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## Population dynamics of Jassid *Amrasca biguttula biguttula* (Ishida) infesting okra and its relationship with weather parameters

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### Abstract

An investigation to study the population dynamics of jassid (nymph/leaf), *Amrasca biguttula biguttula* (Ishida) (Cicadellidae) infesting okra and its relationship with weather parameters was carried out at Anand Agricultural University, Anand, Gujarat during summer 2021. The incidence of jassid commenced after two weeks of germination (10<sup>th</sup> SMW) and continued up to removal of crop in the 20<sup>th</sup> SMW. A higher incidence of jassid was observed during the 13<sup>th</sup> to 17<sup>th</sup> SMW. Jassid population exhibited significant positive correlation with maximum temperature and vapour pressure deficit, whereas it showed non-significant positive correlation with minimum temperature, bright sunshine hours, morning and evening vapour pressure. The morning as well as evening relative humidity, rainfall and wind speed showed non-significant negative correlation with jassid population. Population of coccinellids had significant positive correlation whereas spider population had highly significant positive correlation with jassid population.

**Keywords:** Okra, Jassid, coccinellids, spider, weather parameters

### Introduction

Okra [*Abelmoschus esculentus* (L.) Moench] is also known as Lady's finger, belongs to the family Malvaceae. Okra crop is heavily infested by several insect pests which cause quantitative as well as qualitative loss to the crop. Among various pests jassid *Amrasca biguttula biguttula* (Hemiptera: Cicadellidae) causes 54-66 per cent vegetative growth and yield reduction, if the okra crop remains unprotected (Singh *et al.*, 2013) <sup>[10]</sup>. Nymph and adult are very active with a characteristic way of moving diagonally in relation to their body, but quick to hopping (Singh *et al.*, 2018) <sup>[9]</sup>. Apart from feeding on okra, the jassid has a very wide range of host plants, including herbaceous cultivated plants and weeds. Jassid is a polyphagous insect infesting okra, cotton, brinjal, beans, castor, cucurbits *etc.* (Devi *et al.*, 2018) <sup>[4]</sup>. The nymphal population build-up occurs from the second week of seedling emergence to the harvesting stage that causes considerable loss in yield. Okra is the most suitable host for the survival and feeding of jassid. Both nymphs and adults of jassid suck plant sap from the lower surface of leaves and inject necrotic toxin thereby reducing the assimilation of photosynthate, which leads to browning, bronzing, cupping, withering and necrosis of leaves. Population dynamics of the insect pest provides not only the information of initiation of the pest but also provides the peak activity of the particular pest as well as effect of biotic and abiotic parameters on pest. Correlation study helps in to provide either positive or negative association of pest population with biotic or abiotic factors. It gives direct influence of particular parameter on pest population build-up as well as its indirect effect through other parameters. Knowledge about peak period of infestation helps to tackle these major pests and reduces the yield losses as well as increase production and productivity of okra in Gujarat as well as in India. Therefore, a field experiment was carried out to study the population dynamics of jassid in okra and its relationship with weather parameters.

**Materials and Methods**

The experiment was conducted during summer 2021 at Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat. Okra variety GAO 5 was sown with row to row spacing of 45 cm and plant to plant spacing of 30 cm. The sowing was done on 17<sup>th</sup> February, 2021. The plot size was 9 X 12 m. All standard agronomical practices were followed. The whole experimental plot was kept free from the application of any insecticides.

For recording observations on jassid population, the plot was divided into four equal size sectors. From each sector, five plants were randomly selected. From each selected plant, one leaf from the top, middle and lower canopy was observed and the number of jassids (nymphs & adults) was counted at weekly intervals starting from one week after germination and continued till the removal of the crop. Observations on population of coccinellids (grub + adult) and spiders were also recorded from the randomly selected five plants in each sector.

**Statistical analysis**

In order to study the effect of weather parameters on the population of the jassid, coccinellids and spiders, the weekly data on different physical factors of environment viz., maximum (MaxT) and minimum (MinT) temperature, morning (RH<sub>1</sub>) and evening (RH<sub>2</sub>) relative humidity, bright sunshine hours (BSS), rainfall (RF), wind speed (WS), morning (VP<sub>1</sub>) and evening (VP<sub>2</sub>) vapour pressure, vapour pressure deficit (VPD) were obtained from the Meteorological Observatory of Anand Agricultural University, Anand. Simple correlation coefficient was calculated to find possible relationship between population of jassid, coccinellids and spiders with physical factors of environment by adopting a standard statistical procedure (Steel and Torrie, 1980) [11].

**Results and Discussions**

**Population dynamics of jassid in okra**

The data on population of jassid and natural enemies are presented in Table 1. The incidence of jassid in okra crop commenced in the second week after germination i.e. second week of March (10<sup>th</sup> SMW) and persisted up to the harvest (20<sup>th</sup> SMW). The jassid population ranged from 0.50 to 3.55 jassid/leaf. Initially, the population was low (0.55 jassid/leaf), which gradually increased and attained a peak (3.55 jassid/leaf) during the third week of April i.e. 7 weeks after germination (15<sup>th</sup> SMW). After that, the population was declined and it was recorded up to harvest in the third week of May (20<sup>th</sup> SMW). A higher incidence of jassid (> 2.00 jassid/leaf) was observed during the month of April (13<sup>th</sup> to 17<sup>th</sup> SMW, 5<sup>th</sup> to 9<sup>th</sup> WAG).

In past, Das *et al.* (2011) [3] reported that the jassid first appeared in the third week after sowing, its population gradually increased and the maximum population was observed during 5 to 7 weeks after sowing of okra. Jadhav *et al.* (2015) [6] also reported that the jassid infestation in okra commenced in the 10<sup>th</sup> SMW and the maximum population was recorded during the 18<sup>th</sup> SMW. According to Pathan and Bharpoda (2016) [8], jassid infestation in okra initiated in the first week of March (10<sup>th</sup> SMW). The jassid populations gradually increased and reached the first peak during the fourth week of March and the second peak during the fourth week of April. Further, Dhandge *et al.* (2018) [5] noticed that the jassid incidence in summer okra commenced in the third WAG (11<sup>th</sup> SMW) and first as well as second peaks of jassid population were observed in 17<sup>th</sup> and 19<sup>th</sup> SMW, respectively. As per the report of Jat and Singh (2019) [7], the infestation of leafhopper in okra commenced in the first week of March (12<sup>th</sup> SMW) and reached its peak in the fourth week of March. Thus, the present findings are more or less in conformity with earlier reports.

**Table 1:** Population of jassid and natural enemies in okra

Month	Week	SMW	WAG	No. of jassid/ leaf	No. of natural enemies/ plant	
					Coccinellids (Grub + Adult)	Spiders
March, 2021	I	9	1	0.00	0.00	0.00
	II	10	2	0.55	0.00	0.00
	III	11	3	1.35	0.00	0.00
	IV	12	4	1.92	0.00	0.00
April, 2021	I	13	5	2.52	0.00	0.15
	II	14	6	3.15	0.25	0.25
	III	15	7	3.55	0.35	0.35
	IV	16	8	3.12	0.05	0.15
	V	17	9	2.22	0.00	0.20
May, 2021	I	18	10	1.58	0.00	0.10
	II	19	11	1.05	0.00	0.10
	III	20	12	0.50	0.00	0.10

**Note:** SMW: Standard Meteorological Week, WAG: Week after germination

**Correlation between weather parameters and jassid population**

The correlation coefficient data (Table 2) indicated that maximum temperature (r = 0.684) and vapor pressure deficit (r = 0.698) had significant positive correlation with jassid population. However, minimum temperature (r = 0.279), bright sunshine hours (r = 0.290), morning (r = 0.211) as well as evening (r = 0.021) vapour pressure showed non-significant positive correlation with jassid population. The morning (r = -0.408) as well as evening (r = -0.343) relative humidity and rainfall (r = -0.353), wind speed (r = -0.067) were non-significantly negatively correlated with jassid population.

Earlier Das *et al.* (2011) [3] recorded that the jassid population in okra had a significant positive correlation with maximum temperature and non-significant positive correlations with minimum temperature, bright sunshine, evaporation and vapour pressure. Jadhav *et al.* (2015) [6] also reported that leafhopper population in okra had a significant positive correlation with maximum temperature and a significant negative correlation with relative humidity. Aarwe *et al.* (2016) [1] reported that maximum temperature, average sunshine hours and wind speed had a significant positive correlation, whereas total rainfall had a negative correlation with the jassid population in okra. According to Chouhan *et al.* (2016) [2], the jassid population in okra had a significant

positive correlation with maximum temperature, positive but non-significant correlation with minimum temperature and negative correlation with morning and evening relative humidity. Pathan and Bharpoda (2016) [8] reported that bright sunshine, rainfall, wind speed, morning relative humidity and evening relative humidity showed a negative correlation, whereas maximum temperature and minimum temperature

had a positive impact on the fluctuation of leafhopper population in okra. The leafhopper population showed a positive significant correlation with maximum and minimum temperature in the okra (Jat and Singh, 2019) [7]. Thus, the present findings are more or less in conformity of earlier reports.

**Table 2:** Correlation coefficient (r) between weather parameters and population of jassid & natural enemies in okra

Weather Parameters	Correlation coefficient (r)		
	Jassid	Coccinellids	Spiders
Maximum Temperature, °C (Max. T)	0.684*	0.366	0.696*
Minimum Temperature, °C (Min. T)	0.279	0.072	0.451
Morning Relative Humidity, % (RH <sub>1</sub> )	-0.408	0.064	-0.310
Evening Relative Humidity, % (RH <sub>2</sub> )	-0.343	-0.357	-0.148
Bright Sunshine Hours, hrs/day (BSS)	0.290	0.189	0.228
Rainfall, mm (RF)	-0.353	-0.145	-0.470
Morning Vapour Pressure, mm of Hg (VP <sub>1</sub> )	0.211	0.124	0.479
Evening Vapour Pressure, mm of Hg (VP <sub>2</sub> )	0.021	-0.227	0.176
Wind Speed, km/ hr (WS)	-0.067	-0.081	0.232
Vapour pressure deficit, mm of Hg (VPD)	0.698*	0.414	0.656*

\*Significant at 0.05% level of significance

**Population dynamics of natural enemies**

**Coccinellids**

The activity of coccinellids (grub and adult) commenced in the second week of April (14<sup>th</sup> SMW) with a population of 0.25 coccinellid/plant (Table 1). The population increased up to 0.35 coccinellid/plant in the third week of April (15<sup>th</sup> SMW) and the least population was recorded in the fourth week of April (16<sup>th</sup> SMW). Thereafter, it disappeared from crop. Overall, the population of coccinellids in okra crop was low and it was observed during 14<sup>th</sup> to 16<sup>th</sup> SMW.

**Spiders**

The population of spider in experimental plot was initially observed in the first week of April (13<sup>th</sup> SMW) with 0.15 spider per plant (Table 1). Thereafter, it increased gradually and reached the first peak in the third week of April (15<sup>th</sup> SMW) with 0.35 spider/plant. In the following week (16<sup>th</sup> SMW) there was decline in spider population (0.15 spider/plant). Spider population exhibited the second peak in last week of April (17<sup>th</sup> SMW) with the population of 0.20 spider/plant. During 18<sup>th</sup> to 20<sup>th</sup> SMW the spider population remained static and low (0.10 spider/plant).

**Correlation between coccinellids population and weather parameters as well as jassid population**

The coccinellid population showed non-significant positive correlation with maximum temperature (r = 0.366), minimum temperature (r = 0.072), morning relative humidity (r = 0.064), bright sunshine hours (r = 0.189), morning vapour pressure (r = 0.124) and vapor pressure deficit (r = 0.414). Whereas, it showed non-significantly negative correlation with evening relative humidity (r = -0.357), rainfall (r = -0.145), evening vapour pressure (r = -0.227) as well as wind speed (r = -0.081). Coccinellid population exhibited significantly positive correlation (r = 0.684) with jassid population (Table 3).

In past, Jat and Singh (2019) [7] reported that coccinellid population had a significant positive correlation with temperature and leafhopper population. They also reported that coccinellids population exhibited significant negative correlation with relative humidity. The variation might be due to difference in locality or season.

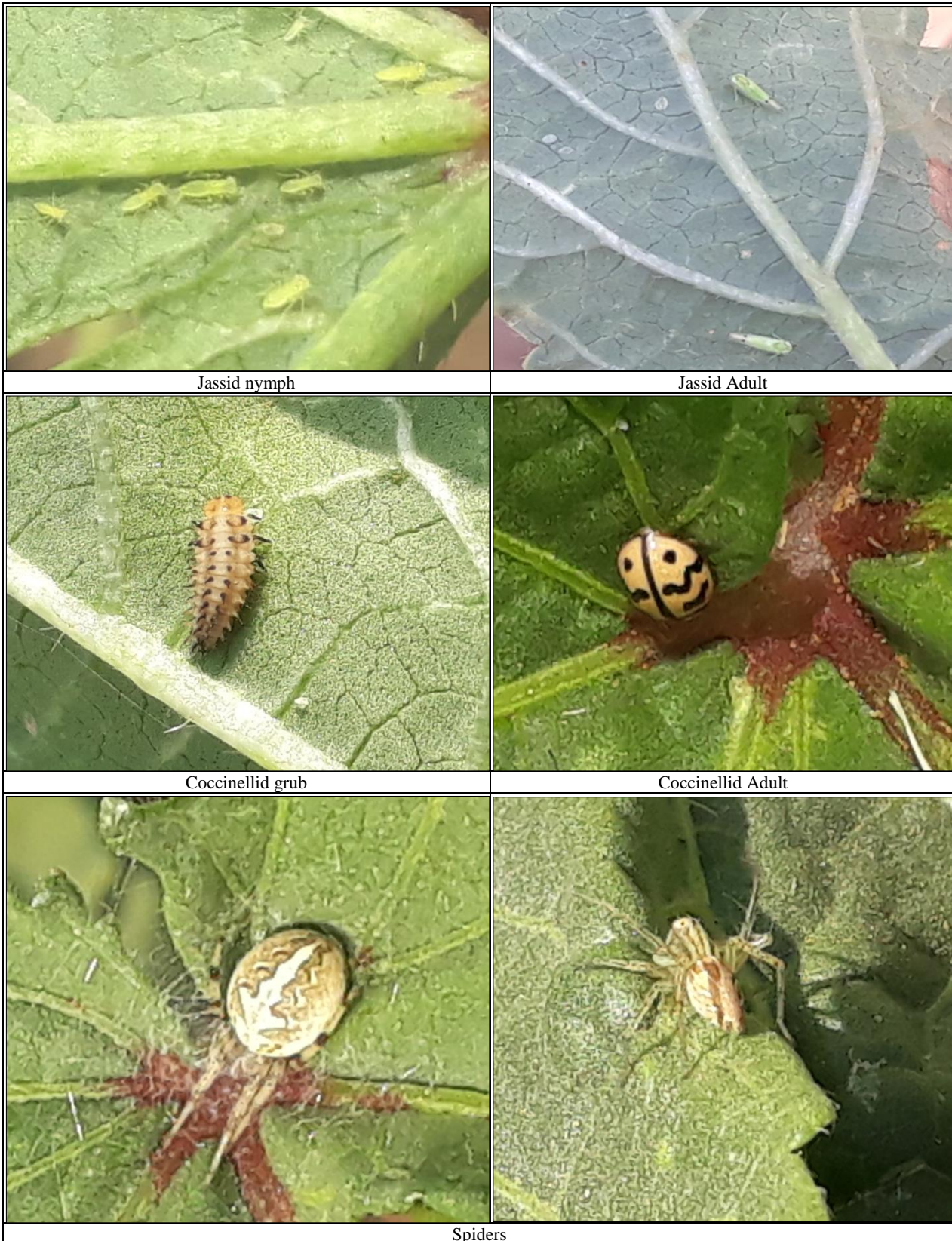
**Table 3:** Correlation coefficient (r) between the population of jassid and natural enemies in okra

Natural enemies	Correlation coefficient (r)
Coccinellids	0.684*
Spiders	0.795**

\*Significant at 0.05% level of significance \*\*Significant at 0.01% level of significance

**Correlation between spider population and weather parameters as well as jassid population**

Correlation coefficient values between weather parameters and spider population are presented in Table 2. Maximum temperature (r = 0.696) and vapor pressure deficit (r = 0.656) had significantly positive correlation with spider population. Whereas, minimum temperature (r = 0.451), bright sunshine hours (r = 0.228), wind speed (r = 0.232), morning (r = 0.479) as well as evening (r = 0.176) vapour pressure exhibited non-significant positive correlation with spider population. The morning (r = -0.310) as well as evening (r = -0.148) relative humidity and rainfall (r = -0.470) were non-significantly negatively correlated with spider population. Population of spiders showed highly significant positive correlation (r = 0.795) with jassid population (Table 3). Present finding are supported by the findings of Pathan and Bharpoda (2016) [8], who reported that spider population had a significantly positive correlation with maximum temperature and non-significant positive correlation with bright sunshine hours and wind speed. They further reported that morning and evening relative humidity showed non-significant negative correlation with spider population.



### Conclusion

Overall, it can be concluded that the activity of jassid, *A. biguttula biguttula* in summer okra was higher during the month of April (13<sup>th</sup> to 17<sup>th</sup> SMW). Jassid population exhibited significant positive correlation with maximum temperature and vapour pressure deficit, whereas it showed non-significant positive correlation with minimum temperature, bright sunshine, morning and evening vapour pressure. The morning as well as evening relative humidity, rainfall and wind speed showed non-significant negative correlation with the jassid population. Population of

coccinellids had significant positive correlation with jassid population whereas spider population showed highly significant positive correlation with jassid population.

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