International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(3): 2307-2311

Received: 12-03-2020
Accepted: 16-04-2020

AP Prajapati
Ph.D., Scholar, Department of Agricultural Entomology NMCA, Navsari Agricultural University, Navsari, Gujarat, India

PB Patel
Assistant Research Scientist, Department of Agricultural Entomology. Soil and Water Management Research Unit, Navsari Agricultural University, Navsari, Gujarat, India

HD Bhimani
Associate Professor, ASPEE Shakilam Institute of Biotechnology, Athawa Farm, Ghod Dod Road, NAU, Surat, Gujarat, India

AV Desai
Ph.D., Scholar, Department of Agricultural Entomology, NMCA, Navsari Agricultural University, Navsari, Gujarat, India

Corresponding Author:
AP Prajapati
Ph.D., Scholar, Department of Agricultural Entomology NMCA, Navsari Agricultural University, Navsari, Gujarat, India

Population dynamics of major insect pests of cowpea (*Vigna unguiculata* L. Walp) and its correlation with different abiotic factors under south Gujarat conditions

AP Prajapati, PB Patel, HD Bhimani and AV Desai

DOI: https://doi.org/10.22271/chemi.2020.v8.i3ag.9554

Abstract
Investigations were carried out to know the population dynamics of major insect pest of cowpea (*Vigna unguiculata* L. Walp) and its correlation with different abiotic factors under south Gujarat conditions at Navsari Agricultural University, Navsari during summer 2018. The results revealed that aphid, jassid and whitefly population started from 3rd week of March reached to a peak level of 3.0 aphid index, 4.66 jassids/leaf and 4.06 whiteflies/leaf respectively. The incidence of cowpea pod borer and spotted pod borer initiated from 4th WAS *i.e.* 3rd week of April (16th SMW) with the initiation of the flower and pod formation occurs pest population reached to a peak level 2.82 larvae/plant and 2.70 larvae per plant during 8th WAS (19th SMW).Then after the pest population declined throughout the cropping period. Almost all the insect pests were found abundant in 2nd week of May, *i.e.* 8th week after sowing. Among various weather parameters, rainfall showed a significantly negative influence on population of almost all pests and morning relative humidity showed a significantly negative influence on population of almost all pests except jassid and *H. armigera*.

Keywords: Cowpea, population dynamics, aphid, jassid, whitefly, pod borer

Introduction
Cowpea [*Vigna ungiculata* (L.) Walp.] belonging to family leguminaceae is one of the principle pulse crops of the tropics and commonly known as *Chala or Choli, Chavli, Lobia, Bobbarlu,* southern pea and black – eyed bean. It can be used as fodder, vegetable, green legume as well as green manure crop. In Gujarat, total area under pulses is 0.70 million hectares having total production of 0.58 million tones with the productivity of 1.20 t/ha. In Gujarat, area under cowpea is 0.52 million hectares and the production 0.35 million tonnes with the productivity of 1.48 t/ha. (Anonymous, 2018) [8]. The losses in grain or foliage of cowpea ranges from 20 to 100 per cent due to field insect pests (Raheja, 1976; Singh and Allen, 1980) [13, 16]. As many as 21 insect pests of different groups were observed on cowpea during summer and Kharif seasons. Among various insect pests, *Aphis craccivora* Koch., *Emposca kerri* Pruthi, *Bemisia tabaci* Genn., *Helicoverpa armigera* Hubner and *Maruca vitrata* Fabricius are potential pests causing considerable damage to cowpea. Sucking pests like aphid, jassid and whitefly are important pests limiting profitable cultivation of cowpea not only by direct sap sucking but also by virus transmission. *Aphis craccivora* cause significant yield losses of 20-40 per cent in Asia and up to 35 per cent in Africa. *E. kerri* causes yield reduction up to 39 per cent (Singh and Van Emden, 1975) [15]. *B. tabaci* is also of considerable importance because it also transmits the viral diseases in cowpea. *H. armigera* cause damage by attacking on various plant parts *viz*., leaves, buds, flowers and pods of cowpea. Young larvae feed on the leaves, later stage larvae feed on the pods by thrusting its head into the pod and keeping remaining body out. The larvae of *M. vitrata* web the flowers or inflorescence with the adjacent leaves and pods, feed from inside the webbed mass which protects them from the natural enemies and adverse natural conditions (Sharma, 1998). About 21.30 and 17.37 per cent fruit damage was estimated due to *H. armigera* and *M. vitrata*, respectively. Study on pest complex is the essential component for entomological aspect to start with any crop.

Information regarding population dynamics is helpful to the farmers for managing the pest population.

Material and Methods

In order to study the population dynamics of major insect pests of cowpea, crop sown at Soil and Water Management Research Unit Farm, Navsari Agricultural University, Navsari, Gujarat during summer 2018.

All the recommended pre- and post-sowing agronomical practices were followed and the experimental area was kept free from insecticidal spray throughout the crop season in order to record the incidence of insect pests. To find out the incidence of major insect pests on cowpea variety AVCP-1, population of major insect pests was recorded at weekly interval from random plants starting from 1st week after sowing till the harvest of the crop.

Table 1: Aphid infestation index

Grade	Aphid index
0	No population of aphid on plant
1	One or two aphids observed on plant but no colony formation
2	Small colony of aphid observed with countable numbers on plant but no damage symptoms seen
3	Big colony of aphids observed on plant and aphids can be counted and damage symptoms seen
4	Big colony of aphids observed on plant and aphids could not be counted and severe damage symptoms seen and plant withered.

Fifty plants were selected randomly. Population of aphids was recorded through the aphid infestation index. Leaves, flowers and pods in selected plants were observed and the degree of infestation level was recorded and categorized into grades as 0, 1, 2, 3 and 4 according to visual and inspection counts. The aphid index is shown in Table A. For jassid and whitefly population twenty plants were randomly selected. Three leaves from top, middle and lower portion of each plant were observed for the presence of nymphs and adults of jassids and whiteflies. The observations were recorded at weekly interval commencing from 10 days after sowing. Fifty plants were selected. Pod borer and spotted pod borer incidence was recorded by counting total number of larvae on separate randomly selected plants at weekly interval from 1st week after sowing.

Results and Discussion

The results on periodic mean population of insect pests explicated that five important pests and a natural enemy of crop were found colonizing cowpea crop in Navsari district of Gujarat. The sequential incidence of insect pests revealed that aphids, whiteflies and leafhoppers were the first to invade the crop at early growth stage *i.e.*, one week after sowing (WAS) and remained active till 11 WAS. The next pest that appeared on cowpea was spotted pod borer followed by cowpea pod borer. Almost all the insect pests were found abundant in 2nd week of May, *i.e.* 8th week after sowing.

The observations on aphid recorded during summer 2018 are presented in Table 2 and graphically depicted in Figure 1 revealed that the aphid population started on cowpea from 2nd week after sowing (WAS) during 4th week of March *i.e.* 13th SMW with 0.56 aphid index and continued till 23rd SMW almost harvesting of crop. Further, the population of aphids increased continuously up to 9th WAS (20th SMW) and reached a peak level of 3.0 aphid index, coincided with peak stage of flowering and pod formation during 3rd week of May. The peak activity of aphids was seen during 8th week to 10th week after sowing (19th to 21st SMW). Thereafter, the population of aphids declined towards the crop maturity. The above results are in agreement with Augustine (2011) [3] who stated that the peak activity of aphids was from 7th to 10th WAS and remained active throughout the crop period. The results are more or less in agreement with Srikanth and Lakkundi (1990) [18] who concluded that population of *A. craccivora* on cowpea increased rapidly with crop growth and their peak coincided with peak pod formation. It is evident from the data presented in Table 2 and Figure 1 that the population of jassid started from 1st WAS *i.e.* 3rd week of March (12th SMW) with 0.26 jassid leaf. The incidence of this pest increased slowly and it reached to a peak level (4.66 jassids/leaf) in 8th week after sowing *i.e.* 2nd week of May. (19th SMW) Thereafter, jassid population decreased gradually and reached to a low level (1.88 jassids/leaf) at the time of final picking. This pest was active throughout the crop period. Thus it was found to be in close relation with the experiment carried out by Patel *et al.* (2010) [11] mentioned that the population of leafhopper, *E. Kerri* on cowpea was initiated from first week of March, increased gradually and reached peak (2.83 hoppers/leaf) during fourth week of March. The present findings are more or less in confirmation with the above report. The data presented in Table 2 and graphically depicted in Figure 1 revealed that the population of whitefly started from 1st WAS *i.e.* 3rd week of March (12th SMW) with 0.66 whitefly/leaf. The population increased with crop growth and reached to a peak level of 4.06 whiteflies per/leaf during 7th WAS in 1st week of May (18th SMW). The whitefly population declined thereafter continuously (0.64 whitefly/leaf). Pai and Dhuri (1991) [8] reported that the pest appeared in 1st week after germination and continued to build up throughout the crop growth with a peak during the 5th week of October. Similarly, Faleiro *et al.* (1986) [4] found that *B. tabaci* was a minor pest and regularly occurred from seedling to pod formation stage of cowpea during kharif season, 1983 and 1984 at IARI, New Delhi. The present investigations are more or less in agreement with the above reports. The data recorded on cowpea pod borer during summer 2018 presented in Table 2 and Figure 2 indicated that the population of cowpea pod borer initiated from 5th WAS *i.e.* 3rd week of April (16th SMW) with the initiation of the flower and pod formation occurs (1.62 larvae/plant). The pest population reached to a peak level (2.82 larvae/plant) during 8th WAS coincided with peak pod formation *i.e.* 2nd week of May (19th SMW) and thereafter decreased gradually and reached to a low level of 0.88 larva per plant during 2nd week of June (24th SMW) In past, Subhash and Singh (2013) [19] reported that pod borer *H. armigera* was present throughout the growing season of chickpea irrespective sowing dates. Patel and Koshiya (1999) [10] from Junagadh, Gujarat revealed that the pest was active from November to February when the chickpea was at pod formation stage. The present findings are in line with the above reports. Spotted pod borer activity was recorded on cowpea during summer 2018 is presented in Table 2 as well as graphically depicted in Figure 2. The population of *M. vitrata* started from 4th WAS *i.e.* 2nd week of April (15th SMW) with 0.24 larva/plant which was coincided with the flower initiation. The population reached to a peak of

2.70 larvae per plant during 8th WAS (19th SMW).Then after the pest population declined throughout the cropped period. The pest was more active during 17th SMW to 20th SMW *i.e.* 4th week of April to 3rd week of May. The results are in agreement with Patel *et al.* (2010) [11]. They stated that *M. vitrata* on cowpea was initially noticed during middle of March at pod setting stage and reached to its highest (1.21 larvae/plant) level during peak pod formation *i.e.* (Fourth week of March) and also the results are in line with Ganapathy (2010) who reported that peak incidence of spotted pod borer in cowpea and pigeon pea started from 40th (October) to 47th standard week (November).

Correlation co-efficient values worked out between insect pests of cowpea and weather parameters (Table 3) revealed that It is evident from the data in Table 3 that aphid population exhibited highly significant positive correlation with Evaporation (r= 0.742**) and negatively correlated with rainfall (r= -0.489) and Morning relative humidity (r= -0.016). However, Maximum temperature (r= 0.178), Minimum temperature (r= 0.457), Evening relative humidity (r= 0.144) Mean vapor pressure (r= 0.340) and Sunshine hours (r= 0.497) had positive correlation with aphid population on cowpea but the results were non significant. Earlier, Prasad *et al.* (2008) stated that maximum and minimum temperature showed non-significant positive correlation with aphid population which goes in line with the present findings. These findings are more or less in confirmation with the earlier research work done by Augustine (2011) [3], who showed a negative correlation with maximum daily temperature, wind speed and sunshine hours and had a positive correlation with minimum daily temperature, relative humidity. Correlation coefficient analysis data of jassid on cowpea are presented in Table 3 clearly shows that evaporation showed highly significantly positive correlation (r= 0.842**) with jassid population. However, rainfall (r= -0.196) showed non-significant negative correlation while remained other factors like Maximum temperature (r= 0.063), Minimum temperature (r= 0.531) Morning relative humidity (r= 0.083) Evening relative humidity (r= 0.297) Mean vapor pressure (r= 0.444) and Sunshine hours (r= 0.438) showed non-significant positive correlation.In past, Falerio *et al.* (1990) studied that the jassid population had non significant correlation with any environmental factors, except evaporation. minimum and maximum temp

Table 2: Population dynamics of aphid, jassid, whitefly, cowpea pod borer and spotted pod borer on cowpea during summer 2018

Month	Week	WAS	SMW	Aphid index	Jassid/leaf	Whitefly/leaf	Larvae of cowpea pod borer/plant	Larvae of spotted pod borer/plant
March	III	1	12	0.00	0.26	0.66	0.00	0.00
	IV	2	13	0.56	0.90	1.06	0.00	0.00
April	I	3	14	0.96	1.50	2.04	0.00	0.00
	II	4	15	1.66	2.00	2.64	0.00	0.24
	III	5	16	2.00	3.34	3.12	1.62	1.04
	IV	6	17	2.20	3.96	3.90	2.46	2.16
May	I	7	18	2.50	4.18	4.06	2.64	2.68
	II	8	19	2.80	4.66	3.88	2.82	2.70
	III	9	20	3.00	4.08	3.56	2.06	2.60
	IV	10	21	2.96	3.28	3.20	1.82	0.40
	V	11	22	1.70	2.64	2.00	1.60	0.18
June	I	12	23	1.64	2.38	1.66	1.36	0.00
	II	13	24	0.00	1.88	0.64	0.88	0.00
SMW - Standard Meteorological Week WAS - Weeks After Sowing								

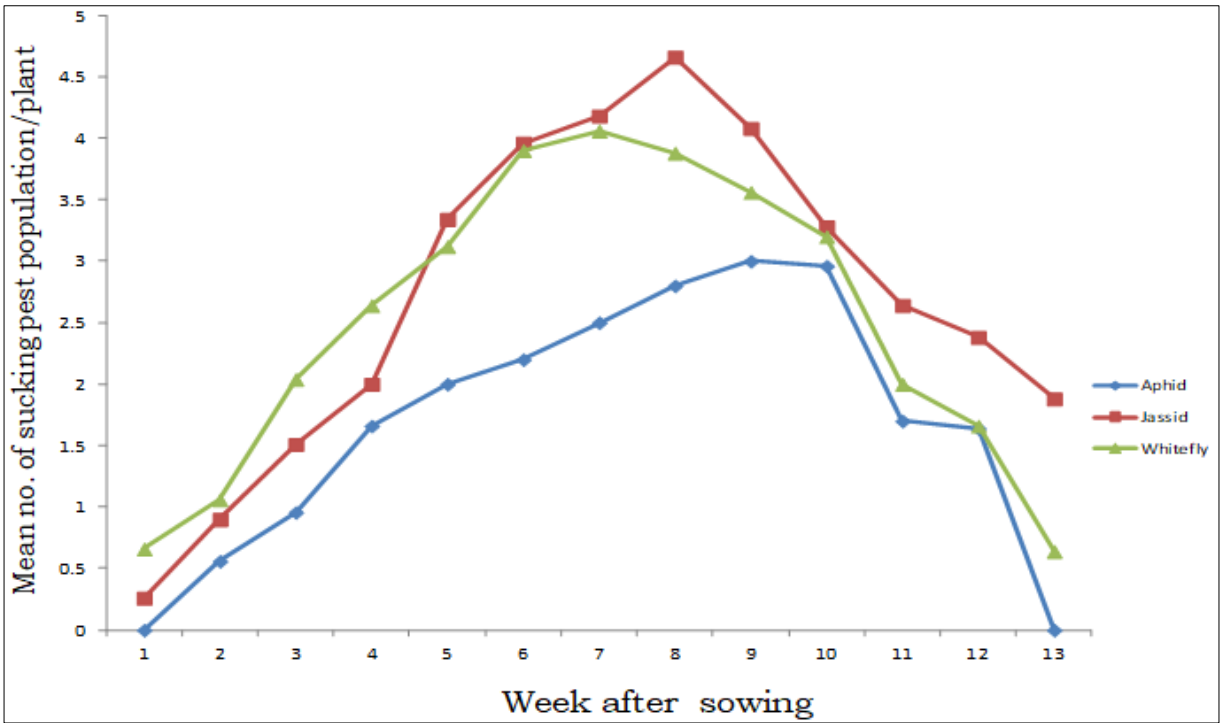

Fig 1: Population dynamics of aphid, jessed and whitefly on cowpea during summer 2018

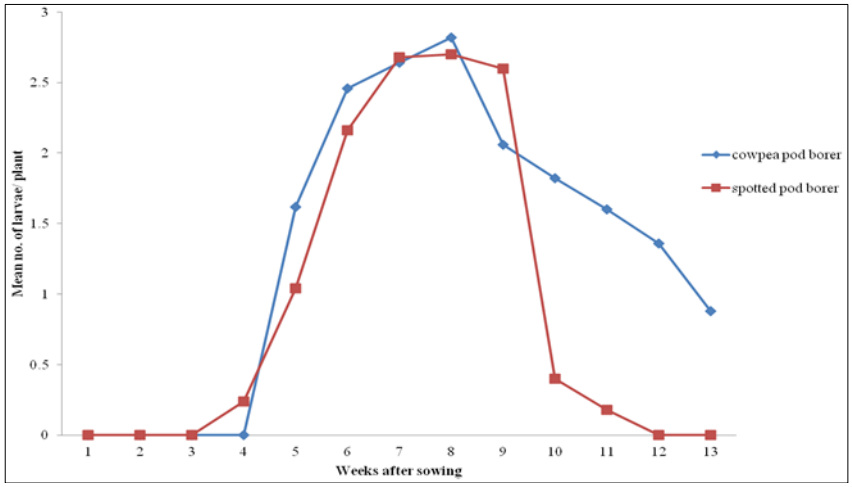

Fig 2: Population dynamics of cowpea Pod borer and spotted pod borer on cowpea

Table 3: Correlation matrix of the relationship between weather parameters and population of major insect pests of cowpea

Sr. No.	Insect pests	Temperature		Relative Humidity		Evapo. (mm/day)	RF (mm)	Sunshine Hours	MeanVP
		Maximum temperature ⁰C	Minimum temperature ⁰C	Morning Relative Humidity	Evening Relative Humidity				
1	Aphid	0.178	0.457	-0.016	0.144	0.742**	-0.489	0.497	0.340
2	Jassid	0.063	0.531	0.083	0.297	0.842**	-0.196	0.438	0.444
3	Whitefly	0.212	0.224	-0.044	0.007	0.787**	-0.496	0.707**	0.139
4	*H. armigera*	-0.017	0.550	0.011	0.315	0.764**	-0.122	0.343	0.460
5	*M. vitrata*	0.028	0.182	-0.180	0.024	0.660*	-0.296	0.641*	0.102

* Significant at 5 per cent level (r = ± 0.5529)
**Significant at 1 per cent level (r = ± 0.6835)

relative humidity had non-significant positive correlation. Thus, the results obtained in the present investigation are more or less in confirmation with the earlier reports. These findings are in close agreement with the work carried out by Soratur *et al.* (2017) they noted that pest population was showing positive correlation with high temperature. The data presented in Table 3 indicated that whitefly population showed highly significant positive correlation with Sunshine hours (r= 0.707**) and Evaporation (r= 0.787**). Maximum temperature (r= 0.212), Minimum temperature (r= 0.224) Evening relative humidity (r= 0.007) and Mean vapor pressure (r= 0.139) showed non-significant positive correlation. Other factors like Rainfall (r= -0.496) and Morning relative humidity (r= -0.044) showed non-significant negative correlation. Kumar *et al.* (2004) [7] noticed that temperature and sunshine hours were favorable for whitefly population with a positive correlation in mungbean and urd bean which goes in line with the present investigation and also these have already been studied and confirmed by Swathi *et al.* (2015) [20] who reported that temperature shows positive correlation. The results shown in the Table 3 indicated that *H. armigera* population was significantly positive correlation with evaporation (r= 0.764**). Other factors like morning relative humidity (r= 0.011), minimum temperature (r= 0.550), evening relative humidity (r= 0.315), sunshine hours (r= 0.343) and mean vapor pressure (r= 0.460) showed positive correlation while and the remaining factors like maximum temperature (r= -0.017) and rainfall (r= -0.122) showed a negative correlation with *H. armigera* population but the results were non significant. Earlier, Kaneria (1994) studied the effect of weather parameters on population fluctuation of *H. armigera* in pigeon pea under Gujarat conditions and reported that the evaporation and sunshine hours significantly positive correlation with the pest population. According to Parmar *et al.* (2005) [9], correlation studies on *H. armigera* in okra exhibited a positive correlation with maximum and minimum temperatures with pest population at Anand, Gujarat. The results presented in Table 3 revealed that larval population of spotted pod borer showed significant positive correlation with evaporation (r= 0.660*) and sunshine hour (r= 0.641*) while non significant positive correlation with different weather parameters like maximum temperature (r= 0.028), minimum temperature (r= 0.182), evening relative humidity (r= 0.024) and mean vapor pressure (r= 0.102) and all the other factors like morning relative humidity (r= -0.186) and rainfall (r= -0.296) showed non-significant negative correlation. Swathi *et al.* (2015) [20] revealed that none of the meteorological parameters like relative humidity and sunshine hours had non-significant negative correlation with the occurrence of *M. vitrata* population. Thus, the result obtains in present investigation is more or less in confirmation with earlier report.

References

1. Anonymous, 2018. https://www.indiaagristat.com/table/agriculturedata/2/agriculturalproduction/225/7270/data.aspx
2. Atwal AS. Agricultural Pests of India and South East Asia. Kalyani Publishers, Ludhiana, 1976, 207-272.
3. Augustine SN. Arthropod assemblage dynamics on cowpea (*Vigna unguiculata* L. Walp.) in a subtropical agro-ecosystem, South Africa. African Journal of Agricultural Research. 2011; 6(4):1009-1015.
4. Faleiro JR, Singh KM. Yield Infestation Studies associated with insects infesting cowpea, [*Vigna unguiculata* (L.) Walp.] in Delhi. Indian Journal of Entomology. 1985; 47(3):287-291.
5. Kaneria DN. Pest complex of pigeon pea, its management through sowing dates and varieties,

chemical control of *Helicoverpa armigera* (Hubner) M.Sc. (Agri.) Thesis, GAU. Sardarkrushinagar, 1994.
6. Kotadia VS, Bhalani PA. Residual toxicity of some insecticides against *Aphis craccivora* Koch on cowpea crop. GAU Research Journal. 1992; 17(2):161-164.
7. Kumar K, Rizvi SMA, Shamshad A. Seasonal and varietal variation in the population of whitefly (*Bemisia tabaci*) and incidence of yellow vein mosaic virus in urd and mungbean. Indian Journal of Entomology. 2004; 66(2):155-158.
8. Pai KM, Dhuri AV. Incidence of insect pest in early variety of cowpea, *Vigna unquiculata* (L). Walp. Indian Journal of Entomology. 1991a; 53(2):329-331.
9. Parmar KD, Borad PK, Rabari DH. Population fluctuation of *Helicoverpa armigera* (Hubner) Hardwick on okra crop in relation to weather parameters. GAU Research Journal. 2005; 30(1-2):56-59.
10. Patel CC, Koshiya DJ. Population dynamics of gram pod borer, *Helicoverpa armigera* (Hubner) Hardwick on cotton, pigeon pea and chickpea. GAU Research Journal. 1999; 24(2):62-67.
11. Patel SK, Patel BH, Korat DM, Dabhi MR. Seasonal incidence of major insect pests of cowpea, *Vigna unguiculata* (Linn.) Walpers in relation to weather parameters. Karnataka Journal of Agricultural Sciences. 2010; 23(3):497-499.
12. Prasad NVVSD, Rao NH. Field evaluation of *Bt* cotton hybrids against insect pest complex under rain fed conditions. Indian Journal of Entomology. 2008; 70(4):330-336.
13. Raheja AK. Assessment of losses caused by insect pests to cowpeas in northern Nigeria. PANS. 1976; 22(2):229-233.
14. Shaonpius M, Charanjit KG. Influence of weather parameters on the incidence of cowpea golden mosaic virus and its vector, *Bemisia tabaci* (Gennadius). Indian Journal of Entomology. 2010; 72(1):79-83.
15. Singh SR, Van Emden HF. Insect pests of grain legumes, Annual Review of Entomology. 1975; 24:255-278.
16. Singh SR, Allen DJ. Pests, diseases, resistance and protection in cowpea. Advances in Legume Science. Summerfield, R. J. and Bunting, H. H. (Eds.), Royal Botanical Garden, Kew, Ministry of Agriculture, Fisheries and Food, London, 1980, 419-433.
17. Soratur MDDR, Naik SM. Population dynamics of major insect pests of cowpea [*Vigna Unguiculata* L. Walp] and their natural enemies. Journal of Entomology and Zoology Studies. 2017; 5(5):1196-1200.
18. Srikanth J, Lakkundi NH. Seasonal population fluctuations of cowpea aphid, *Aphis craccivora* Koch and its predatory coccinellids. Insect Science and Its Application. 1990; 11(1):298-304.
19. Subhash C, Singh V. Effect of different sowing dates on the incidence of *Helicoverpa armigera* on chickpea. Green Farming. 2013; 4(1):125-126.
20. Swathi YK, Pandya HV, Patel SM, Patel SD, Saiyad MM. Population dynamics of major insect pests of cowpea. International Journal of Plant Protection. 2015; 8(1):112-117.