Biological Forum – An International Journal 14(3): 1492-1496(2022)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Incidence of Insect Pests on Summer Mungbean in Relation to Weather Parameters

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(Received 21 July 2022, Accepted 26 August, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Mungbean (*Vigna radiata* (L.) Wilczek), generally known as green gram is the most important and often advanced pulse crop. About 38 insect pests, of which 22 are regular visitors have been identified in India from mungbean that causes economic losses in green gram. The current investigation was carried out on the mungbean variety NDM-1 during the Summer of 2021 to find out the role of weather parameters on the incidence of insect pests. The highest incidence of whitefly was found at 17th SMW (11.40 whitefly per cage) and lowest 22nd SMW (1.20 whitefly per cage), whereas it showed a positive and significant correlation with maximum temperature (0.806*) and positive and non-significant correlation with wind speed, sunshine (0.246 & 0.494, respectively), but negative and non-significant correlations with minimum temperature, relative humidity, and rainfall (-0.252, -0.235 & -0.547, respectively). The highest incidence of Jassid was in 19th SMW (7.20 per cage) and the lowest in 21st SMW (1.40 per cage), which had a significant positive correlation with maximum temperature (0.759*), non-significant negative correlation with minimum temperature, relative humidity, wind speed, rainfall (-0.354, -0.185, -0.058, -0.559, respectively). However, it showed a positive and non-significant correlation with sunshine (0.388). The highest incidence of thrips was in the 19th SMW (12.40 per 10 flowers) and the lowest was in the 22nd SMW (3.60 per 10 flowers). It showed a significant positive correlation with the minimum temperature (0.712*), but a non-significant negative correlation with the maximum temperature and sunshine (-0.073 & -0.102, respectively) (0.437, 0.460 & 0.097, respectively). The spotted pod borer incidence peaked in the 19th SMW (4.20 larvae per plant) and was lowest in the 22nd SMW (0.60 larvae per plant). It showed a positive and non-significant correlation with minimum and maximum temperature, relative humidity, wind speed, and rainfall (0.464, 0.088, 0.258, 0.650 & 0.066, respectively), however, it showed a negative non-significant correlation with sunshine (-0.041). The results of the present experiment may be used in the formulation of suitable management strategies against major insect pests of mungbean.

Keywords: Incidence, Summer Mungbean, Insect pests, Weather factors.

INTRODUCTION

Legume crops have a special role in the sustainable cultivation of crops, and pulse crops, which are the main source of protein in the Indian diet, provide extremely nutritious food while also preserving soil fertility and productivity and boosting India's agricultural economy (Sujata *et al.*, 2017). Pulses play a significant role in human nutrition, particularly for low-income populations in developing nations. Legume crops are regarded as a staple food for the underprivileged in India and are also crucial to sustainable agriculture since they increase soil fertility by fixing nitrogen. One significant leguminous crop for diversifying the global cereal-based cropping system is the green gram. By cultivating more than a dozen different types of pulse crops, India holds the distinction of being the world's largest producer of grain pulses (Singh *et al*., 2020).

In India, green gram is grown almost on 4.26 million hectares with an annual production of 2.01 million tones and a productivity of 472 kg/hectare. More than 80 per cent of green gram production comes from 10 states of India. These are Rajasthan, Madhya Pradesh, Maharashtra, Bihar, Karnataka, Tamil Nadu, Gujarat Andhra Pradesh, Odisha and Telangana. In India, Rajasthan covered the highest 42.23 per cent area and 39 per cent production of green gram. In Rajasthan, green gram is grown in a 17.19 lakh hectare area with a production of 7.42 lakh tones (Anonymous, 2019).

About 38 insect pests, of which 22 are regular visitors, have been identified in India from mungbean that causes economic losses in green gram. Chhabra and Kooner (1985) noted 54.90 per cent yield losses caused by pest complex in green gram. Duraimurugan and Tyagi (2014) observed on different green gram varieties, preventable losses owing to pest complex fluctuated from 27.03 to 38.06 per cent, with an average of 32.97 per cent. The major pests of green gram comprise legume pod borer (*Maruca vitrata* Fabrieius), thrips (*Megalurothrips usitatus* Bagnall), whitefly (*Bemisia tabaci* Gennadius), jassid (*Empoasca kerri* Pruthi), pod bugs (*Clavigralla gibbosa* Spinola), blister beetle (*Mylabris pustulata* Thunberg). The minor pests include Bihar hairy caterpillar (*Spilarctia obliqua* Walker), green semilooper (*Anomis flava* Fabricius), galerucid beetle (*Madurasia obscurella* Jacoby), ash weevil (*Myllocerus* sp.), grasshopper (*Oxya* sp.), red spider mite (*Tetranychus* sp.) and stink bug (*Nezara viridula* Linnaeus) on the green gram. Some other insects, *i.e.* red hairy caterpillar (*Amsacta moorei* Butler), tobacco caterpillar (*Spodoptera litura* Fabricius), pumpkin beetle (*Aulacophora foviecollis* Lucas), termite (*Odontotermus* sp.), bean aphid (*Aphis craccivora* Koch), lablab leaf miner (*Cyphosticha* sp.), pulse beetle (*Callosobruchus chinensis* Linnaeus and *Callosobruchus maculatus* Fabricius) and blue butterfly (*Lampides boeticus* Linnaeus) were also reported to visit greengram (Tikoo, 1996; Kooner *et al.*, 2006; Lal *et al.*, 1980; Lal, 1985; Ooi, 1973; Duraimurugan and Tyagi, 2014; Srivatava and Singh, 1976). Keeping the aforementioned considerations in mind above study was doneto determine the impact of abiotic factors on the prevalence of major insect pests in summer mungbean.

MATERIALS AND METHODS

The current investigation was carried out on the mungbean variety NDM-1 during the *Summer* of 2021 at the students' Instructional Farm at the Acharya Narendra Deva University of Agriculture and Technology in Kumarganj, Ayodhya, Uttar Pradesh, India. The plot's dimensions were well-kept at 6 x 6 metres with a 1metre border. The plant-to-plant distance was also kept at 10 centimetres.The seasonal occurrence of insect pests on Mungbean was recorded from five randomly selected places by using the rectangular split cage for whitefly, jassid and visual counts for thrips (per 10 flowers), and pod borers (larvae per plant). The meteorological data of weather parameters were obtained from the Department of Agricultural Meteorology, College of Agriculture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, (U.P.). The correlation coefficient between insect pests' population and weather parameters like minimum and maximum temperature (°), relative humidity (%), wind speed (km/h), rainfall (mm) and sunshine (hrs.) were worked out.

RESULTS AND DISCUSSION

The observations were made at regular intervals to monitor the appearance of major insect pests in the *Summer* of 2021. At weekly intervals, data were collected on the severity of the insect pest complex, which includes whitefly (*B. tabaci*), Jassids (*E. kerri*), Thrips (*C. indicus*), and Spotted pod borers (*M. vitrata*). These data were analyzed in conjunction with the current environmental conditions. The outcomes demonstrated the insect pests were active during different phases of crop growth.

Incidence of Whitefly (*B. tabaci*). The incidence of whitefly was noticed first time during 15^{th} SMW (3.60 whitefly per cage). The peak population was recorded during17^{th} SMW (11.40 whitefly per cage) (Table 1 & Fig. 1). During 17^{th} SMW, the maximum temperature and minimum temperature was 38.50°C & 17.70°C, respectively whereas, the relative humidity was 58.60%, rainfall 0.00mm, wind speed 3.40 km per hrs. and sunshine 7.50 hrs. The minimum population (1.20 whitefly was noticed in 22^{nd} SMW per cage). During 22^{nd} SMW, maximum temperature and minimum temperature were 31.60°C &24.30°C, respectively followed by relative humidity was 78.60%, rainfall 92.80mm, wind speed 4.30 km per hrs. and sunshine 5.80 hrs. The present findings are in conformity with Ahirwar and Bhowmick (2016) who reported the population of *B. tabaci* ranged from 0.40 to 3.81 per six leaves at the peak incidence of whitefly (*B. tabaci*) observed on 17^{th} SMW of April. These findings are also in agreement with Sujatha and Bharpoda (2017) who reported the incidence of whitefly was appeared and remained on the crop from 13^{th} SMW to 17^{th} SMW with one peak (2.44/3 leaves) during 16^{th} SMW.

Incidence of Jassid (*E. kerri*). The population of jassid was noticed for the first time during 15^{th} SMW (1.80 jassids per cage) and continued up to 21^{st} SMW (1.40 jassid per cage) (Table 1, Fig.1). The peak population was recorded at 17^{th} SMW (7.20 jassid per cage) and during this period maximum temperature was 38.5°C and minimum temperature was 17.7°C while, relative humidity, rainfall, wind speed and sunshine was 58.60%, 0.00mm, 3.40km per hrs, 7.50 hrs respectively. The minimum population was noticed at 21^{st} SMW (1.40 jassid per cage). During 21^{st} SMW maximum temperature and minimum temperature were 34.00°C 24.30°C, whereas, the relative humidity, rainfall, wind speed and sunshine were 64.70%, 16.20mm, 3.80 km per hrs and 6.70 hrs, respectively. The present findings are also similar to Kumar *et al.* (2016) who found that the incidence of *E. kerri* started from the 15^{th} Standard meteorological week and continued up to the 22^{nd} Standard meteorological week with the highest population recorded in the 20^{th} Standard meteorological week. The findings are also supported by Selvam *et al.* (2022) who noticed the highest leafhopper population (18.3/three leaves) on the 15^{th} SMW of the summer crop, and the population afterwards decreased. The present findings are also similar to Sujatha and Bharpoda (2017) who observed that the population of jassids was from the 12^{th} SMW and persisted till the 20^{th} SMW during Summer and reached the first peak during the 14^{th} SMW. In the subsequent week, the jassids population was reduced (15^{th} SMW) and again started to build up and reached its second peak during 17^{th} SMW.

Incidence of Thrips (*C. indicus*). The data was recorded from the time of incidence of thrips to the time of maturity of the crop. The thrips population and meteorological data are presented in (Table1 and Fig.1). The incidence of thrips was noticed for the first time at 17^{th} SMW (4.40 thrips per 10 flowers). The mean population of thrips showed its peak of (12.40 thrips per

10 flowers) during the 19th SWM when maximum, minimum temperature, relative humidity, rainfall, wind speed and sunshine were recorded 35.2°C and 23.9°C, 58.70%, 30.20mm, 5.40km per hrs, 6.70 hrs respectively. The minimum population was observed in standard week number 22nd (3.60 thrips per 10 flowers) during *Summer* 2021. During 22nd SMW maximum temperature 31.60°C and the minimum temperature 24.30°C whereas, whereas the relative humidity was 78.60%, rainfall 92.80mm, wind speed 4.30 km per hrs and sunshine 5.80 hrs. The present findings are in agreement with Hansda (2019) reported that the maximum number of thrips (15.3) was recorded in standard week number 18th. The minimum number of thrips 3.0 observed in standard week number 21st. The present findings are conformity with Selvam *et al.* (2022). The highest mean population of thrips (8.5 thrips/plant) was reported in the 15th SMW of the Summer crop, while the lowest population was recorded in the 19th SMW.

Incidence of Spotted pod borer (*M. vitrata*). The data recorded on the larval population of *M. vitrata* at weekly intervals revealed that the larval population of spotted pod borer was the first time noticed at 17th SMW (1.40 larvae per plant) (Table 1 and Fig. 1). The highest population was recorded at 19th SMW (4.40 larvae per plant) and during this period maximum, minimum temperature, relative humidity, rainfall, wind speed, sunshine was 35.2°C, 23.9°C, 58.70%, 30.20mm, 5.40km per hrs., 6.70 hrs, respectively. The lowest larval population was recorded at 22nd SMW (0.60 larvae per plant) during *Summer* 2021. During 22nd SMW maximum temperature 31.60°C and the minimum temperature 24.30°C whereas, whereas the relative humidity was 78.60%, rainfall 92.80mm, wind speed 4.30 km per hrs and sunshine 5.80 hrs. The present findings are in agreement with Sujatha and Bharpoda (2017). The infestation commenced from 13th SMW (0.50 larva/ plant) and remained on the crop till 18th SMW. The highest larval population of *M. vitrata* was observed during 18th SMW. 1.40 larva per plant and gradually decreased in successive three weeks.

Relationship of Insect pests with weather factors

Whitefly (*B. tabaci*). The relationship between the population of whitefly and weather variables during Summer 2021 are presented in (Table 2). The population of *B. tabaci* had a significant positive correlation with maximum temperature (r= 0.806*) and a non-significant and positive correlation was found with wind speed (r= 0.246) and sunshine(r= 0.494). However, a negative and non-significant correlation was noticed with minimum temperature (r= -0.252), relative humidity (r= -0.235) and rainfall (r= -0.547). These findings are also supported by Selvam *et al.* (2022). The population of whiteflies was favorably with mean relative humidity and wind speed, and negatively correlated with rainfall, with other meteorological factors reporting a non-significant association with *B. tabaci*. The present findings are also similar to Singh and Kumar (2011) who revealed that the *B. tabaci* population exhibited a positive non-significant association with minimum temperature and relative humidity and a non-significant negative connection with rainfall. These findings are in agreement with Khaliq *et al.* (2022) reported that the connection between incidence and weather factors revealed that maximum temperature had a positive relationship (r = 0.51) while the minimum temperature and relative humidity- RH (morning) revealed a negative one (r = -0.03 and r = -0.52); and RH (evening).

Jassid (*E. kerri*). The correlation between the population of Jassid and weather parameters revealed that among all the weather parameters, only maximum temperature (r= 0.759*) showed a significant positive correlation with jassid and a non-significant and positive correlation was found between the jassid population and sunshine (r= 0.388) whereas, the negative and non-significant correlation observed between jassid population and minimum temperature ((r=-0.354), relative humidity (r= -0.185), wind speed (r=-0.058) and rainfall (r= -0.559) during Summer 2021 (Table 2). A similar trend was also reported by Singh *et al.* (2019) reported that the relationship between *E. kerri* population with minimum temperature (r=-0.621), relative humidity (r=-0.289) and rainfall showed a negative correlation (r=-0.425) (Table 2). The present findings are also similar to Selvam *et al*. (2022) reported that *E. kerri* negatively correlated with rainfall, wind speed and all abiotic variables showing a non-significant association.

Thrips (*C. indicus*). The incidence of thrips and the minimum temperature had a significant positive correlation (r=0.712*) whereas positive and non-significant correlation was observed between the population of thrips with relative humidity (r=0.437) wind speed (r=0.460), rainfall (r=0.097) (Table 2). A negative and non-significant correlation was observed between the population of thrips with maximum temperature (r=-0.073), and sunshine (r=-0.102). The present findings are similar to the finding of Kumar and Singh (2020) reported that the thrips population showed a positively significant association with minimum temperature whereas, non-significantly correlated with relative humidity. The population of thrips is non-significantly correlated with rainfall. A similar trend was also reported by Patel *et al.* (2010) reported a non-significant positive connection between all meteorological factors and thrips population.

Spotted pod borer (*M. vitrata*). The larval population correlated to weather parameter data and revealed a positive non-significant connection with minimum temperature (r=0.464), maximum temperature (r=0.088), relative humidity (r=0.258), wind speed (r=0.650) and rainfall (r=0.066), whereas, a non-significant and negative correlation was found with sunshine (r=-0.041) during *Summer* 2021 (Table 2). The present findings are in agreement with Umbarkar *et al*. (2010) concluded that the larval population of *M. vitrata* showed a positive non-significant correlation with RH and minimum temperature on the green gram. The findings are also in conformity with Sravani *et al.* (2015) reported that pest population was significantly negatively correlated with maximum relative humidity.

Table 1: Incidence of Insect pests on mungbean in relation to weather factors during *Summer* 2021.

SMW	Mean No. Whitefly per cage	Mean No. of Jassids per cage	Mean No. of Thrips per 10 flowers	Mean No. of spotted pod borer (larvae/plant)	Weather Parameters						
					Temperature (°C)		Relative Humidity (%)	Wind speed (km/h)	Rainfall (mm)	Sunshine (hrs.)
					Min.	Max.				
15	3.60	1.80	0.00	0.00	18.80	33.30	34.50	3.50	0.00	6.20
16	6.80	2.40	0.00	0.00	20.10	37.90	45.60	4.00	0.00	7.20
17	11.40	7.20	4.40	1.40	17.70	38.50	58.60	3.40	0.00	7.50
18	9.40	5.20	9.60	2.20	24.20	36.60	51.60	4.20	0.00	6.90
19	10.60	4.20	12.40	4.40	23.90	35.20	58.70	5.40	30.20	6.70
20	5.80	3.40	8.20	2.00	24.00	33.30	71.60	3.30	34.60	4.30
21	3.80	1.40	10.60	1.10	24.30	34.00	64.70	3.80	16.20	6.70
22	1.20	0.00	3.60	0.60	24.30	31.60	78.60	4.30	92.80	5.80

SMW= Standard Meteorological Week

Table 2: Relationship of Insect pests with weather factors during *Summer* 2021.

Insect Pests	Weather Parameters					
	Temperature		Relative Humidity (%)	Wind speed (km/h)	Rainfall (mm)	Sunshine (hrs.)
	Min.	Max.				
Whitefly	-0.252	0.806*	-0.235	0.246	-0.547	0.494
Jassid	-0.354	0.759*	-0.185	-0.058	-0.559	0.388
Thrips	0.712*	-0.073	0.437	0.460	0.097	-0.102
Spotted pod borer	0.464	0.088	0.258	0.650	0.066	-0.041

*Correlation is significant at the 0.05 level.

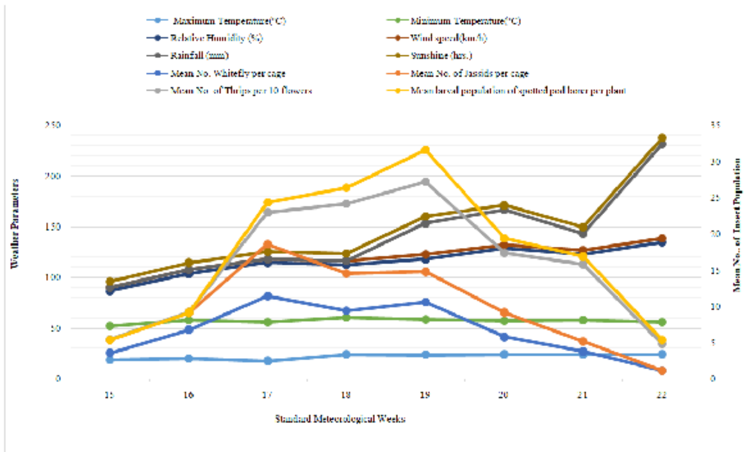

Fig. 1. Incidence of insect pests on mungbean in relation to weather factors during *Summer* 2021.

CONCLUSION

During summer (*Zaid*) 2021; the incidence of insect pests was recorded from germination to maturity stage. The highest incidence of whitefly was found at 17th SMW and showed positive and significant correlation with maximum temperature (0.806*) and positive and non-significant correlation with wind speed, and sunshine (0.246 & 0.494, respectively), but negative and non-significant correlations with minimum temperature, relative humidity, and rainfall (-0.252, -0.235 & -0.547, respectively), whereas, Jassid had a significant positive correlation with maximum temperature (0.759*), non-significant negative correlation with minimum temperature, relative humidity, wind speed, rainfall (-0.354, -0.185, -0.058, -0.559, respectively) and positive and non-significant correlation with sunshine (0.388) and thrips had a significant positive correlation with the minimum temperature (0.712*), but a non-significant negative correlation with the maximum temperature and sunshine (-0.073 & -0.102, respectively) (0.437, 0.460 & 0.097, respectively) with the highest population during 19th SMW. The spotted pod borer incidence peaked in the 19th SMW (4.20 larvae per plant) and was lowest in the 22nd SMW (0.60 larvae per plant). It showed a positive and non-significant correlation with minimum and maximum temperature, relative humidity, wind speed, and rainfall (0.464, 0.088, 0.258, 0.650 & 0.066, respectively), however, it showed a negative non-significant correlation with sunshine (-0.041).

FUTURE SCOPE

The results obtained in the present study may be used in the formulation of suitable weather-based predication models of insect pests infesting summer mungbean.

Acknowledgement. The authors are highly thankful to the Head, Department of Entomology, College of Agriculture, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) India for providing essential facilities and support during the experimentation.

Conflict of Interest. None.

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How to cite this article: Shivendra Pratap Singh, Sameer Kumar Singh and Umesh Chandra (2022). Incidence of Insect Pests on Summer Mungbean in Relation to Weather Parameters. *Biological Forum – An International Journal, 14*(3): 1492-1496.