

Seasonal Abundance of the Fig Pustule Scale Insect, *Russelaspis pustulans* Cockerell (Homoptera: Asterolecaniidae) and its Parasitoids in Middle Egypt

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Abstract: The fig pustule scale insect, *Russelaspis pustulans* Cockerell (Homoptera, Asterolecaniidae), is considered as serious scale pest on different host plants such as, fig, mango, guava, olive, some other fruit trees and many kinds of ornamental plants in Egypt. The pest infests branches, stems, new twigs, leaves and fruits, but it prefers branches and stems, and causes the form of a cup in which the scale is found. Seasonal abundance of pre-adult female gravid females and total population was studied. Four peaks of the total population of *R. pustulans* were recorded; of the pest the first (334 scales /10branch), the second (649 scales /10branch), the third (612 scales /10branch) and the fourth (1097 /10branch) in early of June, early August and November and mid December 2004, respectively while in the second season four peaks were recorded by early June (339), August (659), November (629) and mid December (1510), the highest peak was recorded by the first of December 2005 (1348) / 10 branch. Survey of the parasitoids of *R. pustulans* revealed three parasitoid species. *Aphytis mytilaspidis*, *Bothriophryne* sp. and *Enargopelta* sp. The last two parasitoids were recorded for the first time in Egypt. The highest percentage of parasitism on *R. pustulans* were 19 and 21% recorded in November, 2004 and October 2005 for *A. mytilaspidis*, while it was 14.5 and 13.5 %, recorded in December 2004 and August 2005 for *Bothriophryne* sp., for *Enargopelta* sp. 15.1 and 23.7% were recorded in May 2004 and December 2005, respectively.

Keywords: Seasonal Abundance, *Russelaspis pustulans*, Parasitoids

INTRODUCTION

The fig pustule scale insect, *Russelaspis pustulans* Cockerell (Homoptera: Asterolecaniidae) is one of the major pests in Egypt and in different parts of the world; such as. British Guiana, West Indies, Puerto Rico, Honolulu, Mexico, Virgin Islands, Formosa, Brazil, Kenya and Tenganyika, (Habib, 1943), Texas; USA (Dean and Schuster, 1970), China (Cen, 1986); Puerto-Rico (Medina-Gaud *et al.*, 1987).

In Egypt, the pest was found in the coastal regions, the southern areas of Delta, middle Egypt and several parts of Upper Egypt (El-Eraki, 1991).

The insect has numerous host plants such as, peach, plum, pear, apple, guava, fig, apricot, mango, olive, *Ficus cymorus*, *F. carica*, *F. bengalensis* *Acacia farnisiana*, *Nerium oleander*, *Morus alba*, *Jasminum humili*, *Zizyphus mauritiana*, *Bauhinia variegata* and *Jacaranda mimosofolio* (Morsi, 1999).

R. pustulans is an interesting species in several aspects, particularly in its tendency to produce pits. This habit, however, is apparently governed primarily by the susceptibility of the host to pit formation because some infested hosts do not show any depressions, while, others show gradations from shallow pits to deep cavities. When deep pits are formed, there is a tendency for the host tissue to draw together at the opening, thus concealing the scale insect. The insect infests branches, stems, new twigs, leaves and fruits. The toxic substances secreted by this pest during feeding cause the bunching of the stem which at the end takes the form of cup.

Literature in hand showed a few work on the fluctuation and seasonal abundance of the fig pustule scale insect (Habib, 1943, El-Minshawy *et al.* 1972, and El-Eraki, 1991). The available literatures concerning the natural enemies of *R. Pustulans* are rare, however, Priesner and Hosny (1940) recorded, *Aphytis mytilaspidis* LeBar (Aphelinidae), *Enargopelta* sp. (Pteromalidae) and

Marietta exitiosa Comp. (Aphelinidae) as parasitoids of *R. pustulans*. In Brazil, *Metaphycus portorivensis* (Doz.) was introduced for the control of the fig pustule scale insect, also the same parasitoid species was introduced into Sao Tomee for the same purpose (Castel-Branco, 1973).

The present work aimed to survey and study seasonal abundances of *R. pustulans* and its parasitoid species in Beni-Suef region.

MATERIALS AND METHODS

Seasonal abundance of *R. pustulans*

The present investigation was conducted at Nasser district, Beni-suif Governorate for the two successive years 2004/05 and 2005 /06. A fig orchard about 2 feddans, 12 years old, heavily infested with the fig pustule scale insect, *R. pustulans* was chosen for this study. The orchard was kept free from any pesticide applications or control measures before and throughout the period of this study.

A sample of 10 fig branches, (15 cm each) was collected at random, periodically, 15 day intervals from different directions of the orchard. The branches were transferred to the laboratory, where they carefully inspected by the aid of a stereomicroscope and different fig scale instars and stages were precisely counted and recorded.

Survey of *R. pustulans* parasitoids

A survey of *R. pustulans* parasitoids was carried out in Beni-Suif, Giza and Minia Governorates, throughout two seasons, extending from February 2004 till January 2006. Samples of heavily infested branches from fig, Ficus and apple, trees were randomly collected from different orchards through the two successive seasons. The infested branches, 15 cm long each, were taken from different directions of the trees. These samples were confined in plastic jars and kept in the laboratory for securing emerging parasitoids.

Emerged parasitoid species were collected, sorted into species and preserved in vials containing 70% ethyl alcohol and glycerin, in addition to slide mounting specimens for identification. Parasitoid species was identified in the Biological Control Research Department, Plant Protection Research Institute, Agric. Research. Center, Giza, Egypt.

Seasonal abundance of parasitoids

Fig branches infested with the second and third nymphal instars, adult females and gravid females of *R. pustulans*, were sampled biweekly (10 branches per sample) from the aforementioned orchard from the same directions. Each branch was kept in a glass jar, after removing all other insects, rather than the fig pustule scale insect. The jars were inspected daily for any emerging parasitoids which were counted. The percentages of each parasitoid to the total number of the scales / 10 branches were calculated.

Percentages of parasitism

Rates of parasitism on different stages of *R. pustulans* were estimated throughout the two successive years. Heavily infested branches, at half monthly period, were selected from the fig trees and 100 scales were randomly taken from the infested branches and dissected, by the aid of a stereomicroscope. Parasitized scales were counted and classified as containing parasitoid larvae or pupae or having emerge holes for the adult parasitoids. Percentages of parasitism were calculated in each sample.

Simple correlation and regression value were calculated to obtain information about the relationships between biotic factors. The mean recorded of the three tested weather factors considered in the analysis (Maxi. T., Man. T. and M.RH) on the *R. pustulans* population density as described by F test, (Sendecor 1970) by the aid of the computer.

RESULTS AND DISCUSSION

Seasonal abundance of the fig pustule scale insect, *R. pustulans*.

Half-monthly counts of nymphal stage (2nd, 3rd instar), adults and gravid females of *R. Pustulans* showed four peaks; the first (334 individuals / 10 branches) on the first of June, the second (649) and third (612) on the first of August and November respectively and the fourth peak (1097) occurred by mid December in season 2004 (Fig 1).

Concerning the 2nd nymphal instar, its peaks were recorded on the first of September and mid December 2004 as 237 and 919 individuals / 10 branches, respectively. The peaks of the 3rd instar were on the first of September 2004 as (167 individuals /10 branches) and mid January 2005 as (97 individuals) were recorded. The total number of the nymphal stage showed, two peaks; on the first of September (404 individuals) and mid December 2004 (987 individuals).

Three peaks for the non-gravid females were recorded; on the first of August and October 2004 and on the first of January 2005. These peaks were represented by 250, 176 and 143 individuals, respectively.

At the same time, the populations of gravid females had also 3 peaks; recorded in June (288 individuals), in August, (255 individuals) and in October (214 individuals).

In the second year of investigation as showed in (Fig. 2), the total populations showed four peaks; three were on first of each of June (339 individuals), August (659 individuals) and Nov. (629 in) in addition to the fourth peak recorded (1510 individuals/ 10 branches).by mid December 2005

There were two peaks for gravid females; one on the first of June (296 individuals) and the second on the first of October (273 individuals).

Concerning the non-gravid adult females, five peaks were recorded; three of which were on the first of August, September and October 2005 and the other two peaks were recorded on the first of January and February 2005, with 163, 125, 116, 137 and 99 individuals/ 10 branches, respectively.

The total numbers of the nymphal stage had three peaks; recorded on the first of August (396 individuals), mid September (235 individuals) and mid December (1331 individuals).

As regards to the second nymphal instar, three peaks were recorded, on the first of August (297 individuals), on the first of December (1136 individuals) and on the first of February 2006 (298 individuals).

The third instar population showed also three peaks; by mid August (133 individuals), by mid September 2005 (197 individuals) and mid January 2006 (135 individuals).

Habib, 1943 mentioned that the pest had three generations per year, the first beginning by the end of January, the second about the middle of May and third in September. El-Minshawy *et al.*, 1972 reported that *A. pustulans* had two generations a year, the first from October until May, and the second begin in June and lasted until October. El-Eraki, 1991, indicated that the insect had two annual generations, late of autumn and early of winter.

Survey of Parasitoid species

The samples of fig and apple branches infested with *R. pustulans* collected during the two successive seasons, 2004 and 2006 gave four hymenopteraous parasitoid species.

Primary parasitoids were *Aphytis mytilaspidis* Le Bar, (Aphelinidae), *Bothriophryne* sp. Mercet, (Encyrtidae) and *Enargopelta* sp. Mercet (Pteromalidae). The last two species were recorded for the first time in Egypt, while the first one was recorded earlier by Priesner and Hosny (1940). The hyperparasitoid, *Marietta exitiosa* Compere (Aphelinidae) was also recorded in the present study.

Seasonal abundance of parasitoids

As presented in table (1) the parasitoids of *R. pustulans* were found to occur during the whole season (2004/05 and 2005/06). Concerning the comparative numbers of the three parasitoid species obtained during, 2004, *A. mytilaspidis* ranked first (19.0%), *Enargopelta* sp ranked 2nd (15.1%) and *Bothriophryne* sp ranked 3rd (14.5%). In 2005 season *Enargopelta* sp ranked first

(23.7%, *A. mytilaspidis* ranked 2nd (18.2%) and *Bothriophryne* sp ranked 3rd (13.5%).

Four peaks of parasitism by the parasitoid, *A. mytilaspidis* were recorded in August, September, October, and, November, (18.2, 16.3, 21.0 and 16.4 %) 2005, respectively. The parasitism by the parasitoid, *Bothriophryne* sp. on *R. pustulans*l showed six peaks; occurred in May, June, and, December 2004 (14.2, 10.2 and 14.5%), respectively, May (12.6%) August (11.6 %) and November 2005 (13.5%). The percentages of the parasitoid *Enargopelta* sp. showed six peaks recorded in May (15.1%), September (10.6%), December 2004 (26%), July (11.1 %), October (23.1%) and December 2005 (23.7 %). The results of parasitism percentages showed four peaks of *M. exitosa*. in August 2004 (5.4%) February (3.8 %) July (5.4 %) and October 2005 (9.2%). Castel-Bran co, 1973 mentioned that the parasitoid, *Metaphycus portoricensid* (Doz.) was introduced into Sao Tome. Parasitized reached 85% in one year, and parasited individuals could be found all over the Island.

Percentage of parasitism

Obtained data of the parasitism among the fig

pustule scale insect, *R. pustulans* during 2004/05 and 2005/06 seasons were recorded in table (2).

As present in Table (2), the lowest total percentage of parasitism in 2004 /05 season was in November 2004 (13.5 %) while the highest was in April 2004 (33%). The respective values in 2005 / 06 season were in May 2005 (36.5%) and February 2006 (14%).

The results of the first season of study showed five peaks of activity, by April, June, August, and October when 33, 24, 31.5, 29 and 24.5% parasitism were recorded, respectively. In the second year, six peaks were recorded; in March (30.5%), April (28%), May (36.5%), August (33.5%), October 2005 (30%) and January 2006 (22%).

Statistical analysis showed significant positive correlation between maximum temperature and total population of the insect ($r = 0.3938$), and positive insignificant correlation between total population and minimum temperature ($r = 0.0173$) or relative humidity ($r = 0.0534$). In the first season (2004 / 05). In the second season (2005 /06) showed significant highly positive correlation between maximum temperature and total population of the insect ($r = 0.3646$), or relative humidity ($r = 0.0558$) were recorded.

Table (1): Seasonal abundance of *Russelaspis pustulans* and its parasitoids in Beni-Suif region during 2004 / 05 and 2005/06 seasons.

Month	No. of <i>Russelaspis pustulans</i> /10 branches	No. of Emerged parasitoids			Total
		<i>Aphytis mytilaspisi</i>	<i>Bothriophryne tenicornis</i>	<i>Enargopelta nigra</i>	
Feb.2004	337	3.9	4.2	5.1	13.2
Mar	189	5.2	5.1	4.4	14.7
Apr.	201	13.3	4.7	4.7	22.7
May	433	15.7	14.2	15.1	45.0
Jun.	714	7.3	10.4	13.3	31.0
Jul.	1374	9.8	4.6	14.2	48.6
Aug.	617	15.6	9.5	9.9	35.0
Sept.	1130	18.9	9.9	10.6	39.4
Oct.	1213	5.9	10.4	5.8	22.1
Nov.	1497	19.0	5.8	8.7	33.5
Dec.	1045	12.1	14.5	1.6	28.2
Jan.2005	811	2.3	8.7	0	11.0
Feb.	603	0.0	1.8	0	1.8
Mar	318	3.2	2.5	0	5.7
Apr.	213	4.1	7.4	3.1	14.6
May	264	8.9	12.6	2.4	23.9
Jun.	517	4.2	9.3	5.4	18.9
Jul.	1613	0.7	5.4	11.1	17.2
Aug.	485	18.2	11.6	2.3	32.1
Sept.	917	16.3	3.2	4.7	24.2
Oct.	815	21.0	7.6	23.1	51.7
Nov.	1436	16.4	13.5	12.9	42.8
Dec.	1211	13.2	9.2	23.7	46.1
Jan.2006	890	4.0	3.7	5.6	13.3

Table (2): Percentages of parasitism on *Russelaspis pustulans* in Beni Suf region during 2004 / 05 & 2005 / 06 seasons

Month	Parasitism %	Emergence holes %	Total %
Feb 2004	10	6	16
Mar	10	9	19
Apr.	13.5	10.5	24
May.	16.5	6.5	23
Jun.	17.5	6.5	24
Jul.	12	5	17.
Aug.	21.5	10	31.5
Sept.	12.5	5	17.5
Oct.	16	6.5	22.5
Nov	8.5	5	13.5
Dec.	13	4	17
Jan. 2005	9.5	4	13.5
Feb. 005	15.5	6	21.5
Mar	20.5	10	30.5
Apr.	15.5	12.5	28
May.	25.5	11	36.5
Jun.	18.5	7	25.5
Jul.	13.5	9.5	23
Aug.	20	13.5	33.5
Sept.	18.5	13	31.5
Oct.	21	9	30
Nov	14.5	7	21.5
Dec.	11	8	19
Jan. 2006	14.5	7.5	22
Feb. 006	5	6	11

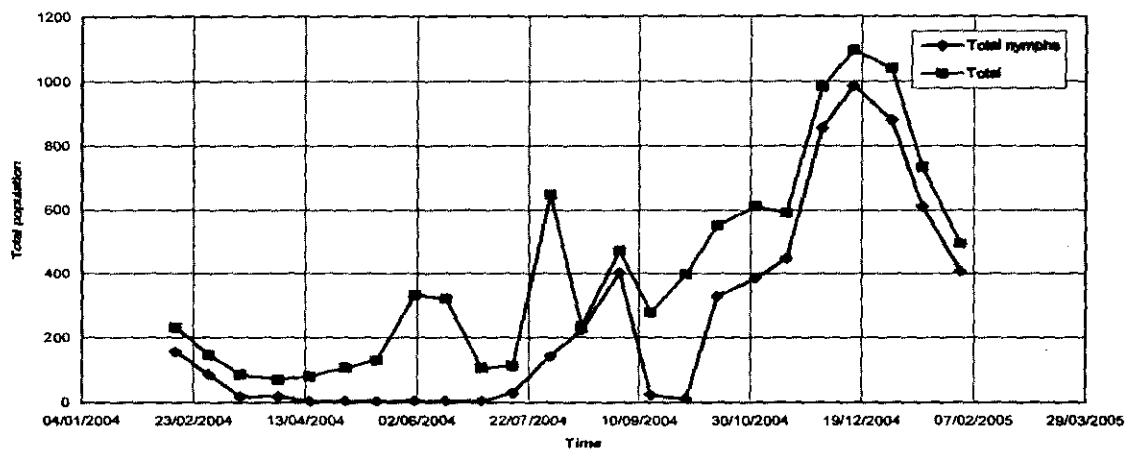
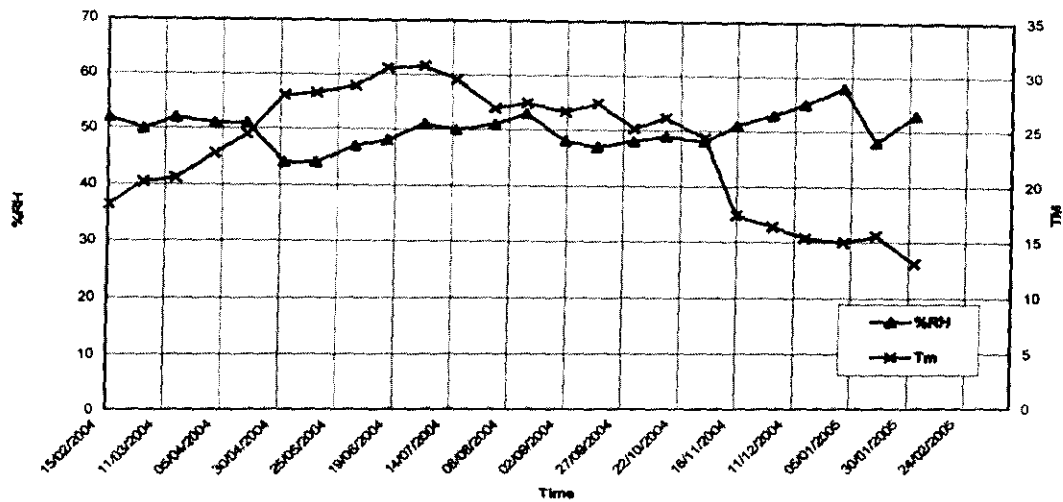


Fig (1): Seasonal abundance of the fig pustule scale insect *Russelaspis Pustulans* in Beni Suif region during 2004 / 05

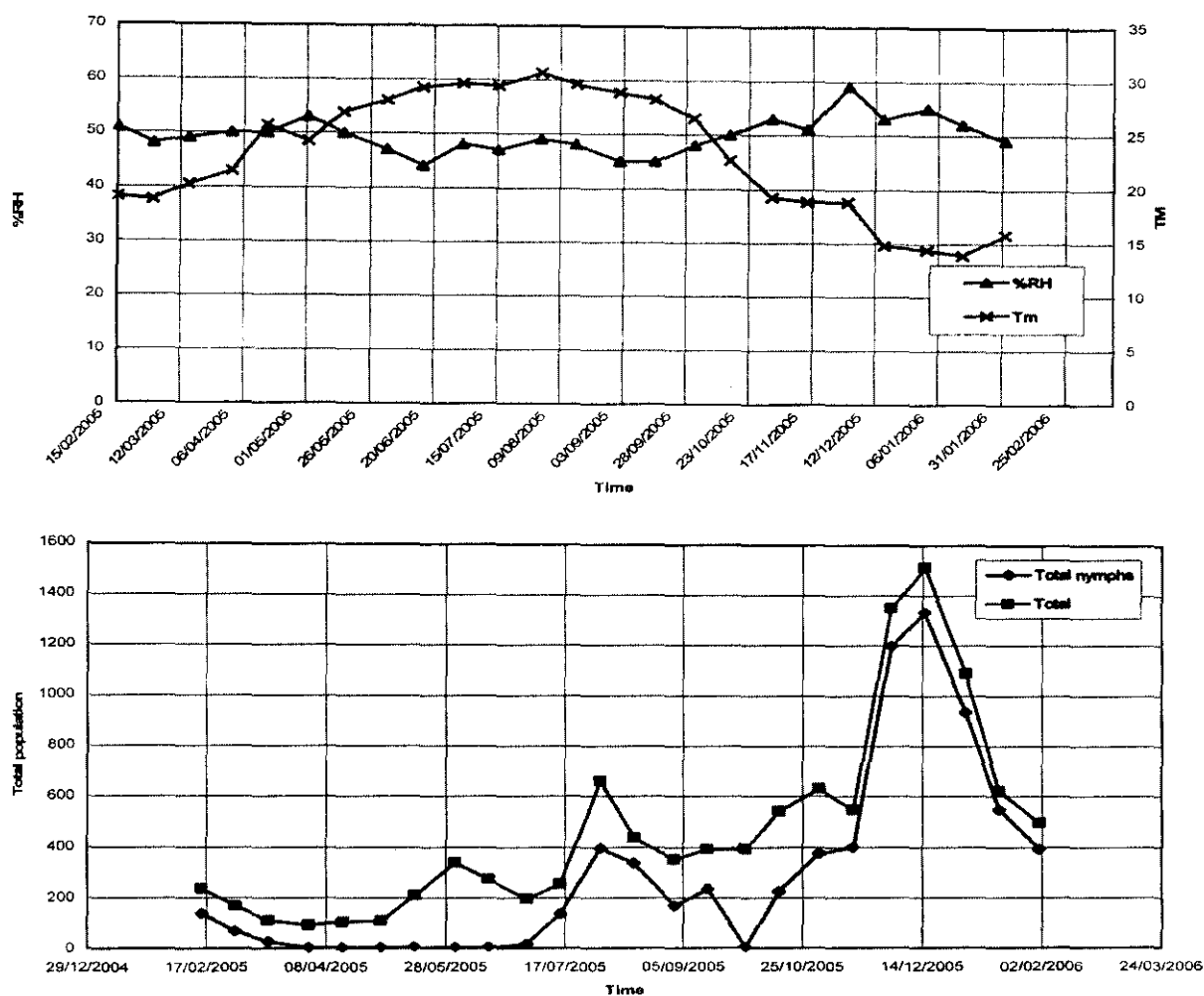


Fig. (2): Seasonal abundance of the fig pustule scale insect *Russelaspis pustulans* in Beni Suif region during 2005/ 06

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