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Seasonal incidence of major sucking pests infesting cowpea and their relation to weather parameters

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ABSTRACT

Investigations were carried out on seasonal incidence of major sucking pests that attack the cowpea at College Farm, Junagadh Agricultural University, Junagadh during summer 2016. The result revealed that jassid population initiated from the second week of March with 0.48 nymph/ 3 leaves/ plant and reached a peak (4.91 nymphs/ 3 leaves/ plant) in first week of May. The population of whitefly and aphid also appeared from the second week of March and reached to a peak of 4.99 whiteflies/ 3 leaves/ plant and 3.82 aphid index / plant during the fifth week of April, respectively. Among the various weather parameters, maximum temperature showed a significant positive correlation with jassid, whitefly and aphid population in summer cowpea. Whereas, wind speed showed negative influence and bright sunshine hours exhibited positive influence on population of all sucking pests in cowpea crop.

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INTRODUCTION

Pulses have been recognized as a major source of dietary proteins for majority of the population in India and also in the world. Pulse crop also helps in the restoration of soil fertility by fixing the atmospheric nitrogen in to soil through symbiotic nitrogen fixation with the help of bacterium called Rhizobia. Thus, every pulse plant is a mini fertilizer factory itself. Cowpea [*Vigna unguiculata* (L.)] is one of the most important principle pulse crop of tropics and commonly known as crowdel pea, *Chala, Chola or Choli, Chavli, Lobia,* southern pea and black eyed bean. Importance of this crop lies in its versatility being a fodder, a vegetable, a grain legume, green manure crop as well as most versatile *Kharif* pulse crop because of its draught tolerant characters, soil restoring properties and multipurpose use. It is consumed as green seeds, green pods and dry grains. Cowpea plays an important role in human nutrition in a predominantly vegetarian country like India because it is considered as vegetable meat due to high amount of proteins. Cowpea grain contains about 60 per cent carbohydrates, 22 to 28 per cent proteins and 11.8 per cent fat. Moreover, it is a rich source of calcium and iron (Sharma and Franzmann, 2000).

Cowpea originated in the Savannah region of west and central Africa (Colby and Steele, 1976). In India it is mainly grown as sole crop both in *Kharif* as well as summer season. It is also frequently grown either as inter or mixed crop along with cereals like sorghum, maize, millet or sometimes with cotton. It is mainly grown in the States of Gujarat, West Bengal, Tamil Nadu, Andhra pradesh, Kerala, Uttar Pradesh, Haryana, Delhi and Punjab. In India, cowpea is cultivated in about 1.5 million hectare with an annual production of 0.5 million tones and average productivity 608 kg/ha (Swaminathan, 2007). In Gujarat, cowpea (grain legume) is cultivated in about 30470 ha area with an annual production of 322084 tones and average productivity of 845 kg/ha whereas, vegetable purpose cowpea occupies an area of 760 ha with an annual production of 6460 mt/ha average productivity of 8.50 mt/ha (Anonymous, 2014).

As many as 21 insect pests of different groups were observed on cowpea during summer and *Kharif* season. Among this, only few of them are considered to be major pest of cowpea. Sucking pests like aphid, *Aphis craccivora*, jassid, *Empoasca kerri* and whitefly, *Bemisia tabaci* are important limiting profitable cultivation of cowpea not only by direct sap sucking but also by virus transmission. Cowpea aphid, *A. craccivora* causes significant yield losses of 20-40 per cent in Asia and upto 35 per cent in Africa. The nymphs and adults suck the cell sap from host plant. The damage to the crop 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 significant reduction in yield. Yield reduction upto 39 per cent due to jassid infection in cowpea has been reported by Singh and Van Emden in 1976. The symptoms of damage are characteristic yellow discoloration of leaf edges, followed by cupping of leaves mostly downwards at their edges. Whitefly, *B. tabaci* is also of considerable important because not only it feeds on leaves but also transmits the yellow vein mosaic virus in cowpea. Direct feeding damage is caused by sucking the sap from the foliage of plants. This feeding causes weakening and early wilting of the plant and reduces the plant growth rate and yield. It also causes leaf chlorosis, leaf withering, premature dropping of leaves and plants death.

Correlation of pest population with different weather parameter provide a valuable information on the basis of such data a predictive model can be developed which can be used for forecasting of the pest population buildup and ultimately farmers can plan for plant protection strategies. The study of seasonal incidence will be useful to generate the information on the population buildup of sucking pests in cowpea crop.

MATERIAL AND METHODS

In order to study the seasonal incidence of major sucking pests of cowpea, the experiment was laid out at College Farm, Junagadh Agricultural University, Junagadh during summer 2016. Cowpea variety, AVC-1 was grown in a plot size of 20.0 × 20.0 m at the spacing of 45×15 cm. All other agronomical practices were followed as per the scientific recommendations. The crop under the experiment was kept free from the insecticides throughout the season. Ten quadrates, 1.0 × 1.0 m was made in crop area from which 5 plants were randomly selected and tagged. Population of sucking pests was recorded from the tagged five plants at weekly interval from appearances of the pests till harvest. The population of jassid and whitefly were recorded early in the morning at weekly interval. Three leaves from top, bottom and lower portion of each plant was observed for the presence of nymphs and adults of jassids and whiteflies. Population of aphid was recorded through aphid 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. Mean pest population was worked out the data was correlated with weather parameter.

Aphid index:

0= No aphid (Nil)

1= One or two aphids observed on plant but no colony formation

2= Small colonies of aphids observed with countable numbers on plant but no damage symptoms seen

3= Big colonies of aphids observed on plant and aphid can be counted and damage symptoms seen

4 = Big colonies of aphids observed on plant and aphid could not be counted and sever damage symptoms seen and plant twisted.

RESULTS AND DISCUSSION

Data presented in Table 1 showed that the jassid population initiated from the 1st weak after sowing (WAS) *i.e.* the second week of March with 0.48 nymph/ 3 leaves/ plant. Jassid population was found to occur throughout the crop period.The population of the pest increased from the 1st to 9th WAS and reached the peak population (4.91 nymphs/ 3 leaves/ plant) in the 9th WAS that is first week of May. Thereafter, jassid population decreased gradually but was active throughout the crop period. These are in agreement Yadav *et al*. (2015) who stated that jassid population started from 3rd week of March, reached a peak of 3.64 aphid index/plant by 2nd week of May and almost a similar trend was also observed by Faleiro and Singh (1990) who noticed population of jassids from 19 days after sowing of the crop and reached a peak at 61 days after sowing.

The population of whitefly (1.86 whiteflies/ 3 leaves/ plant) appeared from the 1st WAS *i.e.* the second week of March and remained active throughout the crop period. The pest population increased gradually and reached to a peak level of 4.99 whiteflies/ 3 leaves/ plant during the 8th WAS that is fifth week of April. Later on, it was found to decline continuously and reached 1.54 whiteflies/ 3 leaves/ plant at the time of harvest. More or less similar results were obtained by Borah (1995) who revealed that whitefly appeared in the first week after germination and then continuously built up throughout the crop growth period. The peak population (8.7 whiteflies/ 5 plants) was observed during the 4th week of April on summer green gram. Pithava (1996) reported that whitefly appeared after fourth week of sowing of mungbean crop and remained active throughout the crop season. The pest showed two peaks of its population, 5.78 and 5.30 whitefly/leaf during sixth and tenth week of sowing, respectively. It was also found to be in relation to the findings of Yadav *et al*. (2015) reported that 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.

The data presented in Table 1 indicated that the aphid population started from 1st WAS that is 2nd week of march with 0.48 aphid index/plant and population increased continuously upto the 9th WAS that is fifth week of April with a peak level of 3.82 aphid index/plant, coinciding with peak stage of pod formation. The population declined gradually during successive weeks and reached 1.86 aphid index / plant at the time of harvest. More or less similar results were obtained by Srikanth and Lakkundi (1990) who stated that population of *A. craccivora* on cowpea increased rapidly with growth

Table 1: Seasonal incidence of sucking pests on cowpea during summer 2016

Date of observation	Week after sowing (WAS)	Standard week	Mean No. of jassid nymphs/ 3 leaves/ plant	Mean No. of whitefly nymphs/ 3 leaves/ plant	Aphids index /plant
12/03/2016	1	11	0.48	1.86	0.48
19/03/2016	2	12	0.91	2.19	0.88
26/03/2016	3	13	1.53	2.68	1.67
02/04/2016	4	14	2.07	2.83	1.73
09/04/2016	5	15	3.64	3.76	2.07
16/04//2016	6	16	4.06	4.28	2.05
23/04/2016	7	17	4.43	4.73	2.98
30/04/2016	8	18	4.78	4.99	3.82
07/05/2016	9	19	4.91	3.68	3.76
14/05/2016	10	20	3.07	2.81	3.64
21/05/2016	11	21	2.36	1.97	3.28
28/05/2016	12	22	1.97	1.54	1.86

Table 2: Correlation between weather parameters and population of sucking pests on cowpea during summer 2016

Insect pest	Temperature (C°)			Relative humidity (%)			Wind speed (km/hr)	Mean bright sunshine hour
	Max.	Min.	Mean	Morning	Evening	Mean		
Jassid	0.689*	0.152	0.564	-0.511	-0.344	-0.424	-0.272	0.196
Whitefly	0.613*	0.265	0.412	-0.769	-0.708	-0.753	-0.054	0.303
Aphids	0.632*	-0.336	0.313	0.019	0.040	0.013	-0.500	0.292

*Significant at 5 per cent level (r = 0.576), **Significant at 1 per cent level (r = 0.707) and their peak coincide with peak pod formation.

The correlation matrix (Table 2) indicated that the population of jassids exhibited significant positive correlation with maximum temperature (r =0.689) and positive correlation with minimum temperature (r= 0.152), mean temperature(r=0.564) and mean bright sunshine hours (r= 0.196). While, negative correlation with morning relative humidity (r= -0.511), evening relative humidity(r= -0.344), mean relative humidity (r= -0.424) and wind speed (r = -0.272) was observed during the summer season of 2016. These findings are in close agreement with the work carried out by Yadav and Singh (2006) who stated that population of jassid was adversely affected by high humidity to a significant level but it was markedly increased by maximum and minimum temperatures, whereas rainfall was found to be detrimental for its multiplication.

Population of whitefly exhibited significant positive correlation with maximum temperature (r= 0.613) and positive correlation with minimum temperature (r = 0.265), mean temperature (r= 0.412) and mean bright sunshine hours (r=0.303).Whereas, significant negative correlation with morning relative humidity (r= -0.769), evening relative humidity (r= -0.708), mean relative humidity (r= -0.753) and negative correlation with wind speed (r= -0.054) was observed during the summer season of 2016. These have already been studied and confirmed by Kumar *et al.* (2004) who reported that that temperature and sunshine hours were favourable for whitefly population and have positive correlation, while minimum and maximum relative humidity have significant and non-significant negative correlation, respectively. Mani and Krishnamoorthy (2007) reported that the whitefly population was positively correlated with maximum temperature and negatively correlated with relative humidity.

The results indicated that the population of aphids exhibited significant positive correlation with maximum temperature (r = 0.632). While, positive non-significant correlation exhibited between pest population, sunshine hours (r = 0.292), mean temperature (r = 0.313), morning relative humidity (r = 0.019), evening relative humidity (r = 0.040) and mean relative humidity (r = 0.013). Whereas, correlation between aphids population, minimum temperature (r=-0.336) and wind speed (r= -0.500) was negatively non-significant.

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