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Pomegranate Whitefly, *Siphoninus phillyreae* (Haliday) (Homoptera: Aleyrodidae) Population Dynamics and Parasitism Rates on Pomegranate Trees at Kafr El-Sheikh Governorate, Egypt

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ABSTRACT

Population dynamics of the pomegranate whitefly, *Siphoninus. phillyreae* (Haliday) immatures and the rates of parasitism on their larval and pupal stages were studied on pomegranate trees at Kafr El-Sheikh Governorate during 1999, 2000 and 2001 seasons. Results indicated that the highest population of the immatures was recorded during September through October in the three seasons. Highest total number of eggs (916 eggs/60 leaves) was detected during September, 1999 and during October 2000 and 2001, when they attained 93 and 106 eggs/60 leaves, respectively. Highest total numbers of larvae and pupae were recorded during September in the three seasons represented by 86, 20 and 47 larvae/60 leaves in 1999, 2000 and 2001, and 213, 20 and 43 pupae/60 leaves in 1999, 2000 and 2001, respectively. Two parasitoid species, *Encarsia inaron* Walker and *Encarsia lutea* (Mas.) emerged from *S. phillyreae* larvae and pupae during the three seasons. *E. inaron* was the most dominant, representing 98.7, 97.1 and 98.8% of the total obtained parasitoids in 1999, 2000 and 2001, respectively. The overall means of the percentages of parasitism were 24.4, 18.5, 17.5 and 20.1% in the north, south, east and west directions, respectively in 1999 season. Respective means were 12.8, 13.3, 10 and 15.2% in 2000 and 17.6, 15.8, 13.9 and 17.7% in 2001.

Key Words: *Siphoninus phillyreae*, parasitism, *Encarsia inaron, Encarsia lutea.*

INTRODUCTION

Whiteflies have become objects of intensive investigations on an international scale owing to the increasing importance of them as pests on ornamental and agricultural plants in greenhouses and outdoors. They spread into new geographic areas, attacked new host plant species, became acclimatized to new environments, developed biotypes that react differently to host plants, transmitted more plant diseases and became resistant to insecticides (Gerling, 1990).

One of the important species of whiteflies in Egypt is the pomegranate whitefly, *Siphoninus phillyreae* (Haliday) (Homoptera: Aleyrodidae) (Priesner and Hosney, 1932, Abd-Rabou 1998). Population increase has resulted to heavy infestations, led to defoliation, yield reduction, honeydew contamination, and tree death (Bellows *et al.* 1990).

S. phillyreae is a polyphagous multivoltine whitefly, occurs much in Europe, partly in Africa, Middle East and Asia (Mound & Halsey, 1978). It feeds on trees and shrubs of at least 15 families, primarily Oleaceae and Rosaceae (Sorensen *et al.*, 1990 and Leady *et al.* 1993).

Two species of natural enemies, the parasitoid, *Encarsia inaran* (= *portenopea*) (Walker) and the predator, *Clitostethus arcuatus* (Rossi) (Coleoptera: Coccinellidae) were introduced for biological control of the *S. phillyreae* whitefly in California (Bellows *et al.*, 1992a).

S. phillyreae densities declined by two to four order of magnitude on both ash and toyon in California, USA after the introduction and establishment of *E. inaron* and *C. arcuatus* (Dreistadt and Flint, 1995). The parasitoid, *E. inaron* is the most effective parasitoid species for controlling this pest in Egypt (Abd-Rabou, 1998).

The present investigation aimed to throw light on population dynamics of the pomegranate whitefly, *S. phillyreae* and its parasitoids on pomegranate trees.

MATERIALS AND METHODS

The study was carried out in a pomegranate orchard, at the Agricultural Experimental Farm of the Faculty of Agriculture, Kafr El-Sheikh, Tanta University at Kafr El-Sheikh Governorate during the three successive seasons, 1999, 2000 and 2001. Experimental orchard received no chemical control throughout the three seasons of the study.

Population Dynamics of the *S. phillyreae* Immature Stages

Ten pomegranate trees (about 10 years old) were chosen for sampling. The ten trees were sampled weekly; three leaves were randomly picked from each cardinal direction (north, south, east and west) of each tree. The leaves of each direction were put separately into plastic bag and transferred to laboratory for examination. By the aid of a binocular stereomicroscope, *S. phillyreae* immatures (eggs, larvae and pupae) were counted on each of the upper and lower surfaces of leaves.

Parasitoids

Percentages of parasitism were estimated by picking 30 infested leaves from each cardinal direction and put into plastic bags and transferred to the laboratory for examination. Third larval instars and pupae of *S. phillyreae* were counted; eggs, first and second larval instars as well as other associated insects were eliminated. Collected larvae and pupae from *S. phillyreae* of each cardinal direction were confined separately into Petri-

dishes (7.5 cm diameter) until emergence of either the parasitoid or the whitefly adults. Percentage of parasitism of each parasitoid species was calculated as follows:

$$\text{Parasitism (\%)} = \frac{A}{B}$$

Where: A= No. of emerged parasitoids
B= Total no. of *S. phillyreae* larvae and pupae

Parasitoid adults were slide mounted in Hoyere's medium and identified to the species level according to Abd-Rabou and Abou Setta, 1998.

Obtained data were subjected to analysis of variance (ANOVA) and Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Population Dynamics of *S. phillyreae* Immatures

Data presented in Table (1) indicate that the *S. phillyreae* immatures did not show up during July, with the exception of few numbers of eggs in the first season (1999). During August, the immatures started to occur with considerable numbers, especially in the south direction in 1999 and in the west in 2001. Highest rates of *S. phillyreae* infestation were recorded during September through October in the three seasons.

Eggs

Highest total number of eggs (916 eggs/60 leaves) was recorded during September, 1999 in the south direction while the lowest (18 eggs/60 leaves) was found during December in the same year in the east direction. Highest total numbers (93 and 106 eggs/60 leaves) in 2000 and 2001, respectively were detected during October in the south direction. 30 and 50 eggs/60 leaves were recorded during December, 2000 and 2001, respectively in the south direction (Table 1).

Larvae

Highest total number of larvae (86 larvae/60 leaves) occurred during September in 1999 in the west direction. Respective peaks (20 and 47 larvae/60 leaves) were recorded in the north direction during September also in 2000 and 2001. The lowest number of larvae (7 larvae/60 leaves) was recorded in the north direction during November, 1999. Correspondent values in 2000 and 2001, occurred during December, when only 2 larvae/60 leaves were found in the south direction in 2000 and 13 larvae/60 leaves in the three directions; east, west and north in 2001 (Table 1).

Pupae

Highest total numbers of pupae (213, 20 and 43 pupae/60 leaves) were recorded during September in the three seasons, 1999, 2000 and 2001 in the east, south and north directions, respectively. Lowest total numbers of pupae (4 pupae/60 leaves) occurred during December in 1999 in the east direction, while no pupae were found in the west direction in 2000 and 2001 seasons.

The overall means of *S. phillyreae* immatures in 1999 season were 194.2, 375.8, 228.0 and 228.2 individ./60 leaves in north, south, east and west directions, respectively (Table 1). Respective means were 36, 37.2, 22.8 and 31.1 individ./60 leaves and 75.8, 64.5, 56.3 and 91.8 immatures/60 leaves, in 2000 and 2001, respectively.

Statistical analysis showed that insignificant differences in the total numbers of *S. phillyreae* immature stages among the different directions in the three seasons, in spite of the obvious difference between the north and south directions in 1999 season. Also, insignificant differences were recorded in the total numbers of immatures among the different months of the year in the three seasons, in spite of the differences between August, September and November in 1999 season and between August and September in 2000 as well as between September and other months in 2001.

Insignificant differences were obtained among the directions in the three seasons although the difference occurred among the north, east and west directions in 1999 and their respective values in both 2000 and 2001 and among the south in 1999, 2000 and 2001. The statistical analysis also showed that no significant differences were found between the temperature and relative humidity among different directions in the three seasons.

The present results are in agreement with those of Driestadt and Flint (1995) who stated that about 98% of ash leaves were infested with *S. phillyreae*. Similar finding was reported by Mani and Krishnomoorthy (1999) who recorded a sever outbreak of *S. phillyreae* on several pomegranate cultivars in Bangalore, India, in October.

Parasitism

Two hymenopterous parasitoid species, *Encarsia inaron* (= *partenopea*) (Walker) and *E. lutea* (Mas.) emerged from *S. phillyreae* larvae and pupae collected from pomegranate trees in 1999, 2000 and 2001.

E. inaron was the most dominated during the three seasons, representing 98.7, 97.1 and 98.8% of the total parasitoids obtained in 1999, 2000 and 2001, respectively. Sex ratio of *E. inaron* was 1.3:1, 1.6:1, 1.4:1 and 1.6:1 in 1999 season and 1:1, 1.5:1, 1.2:1 and 1.6:1 in 2000 and 1.3 1, 1.6:1, 1.3:1 and 1.6:1 in the north, south, east and west directions (female:male), respectively.

Data presented in Table (2) indicate that highest percentages of parasitism on *S. phillyreae* larvae and pupae (40.5 and 37.8%) were recorded during August, 1999 in the east and north directions, respectively. Respective values were 21.4 and 20.2% in 2000 in the north and west directions during September and October, respectively. In 2001 they were 27.2 and 26.1% in the west and north directions during October and September, respectively.

The overall means of the percentages of parasitism in 1999 season were 24.4, 18.5, 17.5 and 20.1% in the north, south, east and west directions, respectively. The respective means were 12.8, 13.3, 10 and 15.2% in 2000 and 17.6, 15.8, 13.9 and 17.7% in 2001 (Table 2).

Table (1): Total numbers of *Siphoninus phillyreae* (Haliday) immature stages /60 leaves at different cardinal directions on pomegranate trees at Kafr El-Sheikh region during 1999, 2000 and 2001 seasons.

Months	Years	North				South				East				West			
		Eggs	Larvae	Pupae	Total	Eggs	Larvae	Pupae	Total	Eggs	Larvae	Pupae	Total	Eggs	Larvae	Pupae	Total
	1999	0	0	0	0	0	1	0	1	7	1	0	8	0	1	0	1
July	2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1999	19	2	1	22	256	20	12	288	13	1	0	14	91	19	31	141
August	2000	7	1	0	8	16	0	0	16	3	0	0	3	18	3	0	21
	2001	60	12	0	72	88	0	1	89	48	4	0	52	206	20	0	226
	1999	262	48	66	376	916	52	79	1047	379	73	213	665	501	86	88	675
Sept.	2000	45	20	17	82	19	2	21	42	32	11	10	53	81	18	21	120
	2001	70	47	43	160	30	5	26	61	94	13	22	129	197	32	37	266
	1999	156	24	123	303	218	55	130	403	70	30	137	237	129	21	115	265
Oct.	2000	41	4	13	58	93	11	3	107	52	6	2	60	5	2	1	8
	2001	66	12	23	101	106	26	6	138	103	13	7	123	6	4	3	13
	1999	209	7	76	292	284	70	97	451	284	54	81	419	87	41	45	173
Nov.	2000	35	2	3	40	7	1	8	16	10	6	4	20	31	6	1	38
	2001	53	3	7	63	10	3	10	23	14	6	6	26	34	10	2	46
	1999	123	43	6	172	37	12	16	65	18	3	4	25	74	34	6	114
Dec.	2000	25	0	3	28	30	2	10	42	0	0	1	1	0	0	0	0
	2001	36	1	22	59	50	4	22	76	0	8	0	8	0	0	0	0
Overall	1999	128.2	20.7	45.3	194.2	285.2	35.0	55.6	375.8	128.5	27.0	72.5	228.0	147.0	33.7	47.5	228.2
mean	2000	25.5	4.5	6.0	36.0	27.5	2.7	7.0	37.2	16.2	3.8	2.8	22.8	22.5	4.8	3.8	31.1
	2001	47.5	12.5	15.8	75.8	47.4	6.3	10.8	64.5	43.2	7.3	5.8	56.3	73.8	11.0	7.0	91.8

Table (2): Percentages of parasitism on *Siphoninus phillyreae* (Haliday) larvae and pupae on pomegranate trees at Kafr El-Sheikh region during 1999, 2000 and 2001.

Months	North			South			East			West		
	1999	2000	2001	1999	2000	2001	1999	2000	2001	1999	2000	2001
July	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aug.	37.8	0.0	26.1	22.9	0.0	10.0	40.5	0.0	19.5	21.7	0.0	17.5
Sept.	25.6	21.4	24.4	17.4	13.9	16.6	20.1	15.4	19.2	18.5	15.7	18.8
Oct.	14.0	10.2	12.1	23.5	16.7	21.2	12.0	7.4	9.9	29.2	20.2	27.2
Nov.	7.8	1.6	6.7	16.3	9.9	15.5	9.8	5.4	9.3	15.6	10.9	13.1
Dec.	0.0	0.0	7.7	0.0	0.0	0.0	0.0	0.0	2.2	10.0	2.9	7.6
Mean *	20.4	12.8	17.6	18.5	13.3	15.8	17.5	10.0	13.9	20.1	15.2	17.7

* Overall mean was calculated on the basis of total numbers of larvae and pupae and parasitoids.

Statistical analysis of the present data revealed insignificant differences in the percentages of parasitism among the different directions in the three seasons. No significant differences were found in the percentages of parasitism among different months during the three seasons.

Abd-Rabou (1998) reported that *E. inaron* was found parasitizing *S. phillyreae* larvae and pupae on pomegranate trees in Upper Egypt, with average parasitism rates of 10.8, 6 and 15.9% in Assiut, El-Minya and Sohag Governorates, respectively. He also mentioned that the parasitism reached 67, 37 and 45%, respectively by the end of season. He also recorded *E. lutea* in Assiut and Sohag with parasitism rates between 0.5 to 1.5% and 0.3 to 1%, respectively.

Bellows *et al.* (1992b) stated that releases of *E. inaron* successfully controlled *S. phillyreae*. Dreistadt and Flint (1995) recorded that *E. inaron* was the most important species against *S. phillyrae*. Similar findings were reported by Charles and Froud (1996) and Robb *et al.* (1999).

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