 19 weeks	7.00	44.16	4.00	77.91	3.67	74.50	3.67	84.33	19.67
After 20 weeks	6.00	42.35	3.67	75.59	2.67	77.66	3.33	82.88	16.33
Mean		56.03		78.51		75.81		82.62	

* = time of the second release.

The mean numbers of tenuipalpid mites (*T. punicae* and *T. granati*), on pomegranate were generally low in the pre-count (just before the predacious release) on 26th of June 2021, mean numbers of tenuipalpid mites (*T. punicae* and *T. granati*) were (99.00, 143.00 individuals) /25 leaves different stages for single release at low and high releasing, respectively; and it were (113.67, 185.00 individuals) /25 leaves different stages for double release at low and high releasing, respectively; and it was (155.33 individuals) /25 leaves different stages for treatment without predacious mite. The first post-count after one week the mean number of tenuipalpid mites (*T. punicae* and *T. granati*) were decreased in all treatment with (87.67, 117.00, 101.00 and 154.33 individuals) /25 leaves different stages and percentage reduction were (48.86, 52.76, 48.69 and 51.83%) for single and double release at low and high releasing, respectively. In contrast, the mean number of tenuipalpid mites (*T. punicae* and *T. granati*) was (269.00 individuals) /25 leaves different stages for treatment without predacious mite. The highest rate of reduction of the double-release low

was after five weeks of release, with mean numbers of tenuipalpid mites *T. punicae* and *T. granati* (35.00 individuals)/25 leaves, and (86.27%) reduction; While the highest rate of reduction of the single-release high level was after three weeks of release, with mean numbers of tenuipalpid mites *T. punicae* and *T. granati* (94.67 individuals)/25 leaves and (85.10%) reduction; While the highest rate of reduction of the high level was double-release after seven weeks, with mean numbers of tenuipalpid mites *T. punicae* and *T. granati* (25.00 individuals)/25 leaves and (91.82%) reduction; While the highest percentage reduction of the low level was single release after three weeks of release, with mean numbers of tenuipalpid mites *T. punicae* and *T. granati* (101.33 individuals)/25 leaves and (76.96%) reduction. The lowest percentage reduction except for the first week in release levels were as follows: level 100 predacious mite/tree single release was after fourteen weeks with 31.05% reduction and Level 200 predacious mite/tree single release was after nine weeks with 70.01% reduction while level 100 predacious mite/tree double release was after sixteen weeks with 64.46% reduction and Level 200 predacious mite/tree double release was after sixteen weeks with 75.25% reduction. In generally the mean of the percentage reduction of population density of tenuipalpid mites (*T. punicae* and *T. granati*) for all level were 56.03, 78.51, 75.81 and 82.62% for single and double release at low and high releasing, respectively.

4. Discussion

These results agree with Croft *et al.* (2004); *A. swirskii* is considered a Type III generalist agent which allows it to suppress many phytophagous mites, including species of the family tenuipalpidae. Also, agrees with Lee *et al.* (1997) successfully *Amblyseius* species in reduced of populations prey at all three ratios within 17 days after the initial infestation**.** Heikal and Fawzy (2003) found that, the maximum reduction of the pest in the open field was (85 and 90%) after 4 weeks from the predacious release. Ibrahim *et al.* (2005) found that, the percentage reduction in the population of mite pest after four months of releasing 40, 50 and 70 individuals per tree reached 57.84, 73.76 and 88.25%, respectively. And agree with Fadamiro *et al.* (2013), Ebrahim (2016), Eleawa and Waked Dalia (2016), and Mesbah Amira (2016**)** they found that, the species of Phytosiid mites have the ability to reduce the population density of phytophagous mites to the least possible extent (5 motiles)/leaf as proposed by Childers *et al.* (2007), which has no effect on the plant or yield. In addition, they found that by using different levels of release for predacious mites belonging to this family, the percentages of reduction differ according to the levels used and the time required to reduce the density decreases as the level of release increases, and vice versa.

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