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Biodiversity and population dynamics of mites inhabiting date palm trees in Qalyubia and New Valley Governorates, Egypt

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Abstract

Incidence and population dynamics of mites inhabiting date palm trees were studied at two localities (Tanan village in Qalyubia and Paris oasis in the New Valley Governorate) from March to November during two seasons 2017-2018. Obtained results indicated that 22 mite species belonging to 21 genera under 15 families. These mites were classified according to their feeding habits into three categories: eight species are phytophagous mites (Tetranychidae, Tenuipalpidae, Eriophyidae and Phytoptidae), nine species are predacious mites (Bdellidae, Cheyletidae, Cunaxidae, Eupalopsellidae, Hemisarcoptidae, Phytoseiidae and Stigmaeidae), while the remaining five species are miscellaneous feeding behaviors (Acaridae, Tarsonemidae, Tydeidae and Oribatulidae). The date palm dust mite, *Oligonychus afrasiaticus* (McGregor) (Acari: Tetranychidae) has become an important pest of immature date palm fruits on Sewi variety in the New Valley Governorate. Whereas, *Raoiella indica* Hirst and *Phyllotetranychus aegypticus* (Sayed) (Acari: Tenuipalpidae) are an important pest on fronds on Zaghlol variety in Qalyubia Governorate. Results indicated that, the population dynamics of *O. afrasiaticus* started with attacks fruits at second week of April and reached its peak in mid June in the first year and in late of June in the second year on Sewi date palm variety. After that the mites migrate from fruits to fronds and weeds. The population density of phytophagous and predaceous mites as well as weather factors was studied at the two governorates. The dust mite, *O. afrasiaticus* and tenuipalpid mites and their relatives, were more dangerous mites; therefore, more studies were carried out. Recognize the time of the annual peaks of seasonal abundance for each phytophagous mite species, concerned with the time of starting the application of the suggested control program.

Introduction

Palms are one of the most important treasures in the Arab Republic of Egypt, which have been famous for their nutritional value in the oases and many agricultural areas of Egypt throughout the ages. Accordingly, Egypt is ranked in the first place among the date-producing countries in the world. Despite of Egypt's high rank in terms of date production that amounts to more than 1.7 million tons,

almost 21% of the world production estimated at eight million tons, its export contribution to the international Dates market is low. The strategy aims to raise date exports from 38 000 tons in 2016 to 120 thousand tons over the next five years (El-Sharabasy and Rizk, 2019).

Diseases and pathogen pests are causing great economic loss to the growers, reducing about 52% of the total yield (Sanad *et al.,* 2017). Date palm trees were observed to be severely affected by different injurious mites, which cause considerable damage and lead to economic losses (Taha *et al.,* 2019). In Iraq, *Oligonychus afrasiaticus* (McGregor) caused 50–80% yield loss of dates in years of dry, dusty and stormy weather (Al-Jboory and Al-Suaide, 2010). Many researchers were studied the population density of mites on date palm trees, the mites can be affected by different environmental condition and biotic factors (El-Halawany *et al.,* 2001; Idder and Pintureau, 2008; Aldosari, 2009; Palevsky *et al.* , 2010; Latifian, 2012; El-Sanady and Mohamed, 2013; Mesbah (2014) and Roshdy *et al.* 2018).

The present work aims to study the incidence and population dynamics of mites inhabiting date palm trees were studied at Qalyubia and New Valley Governorates, from March to November during two seasons 2017-2018.

Materials and methods

Two separate areas for date palm were selected for the study. The area for Sewi (semi dry) date palm variety at Paris Oasis in the New Valley Governorate, and Zaghlol (soft variety) at Tanan Village in Qalyubia Governorate. In each survey area, 20 palms (15 years old) were selected were chosen to survey the mites on palms. Samples were biweekly collected from March to November during two successive years 2017-2018. The sampling included random collection of 40 fronds and 100 fruits from each cultivar. The collected leaves of each cultivar were placed in individual paper bags. Mite specimens were collected from plants by direct examination under stereo–microscope and cleared in Nesbitt solution for about one hour after that, mounted on microscope slides in Hoyer's medium was used to set most mites on the slides (Jeppson *et al.,* 1975). For Eriophyoidea specimens were mounted on microscope slides in Keifer's F–medium (Amrine and Manson, 1996). Mounted slides were kept for 24hrs in electric oven at 45-60°C. The mites were identified with the help of a phase-contrast (Carl Zeiss, Germany); identification, using the world taxonomic literature. Mite specimens are deposited in the mite reference collection of Fruit Trees Acarology Research Department, Plant Protection Research Institute, Agricultural Research Center, Egypt.

Statistical analysis: Data were subjected to the statistical analysis Daily recorded minimum and maximum temperatures (°C) and average relative humidity (R.H%) prevailing in the area during the study were obtained from site http://www.wunderground.com. Simple correlation was used to correlate between weather factors and average monthly number of mites, using SAS statistical software (SAS Institute, 2003).

Results and discussion

1. Ecological studies:

1.1. Incidence:

Incidence of mites inhabiting date palm trees were carried out at two localities (Tanan village in Qalyubia and Paris oasis in New Valley Governorates)

from March to November during two seasons 2017-2018.

1.1.1. Phytophagous mites:

The phytophagous mites cause severe harmful of leaves and fruits. Mites feeding produce variable symptoms such as rusting, leaf chlorosis and malformation of flowering, severe infestations cause fruit distortion and orchard deterioration. The phytophagous mites included eight species representing by four families Eriophyidae, Phytoptidae, Tenuipalpidae and Tetranychidae. These families were recorded in Table (1).

Family Eriophyidae Nalepa, 1898.

This family was represented by one mite species, *Epitrimerus saudiarabis.* Wang *et al.* (2014) was collected vagrant on inner and outer fronds surfaces in moderate number from Qalyubia and New Valley. No damage to the host plant was observed. Similar results were obtained by Elhalawany *et al.* (2014).

Family Phytoptidae Murray, 1877.

This family was represented by one mite species, *Mackiella phoenicis* Keifer, 1939, was collected from inner fronds with moderate number of the two Governorates. This mite infesting inner fronds and buds, preferring folds of unopened central fronds of date palm, causing leaf-folds and rust similar results were obtained by Wang *et al.* (2014).

Family Tenuipalpidae Berlese, 1913.

Members of this family comprise four species, which were mostly infesting date palm trees, causing serious damage. Date palm red flat mite *Brevipalpus pheonicis* (Geijskes), infests fronds, bunches and fruits. It prefers the lower surface around the midrib as well as the places which are protected. By sucking the plant sap, the injured areas become pale, then change to rusty brown. This mite was recorded with low population in Qalyubia Governorate. The tenuipalpid mite, *Phyllotetranychus aegyptiacus* Sayed was recorded with high numbers on upper and lower surface of the fronds of the two Governorates. The incidence of red date palm mite, *Raoiella indica* Hirst was recorded with high numbers on upper and lower surface of the fronds of the two Governorates associated with *P. aegyptiacus* This mite appears as a reddening of the upper surface of the leaf, the reddened area may be either a small blotch or many such blotches that often encompass the entire leaf surface, eventually resulting in complete defoliation of affected trees these results agreement with finding by El-Halawany *et al.* (2001) . The flat mite, *Tenuipalpus eriophyoides* Baker was recorded with a high number at the New Valley Governorate. This mite species was found infesting date palm trees on the lower sides of leaves near the veins, causing a great damage and losses such findings coincide with that was found by Taha *et al.* (2019).

Family Tetranychidae Donnadieu, 1875.

Two species of tetranychid mites were recorded inhabiting date palm trees, the citrus brown mite *Eutetranychus orientalis* (Klein) was recorded with moderate number of upper fronds at two Governorates. This species feeding on the upper leaf surface produces a multitude of gray spots, which gives leaves a chlorotic appearance. The second species is the date palm dust mite, *Oligonychus afrasiaticus* (McGregor) was recorded with a high number in New Valley governorate on fruits and fronds. It attacks the dates from its early stages of development (kamry and khelal fruit stages), spinning its web around the date bunches and multiplies in large numbers, especially on Sewi and

Barhi date palm varieties. The first report of *Oligonychus* spp. as date palm common pests was in Kharga Oasis on Sewi semi dry variety (Saleh and Hosny, 1979); in North and South Sinai Peninsula (El-Kady, 1997); in allover governorate (El-Halawany *et al.,* 2001), in Sharq El-Owainat province from New Valley (Elhalawany *et al.,* 2017) and in Giza, Assiut, Matruh and the New Valley Governorates (Sanad *et al.* , 2017).

1.1.2. Predaceous mites:

The predaceous mites considered the most important agents of biological control of different phytophagous mites and insects. These mites helped to decrease the population of phytophagous mites and increase the yield of date palm orchard trees by limiting the infestation of injuries mites. Nine predacious mites species belonging to seven families and eight genera were registered (Table,2).

Family Bdellidae Dugès, 1834.

Spinibdella bifurcate Atyeo was recorded with moderate numbers on upper fronds at the two Governorates associated with scale insects and phytophagous mites.

Family Cheyletidae Leach, 1815.

One species, *Cheletogens ornatus* (Canestrini &Fanzago) was collected from fronds in the Qalyubia Governorate with moderate number associated with phytophagous mites and scale insect infestation.

Family Cunaxidae Thor, 1902.

Only one species, *Cunaxa capreolus* (Berlese) was detected in this family. It was found on fronds with rear numbers in the two Governorates associated with phytophagous mites and scale insects infestation.

Family Eupalopsellidae Willmann, 1952.

A single predator, *Saniosulus nudus* Summers, 1960 was recorded on fronds with moderate numbers in the two Governorates associated with scale insect**.**

Family Hemisarcoptidae Oudemans, 1904.

One mite species, *Hemisarcoptes malus* Shimer, were usually recorded in moderate numbers in association with scale insects infesting date palm trees in Qalyubia and New Valley Governorates.

Family Phytoseiidae Berlese, 1916.

Many species of the phytoseiid mites are, possibly ranked among the most effective predators of different phytophagous mites, including several serious pests of agricultural crops. The predator mite, *Amblyseius swirskii* (Athias–Henriot) was recorded with high numbers on fronds and fruits in Qalyubia and New Valley Governorates. While *Amblyseius cydnodactylon* (Shehata and Zaher) and *Euseius scutalis* (Athias–Henriot) were recorded with moderate numbers on fronds and fruits in Qalyubia and New Valley Governorates associated with phytophagous mites and scale insects on date palm trees.

Family Stigmaeidae Oudemans, 1931.

Members of this family are potential predators of various phytophagous mite species. *Agistemus exsertus* (Gonzalez) seemed to be the most important stigmaeid mite on date palm trees occurring in Qalyubia and New Valley Governorates. It was recorded in high numbers on the fronds.

1.1.3. Miscellaneous feeding habits:

During this study, five species belonging to five genera and five families were recorded in Table (3).

Family Acaridae Latreille, 1802.

The family Acaridae was represented by a single species *Tyrophagous putresentiae* (Schrank), which was moderate numbers found feeding on fungi from fruits and

fronds in Qalyubia and New Valley Governorates.

Family Tarsonemidae Kramer, 1877.

Tarsonemus stiffer (Ewing) was recorded in moderate numbers from fruits and fronds in Qalyubia and New Valley Governorates. This species was usually found in association with fungal growth.

Family Tydeidae Kramer, 1877.

Two mite species were found on palm trees belonging to family Tydeidae, *Pronematus ubiquitus* (McGregor) was recorded in high numbers of fronds and moderate numbers of fruits in the two Governorates. *Tydeus californicus* (Banks) was recorded with moderate numbers on fronds in the two Governorates. Individuals of this species were seen moving quickly on both sides of leaves and branches, usually in association with the tetranychid and tenuipapid mites.

Family Oribatulidae Thor, 1929.

A single species from this family, *Oribatula sayedi* (El Badry and Nasr) was recorded with moderate numbers on fronds and rear numbers on fruits in the two Governorates. Similar results were obtained by, El-Halawany *et al.* (2001) who collected 16 species of mites belonging to eleven families and classified according to their feeding habits to seven species plant feeders, six species predacious and three species of miscellaneous feeding habits. El-Sanady and Mohamed, 2013 recorded 37 mite species representing 31 genera, 17 families on date palm at Giza and Sohag Governorates. Mesbah (2014) recorded twenty-six mite species in 22 genera and 17 families were collected from date palm trees in the two Governorates, Giza and Sharkia. Roshdy *et al.* (2018) who recorded thirteen species in eleven genera belonging to nine families in Dakahleya and New Valley Governorates.

1.2. Population dynamics:

1.2.1. Population dynamics of phytophagous and predaceous mites on Sewi date palm variety in New Valley Governorate during 2017-2018.

1.2.1.1. Phytophagous mites:

The date palm dust mite *Oligonychus afrasiaticus* population:

The dust mite, *O. afrasiaticus* has become an important pest of immature date palm fruits on Sewi variety in the New Valley Governorate. This pest mite affects the fruits of palm trees during the growth and ripening stages as they suck the fruit juice, leading to stop fruit growth and destroying the crop (Figure,1). The population dynamics of *O. afrasiaticus* started with attacks fruits at second week of April during Kamry stages (characterized by the green color of fruits), and reached its peak at mid of June in the first year 2017 recorded 11450 individuals/100 fruits when maximum, minimum temperatures and averaged relative humidity were 40.9, 23.8°C and 17.2 %, and in late of June in the second year 2018 recorded 11330 individuals/100 fruits when maximum, minimum temperatures and averaged relative humidity were 43.1, 27.0°C and 13.8 %, respectively on Sewi date palm variety. After that the mites migrate from fruits to fronds during khelal stage (characterized by the yellow color of fruits). Whereas, *O. afrasiaticus* started with attacks fronds at the third week of May and gradually increased in number and reached its peak in mid August recorded 120 individuals/40 fronds when temperatures ranged 26.07-41.33°C and relative humidity averaged 21.0 % in the first year 2017, and in late of August 2018 in the second year recorded 133 individuals/40 fronds when the temperature ranged 40.14- 26.6°C and relative humidity averaged 20.8 % (Figure, 2).

Table (1): Incidence of phytophagous mites associated with date palm trees at Qalyubia and New valley Governorates.

Families	Species	Localities	Habitat and abundance
Tetranychidae	*Eutetranychus orientalis* (Klein, 1936)	Qalyubia & New valley	Fronds ++
	Oligonychus afrasiaticus (McGregor, 1939)	New valley	Fronds +++& fruits ++++
Tenuipalpidae	*Brevipalpus pheonicis* (Geijskes, 1936)	Qalyubia	Fronds +
	Phyllotetranychus aegyptiacus Sayed, 1938	Qalyubia & New valley	Fronds +++
	Raoiella indica (Hirst, 1924)	Qalyubia & New valley	Fronds +++
	Tenuipalpus eriophyoides Baker, 1948	New valley	Fronds +++
Eriophyidae	*Epitrimerus saudiarabis* Wang & Elhalawany, 2014	Qalyubia & New valley	Fronds ++
Phytoptidae	*Mackiella phoenicis* Keifer, 1939	Qalyubia & New valley	Inner fronds +++

+ = Low (1-4 individuals/fronds) ++ = Moderate (5-10 individuals/fronds +++ = High (more than 10 individuals fronds)

Table (2): Incidence of predaceous mites associated with date palm trees at Qalyubia and New valley Governorates.

Families	Species	Localities	Habitat and abundance
Bdellidae	*Spinibdella bifurcate* Atyeo, 1960	Qalyubia & New valley	Fronds ++
Cheyletidae	*Cheletogens ornatus* (Can. & Fan., 1876)	Qalyubia	Fronds ++
Cunaxidae	*Cunaxa capreolus* (Berlese, 1889)	Qalyubia & New valley	Fronds +
Eupalopsellidae	*Saniosulus nudus* Summers, 1960	Qalyubia & New valley	Fronds date ++
Hemisarcoptidae	*Hemisarcoptes malus* (Shimer, 1868)	Qalyubia & New valley	Fronds ++
Phytoseiidae	*Amblyseius swirskii* (Athias–Henriot, 1962)	Qalyubia & New valley	Fronds +++ & Fruits +++
	A. cydnodactylon (Shehata and Zaher, 1969)	Qalyubia & New valley	Fronds ++ & Fruits ++
	Euseius scutalis (Athias–Henriot, 1958))	Qalyubia & New valley	Fronds ++
Stigmaeidae	*Agistemus exsertus* (Gonzalez)	Qalyubia & New valley	Fronds +++

+ = Low (1-4 individuals/fronds) ++ = Moderate (5-10 individuals/fronds +++ = High (more than 10 individuals fronds)

Table (3): Incidence of mites of miscellaneous feeding habits associated with date palm trees.

Family	Species	Area	Habitat and abundance
Acaridae	*Tyrophagous putrescentiae* (Schrank, 1781)	Qalyubia & New valley	Fronds ++ & fruit +
Tarsonemidae	*Tarsonemus stiffer* (Ewing)	Qalyubia & New valley	Fronds ++ & fruit +
Tydeidae	*Pronematus ubiquitus* (McGregor, 1932)	Qalyubia & New valley	Fronds +++ & fruit ++
	Tydeus californicus (Banks, 1904)	Qalyubia & New valley	Fronds ++ & fruit +
Oribatulidae	*Oribatula sayedi* (El Badry & Nasr, 1974)	Qalyubia & New valley	Fronds ++ & fruit +

+ = Low (1-4 individuals/fronds) ++ = Moderate (5-10 individuals/fronds +++ = High (more than 10 individuals fronds)

Figure(1): Date palm dust mite *Oligonychus afrasiaticus* infestation symptoms.

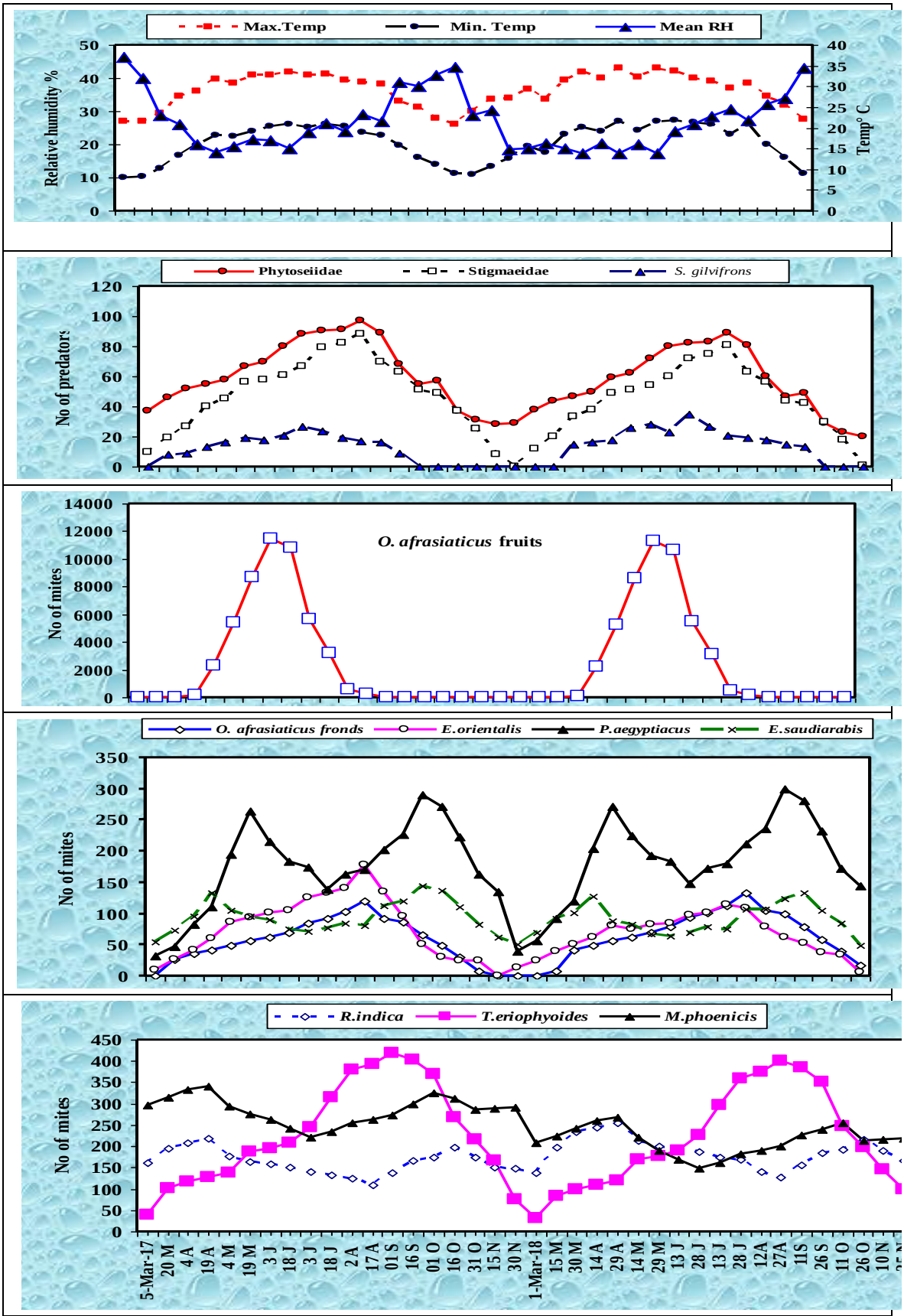

Figure (2): Population dynamics of phytophagous mites and predaceous on sewi date palm variety in New Valley Governorate during 2017-2018.

Statistical analysis present in Table (4) showed that, the temperature was non-significant positive correlation with the density of the population of *O. afrasiaticus* on fruits, during the two successive years, while on fronds it had a high positive correlation between the mite population and temperature. However, Relative humidity had non-significant negative correlation with the mite population during the two successive years of fruits, but on fronds in the first year this relation significant negative. These results indicated that the date palm dust mite prefers high temperature and low humidity.

The obtained results are in harmony with that detected by (Saleh and Hosny, 1979) who indicated that, the dust mite attacks the dates from their early stages of development, and dust collected in the webs plus the remnant of different developmental stages of the date dust mite affect the date bunches, giving them a dusty appearance. (El-Halawany *et al.* , 2001) who reported that the population date palm dust mite on dates begins to increase in June and Peak in July and August. (Negm *et al.,* 2015) who reported that *O. afrasiaticus* infests fronds and feeds on date palm on both sides, mainly along the midrib and at high infestation levels. In Saudi Arabia, *O. afrasiaticus* active from early March until mid october. Infestation usually starts around mid-May to June. Numbers of mites per 100 date fruits may reach it's maximum with 9095.5 mites at the end of July; the population then gradually decreases until the mid of october to an average of 124 mites/ 100 date fruits (Aldosari, 2009). Palevsky *et al.* (2010) indicated that, *O. afrasiaticus* was rarely found during winter and spring; it occurs on fronds only from late April until late August and maintains small populations in the summer, whereas very large numbers occur on the fruit strands, with a rapid increase during June–August, in most cases averaging much more than the 1000 mites per fruit strand. El-Sanady and Mohamed (2013) was collected *O. afrasiaticus* in moderate numbers on both Zaghloul and Sewi varieties in Giza and with high number in Sohag Governorate; the population of mites increasing during July and August. Roshdy *et al.* (2018) who collected *O. afrasiaticus* from date fruits in April and May, the highest peak was observed in June at Gamassa village from Dakahleya Governorate.

The citrus brown mite *Eutetranychus orientalis* population:

E. orientalis was recorded with moderate number of upper fronds on Sewi date palm at the New valley Governorate. Data illustrated from (Figure, 2) clearly showed that *E. orientalis* has one annual peak of seasonal abundance in mid August recorded 177 and 114 individuals/40 fronds when temperatures ranged 26.07-42.0 °C and relative humidity averaged 18.9 -19.25%, during the two successive years. After that, the population gradually decreased in number and the mite disappeared in late November in the first year.

Table (4): the correlation coefficient between temperatures, relative humidity and mite populations on sewi date palm variety in New Valley Governorate during 2017-2018.

Season	Parameters	Correlation coefficient values								Max. Temp	Min. Temp	Mean RH
		Eutetranychus orientalis	***Oligonychus afrasiaticus***	***O. afrasiaticus* fronds**	***Phyllotetranychus aegyptiacus***	***Raoiella indica***	***Tenuipalpus eriophyoides***	***Epitrimerus saudiarabis***	***Mackiella phoenicis***			
2017	Phytoseiidae	0.96***	0.52	0.95***	0.23	-0.55	0.71*	-0.03	-0.65*	0.91***	0.89***	-0.77*
	Stigmaeidae	0.93***	0.4	0.97***	0.47	-0.56	0.83**	0.18	-0.61	0.94***	0.96***	-0.76*
	S. gilvifrons	0.84**	0.75**	0.70*	0.03	-0.41	0.30	-0.23	-0.70*	0.78**	0.70*	-0.85***
	Max.Temp	0.90***	0.58	0.91***	0.51	-0.48	0.73*	0.19	-0.60	-	-	-
	Min. Temp	0.89***	0.51	0.92***	0.60	-0.54	0.82**	0.23	-0.62	-	-	-
	Mean RH	-0.79**	-0.63	-0.72*	-0.38	0.23	-0.44	-0.17	0.46	-	-	-
2018	Phytoseiidae	0.95***	0.68*	0.76**	0.63	-0.30	0.69*	-0.01	-0.58	0.90***	0.82**	-0.67*
	Stigmaeidae	0.97***	0.59	0.88***	0.64	-0.24	0.82**	0.17	-0.49	0.92***	0.93***	-0.58
	S. gilvifrons	0.86***	0.75**	0.71*	0.53	0.13	0.59	0.04	-0.52	0.85***	0.80**	-0.66*
	Max.Temp	0.90***	0.64	0.76*	0.63	-0.16	0.69*	0.14	-0.51	-	-	-
	Min. Temp	0.89***	0.50	0.90***	0.60	-0.22	0.82**	0.32	-0.40	-	-	-
	Mean RH	-0.62	-0.55	-0.24	-0.57	-0.32	-0.12	-0.08	0.25	-	-	-

Statistical data obtained from Table (4) showed that the mite population of *E. orientalis* had highly significant positive correlation with temperature (0.90*** and 0.89***) in the two successive years. The relative humidity was highly significant negative correlated in the first year (-0.79**) and non-significantly correlated (-0.62) in the second year. These results agree with El-Sanady and Mohamed, 2013 and Roshdy *et al.* 2018.

The tenuipalpid mite *Phyllotetranychus aegyptiacus* population:

The tenuipalpid mite, *P. aegyptiacus* Sayed was recorded with high numbers on upper and lower surface of the fronds of Sewi date palm at the New valley Governorates. The obtained data from Fig.(2) indicated that, it has two peaks, which were recorded in mid May and early october recorded 263 and 291 ind./40 fronds in the first year 2017, while, in the second year reached its peaks in mid May and in late october recorded 272 and 300 ind./40 fronds. The tenuipalpid mite appeared in few numbers on fronds in March and increased gradually to may but it had to decrease in number from June to August during the two successive years. Population density of *P. aegyptiacus* exhibited a positive correlation with temperature (0.51& 0.60, 0.63& 0.60), while relative humidity was non-significant negative correlated with the mite population (-0.38& -0.57), during the two successive years on Sewi date palm variety Table (4). These results are in accordance with that of El-Halawany *et al.* 2001; El-Sanady and Mohamed, 2013 and Roshdy *et al.,* 2018.

The red palm mite *Raoiella indica indica* population:

The red palm mite, *R. indica* appeared in low numbers in the summer months, it has two annual peaks were recorded in mid April and october 2017 (218 and 198 ind./40 fronds) when the temperature ranged between 16.7-34.6℃, and in late April and october 2018 (255 and 215 ind./40 fronds) when the temperature ranged between 17.7-35.5℃ Fig.(2). Statistical data obtained from Table (4) showed that, the population of *R. indica* had non-significant negative correlation with temperature (-0.48& -0.54 and -0.16& -0.22) in the two successive years. The relative humidity was non-significant positive correlated in the first year (0.23) and non-significant negative correlated (-0.32) in the second year. These results are in agreement with the finding by Mesbah (2014) who proved the abundant of this pest in the spring months and Roshdy *et al.* (2018) indicated that the red palm mite recorded the highest peak was recorded in May.

The flat mite *Tenuipalpus eriophyoides* population:

The flat mite *T. eriophyoides* mite appeared in few numbers on fronds in March and increased gradually to reached its peak in early September 2017 recorded 419 ind./40 fronds when the temperature ranged between 25.4-39.47℃, and relative humidity 19.07%, but it had to decrease in number from late october to November. While, in the second year 2018 it has one annual peak in late August recorded 400 ind./40 fronds when the temperature ranged between 26.6-40.1℃, and relative humidity 20.8% (Fig. 2). The flat mite, *T. eriophyoides* population was a highly significant positively correlated with temperature (0.73* and 0.82** and 0.69* and 0.82**), whereas, non-significant negative correlation between mite population and relative humidity(-0.44 and -0.12) during the two successive years, respectively (Table, 4) . Similar results were obtained by Roshdy *et al.* (2018) indicated that *T. eriophyoides* was recorded all over the year on the two surfaces of the frond but preferring the upper surface.

The eriophyid mite *Epitrimerus saudiarabis* population:

The eriophyid mite was recorded for the first time in Egypt by Elhalawany *et al.* (2014) in Giza Governorate and this study the first report the population of this mite. The eriophyid mite, *E. saudiarabis* mite appeared in few numbers on fronds in March. The obtained data from (Figure, 2) indicated that, it has two peaks, which were recorded in mid April and early october recorded 133 and 145 ind./40 fronds in the first year 2017 when the temperature ranged between 16.7-34.6℃ in April, and 22.7-38.1℃ in october, while, in the second year reached its peaks in the third week of April and second week of october recorded 128 and 132 ind./40 fronds. Population density of *E. saudiarabis* exhibited non-positive correlation with temperature (0.19& 0.23 and 0.14& 0.32), while relative humidity was non-significant negative correlated with the mite population (-0.17 and -0.08) during the two successive years, respectively on Sewi date palm variety Table (4).

Date palm bud mite *Mackiella phoenicis* population:

The eriophyid mite *M. phoenicis* was appeared on a base of inner fronds in March then increased in number. Two annual peaks of seasonal abundance on Sewi date palm variety were recorded (Figure, 2). The first peak of *M. phoenicis* in the third and fourth week of April recorded (340 and 267 ind./40 fronds) when the temperature ranged between 16.73-34.6℃ and 17.73-33.55℃, and relative humidity 20.8 and 16.36%, during the two successive years, respectively. The second peak was noted in early october in the first year and in the second week of october in the second year were (326 and 254 ind./40 fronds) when the temperature ranged between 22.7-38.1℃ and 26.0-38.5℃, and relative humidity 21.5 and 21.7%, during the two successive years, respectively. Statistical analysis of data showed that non-significant negative correlation occurred between mite population and temperature (-0.60 and -0.62 and -0.51 and -0.40), while non-significant positive between mite population and the relative humidity (0.46 and 0.25) during the two successive years, respectively. These findings are less similar to that detected by El-Halawany *et al.* (2001) who mentioned that *M. phoenicis* was recorded in high number on old fronds and buds in Behera, Alexandria, Kafre El-Shiech Governorates.

1.2.1.2. Predacious mite and insect population:

The phytoseiid mites *A. swirskii*, *A. cydnodactylon* and *E. scutalis* appeared on Sewi date palm variety trees in March during the two successive years. The predators have one annual peak in mid August recorded (97 and 89 ind./ 40 fronds), during two successive years, respectively. After that, the population gradually decreased till November during the two successive years (Figure, 2). Statistical analysis of the obtained data from (Table, 4), clearly demonstrated that the relationship between the predator mites population and density of the tetranychid mite *E. orientalis* was highly positively correlated (0.96***and 0.95***) during two successive years, respectively. However, the relationship between the phytoseiid mite population and the *O. afrasiaticus* on fronds was highly significant positively affected (0.95*** and 0.76**) during two successive years, respectively, while these relations in fruit non-significant positive (0.52) in the first year and significantly affected (0.68*) in the second year. The relationship between the phytoseiid mite population and the tenuipalpid mite, *T. eriophyoides* were significant positively affected (0.71* and 0.69*) during two successive years, respectively. Whereas, the relationship between the phytoseiid mite population and the two eriophyid mites *E. saudiarabis* and *M. phoenicis* had a negative effect during two years, As shown by correlation values, Correlation coefficient values (-

0.03 and - 0.01) and (- 0.65* and - 0.58) in the first and the second year, respectively. These results indicated that, the phytoseiid mites seemed to be important predators to suppress the population density of tetranychid and tenuipalpid mite population. These facts indicate that tetranychid and tenuipalpid mite prey probably plays an important part of the predator diet.

Statistical analysis present in Table (4) showed that, the temperature was a significant positive correlation with the density of the population of the phytoseiid mites (0.91***& 0.89*** and 0.90*** and 0.82**), while relative humidity had a significant negative correlation with the mite population (-0.77 and -0.67*) during the two successive years, respectively.

Data as shown in Table (4) and illustrated in Figure (2) showed that, the population density of the stigmatid mite, *A. exsertus* was recorded with low numbers in May and gradually increased in number and reached the maximum number in mid August during recorded (88 and 81 ind./40 fronds) the two successive years, respectively. Statistical analysis present in Table (4) showed that, temperature was a highly significant positive correlation with density of the population of the stigmaid mite, while relative humidity had significant negative correlation with the mites population in the first year but, non-significant negative correlation in the second year. These results agree with those of Elhalawany and Abou-Setta (2013) who found this predator had one peak in spring and decreased in November then disappeared in winter months; and they reported that it was widely distributed on guava associated with tenuipalpid mites. In addition, El-Sanady and Mohamed (2013) found this predatory mite in associated with pests infesting date palm varieties in Giza and Suhag governorates of zaghloul and sewi varieties as well as, it was recorded by Mesbah (2014) in Giza and Sharkeya.

The results in Table (4) and Figure (2) Clarified that, the ladybirds coccinellid predator, *Stethorus gilvifrons* (Mulsant) was recorded in mid March with a few numbers on Sewi date palm during seasons 2017 and in mid April in 2018. After that, the population gradually increased in mid May in both seasons 2017-2018. Then reach its peak during early July and mid July were 27 and 35 individuals/ 40 fronds at the temperature ranged between 25.6-40.93℃ and 24.29-40.36℃ and relative humidity 16.93& and16.06%, during the first and second year, respectively after that the population gradually decreased in number and disappeared in october. A highly significant positive correlation between the predacious insect density and temperature (0.78** and 0.90***), while, relative humidity had a significant negative correlation with the coccinelid predator population (-0.85*** and -0.66*) during the two successive years, respectively.

Statistical analysis of Table (4) data revealed that, highly significant positive correlation between the predacious insect density and the population fluctuation of tetranychid mites, *E. orientalis* (0.84** and 0.86***) and *O. afrasiaticus* (0.75** and 0.70*) in two seasons (0.74* to 0.95**); but non-significant positive between the predatory insect and both tenuipalpid mites, *P. aegyptiacus* and *T. eriophyoides* during two seasons (0.03 to 0.59), while these relation non-significant with predator *S. gilvifrons* and the two eriophyid mites during two seasons. These facts indicate that tetranychid prey probably play an important part of the predator insect diet.

These results are agreement with finding by Idder and Pintureau (2008) and Latifian (2012) showed that, natural enemies of *O. afrasiaticus* include predatory insects, such as the coccinellids *Stethorus punctillum* Weise, *S. gilvifrons* and phytoseiid mites.

1.2.2. Population dynamics of phytophagous mites and predaceous on zaghlol date palm variety in Qalyubia Governorate during 2017-2018.

The citrus brown mite *Eutetranychus orientalis orientalis* population:

The tetranychid mite, *E. orientalis* was recorded with moderate number of upper fronds on Zaghlol date palm at the Qalyubia Governorate. Data illustrated from (Figure, 3) clearly indicated that, *E. orientalis* has one annual peak of seasonal abundance in early August in the first year recorded 208 individuals/40 fronds and 175 ind./40 fronds in the second year. After that, the population gradually decreased in number till November. Statistical analysis of Table (5) showed that the mite population of *E. orientalis* had highly significant positive correlation with temperature (0.88*** 0.86***) in the two successive years. The relative humidity was non-significant negative correlated in the first year (-0.17) and non-significantly positive correlated (0.11) in the second year.

These results are in accordance with that of Singla (2001) who showed that fluctuations in the populations of *E. orientalis* on guava, in relation to climatic factors and the population of a predatory mite, *E. scutalis*, were investigated in Punjab.

The tenuipalpid mite *Phyllotetranychus aegyptiacus* population:

The flat mite, *P. aegyptiacus* Sayed was recorded with high numbers fronds of Zaghlol date palm at the Qalyubia Governorate. As shown in Figure (3) indicated that, it has two peaks, which were recorded in early June and early october recorded 268 and 296 ind./40 fronds in the first year 2017, while, in the second year reached its peaks in late May and late September recorded 301 and 329 ind./40 fronds. Population density of *P. aegyptiacus* exhibited a positive correlation with temperature (0.55 and 0.58, 0.59 and 0.0.67*), while relative humidity was non-significant negative correlated with the mite population (-0.25) in 2017 season and non-significant positive (0.23) in 2018 season Table (5).

The red palm mite *Raoiella indica* population:

The red palm mite, *R. indica* has two annual peaks were recorded in early May and late october 2017 (199 and 179 ind./40 fronds), and in late April and the second week of october 2018 (232 and 212 ind./40 fronds) Figure (3). Statistical data obtained from Table (5) showed that, the population of *R. indica* had non-significant negative correlation with temperature and relative humidity during two seasons.

The eriophyid mite *Epitrimerus saudiarabis* population:

The data as shown in (Figure, 3) showed that, the eriophyid mite it has two peaks, which were recorded in third week of April and early october recorded 126 and 138 ind./40 fronds in season 2017, while, in the second year 2018 reached its peaks in mid April and fourth week of September recorded 143 and 155 ind./40 fronds. Population density of *E. saudiarabis* exhibited non-positive correlation with temperature and while relative humidity during the two successive years Table (5).

Date palm bud mite *Mackiella phoenicis* population:

The eriophyid mite *M. phoenicis* has two peaks, which were recorded in third week of April and early october recorded 377 and 363 ind./40 fronds in season 2017, while, in the second year 2018 reached its peaks in mid April and fourth week of September recorded 340 and 326 ind./40 fronds. Statistical analysis of data proved that non-significant positive correlation occurred between the eriophyid mite population and both temperature and relative humidity during the two seasons Table (5).

Table (5): the correlation coefficient between temperatures, relative humidity and mite populations on zaghlol date palm variety in Qalyubia Governorate during 2017-2018.

Season	Parameters	Correlation coefficient values					Max. Temp	Min. Temp	Mean RH
		Eutetranychus orientalis	***Phyllotetranychus aegyptiacus***	***Raoiella indica***	***Epitrimerus saudiarabis***	***Mackiella phoenicis***			
2017	Phytoseiidae	0.15	0.79**	0.31	0.73*	0.12	0.39	0.33	-0.62
	Cheyletidae	-0.16	0.76*	0.24	0.82**	0.34	0.11	0.21	0.04
	Stigmaeidae	-0.55	-0.2	0.97***	0.46	0.57	-0.48	-0.58	-0.50
	S. gilvifrons	0.97***	0.25	-0.57	-0.29	-0.86***	0.88***	0.85***	-0.17
	Max.Temp	0.88***	0.55	-0.5	0.16	-0.64	-	-	-
	Min. Temp	0.84**	0.58	-0.061	0.22	-0.62	-	-	-
	Mean RH	-0.17	-0.25	-0.42	0.20	-0.07	-	-	-
2018	Phytoseiidae	0.14	0.82**	0.45	0.73*	0.12	0.43	0.38	-0.09
	Cheyletidae	-0.16	0.76**	0.30	0.80**	0.34	0.13	0.26	0.39
	Stigmaeidae	-0.39	0.12	0.82**	0.46	0.57	-0.38	-0.40	0.48
	S. gilvifrons	0.84**	0.23	-0.44	-0.29	-0.86***	0.78**	0.67	-0.10
	Max.Temp	0.86***	0.59	-0.34	0.16	-0.64	-	-	-
	Min. Temp	0.78**	0.67*	-0.44	0.22	-0.62	-	-	-
	Mean RH	0.11	0.23	-0.46	0.20	-0.07	-	-	-

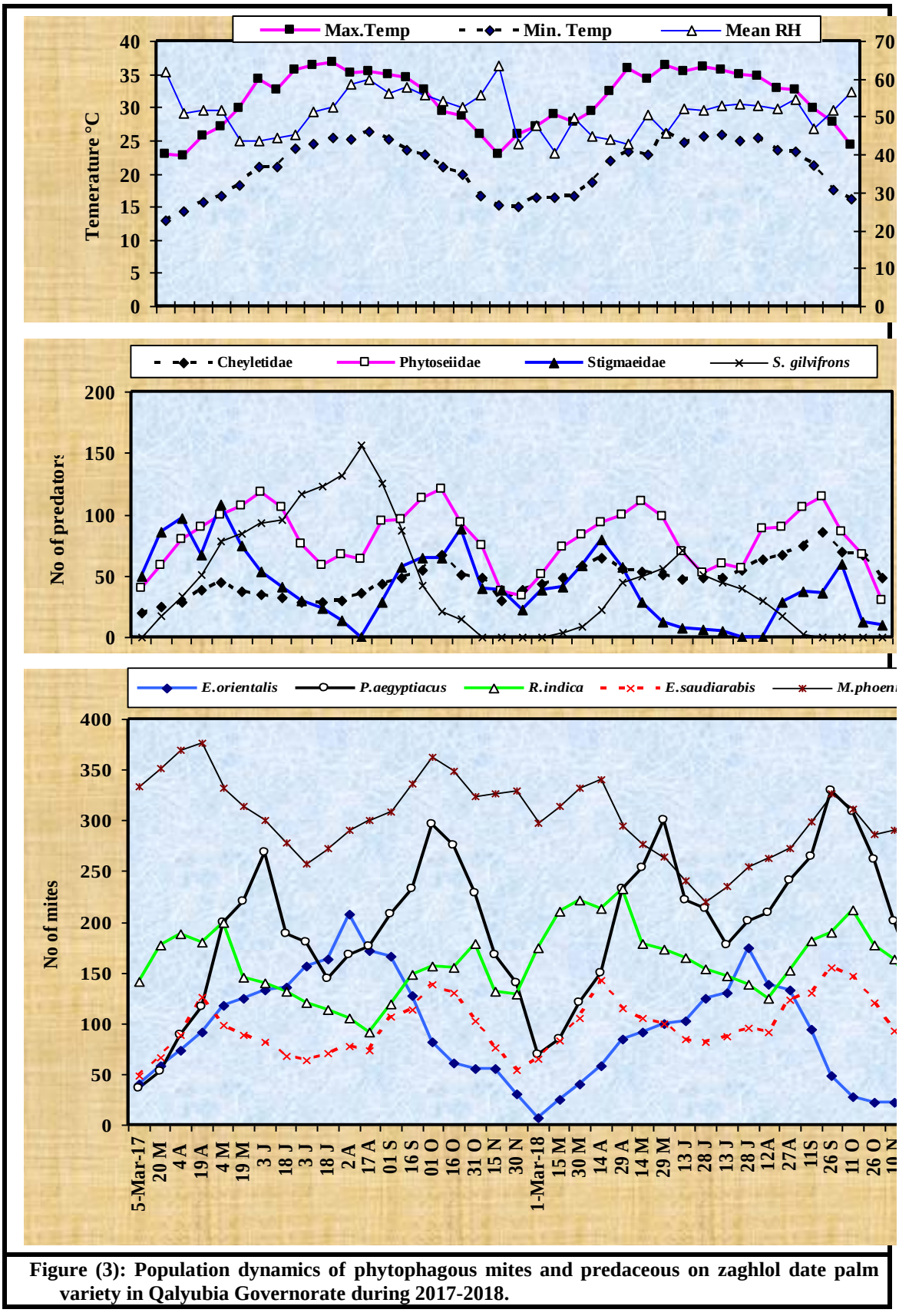

Figure (3): Population dynamics of phytophagous mites and predaceous on zaghlol date palm variety in Qalyubia Governorate during 2017-2018.

2.Predacious mite and insect population:

The predacious cheyletid mite population was appeared on fronds with low number early march and reached it's the first peak in early May 45 ind., and in late April 64 ind., and the second peak in mid october recorded 67 and 86 ind./40 fronds in the first and second season, respectively Figure (3). Statistical analysis of data indicated that, non-significant positive correlation occurred between the cheyletid mite population and both temperature and relative humidity during the two seasons Table (5). Also, the relationship between density of the population of the predator mite and *P. aegyptiacus* and *E. saudiarabis* was positive affected during two successive years.

The phytoseiid mites have two annual peaks in early June and mid october recorded 118 and 121 ind. In the first year, and in late May and mid october in the second year recorded (97 and 89 ind./ 40 fronds), respectively Figure (3). Statistical analysis in (Table, 5), indicated that, the relationship between the predator mites population and density of *P. aegyptiacus* and *E. saudiarabis* was a significant positive affected during two successive years. However, the relationship between the phytoseiid mite population and the *E. orientalis*, *R. indica* and *M. phoenicis* was positive affected during two successive years. These results indicated that, the phytoseiid mites seemed to be important predators to suppress the population density of phytophagous mite population. These results are in accordance with that of (Mukherjee and Singh, 1993) who showed that, the populations of *E. orientalis* were positively correlated with those of *E. scutalis*. *E. orientalis* was observed from July to September, and had a population peak in August at a median temperature of 28.18°C, RH of 81.39%, when the population of *E. scutalis* was also at its peak.

Data as shown in (Figure, 3) and Table (5), showed that, the stigmatid mite, *A. exsertus* has two peaks in early May and late october (108 and 121, 80 and 60 ind./40 fronds) during two seasons, respectively. Statistical analysis proved that, the relation between the stigmatid mite population and *R. indica* was a highly significant positive affected during two successive years (Table, 5).

The results in Table (5) and Figure (3) Showed that, the coccinellid predator, *S. gilvifrons* was recorded in spring with a few numbers on Zaghlol date palm during two seasons. After that, the population gradually increased and reached its peak in mid August 157 ind./40 fronds in the first season, and in late June recorded 71 ind./ 40 fronds in the second year, after that the population gradually decreased in number and disappeared in November. A highly significant positive correlation between the predacious insect density and temperature, while relative humidity had a non-significant negative correlation with the coccinelid predator population during the two seasons.

These results are agreement with finding by Payandeh *et al.* (2013) who found that, the population densities and spatial distribution pattern of *S. gilvifrons* were investigated in date palm orchards in Iran, and the highest population density of this predator on fruits and pinnae has been observed in the first half of August and the spatial distribution pattern of *S. gilvifronsis* a random distribution.

References

Aldosari, S.A. (2009): occurrence of dust mite, *Oligonychus afrasiaticus*

Meg. on fruits, leaflets of some date palm trees and evaluation the efficiency of botanical compound, (Biaco) as compared with some acaricides. Assiut University Bulletin for Environmental Researches, 12(2): 69–77.

Al-Jboory, I.J. and Al-Suaide, T.M. (2010): Effect of temperature on the life history of the old world date mite, *Oligonychus afrasiaticus* (Acari: Tetranychidae). In: Sabelis, M.W. and Bruin, J. (eds) Trends in Acarology: Proceedings of the 12th International Congress, 21–26 August 2006, Amsterdam. Springer, Dordrecht, the Netherlands, pp. 361–363.

Amrine, J.W.Jr. and Manson, D.C.M. (1996): Preparation, mounting and descriptive study of Eriophyoid mites. In: Lindquist, E.E., Sabelis, M.W. & Bruin, J. (Eds), Eriophyoid Mites. Their Biology, Natural Enemies and Control. World Crop Pests, 6, Amsterdam, The Netherlands: Elsevier Science Publishers, 383–396.

Elhalawany, A.S. and Abou-Setta, M.M. (2013): Mites inhibiting guava trees and their dynamics in relation to weather factors and plant phenology. Acarines, 7(2): 17-22.

Elhalawany, A.S.; Sanad, A.S. and Rakha, M.A. (2017): Field evaluation of date palm dust mite, *Oligonychus afrasiaticus* (McGregor) control on date palm trees in New Valley Governorate of Egypt. 12th Arab Congress of Plant Protection, Hurghada, Egypt, 4-10 November 2017, Egyptian Academic Journal of Biological Sciences F. Toxicology and Pest control, 9(3): 129-134.

Elhalawany, A.S.; Sanad, A.S. and Xue, X.F. (2014): Four new records of eriophyids and associated phytoseiids from Egypt. Acarines, 8(2): 1-8.

El-Halawany, M. E.; Abdel-Samad, M. A. and El-Naggar, M. E. (2001): Mites inhabiting date palms. Proc. Second International Conference on Date Palms, March 25–27, 2001, Al-Ain, UAE, pp. 366–373.

El-Kady, G.A. (1997): Mites associated with date palm trees in North and South Sinai Peninsula. 7th Nat. Conf. of Pest. and Dis. of Vegetables and Fruits in Egypt, pp.789-806.

El-Sanady, M.A. and Mohamed, A.A. (2013): Biodiversity and seasonal abundance of mites associated with two varieties of date palm in Giza and Sohag, Egypt. Acarines, 7(2): 57-62.

El-Sharabasy, S.F. and Rizk, R.M. (2019): Atlas of date palm in Egypt. Food and Agriculture Organization of the United Nations. , pp.544

Idder, M.A. and Pintureau, B. (2008): Effectiveness of the ladybird *Stethorus punctillum* (Weise) as a predator of the mite *Oligonychus afrasiaticus* (McGregor) in the palm plantations of the area of Wargla in Algeria. Fruits, 63: 85–92.

Jeppson, L.R.; Keifer, H.H. and Baker, E.W. (1975): Mites injurious to economic plants. University of California Press, Berkeley and Los Angeles, California, pp 614

Latifian, M. (2012): Voracity and feeding preferences of larvae and adult stages of *Stethorus gilvifrons* Mulsant. (Coleoptera: Coccinellidae) on larvae and adult

of *Oligonychus afrasiaticus* McGregor (Acarina: Tetranychidae). International Journal of Agriculture and Crop Sciences, 4:540–546.

Mesbah, A.E. (2014): Mites inhabiting date palm trees and their dynamics with reference to reproduction and life table parameters of *Raoiella indica* Hirst (Tenuipalpidae) at different temperatures. Acarines, 8 (1): 29-38.

Mukherjee, I.N. and Singh, J. (1993): Records of phytophagous mites and predatory mites associated with fruit plants in Uttar Pradesh. Journal of Insect Science (Ludhiana), 6: 13–136.

Negm, M.W.; De Moraes, G. J. and Perring, T. M. (2015): Mite pests of date palms. In: Wakil *et al*., (eds.), Sustainable pest management in date palm: Current status and emerging challenges, sustainability in plant and crop protection, pp 347– 390. Springer International Publishing Switzerland.

Palevsky, E.; Lotan, A. and Gerson, U. (2010): Evaluation of *Eutetranychus palmatus* (Acari: Tetranychidae) as a pest of date palms in Israel. Israel Journal of Plant Sciences, 58: 43–51.

Payandeh, A., Dehghan, A., Kamrani, R., Behzadi, N.M. and Yavarzadeh, M.R. (2013): Population abundance and seasonal activity of *Oligonychus afrasiaticus* (McGregor) and its predator *Stethorus gilvifrons* (Mulsant) in Bam region, Iran. Ecology, Environment and Conservation, 19(1): 225–231.

Roshdy, O.M.; Ameen, A.S.; Ghallab, M.M. and Hussein, A.M. (2018): Phytophagous and predacious mites of economic importance on date palms in Dakahleya and New Valley Governorates. J. Plant Prot. and Path., Mansoura Univ., 9 (11): 767 – 774.

Saleh, M. R. and Hosny, M. M. (1979): Observation on *Oligonychus* spp. occurring on date bunches (Acari: Tetranychidae). Ain Shams Univ. Res. Bull., 1014: 1–8.

Sanad, A.S.; Elhalawany, A.S.; Abou-Setta, M.M. and El-Katteb, H.M. (2017): Partial survey of date Palm dust mite, *Oligonychus afrasiaticus* (McGregor) in Egypt including historical trait. Acarines, 11: 53-55.

SAS Institute, (2003): SAS Statistics and Graphics Guide, Release 9.1.3. SASInstitute, Cary, North . Carolina 27513, USA.

Singla, N. (2001): Effect of weather factors and the predatory mite, *Amblyseius (Euseius) delhiensis* (Narayanan & Kaur) on populations of *Brevipalpus phoenicis* (Geijskes) and *Eutetranychus orientalis* (Klein) on guava. Pest Management and Economic Zoology, 9: 135–140.

Taha, H.A.; Mohamed, A.A. and Nasr, H.M. (2019): Biological and ecological studies on the flat mite *Tenuipalpus eriophyoides* (Acari: Prostigmata: Tenuipalpidae) infesting date palm trees in Egypt. Menufia J. Plant Protection, (4):83-91.

Wang, Q; Elhalawany, A. S.; Xue, X.F. and Hong, X.Y. (2014): New species and records of eriophyoid mites from Saudi Arabia (Acari: Eriophyoidea). Systematic and Applied Acarology, 19(4): 409-430.