Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 951 - 962, 2005

SOME ECOLOGICAL ASPECTS OF TWO WHITEFLY SPECIES INFESTING ARABIAN JASMINE SHRUBS IN EGYPT (HEMIPTERA: STERNORRHYNCHA: ALEYRODIDAE)

[64]

Helmi[1], A.

ABSTRACT

Two whitefly species, *Aleurotuberculatus jasmini* Takahashi and *Dialeurodes kirkaldyi* (Kotinsky) were found infesting Arabian jasmine shrubs, *Jasminium sambac* at the Botanic Garden of Faculty of Agriculture, Ain Shams University, Shoubra, Qalyubiya, Egypt. To obtain basic ecological data for both species, samples of Arabian jasmine leaves were conducted every ten-day intervals throughout one complete year (January to December 2004). Seasonal fluctuations of alive total population, nymphs and adults (empty exuviae) of the both species indicated that the *D. kirkaldyi* was more dominant one than *A. jasmini* throughout the tested year. Three periods of seasonal abundance for both species were established. Three annual field generations were estimated for *D. kirkaldyi*, which lasted 170, 90 and 100 days, respectively. While *A. jasmini* passed throughout five annual field generations, which lasted 80, 80, 70, 60 and 70 days, respectively. The effects of nine ecological factors (7 physical +2 biotic) on the population dynamics of alive nymphs population for both species were estimated. Each factor gave variable effects for both species while the combined effects of these nine factors were responsible as a group for about 74.2% and 95.5% of the changes in nymphal population densities of *D. kirkaldyi* and *A. jasmini*, respectively.

Key words: *Aleurotuberculatus jasmini*, *Dialeurodes kirkaldyi*, Aleyrodidae, Ecological aspects, Arabian jasmine, *Jasminium sambac*

INTRODUCTION

In Egypt whiteflies species had no economic importance during the 20th century but during the last two decades some species became key pests on economic hosts under open fields as well as greenhouses conditions.

The jasmine whitefly, *Dialeurodes kirkaldyi* was recorded for the first time in Hawaii and Fiji, (**1907)** by **Kotinsky**. This species was recorded for the first

1- Plant Protection Department, Fac. of Agric., Ain Shams Univ., Shoubra El-Kheima Cairo, Egypt

(Received April 24, 2005)
(Accepted May10, 2005)

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 951 - 962, 2005

time in Egypt by **Priesner & Hosny (1934)**. While *Aleurotuberculatus jasmini* was recorded for the first time in Formosa in **1932** by **Takahashi**. While was recorded for the first time in Egypt by **Amin *et al* (1997)** on *Citrus limonus* at Digwa, Qalyubiya Governorate. Both adults and immature stages feed on plant sap and secrete large amounts of honeydew, which considered a suitable medium for growth of sooty mould fungi.

Many authors recorded many host plants for these species but mentioned that favored hosts of *D. kirkaldyi* are *Jasminum* spp. (Oleaceae) and *Morinda citrifolii* (Rubiaceae) (**Russell, 1964; Abd-Rabou, 1990; El-Borollosy *et al* 1990; Nada *et al* 1991 and Helmi, 1996 & 2003**). While favored hosts of *A. Jasmini* are Citrus spp. (Rutaceae) in addition to *Jasminum* spp. (**Nguyen *et al* 1993; Amin *et al* 1997 and Helmi, 2003**).

MATERIAL AND METHODS

The population dynamics of whitefly species found to infest Arabian jasmine, *Jasminum sambac* were conducted at the Botanic Garden of Faculty of Agriculture, Ain Shams University, Shoubra, Qalyubiya, Egypt. No-chemical control measures have not been used for a long time as well as during the sampling period of this investigation. Ten shrubs of Arabian jasmine were chosen for the represent study.

Twenty five infested leaves were collected randomly from the host plant at regularly ten-day intervals, from 1st January to 21st December 2004. Leaves were kept in polyethylene bags and transferred to the laboratory, for inspection. Counts were carried out on both surfaces of the leaves using a stereoscopic binocular microscope. The counted insects were sorted as follows: different whitefly species; total number of nymphs (living and dead nymphs; natural death, fungal infection and parasitoid infestation); total number of adults, total number of living adults as pupal exuviae from which adults had emerged through the molting suture; total number of living individuals; total number of dead individuals and total insect population.

To investigate the effects of some ecological factors on the population dynamics of whitefly species, simple correlation and partial regression between both physical and biotic factors and the population density of each species (C-multiple formula) were carried out according to **Fisher, 1950**. Records of seven climatic factors (Maximum temperature, Minimum temperature, Daily Mean air temperature, Relative humidity %, Possible sunshine duration, wind velocity and Dew point) throughout the sampling periods were taken from the nearest Meteorological station at Bahteem (5 Km to east of the experimental area). The number of field generations and their duration of each species were established according to the method recommended by **Audemard & Milaire (1975)** and **Iacob (1977)**.

1- Plant Protection Department, Fac. of Agric., Ain Shams Univ., Shoubra El-Kheima Cairo, Egypt

(Received April 24, 2005)
(Accepted May10, 2005)

RESULTS AND DISCUSSION

1. Identification of different whitefly species infesting Arabian jasmine

Available taxonomic keys for fresh materials and mounted pupal cases were used to identify different whitefly species during the present study. Results showed that the Arabian jasmine shrubs in this area were infested with two whitefly species, *Aleurotuberculatus jasmini* Takahashi and *Dialeurodes kirkaldyi* (Kotinsky).

2. Population dynamics of the two jasmine whitefly species on Arabian jasmine during 2004

Results in Table (1) showed that *D. kirkaldyi* was more dominant than *A. jasmini*, where the annual mean number of *D. kirkaldyi* individuals per plant leaf was about seven folds than of *A. jasmini* the annual means for both species were 103.9 & 15.4 individuals/leaf, respectively.

3. Fluctuations in the seasonal abundance of the two jasmine whitefly species on Arabian jasmine

The population density of the two whitefly species were represented by mean numbers of nymphs, adults (empty exuviae) and total alive population on one Arabian jasmine leaf. It found more convenient to discuss results of each species separately:

3.1. *D. kirkaldyi*

Results in Table (1) and Fig. (1) revealed that, the annual mean number of total population of this species was 103.9 individuals/leaf (68.1 nymphs & 35.8 adults). The seasonal abundance was fluctuated throughout the successive counts. The mean numbers of total alive population recorded three peaks of seasonal abundance on mid-June, late-August and mid-November, 2004 where the mean numbers were 132, 201.5 and 246 individuals/ leaf, respectively. The mean numbers of nymphs recorded also three peaks of seasonal abundance on mid-June, late-August and early-October, 2004 with mean numbers of 97, 142.5 and 140.5 nymphs/ leaf, respectively. Also the mean numbers of adults recorded three peaks of seasonal abundance on late-August, mid-October and mid-November, 2004 with mean numbers of 59, 65 and 169 adults/ leaf for the three peaks, respectively.

From the fore-mentioned results, it could be concluded that, the population density of this species was active allover the year with main active period in summer and autumn months, while in winter and spring months population was less active. It may be due to the low number of plant leaves in these months. These results in agreement with those obtained by **El-Borollosy *et al* (1990)** detected three variable peaks and three falls of the abundance of *D. kirkaldyi* on *Jasminum sambac* throughout two successive seasons (1986-87 & 1987-88). They added that the activity period of this whitefly apparently covered the seasons and was more active during summer and fall.

3.2. *A. jasmini*

Results in Table (1) and Fig. (2) revealed that the annual mean number of total population of this species was 15.4

individuals/ leaf (5.6 nymphs & 9.8 adults). The mean numbers of total alive population also recorded three peaks of seasonal abundance on early-March, late-August and mid-November, 2004 with mean numbers of 20.5, 22.5 and 41.0 individuals/ leaf, respectively. The mean numbers of nymphs recorded also three peaks of seasonal abundance on early-January, late-August and late-November, 2004 with mean numbers of 8.5, 14.5 and 11.0 nymphs/ leaf, respectively. Also the

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 951 - 962, 2005

Table 1. Seasonal fluctuations in the population density of two whiteflies on Arabian jasmine shrubs represented by ten-days mean numbers (Nymphs & Adults) on one leaf at Shoubra-Qalyubiya Governorate during 2004

Mean Numbers/leaf						Sampling
A. jasmini			*D. kirkaldyi*			
Total	Adults	Nymphs	Total	Adults	Nymphs	Dates
17.5	9.0	8.5	48.5	15.5	33.0	JAN.1/2004
19.5	14.0	5.5	59.0	24.0	35.0	11
17.8	10.8	7.0	47.0	24.0	23.0	21
15.0	11.0	4.0	42.0	21.5	20.5	FEB.1
17.0	13.5	3.5	46.5	26.5	20.0	11
18.0	15.0	3.0	41.5	18.0	23.5	21
20.5	17.5	3.0	53.0	14.0	39.0	MAR.1
17.5	15.5	2.0	49.0	18.0	31.0	11
12.5	10.0	2.5	57.0	22.0	35.0	21
11.0	9.5	1.5	63.0	31.0	32.0	APR.1
10.0	8.0	2.0	61.0	20.5	40.5	11
9.5	8.5	1.0	63.5	22.5	41.0	21
5.0	4.5	0.5	83.5	32.0	51.5	MAY, 1
6.0	2.5	3.5	81.5	29.5	52.0	11
3.5	1.5	2.0	73.5	13.5	60.0	21
4.5	1.5	3.0	96.0	30.5	65.5	JUN.1
5.2	4.2	1.0	132.0	35.0	97.0	11
7.0	2.5	4.5	109.5	16.5	93.0	21
5.8	3.3	2.5	101.0	19.0	82.0	JUL. 1
7.5	3.5	4.0	85.0	13.0	72.0	11
12.0	5.5	6.5	79.5	19.0	60.5	21
14.5	6.5	8.0	82.0	20.5	61.5	AUG. 1
21.5	15.0	6.5	128.5	18.0	110.5	11
22.5	8.0	14.5	201.5	59.0	142.5	21
13.0	5.0	8.0	108.5	16.5	92.0	SEP.1
20.0	7.5	12.5	111.5	24.5	87.0	11
14.0	8.5	5.5	144.5	36.5	108.0	21
12.5	6.5	6.0	190.5	50.0	140.5	OCT.1
13.0	4.5	8.5	187.5	65.0	122.5	11
16.5	8.5	8.0	159.5	29.0	130.5	21
17.5	8.5	9.0	197.5	100.0	97.5	NOV.1
41.0	34.0	7.0	246.0	169.0	77.0	11
37.0	26.0	11.0	183.5	100.0	83.5	21
21.0	11.5	9.5	115.0	63.0	52.0	Dec. 1
23.0	14.0	9.0	106.0	44.0	62.0	11

1- Plant Protection Department, Fac. of Agric., Ain Shams Univ., Shoubra El-Kheima Cairo, Egypt

(Received April 24, 2005)
(Accepted May10, 2005)

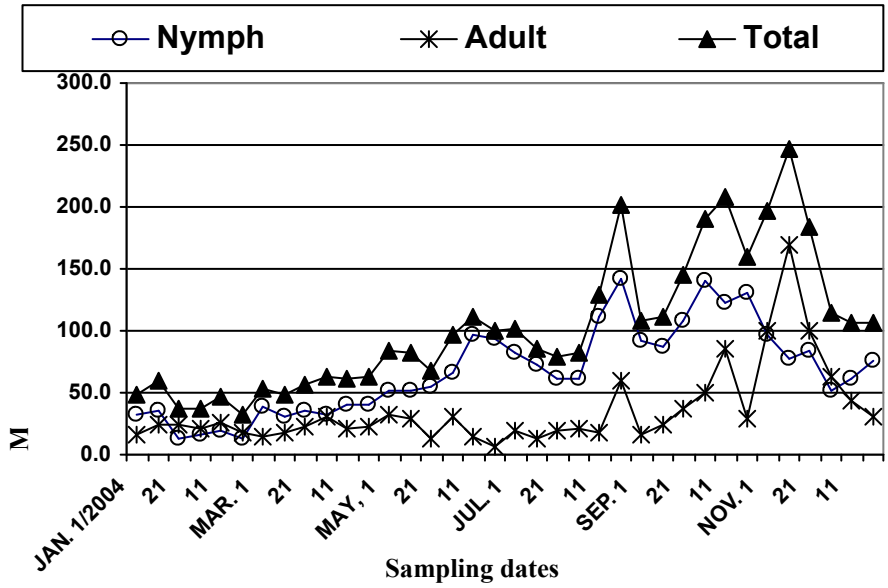


Fig. 1. Seasonal fluctuations in the population densities of *D. kirkaldyi* on Arabian jasmine shrubs represented by ten-day mean numbers on one leaf at Shubra-Qalyubiya Governorate during 2004 season.

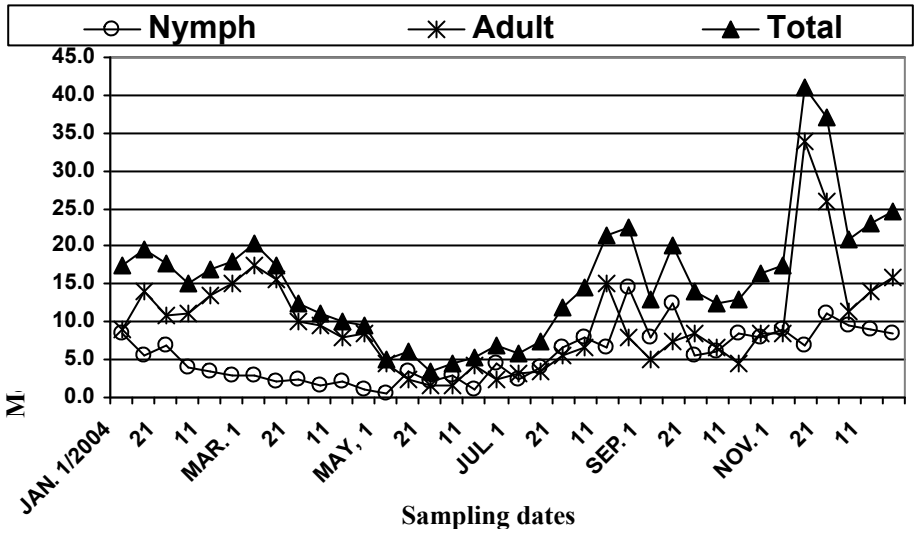


Fig. 2. Seasonal fluctuations in the population densities of *A. jasmini* on Arabian jasmine shrubs represented by ten-day mean numbers on one leaf at Shubra-qalyubiya Governorate during 2004 season

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 951 - 962, 2005

mean numbers of adults recorded three peaks of seasonal abundance on early-March, mid-August and mid-November, 2004 with mean numbers of 17.5, 15.0 and 34.0 adults/ leaf for the three peaks, respectively.

From the fore-mentioned results, it could be concluded that the population density of this species was less active than *D. kirkaldyi* throughout the successive counts allover the year.

4. Number of annual field generations

Graphical representation of mean numbers of nymphs on semi-Gaussion paper (scale gauss) according to the method recommended by **Audemard & Milaire (1975)** and **Iacob (1977)** shows the number and duration of generations represented by regression lines for both species as follows:

4.1. *D. kirkaldyi*

Results in Fig. (3) revealed that this species had three annual field generations, the first generation was the longest one and lasted for about 170 days, occurred between early-January and mid-June. The mean number of nymphs of this generation was the lowest and was about 41.2 nymphs/ leaf. The second generation was the shortest one and lasted for about 90 days and was occurred between late-June and mid-September. The mean number of nymphs of this generation was about 89.0 nymphs/ leaf. The third generation lasted for about 100 days and was occurred between late-September and late-December. The mean number of nymphs of this generation was the highest one with about 95.0 nymphs/ leaf in average.

4.2. *A. jasmini*

Results in Fig. (5) revealed the presence of five annual field generations, the first generation was lasted about 80 days and was occurred between early-January and mid-March. The mean number of nymphs was 4.6 nymphs/ leaf. The second generation was also lasted 80 days and was occurred between late-March and early-June. The mean number of nymphs of this generation was the lowest one which represented by 2.0 nymphs/ leaf. The third generation was lasted about 70 days and was occurred between mid-June and mid-August. The mean number of nymphs was 4.7 nymphs/ leaf. The fourth generation was the shortest one which lasted 60 days only and occurred between late-August and mid-October. The mean number of nymphs was the highest one and represented by 9.2 nymphs/ leaf. The last generation was lasted 70 days and occurred between late-October and late-December. The mean number of nymphs was 8.9 nymphs/ leaf.

These results in agreement with those obtained by **Helmi (2003)** who recorded five generations of *A. jasmini* on Navel orange trees in Egypt**.**

1- Plant Protection Department, Fac. of Agric., Ain Shams Univ., Shoubra El-Kheima Cairo, Egypt

(Received April 24, 2005)
(Accepted May10, 2005)

5. Effects of nine ecological factors on the population dynamics of the two jasmine whiteflies

Nine ecological factors (7 physical + 2 biotic) were tested to clarify their simultaneous effects on the population dynamics of two whitefly species infesting Arabian jasmine shrubs throughout 2004. Counts per ten-days of mean numbers of living nymphs on one leaf of Arabian jasmine shrubs for each species were used as dependent factor (y).

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 951 - 962, 2005

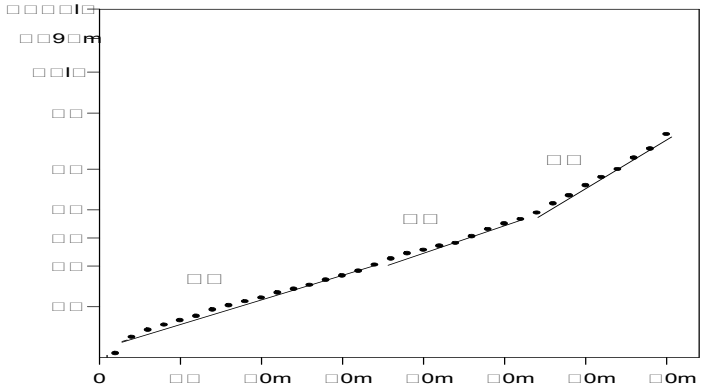
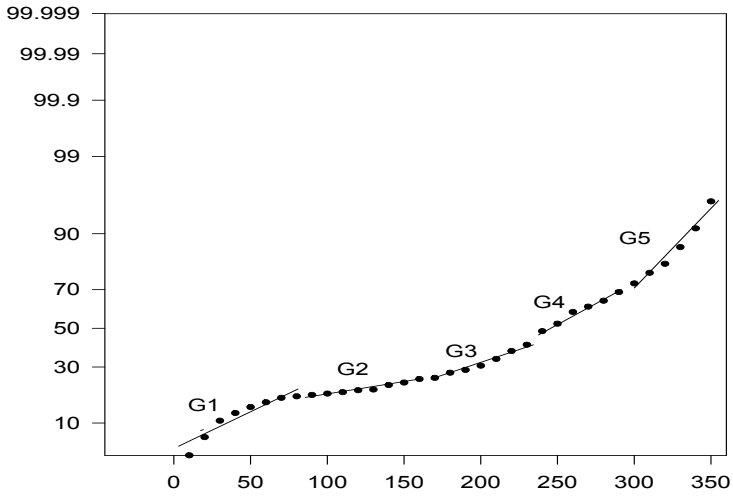


Fig. 3. The sequence of annual generations of *D. kirkaldyi* on Arabian jasmine shrubs at Shoubra, Qalyubiya Governorate during 2004 season



1- Plant Protection Department, Fac. of Agric., Ain Shams Univ., Shoubra El-Kheima Cairo, Egypt

(Received April 24, 2005)
(Accepted May10, 2005)

Fig. 4. The sequence of annual generations of *A. jasmini* on Arabian jasmine shrubs at Shoubra, Qalyubiya Governorate during 2003 seasons

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 951 - 962, 2005

While the corresponding means of the seven selected factors were used as independent factors, i.e. maximum mean temperature (X_1); minimum temperature (X_2); mean temperature (X_3); mean percentage of relative humidity (X_4); mean photoperiod (X_5); mean wind speed (X_6), mean dew point (X_7) mean percentage of fungal infestation (X_8) and mean percentage of parasitoid infestation (X_9). The effect of each factor separately was obtained by applying simple correlation while the combined effects of these factors were estimated by C-multipliers formula and expressed as percentage of explained variance. The variance ratio "F" was used as a measure of significant.

5.1. *D. kirkaldyi*

Results of statistical analysis for the effects of nine ecological factors on the population dynamics of *D. kirkaldyi* nymphs Table (3) revealed that maximum, minimum, mean temperature as well as mean dew point had high positive significant effects on nymph seasonal fluctuations during 2004. Correlation coefficient "r" values were 0.6, 0.7, 0.6 and 0.7 for the four factors, respectively. While mean percentage of relative humidity and mean of photoperiod had positive insignificant effects, where "r" values were 0.3 and 0.2 for the two factors, respectively. Mean of wind velocity had negative significant effect, where "r" value was -0.4. Regarding of the two tested biotic factors both of them showed negative significant effects on the population dynamics of this species. Correlation coefficient value was -0.4 for both mean percentage of fungal infestation and mean percentage of parasitoid infestation.

The combined effects of the nine selected ecological factors showed that these factors (as a group) had highly significant effects on the population dynamics of nymphs throughout this year. The explained variance was 74.2 % and "F" value was 8.31. The remaining of variance was assumed due to the influence of other unconsidered factors in addition to the experimental error.

From the fore-mentioned results, it could be concluded that this whitefly species prefer moderate and high temperature weather. While affected negatively with wind velocity. Also both of two biotic factors play a role in reduces the activity of this species. **El-Borollosy *et al* (1990)** tested the effect of maximum and mean temperature as well as mean percentage of relative humidity on *D. kirkaldyi* abundance they stated that these three factors had influence on the population density of this whitefly species, this influence differed significantly from one influence on the population density of this whitefly species, this influence differed significantly from one weather factor to another and from one season to another.

5.2. *A. jasmini*

1- Plant Protection Department, Fac. of Agric., Ain Shams Univ., Shoubra El-Kheima Cairo, Egypt

(Received April 24, 2005)
(Accepted May10, 2005)

Results of statistical analysis for the effects of nine ecological factors on the population dynamics of *A. jasmini* nymphs Table (3) revealed that maximum, minimum, mean temperature had negative insignificant effects on nymph seasonal fluctuations during 2004. Correlation coefficient "r" values were -0.4, - 0.1 and -0.3 for the three factors, respectively. While mean wind velocity, mean dew point and mean percentage of relative humidity showed positive effects "r"

values were 0.7, 0.5 and 0.3, respectively. These values were significant for the first and second factors while the third factor was insignificant. On contrary, mean photoperiod showed highly negative significant effect (r= -0.7). Regarding the effects of the two biotic factors both showed negative insignificant effects. Correlation coefficient values were -0.4 and -0.1 for mean percentage of fungal infestation and mean percentage of parasitoid infestation, respectively.

The combined effects of the nine selected ecological factors showed that these factors had highly significant effects on the population dynamics of nymphs throughout this year. The explained variance was 95.5 % and "F" value was 19.06.

From the fore-mentioned results, it could be concluded that this whitefly species affected negatively with photoperiod that may be play a role with temperature and the two biotic factors in reduces the activity of this species.

These results in agreement with those obtained by **Helmi, (2003)** who stated that nymphs of *A. jasmini* prefer moderate temperature and negatively correlated with photoperiod.

The present study may be useful for designing and takes a decision to control these two insect pests under the Integrated Pest Management programs.

REFERENCES

Abd-Rabou, Sh. (1990). ***Taxonomic Studies of Whiteflies of Egypt (Homoptera: Aleyrodidae). p. 110.*** M.Sc. Thesis Faculty of Science, Ain-Shams University.

Amin, A.H.; A.K. Emam and A. Helmi (1997). A New Record on a Whitefly Species of The Genus *Aleurotuberculatus* (Homoptera: Aleyrodidae) on Citrus Trees in Egypt. ***Mededelingen Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen, Universiteit Gent, 62: 349-354.***

Audemard, H. and G. Milaire (1975). Le Piegeage du Carpocapce Sexual de Syntheses: Primers Results Utilisables pour L. Estimation des Populations Conduite de la Lulte. ***Ann. Zool. Ecol. Anim; 7: 61-81.***

El-Borollosy, F.M.; M.M. El-Bolok; A.I. Ezz and M. Assem-Shadia (1990). Ecolgical Studies on the Arabian Jasmine Whitefly *Dialeurodes kirkaldyi* Kotinsky (Aleyrodidae, Homoptera) on *Jasminum sambac*. ***Bull. Soc. Ent. Egypt, 69: 327-334.***

Fisher, A.R. (1950). ***Statistical Methods for Research Worker.*** Oliver and Boyd, Edinburgh and London.

Helmi, A. (1996). ***Taxonomical Revision of Whiteflies*** **(Hemiptera: Aleyrodidae) as Known** ***to Occur in Egypt. pp. 55-66.*** M.Sc. Thesis, Faculty of Agriculture, Ain-Shams University, Cairo.

Helmi, A. (2003). ***Taxonomical and Ecological Studies of Whiteflies Fauna in Egypt (Homoptera: Aleyrodidae). pp. 55-66.*** Ph.D. Thesis, Faculty of Agriculture, Ain-Shams University, Cairo.

Iacob, N. (1977). UN Model Matimatic Pentra Stabilirea Limitelor Economic de Lolyrenta a Atacaluimolilor Fructilor in Lupte Integrate. ***Analele I.C.P.D. 15-179, Romania.***

Kotinsky, J. (1907). Aleyrodidae of Hawaii and Fiji with Descriptions of New Species. ***Bull. Bd Commnrs Agric. For. Hawaii Div. Ent., 2: 93-102.***

Nada, S.M.A.; S.K. Mohamed and Sh. Abd-Rabuo (1991). Hosts and Distribution of The Whiteflies of Egypt (Homoptera: Aleyrodidae). ***Fourth Arab Congress of Plant Protection, Cairo, pp. 189-193.***

Nguyen, Ru; R.I. Sailer and A.B. Hamon (1993). Catalog of Aleyrodidae on Citrus and Their Natural Enemies. ***Occasional Papers of the Florida State Collection of Arthropods, Florida Department of Agriculture and Consumer Services, 8: p. 75.***

Priesner, H. and M. Hosny (1934). Contributions to a Knowledge of Whiteflies (Aleurodidae) of Egypt. (Π). ***Bull. Minist. Agric. Egypt. Tech. Scient. Serv., 139: 1-21.***

Russell, L.M. (1964). *Dialeurodes kirkaldyi* (Kotinsky) a Whitefly New to The United States (Homoptera: Aleyrodidae). ***Fla. Ent., 47: 1-4.***

Takahashi, R. (1932). Aleyrodidae of Formosa, Part I. Rep. ***Dep. Agric. Govt. Res. Inst. Formosa, 59: 1-57.***

مجلة اتحاد الجامعات العربية للدراسات والبحوث الزراعية، جامعة عين شمس، القاهرة 13(3)، 951 - 962، 2005

بعض النواحى البيئية لنوعين من الذباب الأبيض يصيبان شجيرات الفاكهة فى مصر
(هوموبترا: اليروديدى)

]64[

أشرف حلمى
1- قسم وقاية النبات - كلية الزراعة - جامعة عين شمس - شبرا الخيمة - القاهرة - مصر

[illegible]

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 951 - 962, 2005

نعوىسمنيتمللوجيكربويتوريال ىايدلاكريلفدوريال عونلالىلغعمتجم
ىفقثداخلاريغتلالىلع % 95.5 ىلاوح 74.2 % علىلالتغيرات ىلاوح نعوىسم
عونلا اذهتايروحعيحاجكيمانيد امنيبتايروحلاعيحاجكيمانيىفقثداحلا
عونلالىلغعمتجملماوعلاكلتنيثاتانك

تحكيم: أ.د عبدالرحمن حسين أمين
أ.د سامى الدسوقى

1- Plant Protection Department, Fac. of Agric., Ain Shams Univ., Shoubra El-Kheima Cairo, Egypt

(Received April 24, 2005)
(Accepted May10, 2005)