SUCCESSION OF MAJOR PESTS OF COWPEA AND ITS RELATION WITH WEATHER PARAMETERS

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ABSTRACT

In order to study the succession and impact of weather parameters on major pests of cowpea, a field experiment was conducted under field condition at College Farm, Navsari Agricultural University, Navsari during summer 2016. The incidence of aphid, jassid, whitefly and thrips were recorded in the range of 0.2 to 3.06 aphid index, 0.7 to 2.15 jassid/leaf, 0.40 to 2.32 whitefly/leaf and 0.6 to 2.03 thrips/twig, respectively. Aphid, jassid and whitefly population reached to a peak 3.06 aphid index, 2.15 jassid/leaf and 2.32 whitefly/leaf, respectively during 4th week of March, while thrips population reached to a peak (2.03 thrips/twig) during 3rd week of April. The pod borer larval population was in the range of 0.40 to 2.04 pod borer larvae/plant and reached to peak (2.04 pod borer larvae/plant) during 17 SMW (9th week after sowing). The infestation of pod borers to flower was noticed in the range of 20.13 to 29.13 per cent. The flower damage by pod borer was highest (29.32 %) during 3rd week of April (16 SMW). The correlation study revealed that aphid population had significant negative correlation with MinT (-0.557*), EvRH (-0.612*), WS (-0.595*) and BSS (-0.591*). The population of jassid and whitefly was significantly and positively correlated with MaxT (0.657** and 0.597*, respectively). The thrips population had significant and positive correlation with MinT (0.591*), MeT (0.590*), BSS (0.844**) and Evapo (0.668**). The larval pod borer population was significantly and positively correlated with MinT (0.562*), MeT (0.554*), BSS (0.861**) and Evapo (0.675**). None of the weather parameters had its influence on flower damage due to pod borer, as the results were non-significant.

KEY WORDS: Aphid, Correlation, Jassid, Pod borer, Thrips, Weather parameters, Whitefly

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) is originated in the savannah region of west and central Africa. In India, it is a mainly grown as a sole crop throughout the year in *kharif, rabi* as well in summer season. Area under cowpea in India is 3.9 million hectares with a production of 2.21 million tonnes with the national productivity of 683 kg/ha (Rajasingh and Lourduraj, 2014). In Gujarat cowpea occupies about 30740 ha. area with the production of 322084 MT (Anonymous, 2015).

Among the different constraints responsible for low or yield and poor quality of grains, the losses due to insect pests is considered to be an important one. As many as 21 insect pests of different groups were reported on cowpea during summer and *kharif* season (Sardana and Verma, 1986). Insect pests attacking cowpea are aphid, jassid, whitefly, thrips, leaf miner, spotted

pod borer, pod borer, semilooper and tobacco leaf eating caterpillar. The basic information on seasonal incidence in relation to impact of weather factors is necessary for deciding IPM strategy for any insect pests. Available literature revealed that very little work has been done on this aspect hence, a field experiment was planned.

MATERIALS AND METHODS

In order to study the succession of major pests of cowpea and its relation with weather parameters, a field experiment was conducted at College Farm, Navsari Agricultural University, Navsari during summer 2016. The cowpea variety GC-4 was sown during 3rd week of February in 20 m x 10 m plot size at 45 cm x 20 cm spacing and all the recommended agricultural practices were adopted for raising the crop.

For recording observations, the whole plot was divided into five sectors and five plants were randomly selected from each sector. The observations on aphid was recorded based on infestation level on plant according to visual as well as inspection count and categorized in to grade as 0, 1, 2, 3 and 4 (Table 1). The average aphid index was worked out based on following formula:

$$\text{Average aphid index/plant} = \frac{0N + 1N + 2N + 3N + 4N}{\text{Total number of plants observed}}$$

Where,

N = Number of plants showing respective aphid index

Jassid and whitefly population was recorded from the three leaves (top, middle and bottom) from same selected five plants from each sector. For recording observations on thrips population, three flower twigs were randomly selected and population of thrips was counted from the same selected five plants from each sector. Population of pod borer (*M. vitrata*) was recorded by examining the same selected five plants from each sector and the larval population was counted from whole plant. For recording observations on flower damage by pod borer, healthy and damaged flowers as well as pods were counted from same selected five plants from each sector. The observations were recorded at weekly interval starting from one week after sowing and continued till the harvest of crop. The whole experiment plot was kept free from any insecticide application.

For determine the impact of weather parameters on insect pests, the periodic mean incidence of the major insect pests were worked out. The data on sucking pest (aphid, jassid, whitefly and thrips) as well as pod borer (larval population and flower damage) was further correlated with different weather parameters [Maximum Temperature (MaxT), Minimum Temperature (MinT), Mean Temperature (MeT), Morning Relative Humidity (MoRH), Evening Relative Humidity (EvRH), Mean Relative Humidity (MeRH), Wind Speed (WS), Bright Sunshine Hours (BSS) and Evaporation (Evapo)] recorded at Department of Meteorology. N. M. College of Agriculture, Navsari Agricultural University, Navsari by following standard statistical procedure (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Population dynamics

The data on population of major pests are presented in Table 2 and also depicted Figure 1.

The data on aphid population revealed that the incidence of aphid was

started at 1st week after sowing during 4th week of February (9 SMW) and in the range of 0.2 to 3.06 aphid index. The aphid population reached to a peak 3.06 aphid index during 13 SMW. The jassid population was imitated at 1st week after sowing during 2nd week of March (11 SMW) and was in the range of 0.7 to 2.15 jassid/leaf. The jassid population reached to the highest peak (2.15 jassid/leaf) during 4th week of March (13 SMW). The population declined slightly (1.02 and 0.7 jassid/leaf) during two next week. Thereafter, the population disappeared till to the removal of crop. The incidence of whitefly was started at 1st week after sowing during 2nd week of March (11 SMW) and it was in the range of 0.40 to 2.32 whitefly/leaf. The whitefly population was recorded in ascending order during 2nd to 4th week of March and recorded to a peak during 4th week of March (2.32 whitefly/leaf). The population declined during 1st and 2nd week of April. The population then after disappeared till to the removal of crop. The data on thrips population revealed that the thrips incidence was noted during the later stage of crop for a short period during April. The population found in the range of 0.6 to 2.03 thrips/twig during 1st week of April (14 SMW) to 4th week of April (17 SMW). The population reached to a peak (2.03 thrips/twig) during 3rd week of April (16 SMW) and declined during next week (4th week of April) and escaped from the field in May.

The pod borer larval population was noticed at 6th week after sowing during 1st week of April (14 SMW) and remained in the field up to 4th week of April (17 SMW) in the range of 0.40 to 2.04 pod borer larvae/plant. The pod borer population was gradually increased during 1st week of April to 4th week of April and reached to peak (2.04 pod borer larvae/plant) during 17 SMW. Then after, the larval population of pod borer was disappeared from the field. The data on per cent flower damage by pod borer revealed that the infestation of pod borer to flower was noticed during 2nd week of April (15SMW) to 4th week of April (17 SMW) in the range of 20.13 to 29.13 per cent. The flower damage by pod borer was highest (29.32 %) during 3rd week of April (16 SMW).

Thus, in the present investigations, the sucking pests aphid, jassid and whitefly were more active during March and April month. Thrips population and larvae of pod borer was recorded from flowering stage during month of April. The succession of major pests infecting cowpea indicated that the population of aphid, jassid and whitefly at early growth stage, whereas, after flower formation, the infestation of thrips and pod borer initiated and remained up to maturity of crop.

Study on population dynamics of pests infesting cowpea ware made by many research workers. Sardana and Verma (1986) noted that aphid population was high during early growth stage. Similarly, Srikanth and Lakkundi (1990) and Patel (2000) also reported the incidence of aphid population at early growth stage. Shukla *et al.* (2009) reported that peak incidence of aphid during 4th WAS and higher activity during 6th WAS. Patel *et al.* (2010) stated that the peak activity of aphid was recorded during 3rd week of March. Thus, above finding are more or less in accordance with present investigations. Vaghasiya (1989) noticed the activity of jassid during 3rd week of March. Shukla *et al.* (2009) reported that peak incidence of jassid during 7th WAS. Patel *et al.* (2010) also reported the higher activity of jassid during 4th week of March. These reports are also talley with the result of present investigations. Shukla *et al.* (2009) reported that the higher activity of thrips was observed between 7th and 9th WAS. This report is also perfectly match with the result of present investigation. The

results on pod borer could not be compared with the research work done at elsewhere as, the experiment was conducted during summer season and most of the researchers have studied the activity of pod borer on cowpea during *kharif* season.

Correlation study

The results of correlation between major pests of cowpea and weather parameters are presented in Table 3.

The results on correlation between aphid population and different weather parameters revealed that out of 9 weather parameters, the population of aphid had significant negative correlation with MinT, EvRH, WS and BSS with correlation coefficient (r) value of -0.557*, -0.612*, -0.595* and -0.591*, respectively. It indicated that as MinT, EvRH, WS and BSS increased, the aphid population also decreased or *vice a versa*. The aphid population had negative correlation with MeT and MeRH as well as Evapo and positive correlation with MaxT as well as MoRH, but the result were found non-significant. The population of jassid was significantly and positively correlated with MaxT with correlation coefficient (r) value of 0.657**. The population had also negative correlation with MinT, EvRH, MeRH, WS and BSS, but the results were non-significant. Similarly, jassid population had positive correlation with MeT, MoRH and Evapo, but the result was found non-significant. The whitefly population significantly and positively correlated with MaxT with correlation coefficient (r) value of 0.597*. The other weather parameters, *viz*., MinT, EvRH, MeRH, WS, BSS and Evapo was negatively correlated, whereas MeT and MoRH were positively correlated with whitefly population, but the result were found non-significant. The thrips population had significant positive correlation with MinT, MeT, BSS and Evapo with correlation coefficient (r) value of 0.591*, 0.590*, 0.844** and 0.668**, respectively. The thrips population negatively correlated with MoRH, whereas positively correlated with MaxT, EvRH, MeRH and WS, but the results were non-significant.

The pod borer population (Column 6) was significantly positively correlated with MinT, MeT, BSS and Evapo with correlation coefficient (r) value of 0.562*, 0.554*, 0.861** and 0.675**, respectively. The pod borer population had negative correlation with MoRH and positively correlation with MaxT, EvRH, MeRH and WS, but the results were found non-significant. The data on correlation between flower damage due to pod borer and weather parameters revealed that none of the weather parameters showed its influence on flower damage due to pod borer, as the results were non-significant.

Over all, it can be concluded that aphid population negatively correlated with Minimum Temperature, Evening Relative Humidity, Wind Speed and Bright Sun Shine Hours. Jassid and whitefly population showed positive correlation with Maximum Temperature. Thrips population positively correlated with Minimum Temperature, Mean Temperature, Bright Sun Shine Hours and Evaporation. Pod borer was positively correlated with Minimum Temperature, Mean Temperature, Bright Sun Shine Hours and Evaporation.

Sardana and Verma (1986) reported the negative correlation of aphid with Wind Speed and Bright Sun Shine Hours. Prasad *et al.* (2008) observed positive correlation of aphid with Morning Relative Humidity and negative correlation with Minimum Temperature. Gauns *et al.* (2014) reported negative correlation of aphid with Minimum and Evening Relative Humidity as well as positive correlation with Maximum Temperature. According to Yadav *et al.* (2015), most of the pests infesting cowpea was negatively correlated with Evening

Relative Humidity. Thus, above reports for correlation of aphid with weather parameters are talley with the results of present finding. According to Faleiro *et al.* (1990), jassid population was negatively correlated with Relative Humidity and Bright Sun Shine Hours, whereas it was positively correlated with Temperature and Wind Speed. Similarly Gauns *et al.* (2014) also observed the negative correlation of jassid with Maximum Temperature. These two reports are talley with the results of present investigation. Faleiro *et al*. (1990) observed that thrips and whitefly population was negatively correlated with Relative Humidity and Bright Sun Shine Hours, whereas it was positively correlated with Temperature and Wind Speed. Duraimurugan and Jagadish (2002) also reported the positive correlation of thrips with Minimum, Maximum Temperature and Sunshine Hours, but negative correlation with the Mean Relative Humidity. Kumar *et al.* (2004) noticed the positive correlation of whitefly and Temperature. Singh *et al.* (2012) reported that Minimum Temperature and Relative Humidity favored to build up population of thrips. Thus, above reports strongly supported the results of present findings. They also reported that Maximum Temperature and Minimum Temperature favoured the incidence of pod borer on cowpea.

CONCLUSION

The incidence of aphid (3.06 aphid index), jassid (2.15 jassid/leaf) and whitefly (2.32 whitefly/leaf) reached to the highest peak (2.15 jassid/leaf) during 4th week of March (13 SMW), whereas thrips (2.03 thrips/twig) reached to a peak during 3rd week of April (16 SMW). The pod borer larval population reached to peak (2.04 pod borer larvae/plant) during 17 SMW. The infestation of pod borers to flower was in the range of 20.13 to 29.13 per cent. Aphid population negatively correlated with Minimum Temperature, Evening Relative Humidity, Wind Speed and Bright Sun Shine Hours. Jassid and whitefly population showed positive correlation with Maximum Temperature. Thrips population positively correlated with Minimum Temperature, Mean Temperature, Bright Sun Shine Hours and Evaporation. Larvae of pod borer positively correlated with Minimum Temperature, Mean Temperature, Bright Sun Shine Hours and Evaporation.

REFERENCES

Anonymous (2015). A report, published by Directorate of Economics and Statistics, Government of Gujarat, Gandhinagar. Horticulture, Gujarat, pp-41.

Duraimurugan, P. and Jagadish, A. (2002). Seasonal incidence and effect of weather parameters on the population dynamics of chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on rose. Proceeding: Resources Management in Plant Protection during twenty first-century, Hyderabad, India, 14-15 November, 2002, Volume-II, pp. 180-183.

Faleiro, J. R.; Singh, K. M. and Singh, R. N. (1990). Influence of abiotic factors on the population build up of important insect pests of cowpea *Vigna unguiculata* (L.) Walp. and their biotic agents recorded at Delhi. *Indian J. Ent*., **52**(4): 675- 650.

Gauns, K. H.; Tambe, A. B.; Gaikwad, S. M. and Gade, R. S. (2014). Seasonal abundance of insect pests against forage cowpea. *Trends Biosci.*, **7**(12):1200-1204.

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.

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.) Walp. in relation to weather parameters. *Karnataka J. Agri. Sci.*, **23**(3): 497-499.

Patel, U. G. (2000). Biology of *Maruca vitrata* (Geyer), population dynamics, varietal screening and chemical control of insect pest complex of cowpea. Ph. D. Thesis (Unpublished) Submitted to Gujarat Agricultural University, Sardarkrushinagar (Gujarat).

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.

Sardana, H. R. and Verma, S. (1986). Preliminary studies on the prevalence of insect pests and their natural enemies on cowpea crop in relation to weather factors at Delhi. *Ind. J. Ent.,* **48**(4): 448-458.

Shukla, N. P.; Patel, G. M. and Patel, P. S. (2009). Succession of important insect pests and natural enemies in cowpea. *Curr. Biotica*, **3**(1): 52-58.

Singh, A. K.; Santosh, K.; Pankaj, K. and Maurya, M. L. (2012). Population dynamics of flowers feeders and pod borers on owpea and their correlation with the meteorological parameters, *J. Pl. Prot. Envnt.*, **9**(2): 49-52.

Rajasingh, R. S. and Lourduraj, A. C. (2014). Growth and yield of cowpea as influenced by integrated nutrient management practices in preceding maize. *Adv. Res. J. Crop Improv.*, **5**(1): 29-33.

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

Steel, R. G. D. and Torrie, J. H. (1980). Principles and Procedures of Statistics.Publ.McGraw-Hill Book Company, New York.

Vaghasiya, U. R. (1989). Seasonal incidence of major insect pests on different varieties on cowpea (Vigna unguiculata) and their chemical control. M. Sc. (Agri.) Thesis (Unpublished) Submitted to Gujarat Agricultural University, Sardarkrushinagar (Gujarat).

Yadav, K. S.; Pandya, H. V.; Patel, S. M., Patel, S. D. and Saiyad, M. M. (2015). Population dynamics of major insect pests of cowpea [*Vigna ungiculata* (L.)Walp.]. *Int. J. Pl. Prot.* **8**:112-117.

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 aphids 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 sever damage symptoms seen and plant withered

Table 2: Population of major insect pests infesting cowpea during summer 2016

Month & Weeks	Meteorological Standard Week	Week After Sowing	Population of Insect Pests					
			Aphid (Index)	Jassid / Leaf	Whitefly Leaf	Thrips / Twigs	Pod Borer / Plant	Flower Damage (%)
February	IV	9	1	0.20	0	0	0	0
March	I	10	2	0.92	0	0	0	0
	II	11	3	1.24	0.80	0.52	0	0
	III	12	4	2.04	1.32	1.82	0	0
	IV	13	5	3.06	2.15	2.32	0	0
April	I	14	6	0.40	1.02	1.92	0.60	0.40
	II	15	7	0	0.70	0.40	1.10	1.30
	III	16	8	0	0	0	2.03	1.48
	IV	17	9	0	0	0	1.88	2.04
May	I	18	10	0	0	0	0	0

Table 3: Relationship between weather parameters and major insect pests of cowpea

Weather Parameters	Correlation Co-efficient (r)					
	Aphid (Index)	Jassid	Whitefly	Thrips	Pod Borer Larval Population	Flower Damage (%)
Max. Temperature (^{0}C) (MaxT)	0.428	0.657**	0.597*	0.220	0.195	0.446
Min. Temperature (^{0}C) (MinT)	-0.557*	-0.304	-0.229	0.591*	0.562*	0.385
Mean Temperature (^{0}C) (MeT)	-0.243	0.075	0.108	0.590*	0.554*	0.544
Morning RH (%) (MoRH)	0.268	0.267	0.306	-0.458	-0.510	0.013
Evening RH (%) (EvRH)	-0.612*	-0.529	-0.498	0.345	0.317	0.048
Mean RH (%) (MeRH)	-0.486	-0.407	-0.365	0.171	0.127	0.049
Wind Speed (Km/h) (WS)	-0.595*	-0.519	-0.498	0.462	0.466	0.071
Bright Sunshine hr (hr/day) (BSS)	-0.591*	-0.508	-0.517	0.844**	0.861**	0.265
Evaporation (mm/day) (Evapo)	-0.262	0.007	-0.031	0.668**	0.675**	0.500

***Significant at 1 per cent level (r= 0.62972)* **Significant at 5 per cent level (r= 0.55240)*

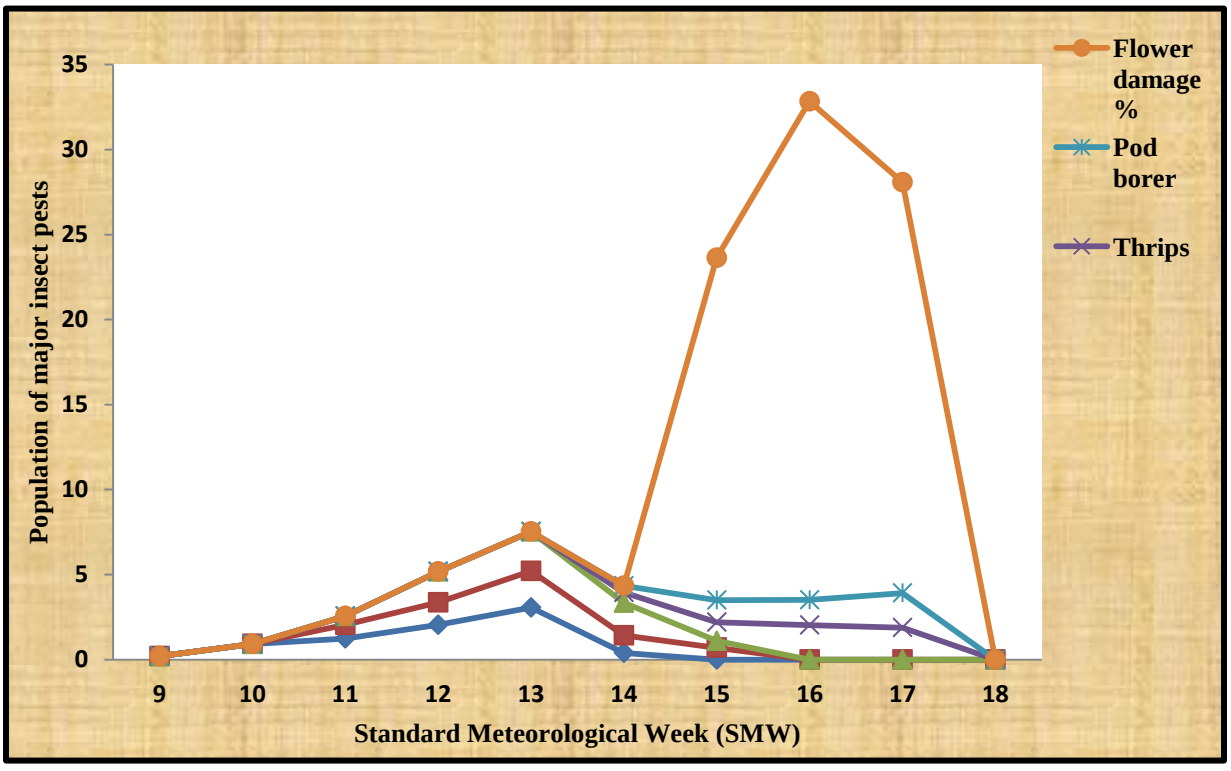

Figure 1: Population of major pests of cowpea

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