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POPULATION DYNAMICS OF THE WHITEFLY *BEMISIA tabaci* (GENN.) INFESTING CUCUMBER PLANT IN NEWLY RECLAIMED LAND

[49]

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ABSTRACT

The seasonal abundance and the distribution pattern of white fly, *Bemisia tabaci* (Genn.) infested cucumber plant in sandy newly reclaimed land, was estimated during the growing late summer seasons for two successive years (2002 and 2003). The population density of *B. tabaci* reached the maximum in October and November. Oviposition behavior of *B. tabaci* females and preferred habit of the immature stages (eggs & nymphs), expressed as high population of whitefly immature stages was recorded on the lower level of cucumber plant, followed by middle then the upper one (182.41, 97.55 and 35.28 individuals/ one square inch of leaf, respectively). On the other hand, the highest infestation of immature stages was found at northern direction, followed by southern direction then in the center one, whereas mean total numbers of 160.87, 121.76 and 35.85 individuals/ one square inch of cucumber leaf were recorded respectively in both 2002 and 2003.

Keywords: Population dynamics, Whitefly, *Bemisia tabaci*, Cucumber, Plant distribution

INTRODUCTION

In recent years, cultivation of vegetables has noticeably increased to face the continuous human requirements. Whitefly, *Bemisia tabaci* (Genn.) is an insect pest of economic importance attacking over 500 plant hosts (**Cock, 1986**; **El-Sayed *et al* 1991** and **Secker *et al* 1998**), including cucumber plants and cause great damages to their productivity. The population dynamics of *B. tabaci* was studied by many authors such as, **Abdel-Ghaffar, (1995)** on broad bean plants and **Daoud *et al* (1999)** on potato plants.

The present work is an attempt to estimate the seasonal abundance and distribution pattern of the population dynamics of *B. tabaci* infesting cucumber plants grown in sandy newly reclaimed land.

MATERIAL AND METHODS

Cucumber *Cucumis sativus* L. var. Primo were cultivated in the newly reclaimed area located at Regwa farm (62 Km. north Cairo Alexandria desert road) during two successive late summer growing seasons 2002 and 2003. Sowing

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started in August and the cultivation was in an area of about half feddan. The area was divided into four equal plots to serve as replicates. The regular agriculture practices were followed in both seasons without using pesticides. To study the seasonal abundance and the vertical distribution of whitefly, *Bemisia tabaci* immature stages. Three weeks after sowing in September and during the growth period of the plants, weekly randomized samples of 5 leaves from each replicate area and each level (Upper, middle and lower levels) to determine the seasonal fluctuations of this insect and their vertical distribution. This means that 20 leaves were taken from each plant level. To study the distributions of this insect in the cardinals' directions of the field, another 5 leaves were taken from each direction of the plot (northern, center and southern directions). Each sample was kept in polyethylene bag and transferred to the laboratory for examination with binocular stereomicroscope; the mean number of *B. tabaci* immature stages (eggs& nymphs) were calculated and recorded per one square inch of one leaf. The data were statistically analyzed according to the method of **Snedecor (1970)**.

RESULTS AND DISCUSSION

1- Seasonal fluctuation of *B. tabaci* immature stages

The data given in Table (1) and Fig. (1) show weekly mean numbers and percentages of *B. tabaci* immature stages on cucumber plants during both growing late summer, seasons of 2002 and 2003 in newly reclaimed land. Data revealed that the infestation started by the beginning of September at low numbers population (1.67 and 1.27 immature per one square inch of leaf, representing 0.43 and 0.24 %of the total population during 2002 and 2003, respectively), then population gradually increased to reach its maximum on October 16 of 2002 (55.37 individuals/ inch^2), making 14.36 % of the total number) or on October 23 of 2003 (85.81 individuals/ inch^2 representing 16.47 % of the total number). After that, immature number, gradually declined towards the end of the cucumber season to reach the minimum on December 18 (2.68/ inch^2) representing 0.69 % of the total number on December 18, 2002 and 5.43 / inch$^{2)}$ making 1.05 % of the total individuals) on December 4, 2003.

Irrespective of the growing season, the same trend could be obtained when considered the average numbers of both seasons. In this case, the population density of the experimental insect started on September 4 at low number (1.47 individuals / inch^2), then gradually increased reaching its maximum of 65.64 / inch^2 on October 16, that following by a decrease towards the end of the season and completely disappeared after December 18. Relatively similar results were given by **Salem, (1993)** who found that the peak of *B. tabaci* on some cucumber varieties occurred in mid of October. **Emam, (1999)** showed that the population density of whitefly was higher in late summer plantation, than in spring plantation of tomato plants.

Data obtained for *B. tabaci* throughout both seasons and statistical analysis revealed that this species was more active during 2003 growing season than 2002. On the other hand, the activity of this insect in 2002 growing season was prolonged two weeks more than 2003.

Table 1. Weekly mean numbers of *B. tabaci* immature stages (eggs & nymphs) on cucumber plant during the growing seasons of 2002 and 2003

Sampling dates	Mean number of *B. tabaci* immature stages / one square inch of leaf					
	2002		2003		Average	
	Mean No.± S.E	Total population %	Mean No.± S.E	Total population %	Mean No.± S.E	Total population %
Sept.,4	1.67 ±0.15	0.43	1.27 ± 0.24	0.24	1.47 ± 0.20	0.32
11	3.72 ± 0.40	0.96	4.15 ± 0.66	0.80	3.94 ± 0.53	0.87
18	11.87 ±1.39	3.08	8.96 ± 1.34	1.73	10.42 ± 1.37	2.30
25	23.31 ±1.88	6.04	26.26 ± 2.83	5.06	24.79 ± 2.36	5.48
Oct., 2	29.69 ± 3.31	7.70	45.75 ± 3.79	8.81	37.72 ± 3.55	8.34
9	40.56 ± 3.99	10.52	62.95 ± 6.60	12.13	51.76 ± 5.30	11.44
16	55.37 ± 5.94	14.36	75.90 ± 7.22	14.62	65.64 ± 6.58	14.51
23	52.33 ± 5.06	13.57	85.81± 8.40	16.47	68.92 ± 6.73	15.35
30	48.46 ± 5.24	12.57	74.27 ± 6.68	14.31	61.37 ± 5.96	13.37
Nov, 2	37.87 ± 5.09	9.82	55.89 ± 5.83	10.77	46.88 ± 5.46	10.36
9	30.77 ± 3.36	7.98	34.74 ± 3.73	6.69	32.76 ± 3.55	7.24
16	22.11± 3.53	5.73	25.89 ± 2.19	4.99	24.00 ± 2.86	5.31
23	11.64 ± 1.61	3.02	12.07 ± 2.41	2.33	11.86 ± 2.01	2.62
Dec., 4	8.47 ±1.22	2.20	5.43 ± 0.86	1.05	6.95 ± 1.04	1.54
11	5.14 ± 0.74	1.33	0	0	2.57 ± 0.37	0.57
18	2.68 ±0.39	0.69	0	0	1.34 ± 1.20	0.30
Average	385.66 ± 43.29	-	519.04 ± 52.78	-	452.39 ± 49.07	-

F. between seasons = 2.12 (insignificant)
F. between dates of samples = 11.26*
L.S.D. at 0.05 = 9.86

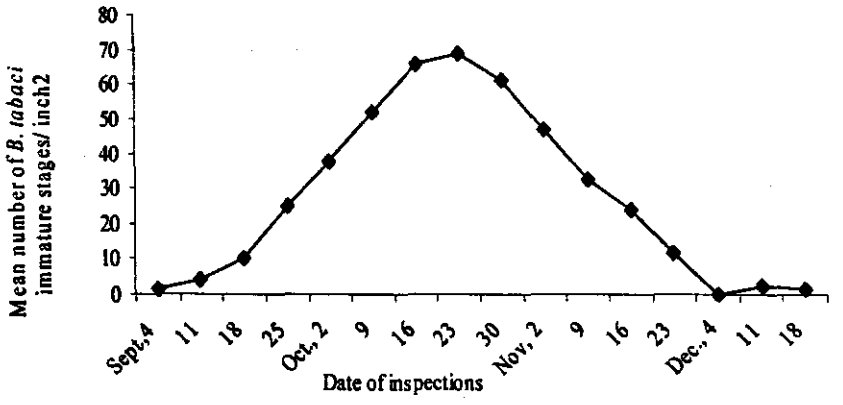

Fig (1):Seasonal fluctuation of *B. tabaci* immature stages on leaves of cucumber plant during late summer planation

Statistical analysis of data showed insignificant differences between the population densities of immature stages in the two experimental seasons. On the other hand, differences between these populations in the different dates of samples proved to be statistically highly significant and the L.S.D value (9.86) emphasizes the obtained results.

2- Vertical distribution of whitefly immature stages on cucumber plants

Data given in Table (2) and Fig. (2) show the vertical distribution of *B.tabaci* immature stages on cucumber plants grown in newly reclaimed land during the late summer plantation of both 2002 and 2003 seasons. When concerning data of both seasons average, statistical analysis demonstrated highly significant effect of plant levels on the distribution of *B. tabaci* immature. According to L.S.D., statistically highest population was recorded on leaves of the lower level of the plants. Mean numbers of 18.43, 96.66, 59.37 and 7.95 immature stages / inch^2 of leaf were recorded on the lower level of the plants, representing 60.49, 57.12, 59.81 and 48.80 % of the total insects. The same trend was found for either 2002 or 2003 growing seasons.

On the other hand, the lowest population of the experimental insect was obtained on the leaves of the upper level of the plants whereas means of 2.55, 19.22, 10.07 and 3.44 insects were recorded, representing 8.37, 11.36, 10.15 and 21.12 % of the total numbers of insects. This was common for both 2002 and 2003 growing seasons.

Middle level of plants ranked as intermediate level for population immature stages distributions where means of 9.49, 53.34, 29.82 and 4.90 / inch^2 of leaf were recorded, representing 31.15, 31.52, 30.04 and 30.08 % of the total number of insects.

Table 2. Monthly abundance of *B. tabaci* immature stages on the different levels of cucumber plant during the growing seasons of 2002 and 2003

Levels	Years	Mean number of *B. tabaci* immature stages / one square inch of leaf cucumber plants per months**				Total number of immature stages/season ± S.E	%
		Sept.	Oct.	Nov.	Dec.		
Lower	2002	16.33 ± 1.38	76.19 ±7.97	47.50 ± 6.40	8.89 ± 1.35	148.92 ± 17.10	47.24
	2003	20.52 ± 2.68	117.13± 11.13	71.24 ± 7.17	7.01 ± 1.36	215.90 ± 22.34	68.49
	Average	18.43 a	96.66 a	59.37 a	7.95 a		
	Total population %	(60.49)	(57.12)	(59.81)	(48.80)	182.41 a	57.86
Middle	2002	11.14 ± 1.10	42.01 ± 4.40	20.58 ± 2.65	5.63 ± 0.77	79.36 ± 8.92	25.17
	2003	7.83 ± 0.82	64.66 ± 6.94	39.05 ± 4.42	4.16 ± 0.79	115.70 ± 12.97	36.70
	Average	9.49 b	53.34 b	29.82 b	4.90 b		
	Total population %	(31.15)	(31.52)	(30.04)	(30.08)	97.55 b	30.94
Upper	2002	2.96 ± 0.35	17.65 ± 1.76	8.71 ± 1.22	1.77 ± 0.23	31.09 ± 3.56	9.86
	2003	2.13 ± 0.53	20.79 ± 2.69	11.42 ± 2.32	5.11 ± 0.58	39.45 ± 6.12	12.51
	Average	2.55 c	19.22 c	10.07 c	3.44 c		
	Total population %	(8.37)	(11.36)	(10.15)	(21.12)	35.28 c	11.19
Total average		30.47 ± 1.14	169.22 ± 5.82	99.26 ± 4.03	16.29± 0.85	315.24±11.84	

F. between vertical levels of the plant = 7.49 *
L.S.D. at 0.05 = 1.42
** Means within a column followed by a different letter are significantly different 5 % probability level.

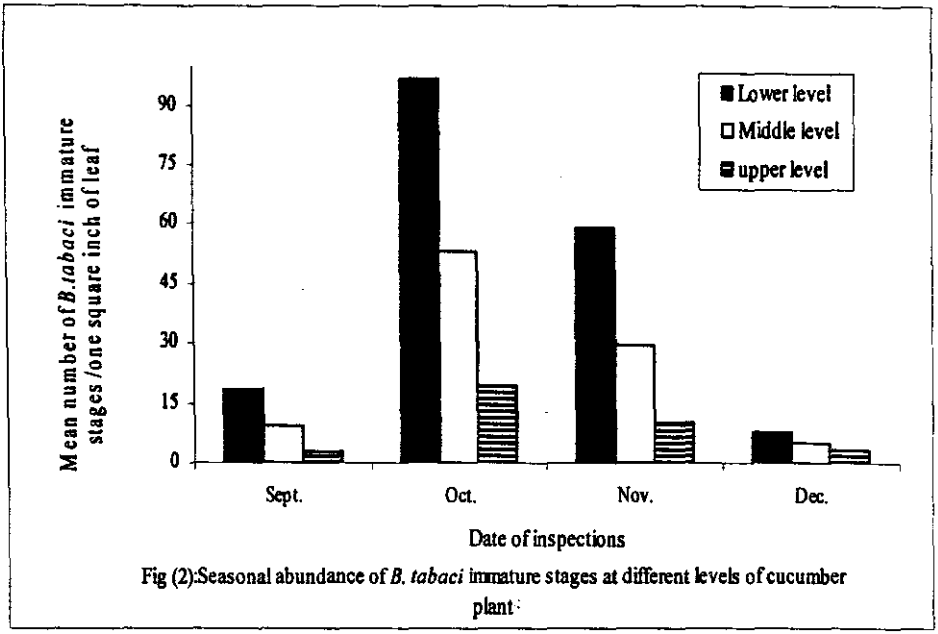

Fig (2):Seasonal abundance of *B. tabaci* immature stages at different levels of cucumber plant

Similar results were given by **Abdel-Baky, (2001)** who observed high population density of *B. argentifolii* on the lower cucumber leaves, followed by middle ones. This may be due to occurrence of adult emergence on the lower leaves. According to **Butler *et al* (1986)**, the adults choose canopy leaves for protection and movement between the leaves of the plant for feeding and oviposition. Therefore, the behaviour of *B. tabaci* adults that is apparently responsible for the vertical distribution on the plant is mostly a function of interaction between the oviposition behaviour of the females and sessile habit of the immature stages, **(Tonhasca *et al* 1994; Liu and Stansly 1995 and Abdel-Baky and Abdel-Salam, 2000)**. In addition, females laid eggs on the light coloured leaves at the lower part of the plant **(Vaishampayan *et al* 1975)**.

3- Distribution of whitefly immature stages in cardinal direction of the field

Cardinal direction of greatly affected the population density *B. tabaci* of whitefly immature stages on the leaves of cucumber plants grown in newly reclaimed land during late summer of 2002 and 2003 seasons. Considering both seasons average, statistical analysis emphasized that field directions affected the distribution of *B. tabaci* individuals. As shown in Table (3) and Fig. (3) significantly the highest population of whitefly immature stages was recorded on the leaves of cucumber plant cultivated in the northern direction. Means of 17.56, 90.22, 47.45 and 5.64 individuals were on one square inch of leaf of plants grown in northern direction,

Table 3. Monthly abundance of *B. tabaci* immature stages (eggs & nymphs) on cucumber leaves located at different directions in the field during the growing seasons of 2002 and 2003

Directions	Years	Mean number of *B. tabaci* immature stages /one square inch of leaf cucumber plants per month **				Total number of immature stages/season ± S.E	%
		Sept.	Oct.	Nov.	Dec.		
Southern	2002	12.10 ± 1.04	51.44 ± 6.02	33.26 ± 4.67	4.21± 1.30	101.01 ±13.03	31.71
	2003	12.16 ± 1.76	80.09 ± 8.65	44.40 ± 5.36	5.86 ±1.18	142.51±16.95	44.74
	Average	12.13 b	65.77 b	38.83 b	5.04 a		
	Total population %	(35.80)	(37.78)	(39.93)	(37.89)	121.76 b	38.23
Center	2002	3.33 ± 0.43	15.95 ± 1.59	9.00 ± 1.37	0.95 ± 0.11	29.23±0.88	9.18
	2003	5.01 ± 0.82	20.22 ± 2.92	12.94 ± 1.58	4.29 ± 0.53	42.46±5.85	13.33
	Average	4.17 c	18.09 c	10.97 c	2.62 a		
	Total population %	(12.31)	(10.39)	(11.28)	(19.70)	35.85 c	11.26
Northern	2002	15.00 ± 1.40	78.16 ± 6.11	30.52 ± 4.64	5.13 ± 0.94	128.81±13.09	40.44
	2003	20.15 ± 1.24	102.28 ± 9.18	64.37 ± 5.80	6.14 ± 0.87	192.94 ±17.09	60.58
	Average	17.56 a	90.22 a	47.45 a	5.64 a		
	Total population %	(51.89)	(51.83)	(48.79)	(42.41)	160.87 a	50.51
Total average		33.88 ± 1.12	174.08 ± 5.75	97.25 ± 3.90	13.30 ± 0.82	318.51±11.15	

F. between cardinal directions = 12.53 *
L.S.D. at 0.05 = 4.22
** Means within a column followed by a different letter are significantly different 5 % probability level.

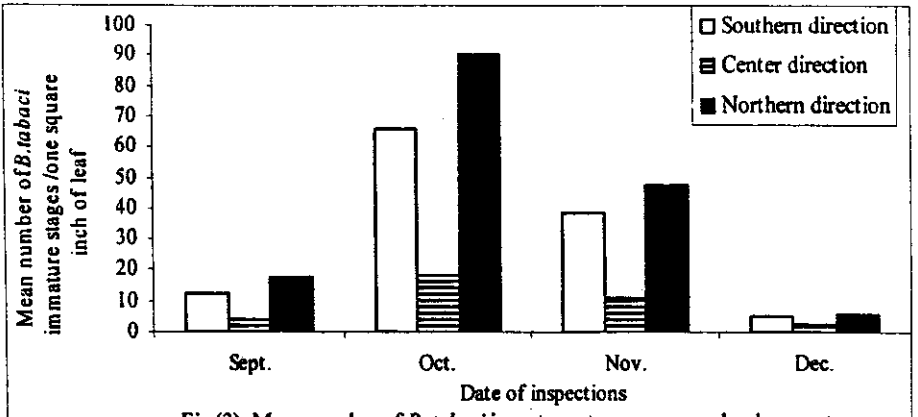

Fig (3): Mean number of *B. tabaci* immature stages on cucumber leaves at different directions in the field

representing 51.89, 51.83, 48.79 and 42.41% of the total number of insects. The same trend was found in both growing seasons for both of 2002 and 2003.

The population density of the armatures seemed to be lower in the center of the field than in the northern direction. However, lowest population individuals were obtained on the leaves of plants grown in the southern direction. In this respect means of 12.13, 65.77, 38.83 and 5.04 individuals / inch^2 of leaf were recorded the southern direction of the field, representing 35.80, 37.78, 39.93 and 37.89 % of the total number of insects.

These results are in agreement with those of **Ismail *et al* (1998); Daoud *et al* (1999); Emam, (1999)** and **Abdel-Khalek, (2000).** They found that the northern direction harbored the highest number of captured whitefly adults followed by the southern direction while the center sites were recorded as least numbers. Hence, most of the wind in Egypt comes from north –west direction and this could explain that the wind carries the adults from neighbor fields to the northern direction of the experimental field.

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مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م٥٠ ، ع(٢)، ٧١٩-٧٢٨ ، ٢٠٠٥

ديناميكية التعداد للذبابة البيضاء التى تصيب نبات الخيار فى الأراضى حديثة الأستصلاح

[٤٩]

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١- قسم وقاية النبات - مركز بحوث الصحراء - المطرية - القاهرة - مصر

أجريت هذة الدراسة لتحديد النشاط الموسمى والتوزيع الرأسى للأطوار غير الكاملة للذبابة البيضاء على نباتات الخيار والتى تعتبر كأحد العوائل النباتية المفضلة لها والمنزرعة فى الأراضى حديثة الاستصلاح خلال موسمين متعاقبين ٢٠٠٢، ٢٠٠٣.

وأوضحت النتائج ان نباتات الخيار المنزرعة فى العروة الصيفى المتأخرة كانت شديدة الاصابة بالذبابة البيضاء خلال شهرى اكتوبر ونوفمبر. كما أوضحت النتائج ان الأطوار غير الكاملة للحشرة على النباتات كانت اكثر تواجدا على الأوراق السفلية بالمقارنة بتعدادها على كل من المستوى الأوسط والعلوى لأوراق النبات، حيث سجل متوسط تعداد ١٨٢,٤١، ٩٧,٥٥، ٣٥,٢٨ حشرة/بوصة مربعة من ورقة النبات للمستويات المذكورة على التوالى.

كما وجد ان أعلى تعداد للحشرة كان فى الاتجاة الشمالى من الحقل يليه الاتجاة الجنوبى ثم الاتجاة الأوسط حيث تم تسجيل ١٦٠,٨٧، ١٢١,٧٦، ٣٥,٨٥ حشرة / بوصة مربعة من ورقة النبات على التوالى).

تحكيم: أ.د عزة كمال إمام
أ.د أحمد أحمد شرف الدين