POPULATION DYNAMICS OF SUCKING PESTS ON BRINJAL IN RELATION TO WEATHER PARAMETERS

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ABSTRACT

An experiment was conducted to study population dynamics of sucking pests on brinjal in relation to weather parameters under field condition at Main Vegetable Research Station, Anand Agricultural University, Anand during kharif 2010-11. The population of aphid, jassid and whitefly ranged between 0.35 and 11.03, 1.47 to 7.93 and 1.52 to 8.50 per leaf with an average of 3.97, 4.89 and 5.02, respectively. The highest peak of aphid (11.03/leaf) was noticed during 1st week of January, while the highest peak of jassid (7.93/leaf) and whitefly (8.50/leaf) were noticed during 4th week of December. The aphid population significantly negatively correlated with rainfall (–0.45765**),maximum temperature (-0.48102**), minimum temperature (-0.60095**), mean temperatur (-0.57064**), morning relative humidity (-0.39796*), evening relative humidity (-0.50928**), mean relative humidity (-0.40216*), morning vapour pressure (-0.59070**), evening vapour pressure (-0.63562**), mean vapour pressure (-0.62136**) and wind speed (-0.54059**). Jassid and whitefly population significantly positively correlated with bright sunshine hours (0.67993** and 0.67417**). However, both these pests were significantly negatively correlated with rainfall (-0.61506** and -0.62344**), maximum temperature (-0.65722** and -0.67008**), minimum temperature (-0.88218** and -0.88260**), mean temperature (-0.82756** and -0.83224**), evening relative humidity (-0.72706** and -0.71820**), mean relative humidity (-0.64429** and -0.63292**), morning vapour pressure (-0.85966** and -0.86899**), evening vapour pressure (-0.88671** and -0.89079**), mean vapour pressure (-0.88170** and -0.88873**), mean vapour pressure deficit (-0.39953* and -0.41124*) and wind speed (-0.64083** and -0.62054**), respectively.

KEY WORDS: Brinjal, population dynamics, sucking pests, weather parameters

INTRODUCTION

Brinjal (*Solanum melongena* Linnaeus) is known as a "King of Vegetables" grown throughout tropical, sub-tropical and warm temperate areas of the world. In world, the production of brinjal is about 4.18 crore metric tonnes. India is the second largest producer of brinjal cultivated in about 5.7 lakh hectares with a production of 96 lakh tonnes after China (Anonymous, 2010a). In Gujarat, it is cultivated in 0.65 lakh hectares area with an annual production of 11.44 lakh tonnes and a productivity of 17.37 tonnes per hectare (Anonymous, 2010b). Brinjal crop suffers severely due to the attack of various insect pests, which reduces its yield and quality of fruits. In India, the crop is damaged by more than 30 insect pests obtaining from nursery

stage (Regupathy *et al.*, 1997). Patel *et al.* (1970) recorded 16 pest species attacking brinjal in Gujarat, of which shoot and fruit borer, *Leucinodes orbonalis* Guenee; jassid, *Amrasca biguttula biguttula* (Ishida); whitefly, *Bemisia tabaci* Gennadius, aphid, *Aphis gossypii* Glover, mites, *Tetranychus cinnabarinus* Boisdual and epilachna beetle, *Henosepilachna vigintioctopunctata* (Fab.) are the major and important insect pests.

Both nymphs and adults of sucking pests, *viz.*, *A. biguttula biguttula*, *B. tabaci* and *A. gossypii* occurs regularly on the crop from the early stage and remains till to the harvest of the crop causing enormous damage by sucking cell sap from the leaves and tender plant parts. Jassid also acts as a vector for transmission of little leaf disease in brinjal.

The basic information on population dynamic is necessary for deciding the strategy for management of any insect pest. Limited work has been done on population dynamics of sucking pests on brinjal in relation to weather parameters particularly in middle Gujarat. Hence, the present investigation was carried out.

MATERIALS AND METHODS

In order to study the population dynamics and impact of weather parameters on incidence of sucking pests on brinjal, a field experiment was conducted at Main Vegetable Research Station, Anand Agricultural University, Anand during *kharif* season of the year 2010-11. Brinjal (cv. Anand Brinjal Hybrid-1) was transplanted during 3rd week of September in a plot size of 20 x 10 m with spacing of 90 x 60 cm and raised successfully by adopting recommended agronomical practices. The observations on sucking peats *viz.*, aphid, jassid and whitefly, were recorded on 25 randomly selected plants from the whole experimental plot. Three (one from top, middle and bottom) leaves of these randomly selected 25 plants were carefully examined for the presence of nymphs and adults during early morning hours, when the pests were less active. The observations were recorded at weekly interval starting from one week after transplanting till to the harvest of the crop. The whole experimental plot was kept free from any insecticide application. To find out the specific impact of different weather parameters on sucking pests in brinjal, the data on number of sucking pests per leaf recorded in the experimental plot of population dynamics were correlated with the different meteorological parameters by standard statistical procedure (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Population dynamics

The periodical week-wise data on number of sucking pests per leaf are presented in Table 1 and also depicted in Figure 1. The data on aphid revealed that the population ranged between 0.35 and 11.03 per leaf with an average of 3.97. The incidence increased up to 4th week of October then declined during next week and further increased during 2nd week of November. Then after, the population declined till the 1st week of December. The population increased during 2nd week of December (50th standard week) and reached to the highest peak (11.03 aphids/leaf) during 1st week of January (1st standard week) and then the population declined till to the crop matured. Overall, the incidence of aphid was higher (> 5 aphids/leaf) between 12th (4th week of December) and 16th (3rd week of January) weeks after transplanting. It was indicated from the available literature that the aphid population was higher during January-February (Benerjee *et al.*, 1986), in the 3rd week of August to 3rd week of December (Mall *et. al.*, 1992), September- October (Prasad and Logiswaran, 1997a), 3rd week of November (Singh *et al.*, 2005), 2nd week of December and January (Chandrakumar *et al.*, 2008). In present investigation, the population increased up to October and reached to the peak during January. Thus, above reports are more or less corroborated with the present findings.

The periodical week-wise data on jassid population (Table 1) revealed that the population was in the range of 1.47 to 7.93 with an average of 4.89 per leaf during cropping period. The incidence increased up to 2nd week of November (45th standard week) then declined during next week and further increased during 4th week of November. The population then increased and reached to the highest peak (7.93 per leaf) during 4th week of December (52th standard week). The population then in decline order till to the maturity of crop. Overall, the incidence of jassid was recorded higher (> 5 per leaf) from 11th (2nd week of December) to 20th (2nd week of February) weeks after transplanting. Mall *et al.* (1992) and Singh *et al.* (2005) noticed the activity of the pest soon after transplanting till to the maturity of crop. The higher density of jassid was exhibited during 4th week of December by Chandrakumar *et al.* (2008). In present study, it was also observed that the population started from transplanting till to the maturity with a highest peak during 4th week of December. Thus, the above reports are perfectly tally with the present findings.

The periodical week-wise data on whitefly population (Table 1) revealed that the population was recorded in the range of 1.52 to 8.50 with an average of 5.02 per leaf throughout the season. The infestation started after 1st week after transplanting *i.e.* first week of October (40th standard week), increased gradually and reached to the first peak (3.56 per leaf) during 2nd week of November (45th standard week). The population then declined during 3rd week of November, further increased during 4th week of November and reached to the second and the highest peak (8.50 per leaf) during 4th week of December (52nd standard week). Then after, the population declined till to the maturity of crop. Overall, whitefly incidence was recorded higher (> 5 per leaf) from 11th (2nd week of December) to 21st (3rd week of February) weeks after transplanting. Chandrakumar *et al.* (2008) reported that the incidence of whitefly in brinjal was the highest during 3rd week of December and lowest in the last week of October. In present investigation also the highest and lowest population was obtained during 4th week of December and 3rd week of November, respectively. The above report gave close conformity to present findings.

Correlation study

The results on correlation between aphid population and different weather parameters (Table 2) revealed that the population of aphid had significant negative correlation with rainfall, maximum temperature, minimum temperature, mean temperature, morning relative humidity, evening relative humidity, mean relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure and wind speed, with correlation coefficient (r) value of –0.45765**, -0.48102**, -0.60095**, -0.57064**, -0.39796*, -0.50928**, -0.40216*, -0.59070**, -0.63562**, -0.62136** and -0.54059**, respectively. Thus, as unit increase in rainfall, maximum temperature, minimum temperature, mean temperature, morning relative humidity, evening relative humidity, mean relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure and wind speed; the incidence of aphid decreased or vice versa. Moreover, aphid population was positively correlated with bright sunshine hours, but the result was non-significant. The correlation between weather parameters and aphid incidence was reported by various research workers. Negative correlation with rainfall (Prasad and Logiswaran, 1997b), positive correlation with sunshine hours and negative correlation with rainfall (Devi *et al.*, 2002), negative correlation with temperature, relative humidity and rainfall (Singh *et al.*, 2005), negative correlation with maximum temperature, evening relative humidity and rainfall (Chandrakumar *et al.*, 2008) was reported in brinjal. In present investigation,

except bright sunshine hours all weather parameters are negatively correlated. Hence, the above reports are strongly supported the present findings. The report of positive correlation between aphid and sunshine hours is also matched with the present findings.

The results on correlation between jassid population and different weather parameters (Table 2) revealed that the population significantly positively correlated with bright sunshine hours (0.67993**). Thus, as unit increase in bright sunshine hours, the population increased or vice versa. However, the jassid population was significantly negatively correlated with rainfall, maximum temperature, minimum temperature, mean temperature, evening relative humidity, mean relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure, mean vapour pressure deficit and wind speed with correlation coefficient (r) value of -0.61506**, -0.65722**, -0.88218**, -0.82756**, -0.72706**, -0.64429**, -0.85966**, -0.88671**, -0.88170**, -0.39953* and -0.64083**, respectively. Thus, as unit increase in rainfall, maximum temperature, minimum temperature, mean temperature, evening relative humidity, mean relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure, mean vapour pressure deficit and wind speed; the incidence of jassid decreased or vice versa. Mahmood *et al.* (2002) found negative correlation of jassid with relative humidity and rainfall, while positive with bright sunshine hours in brinjal. Chandrakumar *et al.* (2008) found negative correlation of jassid with maximum temperature, evening relative humidity and rainfall. Iqbal *et al.* (2010) reported the negative correlation of the pest with rainfall in okra crop. Patel *et al.* (2010) found negative correlation of jassid with relative humidity and vapour pressure deficit in cowpea. Thus, the above reports are tally with the results of present findings.

The results on correlation between whitefly population and different weather parameters (Table 2) revealed that the whitefly population significantly and positively correlated with bright sunshine hours (0.67417**). Thus, as unit increase in bright sunshine hours, the population increased or vice versa. However, the whitefly population was negatively correlated with rainfall (-0.62344**), maximum temperature (-0.67008**), minimum temperature (-0.88260**), mean temperature (-0.83224**), evening relative humidity (-0.71820**), mean relative humidity (-0.63292**), morning vapour pressure (-0.86899**), evening vapour pressure (-0.89079**), mean vapour pressure (-0.88873**), mean vapour pressure deficit (-0.41124*) and wind speed (-0.62054**), indicated that as unit increase in rainfall, maximum temperature, minimum temperature, mean temperature, evening relative humidity, mean relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure, mean vapour pressure deficit and wind speed; the incidence of whitefly decreased or vice versa. The association between whitefly and weather parameters was reported by various research workers. Ghosh *et al.* (2004) reported the negative association between whitefly and mean relative humidity, mean temperature as well as rainfall; with maximum temperature, evening relative humidity and rainfall (Chandrakumar *et al.*, 2008) in brinjal; relative humidity and vapour pressure deficit in cowpea (Patel *et al.*, 2010); temperature, minimum and mean relative humidity and rainfall in tomato (Chaudhari *et al.*, 2001). Thus, the above reports of negative association of whitefly and weather parameters strongly confirmed with present findings. Similarly, Chaudhari *et al.* (2001) reported the positive association between whitefly and bright sunshine hours in tomato. This finding also gave conformity to result of present findings.

CONCLUSION

The peak incidence of aphid (11.03/leaf) was noticed during 1st week of January, while the peak incidence of jassid (7.93/leaf) and whitefly (8.50/leaf) was noticed during 4th week of December. The correlation studies revealed that the aphid population significantly negatively correlated with rainfall, temperature, relative humidity, vapour pressure and wind Speed. Jassid and whitefly population significantly positively correlated with bright sunshine hours. However, both the pests were significantly negatively correlated with rainfall, temperature, relative humidity, vapour pressure, mean vapour pressure deficit and wind speed.

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Table 1: Population dynamics of sucking pests in brinjal

Months and Weeks		Week After Transplanting	Standard Week	Number of Sucking Pests Per Leaf		
				Aphid	Jassid	Whitefly
October	**I**	1	40	00.35	1.47	1.57
	II	2	41	01.70	3.10	3.08
	III	3	42	02.50	3.28	3.25
	IV	4	43	03.06	3.32	3.34
November	**I**	5	44	02.95	3.37	3.45
	II	6	45	03.83	3.48	3.56
	III	7	46	03.13	2.10	1.52
	IV	8	47	02.27	3.52	3.60
	V	9	48	01.10	3.96	4.19
December	**I**	10	49	00.35	4.65	4.61
	II	11	50	02.60	5.36	5.68
	III	12	51	05.17	6.12	6.41
	IV	13	52	09.05	7.93	8.50
January	**I**	14	1	11.03	7.10	7.71
	II	15	2	10.52	6.92	7.09
	III	16	3	08.70	6.73	6.94
	IV	17	4	04.82	6.90	6.60
	V	18	5	01.50	6.62	6.54
February	**I**	19	6	00.73	6.88	7.10
	II	20	7	-	5.94	6.30
	III	21	8	-	4.97	5.13
	IV	22	9	-	3.96	4.16
			Mean	**3.97**	**4.89**	**5.02**

Table 2: Relationship between weather paramean temperatureers and population of sucking pests in brinjal

Weather Paramean temperatureers	Correlation Co-efficient (r)		
	Aphid	Jassid	Whitefly
Rainfall (mm/day)	-0.45765**	-0.61506**	-0.62354**
Bright sunshine hours, (hr/day)	0.37922	0.67993**	0.67417**
Maximum temperature (^{0}C)	-0.48102**	-0.65722**	-0.67008**
Minimum temperature (^{0}C)	-0.60095**	-0.88218**	-0.88260**
Mean temperature (^{0}C)	-0.57064**	-0.82756**	-0.83224**
Morning relative humidity (%)	-0.39796*	-0.29895	-0.28503
Evening relative humidity (%)	-0.50928**	-0.72706**	-0.71820**
Mean relative humidity (%)	-0.40216*	-0.64429**	-0.63292**
Morning vapour pressure (mm of Hg)	-0.59070**	-0.85966**	-0.86899**
Evening vapour pressure (mm of Hg)	-0.63562**	-0.88671**	-0.89079**
Mean vapour pressure (mm of Hg)	-0.62136**	-0.88170**	-0.88873**
Morning vapour pressure deficit (mm of Hg)	-0.28254	-0.28864	-0.29600
Evening vapour pressure deficit (mm of Hg)	-0.07571	-0.03612	-0.04698
Mean vapour pressure deficit (mm of Hg)	-0.28385	-0.39953*	-0.41124*
Wind Speed (km/hr)	-0.54059**	-0.64083**	-0.62054**

, ** Significant at 5 per cent and 1 per cent levels of significance, respectively.

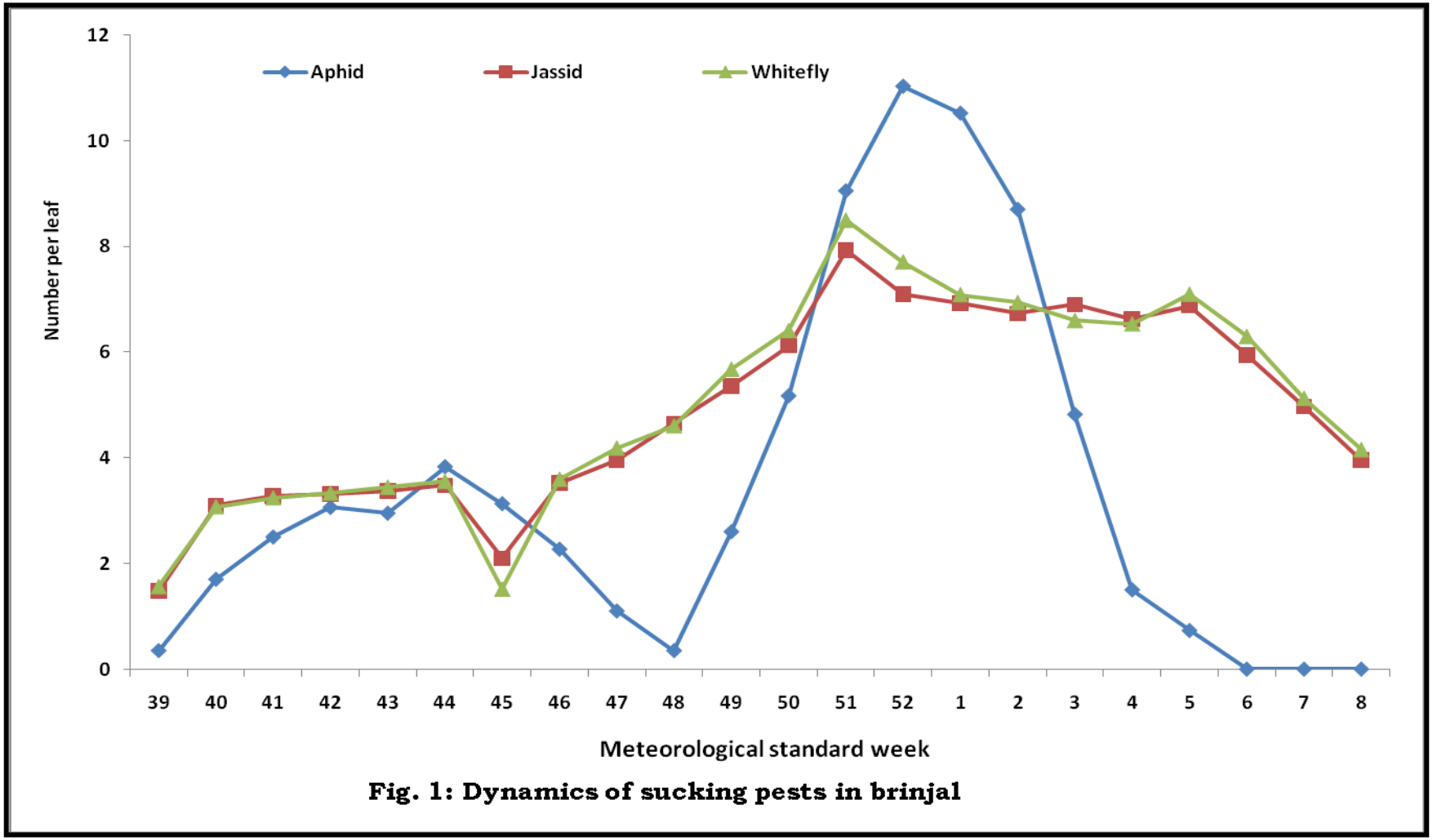

Fig. 1: Dynamics of sucking pests in brinjal

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