

PARASITISM OF *ACEROPHAGUS PAPAYAE* ON PAPAYA MEALYBUG ON ALTERNATE HOST PLANT, *ABUTILON* SP. IN KARACHI, SINDH, PAKISTAN

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ABSTRACT

The study was carried out to observe the parasitism of Papaya mealybug on host plant *Abutilon* sp. For this purpose, Samples were collected from Bhitabad and Nursery located near Memon Goth, Karachi, Pakistan. Experiments were performed in biological control laboratory at Pest Management Research Institute (PMRI) Southern-Zone Agricultural Research Center (SARC), Pakistan Agricultural Research Council (PARC), University of Karachi, Karachi, Pakistan from April 2016 to September 2016. It was observed that different physical parameters such as humidity and temperature were responsible for variation in percent parasitism. Humidity had more effect on mummies and emergence of Adult *Acerophagus papayae* as compared to the temperature.

Keywords: *Abutilon* sp., Parasitism, Papaya Mealybug, *Acerophagus papayae*, Regression analysis.

INTRODUCTION

Paracoccus marginatus is commonly known as Papaya mealybug. It belongs to the Phylum Arthropoda, Order Hemiptera, and Family Psuedococcidae. Papaya mealybug is a small, sucking insect pest. It is polyphagous insect which attacks a number of genera of host plants, economically important vegetables, fruit and ornamentals are included in host plants. There are 80 species of Mealybug found worldwide and they are affecting wide range of plants in different regions of the world (Muniappan, 2014). Papaya mealybug is native of Central America and Mexico. Duration of life cycle for female is 24-26 days and 27-30 days in male. (Tanwar *et al.*, 2010). *A. papayae* Noyes and Schauff is a parasitoid of Papaya mealybug belongs to Order Hymenoptera, Family Chalcididae in class Insecta. The parasitoid *Acerophagus* is native of Mexico. This insect is introduced for Biological Control of Papaya mealybug *Paracoccus marginatus* in so many countries (ICAR, 2013). Above 60 species of plants have been recorded as host of Papaya mealybug *P. marginatus* in around 22 plant families. Understanding of host range of Papaya mealybug Help farmers (Cham *et al.*, 2011). Due to the infestation of Papaya mealybug cotton like clusters with long waxy filaments appeared on the above surface portion of the host plants (Tanwar *et al.*, 2010). The pest occupies all the aerial parts of the host plant *i.e.* fruit and leaves in the form of small and large colonies (Sharma *et al.*, 2013). For the successful control management of Papaya mealybugs scientist and entomologist emphasizes on Biological control which is so far safe method on Papaya mealybugs some primary parasitoids have been identified and they are *Anagyrus loecki*, *Apoanagyrus californicus*, *A. papayae* and *Psuedoleptomastix mexicana* are used in biological control in many countries (Dey, 2016). For the analysis of the effect that insect parasitoids have on the population of their host percentage parasitism commonly used. This estimation refers to parasitized hosts proportion with respect to the number of host that enter the stage of susceptibility. With less or no reference to parasitoid and host phenologies this variable is evaluated from levels of parasitism in field samples (Ruiz-Narváez and Castro-Webb, 2003)

MATERIALS AND METHODS

Experiment was conducted for evaluation of parasitism on Papaya mealybug by parasitoid *A. papayae* on alternative host plant *Abutilon* sp. in Biological Control Laboratory of Centre for Agriculture and Bioscience International Central & West Asia, Pakistan (CABI-CWA) at Pest Management Research Institute (PMRI) Southern-Zone Agricultural Research Center (SARC), Pakistan Agricultural Research Council (PARC), University of Karachi, Karachi, Pakistan. For this purpose host plant *Abutilon* sp. was selected and collected. Parasitism was examined on samples of plant *Abutilon* sp. Examination of samples were carried out for 6 months, from April 2016-September 2016.

To study the parasitism of *A. papayae* on Papaya mealybug, *Paracoccus marginatus* on host plant *Abutilon* sp. observation of samples took place and total 5 replications were performed per month. Each replication contains 6-7 infested leaves with twigs. During replications number of Papaya mealybugs, mummies were counted using a microscope and then mummies if present were separated with the help of a soft brush. Then the separated mummies were collected in test tubes covered with muslin cloth tied with a rubber band for further observation of emergence of adult *A. papayae* placed in the laboratory at room temperature. On the first day of observation already emerged adult of *A. papayae* present on leaves also counted and noted. The whole process of counting of Mealybug, Mummies and Adult *A. papayae* was repeated again after every 7 days in a month and in this manner, the parasitism of *A. papayae* on Papaya mealybug on *Abutilon* sp. is checked by analyzing data using the software.

Humidity and Minimum /Maximum temperature of months from April 2016-September 2016 was collected from Pakistan Meteorological Department at Karachi.

Linear regression analysis of data was carried out after Niel (1995). For this purpose, the relationship was determined between humidity and mummies, humidity and emergence, temperature and mummies, temperature and emergence.

Firstly, all data were entered in MS-Excel 2013 and statistical analysis was carried out with the help of statistical software of IBM SPSS statistics 23.

RESULTS AND DISCUSSION

On host plant *Abutilon* sp. during the month of April 2016 the percentage of parasitism was 9.84% and the percentage of emerged parasitoid *A. papayae* Noyes and Schauff 2003 was 3.80% at 27.60 ± 11.38 °C and 77.45 ± 7.56 % humidity. In month of May 2016 the percentage of parasitism was 4.80% and the percentage of emerged parasitoid *A. papayae* was 1.93% at 27.65 ± 15.86 °C and 78.9 ± 12.04 % humidity. In month of June 2016 the percentage of parasitism was 17.11% and the percentage of emerged parasitoid *A. papayae* was 8.81% at 32.07 ± 1.15 °C and 80.93 ± 4.70 % humidity. In month of July 2016 the percentage of parasitism was 8.40% and the percentage of emerged parasitoid *A. papayae* was 5.59% at 26.69 ± 16.23 °C and 80.82 ± 3.61 % humidity. In month of August 2016 the percentage of parasitism was 14.29% and the percentage of emerged parasitoid *A. papayae* was 11.65% at 23.91 ± 19.24 °C and 82.08 ± 5.16 % humidity. In month of September 2016 the percentage of parasitism was 16.82% and the percentage of emerged parasitoid *A. papayae* was 15.75% at 27.38 ± 7.46 °C and 69.17 ± 4.39 % humidity (Table 1).

The results of present investigation for the regression analysis shows linear relationship between all parameters. The results of coefficient of correlation shows weak to high correlation (Table 2). The results of correlation for plant *Abutilon* sp. shows that humidity has more effect on mummies and emergence than temperature.

In the present study, the parasitism of *Acerophagus papayae* on Papaya mealybug *Paracoccus marginatus* was studied on host plant *Abutilon* sp. in Karachi, Pakistan at biological control laboratory of PARC. The results obtained shows fluctuations in percentage parasitism as well as in emergence of parasitoid *Acerophagus papayae* due change in temperature and humidity.

The current study of regression analysis shows linear relationship between all parameters and correlation of plant *Abutilon* sp. shows that humidity has more effect on mummies and emergence than temperature. This outcome confirms that humidity affect the number of emergence more than the temperature. From Puerto Rico around 46,200 individual of parasitoid were introduced and released into Guam in 2002 where Papaya mealybug causing damage to *Hibiscus* spp., *Plumeria* spp. as well as Papaya, introduction of these parasitoids *Anagyrus loecki*, *Pseudoleptomastix Mexicana* and *A. papayae* results in 99% reduction of Papaya mealybug was obtained (Meyedirk *et al.*, 2004). Besides Papaya on seven host plant including *Plumeria*, *Hibiscus*, *Rosselle*, *Cassava*, *Jatropha*, Eggplant, Broad been etc. From 7965 collected mummies of Papaya mealybug Four species of Parasitoid were emerged, these four parasitoids were *A. papayae*, *Chartocerus* sp., *Marietta leopardina* and *Cheiloneurus* sp. Out of these four parasitoids maximum frequency of *A. papayae* was revealed by parasitoid investigation (Mastoi *et al.*, 2014b).

Knowledge of different host plants of Mealybug other than Papaya is mandatory because it is helpful for farmers to use cultural practices such as to keep these alternative host plants away from around and within their farms as well as crops fields. The understanding of other alternative host plants will be helpful in field of Biological Control as these alternative host plants will serve as targets (Cham *et al.*, 2011).

Table 1. Statistical analysis of parasitism and percent parasitism of *A. papayae* on Papaya mealybug on plant *Abutilon* sp. at Karachi during April to September 2016.

MONTH	HUMIDITY (MEAN \pm S.D)	TEMPERATUR E (MEAN \pm S.D)	MEAN \pm S.E (NO. OF MUMMIES COLLECTED)	PERCENTAGE % (PARASITISM)	MEAN \pm S.E (EMERGENCE OF ADULT) <i>Acerophagus papayae</i>	PERCENTAGE% (EMERGENCE OF ADULT) <i>Acerophagus papayae</i>
April	77.45 \pm 7.56	27.60 \pm 11.38	16.60 \pm 5.41	9.84	6.40 \pm 2.46	3.80
May	78.9 \pm 12.04	27.65 \pm 15.86	8.20 \pm 3.51	4.80	3.20 \pm 1.39	1.93
June	80.93 \pm 4.70	32.07 \pm 1.15	24.60 \pm 4.31	17.11	13.60 \pm 2.15	8.81
July	80.82 \pm 3.61	26.69 \pm 16.23	18.80 \pm 7.71	8.40	12.40 \pm 4.60	5.59
August	82.08 \pm 5.16	23.91 \pm 19.24	28.00 \pm 6.59	14.29	23.00 \pm 5.46	11.65
September	69.17 \pm 4.39	27.38 \pm 7.46	32.60 \pm 5.74	16.82	30.60 \pm 5.51	15.75

Table 2. Simple linear regression between Humidity and Mummies, Temperature and Mummies, Humidity and Emergence, Temperature and Emergence for Plant *Abutilon* sp. during April to September 2016.

Species	X	Y	a	b	r	p-value
<i>Abutilon</i> sp.	Humidity (N=30 _{Days})	Mummies (N=128)	76.84	- 0.708	0.383	0.454
	Temperature (N=30 _{Days})	Mummies (N=128)	30.091	- 0.313	0.094	0.860
	Humidity (N=30 _{Days})	Emergence (N=89)	100.282	- 1.092	0.50260	0.310
	Temperature (N=30 _{Days})	Emergence (N=89)	44.825	- 1.087	0.278	0.594

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