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## Effect of some Ecological Factors on the Population of *Tetranychus Urticae* on Strawberry

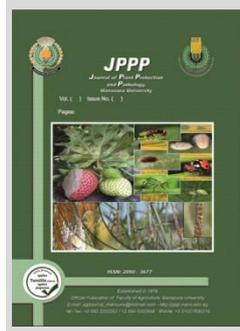


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### ABSTRACT

The experiment was conducted in Hemaïda ELsohby district , Qalubiya Governorate , Egypt, during two successive seasons( 2018-2019 and 2019-2020 )to study the effect of some ecological factors (Max ,Min Temperature ,Relative Humidity (RH) and plant age) on seasonal fluctuations of *Tetranychus urticae* in three strawberry cultivars (Fertona, Felorida and Festival). Results showed that the correlation was significant negative effects of maximum and minimum temperature on the seasonal fluctuations of *Tetranychus. urticae* movable stage for the three cultivars during both seasons. The correlation between relative humidity and the seasonal fluctuations of *Tetranychus. urticae* movable had insignificant negative effect stage for the three Cultivars, during the first season 2018-2019, but it had insignificant positive effect in the second season 2019-2020. Also, age of plant had significant negative correlation on the population of *Tetranychus urticae* in the two seasons.

**Keywords:** The red spider mite– strawberry- correlation- plant age- Temperature.

### INTRODUCTION

Strawberry (*Fragaria sp. L.*) is one of the most important exporting crops in Egypt is consider the fourth largest producer in the world of strawberry crop. It comes after the United States, Turkey and Spain by about 435.3 thousand tons in 2016. Egyptian Export statistics indicate that Egyptian strawberry exports were about 23.6 thousand tons in 2017 (Moussa *et al.* 2019). Strawberry is infested with many pests including *Tetranychus urticae* (Acari: Tetranychidae) which considered the main pest attacking strawberry plants (Selem *et al.* (2018). Weather factors play an important role in the life cycle of pests, so this work focus the attention to the effect of some ecological factors (temperature , humidity and plant age) on the population of *T. urticae*.

### MATERIALS AND METHODS

This study involved the seasonal fluctuation of the investigated pest in relation to certain weekly mean of the weather factors (Maximum temperature, Minimum temp., Mean relative humidity (R.H %) and age of plant, obtained from Hemaïda ELsohby district , Qalubiya governorate the previous factors were tested to clarify their simultaneous effects on the population dynamics of *T.urticae* infesting three cultivars(Felorida, Festival and Fertona) of strawberry during two successive seasons 2018 - 2019and 2019-2020.Seedlings of the three tested cultivars were transplanted at 17<sup>th</sup>of September in the two studied seasons. The three cultivars were arranged in a randomized complete block design with 3 replicates for each cultivar. Samples were collected weakly; 10leaves from each replicate were taken to counts the numbers of red spider mite *Tetranychus urticae* (movable stage). Weekly means of the weather factors (maximum temperature, minimum temperature, mean relative humidity) were obtained from the Meteorological station at Hemaïda ELsohby district, Qalubiya Governorate

#### 4-Statistical analysis:

The simple correlation and regression coefficient was performed to examine the effect of each independent factor

(temperature, relative humidity and plant age) on *T. urticae* population (dependent factors).

### RESULTS AND DISSCUSSION

#### 1-population of *T. urticae* on three strawberry cultivar:

##### Florida cultivar:

Data referred that the *T. urticae* began in a few numbers recorded two peaks in the 4<sup>th</sup> and 1<sup>st</sup> of Oct and Nov (2, 13.67/ 30 leaflet), then reduced in the next two weeks and suddenly increased recorded the third peak (98.67 individual/ 30 leaflet), population decreased gradually, during the first season 2018/2019. But in the second season the population of *T.urticae* was recorded the beigest number and three peaks were recorded, the beigest peak was 253.7 individual/30 leaflet on the fourth week of Feb. Numbers decreased suddenly during Mar, recorded no infestation. Fig(1)

##### Festival cultivar:

Population density of *T. urticae* began to appear in the first inspection in 3<sup>rd</sup> of Oct recorded 7.33 nymphs/ 30 leaflet, then began to reduce throughout the following three inspection, then numbers began to increased gradually reached to the highest peak in 3<sup>rd</sup> week of Jan recorded 99.67 individual/ 30 leaflet, during the first season 2018-2019.in the second season 2019-2020 the population was recorded high number of *T. urticae* ,and recorded the highest peak in the last week of Feb, recorded 348.33 individual/ 30 leaflet. Fig(2)

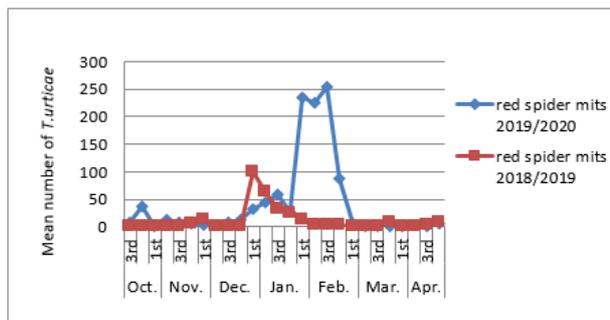
##### Fertona cultivar:

Data indicated that numbers of *T. urticae* began to appeared in a few numbers recording 0.67 individual / 30 leaflet in 3<sup>rd</sup> week of Oct, then numbers increased gradually recording the highest peak in 1<sup>st</sup> week of Jan recording 270 individual/30 leaflet, during 2018-2019 season.in 2019-2020 season the population was less than the first season.the biggest peak was recorded in in 2<sup>nd</sup>, week of Feb, recorded 103 individual / 30 leaflet .Fig(3)

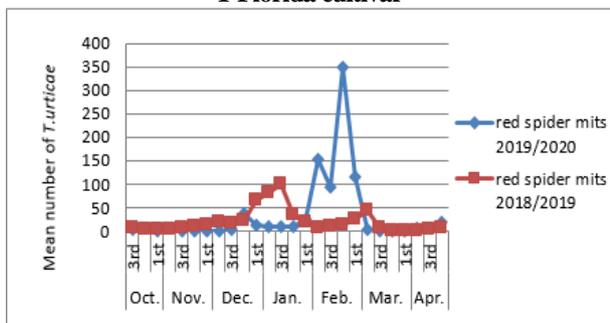
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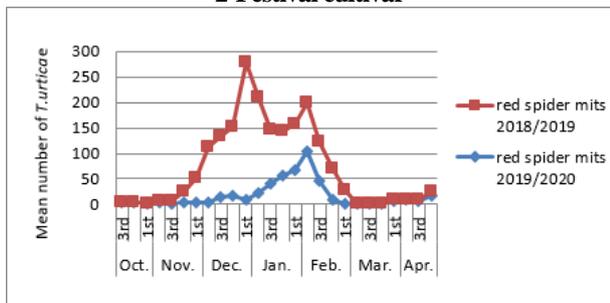
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1-Florida cultivar



2-Festival cultivar



3-Fertona cultivar

Fig. (1-3). Seasonal fluctuation of *T. urticae* on three strawberry cultivars during 2018 / 2019 & 2019/2020 seasons

Table 1. Correlation and partial regression values of the three main weather factors and biotic factors on movable stage of *T. urticae* and corresponding percentage plants of three Cultivars of strawberry in, Qalubiyah Governorate during 2018 - 2019 season.

| Cultivars | Factors           | Correlation coefficient "r" | P value of "T" at 0.05 | Regression coefficient b | S.E    | P       | Total interaction EV% | F value |        |       |
|-----------|-------------------|-----------------------------|------------------------|--------------------------|--------|---------|-----------------------|---------|--------|-------|
| Felorida  | T Max             | -0.66                       | 0.0018                 | -0.57                    | -      | 0.338   | 46.64%                | 4.73    |        |       |
|           | T Min             | -0.65                       | 0.0022                 | -0.57                    | 2.602  | 0.845   |                       |         |        |       |
|           | RH%               | -0.095                      | 0.697                  | -0.33                    | 2.87   | 0.59    |                       |         |        |       |
|           | Plant(Age 1-Age3) | -                           | -                      | -                        | 0.607  | 0.0047  |                       |         | 56.77% | 6.57  |
|           | Combind effect    | -                           | -                      | -                        | -      | 0.0006  |                       |         | 82.26% | 9.27  |
| Festival  | T Max             | -0.727                      | 0.0004                 | -4.32                    | -      | 0.1192  | 64.34%                | 9.02    |        |       |
|           | T Min             | -0.735                      | 0.0003                 | 0.17                     | 2.614  | 0.953   |                       |         |        |       |
|           | RH%               | -0.285                      | 0.2361                 | -1.16                    | 2.89   | 0.0749  |                       |         |        |       |
|           | Plant(Age 1-Age3) | -                           | -                      | -                        | 0.6099 | 0.0049  |                       |         | 56.55% | 6.51  |
|           | Combind effect    | -                           | -                      | -                        | -      | <0.0001 |                       |         | 87.80% | 14.39 |
| Fertona   | T Max             | -0.834                      | <.0001                 | -14.05                   | -      | 0.0439  | 70.35%                | 11.86   |        |       |
|           | T Min             | -0.77                       | <.0001                 | 1.82                     | 6.38   | 0.8003  |                       |         |        |       |
|           | RH%               | -0.012                      | 0.95                   | -0.85                    | 7.069  | 0.5761  |                       |         |        |       |
|           | Plant(Age 1-Age3) | -                           | -                      | -                        | 1.49   | <.0001  |                       |         | 80.13% | 20.16 |
|           | Combind effect    | -                           | -                      | -                        | -      | 0.0002  |                       |         | 85.85% | 12.14 |

T Max= Maximum temperature T Min= Minimum temperature RH= Relative humidity

**3-Relationship between values of the three main weather factors and age of plant of three cultivars of strawberry as biotic factors on *T. urticae* population during 2019 - 2020 season.**

Statistical analysis for the effects of the three selected abiotic factors, one biotic factors and age of plant on the population dynamics of *Tetranychus urticae* during 2019-

**2-Relationship between values of the three main weather factors and biotic factors on *T. urticae* population and corresponding percentage plants of three cultivars of Strawberry in, Qalubiyah Governorate during 2018 - 2019 season.**

Statistical analysis for the effects of the three selected abiotic factors, and age of plant on the population dynamics of *T. urticae* during both seasons at Qalubiyah Governorate are shown in Table(1). These results showed significant negative effects to maximum and minimum temperature on the seasonal fluctuations of *T. urticae* movable stage on three cultivars (Felorida, Festival and Fertona) season (2018 -2019), whereas "r" values were -0.66,-0.65, -0.72, -0.73, -0.83 and -0.77, respectively. Data cleared that, the mean percentage of relative humidity for Cultivars (Felorida, Festival and Fertona) had insignificant negative effect, whereas "r" values were -0.095, -0.285 and -0.012, respectively during (2018-2019) season. The combined effect of maximum, minimum temperature and the mean percentage of relative humidity factors as a group (E.V) showed responsible of 46.64%, 64.34%and 70.35 % effects on the population dynamics of *T. urticae* movable stage throughout 2018-2019 season, respectively. The results showed that the age of plant had significant negative effect in season, whereas "r" value was -0.60. The combined effect of the age plant factor (E.V) showed responsible of 56.77%, 56.55% and 80.13 % effects on the population dynamics of *T. urticae* movable stage throughout the season of 2018-2019, respectively.

The combined effect of maximum , minimum temperature and the mean percentage of relative humidity in addition age of plant factors as a group (E.V) showed responsible of 82.26% , 87.80%and 85.85 % effects on the population dynamics of *T. urticae* movable stage throughout 2018-2019 season, respectively.

2020 season at Qalubiyah Governorate are shown in Table (2). These results showed significant negative effects to maximum and minimum temperature on the seasonal fluctuations of *T. urticae* movable stage on Cultivars (Felorida and Fertona) in season (2019 -2020), whereas "r" values were -0.45, -0.444, -0.622 and -0.589, respectively. But found in Cultivar (Festival) showed that insignificant negative effects whereas "r" values

were -0.316 and -0.291, respectively. Data cleared that, the mean percentage of relative humidity for Cultivars (Felorida, Festival and Fertona) had insignificant positive effect, whereas "r" values were 0.270, 0.227 and 0.220, respectively during (2019-2020) season. The combined effect of maximum, minimum temperature and the mean percentage of relative humidity factors as a group (E.V) showed responsible of 28.76%, 15.75% and 44.87 % effects on the population dynamics of *T. urticae* movable stage throughout 2018-2019 season, respectively. The results showed that the age of plant had significant negative effect in season, whereas "r" value

was -0.60. The combined effect of the age plant factor (E.V) showed responsible of 70.67%, 57.18% and 75.35 % effects on the population dynamics of *T. urticae* movable stage throughout 2019-2020 season, respectively.

The combined effect of maximum, minimum temperature and the mean percentage of relative humidity in addition age of plant factors as a group (E.V) showed responsible of 77.78% , 66.34% and 77% effects on the population dynamics of *T. urticae* movable stage throughout 2019-2020 season, respectively.

**Table 2. Correlation and partial regression values of the three main weather factors and biotic factors on movable stage of *T. urticae* and corresponding percentage plants of three Cultivars of strawberry in, Qalubiyah Governorate during 2019 - 2020 season.**

| Cultivars | Factors           | Correlation coefficient "r" | P value of "T" at 0.05 | Regression coefficient b | S.E     | P      | Total interaction EV% | F value |
|-----------|-------------------|-----------------------------|------------------------|--------------------------|---------|--------|-----------------------|---------|
| Felorida  | T Max             | -0.45                       | 0.0526                 | -4.813                   | 9.956   | 0.6358 |                       |         |
|           | T Min             | -0.444                      | 0.0502                 | -2.547                   | 10.175  | 0.8057 | 28.76%                | 2.02%   |
|           | RH%               | 0.2709                      | 0.2619                 | 2.358                    | 1.77    | 0.2031 |                       |         |
|           | Plant(Age 1-Age3) | -                           | -                      | -                        | -       | 0.0003 | 70.67%                | 12.40%  |
|           | Combind effect    | -                           | -                      | -                        | -       | 0.0023 | 77.68%                | 6.96%   |
| Festival  | T Max             | -0.3162                     | 0.1863                 | -3.597                   | 9.786   | 0.7183 |                       |         |
|           | T Min             | -0.2911                     | 0.2266                 | -1.046                   | 10.0015 | 0.918  | 15.75%                | 0.93%   |
|           | RH%               | 0.2278                      | 0.3481                 | 1.7507                   | 1.7414  | 0.3307 |                       |         |
|           | Plant(Age 1-Age3) | -                           | -                      | -                        | -       | 0.0044 | 57.18%                | 6.68%   |
|           | Combind effect    | -                           | -                      | -                        | -       | 0.0207 | 66.34%                | 3.94%   |
| Fertona   | T Max             | -0.622                      | 0.004                  | -2.542                   | 3.042   | 0.4164 |                       |         |
|           | T Min             | -0.589                      | 0.0079                 | -0.94                    | 3.109   | 0.766  | 44.87%                | 4.07%   |
|           | RH%               | 0.2205                      | 0.3643                 | 0.695                    | 0.5414  | 0.2186 |                       |         |
|           | Plant(Age 1-Age3) | -                           | -                      | -                        | -       | <.0001 | 75.35%                | 15.28%  |
|           | Combind effect    | -                           | -                      | -                        | -       | 0.0026 | 77%                   | 6.72%   |

This results agree with Amaar *et al.* (2014) who showed that minimum, maximum temperature had significant negative effects on *T. urticae* population fluctuation during the second . While the mean relative humidity had insignificant positive effect in both seasons. Data agree with Nyoike and Liburd (2012) in USA, The divergence in mite population between the two growing seasons was attributed mainly to temperature differences between the two seasons that affected mite population development and establishment. Also, Selem *et al.*(2018)in Egypt. Showed that the relative humidity had insignificant positive and negative correlation with *T. urticae* activity. Abdelmaksoud (2021) in Egypt . Revealed that the relative humidity had insignificant positive effects on the population density of *T. urticae*

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## تأثير بعض العوامل البيئية على تعداد العنكبوت الأحمر في الفراولة

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### المخلص

تم إجراء التجربة في منطقة الصهبي في محافظة القليوبية خلال موسم الزراعة 2018-2019، 2019-2020 وذلك لدراسة تأثير بعض العوامل البيئية مثل (درجات الحرارة العظمى والدنيا والرطوبة النسبية) بالإضافة إلى عمر النبات على تعداد العنكبوت الأحمر على ثلاثة أصناف من الفراولة (الاستقال، الفرتونة، الطوريدا) وأظهرت نتائج الدراسة أن هناك ارتباط معنوي سالب بين درجات الحرارة العظمى والدنيا وتعداد العنكبوت الأحمر خلال موسم الدراسة على الثلاثة أصناف بينما وجد أن الارتباط غير معنوي سالب بين الرطوبة النسبية وتعداد العنكبوت الأحمر خلال موسم 2018-2019 بينما كان الارتباط غير معنوي موجب خلال الموسم التثني 2019-2020، كما أظهرت النتائج ارتباط معنوي سالب بين عمر النبات وتعداد العنكبوت الأحمر خلال موسم