Susceptibility of Four Watermelon Cultivars to Infestation with *Tetranychus urticae* Koch.


**Plant Protection Dept., National Research Center, 12622 Dokki, Giza, Egypt
**Zoology and Agric. Nematology Dept., Faculty of Agriculture, Cairo Univ., Giza, Egypt

E-mail: famasamir@hotmail.com and mahmoudmonir@yahoo.com

ABSTRACT

Experiments were conducted to estimate the susceptibility of four watermelon cultivars (Aswan, Daytona, Molokai and Giza-1) to infestation with *Tetranychus urticae* Koch and its population fluctuation during the two successive seasons, summer 2009 and early summer 2010 at Qalubia Governorate. Aswan cultivar was the most highly susceptible recording average of 42.86 and 57.59 mite moving stages/leaf during the two successive seasons, respectively, followed by the moderately infested cultivars (Daytona) recording 28.10 and 39.75 mite individuals during the two seasons, respectively. The lowest infestation was recorded on Molokai and Giza-1 cultivars, being 19.18 & 25.90 for the former and 18.10 & 25.94 for the latter cultivar during the two successive seasons, respectively. Susceptibility of watermelon cultivars to infestation with *T. urticae* may be affected by plant leaf morphological structure and its chemical contents. The number of trichomes/cm² leaf averaged 647.78, 744.44, 1111.11 and 1296.67 for Aswan, Daytona, Molokai and Giza-1 respectively, the less number of trichomes the more mite infestation. Positive relationships occurred between mite infestation levels and total amino acids, free amino acids, nitrogen and total soluble sugars in watermelon cultivars, while negative relationship found with tannins and nearly shown with total phenolic compounds, total flavonoids and total carotenes. Mite populations reached its peak during July and May in the first and second seasons, respectively, and infestation was lower in the first season than in the second, which might be due to early plantation.

Key Words: Susceptibility, Host plant resistance, watermelon cultivars, Population dynamics, *Tetranychus urticae*.

INTRODUCTION

Watermelon *Citrullus lanatus* L. (Family: Cucurbitaceae) is considered one of the most important vegetable crops in Egypt. It is usually infested with the spider mites, *Tetranychus urticae* Koch (Farrag et al., 1984), *T. cinnabarinus* Boisd. (Mansour and Karchi 1994), *T. kanzawai* Kishida (Morishita & Yano 1996), and the tarsenomid mite *Polyphagotarsionemus latus* Banks (Kousik et al., 2007).

Evaluation the susceptibility of some watermelon cultivars to infestation with *T. urticae* in order to select the most resistant ones is considered important to avoid using more pesticides. Chemical contents and morphological characteristics which normally vary from plant variety to another, may affect the population levels of herbivores. There are several studies on the host plant resistance to the infestation with *T. urticae*, Ahmed (1994), Tomezyk et al., (1996), Hanafy (2004), Lopez et al., (2005), Jyotika (2006), Ibrahim et al., (2008) and (Abdallah et al., 2009).

The present work was conducted to determine the level of infestation of four watermelon cultivars with the two spotted spider mite *T. urtica*, and its relationship with plant leaf morphological characteristics and certain chemical contents. The population dynamics of the mite throughout the two successive seasons; 2009 and 2010 was studied.

MATERIALS AND METHODS

Experimental procedures:
Four different watermelon cultivars; Aswan, Daytona, Molokai and Giza-1 were cultivated in open field during the two successive seasons (i.e. summer season 2009 and early summer season 2010). An area of 612 m² in Qalubia Governorate was chosen for these experiments. Watermelon cultivars were planted in the fourth week of April in season 2009 and the last week of January in season 2010.

For population dynamics of *T. urticae*, weekly samples, each of 20 leaves, were randomly collected from every watermelon cultivar from the fourth week of May till the last week of August (2009) and from the second week of March till the second week of June (2010). Leaf samples were examined for *T. urticae* occurrence.

Morphological and Biochemical Studies:
Imaging the bottom surface of the four watermelon cultivars leaves using the Scanning Electron Microscopic technique (SEM) (Joel GM 4200) was used at the Applied Center for Entomonematodes (ACE), Faculty of Agriculture, Cairo University. Samples for SEM technique were dehydrated in ethyl alcohol and dried using the critical point procedure, then individually affixed using double sided sticky tape, and sputter coated with gold palladium according to Fashing et al., (2000). Some specific chemical constituents of watermelon leaves were determined as follow: Acid
hydrolysis was carried out according to method of Bloch et al., (1958). Total free amino acids was carried out according to method of Chiang and Nip (1973). Total amino acids and free amino acids were determined according to the method of Etsushiro et al., (1981). Total phenols content were determined by the Folin-Ciocalteau method described by Meda et al., (2005). Total flavonoids content were determined by Folin-Ciocalteau method according to Hung & Morita (2008). Dried sample was extracted by boiling in 80% neutral aqueous ethanol for 6 h. Total soluble sugars were determined using the phenol-sulfuric acid method, according to Dubois et al., (1956). Total carotenoids were determined colorimetrically according to Holden (1965). Alkaloids were determined titrimetrically according to Sabri et al., (1973). Tannins were determined using vanillin hydrochloric acid method according to Burn (1971). Total nitrogen was determined according to the method of analysis, Association of Official Agriculture Chemists (1995). Chemical analysis was carried out during the growing season of the four watermelon cultivars in the second season 2010 during two periods peak and late season of infestation. Watermelon leaves were collected and transferred to laboratory and dried at room temperature & relative humidity then transferred to the Faculty of Agriculture Research Park, Cairo Univ. for chemical analysis.

RESULTS AND DISCUSSION

Susceptibility of different watermelon cultivars to *T. urticae* infestation:
The tested watermelon cultivars significantly *(P < 0.05)* differed in their susceptibility to *T. urticae* infestation except in case of Giza-1 and Molokai. (Table 1). During the two successive seasons (2009 & 2010), it could be arranged in a descending order as follows: Aswan highly susceptible (39.60% & 38.60%), followed by Daytona moderately infested (25.96% & 26.65%) and the lowest infested were Molokai and Giza-1 cultivars (17.72% & 17.36% and 16.72% & 17.39%) respectively.

Therefore, it could be concluded that all tested watermelon cultivars were variably infested with *T. urticae*. These results are in agreement with those obtained by, Tomeczyk et al., (1996), Edelstain et al. (2000), Castagnoli et al., (2003), Maklad (2004), Ibrahim et al., (2008) and Abdallah et al., (2009).

The relationship between morphological characteristics leaves and some phytochemical compounds of watermelon cultivars with *T. urticae* infestation level:
Susceptibility of watermelon cultivars to infestation with *T. urticae* may be affected by plant leaf morphological structure. Therefore the differences between the four watermelon cultivars, Aswan, Daytona, Molokai and Giza-1, leaf morphological structure were studied. Average number of trichomes/cm² leaf was 647.78, 744.44, 1111.11 and 1296.67 for Aswan, Daytona, Molokai and Giza-1 respectively. Also the shape and length of trichomes differed with watermelon cultivars. (Figs. 1 & 2). Length, thickness and density of leaf trichomes are considered to be factors that affect strawberry plant resistance to infestation with *T. urticae*. Afifi et al., (2009) and Ibrahim et al., (2008), stated that the Sudanian watermelon has thick hairiness leaves compared with those of Snake watermelon (hairy), whereas Squash leaves are nearly hairless.

One of the most important factors which play a role in the susceptibility of watermelon cultivars to *T. urticae* infestation is leaf phytochemical components. Obtained data indicated positive relationships occurring between mite infestation levels and total amino acids, free amino acids, nitrogen and total soluble sugars in watermelon cultivars, while negative relationship found with tannins and nearly shown with total phenolic compounds, total flavonoids and total carotenoids. (Table 2). These results are in agreement with those recorded by Tomeczyk and Kropczynska (1985), Tomeczyk et al., (1987), Aggour et al., (2001), Lopez et al., (2005), Jytika (2006), Korb (2007), Ibrahim et al., (2008), Abdallah et al., (2009) and Afifi et al., (2009).

Population dynamics of *Tetranychus urticae* on four watermelon cultivars:
Population dynamics of the two spotted spider mite, *T. urticae* were recorded during the summer season 2009 from the fourth week of May till the last week of August and during the early summer season 2010 from the second week of March till the second week of June.

During season 2009, the infestation of watermelon cultivars; Aswan, Daytona, Molokai and Giza-1 with *T. urticae* started from the 4th week of May then gradually increased to reach its peaks in the 3rd week of July for Aswan cultivar, and the 4th week for Daytona, Giza-land Molokai cultivars. Then gradually decreased till the end of the season. The peak recorded the highest level on Aswan cultivar, followed by Daytona, Molokai and Giza-1 (Fig. 3).

The numbers, of motile stages of *T. urticae/, leaf, for Aswan, Daytona, Molokai and Giza-1 cultivars averaged 10.10, 3.15, 6.50 and 3.20 at the beginning of infestation, respectively, then increased to 80.95, 55.55, 45.85 and 33.45 in peak of infestation, respectively.
Table (1): Susceptibility of four watermelon cultivars to *Tetranychus urticae* infestation during 2009 & 2010 seasons

<table>
<thead>
<tr>
<th>Watermelon cultivars</th>
<th>Mean number of <em>T. urticae</em> movable stages/leaf</th>
<th>Infestation %</th>
<th>Mean No.</th>
<th>Infestation %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean No.</td>
<td></td>
<td>Early summer season 2010</td>
<td></td>
</tr>
<tr>
<td>Aswan</td>
<td>42.86±7.35</td>
<td>39.60</td>
<td>57.59±11.29</td>
<td>50.69</td>
</tr>
<tr>
<td>Daytona</td>
<td>28.10±4.07</td>
<td>25.96</td>
<td>39.75±3.26</td>
<td>26.65</td>
</tr>
<tr>
<td>Molokai</td>
<td>19.18±3.71</td>
<td>17.72</td>
<td>25.90±4.12</td>
<td>17.36</td>
</tr>
<tr>
<td>Giza-1</td>
<td>18.10±2.24</td>
<td>16.72</td>
<td>25.94±5.31</td>
<td>17.39</td>
</tr>
<tr>
<td>LSD value at 0.05</td>
<td>3.50</td>
<td></td>
<td>6.65</td>
<td></td>
</tr>
</tbody>
</table>

Means with the same letter are not significant.

Fig. (1): Scanning electron microscopy of Aswan and Giza-1 watermelon cultivars trachoma.

Fig. (2): Scanning electron microscopy of Daytona and Molokai watermelon cultivars trachoma.
Table (2): Relationship between phytochemical components of four watermelon cultivars leaves and population of *Tetranychus urticae*

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Infestation</th>
<th>Mean of <em>T. urticae</em> movable stages</th>
<th>Phytochemical components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total amino acids (g/100g)</td>
<td>Total free amino acids (g/100g)</td>
</tr>
<tr>
<td>Daytonia</td>
<td>Peak</td>
<td>94.45 (27.61)</td>
<td>5.36 (4.61)</td>
</tr>
<tr>
<td></td>
<td>Late season</td>
<td>56.65 (27.84)</td>
<td>4.88 (4.21)</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>60.48 (22.62)</td>
<td>4.92 (3.71)</td>
</tr>
<tr>
<td>Giza-1</td>
<td>Peak</td>
<td>45.95 (22.03)</td>
<td>3.93 (3.11)</td>
</tr>
<tr>
<td></td>
<td>Late season</td>
<td>14.10 (6.92)</td>
<td>3.98 (2.71)</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>33.10 (22.47)</td>
<td>3.97 (3.61)</td>
</tr>
</tbody>
</table>

Fig. (3): Population dynamics of *T. urticae* Koch movable stages of four watermelon cultivars at during season 2009.

Fig. (4): Population dynamics of *T. urticae* Koch movable stages of four watermelon cultivars at during season 2010.
In early summer season 2010, the infestation of watermelon cultivars with *T. urticae* started on the 2nd week of March, then gradually increased to reach its peaks in the 3rd week of May for Daytona, Aswan and Molokai cultivars, while for Giza-1 cultivar it occurred in the 4th week of May. Thus, the population dynamics and number of *T. urticae* stages followed similar trend as in summer season 2009 (Fig. 4).

**ACKNOWLEDGMENT**

The authors are grateful to Dr. M. A. Zugher, professor of Acarology, Fac., of Agriculture, Cairo University for his great advices and reviewing the manuscript.

**REFERENCES**


Lopez, R.; Levi, A.; Shepard, B. M.; Simmons, A. M. and Jackson, D. M. 2005. Sources of


