

Survey and Population Densities of Phytophagous Mites and Their Natural Enemies Inhabiting Pomegranate Orchards in Assiut Governorate

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Received on: 1/11/2020

Accepted for publication on: 9/11/2020

Abstract

The present study was conducted in three pomegranate orchards at Manfalut area (north Assiut) and three orchards at Sidfa area, (south Assiut, Egypt) in order to survey phytophagous and predacious mites and insects inhabiting leaves of pomegranate trees (*Punica granatum L.*) and explore their population densities during the two successive years starting from November 2018 to October 2020. A total of twelve species were recorded. Of these, two species are phytophagous mites belonging to family Tenuipalpidae; four species are predacious mites (belonging to family Phytoseiidae and to family Stigmaeidae) and six species are predacious insects belonging to three families. The phytophagous and predacious mites and predacious insects recorded one annual peak during the two studied years. The phytophagous mites reached its peak number in July with an average of 629.50 and 696.00 individuals/25leaves in Manfalut area during the two successive years, respectively. While at Sidfa area the peak number was recorded in August of both years with a mean numbers of 149.00 individuals in the first year and 192.00 individuals/25 leaves in the second year. The predacious mites and insects recorded only one annual peak in August of both regions. Significant positive correlations were found among the temperature degrees (C°), phytophagous and predacious mites and predacious insects. Whereas, relative humidity has no effect.

Keywords: Population density, Predacious mites, Tenuipalpidae, Phytoseiidae, *Punica granatum*.

Introduction

Pomegranate (*Punica granatum L.*) (Lythraceae) is an important fruit trees planted in different regions of Egypt, and it is an important crop for local markets and export. Pomegranate is an important source of phytochemicals and also has high content of antibacterial agents, (Fischer *et al.* 2011). The *P. granatum* is a deciduous shrub host of many harmful and beneficial mites and insects. The arthropod pests most damaging to pomegranate cultivations in the main production regions of the Circum-

Mediterranean area, (Giuseppe, *et al.* 2016). The eriophyid bud mite, *Aceria granati* caused rolling of the pomegranate leaves in tight rolls from the edges of the leaves on a whole shoot, (Nazanin *et al.* 2013). Kotikal *et al.* (2011), surveyed mites and insects associated with *P. granatum* and revealed the presence of pomegranate aphid, *Aphis punicea passerini*; thrips, (*Rhipiphorothrips cruentatus* Hood; *Scirtothrips dorsalis* Hood; *Anaphothrips oligochaetus* Kerny; whitefly, *Siphoninus phillyreae* Haliday; spiralling

whitefly, *Aleurodicus disperses* Russell, mealy bug *Planococcus lilacinus* (Cockrell) and eriophyid mite, *Aceria granati* Canestrini; false spider mite, *Tenuipalpus granati* Sayed. The population density of mites reached a peak during the first fortnight of March. The most frequently collected species from different agricultural crops were the phytoseiids (*Amblyseius largoensis* (Muma) and *Neoseiulus longispinosus* (Evans)). The stigmatids *Agistemus* spp. and the anystid, *Walzia indiana* Smith-Meyer & Ueckermann, they can be considered potentially useful in suppressing the associated phytophagous mites, (Krishna and Salil 2011). The *Parascolothrips priesneri* insect is a predator of mites, but also it can cause severe feeding damage to the leaves of apple, (Ben-David and Mound 2016). Amongst mortality factors were pathogens followed by predators were responsible of deaths in different stages of date palm mite *Oligonychus afrasiaticus*, (Alatawi 2020). Among the identified species of invertebrates, 32 species are herbivore feed on 134 plant species, 19 species are insect predator, 8 species of omnivores and 2 species are scavengers were recorded in coniferous forest of District Bagh, (Khifza *et al.* 2019). The present study aimed to determine the effectiveness of local climatic conditions (temperature degrees and relative humidity) on the phytophagous mites infesting pomegranate and its predators in Assiut Governorate.

Materials and Methods

1-Population densities of mites:

The population density of phytophagous and predacious mites and pre-

dacious insects inhabiting pomegranate (*Punica granatum L.*) (Lythraceae) were recorded from November 2018 to October 2020. The experiments were carried out at two areas of Assiut Governorate (Manphalut and Sidfa). Three orchards of each area, of Assiut suburbs were studied. Five randomly samples (25 plant leaves) were collected weekly for each orchard. The leave samples were examined in the laboratory as soon after collection using a stereomicroscope. (the motile stages of mites on upper and lower leaf surfaces were recorded). A beating sheet (500×500 mm) was used to collect insects shaken from branches not searched. Predacious insects were collected and placed in 95% ethanol for identified in the laboratory.

2-Statistical analysis of data:

Correlation coefficients between the number of phytophagous mites and monthly average of temperatures and relative humidity were recorded. Also, significance calculated regression was tested according to Steel and Torric (1960).

Results

1- Survey of pomegranate phytophagous mites and their predacious mites and insects at Assiut governorate.

The surveyed mite and insect species inhabiting pomegranate trees (*Punica granatum L.*) during the current study were: two species of phytophagous mites belonging to family Tenuipalpidae (*Tenuipalpus punicea* Pritchard & Baker and *Tenuipalpus granati* Sayed); three species of phytoseiid mites (*Amblyseius swirskii* Athias-Henroit, *Typhlodromus pyri* Scheuten and *Typhlodromus athiasae*

Porathand and Swirski) and one species belonging to family Stigmaeidae (*Agistemus exsertus* Gonzales). A total of six species of predatory insects, belonging to three families were also recorded. Family Coccinellidae represented by four species (*Rodolia cardinalis* Mulsant, *Nephus includens* Kirsch, *Coccinella undecimpunctata* L. and *Stethorus punctum* Le Conte); Family Chrysopidae represented by single species (*Chrysoperla carnea* Steph) and family Anthocoridae represented by *Orius* sp.

2- Population densities of pomegranate phytophagous mites and predatory mites and insects species on pomegranate trees cultivated in Manfalut region:

Data in Table (1) showed that, both phytophagous mites (i. e. *T. punicae* and *T. granati*) on pomegranate trees were firstly appeared in May with a moderate numbers and increased gradually to reach its peak in July of the first year (2018/2019), with an average of 629.50 individuals/25 plant leaves.

Table 1. Population densities of phytophagous mites infesting pomegranate trees and their predacious (mites and insects) in Manfalut region

Months	Mean no. of mites and insects/25 leaves									
	2018-2019					2019/ 2020				
	Mean of Temp. °C	Mean of RH.	Phytophagous mites	Predacious mites	Predacious insects	Mean of Temp. °C	Mean of RH.	Phytophagous mites	Predacious mites	Predacious insects
Nov.	20.23	36.7	12.00	1.50	3.50	22.27	40.60	16.50	3.50	5.00
Dec.	14.71	42.15	1.00	0.00	0.50	15.90	51.80	6.50	0.50	1.50
Jan.	13.16	36.00	0.00	0.00	0.00	14.32	53.80	0.00	0.00	0.00
Feb.	15.30	39.00	0.00	0.00	0.00	15.18	48.60	0.00	0.00	0.00
Mar.	18.68	30.20	0.00	0.00	0.00	20.10	34.40	0.00	0.00	0.00
Apr.	23.38	25.00	0.00	0.00	1.50	24.23	27.70	0.00	0.50	2.00
May	30.89	17.20	108.00	0.50	2.50	29.77	23.20	111.00	1.00	2.50
Jun.	33.03	23.00	145.00	3.50	6.00	32.12	22.26	152.50	4.50	8.50
Jul.	33.11	25.00	629.50	7.00	5.50	32.89	24.70	696.00	7.50	6.50
Aug.	32.44	26.00	330.00	2.50	10.00	32.92	25.50	426.00	3.50	10.50
Sep.	30.22	37.40	11.00	4.00	8.50	32.63	30.16	15.50	6.50	7.50
Oct.	27.95	35.40	15.00	3.50	6.50	27.40	32.20	17.50	4.00	6.00
(R) Predacious mites			0.745**					0.616*		
Predacious insects			0.468	0.735**				0.555	0.814**	
Mean of Temp. °C			0.618*	0.747**	0.823**			0.599*	0.790**	0.856**
Mean of RH.%			-0.487	-0.218	0.233			-0.500	-0.552	-0.615*

(**) Correlation is significant at 0.01 level.

(*) Correlation is significant at 0.05 level.

While, in the second year (2019/2020), the highest population of the phytophagous mites was recorded also in July with a mean number of 696.00 ind. /25 plant leaves. A few or no numbers of both two species were recorded during the period from December to April of both studied years. On the other side, scarce or

no numbers of predatory mites and insects were observed during the two studied years (2018/2019 and 2019/2020). Highly significant positive correlations were recorded between the number of predaceous mites and temperature ($r = 0.747^{**}$) and the numbers of predaceous insects ($r = 0.823^{**}$). Also, significant

positive correlation was noticed between temperature and the number of phytophagous mites ($r = 0.618^*$) during the two studied years. While, the statistical analysis showed that, there was no effect of relative humidity on the numbers of phytophagous and predaceous mites during the two studied years. While significant negative correlation was recorded between relative humidity and the numbers of predacious insects in the second year.

3- Population dynamic of phytophagous mites on pomegranate trees and their predaceous mites and insects at Sidfa region:

Table (2) explained that, the numbers of phytophagous mites (*T. punicae* and *T. granati*) infesting pomegranate trees in Sidfa region had one annual peak of abundance, was recorded in August during both studied years with a mean numbers of 149.00 and 192.00 individuals/25 leaves during the first and second

years, respectively. The numbers of phytophagous mites decreased rapidly to record a mean Numbers of 57.50, 31.00, 10.00 and 2.00 individuals/25 leaves during September, October, November and December of the first year and 66.50, 38.00, 15.50 and 4.50 individuals/25 leaves in the second year, respectively. The predacious mites inhabiting pomegranate trees cultivated in Sidfa region were recorded a comparatively higher numbers than in Manfalut region, with one annual peak in August during the two years. Also, Predacious insects had one annual peak of abundance in August with a few numbers (10.00 individuals/sample) during the first year and (8.00 individuals/sample) during the second year. High significant positive correlations were found between predacious mites and phytophagous mites during the first year ($r = 0.886^{**}$) and the second year ($r = 0.869^{**}$).

Table 2. Population densities of phytophagous mites and their natural enemies on Pomegranate trees in Sidfa region

Months	Mean no. of mites and insects/25 leaves									
	2018-2019					2019/ 2020				
	Mean of Temp. °C	Mean of RH.	Phytophagous mites	Predacious mites	Predacious insects	Mean of Temp. °C	Mean of RH.%	Phytophagous mites	Predacious mites	Predacious insects
Nov.	20.23	36.7	10.00	2.00	1.50	22.27	40.60	15.50	3.50	2.50
Dec.	14.71	42.15	2.00	1.00	1.00	15.90	51.80	4.50	1.00	2.00
Jan.	13.16	36.00	0.00	0.00	0.00	14.32	53.80	0.50	0.00	0.00
Feb.	15.30	39.00	0.00	0.00	0.00	15.18	48.60	0.00	0.00	0.00
Mar.	18.68	30.20	0.00	0.00	0.00	20.10	34.40	0.00	0.00	0.00
Apr.	23.38	25.00	0.00	0.00	3.00	24.23	27.70	0.00	0.50	3.50
May	30.89	17.20	0.00	0.00	4.00	29.77	23.20	0.00	0.00	5.00
Jun.	33.03	23.00	5.00	1.50	6.50	32.12	22.26	7.00	1.00	6.00
Jul.	33.11	25.00	83.50	8.50	1.50	32.89	24.70	110.00	4.50	3.50
Aug.	32.44	26.00	149.00	11.50	10.00	32.92	25.50	192.00	12.50	8.00
Sep.	30.22	37.40	57.50	11.00	7.00	32.63	30.16	66.50	10.50	6.00
Oct.	27.95	35.40	31.00	7.50	2.50	27.40	32.20	38.00	5.00	3.00
(R)										
Predacious mites			0.886**					0.869**		
Predacious insects			0.666*	0.640*				0.638*	0.695*	
Mean of Temp. °C			0.589*	0.638*	0.750**			0.614*	0.624*	0.876**
Mean of RH.%			-0.184	0.004	-0.409			-0.415	-0.359	-0.752

(**) Correlation is significant at 0.01 level.

(*) Correlation is significant at 0.05 level.

Predacious insects gave significant positive correlation with phytophagous mites ($r = 0.666^*$ and 0.638^*) and predacious mites ($r = 0.640^*$ and 0.695^*) in the first and second years. Also, significant positive correlation was found among the temperature degrees, phytophagous mites ($r = 0.589^*$ and 0.614^*), Predacious mites ($r = 0.638^*$ and 0.624^*) and predacious insects ($r = 0.750^{**}$ and 0.876^{**}) during the two successive years. In significant positive correlation were recorded among R. H.(%) and the numbers of phytophagous mites, predacious mites and predacious insects.

Desiccation

The present results are in agreement with those obtained by Sathyan *et al.* (2018) they mentioned that, whitefly occurrence was positively associated with the maximum temperature on pomegranate whereas, negative relationship was observed with morning relative humidity. Rahmathulla *et al.* (2012) mentioned that, there was a significant negative correlation between the increase in temperature and the pest infestation. Suvash *et al.* (2018) surveyed six mite species belonging to the family Phytoseiidae on different fruit trees, namely *Euseius alstoniae*; *Euseius* sp; *Typhlodromus* sp, *Typhlodromips syzygii*; *Amblyseius largoensis* and *Scapulaseius asiaticus*. Also, Giuseppe *et al.* (2016) recorded two tenuipalpid mites (*Tenuipalpus granati* and *Tenuipalpus punicae*) and one eriophyoid mite (*Aceria granati*) on leaves of pomegranate in the Mediterranean area. The obtained data and statistical analysis showed high intra population variation ac-

ording to location. In Manfalut region the population densities of phytophagous mites were higher than in Sidfa region and the peak number was recorded in July with a mean of 629.50 and 696.00 individuals /25 leaves during the two years. While, the peak numbers of phytophagous mites in Sidfa region were recorded during August of both years with a mean of 149.00 and 192.00 individuals /25 leaves. This may be affected by the predacious mites and insects. The numbers predacious mites at Manfalut area were affected by the presence of the predacious insects during the two successive years. So, they were recorded with few numbers. Conversely, predacious mites were recorded with high numbers in Sidfa area during the two studied years, may be due mainly to the decrement of the number of predacious insects.

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حصر وتذبذبات عددية للأكاروسات نباتية التغذية وأعدائها الطبيعية في بساتين الرمان بمحافظة أسيوط

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الملخص

اجريت الدراسة الحالية لمدة عامين بداية من شهر نوفمبر عام ٢٠١٨ حتى نهاية شهر اكتوبر عام ٢٠٢٠ م. على ثلاثة بساتين رمان في منطقة منفلوط (شمال أسيوط) وثلاث بساتين رمان في منطقة صدفا (جنوب أسيوط)، لحصر الأنواع الأكاروسية نباتية التغذية ومفترساتها الطبيعية الأكاروسية والحشرية المتواجدة على اوراق الرمان، وكذلك دراسة التذبذبات العددية لها اثناء فترة الدراسة. حيث تم تسجيل ١٢ نوعاً من خلال الحصر. وهما نوعان من الأكاروسات نباتية التغذية التابعة لفصيله اللحم المبطن *Tenuipalpidae* واربعة انواع كمفترسات أكاروسية ثلاثة منهم ينتمون الي فصيله *Phytoseiidae* ونوع واحد فقط يتبع فصيله *Stigmaeidae*. كما تم تسجيل ستة مفترسات حشريه ينتمون الي ثلاث فصائل حشريه. الأكاروسات نباتية التغذية والمفترسات الأكاروسية والحشرية وجد ان لها قمة عددية واحده في الموسم خلال العامين المتتاليين. الأكاروسات نباتية التغذية سجلت اعلى زيادة عددية لها في منطقه منفلوط خلال شهر يوليو بمتوسط عددي قدره ٦٢٩,٥ فرد / ٢٥ ورقة في العام الاول و ٦٩٦,٠٠ فرد / ٢٥ ورقة في العام الثاني بينما سجلت الزيادة العددية لهذه الأكاروسات خلال شهر اغسطس بمنطقة صدفا بمتوسط عددي قدره ١٤٩,٠٠ فرد / ٢٥ ورقة في العام الاول، ١٩٢,٠٠ فرد / ٢٥ ورقة في العام الثاني. لكن المفترسات الأكاروسية والحشرية سجلت الزيادة العددية لها في شهر اغسطس في المنطقتين وخلال العامين. كما وجد من خلال التحليل الاحصائي ان هناك ارتباط معنوي بين درجات الحرارة واعداد كلا من الأكاروسات نباتية التغذية والمفترسات الأكاروسية والحشرية، بينما الرطوبة النسبية كانت غير مؤثره علي تعداد معظم الأنواع سواء نباتية التغذية او المفترسة (الحشرية والأكاروسية).