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Seasonal Incidence of *Campoletis chloridae* Uchida—A Larval Parasitoid of *Helicoverpa armigera* Hubner on Chickpea in Central (U.P.)

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Abstract: Study on seasonal incidence of *Campoletis chloridae* Uchida, a larval parasitoid of *Helicoverpa armigera* (Hubner), in chickpea crop was conducted at Kanpur during rabi 2007-08. The parasitoid made its first appearing during 3rd standard meteorological week of the year in different date of sowing and verities varied between 4.4 to 93.3 %. The verity Udai sown at November 11-2007 D1 and D2 November 28 was Mean \pm SD 44.75 \pm 31.93 and 42.61 \pm 27.65, verity Avarodhi date of sown of October 21 2007 D1 and November 17 2007 D2 was Mean \pm SD 32.43 \pm 29.22 and 36.36 \pm 29.22 and verity Pragati date of sowing November 17 2007 D1 was Mean \pm SD 31.47 \pm 31.47 \pm 26.79 during December, January, February and March respectively. The per cent parasitization of *C. chloridae* showed a negative correlation with means temperature, sunshine hours and relative humidity. Where a significant positive correlation was found between per cent parasitization rainfall and wind velocity.

Keywords: Chickpea; *Campoletis chloridae* Uchida; *Helicoverpa armigera* Hubner; Parasitization, incidence; Weather parameters.

1. Introduction

Chickpea (*Cicer arietinum* L) commonly known as gram, Bengal gram, and garbanzo bean is only of the most important Rabi crop grown India. The grains consist about 52-70 percent carbohydrate, 8-22 percent protein and 4-10 percent fat. The daily per capita availability of 14 gm chickpea is source of approximately 2.3 percent 956 k (CAL) energy, 4-7 percent (2.5g) protein to Indian population, besides being a major source of calcium and iron [1]. Chickpea is raised over an area of 11.5 million tone in the world with a production of 8.58 million tone and productivity around 769.4 kg/ ha. [2]. India occupies first position in the world in term of area (64%) during 2003-04. The crop occupies 5.12 million hectare area with production of 5.79 million tonnes and 813 kg/ ha productivity [3] Chickpea faces the attack of more than 60 insects–pests right from germination to maturity [4] Among them, gram pod borer, *Helicoverpa armigera* Hubner is considers as key pest causing 29% yield losses in chickpea at national level. For effective management of *Helicoverpa armigera* Hubner greater emphasis is now being laid on Biological control natural enemies play an important role in biological control. Among the different parasites and predators recorded, egg parasitoid, *Trichogramma chilonis* Ichchu is one of the potential of *Helicoverpa armigera*. However, parasitization by this species is rather negligible in chickpea ecosystem [5] and *Campoletis chloridae* Uchida has been reported widely distributed and potential parasite of *Helicoverpa armigera* Hubner damaging chickpea crop [6-9], However detail information on its degree of parasitization during different months of crop period studies were under taken on the seasonal occurrence and extent of parasitization in relation to crop phenology.

2. Materials and Methods

2.1. Experimental Design

The investigation on the natural parasitization of gram pod borer on chickpea verities (Avarodhi, Udai (KPG-59) and Pragati) sown on different dates, were conducted under laboratory condition. For this purpose, twenty larvae of first/second instar were collected each field, at student Instruction Farm, Crop research Farm, Nawabganj, Old dairy Farm and oil Farm and Oiled seed Research farm, Kalayanpur and laboratory of Department of Entomology C.S.A. University of Agriculture and Technology Kanpur (U.P.) during rabi.

2.2. Collection of Larvae

First second instar was selected because only these stages are parasitized by *Campoletis chloridae* Uchida. [10]. The field was kept from any type of insecticide application. The collection of larvae was carried out during morning hours and brought to the laboratory for further rearing. To avoid cannibalism each larvae were kept in separate glass vial. The glass vials were labeled with date of collection etc. In this manner each day larval collection was kept in separate plastic tray to avoid mixing. Every day the glass vials were cleaned for excreta, and fresh chickpea leaves were provide.

2.3. Data Collection

Observations were recorded regularly on extent of parasitization. It was observed that larvae which were parasitized by *Campoletis chloridae* Uchida change into a typical cocoon of parasite during the first/ second larval instar it. However, unparasitized larvae of *Helicoverpa armigera* Hubner grew to the further instars and shaped into normal pupa from which adult moth emerged out. These were some natural mortality of the larvae. The data on maximum and minimum temperature, relative humidity, sunshine hours, and rainfall and wind velocity prevailing during the crop season was collected from department of Agronomy of University, which were converted as according to the standard weeks. The data were correlated with the population of pod borer.

$$\text{Parasitization \%} = \frac{\text{Number of parasitized larvae}}{\text{Total number of larvae recorded}} \times 100$$

3. Result and Discussion

3.1 Parasitization of *Campoletis chloridae* Uchida

To find out the natural parasitization of *Campoletis chloridae* Uchida collection and rearing of first, second instar larvae of *Helicoverpa armigera* Hubner started in the month of December in the chickpea field from each date of sowing of varieties up to march during the year 2008. Data collected during the course of study were summarized in Table-1. The parasitization of the larvae occurred at the slower rate being 6-66 to 15.10 percent in 50th standard week (Mid December) showing the highest parasitization of the larvae collected from chickpea variety sown in last week of November larval parasitization on chickpea variety Udai varies between 5 to 93.33 and 5.0 85.30 percent 3rd and 4th week of November sown crop respectively. The parasitization was recorded 13.33 to 28.89 percent in first week of January on different date of sowing chickpea. Second week of January (2nd standard week) to end February (9th standard week) was observed the parasitization varied between 45.0 to 93.33, 53.00 to 85.30, 25.00 to 80.00, 35.00 to 85.70 and 30.00 to 80.00 percent on chickpea variety Udai sown in 3rd and 4th week of November, respectively. Average parasitization was highest 44.75 percent on 3rd week of November sown chickpea followed by 42.61, 39.36, 32.43 and 31.47 percent parasitization recorded in Udai sown 4th week of November, Avarodhi sown 3rd week of October and Pragati sown in 3rd week of November respectively. Based on a have cited result, it can be summarized that parasitization of the larvae of gram pod borer by its natural parasite, *Campoletis chloridae* Uchida suppressed well below economic threshold level during vegetative phase of the crop on all the variety of chickpea sown at different date. But the parasitization was noticed in decreasing manner during reproductive phase of crop resulting in higher intensity of gram pod borer particularly in late sown crop. Higher extent of parasitization ranging between 25.00 to 93.33 percent by the Ichneumonid wasp, *Campoletis chloridae* Uchida during January, February was observed in present finding, which was in conformity with those Srinivas [11], Sachan and Bhaumik [12], Kau, et al. [13] and Rai, et al. [14] Who reported the higher parasitization by *Campoletis chloridae* Uchida to be 43.9, 80.64, 68.50 and 41.00 percent during, December, January, February and March, respectively.

3.2. Effect of Weather on Parasitization

The larvae of gram pod borer in chick pea under natural condition were found to be parasitized by *C. chloridae* immediately after ignition of its incidence during mid December irrespective of varieties and sowing dates (Table 1). Significant negative correlation ($r = -0.4818$ to -0.5139) was established between the larval intensity and its parasitization (Table 2). As the pest intensity increased towards the end of December crossing the economic threshold level on almost all varieties and sowing dates, its parasitization was also found increase [15]. Reported the correlation coefficient were found to be positive significant in case of maximum and minimum temperature but negative non-significant with relative humidity and per cent parasitization. Higher parasitization ranging between 26.67 to 93.33 percent was noticed during January-February on chickpea varieties sown different dates with its mean 24.35 to 78.98 percent in different weeks this period. Gupta and Raj [16] observed multiple regression analysis significant effect of relative humidity and total rainfall on parasitization both individually as well as biotic factors was upto the extent of 74.15 per cent. The parasitization of the pest was influenced negatively by the temperature (maximum, minimum and average) and minimum relative humidity. Rainfall and wind velocity showed their insignificant positive impact on the parasitization, while sun shine hours were correlated negatively. The evaporation rate could show significant negative relationship on the parasitization of the pest population collected from second fortnight of the November sown crop.

4. Summary

The larvae of gram pod borer in chick pea under natural condition were found to be parasitized by *C. chloridae* immediately after ignition of its incidence during mid December irrespective of varieties and sowing dates. Since the observation on parasitization of field collected larvae of gram pod borer by the parasitoid, *C. chloridae* were under taken in laboratory at the room temperature, the effect of weather parameter on the parasitization was not distinct. However, negative impact of temperature and minimum relative humidity, evaporation rate and sunshine hours was noticed on parasitization of this pest, while maximum relative humidity, rainfall and wind velocity had shown their positive impact.

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Table-1. weekly Parasitization (%) of gram pod borer on chickpea varieties sown at different dates by parasitoid *Compoletis chloridae*

Variety	Date of sowing	Parasitization %															Mean \pm SD	
		December				January				February				March				
		49	50	51	52	1	2	3	4	5	6	7	8	9	10	11		12
Vudai (KGB-59)	Nov.11,2007 (D1)	0	8.33	11.3	15.55	28.89	71.11	75.55	85.71	86.66	93.33	70.00	64.70	45.00	35.00	20.00	5.00	44.75 \pm 31.93
	Nov.28,2007 (D2)	0	15.10	17.78	20.0	26.67	71.11	80.70	85.30	70.00	60.00	65.00	65.00	50.00	30.00	20.00	0	42.6 \pm 27.65
Avrodhi	Oct. 21,2007 (D1)	0	0	4.44	6.67	13.33	60.00	62.00	68.89	80.00	73.33	65.00	25.00	30.00	20.00	10.00	0	32.43 \pm 29.22
	Nov.17,2007 (D2)	0	6.66	20.00	22.22	28.89	80.00	85.70	80.00	60.00	60.00	71.40	40.00	35.00	20.00	20.00	0	39.36 \pm 28.55
Pragati	Nov.17,2007 (D1)	0	0	17.78	24.7	24.44	40.00	80.00	75.00	70.00	60	45.00	26.00	30.00	5.00	5.00	0	31.47 \pm 26.79
Mean \pm SD		0	6.13 \pm 7.02	10.13 \pm 7.02	17.82 \pm 6.33	24.35 \pm 5.79	64.44 \pm 13.77	76.83 \pm 7.90	78.98 \pm 6.38	73.73 \pm 9.18	69.33 \pm 13.06	63.20 \pm 9.43	44.27 \pm 11.50	38.00 \pm 8.12	22 \pm 10.29	15 \pm 6.32	2 \pm 2.45	38.12 \pm 5.33

Table-2. Simple Correlation Coefficient (r) parasitization (%) of larvae of gram pod borer on chickpea varieties sown at different dates and whether factors.

Variety	Sowing Date	Temperature (0c)			Relative Humidity (%)			Rainfall (cm)	Wind velocity (km/hr)	Evaporation rate (mm/day)	Sunshine hours (hrs/day)
		Maximum	Minimum	Average	Maximum	Minimum	Average				
Udai (KPG-59)	Non.11, 2007(D1)	-0.4657	-0.3566	-0.3955	-0.0256	-0.1223	-0.0397	0.0312	0.2978	-0.4717	-0.2622
	Non.28, 2007(D2)	-0.4714	-0.3544	-0.3592	-0.0633	-0.1460	-0.0520	0.2263	0.2403	-0.5086*	-0.2687
Avrodhi	Oct.21, 2007(D1)	-0.4736	-0.3659	-0.4322	-0.2938	-0.2553	-0.2586	0.1601	0.0761	-0.4563	-0.1808
	Nov.17 2007(D1)	-0.3979	-0.2982	-0.3582	-0.3173	-0.3382	-0.3636	0.0031	0.3776	-0.5506*	-0.1436
Pargati	Nov.17 2007(D1)	-0.3444	-0.4794	-0.6124	-0.1180	-0.1892	-0.0676	0.0603	0.0725	-0.5229	-0.3386
Mean		0.4306	-0.3709	0.4316	-0.1636	-0.2102	-0.1563	0.0962	0.2128	-0.5033	-0.2387