Study onSeasonal Incidence of Whitefly (*Bemisiatabaci*) and Leafhopper (*Empoascakerri*) onSoybean

ABSTRACT

The investigationtitled "Study on Seasonal Incidence of Whitefly (*Bemisiatabaci*Gennadius) and Leafhopper (*Empoascakerri*Pruthi) on Soybean" was conducted at the Agricultural Research Station (ARS), Adilabad, Professor Jayashankar Telangana State Agricultural University during the kharif seasons of 2017 and 2018. The pooled results revealed that among various sowing dates, namely, 18th-15thof June (sowing I), 28th-25thof June (sowing II), 7th-5thof July (sowing III), 17th-15th of July (sowing IV), and 27th-25thof July (sowing V), sowingI recorded the minimum incidence of the whitefly(*Bemisiatabaci*Gennadius) population (2.00), and the maximum incidence was observed in sowing III (2.77) during *kharif* 2017. In the *kharif* season of 2018, the minimum incidence was noted in sowing IV (4.25), while the maximum was observed in sowing II (5.22). Similarly, the incidence of leafhoppers(*Empoascakerri*Pruthi) was at its minimum during sowing I (2.99 and 4.41) and reached its maximum during sowing III (3.67 and 6.16) in *kharif* 2017 and 2018, respectively.

KEY WORDS: Seasonal incidence,Whitefly, Leafhopper,Soybean, *Kharif*, Sowing dates,Minimum incidence, Maximum incidence.

INTRODUCTION:

Soybean is native to East Asia, where it appears to have been cultivated from a wild species known as 'Glycine soja' starting about 5000 years ago. Soybean (*Glycine max* L. Merril), commonly known as soya, is primarily grown for its protein (40%) and oil (20%) worldwide. The major soybean-growing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka and Telangana. Soybean cultivation in India covers an extensive area of 12.27 million hectares, yielding a total production of 12.99 million tonnes, resulting in a productivity rate of 10,599 kg. ha^{-1}. Among the states contributing significantly to this production, Rajasthan, Gujarat, Madhya Pradesh and Maharashtra hold the top positions, accounting for approximately 20%, 20%, 19%, and 16% of the overall output, respectively (Agricultural Statistics at a Glance 2022).

In India, during 2022-23, the area of the soybean crop is predicted to be 128.92 lakh tonnes compared to 129.95 lakh tonnes in 2021-22, while in Telangana, its production is projected to be 2.87 lakh tonnes for 2022-23, contrasting with 2.66 lakh tonnes in 2021-22.In Telangana, the area under soybean was 3,74,487 acres. Among the districts, Adilabad stood first with 1,01,588 acres, followed by Nirmal (82,006 acres), Kamareddy (69,191 acres), Nizamabad (58,272 acres), and Sangareddy (56,116 acres) (Soybean outlook, August 2023, Agricultural Marketing Intelligence Centre, PJTSAU).

Madhya Pradesh, known as the "Soya state," contributes over 48% of the soybean cropped area. Madhya Pradesh, Maharashtra and Rajasthan account for around 97% of the total land and 96% of the total soybean output in the country. Soybean, cultivated as a *kharif* crop in Telangana, covers an area of 1.77 lakh ha, with a production potential of 2655 tonnes and productivity of 1500 kg. ha^{-1}.

Among the dozen major pests, whitefly (*Bemisiatabaci*Gennadius) and leafhopper (*Empoascakerri*Pruthi) were found to cause extensive damage to the soybean crop in the Adilabad district of

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Telangana. Whiteflies, somewhat similar to aphids, have a high reproductive potential and are notorious for quickly developing resistance to insecticides. For these reasons, whiteflies have historically been major pests of greenhouse plants, commercial vegetables, and cotton. The adults are easily disturbed and often fly up as you walk through a field. The nymphs feed on the undersides of leaves. Whiteflies are sucking insects that feed on plant juices in both the immature and adult stages. Whiteflies produce honeydew on the leaves and other plant parts where sooty mold can develop and inhibit photosynthesis. Whiteflies are most commonly seen on velvetleaf or button weed, and soybean fields with heavy weed populations may have higher whitefly numbers. Leafhoppers feed on soybean leaves and cause injury by sucking sap out of leaves and injecting toxic saliva into the plant. This feeding destroys plant cells and blocks the transport of fluids within the leaves. Leafhoppers make plants wither or completely dry out by sucking the plant sap, leading to yellowing of leaves from the tip downwards.

The population dynamics, distribution and period of infestation of insect pests on crops are highly dependent on weather variables. Understanding the congenial predisposing weather conditions for the multiplication and spread of insects is essential for timely, efficient and cost-effective management. Hence, it is of paramount importance to assess the crucial weather factors responsible for the prevalence of whitefly and leafhoppers. Temperature, relative humidity, and rainfall are among the key abiotic factors that influence whitefly and leafhopper infestation.

MATERIALS AND METHODS

The present experiment was conducted at the Agricultural Research Station (ARS), Adilabad, to study the seasonal incidence of whitefly (*Bemisiatabaci*Gennadius) and leafhopper (*Empoascakerri*Pruthi) on soybean based on different sowing dates and to determine the effect of sowing dates on the incidence of whitefly and leafhopper on soybean crops.

The experimental layout was established at the Agricultural Research Station (ARS), Adilabad, during the kharif seasons of 2017 and 2018. Adilabad is located in the Northern zone of Telangana state at a latitude of 19º 40' 12.00" North and longitude of 78º 31' 48.00" East, with an altitude of 264 m above Mean Sea Level (MSL). The experimental field featured medium black soil with good drainage, low to medium organic matter and potash contents. The pH and soluble salts were within the normal range. Fertilizers were applied at the time of sowing as a basal dose of 30 kg N, 60 kg P2O5, and 40 kg K2O/ha in the form of Urea, Diammonium phosphate, and Murate of potash, respectively.

Soybean variety JS 335 was sown in an area of 1250 sq.m with a plot size of 50 x 5 m. Five sowings were conducted on different dates during *kharif* 2017 (18.06.2017, 28.06.2017, 07.07.2017, 17.07.2017, and 27.07.2017), and similar sowings were done during *kharif* 2018 (15.06.2018, 25.06.2018, 05.07.2018, 15.07.2018, and 25.07.2018). A spacing of 45 x 5 cm was maintained between rows and plants of soybean. The experiment was conducted under unprotected conditions.

For whitefly (*B. tabaci*Gennadius), adults (No. / 3 leaves/ plant) were counted on ten randomly selected tagged plants in each plot. The whitefly populations were recorded at three portions of the plant (top, middle, and bottom canopy) of the tagged plants at weekly intervals.

For leafhopper (*E. kerri*Pruthi), adults (No. / 3 leaves/ plant) were counted on ten randomly selected tagged plants in each plot. The leafhopper populations were recorded with respect to three portions of the plant (top, middle, and bottom canopy) of the tagged plants at weekly intervals

Correlation coefficients between insect pests and weather parameters were calculated by correlating the incidence of insect pests with the corresponding weekly records of meteorological data (Appendices 1), including maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, and rainfall.

RESULTS AND DISCUSSION

The observations recorded on population dynamics of whitefly and leafhopperof soybeanatfivedifferentdatesofsowings*i.e.*,18.06.17(sowingI),28.06.17(sowingII), 07.07.17(sowingIII),17.07.17(sowingIV)and27.07.17(sowingV)during*kharif*,2017 andat15.06.18(sowingI),25.06.18(sowingII),05.07.18(sowingIII),15.07.18(sowing IV) and 25.07.18 (sowing V) during *kharif*,2018 are presented in tables 1 to 5, respectively.

I.Seasonal incidence of whitefly (*Bemisiatabaci*Gennadius) onsoybean.

The incidence of whitefly was observed on all sowing dates during *kharif* 2017. In sowing I, the whitefly population ranged from 0.3 to 5.4 per 3 leaves/plant. Its incidence commenced from the 28th Standard Meteorological Week (SMW) with 0.6 adults/3 leaves/plant and increased gradually, reaching its peak during the 32nd SMW with 5.4 adults/3 leaves/plant. Similarly, during sowing II, the incidence of whitefly populations was noticed from the 29th SMW (1.02 adults/3 leaves/plant) and reached a peak of 3.50 adults/3 leaves/plant during the 38th SMW. Likewise, in sowings III, IV, and V, the whitefly population ranged between 0.40 to 5.40, 1.02 to 3.58, and 1.00 to 3.25 adults/3 leaves/plant with the peak incidence during the 32ndSMW (5.4 adults/3 leaves/plant), 40th SMW (3.58 adults/3 leaves/plant), and 38thSMW (3.25 adults/3 leaves/plant), respectively (Table 1).

During *kharif* 2018, the incidence of whitefly ranged between 3.80 to 6.80, 2.50 to 7.20, 2.95 to 6.20, 3.20 to 5.40, and 2.50 to 6.00 adults/3 leaves/plant, with the highest population in the 38th SMW (6.8 adults/3 leaves/plant), 37th SMW (7.20 adults/3 leaves/plant), 35th SMW (6.20 adults/3 leaves/plant), 36thSMW (5.40 adults/3 leaves/plant), and 38th SMW (6.00 adults/3 leaves/plant) during sowings I, II, III, IV, and V, respectively (Table 2).

During *kharif* 2017, the mean incidence of whitefly population was recorded as 2.0, 2.47, 2.77, 2.40, and 2.14 per 3 leaves/plant during sowings I, II, III, IV, and V, respectively. Among different sowing dates, the incidence of whitefly population was low in sowing I (2.0 adults/3 leaves/plant), followed by a gradual increase in II (2.47 adults/3 leaves/plant) and III (2.77 adults/3 leaves/plant) sowings. Then, the incidence decreased in sowings IV (2.4 adults/3 leaves/plant) and V (2.14 adults/3 leaves/plant).

However, during *kharif* 2018, the lowest incidence of whitefly population was recorded in sowings IV (4.25 per 3 leaves/plant), followed by V (4.36 per 3 leaves/plant), III (4.46 per 3 leaves/plant), and I (5.11 per 3 leaves/plant), respectively. The maximum mean incidence of whitefly population was recorded in sowing II (5.22 per 3 leaves/plant) (Table 5).

The above findings are supported by the Annual Report, AICRP on soybean (1994), Sachan and Gangwar (1980) who reported that the whiteflyincidence could be noticed from July to September. Lin *et al.*

(2002) also observed the population dynamics of *B. tabaci* on soybean and reported its peak on 22nd August; thereafter, the population decreased gradually.

II. Seasonal incidence of leafhopper (*Empoascakerri*Pruthi)onsoybean.

The incidence of leafhopper was observed on all the dates of sowing during *kharif* 2017. In sowing I, the leafhopper population ranged from 1.12 to 4.80 adults/3 leaves/plant. Its incidence commenced from the 28thStandard Meteorological Week (SMW) with 1.12 adults/3 leaves/plant and increased gradually, reaching its peak during the 31stSMW with 4.25 adults/3 leaves/plant. Similarly, during sowing II, the incidence of leafhopper population was noticed from the 29th SMW (2.24 adults/3 leaves/plant) and reached a peak of 3.52 adults/3 leaves/plant during the 33rd SMW. Likewise, in sowings III, IV, and V, the leafhopper population ranged between 1.05 to 5.60, 2.24 to 4.50, and 1.59 to 3.90 adults/3 leaves/plant with the peak incidence during the 32nd SMW (5.60 adults/3 leaves/plant), 37thSMW (4.50 adults/3 leaves/plant), and 37th SMW (3.5 adults/3 leaves/plant), respectively (Table 3).

During *kharif* 2018, the incidence of leafhopper ranged between 2.45 to 6.20, 3.24 to 7.80, 4.50 to 8.60, 3.25 to 6.80, and 2.25 to 6.52 adults/3 leaves/plant, with the highest population in the 35th SMW (6.20 adults/3 leaves/plant), 39thSMW (7.80 adults/3 leaves/plant), 38thSMW (8.60 adults/3 leaves/plant), 37thSMW (6.80 adults/3 leaves/plant), and 40thSMW (6.52 adults/3 leaves/plant) during sowings I, II, III, IV, and V, respectively (Table 4).

During *kharif* 2017, the mean incidence of leafhopper population was recorded as 2.99, 3.27, 3.67, 3.24, and 2.58 adults/3 leaves/plant during sowings I, II, III, IV, and V, respectively. Among different dates of sowings, the incidence of leafhopper population was low in sowings I (2.99 adults/3 leaves/plant) followed by a gradual increase in II (3.27 adults/3 leaves/plant) and III (3.67 adults/3 leaves/plant). Then, the incidence decreased in sowings IV (3.24 adults/3 leaves/plant) and V (2.58 adults/3 leaves/plant). However, during *kharif* 2018, the lowest incidence of leafhopper population was recorded in sowing I (4.41/3 leaves/plant) followed by sowing V (4.56/3 leaves/plant), sowing II (5.38/3 leaves/plant), and sowing IV (5.26/3 leaves/plant). The maximum mean incidence of whitefly population was recorded in sowing III (6.16/3 leaves/plant) respectively (Table 5).

Netam*et al.* (2013) reported five insect species, *viz.*, girdle beetle, tobacco caterpillar, greensemilooper, leafhopper and whitefly, as the major pests of soybean variety JS 93-05 causing damage at various stages of the crop. All these insects made their first appearance on the crop to a greater or lesser extent in the last week of July.

III. Correlation coefficients between whitefly and leafhopper of soybean and weather parameters:

Whitefly (*B.tabaci*Gennadius)

Whitefly population showed significant positive correlation with morning relative humidity at 34 DAS (r = 0.658*), 41 DAS (r = 0.647), 48 DAS (r = 0.719*) and 55 DAS (r = 0.763*). At 48 DAS (r = 0.657*) whitefly population showed significant positive correlation with evening relative humidity (Table 6). Padiwal*et al*. (2007) reported that whitefly population showed positive correlation with all the abiotic factors except maximum temperature which showed non-significant correlation.

Leafhopper (*E. kerri*Pruthi)

A significant positive correlation between maximum temperature and leafhopper population was recorded at 83 DAS (r = 0.663*). However, it also showed significant positive correlation with morning relative humidity at 41

DAS (r = 0.692*) and 76 DAS (r = 0.672*) (Table 7). Positive correlation was observed with morning relative humidity which is in corroboration with Sutaria *et al.* (2010a), Yadav *et al.* (2013) and Patidar (2019).

IV. Simple and multiple linear regressions forwhitefly and leafhopper of soybean with preceding one week weatherparameters:

Whitefly(*B.tabaci*Gennadius)

Simple linear regression indicated that morning relative humidity has influenced13.9 per cent (R^2 = 0.139) of variation in whitefly population at 34 DAS, whereas, in multiple linear regression, morning and evening relative humidity together contributed for 51.2 per cent (R^2 = 0.512) whitefly population at 48 DAS. At 55 DAS, morning relativehumiditycontributedfor38.8percent(R^2=0.388)whiteflypopulationinsimple linearregression. (Table 8)

Leafhopper(*E. kerri*Pruthi)

The simple linear regression for leafhopper population showed that morning relative humidity was responsible for 60.2 per cent (R^2 = 0.602) at 41 DAS and 46.0 per cent (R^2 = 0.460) at 76 DAS. While maximum temperature has influenced for 10.6 per cent (R^2 = 0.106) leaf hopper population at 83 DAS.(Table 8)

CONCLUSION:

Results on seasonal incidence of whitefly and leafhopper on soybean made from seedling to harvest stage during five dates of sowing in *kharif*, 2017 and 2018 revealedthat SowingI(18-06-17)recordedlowwhiteflyincidence(2.00adults/leaf)compared to the sowing III (07-07-17) which recorded maximum incidence (2.77 adults/leaf). Thereafter, the whitefly incidence (2.40 and 2.14 adults/leaf) reduced gradually in late sown crops *i.e.,* sowings IV and V (17-07-17 and 27-07-17, respectively). Similar observations(5.11,5.22,4.46,4.25and4.36adults/leaf,respectively)werealsomadeduring *kharif*, 2018 in all the five dates of sowings (15-06-18, 25-06-18, 05-07-18, 15- 07-18and25-07-18,respectively).Similarly,sowingIrecordedlowleafhopperincidence (2.99 adults/leaf) compared to the sowing III which recorded maximum incidence (3.67 adults/leaf). Thereafter, the leafhopper incidence (3.24 and 2.58 adults/leaf) reduced gradually in late sown crops *i.e.,* sowings IV and V. Similar observations (4.41, 5.38, 6.16,5.26and4.56adults/leaf,respectively)weremadeduring*kharif*,2018inallthefive dates of sowings (15-06-18, 25-06-18, 05-07-18, 15-07-18 and 25-07-18,respectively.

SowingsI(18-06-17and15-06-18),II(28-06-17and25-06-18)andIII(07-07-17and 05-07-18)werefoundtobesuitableforsoybeanevenundernormalinsectpestincidence comparedtosowingsIV(17-07-17and15-07-18)andV(27-07-17and25-07-18)which resulted in lowest yields even though the pest incidence was low during these two late sowing dates.

Among different weather factors, Whitefly population showed significant positive correlation with morning relative humidity and with evening relative humidity. Similarly, leafhopper population showed significant positive correlation with maximum temperature and morning relative humidity.

In case of whitefly simplelinear regression indicated that morning relative humidity was accounted for 13.9 per cent(R^2 = 0.139) pest population at 34 DAS, whereas in multiple linear regression, morning and eveningrelativehumiditywerejointlyresponsiblefor51.2percent(R^2=0.512)whitefly population at 48 DAS. At 55 DAS, whitefly population influenced by morning relative humidity with 38.8 (R^2 = 0.388) incidence in simple linear regression. The simple linear regression for leafhopper population showed that morning relative humidity has responsible for 60.2 per cent (R^2 = 0.602) at 41 DAS and 46.0 per cent (R^2 = 0.460)

incidenceat76DAS.Whileitwasalsoshowedthatmaximumtemperaturehasinfluenced for 10.6 per cent (R^2 = 0.106) leaf hopperpopulation.

FUTURE SCOPE

Further research can build upon these findings to develop more comprehensive and sustainable strategies for managing whitefly and leafhopper infestations and ensuring soybean productivity.

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Table 1: Seasonal incidence of whitefly (*Bemisiatabaci*) on soybean during *kharif*, 2017.

Sowing I		Sowing II		Sowing III		Sowing IV		Sowing V	
SMW	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**
28	0.60	29	1.02	30	1.60	31	1.02	32	1.86
29	2.20	30	1.20	31	5.21	32	1.20	33	1.90
30	3.20	31	1.90	32	5.40	33	1.90	34	2.02
31	3.80	32	2.01	33	4.32	34	2.01	35	2.20
32	5.40	33	2.50	34	4.90	35	2.50	36	2.60
33	3.20	34	2.70	35	3.07	36	2.70	37	3.02
34	1.80	35	2.90	36	1.92	37	2.90	38	3.25
35	0.60	36	3.00	37	2.00	38	3.00	39	2.02
36	0.50	37	3.21	38	1.08	39	3.21	40	1.98
37	0.40	38	3.50	39	0.60	40	3.58	41	1.74
38	0.30	39	3.20	40	0.40	41	2.40	42	1.00
Mean	**2.00**	**Mean**	**2.47**	**Mean**	**2.77**	**Mean**	**2.40**	**Mean**	**2.14**

Table 2: Seasonal incidence of whitefly (*Bemisiatabaci*) on soybean during *kharif*, 2018.

Sowing I		Sowing II		Sowing III		Sowing IV		Sowing V	
SMW	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**	**SMW**	**Whitefly (No./ 3 leaves/ plant)**
28	4.00	29	2.50	30	3.21	31	3.20	32	2.50
29	3.80	30	2.90	31	3.60	32	4.20	33	3.50
30	4.52	31	3.20	32	4.00	33	3.89	34	4.00
31	4.80	32	4.20	33	5.00	34	4.50	35	4.20
32	5.20	33	5.00	34	5.80	35	5.00	36	5.00
33	5.60	34	5.90	35	6.20	36	5.40	37	5.80
34	4.20	35	6.20	36	4.94	37	4.20	38	6.00
35	5.00	36	6.80	37	5.64	38	3.69	39	3.50
36	5.90	37	7.20	38	2.95	39	3.52	40	3.8.0
37	6.40	38	6.40	39	3.69	40	4.20	41	4.50
38	6.80	39	7.12	40	4.00	41	5.00	42	5.20
Mean	**5.11**	**Mean**	**5.22**	**Mean**	**4.46**	**Mean**	**4.25**	**Mean**	**4.36**

Table 3: Seasonal incidence of leafhopper (*Empoascakerri*) on soybean during *kharif*, 2017.

Sowing I		Sowing II		Sowing III		Sowing IV		Sowing V	
SMW	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**
28	1.12	29	2.24	30	3.80	31	2.24	32	2.00
29	2.15	30	2.90	31	4.20	32	2.90	33	2.50
30	3.25	31	3.20	32	5.60	33	3.20	34	2.90
31	4.25	32	3.35	33	5.30	34	3.35	35	3.20
32	4.80	33	3.52	34	5.00	35	3.52	36	3.50
33	3.52	34	4.20	35	4.90	36	4.20	37	3.90
34	3.12	35	4.50	36	4.00	37	4.50	38	2.54
35	3.10	36	3.20	37	3.00	38	3.20	39	2.20
36	2.89	37	3.35	38	2.08	39	3.35	40	2.01
37	2.50	38	3.00	39	1.40	40	2.83	41	2.03
38	2.20	39	2.50	40	1.05	41	2.35	42	1.59
Mean	**2.99**	**Mean**	**3.27**	**Mean**	**3.67**	**Mean**	**3.24**	**Mean**	**2.58**

Table 4: Seasonal incidence of leafhopper (*Empoascakerri*) on soybean during *kharif*, 2018.

Sowing I		Sowing II		Sowing III		Sowing IV		Sowing V	
SMW	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**	**SMW**	**Leafhopper (No./ 3 leaves/ plant)**
28	3.20	29	3.24	30	4.52	31	3.25	32	2.25
29	4.52	30	3.90	31	5.23	32	4.25	33	3.60
30	3.15	31	4.20	32	5.90	33	4.52	34	2.52
31	2.45	32	4.90	33	6.20	34	5.20	35	4.52
32	4.20	33	5.20	34	6.54	35	5.90	36	4.00
33	5.20	34	5.90	35	7.20	36	6.40	37	5.00
34	5.90	35	6.42	36	7.59	37	6.80	38	5.50
35	6.20	36	4.20	37	5.23	38	4.20	39	6.00
36	4.20	37	6.45	38	8.60	39	5.20	40	6.52
37	5.24	38	7.00	39	4.50	40	5.90	41	6.00
38	4.21	39	7.80	40	6.20	41	6.20	42	4.20
Mean	**4.41**	**Mean**	**5.38**	**Mean**	**6.16**	**Mean**	**5.26**	**Mean**	**4.56**

Table 5: Cumulative mean of whitefly (*Bemisiatabaci*) and leafhopper (*Empoascakerri*) on soybean in different dates of sowings during *kharif*, 2017 and 2018.

***Average of 3-meterrowlengths**Significantat5%Figures in parenthesis are angulartransformedvalues**

Treatments	Whitefly (No./ 3 leaves/ plant)	Leafhopper (No./ 3 leaves/ plant)	Treatments	Whitefly (No./ 3 leaves/ plant)	Leafhopper (No./ 3 leaves/ plant)
(Sowing I) 18-06-17	2.00 (1.74)	2.99 (1.99)	**(Sowing I) 15-06-18**	5.11 (2.48)	4.41 (2.33)
(Sowing II) 28-06-17	2.47 (1.87)	3.27 (2.07)	**(Sowing II)25-06-18**	5.22 (2.50)	5.38 (2.53)
(Sowing III) 07-07-17	2.77 (1.95)	3.67 (2.17)	**(Sowing III) 05-07-18**	4.46 (2.34)	6.16 (2.68)
(Sowing IV) 17-07-17	2.40 (1.85)	3.24 (2.06)	**(Sowing IV) 15-07-18**	4.25 (2.29)	5.26 (2.50)
(Sowing V) 27-07-17	2.14 (1.78)	2.58 (1.89)	**(Sowing V) 25-07-18**	4.36 (2.32)	4.56 (2.36)
SE m±	0.003	0.002	**SE m±**	0.002	0.001
CD at 5%**	0.008	0.008	**CD at 5%****	0.005	0.004
CV %	0.34	0.273	**CV %**	0.149	0.118

Table 6:Correlation coefficients between whitefly, *B. tabaci*population on soybean and preceding one week weather parameters:(Pooled data of *kharif*, 2017 and *kharif*, 2018)

Days after sowing (DAS)	Maximum temperature (^{0}C)	Minimum temperature (^{0}C)	Morning relative humidity (%)	Evening relative humidity (%)	Rainfall(mm)
20	-0.388	-0.844**	0.569	0.584	0.307
27	-0.129	-0.703*	0.419	0.421	0.021
34	-0.316	-0.737*	0.658*	0.491	0.350
41	0.018	-0.794**	0.647*	0.228	0.194
48	-0.055	-0.767**	0.719*	0.657*	0.451
55	-0.207	-0.736*	0.763*	0.283	0.112
62	0.074	-0.829**	0.582	0.320	-0.388
69	0.101	-0.817**	0.364	-0.059	0.088
76	-0.196	-0.760*	0.565	0.187	-0.161
83	0.563	-0.683*	-0.312	-0.570	-0.403
90	0.390	-0.748*	-0.112	-0.458	0.551

***Significantat5%** ****Significant at1%**

Table 7: Correlation coefficients between leaf hopper, *E. kerri*population on soybean and preceding one week weather parameters:(Pooled data of *kharif*, 2017 and *kharif*, 2018)

Days after sowing (DAS)	Maximum temperature (^{0}C)	Minimum temperature (^{0}C)	Morning relative humidity (%)	Evening relative humidity (%)	Rainfall(mm)
20	-0.064	-0.455	0.198	0.133	-0.220
27	0.545	-0.121	-0.103	-0.253	-0.526
34	-0.042	-0.381	0.283	0.390	0.276
41	-0.584	-0.696*	0.692*	0.478	0.614
48	-0.457	-0.519	0.547	0.556	0.602
55	-0.076	-0.331	0.494	0.150	-0.241
62	0.126	-0.467	0.247	0.121	-0.531
69	0.025	-0.388	0.138	0.166	0.448
76	-0.175	-0.435	0.672*	0.241	0.094
83	0.663*	-0.269	-0.062	-0.566	-0.487
90	0.549	-0.474	-0.413	-0.526	0.166

***Significantat5%** ****Significant at1%**

Table 8: Simple and multiple linear regressions for whitefly and leafhopperof soybean with preceding one week weather parameters:(Pooled data of *kharif*, 2017 and *kharif*, 2018)

Days after sowing (DAS)	Insect pests	Regression equation	R^2 value
34	Whitefly	Y = -3.593 + (0.90*) X_3	0.139
41	Whitefly	Y = 8.175 + (0.152*) X_3	0.416
48	Whitefly	Y = -7.595 + (0.25*) X_3 + (0.136*) X_4	0.512
55	Whitefly	Y = -9.861 + (0.182*) X_3	0.388
41	Leafhopper	Y = -9.934 + (0.182*) X_3	0.602
76	Leafhopper	Y = -5.081 + (0.125*) X_3	0.500
83	Leafhopper	Y = -19.351 + (0.692*) X_1	0.106

***Significant at 5%, Y = Dependent variable, X1 = Max. temp. (^{0}C), X2 = Min. temp. (^{0}C), X3 = Morning RH (%), X4 = Evening RH (%), X5 = Rainfall (mm)**