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Population dynamics of major insect pests of cowpea [*Vigna ungiculata* (L.) Walp.]

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ABSTRACT

Investigations were carried out on population dynamics of major insect pests that attack cowpea [*Vigna ungiculata* (L.) Walp.] at Regional Horticultural Research Station, Navsari Agricultural University, Navsari during 2012-13. The results revealed that aphid and jassid population started from 3rd week of October, reached a peak of 3.4 aphid index and 3.8 jassids/ leaf by 1st week of December whereas whitefly population started from 3rd week of October and reached to a peak level of 3.7 whiteflies per leaf in 4th week of November. Cowpea pod borer population started in 2nd week of November and reached to a peak level (2.8 larvae/plant) in 1st week of December and thereafter, decreased gradually. Spotted pod borer population started from 1st week of November coinciding with the flower initiation and reached to a peak of 2.8 larvae per leaf in 1st week of December. Among various weather parameters, evening relative humidity showed a significantly negative influence on population of almost all pests and minimum temperature showed a significantly negative correlation with aphid, cowpea pod borer and ladybird beetle population.

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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, Cowpea is cultivated in about 23,600 ha with an annual production of 19,900 tonnes and on average cowpea occupies area of 6937 hectares with an annual production of 42,432 tonnes (Anonymous, 2003-04). 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). 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. Besides cowpea, this aphid has become a serious pest for legume crops such as faba bean, Indian bean and pea (El-Ghareeb *et al*., 2002). The damage to the crop

Table A : 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 aphids observed with countable numbers on plant but no damage symptoms seen
3.	Big colony of aphids is 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

results in profuse draining of plant sap and development of honey dew leading to black sooty mould on leaves and leaf shedding (Kotadia and Bhalani, 1992). A virus "Rosette" is known to be transmitted by this aphid (Atwal, 1976). *E. kerri* causes yield reduction up to 39 per cent (Singh and Van Emden, 1975). *B. tabaci* is also of considerable importance because it also transmits the viral diseases in cowpea. One of the most important viruses infecting cowpea is cowpea golden mosaic virus which is actively transmitted by *B. tabaci* (Shaonpius and Charanjit, 2010). *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 was sown at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat during October 2012-2013. The experiment was laid out in Randomized Block Design (RBD) with three replications. The variety used was Pusa Phalguni.

All the recommended 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. Population of major insect pests was recorded at weekly interval from tagged plants starting from 10 days after sowing till the harvest of the crop.

Twenty plants were selected and tagged. 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 and tagged. 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. Twenty plants were selected and tagged. Pod borer and spotted pod borer incidence was recorded by counting total number of larvae on separate tagged plants at weekly interval from 10 days after sowing. The numbers of damaged pods per plant were also recorded during the time of each harvest.

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 1st week of December, *i.e.* 8th week after sowing.

The data presented in Table 1 and graphically depicted in Fig. 1 revealed that the aphid population started from 1st week after sowing (WAS) *i.e.* the 3rd week of October with 0.2 aphid index and the population increased continuously up to 8th WAS with a peak level of 3.4 aphid index, coinciding with peak stage of flowering and pod formation in 1st week of December. The peak activity of aphids was seen from 7th week to 10th week after sowing. Thereafter, the population decreased but remained active throughout the crop period. The results are in agreement with Augustine (2011) who stated that peak activity of aphids was from 7th to 10th WAS and remained active throughout the crop period and also more or less in agreement with Srikanth and Lakkundi (1990) who stated that population of *A. craccivora* on cowpea increased rapidly with crop growth and their peak coincided with peak pod formation. Adipala *et al.* (1999) stated that *A. craccivora* was the main vegetative pest of cowpea. The present findings are also in agreement with them. The population of jassid (Table 1 and Fig. 2) started from 1st WAS *i.e.* 3rd week of October (0.2 jassid/leaf). The incidence of this pest increased slowly and it reached to a peak level (3.8 jassids/leaf) in 8th week after sowing *i.e.* 1st week of December. Thereafter, jassid population decreased gradually but was active throughout the crop period. Patel *et al*. (2010) 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 population of whitefly (Table 1 and Fig. 2) started from 1st WAS *i.e.* 3rd week of October, increased with crop growth and reached to a peak level of 3.7 whiteflies per leaf in 7th WAS coinciding with 4th week of November, the population declined continuously but was present till the last picking of the crop. Pai and Dhuri (1991) 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) found that *B. tabaci* was a minor pest, regularly occurred from seedling to pod formation stage of cowpea during *Kharif* season, 1983 and 1984 at IARI, New Delhi. The population of cowpea pod borer (Table 1 and Fig. 3) started from 5th WAS *i.e.* 2nd week of November with the initiation of the flower formation and reached to a peak level (2.8 larvae/plant) during 8th WAS coinciding with peak pod formation *i.e.* 1st week of December and thereafter, decreased gradually and reached to a low level of 0.8 larva per plant during the final picking. In past, Subhash and Singh (2013) reported that pod borer *H. armigera* was present throughout the growing season of chickpea irrespective sowing dates. Patel and Koshiya (1999) from Junagadh, Gujarat revealed that the pest was active from November to February when the chickpea was at pod formation stage. The population of *M. vitrata* (Table 1 and Fig. 3) started from 4th WAS *i.e.* 1st week of November (0.2 larva/plant) coinciding with the flower initiation. The population reached to a peak of 2.8 larvae per leaf during 8th WAS. The second peak population was present two times *i.e.* 7th and 9th WAS during the last week of November and 2nd week of December which are the peak pod formation stages. Thereafter, the population declined and reached to zero larvae per plant by the time of final picking. The results are in agreement with Patel *et al.* (2010). 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. Ganapathy (2010) reported the peak incidence of spotted pod borer in cowpea and pigeon pea started from 40th (October) to 47th standard week (November). Ladybird beetle is an important predator which feed on aphids, jassids, whiteflies and few other sucking pests. The data presented in Table 2 and graphically depicted in Fig. 2 revealed that the population of ladybird beetle started in 3rd WAS and present up to 12th WAS.

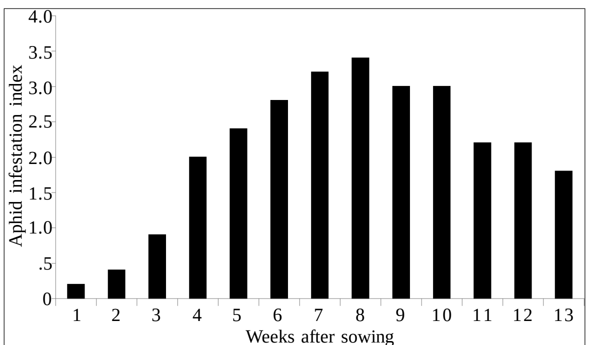

Fig. 1 : Population dynamics of aphid on cowpea during *Rabi* 2012

Table 1 : Population dynamics of aphid, jassid, whitefly, Ladybird beetle, *H. armigera* and *M. vitrata* on cowpea during *Rabi* 2012

SMW	Date	WAS	Aphid index	Mean population/leaf		Average No. of		
			Aphid	Jassid	Whitefly	Larvae of *H. armigera*/ plant	Larvae of *M. vitrata*/ plant	LBB/ plant
41	17-10-2012	1	0.2	0.2	0.6	0.0	0.0	0.0
42	24-10-2012	2	0.4	1.2	0.8	0.0	0.0	0.0
43	31-10-2012	3	0.9	1.4	1.4	0.0	0.0	0.5
44	07-11-2012	4	2.0	1.9	1.8	0.0	0.2	0.9
45	14-11-2012	5	2.4	2.1	2.8	1.8	1.0	1.6
46	21-11-2012	6	2.8	2.2	3.3	2.5	2.2	1.8
47	28-11-2012	7	3.2	2.5	3.7	2.5	2.4	1.4
48	05-12-2012	8	3.4	3.8	2.7	2.8	2.8	1.2
49	12-12-2012	9	3.0	3.2	2.1	2.1	2.4	0.9
50	19-12-2012	10	3.0	2.4	1.8	1.8	0.3	0.5
51	26-12-2012	11	2.2	2.2	1.9	1.6	0.0	0.6
52	03-01-2013	12	2.2	1.7	1.1	1.2	0.0	0.4
1	10-01-2013	13	1.8	1.6	0.6	1.2	0.0	0.0

SMW - Meteorological standard week; WAS - Weeks after sowing; LBB – Ladybird beetle

Their population reached to a peak level (1.8 beetles/plant) at 6th WAS *i.e.* 3rd week of November where aphids, whiteflies and jassids were present in large numbers. Thereafter, the population of ladybird beetle decreased gradually with the decrease in the sucking pest population and finally disappeared at the last stages of the crop.

Correlation co-efficient values worked out between insect pests of cowpea and weather parameters (Table 3) revealed that aphid population exhibited significant negative correlation with minimum temperature (r= -0.613), average temperature (r= -0.568) and highly significant negative correlation with evening relative humidity (r= -0.705). All the other factors had no significant correlation with aphid population on cowpea. Earlier, Prasad *et al*. (2008) stated that morning and evening

Table 2 : Correlation matrix of the relationship between weather parameters and population of major insect pests of cowpea

Sr. No.	Insect pests	Maximum temperature °C	Minimum temperature °C	Average temperature °C	Morning relative humidity	Evening relative humidity	Average relative humidity	Wind velocity (km/hr)	Sunshine hours
1.	Aphid	-0.457	*-0.613	*-0.568	-0.242	**-0.705	-0.487	0.065	0.238
2.	Whitefly	0.078	-0.202	-0.101	-0.360	**-0.726	*-0.569	0.071	*0.597
3.	Jassid	-0.253	-0.450	-0.386	-0.204	*-0.598	-0.412	-0.040	0.158
4.	*H. armigera*	-0.421	*-0.569	-0.527	-0.029	-0.533	-0.274	-0.217	0.362
5.	*M. vitrata*	0.019	-0.205	-0.125	-0.082	-0.479	-0.281	-0.244	0.254
6.	Ladybird beetle	0.145	-0.141	-0.036	-0.424	*-0.678	*-0.585	-0.128	*0.599

* and ** indicate significant of value at P=0.01 and 0.05 is (r = ± 0.6835) and (r = ± 0.5529) , respectively

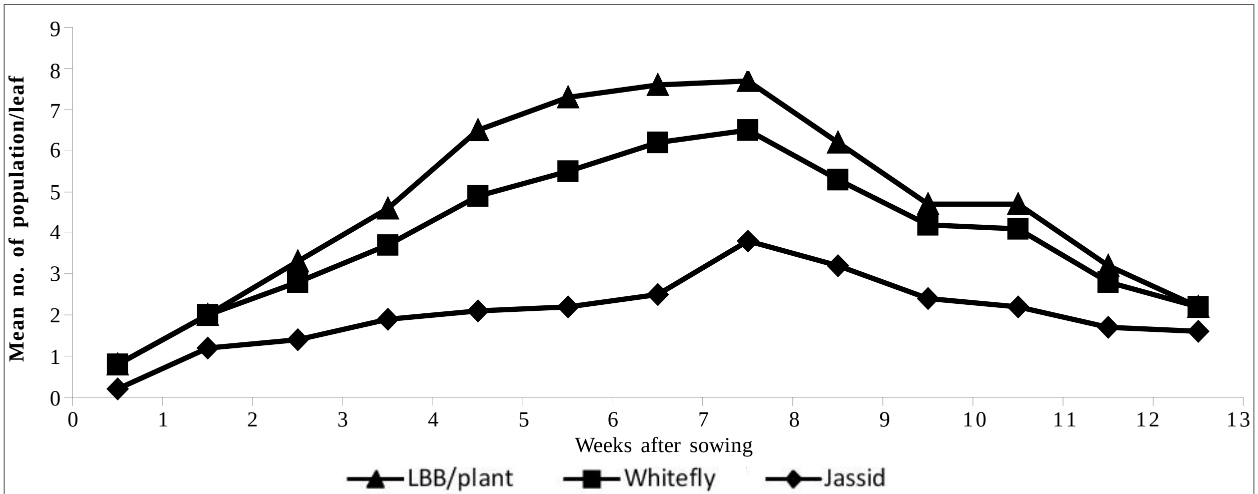

Fig. 2 : Population dynamics of jassid, whitefly and ladybird beetle on cowpea during *Rabi* 2012

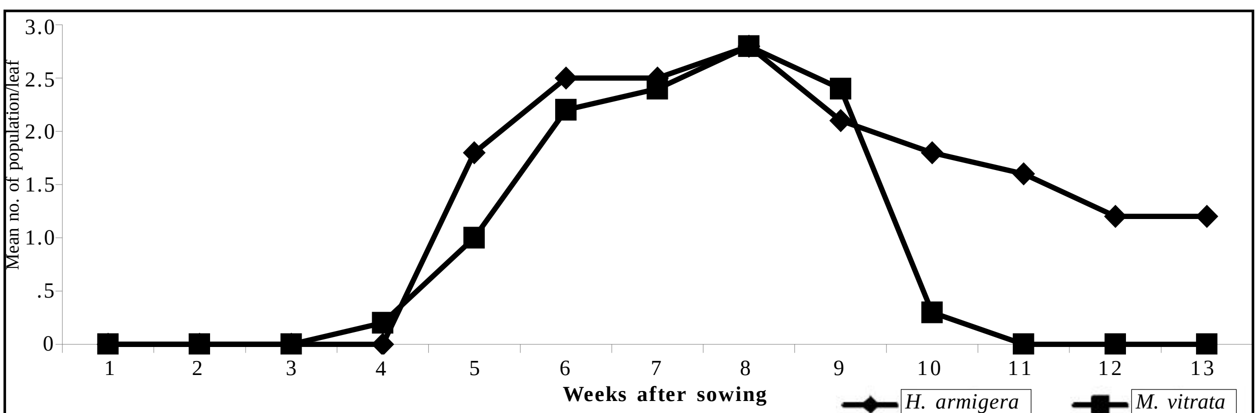

Fig. 3 : Population dynamics of pod borers *H. armigera* and *M. vitrata* during *Rabi* 2012

relative humidity were significantly positive, they also stated that minimum temperature showed significant negative correlation with aphid population. Jassid population showed significantly negative correlation with evening relative humidity (r = -0.598), other factors like maximum temperature, minimum temperature, average temperature, morning relative humidity, average relative humidity and wind velocity showed non- significant negative correlation while sunshine hours showed non-significant positive correlation. In past, Falerio *et al*. (1986) studied that the jassid population had no significant correlation with any environmental factors, except rainfall. The whitefly population showed highly significant negative correlation with evening relative humidity (r = -0.726) and significant negative correlation with average relative humidity (r = -0.569) and significant positive correlation with sunshine hours (r = 0.597). Other factors like minimum temperature, average temperature and morning relative humidity showed non-significant negative correlation. Maximum temperature and wind velocity showed non-significant positive correlation. Kumar *et al*. (2004) noticed that temperature and sunshine hours were favourable for whitefly population with a positive correlation in mungbean and urd bean which goes in line with the present investigation. *H. armigera* population showed a significantly negative correlation with the minimum temperature (r = -0.569) and the remaining factors like maximum temperature, average temperature, morning relative humidity, evening relative humidity, average relative humidity and wind velocity showed a non-significant negative correlation with *H. armigera* population whereas sunshine hours showed a non-significant positive correlation. Earlier, Kaneria (1994) studied the effect of weather parameters on population fluctuation of *H. armigera* in pigeonpea under Gujarat conditions and reported that the sunshine hours and maximum temperature showed significant positive correlation with the pest population, whereas minimum temperature and relative humidity exhibited a significant negative correlation. Patel (1997) reported that *H. armigera* exhibited negative correlation with relative humidity, while maximum temperature and sunshine hours showed significant positive correlation with pest population, whereas, the other factors did not show any correlation at Junagadh, Gujarat. According to Parmar *et al*. (2005), correlation studies on *H. armigera* in okra exhibited a positive correlation with maximum and mean temperatures while relative humidity had a negative correlation with pest population at Anand, Gujarat. None of the meteorological parameters had significant correlation with the occurrence of *M. vitrata* population. However, maximum temperature, sunshine hours showed non-significant positive correlation and all the other factors showed non-significant negative correlation. The population of ladybird beetles showed significant negative correlation with evening relative humidity (r = -0.678) and average relative humidity (r = -0.585) whereas it exhibited a significant positive correlation with sunshine hours (r = 0.599). All the other factors did not show any significant correlation with the beetle population. Suresh *et al.* (2012) also workes on the topic related to the present investigation.

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REFERENCES

Adipala, E., Omongo, C.A., Sabiti, A., Obuo, J.E., Edema, R., Bua, B., Atyang, A., Nsubuga, E.N. and Ogenga-latigo, M.W. (1999). Pests and diseases on cowpea in Uganda: Experiences from a diagnostic survey. *African Crop Sci. J.*, **7**(4) : 465-478.

Anonymous (2003-2004). Report. Directorate of Horticulture, Gujarat State, Gandhinagar.

Atwal, A.S. (1976). *Agricultural Pests of India and South East Asia*. Kalyani Publishers, Ludhiana, 207-272pp.

Augustine, S.N. (2011). Arthropod assemblage dynamics on cowpea (*Vigna unguiculata* L. Walp.) in a subtropical agro-ecosystem, south Africa. *African J. Agric. Res*., **6**(4) : 1009-1015.

El-Ghareeb, M., Nasser, M.A.K., El-Sayed, A.M.K. and Mohamed, G.A. (2002). Possible mechanisms of insecticide resistance in cowpea aphid, *Aphis craccivora* (Koch.)-The role of general esterase and oxidase enzymes in insecticide resistance of cowpea. *The First Conf. Central Agric. Pesticide Lab.*, **3-5**(2) : 635-649.

Faleiro, J.R., Singh, K.M. and Singh, R.N. (1986). Pest Complex and Succession of insect pests in cowpea, *Vigna unguiculata* (L.) Walp. *Indian J. Ent*., **48**(1) : 54-56.

Ganapathy, N. (2010). Spotted pod borer, *Maruca vitrata* Geyer in Legumes: Ecology and Management. *Madras Agric. J.*, **97**(7-9) : 199-211.

Kaneria, D.N. (1994). Pest complex of pigeonpea, its management through sowing dates and varieties, Chemical control of *Helicoverpa armigera* (Hubner) M.Sc. (Ag.) Thesis, Gujarat Agricultural University, Sardarkrushinagar (GUJARAT) INDIA.

Kotadia, V. S. and Bhalani, P. A. (1992). Residual toxicity of some insecticides against *Aphis craccivora* Koch on cowpea crop. *GAU Res. J.*, **17**(2) : 161-164.

Kumar, K., Rizvi, S.M.A. and Shamshad, A. (2004). Seasonal and varietal variation in the population of whitefly (*Bemisia tabaci*) and incidence of yellow vein mosaic virus in urd and mungbean. *Indian J. Ent*., **66**(2) : 155-158.

Pai, K.M. and Dhuri, A.V. (1991). Incidence of insect pest in early variety of cowpea [*Vigna unguiculata* (L.) Walp]. *Indian J. Ent*., **53**(2) : 329-331.

Parmar, K.D., Borad, P.K. and Rabari, D.H. (2005). Population fluctuation of *Helicoverpa armigera* (Hubner) Hardwick on okra crop in relation to weather parameters. *GAU Res. J.*, **30**(1-2) : 56-59.

Patel, A.G. (1997). Population dynamics, varietal screening and chemical control of pest complex of cowpea, *Vigna unguiculata* (L.) Walp. M.Sc. (Ag.) Thesis. College of Agriculture, Gujarat Agricultural University, Junagadh (GUJARAT) INDIA.

Patel, C.C. and Koshiya, D.J. (1999). Population dynamics of gram pod borer, *Helicoverpa armigera* (Hubner) Hardwick on Cotton, Pigeonpea and Chickpea. *GAU Res. J.*, **24**(2) : 62-67.

Patel, S.K., Patel, B.H., Korat, D.M. and Dabhi, M.R. (2010). Seasonal incidence of major insect pests of cowpea, *Vigna unguiculata* (Linn.) Walpers in relation to weather parameters. *Karnataka J. Agric. Sci*., **23**(3) : 497-499.

Prasad, T.V., Nandagopal, V. and Gedia, M.V. (2008). Effect of abiotic factors on the population dynamics of *Aphis craccivora* Koch in groundnut in Saurashtra region of Gujarat. *Indian J. Ent*., **70**(4) : 309-313.

Raheja, A.K. (1976). Assessment of losses caused by insect pests to cowpea caused by insect pests to cowpea in northern Nigeria. *PANS*, **22** : 229-233.

Shaonpius, M. and Charanjit, K.G. (2010). Influence of weather parameters on the incidence of cowpea golden mosaic virus and its vector, *Bemisia tabaci* (Gennadius). *Indian J. Ent*., **72**(1) : 79-83.

Sharama, H.C. (1998). Bionomics, host plant resistance and management of the legume pod borer, *Maruca vitrata* – a review. *Crop Prot*., **17**(5) : 373-386.

Singh, S.R. and Allen, D.J. (1980). Pests, diseases, resistance and protection in cowpea. Advances in Legume Science. Summerfield, R. J. and Bunting, H. H. (Eds.), pp.419-433. Royal Botanical Garden, Kew, Ministry of Agriculture, Fisheries and Food, London.

Singh, S.R. and Van Emden, H.F. (1979). Insect pests of grain legumes, *Ann. Review Ento*., **24** : 255-278.

Srikanth, J. and Lakkundi, N.H. (1990). Seasonal population fluctuations of cowpea aphid *Aphis craccivora* Koch and its predatory coccinellids. *Insect Sci. Applic.*, **11**(1) : 21-25.

Subhash, C. and Singh, V. (2013). Effect of different sowing dates on the incidence of *Helicoverpa armigera* on chickpea. *Green Fmg*., **4**(1) : 125-126.

Suresh, B.C., Khader Khan, H. and Prasanna, P.M. (2012). Efficacy of different entomopathogenic fungi against cowpea aphid, *Aphis craccivora* Koch under laboratory and field condition. *Internat. J. Pl. Prote*c., **5**(1) : 68-71.