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IMPACT OF STAGGERED PLANTING ON THE INCIDENCE OF MAJOR SUCKING PESTS ON SOYBEAN WITH RELATION TO WEATHER PARAMETERS IN THE LOWER GANGETIC PLAINS OF WEST BENGAL INDIA

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ABSTRACT

A study was conducted across two *kharif* seasons of 2024 and 2025 at District Seed Farm, B.C.K.V., Kalyani, Nadia, West Bengal to study the temporal variation in incidence of important sucking pests of soybean under staggered planting system. Important sucking pests were: thrips (*Megalurothrips* sp.) and soybean aphid (*Aphis glycines* Matsumura). The experiment was set out in RBD, with 5 treatments (Different dates of sowing) and four replications for each. Results showed that lowest incidence of thrips (2.67/flower in first year and 2.26/flower in second year) was recorded on D3 (2nd July,2024 and 2025) and the highest incidence (3.04/flower and 2.71/flower in 2024 and 2025, respectively) was recorded in treatment D1 (18th June). Again, lowest incidence of aphid (6.64/10 cm twig in first year and 6.56/10 cm twig in second year) was recorded on D5 (16th July) and highest incidence ((9.64 and 8.44 in those two years, respectively) was recorded in D3 2nd July. Correlation analysis indicated that rainfall had a significant negative effect on thrips population in both the years while evening relative humidity had significant negative effect in 1st year only. Again, maximum temperature had a significant positive effect on aphid population in the 1st year while rainfall had a significant negative effect in 2nd year. Most other weather parameters showed non-significant association with thrips and aphid.

Keywords : Soybean, sowing dates, *Megalurothrips* sp., *Aphis glycines*, weather parameters

Introduction

Soybean [*Glycine max* (L.) Merrill] is among the major oilseed crop around the world. Because of its multi-dimensional uses it is known as “Golden Bean” or “Miracle bean”. It is an excellent source of protein and oil. It is a two-dimensional crop as it contains about 40 to 42% high quality protein and 20 to 22% oil (Sharma *et al.*, 2014). India ranks fourth in area with 12.12 million hectares (29.94 million acres) accounting for 8.86% of the world area and fifth in production with 11.23 million tonnes in 2020-21 (Masih and Saini, 2024). Like other crops, soybean also suffers from different production constraints and biotic stress is an important factor for this. In India soybean was attacked by 273 species of insects (Rawat and Kapoor, 1968) of which, 20 insect pest species have been recorded as major pests infesting soybean (Singh and Singh, 1990). They damage the crop from seedling to maturity and yield loss occurs upto 25% (Gaur and Mongalapu, 2018). West Bengal does not come under the prime soybean growing areas of the country but still it is grown in substantial areas (Anonymous, 2023; 2023a). During 2022-23, soybean was cultivated in an area of 235 ha with productivity of 848 kg/ha and total production stood at 192 tonnes (Anonymous, 2023b). Sowing time significantly influences the damage potential of insect pests as well as the ability of plants to withstand and recover from pest-induced injury (Rusch *et al.*, 2010). Adjustment of sowing time is an important cultural practice for the management of insect pests in crops. Manipulation of the sowing schedule enables the crop to escape its most susceptible growth stage during periods of lower pest incidence. Moreover, altered sowing dates may expose the crop to environmental conditions that are unfavourable for insect pest proliferation but favourable for crop growth and development, thereby reducing pest damage during the critical stages of crop establishment and growth. Again, environmental factors significantly influence the bioecology of insect pests and their damage potential. Therefore, monitoring pest populations in relation to prevailing weather parameters is essential for developing timely and ecologically sustainable pest management strategies. However, practically no information is available on soybean pests and their management in West Bengal and this encouraged us to undertake the present study. The purpose of the present study was to record the influence of differential dates of sowing on incidence of the important insect pests and its correlation with weather parameters.

Materials and Methods

The field experiment was conducted at the District Seed Farm (AB Block) of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal (22˚87'N latitude, 88˚20'E longitude) over two successive *kharif* seasons in 2024 and 2025.The soil of the experimental site is inceptisol type and comes under new alluvial zone of lower Gangetic plain with a pH of 7.1. The experiment was laid out in randomized block design (RBD) comprising of dates of sowing as treatments with four replications for each. The crop was raised following standard agronomic practices in 5m × 4m plots with 30 cm × 10 cm spacing. The treatments were: D1-18th June; D2- 25th June; D3- 2nd July; D4- 9th July; D5- 16th July. Sowing dates were same for both the years. Observations were taken from randomly selected tagged plants and started from three weeks after sowing (WAS) and continued till harvest of the crop at an interval of 7 days. Observations were taken at early morning with minimum disturbance to pests. For collecting data on flower thrips (*Megalurothrips* sp.), ten flowers were randomly selected from five tagged plants per replication and shaken on a white paper to count the number of individuals. For aphid (*Aphis glycines*), total number of individuals per 10 cm terminal shoot was observed and counted using a 10× hand lens. Collected data were suitably converted to their mean and subjected to statistical analysis following standard statistical procedures described by Gomez and Gomez (1984) using MS Excel 2007.

Results and Discussion

Effect of staggered planting on the incidence of flower thrips:

Results (Table 1 and 2) indicated that staggered sowing had considerable impact on incidence and population build-up of thrips on soybean. However, certain treatments (different sowing dates) exhibited comparatively lower pest population build-up than others, and significant differences were observed among some of the treatments. First year results (Table 1) showed that D1(18th June) had highest infestation (3.04 thrips/flower) of thrips followed by D2(25th June). In rest of the sowing dates *i.e.* in D3, D4 and D5 pest population varies from 2.67 - 2.76 thrips /flower. In D1 and D3 thrips population started to occur from six weeks after planting but in D2, D4 and D5 pest appeared one week earlier on the crop. Results showed that pest population varied significantly across different dates of sowing. Significant differences were observed in the weekly flower thrips population in all the five treatments. In case of D1 (18th June), peak thrips population occurrence was recorded at 9 WAS (8.8 thrips/flower). Treatment D2(25th June) recorded lower thrips population as compared to D1(18th June) and the peak (8.6 thrips/ flower) was observed during 9 WAS. The lowest thrips population was recorded in D3 (2nd July) and the peak (7.8 thrips /flower) was recorded during 10 WAS. D4 (9th July) recorded a little higher thrips population as compared to D3 and its peak (8.2 thrips/ flower) was achieved in the 9 WAS. Treatment D5 (16th July) recorded higher thrips population as compared to D4 and the peak (8.2 thrips/ flower) was recorded during 10 WAS.

Similarly in the 2nd year, same trend was followed. Results (Table 2) showed that D1(18th June) had highest infestation (2.71 thrips/flower) of thrips followed by D2(25th June). In rest of the sowing dates *i.e.* in D3, D4 and D5 pest population varies from 2.26 - 2.41 thrips /flower. In D1 and D2 thrips population started to occur from six weeks after planting but in D3, D4 and D5 pest appeared one week earlier on the crop. Results showed that pest population varied significantly across different dates of sowing. Significant differences were observed in the weekly flower thrips population in all the five treatments. In case of D1 (18th June), peak thrips population occurrence was recorded at 9 WAS (8.2 thrips/flower). Treatment D2(25th June) recorded lower thrips population as compared to D1(18th June) and the peak (7.4 thrips/ flower) was observed during 10 WAS. The lowest thrips population was recorded in D3 (2nd July) and the peak (6.4 thrips /flower) was recorded during 10 WAS. D4 (9th July) recorded a little higher thrips population as compared to D3 and its peak (7.2 thrips/ flower) was achieved in the 9 WAS. Treatment D5 (16th July) recorded higher thrips population as compared to D4 and the peak (7.0 thrips/ flower) was recorded during 10 WAS.

Results of the study across two seasons showed that treatment D3 exhibited comparatively lower incidence and population build-up of thrips than the other treatments, whereas treatment D1 recorded the highest thrips infestation, population build-up, and associated damage.

Almeida and Corso (1991) conducted a four-year trial to study the effect of sowing time on bud blight of soybean whose causal agent is TSV virus and which is transmitted by thrips. They stated that the pest population starts declining every time the amount of accumulated rain is over 300 mm and by delaying the sowing time it was possible to drastically reduce the incidence of the disease. It corroborates with our present findings. Thrips were found during late vegetative and flowering stage. Pattar *et al.* (2022) observed that the population of thrips attained peak at 7 weeks after sowing and later declined gradually. This type of succession is also seen in our results but we got our peak 9 WAS. Mishra (1990) found out the effect of sowing dates on thrips population in *kharif* and he stated that lowest population of thrips was seen in 1st July sown crops which also supports our present findings. Variations in pest load among sowing windows may be attributed to changes in crop phenology, prevailing climatic conditions, rainfall pattern, temperature, relative humidity, and other abiotic factors during the crop growth period.

Effect of staggered planting on the incidence of aphid

Results (Table 3 and 4) indicated that staggered sowing had considerable impact on incidence and population build-up of aphid on soybean. However, certain treatments (different sowing dates) exhibited comparatively lower pest population build-up than others, and significant differences were observed among some of the treatments. First year results (Table 3) showed that D3(2nd July) had highest infestation (9.64 aphid/10 cm twig) of aphid followed by D2(25th June). In rest of the sowing dates *i.e.* in D1, D4 and D5 pest population varies from 6.64 – 7.26 aphid /10 cm twig. In D1, D2 D3 and D5 aphid population started to occur from six weeks after planting but in D4 pest appeared one week earlier on the crop. Results showed that pest population varied significantly across different dates of sowing. Significant differences were observed in the weekly 10 cm twig aphid population in all the five treatments. In case of D1 (18th June), peak aphid population occurrence was recorded at 9 WAS (22.2 aphid/10 cm twig). Treatment D2(25th June) recorded higher aphid population as compared to D1(18th June) and the peak (25.4 aphid/ 10 cm twig) was observed during 9 WAS. The highest aphid population was recorded in D3 (2nd July) and the peak (32.6 aphid /10 cm twig) was recorded during 8 WAS. D4 (9th July) recorded a little lower aphid population as compared to D3 and its peak (26.4 aphid/ 10 cm twig) was achieved in the 9 WAS. Treatment D5 (16th July) recorded lower aphid population as compared to D4 and the peak (24.2 aphid/ 10 cm twig) was recorded during 8 WAS.

Similar trend was followed in 2nd year also. Results (Table 4) showed that D3(2nd July) had highest infestation (8.44 aphid/10 cm twig) of aphid followed by D1(18th June). In rest of the sowing dates *i.e.* in D2, D4 and D5 pest population varies from 6.56 – 7.17 aphid /10 cm twig. In D1, D2 and D5 aphid population started to occur from six weeks after planting but in D3 and D4 pest appeared one week earlier on the crop. Results showed that pest population varied significantly across different dates of sowing. Significant differences were observed in the weekly 10 cm twig aphid population in all the five treatments. In case of D1 (18th June), peak aphid population occurrence was recorded at 9 WAS (20.2 aphid/10 cm twig). Treatment D2(25th June) recorded lower aphid population as compared to D1(18th June) and the peak (22.4 aphid/ 10 cm twig) was observed during 8 WAS. The highest aphid population was recorded in D3 (2nd July) and the peak (26.6 aphid /10 cm twig) was recorded during 8 WAS. D4 (9th July) recorded a little lower aphid population as compared to D3 and its peak (24.2 aphid/ 10 cm twig) was achieved in the 9 WAS. Treatment D5 (16th July) recorded lower aphid population as compared to D4 and the peak (24.6 aphid/ 10 cm twig) was recorded during 8 WAS.

Results of the study across two seasons showed that treatment D5 suffered lower incidence and population build-up of aphid as compared to other treatments while treatment D3 recorded the highest incidence of aphid population build up and damage.

Chung, Kwon and Lee (1980) observed the effect of planting dates on soybean aphid and they opined that the highest density of aphid population was shown in the plot planted on July 5 and the lowest in the plot planted on June 20. This outcome supports our present finding. Abdallah (2012) also found out that plants sown in the 1st of June harboured more aphids than those sown in the 15th of April during both seasons. This also partially favours the current finding.

Metwally (1989) in Egypt observed that soybean plants sown in the 20th of April harboured the lowest rate of *A. craccivora* infestation compared to the later sowing date. All these findings completely or partially support our findings. Differences in pest incidence among various sowing windows could be associated with variations in crop phenology, prevailing weather conditions, rainfall distribution, temperature, relative humidity, and other abiotic factors prevailing during the crop growth period.

Table 1: Effect of staggered planting on thrips during 2024

Date of Sowing	Pest population (No. of thrips/ flower) recorded in different dates of observation														Mean
	3WAS	4WAS	5WAS	6WAS	7WAS	8WAS	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS	15WAS	16WAS	
D1 18/06/24	0.0 (0.71)*	0.0 (0.71)	0.0 (0.71)	0.8 (1.14)	4.2 (2.17)	6.8 (2.70)	8.8 (3.05)	8.2 (2.95)	7.4 (2.81)	3.8 (2.07)	2.2 (1.64)	0.4 (0.95)	0.0 (0.71)	0.0 (0.71)	3.04 (1.88)
D2 25/06/24	0.0 (0.71)	0.0 (0.71)	0.4 (0.95)	1.6 (1.45)	6.4 (2.63)	7.6 (2.85)	8.6 (3.02)	6.2 (2.58)	5.2 (2.39)	2.2 (1.64)	1.6 (1.45)	0.4 (0.95)	0.0 (0.71)	0.0 (0.71)	2.87 (1.84)
D3 02/07/24	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	1.2 (1.30)	2.8 (1.82)	6.2 (2.58)	6.8 (2.70)	7.8 (2.88)	7.2 (2.77)	3.6 (2.02)	1.2 (1.30)	0.6 (1.04)	0.0 (0.71)	0.0 (0.71)	2.67 (1.78)
D4 09/07/24	0.0 (0.71)	0.0 (0.71)	0.2 (0.84)	1.4 (1.38)	5.4 (2.43)	6.8 (2.70)	8.2 (2.95)	6.6 (2.66)	4.6 (2.26)	2.8 (1.82)	1.2 (1.30)	0.8 (1.14)	0.0 (0.71)	0.0 (0.71)	2.71 (1.79)
D5 16/07/24	0.0 (0.71)	0.0 (0.71)	0.4 (0.95)	1.6 (1.45)	3.2 (1.92)	6.6 (2.66)	7.2 (2.77)	8.2 (2.95)	6.2 (2.58)	3.2 (1.92)	1.8 (1.52)	0.2 (0.84)	0.0 (0.71)	0.0 (0.71)	2.76 (1.80)
SEm (+/-)	NS	NS	0.08	0.08	0.11	0.12	0.11	0.05	0.08	0.13	0.07	0.09	NS	NS	0.24
CD(5%)	NS	NS	0.23	0.24	0.34	0.37	0.33	0.16	0.25	0.40	0.21	0.27	NS	NS	0.72

Table 2: Effect of staggered planting on thrips during 2025

Date of Sowing	Pest population (No. of thrips/ flower) recorded in different dates of observation														Mean
	3WAS	4WAS	5WAS	6WAS	7WAS	8WAS	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS	15WAS	16WAS	
D1 18/06/25	0.0 (0.71)*	0.0 (0.71)	0.0 (0.71)	1.8 (1.52)	4.8 (2.30)	7.0 (2.74)	8.2 (2.88)	6.8 (2.70)	5.2 (2.39)	2.6 (1.76)	1.2 (1.30)	0.4 (0.95)	0.0 (0.71)	0.0 (0.71)	2.71 (1.79)
D2 25/06/25	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.8 (1.14)	3.2 (1.92)	5.6 (2.47)	6.4 (2.63)	7.4 (2.81)	5.8 (2.51)	4.2 (2.17)	1.8 (1.52)	0.8 (1.14)	0.0 (0.71)	0.0 (0.71)	2.57 (1.75)
D3 02/07/25	0.0 (0.71)	0.0 (0.71)	0.2 (0.84)	0.6 (1.05)	2.6 (1.76)	5.4 (2.43)	6.2 (2.59)	6.4 (2.70)	5.4 (2.43)	3.2 (1.92)	1.2 (1.30)	0.4 (0.95)	0.0 (0.71)	0.0 (0.71)	2.26 (1.66)
D4 09/07/25	0.0 (0.71)	0.0 (0.71)	0.6 (1.05)	1.6 (1.45)	3.2 (1.92)	6.2 (2.59)	7.2 (2.77)	5.6 (2.47)	3.2 (1.92)	3.2 (1.92)	1.6 (1.45)	0.6 (1.05)	0.0 (0.71)	0.0 (0.71)	2.36 (1.69)
D5 16/07/25	0.0 (0.71)	0.0 (0.71)	0.4 (0.95)	1.2 (1.30)	2.4 (1.70)	5.2 (2.38)	6.4 (2.63)	7.0 (2.77)	5.4 (2.43)	3.6 (2.02)	1.4 (1.38)	0.8 (1.14)	0.0 (0.71)	0.0 (0.71)	2.41 (1.70)
SEm (+/-)	NS	NS	0.12	0.13	0.12	0.10	0.10	0.20	0.13	0.13	0.10	0.13	NS	NS	0.15
CD(5%)	NS	NS	0.35	0.38	0.36	0.31	0.29	0.60	0.40	0.40	0.30	0.38	NS	NS	0.44

* Figures in the parentheses are square root transformed value $\sqrt{x+0.5}$.

Table 3: Effect of staggered planting on aphid during 2024

Date of Sowing	Pest population (No. of aphid/10 cm top twig) recorded in different dates of observation														Mean
	3WAS	4WAS	5WAS	6WAS	7WAS	8WAS	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS	15WAS	16WAS	
D1 18/06/24	0.0 (0.71)*	0.0 (0.71)	0.0 (0.71)	3.2 (1.92)	9.6 (3.18)	15.6 (4.01)	22.2 (4.76)	17.2 (4.21)	12.8 (3.65)	8.4 (2.98)	3.2 (1.92)	4.8 (2.30)	0.0 (1.30)	0.0 (0.71)	6.93 (2.73)
D2 25/06/24	0.0 (0.71	0.0 (0.71)	0.0 (0.71)	4.2 (2.17)	7.6 (2.85)	15.2 (3.96)	25.4 (5.09)	16.2 (4.09)	18.6 (4.37)	10.6 (3.33)	11.2 (3.42)	3.2 (1.92)	0.0 (0.71)	0.0 (0.71)	8.01 (2.92)
D3 02/07/24	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	6.4 (2.63)	13.8 (3.78)	32.6 (5.75)	24.8 (5.03)	30.8 (5.59)	8.8 (3.05)	8.4 (2.98)	6.2 (2.59)	3.4 (1.92)	0.0 (0.71)	0.0 (0.71)	9.64 (3.18)
D4 09/07/24	0.0 (0.71)	0.0 (0.71)	3.2 (1.92)	8.6 (3.02)	17.4 (4.23)	15.2 (3.96)	26.4 (5.19)	10.4 (3.30)	14.6 (3.89)	4.2 (2.17)	1.6 (1.45)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	7.26 (2.79)
D5 16/07/24	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	6.2 (2.59)	15.6 (4.01)	24.2 (4.97)	7.6 (2.85)	14.2 (3.83)	12.2 (3.56)	7.2 (2.77)	5.8 (2.51)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	6.64 (2.67)
SEm (+/-)	NS	NS	0.26	0.63	0.61	0.52	0.63	0.55	0.43	0.26	0.15	0.48	NS	NS	0.52
CD(5%)	NS	NS	0.78	1.92	1.84	1.57	1.92	1.66	1.32	0.78	0.45	1.47	NS	NS	1.57

Table 4: Effect of staggered planting on aphid during 2025

Date of Sowing	Pest population (No. of aphid/10 cm top twig) recorded in different dates of observation													Mean
	3WAS	4WAS	5WAS	6WAS	7WAS	8WAS	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS	15WAS	16WAS	
D1 18/06/24	0.0 (0.71)*	0.0 (0.71)	0.0 (0.71)	4.4 (2.21)	12.2 (3.56)	17.2 (4.21)	20.2 (4.55)	17.4 (4.23)	11.2 (3.42)	10.2 (3.27)	5.2 (2.39)	2.8 (1.82)	0.0 (0.71)	0.0 (0.71)	7.20 (2.77)
D2 25/06/24	0.0 (0.71	0.0 (0.71)	0.0 (0.71)	3.2 (1.92)	14.2 (3.83)	22.4 (4.79)	18.4 (4.35)	13.8 (3.78)	14.6 (3.89)	8.4 (2.98)	5.4 (2.43)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	7.17 (2.77)
D3 02/07/24	0.0 (0.71)	0.0 (0.71)	3.2 (1.92)	5.4 (2.43)	11.6 (3.48)	26.6 (5.21)	18.4 (4.35)	22.6 (4.81)	11.6 (3.48)	8.8 (3.05)	6.4 (2.63)	3.6 (2.02)	0.0 (0.71)	0.0 (0.71)	8.44 (2.99)
D4 09/07/24	0.0 (0.71)	0.0 (0.71)	4.2 (2.17)	7.2 (2.77)	14.6 (3.89)	17.2 (4.20)	24.2 (4.97)	14.4 (3.86)	8.8 (3.05)	5.2 (2.39)	2.4 (1.70)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	7.01 (2.74)
D5 16/07/24	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	6.8 (2.70)	11.2 (3.42)	24.6 (5.01)	15.8 (4.04)	10.2 (3.27)	12.6 (3.62)	7.8 (2.88)	2.8 (1.82)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	6.56 (2.66)
SEm(+/-)	NS	NS	0.41	0.27	0.32	0.15	0.60	0.57	0.63	0.52	0.26	0.32	NS	NS	0.63
CD(5%)	NS	NS	1.24	0.81	0.96	0.45	1.81	1.72	1.92	1.57	0.78	0.96	NS	NS	1.92

* Figures in the parentheses are square root transformed value $\sqrt{x+0.5}$.

Effect of weather parameters on thrips:

From Table 5, it can be seen that both maximum temperature (r = 0.289) and minimum temperature (r = 0.290) exhibited non-significant positive correlation with thrips population during first year. Morning relative humidity (RH) (r = -0.385) exhibited non-significant negative correlation but evening RH (r = -0.768*) exhibited significant negative correlation with thrips population. Rainfall (r = -0.776*) showed significant negative correlation with thrips population. Other weather factors like wind speed (-0.227) exhibited non-significant negative correlation and bright sunshine hour (0.376) exhibited non-significant positive correlation with pest population.

During 2nd year, maximum temperature (r = 0.271) and minimum temperature (r = 0.382) exhibited non-significant positive correlation with thrips population whereas wind speed (r =- 0.039) and bright sun shine hour (r = -0.121) showed non-significant negative correlation (Table 5). Other factors like morning RH (r = -0.132) and evening RH (r = -0.063) exhibited non-significant negative correlation with thrips population. Rainfall (r = -782*) also showed significant negative correlation with pest population.

Bhamare *et al.* (2018) showed that rainfall, maximum temperature and afternoon relative humidity exhibited direct negative effect (-1.0295*, -0.6177*, and -0.5925*, respectively) on thrips population of soybean. However, minimum temperature showed direct positive effect (0.6668*) on the population of thrips. It supports the findings of our experiment. Jayanthi *et al.* (1993) opined that populations of *Caliothrips indicus* had a positive correlation with temperature, sunshine, rainfall and morning relative humidity and a negative correlation with evening relative humidity and wind speed. It also partially supports our present findings.

Effect of weather parameters on aphid:

From Table 5, it can be seen that maximum temperature (r = 0.792*) exhibited significant positive correlation whereas minimum temperature (r = 0.535) exhibited non-significant positive correlation with aphid population during first year. Morning RH (r = -0.145), evening RH (r = -0.275), wind speed (r = -0.207) and rainfall (-0.445) exhibited non-significant negative correlation with pest population. Bright sunshine hour (r = 0.337) exhibited non-significant positive correlation with pest population.

During 2nd year, maximum temperature (r = 0.559) and minimum temperature (r = 0.438) exhibited non-significant positive correlation with aphid population whereas morning RH (r = -0.397), evening RH (r = -0.316) wind speed (r =- 0.088) showed non-significant negative correlation (Table 5). Rainfall (r = -0.803*) showed significant negative correlation whereas bright sunshine hour (r = 0.216) exhibited non-significant positive correlation with pest population.

Bhamare *et al.* (2018) found out that rainfall (-1.3583*), maximum temperature (-1.1609*) and afternoon relative humidity (-1.1966*) showed direct negative effect on population of *A. glycines* infesting soybean. It partially supports our present findings. Kandil (2022) reported that maximum temperature (0.739) showed significant positive correlation with aphid population. It also supports our present findings.

Table 5: Correlation of pests with weather parameters

Weather Parameters	**2024**		**2025**	
	Correlation coefficient (r) values in respect of different meteorological variables			
	Thrips	Aphid	Thrips	Aphid
Maximum temperature	0.289	0.792*	0.271	0.559
Minimum temperature	0.290	0.535	0.382	0.438
Morning RH	-0.385	-0.145	-0.132	-0.397
Evening RH	-0.768*	-0.275	-0.063	-0.316
Wind speed	-0.227	-0.207	-0.039	-0.088
BSH	0.376	0.337	-0.121	0.216
Rainfall	-0.776*	-0.445	-0.782*	-0.803*

Conclusion

The two-year investigation on the influence of sowing dates on sucking pests of soybean revealed that the incidence of thrips and aphids varied considerably with crop phenology and time of sowing. In general, pest population remained negligible during the early crop growth stages and gradually increased from 6–7 WAS onwards, reaching peak infestation mostly between 8–10 WAS, followed by a declining trend towards crop maturity. The time of appearance (onset of infestation) of different insect pests did not vary among crops sown on different dates; however, their population abundance and infestation intensity differed significantly. For thrips D1(18th June) showed highest infestation of thrips followed by D2(25th June) and D3(2nd July) showed lowest population in both the seasons. But for aphid, D3(2nd July) showed highest pest population followed by D2 (25th June) and D5 (16th July) showed lowest population in both the seasons. The study indicated that adjustment of sowing time significantly influenced the population dynamics of major sucking pests of soybean. Early sowing during the latter half of June appeared relatively favourable in minimizing aphid infestation, whereas sowing around early July was comparatively less conducive for thrips incidence. Hence, optimum sowing time may serve as an important cultural practice for reducing sucking pest pressure and improving eco-friendly pest management in soybean. Overall, the study also indicated that warm and comparatively dry weather conditions favoured the development of sucking pests in soybean, whereas higher rainfall and relative humidity suppressed their population build-up. Hence, meteorological parameters played an important role in regulating seasonal incidence of thrips and aphids in soybean under the agro-climatic conditions of the Lower Gangetic Plains of West Bengal.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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