International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(2): 150-153

Received: 19-01-2019
Accepted: 23-02-2019

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Pest population incidence and severity in relation to weather parameters at different phenophases of chickpea (*Cicer arietinum* L.)

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Abstract
The present investigation entitled "Pest population incidence and severity in relation to weather parameters at different phenophases of chickpea (*Cicer arietinum* L.)" was conducted during rabi season of 2006-07 at Instructional Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad: to study the pest population incidence and severity (dynamics of pod borer) in relation to weather parameters at different phenophases of the crop and to assess the yield losses caused by pod borer under variable weather conditions and also to record the effectiveness of pod borer in different cultivars of chickpea. Experiment was conducted in Split Plot Design with four sowing with dates/sowing temperature viz. October 15, 06 with sowing temperature 30.3 ^{o}C October 30, 06 with sowing temperature 30.5 ^{o}C November 15, 06 with sowing temperature 28.9 ^{o}C November 30, 06 with sowing temperature 25.8 ^{o}C and three varieties viz. Awarodhi (V_1) Radhey (V_2) and Uday (V_3). Insect react to external heat changes. The oviposition is held within certain temperature limits. Adult *H. armigera* larvae active during morning to mid-day when the sky is clear and temperature is high. The activity with reduction in light intensity and stops in the evening. Peak period of larval population was recorded twice during the entire crop season first from 13^{th} November to 3^{rd} December and second from (22^{nd} January to 31 March). First incidence was recorded on the 25^{th} October in the experimental plots. Peak period of larval population was recorded twice during the entire crop season, first from 13^{th} November to 3^{rd} December and second from 22^{nd} January to 31^{st} March.

Keywords: chickpea, phenological stages, LAI, larval population

Introduction

Chickpea (*Cicer arietinum* L.) is an important pulse crop of India. It is native to India, Afghanistan and Ethopia. Chickpea which is also known as Bengal gram and Chana is mostly consumed in the form of processed whole seed (boiled, roasted, parched, fried etc.) or Dal and Bason. Mallic & Oxalic acids collected from green leaves are prescribed for intestinal disorders. It is rich source of protein (18-22%), as compared to cereals. Besides protein it also contain carbohydrate (52-70%), fat (4-10%), mineral elements like calcium, phosphorus, iron and vitamin B & vitamin C. It is excellent animal feed and its straw has also good forage value. It is most important pulse crop of the world, cultivated on in an area of 11.15 million hectares, with a production of 8.88 million tones. In U.P. it is cultivated in an area of 0.97 million hectares with an annual production of 0.85 million tonnes. Its average yield is 773 kg ha-1, which is far lower than its potential (upto 4 tonnes ha-1) yield (Ali and Kumar, 2001) [1] and there has been no significant increase in chickpea yield as compared to the cereal crops (Lakshmi Narayanamma *et al*., 2007) [5]. This is because of several biotic and abiotic constraints. Among the biotic factors responsible for low yield the, damage due to insect pests is the major limiting factor (Sharma, 2005) [10]. However there are many pests infesting chickpea *i.e.*, around 57 species in India (Lal, 1996) [4] are causing economic damage. Among them gram pod borer, *Helicoverpa armigera* (Hubner) and cutworm, *Agrotis ipsilon* (Hufnage) are recognized as major pests (Ranga Rao and Shanower 1999) [8] causing an extent of 25-30 per cent crop loss in India. The gram caterpillar, *H. armigera* is an important old world species that inflicts serious damage to several crops. In India alone this highly polyphagous insect feeds on at least 181 plant species spread across 45 botanical families (Manjunath *et al*., 1989) [6]. In India its incidence has been reported to be quite erratic and variable (Bhatnagar and

Davies, 1978 and Lal *et al.*, 1981) [2, 3]. It is reported that *H. armigera* causes an estimated loss of US $ 927 million in chickpea (Sharma, 2001) [9]. A conservative estimate is that US $ one billion is spent on insecticides to control this pest. The population density of this serious pest vary greatly across seasons and among the years, this wide fluctuations in abundance are unknown by virtue of its biological make-up (Pimbert and Srivastava 1991) [7]. The study of population trend of the pest forms one of the major components of pest management. The studies on population dynamics could provide appropriate planning for pest control strategy prior to its active feeding stage and the distribution of its population determined by different components of environment in nature. Therefore, an understanding the trends of its population build up was considered imperative (Yadav, 1990) [11] and understanding the factors responsible for changes in population dynamics and migration of insect pests is also important which will ultimately affect the monitoring and forecasting system.

Materials and Methods

An experiment was conducted during *Rabi* seasons of 2006-2007 at student instructional farm NDUA&T Kumarganj Faizabad (U.P.), India on the topic entitled "Pest population incidence and severity in relation to weather parameters at different phenophases of chickpea (*Cicer arietinum* L.)" The experimental site is located in the main campus of NDUA & T, Kumarganj, (Faizabad) situated at a distance of about 42 km. away from Faizabad district headquarter on Faizabad Raibarelly road. The geographical situation of experimental site lies at latitudes 26^{o} 47' North longitude 82^{0} 12′ East and altitude of 113 meter from mean sea level in the Indo genetic alluvium of eastern Uttar Pradesh. The details of materials and methods employed & a technique adopted during the course of experimentation has been described in this paper. The experiment was conducted in Split Plot Design (S.P.D) and replicated the three times. The different growth parameters studied were white as phenological stages, LAI, Larval population and Percentage of pod damage.

Results

Phenological stages of chickpea as affected by sowing dates/sowing temperatures and varieties have been presented in Table-1. Days taken to vegetative stage was recorded maximum (113 days) when crop was sown on October 15 with sowing temperature 30.3 ºC and minimum (109 days) when crop was sown on November 30 with sowing temperature 25.8 ºC. Hence, delayed in sowing by one month (30 Nov.) reduced the vegetative phase 3 days over October 30 sowing. Days taken to initiation of 50% flowering was maximum (126 days) in crop sown on October 15 with sowing temperature 30.3 ºC followed by October 30 sowing with temperature 30.5 ºC. Maximum days taken from sowing to maturity (167 days) were recorded under sowing temperature 30.3 ºC (occurred on October 15) followed by crop sown on October 30 with sowing temperature 30.5 ºC. It is also evident from the data that November 30 sowing with sowing temperature 25.8 ºC reduced the crop duration by 22 days and 20 days; over October 15th and October 30th sowing with temperature 30.3 ºC and 30.5 ºC, respectively. Different varieties marked by influenced at all phenological stages of chickpea. Comparatively higher days taken to vegetative stage, 50% flowering and reproductive stages were obtained in Awarodhi (small seeded, (167 days) followed by Radhey while lowest days to all phase duration were recorded in Uday variety of chickpea.

Leaf area index of chickpea as affected by sowing dates/sowing temperature and different varieties have been presented in Table - 2. It is quite obvious from the data that LAI was significantly effected due to different sowing dates/sowing temperature at all the stages of crop growth. Significantly higher leaf area index was obtained at sowing temperature 30.5 ºC (occurred on October 30) as compared to sowing done on October 15 and November 30 while, later sown *i.e.*, November 30 produced lowest LAI at all stages leaf area index of chickpea sown on October 30 has been illustrated in table.1 revealed that trend of leaf area index was highest LAI (2.83) was recorded when crop was sown on October 30 with sowing temperature 30.5 ºC followed by October 15 which recorded LAI (2.69). Lowest LAI (1.32) at harvest was recorded under sowing done on November 30, with sowing temperature 25.8 ºC. Different varieties had significant variation on leaf area index at all stages. It is quite evident from the data higher leaf area index was obtained in Awarodhi followed by Radhey and significantly superior over Uday at all the successive stages of chickpea.

Larval population of (*H. armigera*) during *Rabi* season of 2006-07 have been presented in Table-3. It is evident from the table that the larval activity continued throughout the crop season. The population peaked twice, first from 13th November to 3rd December (43rd to 50th standard week) and second from 22nd January to 31st march (3rd to 11th standard week). The highest mean larval population was observed in the 43rd and 12th Standard Weeks, respectively *i.e*. 6.5 and 4.7 larva per meter row. The decline in larval population was recorded from 14th December to 29th January (50th -5th standard weeks) due to decrease in ambient temperature. It is also evident from the Table - 4. That both minimum and maximum temperature showed a negative correlation of-0.2918 and -0.5626 respectively, with the population of Helicoverpa larvae and relative humidity a positive correlation 0.4038. It was also found that cloud cover (Okta) and bright sunshine was positively correlated *i.e*. 0.4520 and 0.0550, 1.000 hrs.

Percentage of pod damage presented in Table- 5 revealed that it was significantly affected by sowing dates/sowing temperature and varieties. It is evident from the data that higher pod damage per cent at (26.4%) was in crop sown on October 15 of the temperature 30.3 ºC followed by crop sown on November 15 with temperature 28.9 ºC was found (24.5%) while significant over October 15th with sowing temperature of 30.3 ºC and November 30th with sowing temperature (25.8 ºC). A perusal of data, quite evident that the pod damage percent was affected by significantly different varieties. The higher pod damage per cent at all the stages was recorded in Uday followed by Radhey, while lowest pod damage percentage was recorded in variety of Awarodhi.

Table 1: Days taken to stages of chickpea as affected by various treatments

Treatments	Emergence	Vegetative	50% flowering	Podding	Maturity
Sowing dates/sowing temperature					
October 15/ 30.3 ºC	6	113	126	148	167
October 30/ 30.5 ºC	7	112	125	144	162
November 15/ 28.9 ºC	7	110	124	144	154
November 30./25.8 ºC	8	109	122	138	145
Varieties					
Awarodhi	8	113	126	148	167
Radhey	7	112	125	145	159
Uday	6	109	124	138	154

Table 2: Leaf area index of chickpea as affected by different treatments

Treatments	Days after sowing									
	15	30	45	60	75	90	105	120	135	AH
Sowing dates/Sowing temp.										
October 15/ 30.3 ºC	0.15	0.24	0.55	1.58	1.95	2.39	2.55	2.69	1.39	1.49
October 30/ 30.5 ºC	0.13	0.26	0.59	1.74	2.14	2.55	2.72	2.83	1.53	1.61
November 15/ 28.9 ºC	0.13	0.25	0.58	1.50	1.59	2.14	2.34	2.45	1.25	1.35
November 30./ 25.8 ºC	0.12	0.23	0.51	1.48	1.84	2.25	2.45	2.45	1.32	1.40
SEm±	0.02	0.02	0.01	0.01	0.04	0.04	0.04	0.06	0.03	0.04
CD at 5%	0.06	0.06	0.03	0.03	0.13	0.14	0.13	0.20	0.10	0.13
Varieties										
Awarodhi	0.14	0.20	0.59	1.69	2.08	0.54	0.78	0.89	1.49	1.60
Radhey	0.13	0.17	0.55	0.54	0.74	2.14	2.42	2.40	1.34	1.38
Uday	0.12	0.10	0.54	1.52	1.72	2.14	2.39	2.37	1.29	1.35
SEm±	0.03	0.03	0.02	0.01	0.04	0.04	0.09	0.34	0.02	0.04
CD at 5%	0.10	0.10	0.05	0.03	0.11	0.12	0.26	1.02	0.05	0.11

Table 3: Weekly larval population of *H. armigera* (Hub.) of chickpea during crop growth period

Standard Met. week	Temperature		Relative humidity (%)	Rainfall (mm)	Cloud cover (Okta)	Bright sunshine (hrs)	Mean larval population per m^2
	Min. (ºC)	Max. (ºC)					
42	19.2	30.3	91.0	41.0	0.0	7.5	0.0
43	16.6	31.6	71.2	0.0	0.0	7.9	0.0
44	17.3	30.5	74.0	0.0	0.0	6.9	0.0
45	16.1	30.2	75.4	0.0	0.0	6.3	0.0
46	12.2	28.9	74.7	0.0	0.0	7.8	0.0
47	10.3	28.0	66.7	0.0	0.0	7.2	0.0
48	10.0	25.8	69.1	0.0	0.0	6.8	1.2
49	9.3	25.3	73.2	0.0	0.0	5.8	1.6
50	8.9	24.4	74.6	0.0	0.0	6.1	2.0
51	4.6	22.6	67.4	0.0	0.0	4.6	0.8
52	6.5	26.8	61.1	0.0	0.0	7.8	0.6
1	4.3	23.8	64.6	0.0	0.0	6.8	0.0
2	9.2	24.8	63.7	0.0	0.0	6.3	0.0
3	8.2	22.9	68.4	0.0	0.0	6.1	2.1
4	6.1	18.5	69.6	0.0	0.0	4.5	2.0
5	4.6	20.3	64.2	0.0	0.0	5.5	3.8
6	9.9	23.1	67.3	0.0	0.0	6.4	4.6
7	4.7	23.7	55.8	0.0	0.0	7.1	4.8
8	8.7	26.4	63.1	0.0	0.0	6.9	7.7
9	10.5	27.9	68.0	0.0	0.0	8.4	6.8
10	13.8	30.1	68.0	0.0	0.0	6.6	7.7
11	15.1	31.8	51.4	0.0	0.0	4.3	5.7
12	16.1	34.9	51.5	0.0	0.0	7.8	5.9
13	15.5	35.5	42.7	0.0	0.0	3.4	5.7
14	15.9	32.3	47.2	0.0	0.0	5.8	4.5

Table 4: Relationship between abiotic factors with larval population of *H. armigera*

S. No	Population	Abiotic factors					
		Temperature (ºC)		Relative humidity (%)	Rainfall (mm)	Cloud cover (Okta)	Bright sunshine (hrs)
		Min.	Max.				
1.	*H. armigera* larvae	-0.2918	-0.5626	0.1041	0.4038	0.0550	1.000

Table 5: Percentage of pod damage in chickpea as affected by various treatments

Treatments	Days after sowing								
Sowing dates/ Sowing temp.	**30**	**45**	**60**	**75**	**90**	**105**	**120**	**135**	**AH**
October 15/ 30.3 °C	24.7	22.6	22.6	22.7	23.8	24.3	23.4	21.3	26.4
October 30/ 30.5 °C	23.5	24.0	21.7	20.5	20.7	23.7	21.7	20.3	22.7
November 15/ 28.9 °C	26.2	24.2	23.7	23.6	24.7	24.6	25.6	23.5	24.5
November 30./ 25.8 °C	26.8	24.8	25.6	26.7	25.7	25.4	26.3	24.6	25.7
SEm±	0.48	0.49	0.34	0.54	0.44	0.56	0.64	0.74	0.76
CD at 5%	1.44	1.47	1.02	1.62	1.32	1.68	1.92	2.22	2.28
Varieties									
Awarodhi	23.3	12.6	15.7	16.6	18.3	19.3	20.3	21.6	18.8
Radhey	24.6	20.6	27.3	22.6	23.5	24.3	23.5	24.6	23.8
Uday	26.8	27.6	29.3	25.4	26.8	26.4	27.3	26.5	27.0
SEm±	0.56	0.64	0.54	0.59	0.58	0.62	0.54	0.60	0.61
CD at 5%	1.68	1.92	1.62	1.77	1.74	1.86	1.62	1.80	1.83

Conclusion

It is concluded that study in larval population declined from 14 December to 29 January. Weather parameters play a key role in build-up of larval population. Higher pod damage percentage was observed crop sown under October 30th with sowing temperature 30.5 °C followed by November 15 with sowing temperature 28.9 °C.

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