J. Biol. Control, 21(Special Issue): 149-152, 2007

Parasitoids and effect of weather factors on their parasitism on babul whitefly, *Acaudaleyrodes rachipora* (Singh) (Hemiptera: Aleyrodidae) infesting *Prosopis juliflora* in Indian arid zone

V. P. PANDEY*[1], R. SUNDARARAJ[2] and S. I. AHMED[3]
Himalayan Forest Research Institute, Conifer Campus Panthaghati
Shimla - 171009, Himachal Pradesh, India
E-mail: pandeyvp@sify.com

ABSTRACT: Studies on the parasitoid complex of *Acaudaleyrodes rachipora* (Singh) infesting *Prosopis juliflora* in Jodhpur revealed the presence of four species of hymenopterous parasitoids, *viz. Encarsia acaudaleyrodis* (Hayat), *Encarsia transvena* (Timberlake), *Encarsia* sp. nr. *davidi* (Viggiani and Mazzone) and *Eretmocerus rajasthanicus* (Hayat) parasitizing the nymphs / pupae of *A. rachipora*. The overall parasitism varied from 80 to 97 per cent, maximum in month of October 1998 and minimum in January and March 1999. The host - specific parasitoid, *Encarsia acaudaleyrodis* was found predominantly associated throughout the year of observation, whereas, the other parasitoids were very less in number. The parasitoid population exhibited significant positive correlation with temperature (maximum & minimum°C), and non-significant positive correlation with relative humidity (morning & evening per cent) and total rainfall (mm). In partial correlation, temperature (maximum & minimum, °C) exhibited significant negative correlation whereas morning relative humidity exhibited non-significant positive correlation while evening relative humidity and total rainfall (mm) exhibited negative correlation. The multiple regression showed that all abiotic factors exhibited 35 per cent influence on the build up (R^2) of its population.

KEY WORDS: *Acaudaleyrodes rachipora, Encarsia acaudaleyrodis, Encarsia* sp. nr. *davidi, Encarsia transvena, Eretmocerus rajasthanicus*, parasitoid, *Prosopis juliflora*

INTRODUCTION

The babul whitefly, *Acaudaleyrodes rachipora* (Singh) is a serious pest of economically important forest tree species in Indian arid zone (Sundararaj and Murugesan, 1996). The pest causes direct damage to plant by sucking the plant sap and the sooty mold which develops on the honeydew excreted by whitefly, interferes with the photosynthesis in host plants. It was found distributed in many states of India and breeding on 77 host plants representing 24 families from the Indian subcontinent (Pandey and Sundararaj, 2005). The natural enemies of any pest form the most important component of Integrated Pest Management and desired success can be achieved by incorporating these on a sound ecological basis. The use of natural enemies of *A. rachipora* as biological control agents for its management is a promising and viable strategy. Hayat (1976) reported its parasitism by two host - specific parasitoids, *Encarsia acaudaleyrodis* and *Eretmocerus rajasthanicus*. Krishnan and David (1996) recorded *Encarsia transvena* on *A. rachipora* from Rajasthan. In the present study, surveys were undertaken to know the parasitoid complexes of *A. rachipora* and the effect of weather factors on their parasitism on *A. rachipora* infesting *Prosopis juliflora* in Indian arid zone.

* Corresponding author; [2]Institute of Wood Science and Technology, 18th Cross, Malleswaram, Bangalore 560003 (rsundara@iwst.res.in); [3]Arid Forest Research Institute, New Pali Road, Jodhpur 342005 (ahmedsi@afri.res.in)

MATERIAL AND METHODS

Studies on the parasitoid complex and the extent of their parasitization on *Acaudaleyrodes rachipora* infesting *P. juliflora* were conducted at Arid Forest Research Institute, Jodhpur, from June 1998 to May 1999. Twigs of *P. juliflora* having whitefly infestation were brought to laboratory and kept in plastic jars in three replications with 100 nymphs in each, for emergence of parasitoids. Direct and indirect methods were followed to assess the parasitoid population. In direct method, the number of parasitoids emerged from 100 whitefly nymphs was counted and the per cent infestation was calculated while in indirect method, 100 whitefly nymphs were kept in 10 per cent KOH for a period of 24 hours. Then the numbers of parasitoid emergence holes were counted and percent parasitization was calculated. The count of total number of parasitized nymphs was made at monthly interval. The relative incidence of natural enemies was calculated based on emergence holes and number of the parasitoids emerged from the host. This was converted into percentage parasitism and the data were analysed statistically involving the percentage parasitization as dependent variables and the mean values of abiotic factors (maximum & minimum temperature, morning & evening relative humidity and total rainfall) as the independent variables. Methods described by Fischer (1938) were followed for simple correlation, simple linear regression, partial correlation and multiple regression analysis of the above data.

RESULTS AND DISCUSSION

During the investigation on the natural enemies of *A. rachipora*, four hymenopterous parasitoids belonging

Table 1. Parasitoids of *Acaudaleyrodes rachipora* in *P. juliflora* plants of arid zone, at Jodhpur during September – October 1998

Parasitoids	No. of parasitoids emerged(Female: Male)
1. *Encarsia acaudaleyrodis* (Hayat)	90: 1
2. *Encarsia transvena* (Timberlake)	40: 1
3. *Encarsia* sp. nr. *davidi* (Viggiani & Mazzone)	3: 0
4. *Eretmocerus rajasthanicus* (Hayat)	3: 1

Table 2. Per cent parasitization of *A. rachipora*

Date of observation	By counting the number of holes*	By counting the number of adults emerged **
25-06-98	60.9 ± 4.8	43.3 ± 3.4
24-07-98	64.6 ± 8.2	60.7 ± 7.4
26-08-98	61.3 ± 5.0	70.4 ± 6.7
28-09-98	66.7 ± 1.7	85.0 ± 4.1
28-10-98	80.3 ± 2.1	97.5 ± 2.0
30-11-98	69.7 ± 2.9	80.8 ± 1.4
24-12-98	52.3 ± 2.9	66.3 ± 1.7
24-01-99	12.0 ± 3.6	65.0 ± 13.3
26-02-99	32.7 ± 4.5	40.3 ± 1.6
24-03-99	37.7 ± 4.8	20.0 ± 8.2
27-04-99	54.0 ± 5.1	23.3 ± 1.2
26-05-99	60.7 ± 6.5	25.0 ± 1.4

* = Nymph of BWF mounted in 10 per cent KOH; ** = Adult parasitoids emerged from BWI

Table 3. Correlation between the population levels of parasitoids and abiotic factors

Temperature (°C)		Relative humidity (%)		Rainfall (mm.)
Maximum	Minimum	Morning	Evening	
r = 0.468 316.185 - 6.74x**	r = 0.508 200.502 -5.609x **	r = 0.113 50.756 + 0.536x	r = 0.179 111.062 - 0.932x	r = 0.321 104.590 - 0.703 x
Partial correlation coefficient				
- 0.465**	- 0.509**	0.257	- 0.164	- 0.389
Multiple regression equation				
$Y = - 25.492 + 2.031(x_1) - 4.274 (x_2) + 3.222 (x_3) - 1.883 (x_4) - 0.545 (x_5)$ $R^2 = 0.352$, F = 3.252, P= 0.018				

** = Significant level at 0.005

to the family Aphelinidae were recorded and identified (Table 1). Earlier, Singh (1931) reported that the pupae of *A. rachipora* were parasitized by a chalcidoid from Bihar. *Encarsia acaudaleyrodis* and *Eretmocerus rajasthanicus* were recorded by Hayat (1976) on *A. rachipora* from Rajasthan. Viggiani and Mazzone (1980) reported *Encarsia davidi* on *A. rachipora* from Israel. Krishnan and David (1996) recorded *Encarsia transvena* on *A. rachipora* from Rajasthan.

The percentage of parasitism of *A. rachipora* ranged from 12.0 to 80.3 based on the number of emergence holes while it was 20.0 to 97.5 by counting the number of adults emerged (Table 2).

Maximum parasitization was found in October 1998 in both methods, while minimum was found in January 1999 by the assessment of emergence holes in pupal case and in March 1999 by the assessment of adult emergence. More or less similar observation was recorded by Kajita *et al.* (1992) on *Bemisia tabaci*. Kapadia and Puri (1990) recorded maximum emergence (88 – 95 per cent) of adults of *Encarsia transvena* and *Eretmocerus mundus* in the humid months (August-September) and thereafter, it decreased gradually from October to January (89.50-43.33 per cent in *Encarsia transvena* and 71.11-49.0 per cent in *Eretmocerus mundus*) on *B. tabaci*.

Influence of abiotic factors on the population dynamics of the parasitoids showed that maximum and minimum temperature exhibited a significant positive correlation while morning and evening relative humidity and total rainfall had non-significant positive correlation, which was also confirmed from the partial correlation. Multiple regression equation shows 35 per cent cumulative effect of all the abiotic factors on the parasitoid population. The present study revealed quite a good level of natural parasitization on *A. rachipora*. However its impact on the population of *A. rachipora* needs to be critically assessed for substantial control of this polyphagous pest.

ACKNOWLEDGEMENTS

The authors are thankful to Director, Arid Forest Research Institute, Jodhpur for the facilities provided. Help rendered by Prof. M. Hayat in the identification of parasitoids is gratefully acknowledged.

REFERENCES

Fisher, R. A. 1938. *Statistical methods for research workers*. Oliver and Boyd, London, UK.

Hayat, M. 1976. Two new species of Aphelinidae (Hymenoptera: Chalcidoidea) parasitic on *Acaudaleyrodes rachipora* (Homoptera: Aleyrodidae) from India. *Entomophaga*, **21**: 157-162.

Kajita, H., Samudra, I. M. and Naito, A. 1992. Parasitism of the tobacco whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae), by *Encarsia transvena* (Timberlake) (Hymenoptera: Aphelinidae) in Indonesia. *Applied Entomology and Zoology*, **27**: 468-470.

Kapadia, M. N. and Puri, S. N. 1990. Development, relative proportions and emergence of *Encarsia transvena* (Timberlake) and *Eretmocerus mundus* Mercet, important parasitoids of *Bemisia tabaci* (Gennadius). *Entomon*, **15**: 235-239.

Krishnan, B. and David, B. A. 1996. *Records and descriptions*

of some aphelinid parasitoids of the Aleyrodidae (Homoptera: Insecta) from India. Jai Research Foundation, Valvada 396 108, 47 p.

Pandey, V. P. and Sundararaj, R. 2005. Distribution and host range of babul whitefly (*Acaudaleyrodes rachipora* Singh) in Indian subcontinent. Paper presented in "National Symposisum on Entomology" organized by Entomological Research Institute, Loyola College, Chennai, 2-3 February 2005.

Singh, K. 1931. A contribution towards our knowledge of the Aleyrodidae (Whiteflies) of India. *Memoirs, Department of Agriculture, India, Entomological Series*, **12**: 1-98.

Sundararaj, R. and Murugesan, S. 1996. Occurrence of *Acaudaleyrodes rachipora* (Singh) (Homoptera: Aleyrodidae) as a pest of some important forest trees in Jodhpur (India). *Indian Journal of Forestry*, **19**: 247-248.

Viggiani, G. and Mazzone, P. 1980. The palaearctic species of *Encarsia lutea* Masi (Hymenoptera: Aphelinidae) with description of two new species. *Bolletino del Laboratorio di Entomologia Agrararia "Filippo Silvestri" Portice*, **37**: 51-57.