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SEASONAL INCIDENCE OF SUCKING PESTS ON OKRA

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ABSTRACT
Okra was attacked by sucking pests like leafhoppers, *Amrasca biguttula biguttula* (Ishida), Aphids, *Aphis gossypii* (Glover), whitefly, *Bemisia tabaci* (Gennadius) in the early crop growth stages. Whereas, two spotted spider mite, *Tetranychus urticae* Koch dominated in the mid and later crop growth stages resulting in substantial losses in the yield. A thorough knowledge of seasonal activity of different insect pests determines the predisposing climatic factors affecting their population dynamics. Maximum temperature and average temperature had significant positive effect on leaf hoppers, aphids and whiteflies but negative on mites. Morning and evening relative humidity did not influence much on the population of sucking pests, whereas rainfall had significant effect on the sucking pest population.

KEY WORDS: Okra, sucking Pests, seasonal Incidence, leafhoppers, Aphids, mite.

INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench) is an important warm season vegetable crop cultivated comprehensively in tropical and sub-tropical regions of the world. The total area under okra in the world is reported to be 1.11 lakh ha with a production of 8.70 lakh tonnes. In India, okra is cultivated over an area of 0.53 million ha with an annual production and productivity of 63.46 lakh tonnes and 11.9 tonnes/ ha, respectively. The major okra producing states are Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh, Karnataka and Assam (Anon., 2014). Among the insect pests, the sucking pests *viz.*, aphid, *Aphis gossypii* (Glover), leafhopper (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Genn) and mite (*Tetranychus* sp.) are of regular occurrence and cause considerable damage in okra (Anitha and Nandihalli, 2008). Studies on seasonal abundance and population fluctuations will help in formulating effective management strategies against the pest in okra ecosystem. This will not only be useful in framing an integrated pest management schedule but will also help in getting information about the low incidence and pest free periods. Keeping this in view present study was undertaken.

MATERIAL & METHODS

The experiments were carried out under field conditions at Haveli Farm, College of Horticulture, University of Horticultural Sciences (UHS), Bagalkot in three seasons (*rabi* 2014, summer and *kharif* 2015). Bagalkot is located in Northern dry zone (Zone 3) of Karnataka state at 16^{o} 46' North latitude, 74^{o} 59' East longitudes and at an altitude of 534.0 m above the mean sea level. Experimental field with five guntas was prepared by thoroughly ploughing and harrowing to bring the soil to fine tilth. Seeds (Arka Anamika) were sown with row-to-row spacing and plant to plant spacing of 60 cm and 30 cm, respectively. The crop was raised as per the Package of Practices of UHS, Bagalkot, except the plant protection. Observations on the population of sucking pests were recorded by randomly selecting 20 plants from experimental area at weekly intervals starting from 15 days after sowing (DAS). Population of leafhoppers, aphids and whiteflies were recorded on three randomly selected leaves from top, middle and bottom canopy of the plant. Later the population was worked out per leaf. Similarly, the population of the two spotted spider mite, *Tetranychus urticae* Koch was recorded on three leaves each from the top, middle and bottom canopy of each plant by using 1 cm^2 windows made on the card board and at three places on each leaf and was expressed as number of mites per cm^2. The data on major insect-pests were subjected to correlation analysis with various abiotic factors, and the correlation coefficients thus obtained were compared for their significance following the method described by Fisher and Yates (1963).

RESULTS & DISCUSSION

Leafhopper, *Amrasca biguttula biguttula* (Ishida)

The pest was initially noticed on the crop on second week of October (41st SW) with a population density of 4.10 per leaf (Fig. 1). The population of the pest increased with the advancement of crop growth stage reaching the highest of 10.6 leaf hoppers per leaf observed during 48th SW (last week of November) and remained at moderate densities (3.33 to 7.33 leaf hoppers/leaf) in the succeeding weeks, then followed a declining trend towards the crop maturity stage. Anitha and Nandihalli (2008) reported leaf hopper on *rabi* crop (November sown) during 49th SW and its peak during first week of January. The activity of the pest might be related to the crop growth stage irrespective of the sowing time. Similarly, in the summer season of 2015, the infestation was observed between 10th and 19th SW in a higher magnitude compared to previous season with a population of 9.83 per leaf during its peak activity on 17th SW, which was favoured by high temperature (36^{o}C). But, to rainfall of 10 mm and 46 mm on 20th and 21st SW,

respectively, no pest population was observed (Fig. 2). Pal *et al.* (2013) observed the initiation of pest from 15th standard week and reaching its maximum at 19th SW after which population of the insect decreased. During 2015 *kharif*, the incidence commenced from second week of July, which rapidly increased and attained its peak at 33rd SW (second week of August) with a mean population density of 9.83 leaf hoppers per leaf which was probably because of the higher morning relative humidity (78.58 %) (Fig. 3). Nath *et al.* (2011) also observed the activity of *A. biguttula biguttula* from July to October with peak from mid August to mid September. However, Singh *et al.* (2013) reported the peak population of *A. biguttula biguttula* during fourth week of September (39th SW) in Madhya Pradesh. The leafhoppers had significant positive correlation with maximum temperature and average temperature during 2014 *rabi*. However, leafhopper had a significant positive correlation with evening relative humidity during *kharif*. Rainfall exhibited a significant negative correlation during *rabi* 2014 and summer 2015. Wind speed showed a significant negative correlation with leafhopper population during summer (Table 1). Present findings are in accordance with Pal *et al.* (2013) who reported significant positive correlation with maximum temperature and rainfall during *rabi*.

Aphids, *Aphis gossypii* (Glover)

The pest appeared on crop during second week of October with 3.20 aphids per leaf (Fig. 1). Maximum population of aphids (6.23/leaf) was recorded during fourth week of October and followed a declining trend afterwards with no population of the pest between 48th and 52nd standard weeks during *rabi* 2014. During summer 2015 season, the highest population (6.33/ leaf) of the pest was recorded during 11th SW. Beyond that, the population decreased although the activity did not stop altogether and the pest was present in sizeable numbers (6.30/ leaf) during 14th SW (Fig. 2). Anitha and Nandihalli (2008) also found, on summer okra crop, sown during last week of March, the incidence of aphids was noticed from first week of April (6.01 aphids/3 leaves). Pal *et al.* (2013) found the first appearance of the pest on 2nd week of May and could last for only three weeks probably due to rising temperature and ageing of the crop. During *kharif* 2015, the incidence commenced from second week of July, which rapidly increased and attained its peak on 31st SW (last week of July) with a mean population density of 6.20 aphids per leaf (Fig. 3). Chundawat and Ameta (2011) reported the initiation of aphid in the second week of August and touching the peak during fourth week of August (86.5 aphids/ten plants). Maximum temperature showed a significant positive correlation with population of aphids during *rabi* 2014. Further, both minimum temperature and average temperature showed a noteworthy positive effect on pest population during *rabi* 2014. During summer 2015, rainfall and wind speed showed significant negative correlation while bright sunshine hours had significant positive correlation on aphid population. On contrary, during *kharif* 2015 wind speed showed significant positive correlation.

Whitefly, *Bemisia tabaci* (Gennadius)

Whitefly incidence was noticed on 15 days old crop during second week of October (41st SW) (Fig. 1) and attained peak during 42nd and 43rd SW. The population of whiteflies on the okra ranged from 4.93 to 2.47 per leaf was observed from 10th to 16th SW (Fig. 2). The crop season *kharif* 2015 witnessed very low activity of adult whiteflies on the okra crop that too during the early growth stages of the crop and the peak population was observed on 28th SW with 2.07 whiteflies per leaf (Fig. 3). These observations are not totally in accordance with Nath *et al.* (2011) and Mohanasundaram and Sharma (2011) who reported peak population of adult whiteflies on okra during the early stage of the crop growth. However, Anitha and Nandihalli (2008) observed the peak densities of adult whiteflies during the fourth week of October while Singh *et al.* (2013) observed during fourth week of September. This variation may be attributed to changes in the agro-climatic conditions and cultivar used for the study. Whiteflies population had significant positive correlation with maximum temperature during *rabi* 2014 and *kharif* 2015 with minimum temperature during *kharif* 2015 and with average temperature during *rabi* 2014 and *kharif* 2015. Rainfall exhibited a significant negative correlation with *B. tabaci* population during *rabi* 2014, summer and *kharif* 2015. Wind speed showed a significant negative correlation with whiteflies population during summer and *kharif* 2015. The findings of Selvaraj *et al.* (2010), Mohanasundaram and Sharma (2011) and Nath *et al.* (2011) supported the present findings, who also reported positive correlation with maximum and minimum temperature and non-significant negative correlation with relative humidity and rainfall.

Two spotted spider mite, *Tetranychus urticae* Koch

During *rabi* 2014, the infestation of *T. urticae* was initially noticed on 49 days old crop at 47th SW (fourth week of November) with a lowest density of 4.83 mites per cm^2 (Fig. 1). The pest population increased rapidly and attained its peak at 49th SW. The mite population on okra crop during summer 2015 was noticed from 15th SW (second week of April) (Fig. 2) with population density of 0.93 mites per cm^2 with early appearance by one week compared to previous season. Thereafter, the mite population increased at an accelerated pace in the succeeding weeks to reach peak of 10.50 mites per cm^2 at 17th SW. Similar trend in the population fluctuation of *T. urticae* was observed in the *kharif* 2015 (Fig. 3), with the incidence of *T. urticae* between 32nd and 38th SW and the population density ranging between 1.07 and 10.33 mites per cm^2. Similar trends in the population fluctuation of spider mite was reported by Mohanasundaram and Sharma (2011) from Delhi, Nath *et al.* (2011) from Uttar Pradesh and Anitha and Nandihalli (2008) from Karnataka, who observed the initiation of *T. urticae* infestation on okra between mid August and first week of September with its peak during the last week of September.

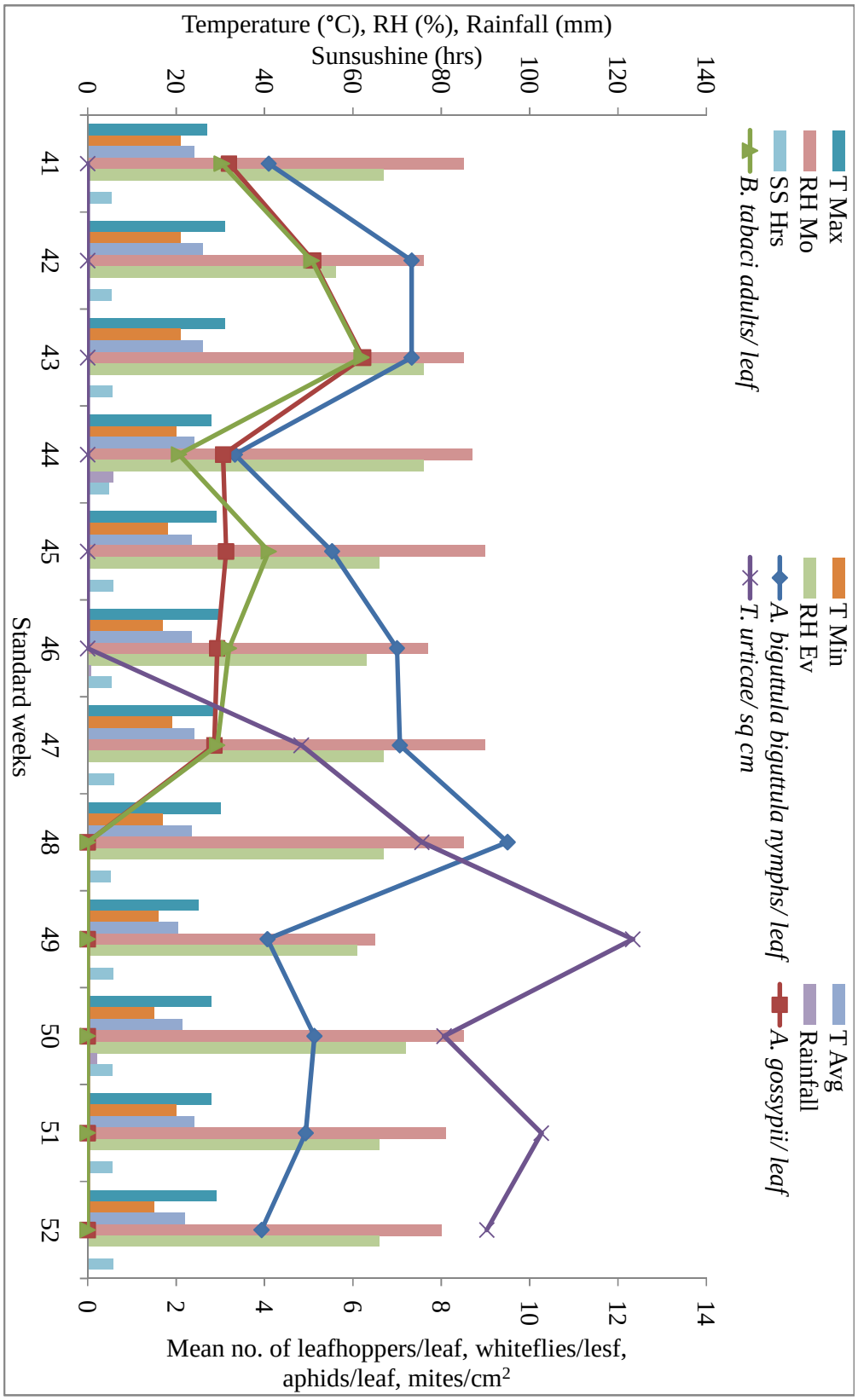

FIGURE 1. Population of *A. biguttula biguttula, A. gossypii, B. tabaci* and *T. urticae* during different standard weeks on okra (*rabi* 2014)

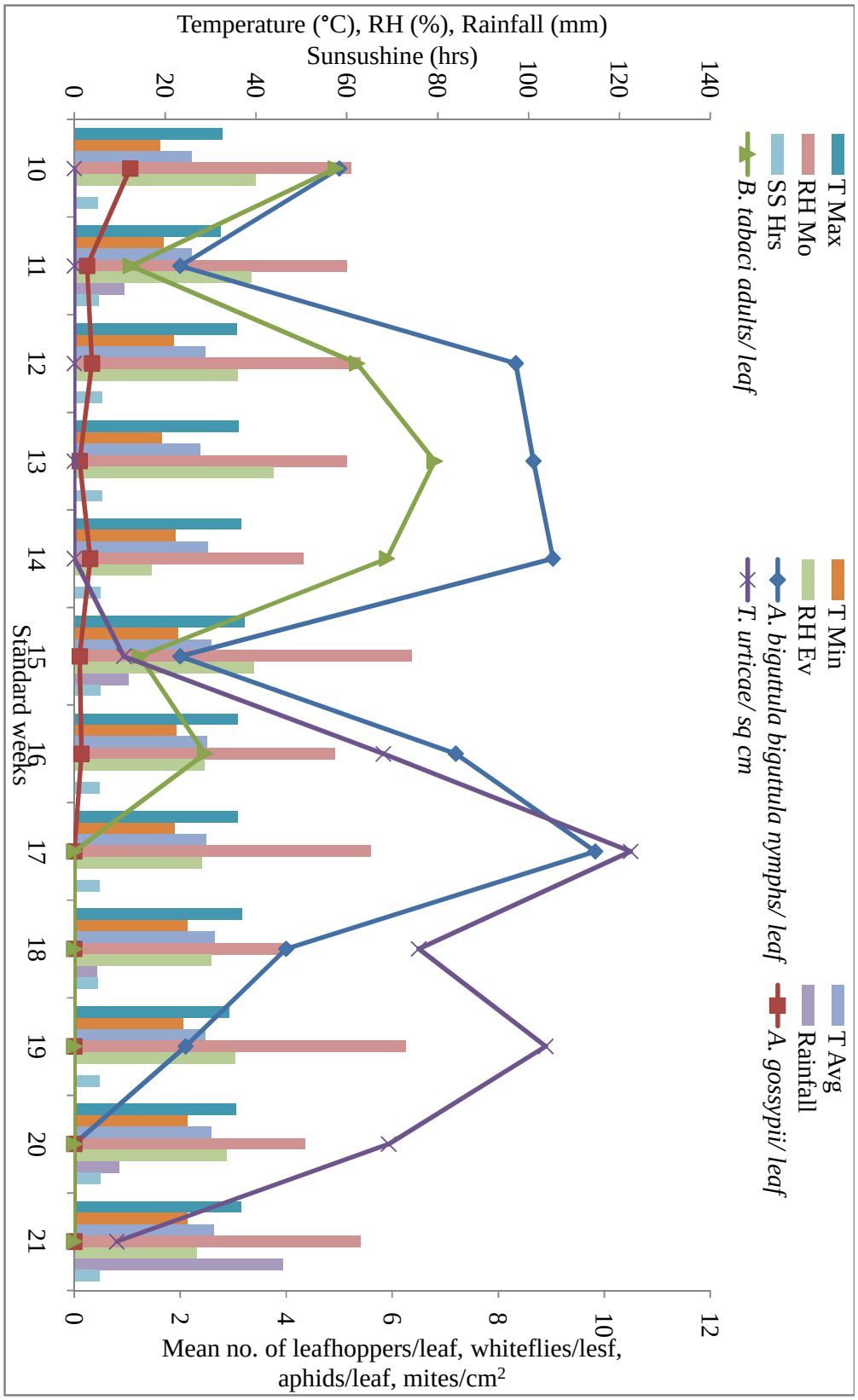

FIGURE 2. Population of *A. biguttula biguttula, A. gossypii, B. tabaci and T. urticae* during different standard weeks on okra (summer 2015)

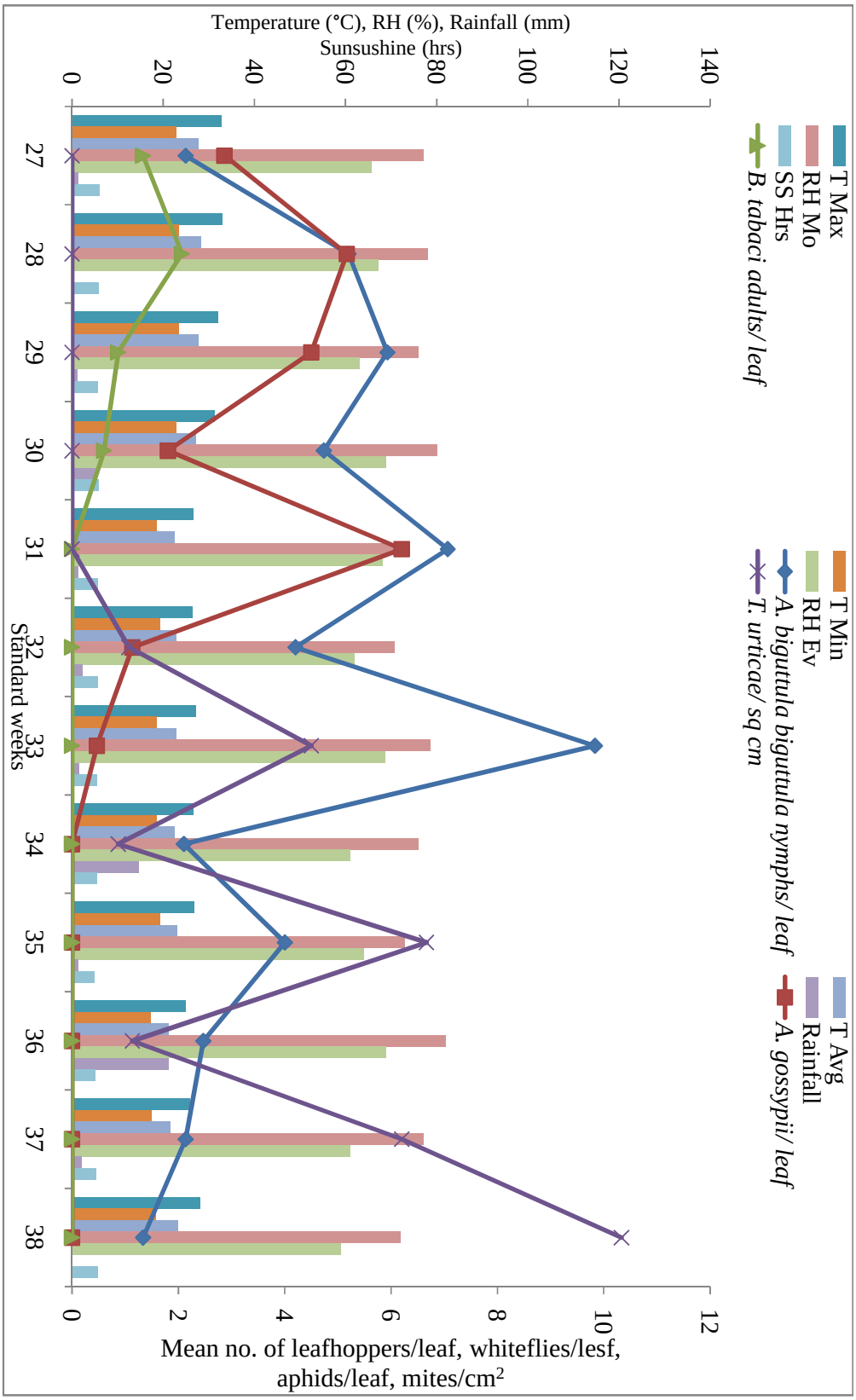

FIGURE 3. Population of *A. biguttula biguttula, A. gossypii, B. tabaci and T. urticae* during different standard weeks on okra (*kharif* 2015

TABLE 1. Correlation matrix between abiotic factors and population of sucking pests on okra

Season	Max. temp. (°C)	Min. temp. (°C)	Avg. temp. (°C)	Morning RH (%)	Evening RH (%)	Rainfall (mm)	Wind speed (km/hr)	Bright Sun Shine (Hrs)
Leaf hoppers								
Rabi 2014	0.83**	0.20	0.68*	0.37	-0.13	-0.61*	-0.11	0.08
Summer 2015	0.45	0.27	0.08	-0.35	-0.43	-0.70*	-0.58*	0.49
Kharif 2015	0.03	0.22	0.09	0.07	0.57*	-0.33	0.35	0.17
Aphids								
Rabi 2014	0.74*	0.62*	0.95**	0.33	0.06	0.28	0.19	0.15
Summer 2015	0.47	-0.13	0.13	-0.52*	-0.33	-0.79*	-0.71*	0.56*
Kharif 2015	0.25	0.24	0.19	-0.26	0.09	-0.49	0.72*	0.10
Whitefly								
Rabi 2014	0.78*	0.39	0.81**	-0.25	-0.11	-0.57*	-0.28	0.43
Summer 2015	0.28	-0.36	0.18	-0.43	-0.16	-0.83**	-0.70*	0.47
Kharif 2015	0.85**	0.64*	0.71*	-0.19	0.08	-0.78*	-0.52*	0.26
Mites								
Rabi 2014	-0.79*	-0.28	0.21	0.24	0.43	-0.11	-0.41	-0.04
Summer 2015	-0.65*	-0.28	-0.60*	-0.12	-0.24	-0.77*	-0.39	-0.25
Kharif 2015	0.66*	-0.15	0.27	-0.36	-0.39	-0.67*	-0.68*	0.08

* Significant at 5%, ** significant at 1%

The mite population had a highly significant negative correlation with maximum temperature during *rabi* 2014 and summer 2015, while mite population had significant positive correlation with maximum temperature during *kharif* 2015. During summer 2015 average temperature had significant negative correlation with the mites population. On the other hand, rainfall exhibited a significant negative effect on mites population during summer and *kharif* 2015. The mite population showed a significant negative correlation with wind speed during *kharif* 2015. The results are in accordance with the observations of Gulati (2004), Mohanasundaram and Sharma (2011), Nath *et al.* (2011) who reported negative effect of minimum temperature on the red spider mite.

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