The Pharma Innovation Journal 2023; 12(6): 5189-5192

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(6): 5189-5192

www.thepharmajournal.com
Received: 15-03-2023
Accepted: 19-04-2023

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Incidence and damage severity with different treatment of chickpea (Gram) pod borer, *Helicoverpa armigera* (Hubner)

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Abstract
A field experiment was conducted during *rabi* season of 2014-2015 at the research farm of Sam Higginbottom Institute of Agriculture Technology and Science, Deemed-to-be-University, Allahabad to evaluate the comparative efficacy of certain bioagents and botanical insecticides against pod borer, *Helicoverpa armigera* (Hubner) on chickpea, *Cicer arietinum* (L.). The occurrence of pod borer commenced from 6th standard week (February second week) with an average population of 0.26 larvae/plant The pod borer population increased and gradually reached its peak level of 6.32 larvae/plant at 13th standard week (March last week) there after declined trend was observed as temperature increased. It was observed that the temperature between 25-35 °C favoured the multiplication of gram pod borer.

Keywords: Chickpea, pod borer, population fluctuation, damage severity with different treatment, yield

Introduction
Chickpea (*Cicer arietinum*) is the largest produced food legume in South Asia and the third largest produced food legume globally. The world's total production of chickpea is around 8.5 million metric tonnes annually and is grown over 11million hectares of land approximately. The Desi type chickpea contribute to around 80% and the Kabuli type around 20% of the total production. Regarding the consumption pattern almost all of the chickpea is consumed in the countries where it is produced (Anonymous, 2010) [6]. Despite being the largest producer in the world, the country is in short supply of pulses. During 2004-2005 the pulses production in the country was 13.38 million tonnes from 22.47 million ha. area which is below the domestic requirements leading to import of pulses to the tune of 1.47 million tonnes (Ali and kumar, 2006) [3]. On an average in 2013, it covers 10.91 million ha. area with an annual production is 9.78 million tones and yield is 896kg per hectare (Faostat, 2013) [7]. Chickpea, *Cicer arietinum* (L.) a member of family Fabaceae, is a self pollinated crop. Pulses are important sources of protein for India's large and growing population. Gram commonly known as Chick pea or Bengal gram is the most important Rabi season pulse crop of India. In India it is also known as 'King of pulses'. It is one of the first cultivated crops and originated in south eastern turkey (Ackcin, 1988) [1]. It is grown usually as a rainfed, cool-weather crop (or) as dry climate crop in semi arid regions, with relative humidity of 21-41% as optimum for seed setting (Muehlbauer and Tullu, 1998) [8]. The pulses are known to improve the physical characteristics of the soil by their tap root system apart from fixing atmospheric nitrogen through biological fixation (Anonymous, 2003) [4]. Chickpea is the third most important grain legume in the world, after dry beans and peas. Chickpea is a highly nutritious pulse and is placed third in the important list of food legumes that are cultivated throughout the world. It contains 21.1% proteins, which is the maximum provided by any pulse and 61.1% carbohydrates (Singh *et al*., 2003) [9]. Chickpea provide a rich source of soluble fibre which helps in lowering cholesterol. It is also rich in calcium, iron and niacin. The per capita availability of pulses has declined from 64 gms per day during 1950's to 27 gms per day as against the FAO/ WHO's recommendation of 80gm per capita per day (Anonymous, 2007) [5]. Major Chickpea producing states in India are Madhya Pradesh, Uttar Pradesh, Maharastra, Andhra Pradesh, Rajasthan, Gujarat and Karnataka together they contributes 93% of the production from 92% of area (Ali and Kumar, 2005) [2]. field trial was conducted at farm of Sam Higginbottom Institute of Agriculture Technology and Science, Deemed-to-be-University, Allahabad Uttar Pradesh during Rabi season 2014-2015. Chick pea was raised by all the recommended agronomical practices except plant protection measures which enabled the build up of insect

pests in a pesticide free environment. Weekly observation on the appearance and population buildup of larvae was recorded on 15 randomly selected plants. The observation was recorded at seven days interval from the time of planting to harvesting. The data on maximum and minimum temperature, relative humidity, sunshine hours, rainfall and wind velocity were collected from the unit of meteorological observatory, SHIATS-DU, Allahabad located close to the experimental site. The data were correlated with the population of pod borer.

Materials and Methods

Experiments were conducted at farm of Sam Higginbottom Institute of Agriculture Technology and Science, Deemed-to-be-University, Allahabad Uttar Pradesh during Rabi season 2014-2015. Taking a Date of sowing 21 november. The experiments were laid out in randomized block design (RBD) with three replications. The treatments were randomly allotted in each block. The unit plot size was 2m x 2m with a plot bund/distance of 0.30m between the plots and 0.50m sub-irrigation channel between the replications. The seeds of PUSA 362 of chickpea were sown in rows with the spacing of 30 cm. The populations of the plants were maintained constant by keeping plant to plant distance of 15 cm. at maturity, all the pods were collected from 5 randomly selected plants from middle rows of each plot and examined. The damaged (bored) and total numbers of pods were counted and the per cent pod damage was determined using the following formula:

$$\% \text{ Pod damage} = \frac{\text{Number of Damage Pod}}{\text{Total No of Pod}} X100$$

The crops of middle rows, avoiding border rows, of each plot compairing (2mx2m) area was harvested. The pods were then threshed; grains were cleaned and dried in the bright sunshine. The grain yield obtained from each plot was converted into per hectare.

Results and Discussion

Seasonal incidence of chickpea pod borer [*Helicoverpa armigera* (Hubner)] during *rabi* season in 2014-2015.

Observations on the incidence of pod borer population with weather parameters are given in table 4.1. The occurrence of chickpea pod borer, *H. armigera* in 2014-2015 *rabi* season commenced from 6th standard week (February second week) with an average 0.26 larvae/plant. The pod borer population increased and gradually reached peak level of 6.32 larvae/plant at 13th standard week (March last week). Thereafter, declined trend was observed.

The occurrence of larvae of *H. armigera* could be noticed for the first time in 6th standard week at the minimum temperature of 11.17, maximum temperature of 27.08, relative humidity in the morning 91.28% and evening 54.42% and 0.74mm rainfall and 3.08 (hr/day) sunshine's, the population at above periods of observation was 0.26 larvae/plant. The maximum population of 6.32 larvae/plant was recorded in 13th standard week at a minimum temperature of 18.37 °C, maximum temperature of 34.14 °C, relative humidity in the morning 91.14% and evening 44.14% and 1.20 mm rainfall and 10.32 (hr/day) sunshine's. There after there was decline in number of larval population in subsequent week and reached to its minimum *i.e.*1.06 larvae/plant. It was observed that the temperature between 25-35 °C favoured the multiplication of gram pod borer whereas, more than 35 °C might be attributed to decline of the population.

Applied treatment, Damage Severity of Pod Borer damage % and get yield

Cypermethrin 10 EC (15.86%, 1720 kg), Ha-NPV (25.00%, 1340 kg), Bt (26.10%, 1290 kg), Nimbicidine (29.10%, 1140 kg), Pongamia leaf extract (29.43%, 1125 kg), Tobacco leaf extract (30.00%, 990 kg) NSKE (Neem seed kernal extract) (31.40%, 850 kg).

Table 1: Following Table Occurrence of chickpea pod borer, *H. armigera* (Hubner) and weather parameters during *rabi* season, 2014-2015

Standard week	Date	No. of larvae/plant	Temperature		Humidity %		Rainfall (mm)	Wind Velocity	Sunshine (hr/day)
			Max.	Min.	Morning	Evening			
47th	19-25 Nov	0.00	30.02	11.88	82.71	44.57	0.00	0.64	7.8
48th	26-2 Dec	0.00	31.05	11.62	82.71	41.85	0.00	0.52	8.44
49th	3-9 Dec	0.00	29.54	10.37	84.28	45.14	0.00	0.69	8.28
50th	10-16 Dec	0.00	27.51	9.54	87	56.42	1.20	0.73	6.22
51st	17-23 Dec	0.00	22.25	7.84	91.28	58.57	0.00	1.77	3.51
52nd	24-30 Dec	0.00	17.20	8.2	93.42	62.57	0.00	0.83	1.10
1st	31-6 Jan	0.00	20.65	12.74	92.28	56.42	4.71	1.46	0.00
2nd	7-13 Jan	0.00	19.71	9.65	91.28	68.57	0.00	1.40	0.00
3rd	14-20 Jan	0.00	15.71	7.92	94.57	67.14	0.00	1.29	0.00
4th	21-27 Jan	0.00	18.62	11.64	93.42	69.14	3.28	1.25	0.00
5th	28-3 Feb	0.00	23.62	12.90	92.28	51.57	1.51	1.43	2.65
6th	4-10 Feb	0.26	27.08	11.17	91.28	54.42	0.74	2.10	3.08
7th	11-17 Feb	0.43	28.20	11.94	94.57	48.14	0.00	0.79	6.45
8th	18-24 Feb	1.53	30.85	13.34	93.42	49.42	0.00	1.68	15.68
9th	25-3 Mar	1.56	29.58	14.71	89.57	60.57	9.62	2.16	13.35
10th	4-10 Mar	3.36	33.20	15.11	89.85	50.42	0.00	1.73	12.20
11th	11-17 Mar	4.65	33.37	15.02	86.71	45.14	0.02	1.78	11.25
12th	18-24 Mar	5.37	34.31	16.45	87.57	45.71	0.00	2.66	13.25
13th	25-31 Mar	6.32	34.14	18.37	91.14	44.14	1.20	3.09	10.32
14th	1-7 Apr	2.45	38.76	20.24	89.00	40.23	0.00	5.23	9.73
15th	8-14 Apr	1.06	39.25	21.00	87.00	38.74	0.00	4.02	9.32
		r=	0.605	0.662	-0.099	-0.439	-0.062	0.512	0.642
		t=	3.312	3.846	-0.434	-2.132	-0.273	2.596	3.654
		F- test	S	S	NS	NS	NS	S	S

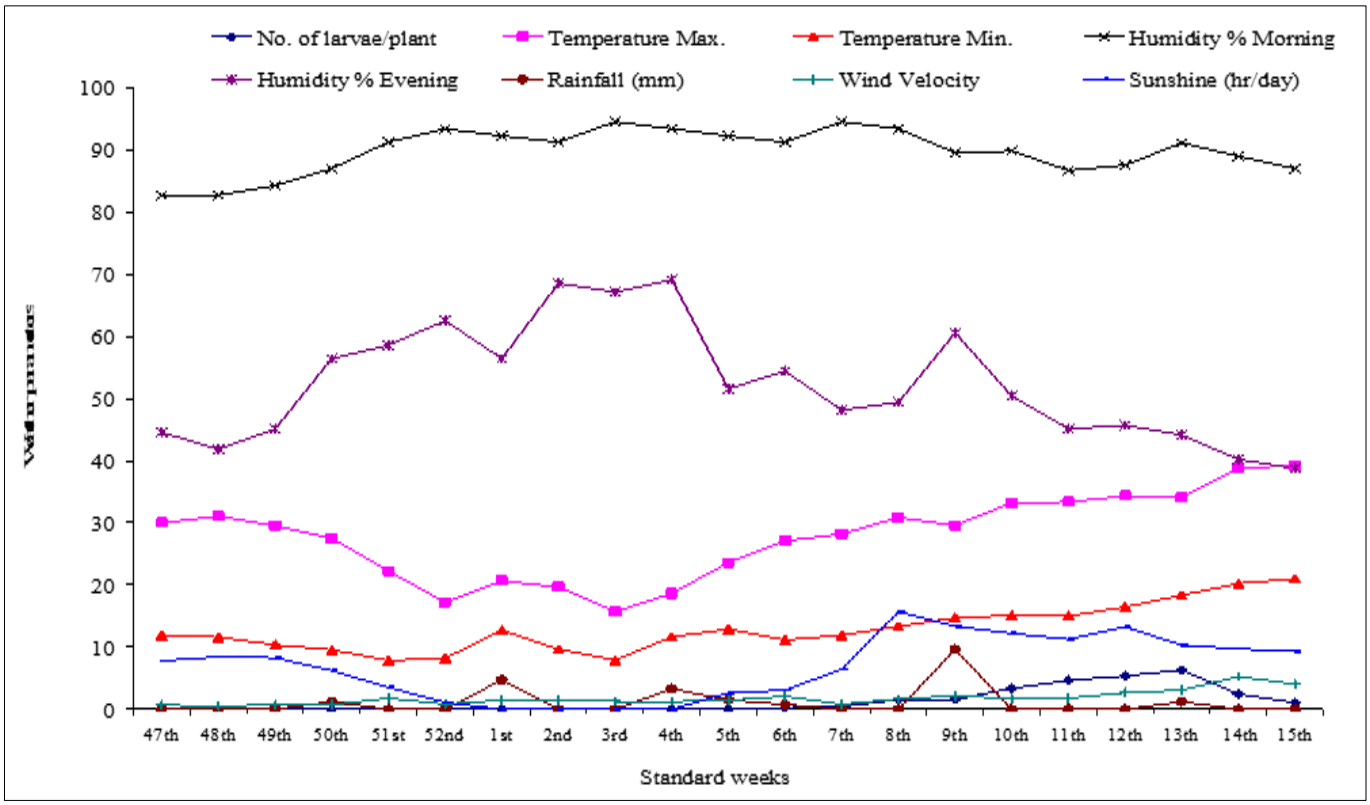
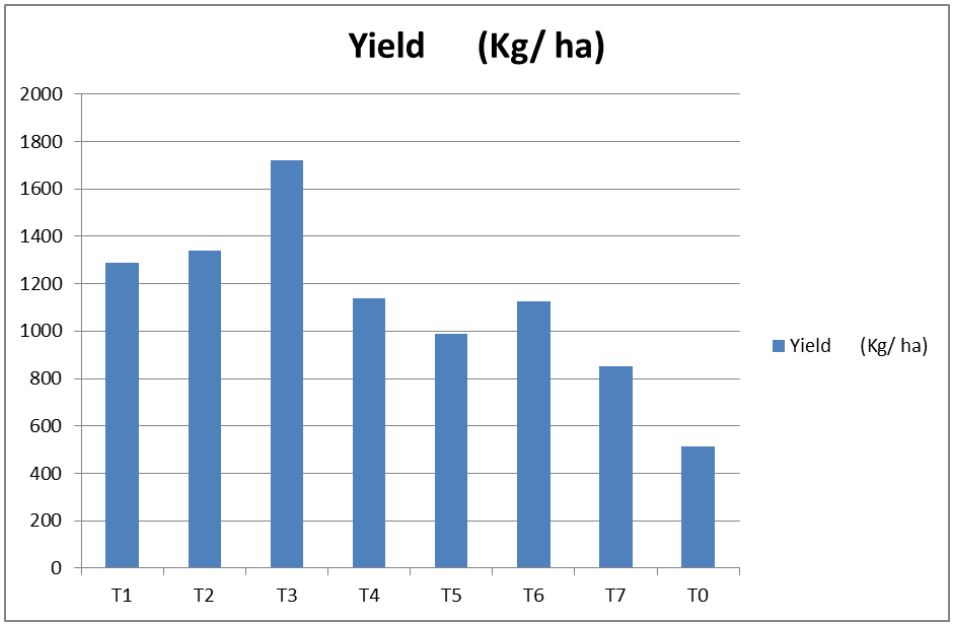


Fig 1: Occurrence of chickpea pod borer, *H. armigera* (Hubner) and weather parameters during *rabi* season, 2014-2015

Table 2: Efficacy of botanicals & chemical insecticides on Pod damage and Yield of chickpea (*Cicer arietinum* L.)

Treatment No.	Treatment	Pod damage (%)	% Decrease in pod damage over UTC	% Increase in yield over UTC	Yield (Kg/ ha)
T_1	*Bacillus thuringiensis*	26.10	38.37	150.48	1290
T_2	Ha-NPV	25.00	41.31	160.19	1340
T_3	Cypermethrin 10 EC (control treated)	15.86	62.76	233.98	1720
T_4	Nimbicidine	29.10	31.69	121.35	1140
T_5	Tobacco leaf extract	30.00	29.57	92.23	990
T_6	Pongamia leaf extract	29.43	30.91	118.44	1125
T_7	NSKE (Neem seed kernal extract)	31.40	26.29	65.04	850
T_0	Control (untreated)	42.60	……..	……	515
	F-Test	S			
	S.Ed(±)	0.401			
	C.D.	1.205			



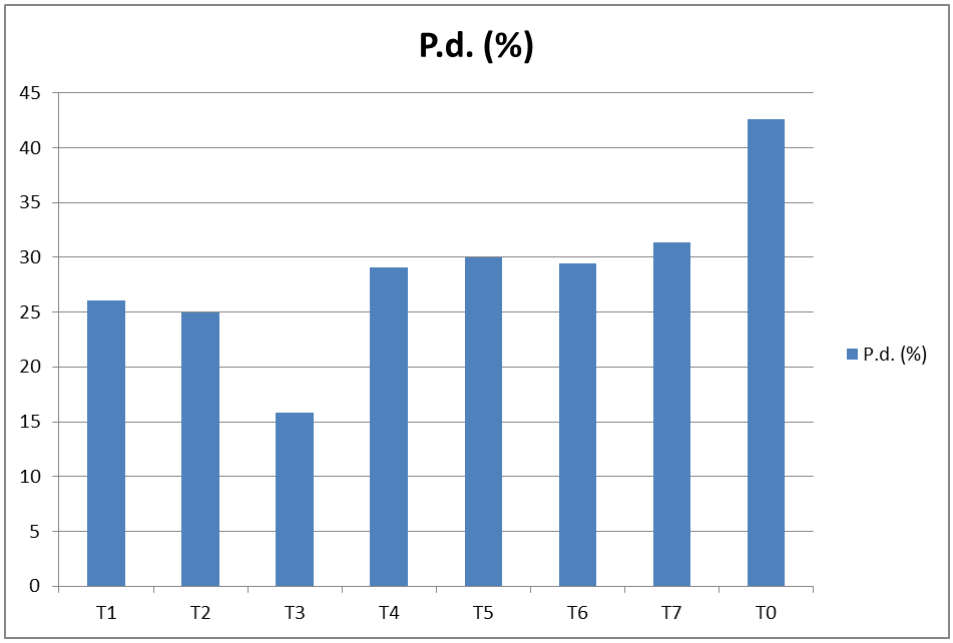


Fig 2: Efficacy of bioagents and botanicals insecticides on Yield (Kg/ ha) and pod damage percent of chickpea

From the critical analysis of the present findings it can be concluded that chickpea pod borer population increased with increasing maximum temperature 35 °C, and decreased with increasing maximum temperature above 35 °C, So that time of sowing has to planned in order to escape from peak infestation of pest. Insecticides like Ha-NPV and Bt can be suitably incorporated in integrated pest management schedule against *Helicoverpa armigera* as an effective tool for their management under biopesticide control.

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