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RESISTANCE IN CERTAIN CANTALOUPE *CUCUMIS MELO* L. CULTIVARS TO SOME SAP SUCKING PESTS IN EGYPT

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ABSTRACT

Field and laboratory studies were oriented to evaluate the relative resistance of three cantaloupe cultivars; Tenorio RZ, 62, and Ideal to some sap sucking pest; whitefly, *Bemisia tabaci* (Genn), onion thrips, *Thrips tabaci* L, aphid, *Aphis gossypii* (Glover) and two spotted spider mite *Tetranychus urticae* Koch. The results showed that the total number of pests were the highest on Tenorio RZ cultivar and the least on Ideal during two seasons. Ideal cultivar had the highest levels of alkaloids and phenolics compound, while terpene compounds was undetectable. Also, the results showed that Tenorio RZ cultivar was having the lowest least levels of secondary metabolites. During summer, numbers of sucking pests were the least on Ideal. Results showed also that the levels of plant secondary metabolites tend to decrease pest population levels.

Key words: Cantaloupe cultivars, sap sucking pests, secondary metabolites, *Bemisia tabaci, Thrips tabaci*, *Aphis gossypii*, *Tetranychus urticae*, alkaloids, phenolics, terpenes

Cantaloupe *Cucumis melo* L. (Fam. Cucurbitacae) is one of the world's most important vegetable cash crops (Numfez-Palenius et al., 2008). In Upper Egypt cantaloupe plants are commonly infested with several types of pests that endanger yields, namely: the cotton aphid *Aphis gossypii* (Glover), onion thrips *Thrips tabaci* L., whitefly *Bemisia tabaci* (Gen.) as well as the two-spotted spider mite *Tetranychus urticae* Koch. (Abdel- Rahman et al., 2016). Antibiosis-resistant plants may result in decreased insect survival, delayed insect growth time, decreased insect size, and decreased fitness of new generation adults (Sarfraz et al., 2006, 2007; Gogi et al., 2010). Host plant resistance is often based on a strong natural chemical defense that negatively influences the fitness and performance of herbivores. It can also act as a feeding deterrent (Hopkins et al., 2009). The present study was carried out to evaluate relative susceptibility of some cantaloupe cultivars to certain sap sucking pests. In addition, little is known about the secondary metabolites of cantaloupe crop.

MATERIALS AND METHODS

The present studies were conducted at the farmer fields in Dirout city, Assiut governorate, Upper Egypt during summer and Nile (fall) plantations of 2021. Field and laboratory studies were oriented with an area of about quarter feddan (1050 m^2) divided into 60 plots. Three varieties were sown (Tenorio, 62 and Ideal). All the recommended agricultural practices were performed. Weeds were removed by hand. Plants were sown in two plantations of 2021. In summer plantations the seeds were sown on 31^{st} of April, whereas Nile (fall) plantations were sown on 14^{th} of August. Sap sucking pests were examined and counted on leaves. Weekly 14th samples of ten plant leaves were collected and numbers of pest species counted and recorded. Analysis of plant secondary metabolites was carried out at the analytical chemistry unit (ACAL) of the Chemistry Department at Assiut University, Egypt. Secondary metabolites were extracted from cantaloupe leaves from each cultivar, after one month planting and five leaves of each cultivar were collected. The most juicy and healthy leaves were selected and were washed well prior to extraction. One gram of leaves from each cultivar was ground well, and then added 2.5 ml of chloroform and 0.5 ml of phosphoric acid to the ground leaves. The mixture was sonicated (the mixture injected in ultra sonic 104x instrument) for 15 min, and then centrifuged at 8,000 r.p.m. for 15 min. The clear chloroform layer was collected and injected in a gas chromatography instrument (GC/Ms) (7890A-5975B) in USA. Dominance (%) degrees of the identified species were calculated according to the formula of Facylate (1971). Susceptibility degrees of the cultivars were evaluated according to the Semeadah (1985) and Nosser

(1996). The cultivars could be categorized as follows:

1. Cultivars with higher infestation than (MN+UC) belong to the highly susceptible group (HS);
2. Cultivars with infestations ranging from MN to (MN+UC) belong to the susceptible group (S);
3. The relative resistant group (RR) consists of cultivars infestation less than MN to (MN-UC);
4. The moderately resistant (MR) cultivars: Cultivars with infestation levels ranging from (MN-UC) to (MN- 2UC); and 5. The resistant group (R) consists of cultivars with a low infestation rate (less than (MN-2UC). Data obtained were statistically analyzed by ANOVA conducted by F-test and means were compared according to Duncan's multiple range tests (Duncan, 1955).

RESULTS AND DISCUSSION

Four species of sap-sucking pests were found infesting cantaloupe plants. These species were: *B. tabaci*, *A. gossypii*, *T. tabaci,* and *T. urticae*. Table 1 showed that during summer regardless of the cultivars, the whitefly, *B. tabaci* was dominant (94.08%). On the other hand, *A. gossypii* and *T. urticae* was dominant degrees (1.91% and 2.92%) suggesting that these species could be economically valuable if environmental conditions switched in their benefit. Furthermore, *T. tabaci* (1.09%) may have a little role as a pest in cantaloupe during summer plantations. In the Nile (fall) plantations, data showed that *B. tabaci* is the most important (88.44%). The relatively high dominance of *A. gossypii* and *T. urticae* (1.89% and 6.55%) suggests that if environmental conditions changed in their favour, these could become economically important. On the other hand, *T. tabaci*, is of minimal importance due to its low dominance and abundance (3.12%). In general, regardless of two plantations (summer and Nile), whitefly, *B. tabaci* is the most important pest.

In summer plantations, maximum population level of the pests (503 individuals/ 10 leaves) was recorded on the cultivar of Tenorio RZ followed by 62 (357 individuals/ 10 leaves) wherase, cultivar Ideal had the lowest number (247 individuals/ 10 leaves). In the Nile plantations, cultivars of Tenorio RZ and 62 6 harbored the highest number of the pests (1703 and 1197 individuals/ 10 leaves, respectively). Ideal harbored the lowest number of the pests (658 individuals/ 10 leaves). Thus, Tenorio RZ was highly susceptible (HS) and 62 as well as Ideal Relative resistance (RR) of the remain pests during the two plantations. The mean numbers of the pests ten leaves during the growing seasons were subjected to evaluate and arrange the infestation rank. ANOVA of susceptibility of the cultivars to pest infestation revealed highly significant differences among the cultivars. In conclusion, resistant cultivars sometimes provide a vital management component in the cantaloupe plants. Resistance in a plant may be due to antixenosis, antibiosis and tolerance, or a combination of these components (Painter, 1951). The resistance or susceptibility of plants to insect attack is the result of their having inherited qualities that determine the extent of insect damage.

The analysis of cantaloupe leaves revealed that the leaves contain three groups of secondary metabolites: alkaloids, terpenes and phenolic compounds (Table 3). Except Ideal cultivar, all the cultivars contained terpenes. The highest concentration of alkaloids was detected in Ideal, followed by 62, and lastly by Tenorio RZ (which contained the lowest levels). The highest levels of phenolic compound was found in Ideal (2.63%), followed by 62; and no phenolic compounds were detected in Tenorio RZ cultivar.

The current study revealed that four species of pests attacked cantaloupe plants; *B. tabaci*, *A. gossypii*, *T. tabaci*, and *T. urticae*. (El-Dabi, 1999; Amro, 2008;

Table 1. Pests infesting cantaloupe cultivars (summer and Nile plantations, Assiut, Egypt, 2021)-Numbers/ 10 leaves and dominance degrees (%)

Pests	Growing plantations							
	Summer				Nile			
	Tenorio RZ	62	Ideal	Total	Tenorio RZ	62	Ideal	Total
A. gosypii	16b	9b	6b	21b	114b	60b	0d	174b
T. tabaci	4b	4b	4b	12b	63	46b	2c	111b
B. tabaci	469a	331a	232a	1032a	1406a	1031a	603a	3040a
T. urticae	14b	13b	5b	32b	120b	60b	53b	233b
Total	503	357	247	1097	1703	1197	658	3558

*Numbers followed by the same letter vertically not significantly different (p=0.05)

Table 2. Susceptibility Index (S. I) of cantaloupe cultivars to sap sucking pests (summer and Nile plantations, Assiut, Egypt, 2021)

Pests	Growing plantations					
	Summer			Nile		
	Tenorio RZ	62	Ideal	Tenorio RZ	62	Ideal
A. gosypii	RR	RR	RR	RR	RR	RR
T. tabaci	RR	RR	RR	RR	RR	RR
B. tabaci	HS	HS	HS	HS	HS	HS
T. urticae	RR	RR	RR	RR	RR	RR

HS= Highly susceptible S= Susceptible RR= Relative resistant

Table 3. Alkaloid compounds in cantaloupe cultivars (leaves)

Cultivars	Alkaloid compounds					
	Alkaloids	Value (%)	Terpene	Value (%)	Phenolic	Value (%)
Tenorio RZ	2,6-dimethylmorpholine	1.52	Squalene	4.68	Non	----
	3-(perhydro-2,5-dioxoimidazo[4,5-d] imidazole-1-yl)-propanoic acid	0.54				
62	hydroxy-2-(methylamino)ethyl]1.2-benzenediol l	0.219	Farnesol	1.056	4-(2-Amino-1-hydroxypropyl)phenol	1.45
	Isobutyl urea	0.338	Squalene	4.68		
Ideal	Cyanoacetyl urea	1.86				
	Cyanoacetyl urea	2.24			2[(Dimethylamino)methyl] -4-methoxy-phenol	2.63
	1-Hydroxy-2-o-fluorophenyl-4-nitroimidazole-3-oxide	3.07				
	1-(1-Oxooctadecyl)-1H-imidazole	1.10				
	2-(4-fluoro-1H-imidazole-5-yl) ethylamine	0.18				
	Alpha-methyl-beta-oxo-2-pyridinepropanoic acid ethyl ester	2.41				

Metwally et al., 2013; Abou-El-Saad, 2015). Three groups of secondary metabolites were investigated: alkaloids, terpenoid, phenolic compounds. These metabolites are non-nutritive chemical compounds whose distributions are restricted to the plant species (Shyaula and Manandhar, 2021). Secondary metabolites are molecules produced by plants that serve as defense agents against herbivores and microbes; and types such as alkaloids, terpenoids, phenolics, quinones, polyacetylenes, and peptides are very structurally diverse (Wink, 2003). The same results have been observed by other researchers who reported that secondary metabolites such as alkaloids, phenolics, and terpenoids aid plants in defending against herbivores and disease-causing microorganisms (Tang et al., 1995; Meijden, 1996). The composition of secondary metabolites is not fixed; rather, they vary in both composition and concentration (Wink, 2003). The present results are consistent with this view, i.e., different concentrations of secondary metabolites were found among three different cultivars of cantaloupe.

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CONFLICT OF INTEREST

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AUTHOR CONTRIBUTION STATEMENT

All authors equally contributed.

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