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INCIDENCE AND PARASITIZATION OF C*AMPOLETIS CHLORIDEAE* (UCHIDA) AGAINST *HELICOVERPA ARMIGERA* (HUBNER) IN CHICKPEA

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ABSTRACT

Campoletis chlorideae (Uchida) (Hymenoptera: Ichneumonidae) is a an prominent parasitoid of *Helicoverpa armigera* (Hubner) infesting chickpea under natural ecosystem. The purpose of the present study was to investigate how weather parameters influence the per cent parasitization under laboratory and field conditions. The population of *C. chlorideae* appeared in the second week of December which reached to its peak activity in the second (1.50 adult/plant) and first week of February (1.60 adult/plant) (7^{th} and 6^{th} SMW) during *rabi* 2012-13 and 2013-14, respectively. Parasitoid population showed positive and significant correlation with mean temperature and negative but non-significant correlation with mean relative humidity.

Keywords: Incidence, parasitization, C*ampoletis chlorideae*, chickpea, *H. armigera*

INTRODUCTION

Gram pod borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae), is an international pest and polyphagous in nature. It causes economic damage at reproductive stages, primarily on pods, highly mobile and nocturnal in nature, spreads speedily in wide areas, and causes damage to several cultivated crops *viz*., chickpea, pigeonpea, tomato, chilli, okra, etc in India. Its larvae appeared on chickpea crop after 15-20 days of germination (Kambrekar, 2005). Larvae remained active throughout the chickpea crop from vegetative to harvest stage (Singh and Ali, 2006). The ecological parameters *viz*., temperature (14-45° C), photoperiod (10-14 hrs), relative humidity (15-95%) coupled with optimal and intermittent rainfall were found to influence the population buildup, adult emergence and maximum fecundity of the female moths of *H. armigera* (Tripathi and Singh, 1993). The pest could be managed by larval parasitoid, *Campoletis chlorideae* Uchida (Hymenoptera: Ichneumonidae) in chickpea ecosystem, causing up to 78% parasitisation of early instars under natural conditions (Agnihotri *et al*., 2011). However, activity of the parasitoid occured only during November to March, coinciding with the vegetative stage of the crop and winter season. Host searching behavior, an important component of parasitoid biology, often influences the success of inoculative biological control (Gross *et al*., 2005). The parasitoid is basically male biased in nature. The impact of weather parameters on the pest and its parasitoid, *C. chlorideae* population for two consecutive years i.e., *rabi* season 2012-13 and 2013-14 was studied and has been reported in this article.

MATERIALS AND METHODS

Biological attributes of the parasitoid:

The field collected cocoons of *C. chlorideae* were reared in the laboratory (22 ± 4°C, 70 ± 10% RH) and used for biology studies of *C. chlorideae*. Its culture was maintained on early instars (2^{nd} instar) of *H. armigera* under laboratory conditions. Male and female of similar age were kept in plastic cages (10 cm height and 6 cm diameter) for mating upto two days, and 10% honey solution was kept for feeding. For oviposition, a mated *C. chlorideae* was released in 25 ml plexi glass containing 25 neonate larvae of *H. armigera*. After parasitization, *H. armigera* larvae were placed on artificial diet/fresh chickpea leaves for parasitoid development. Fifty *H. armigera* larvae were maintained for each replication, and there were four replications in a completely randomized design. Observations were recorded only on the biological attributes such as larval, pupal periods of *C. chlorideae* larvae and adult emergence.

Per cent parasitization

The larval parasitization of *H. armigera* was studied by field collecting 50 numbers of larvae at weekly interval. The larvae were brought to the laboratory from chickpea field at weekly interval and kept in jars (500 ml capacity). The jars were covered with a muslin cloth secured with rubber bands and placed in the laboratory at ambient conditions of temperature and humidity. The larvae were observed for the emergence of parasitoids and the numbers of parasitized larvae were counted. The emerged parasitoid from larvae was identified and preserved.

Meteorological observations

The minimum and maximum temperatures, R.H. and rainfall during the period of experimentation from October to March 2012- 13 and 2013-14 was recorded at University Meteorological Observatory Unit and used for statistical analysis.

RESULTS AND DISCUSSION

In the present investigation, the egg-larval period ranged from 9-12 days. The data recorded on the adult population of *C. chlorideae* are presented in Table (1). The data reveal that the population of *C. chloridae* initiated in the second week of December (50th SWM) with a mean of 0.60 adult/plant and continued up to first week of March (10th SMW) during *rabi* 2012-13. The population of *C. chlorideae* touched its peak (1.50 adult/plant) during the second week of February (7th SMW) when *H. armigera* population was at its peak activity (1.80 larvae/plant) and then declined gradually. The mean temperature and relative humidity during the peak activity were 19.0°C and 55.3 per cent, respectively. The parasitoid, *C. chlorideae* population exhibited a significant and positive correlation with mean temperature and non-significant negative correlation with relative humidity during *rabi* 2012-13. Similarly, during *rabi* 2013-14 the activity of *C. chlorideae* population was initiated in the second week of December (50th SMW) with a mean of 0.50 adult/ plant and continued up to first week of March (10th SMW). The population gradually increased and touched at its peak (1.60 adult/plant) during the first week of February (6th SMW) when mean temperature and relative humidity were 18.3°C and 50.1 per cent, respectively. *C. chlorideae* exhibited a positive correlation with mean temperature and negative non-significant correlation with relative humidity during *rabi* 2013-14 (Table 1).

The parasitisation of *H. armigera* by the parasitoid *C. chloridae* ranged from 8.00 to 33.30 per cent and 10.00 to 35.00 per cent during 2012-13 and 2013-14, respectively (Tables 1 & 2). The influence of the parasitoid *C. chlorideae* on *H. armigera* was moderate

Table 1. Seasonal incidence of *Campoletis chlorideae* (Uchida) on *Helicoverpa armigera* (Hubner) in chickpea crop during *rabi*, 2012-13

SMW	Dates of Observation	Mean abiotic factors		Mean population /plant	Parasitization (%)
		Temperature (°C)	Relative Humidity (%)	*C. chlorideae*	
50	14/12/2012	19.10	54.10	0.60	8.00
51	21/12/ 2012	16.80	53.70	0.80	11.00
52	28/12/2012	16.15	51.60	0.50	15.40
1	04/01/2013	13.70	58.15	0.20	20.00
2	11/01/2013	15.70	48.20	0.50	24.00
3	18/01/2013	15.70	54.20	0.50	29.00
4	25/01/2013	13.35	52.75	0.20	27.00
5	01/02 2013	17.95	51.60	1.00	30.50
6	08/02/2013	17.55	53.05	1.00	27.00
7	15/02/2013	19.00	55.30	1.50	33.30
8	22/02/2013	18.70	56.50	0.80	19.00
9	01/03/2013	18.85	42.15	0.90	13.00
10	08/03/2013	20.80	38.90	0.60	10.00
Seasonal Mean		17.18	51.55		
Correlation coefficient between population of *H. armigera*, *C. chlorideae* and abiotic factors					
Mean temperature (°C)				0.556*	
Mean relative humidity (%)				-0.006	

SMW= Standard Meteorological Week, * Significant at 5% level

Table 2. Seasonal incidence of *Campoletis chlorideae* (Uchida) on *Helicoverpa armigera* (Hubner) in chickpea crop during *rabi*, 2013-14

SMW	Dates of Observation	Mean abiotic factors		Mean population /plant *C. chlorideae*	Parasitization (%)
		Temperature (°C)	Relative Humidity (%)		
50	14/12/2013	17.80	53.75	0.50	10.00
51	21/12/ 2013	15.85	59.20	0.60	12.00
52	28/12/2013	14.95	63.18	0.50	15.00
1	04/12/2014	14.85	60.75	0.40	19.50
2	11/01/2014	13.95	63.85	0.20	23.00
3	18/01/2014	14.40	67.55	0.30	26.00
4	25/01/2014	15.55	69.40	0.70	30.50
5	01/02 2014	17.40	58.70	1.50	32.00
6	08/02/2014	18.30	50.10	1.60	35.00
7	15/02/2014	15.45	60.55	0.90	31.00
8	22/02/2014	16.20	62.80	0.60	29.00
9	01/03/2014	17.80	58.95	0.80	13.00
10	08/03/2014	17.70	51.56	0.30	11.00
Seasonal Mean		16.16	60.02		
Correlation coefficient between population of *H. armigera*, *C. chlorideae* and abiotic factors					
Mean temperature (°C)				0.556*	
Mean relative humidity (%)				-0.494	

SMW= Standard Meteorological Week, * Significant at 5% level

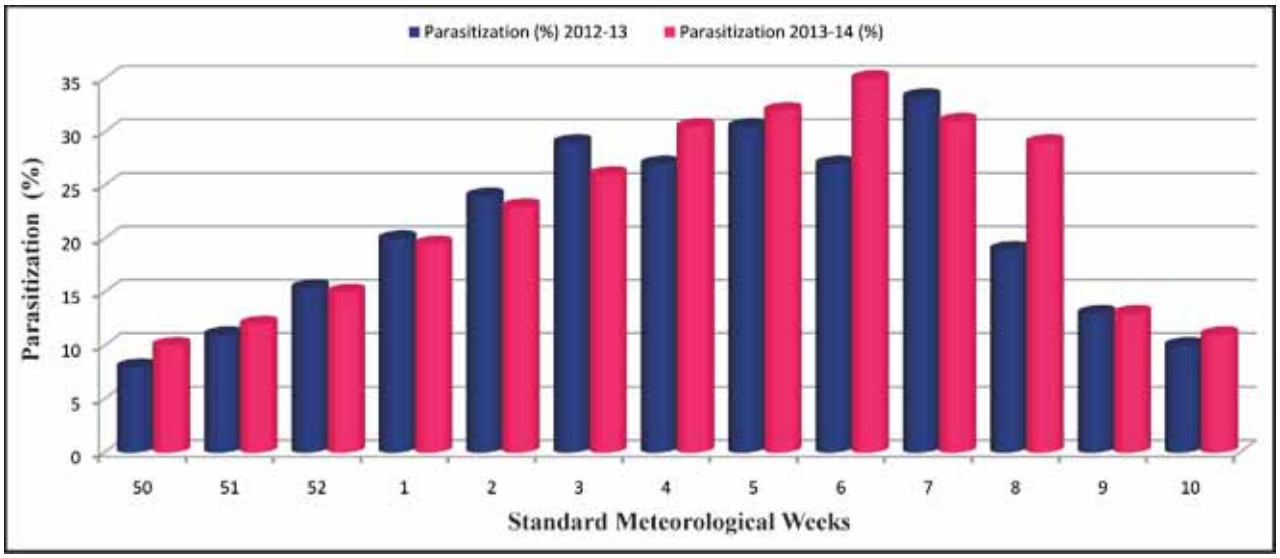


Fig. 1: Per cent parasitization of *Campoletis chlorideae* (Uchida) in chickpea in relation to population of *H. armigera* during *rabi* 2012-13 and 2013-14

and with 33.30 and 35.00 per cent parasitisation during *rabi* 2012-13 and 2013-14, respectively. The present findings are in close conformity with the findings of Gupta and Raj (2003), Chandel *et al.* (2005) Singh and Ali (2006), Bhede *et al.* (2014) and Singh *et al.* (2015).

According to Gupta and Raj (2003) the parasitism of *H. armigera* larvae in chick pea by *C. chlorideae* ranged from 8.33 to 28.00%. Singh and Ali (2006) reported maximum parasitization of *H. armigera* by *C. chlorideae* in the month of January (4th standard week) which was 3.5/m^2, parasitization declined from the 44th to 50th standard weeks. Bhede *et al.* (2014) recorded that the parasitization of *Helicoverpa* larvae by *C. chlorideae was* 5.61 per cent. Singh *et al.* (2015) reported that the parasitization by *C. chlorideae* on *H. armigera* in chickpea was 10.25 to 13.24 per cent.

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