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**INFESTATION DENSITIES OF *APHIS GOSSYPHII* GLOVER AND ITS
 EFFECT ON CERTAIN CHEMICAL COMPONENTS OF FIVE
 SUSCEPTIBLE HOST PLANTS BELONGING TO THREE DIFFERENT
 PLANT FAMILIES AT QALYOUBIA GOVERNORATE – EGYPT
 BY**

**El-Dessouki, S.A. *; El-Ansary, M.K. *; El-Sayed, H.A.M. **
 and Khalil, A.A.H. ****

* Plant Protection Dept., Fac. Agric. Al-Azhar University.

** Plant Protection Res. Inst., ARC, Minist. Agric., Dokki, Giza-Egypt.

ABSTRACT

Studies carried out at Mostoured area, Qalyoubia Governorate to follow up population density of the cotton aphid, *Aphis gossypii* Glover, on five field hosts, e.g., cotton; okra; cucumber; aubergine and squash, throughout two summer growing seasons of 2003 and 2004. Results showed highly significant difference between weekly mean numbers of cotton aphid population infesting the five hosts, and therefore could be arranged in descending order according to their response to aphid infestation level as follows: okra plants (196.23 aphids /10 inch²); < squash (142.10 insects); < cotton (90.25 insects); < cucumber (78.60 insects) and < aubergine (54.62 insects /10 inch²).

The relation between cotton aphid, *A. gossypii*, populations on five host plants and phytochemical components of their leaves, were studied at six growth periods (56, 91, 105, 126, 140 and 154 days plant old). Data exhibited positive correlation and significant relationship detected between aphid populations and percentage of total carbohydrates in okra and squash leaves; while this relation being positive but insignificant in cotton leaves. On contrary, the correlation appeared negative and statistically insignificant in the case of cucumber and aubergine. Data also, revealed inconsistency clear correlation between the cotton aphid infestation and each of soluble and reducing sugars and total protein in plant leaves. Aphid infestation levels on the five host plants was negatively correlated with total ash contents and statistically insignificant. The higher reduction in ash content was recorded in cotton by 28.75 %, while the lower host affected by aphid infestation being in okra plants by reduction of about 11.80 %. The other hosts i.e., cucumber, aubergine and squash were gave intermediate position in their acceptability to cotton aphid infestation.

INTRODUCTION

The cotton aphid, *Aphis gossypii* Glover, is an important insect pest of several agricultural field crops that feeding on plants in 25 plant families. Among these, cucurbit vegetables, it could be a serious pest on squash, cucumbers, cantaloupes and watermelons (Habib and El-Kady, 1961). Other vegetables crops seriously affected are okra, eggplant, asparagus and pepper (Capinera, 2001). Principle other important crops injured regularly are cotton, hibiscus and citrus (Moursi *et al.*, 1985). In North Delta, Middle and Upper Egypt, cotton and okra are an

important hosts, which explains the first name "Cotton aphid". This species of aphid feed on the underside of plant leaves, or on growing tip of plants, sucking nutrients from the plant. The foliage may become chlorotic and die prematurely. Their feeding also causes a great deal of distortion and leaf curling, hindering photosynthetic capacity of the plant fruit (Panchabhavi *et al.*, 1990). In addition, they secrete a honeydew which provides a substrate for growth of sooty mold, so the quality of cotton lent may be impaired and the photosynthetic capacity of foliage further hindered (Abdallah, 1997). The nature of damage caused by cotton aphid varies seasonally with growth stage of the plant (Abd-El-Wahab, 1998). Generally, large numbers of aphids feeding on young plant leaves can have a debilitating effect on cotton growth. Therefore, the growers may need to adopt a more intensive approach to monitoring and controlling this pest, especially when yield losses can be occurred (Shawki, 1968).

Investigations on plant sap, and on honeydew, were carried out by (Reese, 1981) to determine the nature of the food material ingested by aphids, its source in the plant, and the utilization of its component parts. The information gained may be used in designing artificial diets for further study of feeding relations, in understanding firstly the damage reflected on plants and the secondly reasons for host plant choice. Also, the phytochemical compositions of the host plant are of the most important factors, that govern the relationships between pests and their host plants.

The present investigation was carried out to study the population of cotton aphid, *A. gossypii* Glover, on different host plants throughout two successive years 2003/04 and 2004/05 at Qalyoubia Governorate, Delta Region of Egypt. Also, to find out the correlation between the results obtained on population and the phytochemical contents of which, total carbohydrates, soluble carbohydrate fractions: reducing and non-reducing sugars, total proteins and ash in fresh leaves of five host plant species belongs to three different plant families. It is hoped that this study may add a new information about the interrelationships between this serious insect pest and certain host plants infested with it. That could be leads to good programs for controlling this insect.

MATERIALS AND METHODS

A field experiment was conducted at the Mostourod Experimental Farm, Faculty of Agriculture, Al-Azhar University at Qalyoubia Governorate, Delta Region Egypt. The chosen experimental area was divided into twenty equal plots. Plot size was 6 x 7 m = 1/100 feddan. In summer plantation of 2003 and 2004, area cultivated with five of the known host plants of *Aphis gossypii*, in the first week of April. The investigated five host plant species belonging to three plant families were: Fam. Malvaceae: cotton (*Gossypium barbadense*) var. Giza 85 and okra (*Hibiscus esculentus*) var. Golden coast; Fam. Cucurbitaceae: cucumber (*Cucumis sativus*) var. Beta Alpha and squash (*Cucurbita pepo*) var. Eskandrany and Fam. Solanaceae: aubergine (*Solanum melongena*) var. Black-Beauty. The experimental design used was the complete randomized block with four replicates to each host plant tested. All the experimental plots received the same agricultural practices without any pesticide treatments during the whole experimental period. Two weeks after sowing date,

population study of *A. gossypii* on the five investigated host plants started under field conditions until harvesting time of each host plant. Regular weekly samples were carried out (early in the morning at 8 a.m.). From each plot, four seedlings or plants were randomly selected and 3 leaves were chosen from each plant at three different levels; i.e., upper, middle and lower levels. Mean aphids of the four replicates were worked out to represent the population density. Also, Aphids were counted on one square inch on the same three leaves per plant for the five tested hosts to represent the population density of cotton aphid per unit area on each host for comparing the general infestation level by the 5 tested hosts. The actual counting method WAS adopted after Hafez, 1964.

To find out the relationship between host leaf phytochemical components and *Aphis gossypii* infestation. Forty-eight leaves un-protected and protected against aphids were selected from each host at age of 8 to 22 weeks after sowing date. The collected leaves were picked, washed by distilled water, weight and quickly dried between filter papers to remove the excess of water. At the Central Laboratory of Faculty of Agriculture, Moshtohor, Benha University. The fresh weight for each host plant species was determined, then leaves were put in a drying oven at 70 °C, for 24 hours. The dry powder of leaves of the five host plants was stored in glass bottle to estimate the carbohydrate, crude protein, reducing and non-reducing sugars. Carbohydrates was determined according to the method of Adasimaf (1987); while those of soluble carbohydrate fractions: reducing and non-reducing sugars as described by Shaffer and Hartman (1921) and modified by Said (1945) technique's. All the obtained results were statistically analyzed according to completely randomized block design. The analysis of variance ("F" test) and L.S.D. values at 5 %, were calculated after Snedecor and Cochran, 1980. The reduction percentages in chemical components of plant leaves of the five tested hosts as a result of aphid infestations were calculated. Total carbohydrates; soluble carbohydrate fractions: reducing and non-reducing sugars; total protein and ash values were determined in protected plant leaves (control) and compared with those in infested plants by adopting the Henderson and Tilton equation (1955).

RESULTS AND DISCUSSION

I- Relative Susceptibility of Five Summer Hosts to Cotton Aphid, *Aphis gossypii*, Infestation:

The population density averages (as mean number of aphids per 10 inch²) of cotton aphid *Aphis gossypii* infested cotton, okra, cucumber, aubergine and squash plants throughout the two summer growing seasons of 2003 and 2004 were shown in Table (1). Statistical analysis of the obtained data showed a significant difference between the means of aphid population per 10 inch² throughout the twelfth successive counts. Accordingly, the investigated five hosts could be classified, based on their response to cotton aphid infestation under field conditions into three main groups. The first one contains okra plants (196.23 aphids /10 inch²). The second group contains squash host (142.10 insects). The third group characterized lower aphid infestation and comprised cotton, cucumber and aubergine were 90.25, 78.60 and 54.62 insects /inch², respectively (Table 1).

Table (1): Weekly mean numbers of cotton aphid, *Aphis gossypii* per 10 inch² of the five tested summer host Plants throughout the two successive seasons of 2003 and 2004, at Mostourod area, Qalyoubia Governorate.

Inspection Date	Mean number of aphids per 10 inch ² on indicated summer host plants				
	Cotton	Okra	Cucumber	Aubergine	Squash
3 rd . May	21.60	4.97	63.61	12.20	50.22
4 th . May	32.40	35.53	96.23	20.41	76.79
1 st . June	43.20	69.12	92.34	25.16	109.19
2 nd . June	20.63	88.67	102.60	38.12	160.70
3 rd . June	30.02	159.62	107.03	54.54	250.88
4 th . June	33.48	162.43	96.23	92.99	208.33
1 st . July	51.95	149.90	73.33	108.32	193.10
2 nd . July	65.23	130.46	81.11	120.74	199.04
3 rd . July	103.46	117.83	57.78	74.09	170.96
4 th . July	121.82	193.21	71.60	51.41	135.32
1 st . August	227.12	441.72	81.43	36.83	90.61
2 nd . August	332.10	801.25	19.87	20.63	60.05
Total	1083.02	2354.72	943.16	655.45	1705.21
Mean	90.25	196.23	78.60	54.62	142.10

"F" value = 3.24 (0.05) and L.S.D. (0.05) value = 52.49

Okra	Squash	Cotton	Cucumber	Aubergine
196.23	142.10	90.25	78.60	54.62

G. I	G. II	_____		

G. III				

From the above mentioned discussion it could be concluded that the both okra and squash plants were the susceptible hosts than other one and can be used as plant traps for cotton aphid in cotton fields. But in fact, okra plants were mostly preferable to cotton aphid infestation than cucumber and squash because it's growing season in harmony with cotton plantations. These results are in agreement with those obtained by Azmy (1995) who found that okra plants could be planted surrounded cotton fields as attractants for cotton aphids. El-Ansary (1998) concluded that okra plants were more preferable to *A. gossypii* infestation than cotton plants from the beginning of the season until the end of September where plants were in full filling. Afterwards, the population of cotton aphid began to increase on cotton leaves and stems than okra plants. Therefore, okra plants should be removed or chemical control must be applied on okra at the end of the season to avoid cotton plants re-infested or caused damage for the premature ripened fruit.

From these results it could be concluded that cotton aphid, *A. gossypii*, proved to be the most injurious insect pest of the major economic summer hosts cultivated for food human and livestock and industries in the country. The variations in their population abundance among their hosts may be due to changes in the primary pattern of distribution of an early emigration of aphids that affects the final

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distribution and abundance on the crop later in the season and the interaction with the micro-climatic conditions prevailing, and also for acceptability to harbor (Aly, 1990; Al-Shannaf, 1994; Hassanein *et al.*, 1995; Abdel-Wahab, 1998; Ata, 2004). Kandoria *et al.* (1989) in Punjab-India, recorded 37 plant species for cotton aphid's related hosts. It was most active on okra and cotton during September-October. The population declined from mid-May to the end of June on okra, chili and cucurbits due to high temperatures (40-45 °C).

II- Relationship Between Cotton Aphid, *Aphis gossypii*, Infestation Densities and the Chemical Components of Infested Leaves of Five Host Plants:

A- Effect of Cotton Aphids *Aphis gossypii* Infestation on Total Carbohydrate, Total Soluble Sugars and Reducing Sugars:

Total Carbohydrates:

The obtained results in Table (2) revealed that the total carbohydrates percentages were higher by the aphid infested plant spp. of 105, 126 and 140 days from sowing date than the others plant ages of 56, 91 and 154 days (see Table, 2). These percentages were 34.20, 36.43, 38.40, 27.04 and 39.41 % by cotton, okra, cucumber, aubergine and squash, respectively after 105 days from sowing date. By 126 & 140 days as plant age, the percentages were 39.74 & 38.56; 48.95 & 38.18; 40.92 & 37.62; 26.44 & 33.81; 32.35 & 28.25 % by cotton, okra, cucumber, aubergine and squash plants. By control the total carbohydrate percentages were 40.32, 50.17, 42.05, 37.26 and 41.16 % by cotton, okra, cucumber, aubergine and squash respectively (Table 2).

The correlation between the aphid infestation and the total carbohydrates contents in the plant leaves of the tested five plant spp., was varied as the obtained results shown in Tables (2 & 3). No correlation could be detected between the infestation level or densities and total carbohydrate in leaves of cotton, cucumber and aubergine plants. However a significant positive correlation (Table, 3) could be recorded between the infestation densities of aphids and the total carbohydrate content in okra and squash plant leaves.

The statistical analysis "r"- values were 0.8166 and 0.9302 by okra and squash infested plants respectively. But in other point of view, the data showed a decrease in total carbohydrates (as %) by the infested tested five plant leaves when compared by uninfested plant leaves of the same plant spp. Throughout the plant age generally, the mean of total carbohydrates contents were 33.64, 36.20, 35.61, 29.97 and 32.53 % by the five infested plant leaves of cotton, okra, cucumber, aubergine and squash respectively. While the total carbohydrates contents in uninfested leaves of the same five plant spp. were 40.32, 50.17, 42.05, 37.26 and 41.16 % respectively (Table 2). The reductions were about 16.57, 27.85, 15.32, 19.57 and 20.97 % in infested leaves in comparing with uninfested plant leaves respectively (Table, 2).

Total Soluble sugars:

The obtained results in Table (4) revealed that the total soluble sugar contents percentages were higher by the aphid infested cotton of 126 and 140 days from sowing date than the other plant ages of 56, 91, 105 and 154 days (see Table, 4); while by aphid infested okra, cucumber and aubergine plants of 56, 91, 105 and 126

days from sowing date than the others plant ages of 140 & 154 days. On squash, the total soluble sugars contents were higher by the aphids infested their plants of 91 & 105 days from sowing date than the others plant ages of 56, 126, 140 & 154 days. These percentages were 2.55, 2.46, 2.35, 1.14 and 1.74 % by cotton, okra, cucumber, aubergine and squash, respectively after 126 days from sowing date. By 154 days plants ages infested by aphids, the percentages were 1.15, 1.15, 1.45, 1.48 and 1.09 % by cotton, okra, cucumber, aubergine and squash plants. By control the total soluble sugars percentages were 1.89, 2.53, 2.88, 1.74 and 2.64 % by cotton, okra, cucumber, aubergine and squash respectively (Table 4).

Table (2): Effect of *Aphis gossypii* infestation (mean no. of aphids per 3 plant leaves) on total carbohydrate (mg /100mg dry weight) percentage in leaves of five host plants at different growth periods.

Growth period (day)	Infestation densities correlated with total carbohydrate percentages values by different hosts infested									
	Cotton		Okra		Cucumber		Aubergine		Squash	
	Mean no. of aphids /3 leaves	Total Carbohydrate (%)	Mean no. of aphids /3 leaves	Total Carbohydrate (%)	Mean no. of aphids /3 leaves	Total Carbohydrate (%)	Mean no. of aphids /3 leaves	Total Carbohydrate (%)	Mean no. of aphids /3 leaves	Total Carbohydrate (%)
56	0.83	30.48	1.50	30.43	7.23	31.68	1.65	28.85	3.50	31.38
91	2.08	33.70	4.48	34.23	4.90	30.06	5.65	29.13	10.50	38.64
105	11.00	34.20	14.03	36.43	11.58	38.40	2.95	27.04	15.73	39.41
126	62.65	39.74	144.10	48.95	2.48	40.92	1.30	26.44	3.35	32.35
140	53.23	38.56	121.65	38.18	0.40	37.62	0.60	33.81	1.63	28.25
154	34.40	25.15	28.75	28.92	0.08	35.00	0.05	34.52	0.85	25.16
Mean	27.37	33.64	52.42	36.20	4.45	35.61	2.03	29.97	5.93	32.53
Control	0.0	40.32	0.0	50.17	0.0	42.05	0.0	37.26	0.0	41.16
Red. %		16.57		27.85		15.32		19.57		20.97

Table (3): Results of simple correlation and regression coefficient values between total carbohydrates percentage and the corresponding population densities of *Aphis gossypii* on five host plants at 6 different growth periods.

Statistical Coefficients	Statistical coefficient values by different host plants infested					
	Cotton	Okra	Cucumber	Aubergine	Squash	Total
Simple correlation " r "	0.4964	0.8166	-0.1026	-0.4967	0.9302	0.5729
Significance " P "	-	0.01	-	-	0.001	0.05
Simple regression " b "	2.4752	7.2329	-0.1093	-0.2948	0.9735	3.6721

The correlation between the aphid infestations and the total soluble sugars contents in the plant leaves of the tested five plant spp., was varied as the obtained results shown in Tables (4 & 5). No correlation could be detected between the

infestation level or densities and total soluble sugars in leaves of okra and aubergine plants. However a significant positive correlation (Table, 5) could be recorded between the infestation densities of aphids and the total soluble sugars content in cotton, cucumber and squash plant leaves.

The statistical analysis "r"- values were 0.7227, 0.5919 and 0.9764 by cotton, cucumber and squash infested plants respectively (Table 5). But in other point of view, the data showed a decrease in total soluble sugars (as %) by the infested tested five plant leaves when compared by uninfested plant leaves of the same plant spp. throughout the plant age generally, the mean of total soluble sugars contents were 1.76, 2.04, 2.22, 1.36 and 1.80 % by the five infested plant leaves of cotton, okra, cucumber, aubergine and squash respectively (Table 4). While the total soluble sugars contents in uninfested leaves of the same five plant spp., were 1.89, 2.53, 2.88, 1.74 and 2.64 % respectively. The reductions were about 6.88, 19.37, 22.92, 21.84 and 31.82 % in infested leaves in comparing with uninfested plant leaves respectively (Table, 4).

Table (4): Effect of *Aphis gossypii* infestation (mean no. of aphids per 3 plant leaves) on total soluble sugars (mg/ 100mg dry weight) percentage in leaves of five host plants at different growth periods.

Growth period (day)	Infestation densities correlated with total soluble sugars percentages values by different hosts infested									
	Cotton		Okra		Cucumber		Aubergine		Squash	
	Mean no. of aphids /3 leaves	Total soluble sugars (%)	Mean no. of aphids /3 leaves	Total soluble sugars (%)	Mean no. of aphids /3 leaves	Total soluble sugars (%)	Mean no. of aphids /3 leaves	Total soluble sugars (%)	Mean no. of aphids /3 leaves	Total soluble sugars (%)
56	0.83	1.25	1.50	2.42	7.23	2.64	1.65	1.43	3.50	1.59
91	2.08	1.52	4.48	2.44	4.90	2.74	5.65	1.40	10.50	2.17
105	11.00	1.86	14.03	2.47	11.58	2.28	2.95	1.48	15.73	2.83
126	62.65	2.55	144.10	2.46	2.48	2.35	1.30	1.14	3.35	1.74
140	53.23	2.23	121.65	1.28	0.40	1.86	0.60	1.25	1.63	1.38
154	34.40	1.15	28.75	1.15	0.08	1.45	0.05	1.48	0.85	1.09
Mean	27.37	1.76	52.42	2.04	4.45	2.22	2.03	1.36	5.93	1.80
Control	0.0	1.89	0.0	2.53	0.0	2.88	0.0	1.74	0.0	2.64
Red. %		6.88		19.37		22.92		21.84		31.82

Reducing sugars:

The obtained results in Table (6) revealed that the total reducing sugars percentages were higher by the aphid infested okra, cucumber and squash plants of 56, 91, 105, 126 and 140 days from sowing date than the other plant age of 154 days (see Table, 6). In cotton the total reducing sugars percentage were higher by the aphid infested plants of 126, 140 and 154 days from sowing date than other of 56, 91 and 105 days. Aubergine plants had higher total reducing sugar contents after 154 days from sowing date in infested plant leaves with aphids than others by plant ages of 56, 91, 105, 126 and 140 days (see Table, 6). These percentages were 34.64, 36.90, 33.50,

28.47 and 33.22 % by cotton, okra, cucumber, aubergine and squash, respectively after 140 days from sowing date. By 154 days as plant age, the percentages were 30.15, 27.77, 30.50, 32.56 and 28.14 % by cotton, okra, cucumber, aubergine and squash plants respectively. By control the total reducing sugars percentages were 40.16, 40.94, 42.47, 35.42 and 38.09 % by cotton, okra, cucumber, aubergine and squash respectively.

Table (5): Results of simple correlation and regression coefficient values between total soluble sugars percentage and the corresponding population densities of *Aphis gossypii* on five host plants at 6 different growth periods.

Statistical coefficients	Statistical coefficient values by different host plants infested					
	Cotton	Okra	Cucumber	Aubergine	Squash	Total
Simple correlation "r"	0.7227	-0.2376	0.5919	0.2200	0.9764	0.1470
Significance "P"	0.01	-	0.05	-	0.001	-
Simple regression "b"	34.7651	-23.6208	5.3759	3.2260	9.2746	9.0340

Table (6): Effect of *Aphis gossypii* infestation (mean no. of aphids per 3 plant leaves) on total reducing sugars (mg / 100mg dry weight) percentage in leaves of five host plants at different growth periods.

Growth period (day)	Infestation densities correlated with total reducing sugars percentages values by different hosts infested									
	Cotton		Okra		Cucumber		Aubergine		Squash	
	Mean no. of aphids /3 leaves	total reducing sugars (%)	Mean no. of aphids /3 leaves	total reducing sugars (%)	Mean no. of aphids /3 leaves	total reducing sugars (%)	Mean no. of aphids /3 leaves	total reducing sugars (%)	Mean no. of aphids /3 leaves	total reducing sugars (%)
56	0.83	21.23	1.50	38.01	7.23	39.04	1.65	26.72	3.50	39.79
91	2.08	22.88	4.48	30.15	4.90	37.65	5.65	25.49	10.50	36.54
105	11.00	28.34	14.03	34.26	11.58	36.12	2.95	25.56	15.73	29.58
126	62.65	36.31	144.10	32.49	2.48	38.57	1.30	25.30	3.35	37.61
140	53.23	34.64	121.65	36.90	0.40	33.50	0.60	28.47	1.63	33.22
154	34.40	30.15	28.75	27.77	0.08	30.50	0.05	32.56	0.85	28.14
Mean	27.37	28.93	52.42	33.26	4.45	35.90	2.03	27.35	5.93	34.15
Control	0.0	40.16	0.0	40.94	0.0	42.47	0.0	35.42	0.0	38.09
Red. %		27.96		18.76		15.47		22.78		10.34

The correlation between the aphid infestation and the total reducing sugars contents in the plant leaves of the tested five plant spp., was varied as the obtained results shown in Tables (6 & 7). No correlation could be detected between the infestation level or insect densities and total reducing sugars in leaves of okra, cucumber, aubergine and squash plants. However a significant positive correlation (Table, 7) could be recorded between the infestation densities of aphids and the total reducing sugars content in cotton plant leaves.

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Table (7): Results of simple correlation and regression coefficient values between total reducing sugars percentage and the corresponding population densities of *Aphis gossypii* on five host plants at 6 different growth periods.

Statistical coefficients	Statistical coefficient values by different host plants infested					
	Cotton	Okra	Cucumber	Aubergine	Squash	Total
Simple correlation "r"	0.9641	0.1445	0.5327	-0.6495	-0.1608	0.1959
Significance "P"	0.001	-	-	-	-	-
Simple regression "b"	4.2405	2.3335	0.7114	-0.4680	-0.2046	1.3160

The statistical analysis "r"- values was 0.9641 by cotton infested plants. But in other point of view, the data showed a decrease in total reducing sugars (as %) by the infested tested five plant leaves when compared by uninfested plant leaves of the same plant spp. Throughout the plant age generally, the mean of total reducing sugars contents were 28.93, 33.26, 35.90, 27.35 and 34.15 % by the five infested plant leaves of cotton, okra, cucumber, aubergine and squash respectively. While the total reducing sugars contents in uninfested leaves of the same five plant spp. were 40.16, 40.94, 42.47, 35.42 and 38.09 % respectively. The reductions were about 27.96, 18.76, 15.47, 22.78 and 10.34 % in infested leaves in comparing with uninfested plant leaves respectively (Table, 6).

B- Effect of Cotton Aphid, *Aphis gossypii*, Infestation on Total Protein Content:

The obtained results in Table (8) revealed that the total protein percentages were higher by the aphid infested cotton and okra plants of 105 days from sowing date than the others plant ages of 56, 91, 126, 140 and 154 days (see Table, 8); after 140 & 154 days plant ages from sowing date in aubergine than others plant ages of 56, 91 and 105 days. In squash plants of 56 days had higher protein contents than others plant ages of 91, 105, 126, 140 and 154 days. These percentages were 27.02, 27.84, 19.20, 21.70 and 16.16 % by cotton, okra, cucumber, aubergine and squash, respectively after 105 days from sowing date. By 140 & 154 days as plant age, the percentages were 23.10 & 16.04; 18.15 & 23.15; 23.66 & 20.15; 29.08 & 29.26; 19.23 & 16.70 % by cotton, okra, cucumber, aubergine and squash plants. By control the total protein percentages were 27.05, 28.16, 26.32, 30.27 and 30.19 % by cotton, okra, cucumber, aubergine and squash respectively.

The correlation between the aphid infestation and the total protein contents in the plant leaves of the tested five plant spp., was varied as the obtained results shown in Tables (8 & 9). No correlation could be detected between the infestation level or densities and total protein in leaves of cotton, cucumber and squash plants. However a significant negative correlation (Table, 9) could be recorded between the infestation densities of aphids and the total protein content in okra and aubergine plant leaves.

The statistical analysis "r"- values were -0.8750 and -0.5654 by okra and aubergine infested plants respectively. But in other point of view, the data showed a decrease in total protein contents (as %) by the infested tested five plant leaves when

compared by uninfested plant leaves of the same plant spp. Throughout the plant age generally, the mean of total protein contents were 22.60, 23.65, 21.34, 23.45 and 20.98 % by the five infested plant leaves of cotton, okra, cucumber, aubergine and squash respectively. While the total proteins contents in uninfested leaves of the same five plant spp. were 27.05, 28.16, 26.32, 30.27 and 30.19 % respectively. The reductions in protein contents were about 16.45, 16.02, 18.92, 22.53 and 30.51 % in infested leaves in comparing with uninfested plant leaves respectively (Table, 8).

Table (8): Effect of *Aphis gossypii* infestation (mean no. of aphids per 3 plant leaves) on total protein content percentages (0.1 gm dry weight basis) in leaves of five host plants at different growth periods.

Growth period (day)	Infestation densities correlated with protein percentages values by different hosts infested									
	Cotton		Okra		Cucumber		Aubergine		Squash	
	Mean no. of aphids /3 leaves	total Protein (%)	Mean no. of aphids /3 leaves	total Protein (%)	Mean no. of aphids /3 leaves	total Protein (%)	Mean no. of aphids /3 leaves	total Protein (%)	Mean no. of aphids /3 leaves	total Protein (%)
56	0.83	22.42	1.50	26.84	7.23	22.13	1.65	13.17	3.50	28.75
91	2.08	24.07	4.48	25.16	4.90	20.54	5.65	18.64	10.50	24.23
105	11.00	27.02	14.03	27.84	11.58	19.20	2.95	21.70	15.73	16.16
126	62.65	22.94	144.10	20.75	2.48	22.34	1.30	28.83	3.35	20.80
140	53.23	23.10	121.65	18.15	0.40	23.66	0.60	29.08	1.63	19.23
154	34.40	16.04	28.75	23.15	0.08	20.15	0.05	29.26	0.85	16.70
Mean	27.37	22.60	52.42	23.65	4.45	21.34	2.03	23.45	5.93	20.98
Control	0.0	27.05	0.0	28.16	0.0	26.32	0.0	30.27	0.0	30.19
Red. %		16.45		16.02		18.92		22.53		30.51

Table (9): Results of simple correlation and regression coefficient values between total proteins content percentage and the corresponding population densities of *Aphis gossypii* on five host plants at 6 different growth periods.

Statistical coefficients	Statistical coefficient values by different host plants infested					
	Cotton	Okra	Cucumber	Aubergine	Squash	Total
Simple correlation "r"	-0.2610	-0.8750	-0.5353	-0.5654	-0.1519	-0.2045
Significance "p"	-	0.001	-	0.05	-	-
Simple regression "b"	-1.9338	-14.9513	-1.4358	-0.1706	-0.1863	-1.6737

C- Effect of cotton aphid *Aphis gossypii* infestation on total ash content:

The obtained results in Table (10) revealed that the total ash contents were higher by the aphid infested plants of cucumber, aubergine and squash of 56 and 91 days from sowing date than the others plant ages of 105, 126, 140 and 154 days (see

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Table, 10; while in 105 days plant ages of cotton and okra infested with aphids than others of 56, 91, 126, 140 and 154 days. These percentages were 32.11 & 30.17; 21.80 & 17.23; 23.80 & 20.27 % by cucumber, aubergine and squash, respectively after 56 & 91 days from sowing date respectively. By 105 days as plant age, the percentages were 21.19 and 24.37 % by cotton and okra plants respectively. By control the total ash percentages were 22.09, 23.14, 32.15, 22.25 and 24.07 % by cotton, okra, cucumber, aubergine and squash respectively.

Table (10): Effect of *Aphis gossypii* infestation (mean no. of aphids per 3 plant leaves) on percentages of total ash contents (0.1 gm dry weight basis) in leaves of five host plants at different growth periods.

Growth period (day)	Infestation densities correlated with percentage of total ash contents by different hosts infested									
	Cotton		Okra		Cucumber		Aubergine		Squash	
	Mean no. of aphids /3 leaves	total ash content (%)	Mean no. of aphids /3 leaves	total ash content (%)	Mean no. of aphids /3 leaves	total ash content (%)	Mean no. of aphids /3 leaves	total ash content (%)	Mean no. of aphids /3 leaves	total ash content (%)
56	0.83	11.19	1.50	18.47	7.23	32.11	1.65	21.80	3.50	23.80
91	2.08	18.26	4.48	22.32	4.90	30.17	5.65	17.23	10.50	20.27
105	11.00	21.19	14.03	24.37	11.58	25.63	2.95	12.93	15.73	19.42
126	62.65	13.68	144.10	22.25	2.48	20.33	1.30	14.00	3.35	17.77
140	53.23	17.65	121.65	16.73	0.40	18.74	0.60	16.44	1.63	16.40
154	34.40	12.45	28.75	18.34	0.08	18.20	0.05	18.11	0.85	15.12
Mean	27.37	15.74	52.42	20.41	4.45	24.20	2.03	16.75	5.93	18.80
Control	0.0	22.09	0.0	23.14	0.0	32.15	0.0	22.25	0.0	24.07
Red. %		28.75		11.80		24.73		22.72		21.89

The correlation between the aphid infestation and the total ash contents in the plant leaves of the tested five plant spp., was varied as the obtained results shown in Tables (10 & 11). No correlation could be detected between the infestation level or densities of cotton aphids and total ash in infested leaves of cotton, okra, aubergine and squash plants. However a significant positive correlation (Table, 10) could be recorded between the infestation densities of aphids and the total ash content in cucumber plant leaves.

The statistical analysis "r"- values were 0.6814 by cucumber infested their plants. But in other point of view, the data showed a decrease in total ash (as %) by the infested tested five plant leaves when compared by uninfested plant leaves of the same plant spp. Throughout the plant age generally, the mean of total ash contents were 15.74, 20.41, 24.20, 16.75 and 18.80 % by the five infested plant leaves of cotton, okra, cucumber, aubergine and squash respectively. While the total ash contents in uninfested leaves of the same five plant spp. were 22.09, 23.14, 32.15, 22.25 and 24.07 % respectively. The reductions were about 28.75, 11.80, 24.73, 22.72 and 21.89 % in infested leaves in comparing with uninfested plant leaves respectively (Table, 10).

Table (11): Results of simple correlation and regression coefficient values between percentages of total ash contents and the corresponding population densities of *Aphis gossypii* on five host plants at 6 different growth periods.

Statistical coefficients	Statistical coefficient values by different host plants infested					
	Cotton	Okra	Cucumber	Aubergine	Squash	Total
Simple correlation "r"	-0.1513	-0.1926	0.6814	-0.1229	0.3542	-0.0471
Significance "P"	-	-	0.05	-	-	-
Simple regression "b"	-1.0415	-4.1051	0.5017	-0.0790	0.6745	-0.3418

These results are in agreement with the observation of Henneberry *et al.* (2000) in the USA., who found that adult of *A. gossypii* alone and adults plus their nymphs in leaves of cotton over 28 and 24 days, respectively, related averaged for all measured sugars 1.83 and 2.68 micrograms per day. Slosser *et al.* (2004) in the northern Texas USA, concluded that carbohydrate concentrations percentage leaf moisture, nitrogen, and total amino acids were not significantly altered aphids in cotton leaves by lambda-cyhalothrin. Glucose, fructose, sucrose, sugar ratio glucose + fructose) / sucrose concentrations), leaf nitrogen, and moisture were significantly influenced by season and irrigation regime. They pointed out regression analysis of data indicated that change in aphid numbers was influenced by numbers of aphids per leaf, temperature, leaf moisture and nitrogen, and sugar ratio. A negative linear relationship was observed between change in aphid numbers and sugar ratio; population growth was limited by high levels of glucose and fructose in cotton leaves, especially when temperatures were high and leaf moisture low. El-Ansary (1998) in Egypt, observed close correlation between an increase of ash and increase in cotton aphid infestation and has been found in several cotton varieties; while no clear relationship between distribution of aphids on the three levels of cotton plants and percentages of total free amino acids and total carbohydrate. Ahmad (1983) reported that changes in insect host plant selection depend on the dynamic equilibrium existing between insects and their potential host plants. The outcome of this equilibrium at any point in time depends on the respective genetic potentials of the plant and the insect and their rates of change relative to one another, along with the tempering influences of the external environment (House, 1969). At any given point in evolutionary time, either the plant or the insect will have the genetic "upper hand" (Reese, 1981). The physical and chemical changes that have occurred in plants in response to insect behavioral and metabolic changes that insects have undergone in order to adapt to new host plants underscore the genetic plasticity of each of the participating organisms (Kennedy, 1965).

The positive correlation detected in this investigation between reducing sugars in leaves and the associated level of infestation with cotton aphid is in accordance with Bacon and Dickinson (1957) who indicated that several aphids convert the reducing sugars to no reducing sugars. This may give an interpretation of the present results as no fixed correlation could be deduced between reduced sugar content in plant leaves and the rate of *A. gossypii* infestation at aubergine and squash. The direct and positive or negative correlation between the carbohydrate content in

host plant leaves and the rate of infestation with *A. gossypii* was more pronounced among okra and squash crops. This may be due to that cotton aphids preferred these hosts than others. On the contrary with carbohydrates, the infestation *A. gossypii* on cotton, cucumber and aubergine were none significantly correlated. This conclusion could be lead to attributable complex factors. Thus, this point of view must be studied in details in further works to detect the fraction of amino acids influence the size of aphid infestation on different hosts.

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كثافة الإصابة بحشرة من القطن وتأثيرها على المكونات الكيميائية في أوراق خمسة عوائل نباتية تابعة لثلاث فصائل نباتية في محافظة القليوبية بمصر

- سامي عبد الحميد السوقي * ، محمد كمال الدين الانصاري *
 حامد عبد الدايم محمد السيد ** ، عبد الحلیم السيد حسين خليل **
 * قسم وقاية النبات - كلية الزراعة جامعة الأزهر - مدينة نصر - القاهرة.
 ** قسم بحوث الحشرات الثاقبة الماصة - معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - القاهرة.

- خلال الموسم الصيفي لعامي ٢٠٠٣ و ٢٠٠٤ أجريت دراسة لغرض دراسة أثر كثافة الإصابة بحشرة من القطن على المكونات الكيميائية في أوراق نباتات خمسة عوائل نباتية تابعة لثلاث فصائل نباتية وهي القطن - الباميا - الخيار - الباذنجان والكوسة.

- أوضحت النتائج وجود اختلافات معنوية بين أعداد حشرة من القطن التي تصيب الخمس عوائل نباتية تحت الدراسة ويمكن ترتيب تفضيل حشرة من القطن لهذه العوائل تنازليا تبعا لمتوسط شدة الإصابة خلال الموسم كالآتي: أعلى كثافة عددية لحشرة من القطن كانت على نباتات الباميا (١٩٦,٢٣ حشرة في كل ١٠ بوصات مريعة على الأوراق)، ثم يأتي من بعدها نباتات الكوسة (١٤٢,١٠ فردا) ، ثم نباتات القطن (٩٠,٢٥ فردا) ، ثم نباتات الخيار (٧٨,٦٠ حشرة) وأخيرا نباتات الباننجان (٥٤,٦٢ حشرة في كل ١٠ بوصات مريعة من الأوراق).
- للتعرف على العلاقة بين الكثافة العددية لحشرة من القطن التي تصيب خمس عوائل نباتية تحت الظروف الحقلية والمكونات الكيميائية لأوراق النباتات أجرى تحليل للمكونات الرئيسية في أوراقها المصابة بالحشرات وأخرى خالية للمقارنة في المعمل المركزي بكلية الزراعة بمشهر - جامعة بنها بأخذ عينات من أوراق الخمس عوائل نباتية على فترات زمنية مختلفة من عمر النباتات وهي ٥٦ ، ٩١ ، ١٠٥ ، ١٢٦ ، ١٤٠ ، و ١٥٤ يوما من الزراعة.
- أوضحت الدراسة وجود علاقة ارتباط معنوية ايجابية بين تعداد حشرة من القطن والنسب المئوية للكربوهيدرات الكلية في أوراق نباتات الباميا والكوسة ، بينما كانت قيم الارتباط البسيط ايجابي ولكن إصابة غير معنوية بتغير شدة أصابت نباتات القطن.
- وعلى النقيض من النتائج السابقة فإن هذه العلاقة كانت سالبة وغير معنوية في حالة إصابة نباتات الخيار والباننجان بحشرة من القطن.
- أوضحت النتائج أيضا عدم ثبات العلاقة ما بين إصابة نباتات العوائل الخمس بحشرة من القطن وكل من مكونات الأوراق للسكريات الذائبة والسكريات المختزلة والمحتوى الكلي للبروتين في أوراق النباتات.
- أوضحت الدراسة أيضا أن كميات الرماد لا ترتبط معنويا بحجم الإصابة بحشرة من القطن وقدرت أعلى نسبة انخفاض في محتوى أوراق نباتات القطن للرماد نتيجة الإصابة بحشرة من القطن بحوالي ٢٨,٧٥ % ، بينما تقلصت نسبة الانخفاض في محتوى الرماد إلى أقل نسبة (١١,٨٠ %) عند إصابة نباتات الباميا بهذه الآفة.
- تبينت قدرة باقي العوائل على تحمل الإصابة بحشرة من القطن وكانت التأثيرات على محتوى الأوراق للرماد متوسطة نسبيا وقدر هذا الانخفاض ليصل نسبته إلى ٢٤,٧٣ % في أوراق نباتات الخيار و ٢٤,٧٢ % في الباننجان و ٢١,٨٩ % في الكوسة.