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SEASONAL INCIDENCE OF MAJOR SAP–SUCKING PESTS OF COTTON

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ABSTRACT

A study was conducted to investigate the major sap–sucking insect pests of cotton, which revealed that cotton jassids (*Amrasca biguttula biguttula* Ishida.), aphids (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Genn.), red cotton bug *(Dysdercus koenigii* Fabricius), dusky cotton bug (*Oxycarenus laetus* Kirby) and thrips (*Thrips tabaci* Linnman) were the dominant. The peak infestation of thrips (33.8 thrips/plant) was noted during second week of August, while maximum jassid (21.87 jassids/plant) and whitefly (20.33 whiteflies/plant) were recorded during fourth week of August. Aphid was recorded (36.27 aphids/plant) during last week of August, 2012. The peak population levels for red cotton bug (15.33 red cotton bug /plant) and dusky cotton bug (14.27 dusky cotton bug/plant) were observed during last week of October and first week of November 2012, respectively. The population of jassid and whitefly showed significant positive correlation with mean RH whereas, the population of red cotton bug and dusky cotton bug showed significant negative correlation with mean RH and temperature, respectively.

Key words: Sap sucking insects, seasonal incidence, correlation

INTRODUCTION

Cotton (*Gossypium hirsutum*) the 'White Gold', is one of the most important commercial/cash crops playing a key role in Indian agriculture and economics. It is cultivated in varied agro–climatic conditions across nine major states of India covering 12.20 m ha area with the production and productivity of 37.10 m bales and 484 kg per hectare, respectively. In Rajasthan, this crop occupies an area of 5.30 lakh hectares with production of 17.10 lakh bales and productivity of 548 kg per hectare, respectively (Annual Report of CAB, 2011–12).

The crop is infested by about 1326 insect pests all over the world (Hargreaves, 1948; Santham, 1997); however, only 166 of them are reported to damage the crop in India. Of these, 12 species are recorded as major pests of cotton due to their recurrent occurrence almost every year in serious proportions in one or other agro–climatic zone. Among the sap–sucking insect pests, jassids, *A. biguttula biguttula* (Ishida); thrips, *Thrips tabaci* (Linn.); aphid, *Aphis gossypii* (Glover) and whiteflies, *Bemisia tabaci* (Genn.) to the are important from seedling stage and cause heavy losses tune of 21.20 to 22.86 per cent (Kulkarani *et al*., 2003 and Satpute *et al*., 1990). These pests are also vectors for a number of viral diseases (Sreedhar *et al*., 1999). The yield loss in *Gossypium hirsutum* cotton due to sucking pests, bollworms and both has been recorded up to 8.45, 16.55 and 17.35 quintal ha^{-1}, respectively; whereas, out of 14 per cent losses recorded in total agriculture due to insect pests, of which 84 per cent is in cotton (Oerke *et al.,* 1994).

MATERIALS AND METHODS

The proposed investigation on seasonal incidence of insect pests of cotton was conducted during *kharif* 2012. Cotton variety GH–8 was sown at the Instructional Farm of Rajasthan College of Agriculture, Udaipur, Rajasthan. The experiment was laid out in uniformly sized plots measuring 4.5m × 4.5m replicated three times. Variety GH–8 (Gujarat Hybrid) grown under natural conditions, without insecticidal application for pest control was maintained at row to row and plant to plant spacing of 90cm × 90cm, respectively. Five plants per plot were selected randomly and tagged for recording the insect pests and natural enemies. Following observations were also noted:

a) First appearance of insect pests
b) Peak period of influence
c) Lowest period of incidence

Observations

Population of jassids, thrips, white flies and aphids were recorded after 7 days of germination at weekly interval from 5 tagged plants selected at random during morning hours between 6:30 a.m. to 8:00 a.m., when most of the insect species remain less active. Red cotton bug and dusky cotton bug were observed later after square formation and during boll development stages.

A. Sampling techniques

(i) Jassids, Thrips and Whiteflies: The population of jassids, thrips and whiteflies were recorded on three leaves, selecting one each from the basal, middle and upper portion of the 5 tagged untreated plants. The population was estimated by gently holding the leaf between the halves of Petriplate (10 cm diameter) and then counting the adults and the nymphs within the Petriplate. However, when the nymphal prevalent stage was direct counting of the population was done with the help of magnifying lens**.** An aspirator was used to collect the adults for identification**.**

(ii) Aphids: The population of aphids was counted from the five tagged plants in each plot. The counting of aphids was done on three leaves chosen from the top, middle and bottom of each plant. For the purpose of recording the population marked leaves were grasped at the petiole by thumb and finger and turned until the entire under surface of leaf was clearly visible. With the help of magnifying lens, the aphids present were counted and population was expressed on a per plant basis.

(iii) Red Cotton Bug and Dusky Cotton Bug: The adults and nymphs of both bugs were counted visually after gently shaking them off from the plants on to a blotting sheet placed underneath one randomly selected sympodial branch and the numbers were expressed on per plant basis.

B. Statistical analysis: Population data of different insect pests thus obtained were subjected to statistical analysis to find out the coefficient of correlation with average temperature and relative humidity, which was obtained from the meteorological observatory, Rajasthan College of Agriculture, Udaipur. Following formula was used for calculating the correlation coefficient. A simple correlation was calculated between insect population and abiotic factors.

$$r_{xy} = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\left[\sum X^2 - \frac{(\sum X)^2}{n}\right]\left[\sum Y^2 - \frac{(\sum Y)^2}{n}\right]}}$$

Where

r_x = Simple correlation coefficient.

X = Variable *i.e.* abiotic component. (Average temperature, relative humidity and rainfall)

Y = Variable *i.e.* mean number of insect pests.

n = Number of paired observation.

The correlation coefficient (r) values were subjected to the test of significance using t–test:

$$t = \frac{r}{\sqrt{1-r^2}} \times \sqrt{n-2}$$

The calculated t–value obtained was compared with tabulated t–value at 5% level of significance.

RESULTS AND DISCUSSION

Studies conducted on the seasonal incidence of sap–sucking insect pests of cotton revealed that *A. biguttula biguttula*, *A. gossypii*, *B. tabaci*, *T. tabaci, D. koenigii* and *O. laetus* were of regular occurrence and caused considerable damage to the crop under prevailing climatic conditions of Udaipur (Rajasthan).

Jassids: The incidence of jassids was first noticed in the first week of July (0.33 jassids/plant) that increased gradually and touched the peak (21.87 jassids/plant) in the fourth week of August; thereafter, the population decreased gradually and reached to a minimum level of 1.33 jassids/plant during last week of November (Table 1).

The mean atmospheric temperature, relative humidity and total rainfall during the peak period of incidence were 25.84 °C, 75.65 per cent and 17.40 mm, respectively. The pest had a positive non–significant correlation with temperature ($r_1 = 0.20$) and total rainfall ($r_3 = 0.28$), while with relative humidity the correlation was significantly positive ($r_2 = 0.64$).

The results obtained in the present investigation are in close agreement with the earlier reports of Shitole and Patel (2009), who observed higher incidence of jassids during last week of August, which might be due to local weather conditions that prevailed during the study period.In the present investigation, it was found that temperature range of 21.96 to 29.71˚C along with high relative humidity 75.65 per cent provided congenial conditions for the multiplication of jassids. This finding is in close conformity with the findings of Bishnoi *et al*., (1996), who reported temperature ranging from 27.0 to 34.0˚C with 52 to 82 per cent relative humidity as the most suitable conditions for jassids.

Aphids (*Aphis gossypii* Glover): The infestation of aphids appeared in the first week of July (0.67 aphids/plant) and reached to the peak (36.27 aphids/plant) during the last week of August, the population then decreased gradually and reached a minimum level of 9.67 aphids/plant during last week of November (Table 1).

The mean atmospheric temperature, relative humidity and total rainfall during the peak period of incidence were 25.87 ˚C, 78.29 per cent and 58.60 mm, respectively. The aphid population had a negatively non–significant correlation with temperature ($r_1 = –0.06$); while with relative humidity ($r_2 = 0.15$) and total rainfall ($r_3 = 0.11$) it had positive non–significant correlation.

Table 1. Seasonal incidence of sap–sucking insect pests of cotton (GH–8) during 2012

Date of observation (Periods)	Abiotic factor			Mean population of sap–sucking insect pests per plant					
	Mean temp. (^{0}C)	Mean R.H. (%)	Rainfall (mm)	Aphids	Jassids	Whiteflies	Thrips	R C B	D C B
29 June – 05 July	31.60	55.64	27.50	0.67	0.33	0.33	1.00	–	–
06 – 12 July	27.63	63.53	104.60	1.00	0.87	0.67	1.33	–	–
13 – 19 July	27.19	66.36	0.00	1.33	1.53	1.33	2.67	–	–
20 – 26 July	27.44	67.57	1.00	3.67	3.53	2.67	5.93	–	–
27 July – 02 Aug	22.34	70.57	13.60	4.87	7.80	8.87	20.67	–	–
03 – 09 Aug	26.13	70.49	15.67	15.67	8.00	9.33	**33.87**	–	–
10 –16 Aug	24.37	82.93	19.27	13.27	8.67	9.87	31.67	–	–
17 – 23 Aug	25.84	75.65	17.40	34.87	**21.87**	**20.33**	30.13	–	–
24 – 30 Aug	25.87	78.29	58.60	**36.27**	18.33	18.47	10.67	–	–
31 Aug – 06 Sept	27.53	78.08	69.80	32.53	14.67	13.67	10.00	–	–
07 – 13 Sept	24.55	90.00	193.0	27.73	10.06	9.33	0.33	–	–
14 – 20 Sept	26.03	75.93	0.40	27.00	7.27	6.87	0.87	–	–
21 – 27 Sept	26.22	68.08	34.00	33.87	7.73	6.33	0.67	1.67	–
28 Sept – 04 Oct	25.98	54.87	0.00	34.87	8.40	5.80	0.33	2.87	1.33
05 – 11 Oct	26.00	51.15	0.00	26.00	4.93	4.53	2.00	4.13	2.67
12 – 18 Oct	24.41	47.89	0.00	25.87	5.60	3.80	0.53	11.40	4.33
19 – 25 Oct	24.19	46.94	0.00	25.33	4.40	3.60	0.87	8.00	4.87
26 Oct – 01 Nov	21.45	43.36	0.00	23.33	3.87	2.80	0.00	**15.33**	9.73
02 – 08 Nov	19.45	50.36	0.00	22.00	2.33	1.73	0.00	8.27	**14.27**
09 – 15 Nov	21.16	47.56	0.00	17.87	2.06	1.67	0.00	6.67	10.20
16 – 22 Nov	19.56	47.65	0.00	13.20	1.67	1.27	0.00	3.33	5.67
23 – 29 Nov	19.46	50.93	0.00	9.67	1.33	1.07	0.00	2.33	4.36
	r_1			–0.06	0.20	0.20	–0.28	–0.17	–0.67*
	r2			0.15	0.64*	0.69*	0.44	–0.65*	–0.45
	r3			0.11	0.28	0.28	–0.15	–0.37	NA

R C B = Red Cotton Bug D C B = Dusky Cotton Bug; *Significant at 5% level 't' value significant at 5% P= 0.05

r_1 = Coefficient of correlation between mean temperature (^{0}C) and sap–sucking insect pests population

r_2 = Coefficient of correlation between mean relative humidity (%) and sap–sucking insect pests population

r_3 = Coefficient of correlation between rainfall (mm) and sap–sucking insect pests population

The present findings are similar to the findings of Purohit *et al*., 2006 who observed the appearance of aphid population in the first fortnight of July and reached at peak during fourth week of August.

Whiteflies (*Bemisia tabaci* Gennadius.): Infestation initiated in the first week of July (0.33 whiteflies/plant); thereafter, their population increased gradually and touched the peak (20.33 whiteflies/plants) in the fourth week of August, the population decreased gradually and reached to a minimum level of 1.07 whiteflies/plant during last week of November (Table 1).

The mean atmospheric temperature, relative humidity and total rainfall during the peak period of incidence were 25.84 ˚C, 75.65 per cent and 17.40 mm, respectively. The whitefly population had a positive non–significant correlation with temperature (r_1= 0.20) total rainfall (r_3 = 0.28) and positive significant with relative humidity (r_2 = 0.69).

The present finding is in close conformity with the findings of Purohit *et al.,* (2006), who reported that whitefly appeared in the first week of July and attained its peak in second week of August (12/3 leaves) in cotton cultivar GH–8.

Thrips (*Thrips tabaci* Linnman): The data presented in the (Table 1) indicate that thrips were noticed in the first week of July and then population increased suddenly and touched the peak (33.87 thrips/plants) in second week of August; thereafter, the population decreased gradually and reached to a minimum level of 0.33 thrips/plant during the first week of November.

The mean atmospheric temperature, relative humidity and total rainfall during the peak period of incidence were 26.13 °C, 70.49 per cent and 15.67 mm, respectively. The pest exhibited a non–significant negative correlation with temperature ($r_1 = –0.28$), while with relative humidity ($r_2 = 0.44$) the pest showed non–significant positive correlation and with total rainfall ($r_3 = –0.15$) the relationship was non–significant and negative.

Gupta *et al*. (1997) also observed similarly who reported maximum numbers of thrips (*Thrips tabaci*) on cotton cultivars H–4, H–6, JKH– 1, DCH–32 and AHH–468 during second fortnight of August.

Red Cotton Bug *(Dysdercus koenigii* Fabricius): The incidence of red cotton bug initiated in the fourth week of September (1.67 red cotton bugs/plant) which increased gradually and touched the peak (15.33 red cotton bugs/ plant) in the last week of October; thereafter, the population decreased gradually and reached to a minimum level of 2.33 red cotton bugs/ plant during last week of November (Table 1).

The mean atmospheric temperature and relative humidity during the peak period of incidence were 21.44 °C and 43.36 per cent with no record of rainfall. The pest had a negative non–significant correlation with temperature ($r_1 = –0.17$) and total rainfall ($r_3 = –0.37$), while with relative humidity the correlation was significantly negative ($r_2 = –0.65$).

Dusky Cotton Bug (*Oxycarenus laetus* Kirby): Dusky cotton bug infestation initiated in the first week of October (1.33dusky cotton bugs/ plant), thereafter, their population increased gradually and touched a peak (14.27dusky cotton bugs/ plant) in the first week of November, the population decreased gradually and reached to a minimum level of 4.36 dusky cotton bugs/ plant during last week of November (Table 1).

The mean atmospheric temperature and relative humidity during the peak period of incidence were 19.45 °C and 50.36 per cent, respectively. The dusky cotton bug population had a negatively significant correlation with temperature ($r_1 = –0.67$), but negatively non–significant coefficient of correlation with relative humidity ($r_2 = –0.45$).

The results obtained in the present investigation are in close conformity with the findings of Patil and Rajnikantha (2005), who reported that a higher incidence of dusky cotton bug (*Oxycarenus laetus*) on MECH–184 (Bt cotton) from the 50th to the 5th international standard week (ISW), with peak incidence on the 52nd ISW (12.72 and 17.20 bugs per boll at the research station and farmer's field, respectively), compared to MECH–184 non–Bt and NHH–44.

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