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Impact of Weather Factors on Major Insect Pest of Brinjal (*Solanum melongena*) at Raisen District of Madhya Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Finding of the investigation on "Impact of weather factors on major insect pest of brinjal (*Solanum melongena*) at Raisen district of Madhya Pradesh,India" was conducted at Agriculture Research Farm, Faculty of Agriculture, Rabindranath Tagore University, Raisen, M.P. during the *Rabi* season of 2020-21 and 2021-22 have been presented below: A total of six insect pest species like *A.gossypii*, *A. biguttula biguttula*, *B .tabaci*, *N. viridula* , *E. vigintioctopunctata* Fabricius and *L. orbonalis* and were recorded from brinjal crop during study period 2020-21 and 2021-22.

Keywords: Weather factor; aphid; jassid; whitefly; fruit borer.

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1. INTRODUCTION

India's diverse climate ensures a plentiful supply of fruits and vegetables. India is the second-largest producer of vegetables in the world, behind China. India produced 21390 metric tonnes of vegetables on 1475 million acres in 2020–21, according to the Ministry of Agriculture and Farmers Welfare. India generated 13154 metric tonnes of brinjal from 758 million hectares in 2020–21 [1]. Many people refer to brinjal as the "King of Vegetables." It is a nutrient-rich food with a high fibre content and few calories. It thus lowers the risk of heart disease and regulates blood sugar levels [2]. Brinjal crop highly affected by different insect pest Different biotic and abiotic elements control the agro-ecosystem that produces crops [3-7]. For instance, due to biotic stressors, insect pests attack the crop from the nursery stage till harvest, greatly reducing the production of brinjal [8-11]. A brinjal crop's quantitative and qualitative losses are heavily influenced by insect pests [12-14]. More than 70 insect pests are attacking brinjal [15]. Jassids (A*mrasca biguttula biguttula*), Aphids (*Aphis gossypii*), Whitefly (*Bemisia tabaci*), leaf roller (*Eublemma olivacae*), shoot and fruit borer (*Leucinodes orbonalis*), epilachna beetle (*Epilachna vigintioctopunctata*), and leaf webber (*Psara bipunctalis*). Brinjal shoot and fruit borer *(L. orbonalis*) were recorded as significant brinjal pests [16,17]. We can efficiently manage those using insecticides with judicious doses.

Among the all insect pest sucking pest create the hug loss of brinjal crop Gangwar and Singh, [16]. We are surviving under the natural system and natural system also includes the weather factors. All the component of weather influences the active and passive activity of insect pest. Aphids, jassids, whiteflies, and lacewing bugs are ubiquitous. So often, these insects are seen on the plant's leaves, especially the delicate portions [18-22]. When they suck the cell sap from leaves and the tender portions of plants, they induce yellowing, distortion, withering, and eventually drying of the affected areas. Additionally, sucking insects act as disease vectors, such as jassids that consume tiny leaves and aphids and whiteflies that cause sooty mold on brinjal [23-26].

Shoot and fruit borer *Leucinodes orbonalis* Guenee is one of the most destructive pests of Brinjal in India [27-30]. *Leucinodes orbonalis* Guenee generally depends on brinjal but sometimes turns towards other solanaceous field crops and maybe on wild hosts Soren et al*.,* [17]. Here we are studying the “Impact of weather factors on major insect pest of brinjal (*Solanum melongena*) at Raisen district of M.P.

2. MATERIALS AND METHODS

The current investigation, which is, “Impact of weather factors on major insect pest of brinjal (*Solanum melongena*) at Raisen, district of M.P. was carried out in the experimental field Agriculture Research Farm, Faculty of Agriculture, Rabindranath Tagore University, Raisen (M.P.) during *Rabi* 2020-21 and 2021-22, coordinates 23°19'58"N 77°46'54"E. Only control plots were used for observation, and 10 randomly chosen plants were chosen for observation twice during a typical week, beginning with the first appearance of the pest and ending with the crop's availability or maturity. At the same time, weather data as per the standard meteorological week (SMW) were recorded. The influence of different meteorological parameters on major insect pest populations was studied by the graphical superimposition technique. Aphid (*Aphis gossypii*) Nymph and adult *A. gossypii* observations were made on two leaves from the upper, middle, and lower /plant canopy, infestations were recorded on 10 randomly selected plants. Jassid (*Amrasca biguttula biguttula*) Nymph and adult *A. biguttula biguttula* observations were made on two leaves from the upper, middle, and lower /plant canopy, infestations were recorded on 10 randomly selected plants. Whitefly (*Bemisia tabaci)* Nymph and adult *B. tabaci* observations were made on two leaves from the upper, middle, and lower /plant canopy, infestations were recorded on 10 randomly selected plants. Green Sting bug (*Nazara viridulla*) -Nymph and adult of *Nazara viridulla* observation were made on per plant. Shoot and fruit borer infestations were recorded on 10 randomly selected plants, similarly, fruit infestation by *L. orbonalis* was judged by counting healthy fruits and fruits damaged by shoot and fruit borer on 10 randomly selected plants. After each observation, damaged fruits were removed. Shoot infestation observations were noted. Soon after becoming aware of the *L. orbonalis* infestation in the shoots and the shoot and fruit borer. By counting healthy plants and plants with shoots infested by the shoot and fruit borer on 10 randomly chosen plants from five different sites, the shoot infestation was determined. Damaged shoots were taken out after each examination. Similarly, fruit infestation by *L. orbonalis* was judged by counting healthy

fruits and fruits damaged by shoot and fruit borer on 10 randomly selected plants. The percent fruit borer infestation was computed as follows: five from different sites. After each observation, damaged fruits were removed.

$$\%\ \text{shootfruit infestation} = \frac{\text{Number of shoots / fruits damaged}}{\text{Total number of shoots / fruits observed}}\ \text{x}\ 100$$

3. RESULTS

The minimum aphid population was recorded in the 25th standard week (SMW) during 2020-21 and 22nd SMW during 2021-22, along with the peak population noticed at the 5th SMW during 2020-21 and 6th SMW during 2021-22. It contributed 44.1% and 40.6% to the total population during 2020-21 and 2021-22, respectively. The maximum population of whitefly was recorded from 14th SMW and 16th SMW during 2020-21 and 2021-22. It contributed 19.2% and 22.7% to the total population during 2020-21 and 2021-22, respectively. The jassid was attacked on the crop plant during vegetative stage and the peak population was recorded from 12th SMW and 16th SMW during study period. It contributed 22.2% and 17.7% to the total population during 2020-21 and 2021-22, respectively. The peak activity of green stink bug was recorded in March month during the both the years. It contributed 1.1% and 1.8% to the total population during 2020-21 and 2021-22, respectively. The hadda beetle population was initiated during, vegetative, flowering and fruiting stages of brinjal crop during both the years. The peak population was recorded on 11th SMW with 5.1 adults /plant/week during 2020-21 and 4.8 adults /plant/week at 13th SMW during 2021-22. It contributed 44.1% and 40.6% to the total population during 2020-21 and 2021-22, respectively. The maximum shoot infestation was recorded from February month. The maximum fruit infestation activity of shoot and fruit borer was recorded at 9th SMW during first year. The richest fruit infestation (56.4%) was recorded on 18th SMW during second year. There was a significant negative correlation between the aphid population and the temperature, relative humidity (RH), and rainfall in first year. There was a negative correlation between maximum temperature, maximum relative humidity, and rainfall in second year. *A. biguttula biguttula* significant negative correlation was calculated between the *B. tobaci* population and abiotic factors such as minimum temperature, wind speed, and rainfall. In contrast, a significant positive correlation was found for maximum temperature A population found a non-significant positive correlation with maximum temperature and a negative with minimum temperature, wind speed, and rainfall in the first year. The green stink bug population correlation was non-significant negative with maximum temperature, wind speed & rainfall during the stud. The *E. vigintiocto punctata* population was founded significant negative correlation with minimum temperature, maximum & minimum RH and rainfall during both the years except remaining factors. The correlation between shoot infestation and abiotic factors was calculated and founded that non-significant negative with maximum temperature during both the years. The shoot infestation was found significant negative correlation with minimum temperature, maximum & minimum RH, wind speed and rainfall.

4. DISCUSSION

Aphids first appeared at the vegetative stage of the crop at 43rd SMW during 2020-21 and 44th SMW during 2021-22. A peak aphid population was recorded on 5th and 6th SMW during 2020-21 and 2021-22, respectively. The present findings are in line with Rashid et al. [31]; Rathore et al. [32] observed a peak population of aphid (91.8 aphids/5 leaves/week) in the last week of February [33].

After first appearance of whitefly population peak was recorded from 14th SMW with 12.3 whiteflies/plant/week during 2020-21 and on 16th SMW with 8.9 whiteflies/plant/week during 2021-22. The finding is supported by funding of Deole [34] who founded maximum population activity of whitefly was recorded in the began first week of April with mean density of 6.33 whiteflies/ plant/week.

The *A. biguttula biguttula* infestation was initiated during vegetative stage of the crop with lowest population (0.3 *A. biguttula biguttula/plant /weeks*) during 2020-21 and 0.2 *A. biguttula biguttula*/plant/week during 2021-22. The maximum pest activity was recorded during February to April during both the years. The peak population was recorded from 12th SMW and 16th SMW during 2020-21 and 2021-22. These results are in confirmatory with the findings of Rashid et al. [31] that recorded a peak population of *A. biguttula biguttula* was recorded during April month.

Table 1. Seasonal incidence of insect pests of brinjal during 2020-21 and 2021-22

SMW	Mean population (No. of insect's/plant/week)									
	A. gossypii		*B. tabaci*		*A. biguttula biguttula*		*N. viridula*		*E. vigintioctopunctata*	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
43	0.2	0	0	0	0	0	0	0	0	0
44	0.8	0.2	0	0	0.3	0	0	0	0	0
45	1.2	0.4	0.3	0	0.3	0	0	0	0.2	0
46	2.2	0.8	0.7	0.1	0.7	0.2	0	0	0.3	0
47	3.8	1.8	0.9	0.4	1.4	0.4	0	0	0.4	0.2
48	4.7	2.7	1.2	0.8	1.7	0.8	0	0	0.3	0.5
49	6.9	3.8	1.5	1.0	2.2	1.0	0	0.2	0.4	0.4
50	8.7	3.9	2.3	1.1	2.9	1.0	0	0.1	0.6	0.4
51	9.9	4.9	2.9	1.9	4.1	1.2	0.1	0.1	1.2	0.6
52	10.8	7.6	3.0	2.0	3.7	1.4	0.1	0.3	1.3	0.7
01	14.1	8.9	3.8	2.7	4.8	1.3	0.2	0.3	1.5	0.5
02	16.9	10.2	4.9	3.6	5.3	1.5	0.3	0.5	1.6	1.3
03	22.6	14.2	5.5	4.2	5.9	1.8	0.3	0.4	1.5	1.5
04	28.8	17.9	5.6	4.9	6.2	2.0	0.5	0.5	2.7	1.8
05	36.6	20.4	6.6	5.1	7.7	2.4	0.4	0.3	2.9	2.2
06	36.2	20.6	6.6	5.1	9.6	3.0	0.7	0.5	3.5	2.5
07	35.1	19.5	7.5	5.2	9.3	3.2	1.0	0.6	4.5	2.8
08	28.6	17.3	7.8	6.7	10.8	3.5	1.3	0.9	4.6	2.7
09	27.3	15.6	8.0	6.9	11.9	3.5	1.5	1.0	4.8	3.6
10	23.9	14.2	8.1	7.0	12.9	3.8	1.7	1.2	5.0	3.9
11	20.4	14.0	9.2	7.1	12.9	4.2	1.1	1.4	5.1	4.5
12	16.5	12.4	10.2	7.0	15.9	5.8	0.7	1.2	4.7	4.5
13	13.6	10.2	10.4	7.2	14.5	6.1	0.4	1.0	4.1	4.8
14	11.9	12.0	12.3	8.0	14.6	9.1	0.2	0.4	3.2	4.1
15	9.1	8.5	10.5	8.6	10.6	10.2	0	0.2	3.0	3.1
16	7.4	4.1	9.5	8.9	8.6	10.3	0	0.1	2.1	2.1
17	5.6	2.3	8.4	6.2	7.3	9.4	0	0	1.5	2.0
18	5.3	1.1	8.1	5.5	5.9	8.8	0	0	1.5	1.2
19	4.1	0.4	5.0	5.2	5.9	5.6	0	0	1.2	0.2
20	3.8	0.4	7.8	5.1	5.2	4.3	0	0	0.4	0.1
21	2.3	0.2	8.2	5.0	3.4	3.5	0	0	0.2	0.2
22	1.5	0.1	5.0	4.2	3.2	2.1	0	0	0.1	0.3
23	0.8	0	2.1	2.0	1.5	1.0	0	0	0.1	0.1
24	0.3	0	0.4	1.1	0.7	1.2	0	0	0	0.2
25	0.1	0	0	0.4	0.3	1.0	0	0	0	0.1

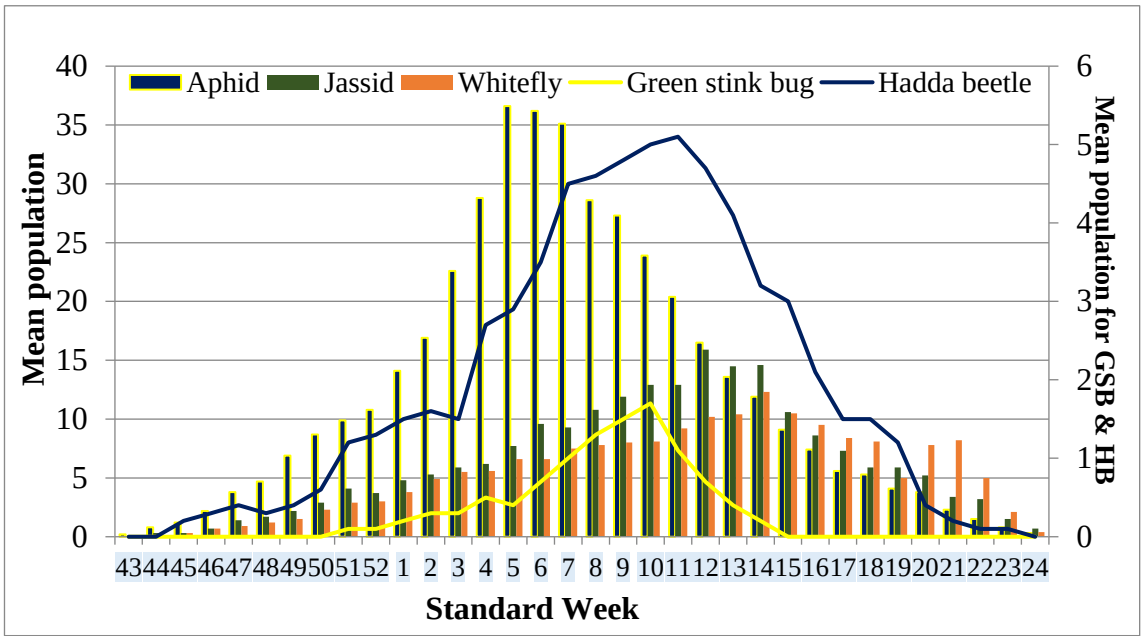

Fig. 1. Seasonal incidence of insect pest of brinjal crop during 2020-21

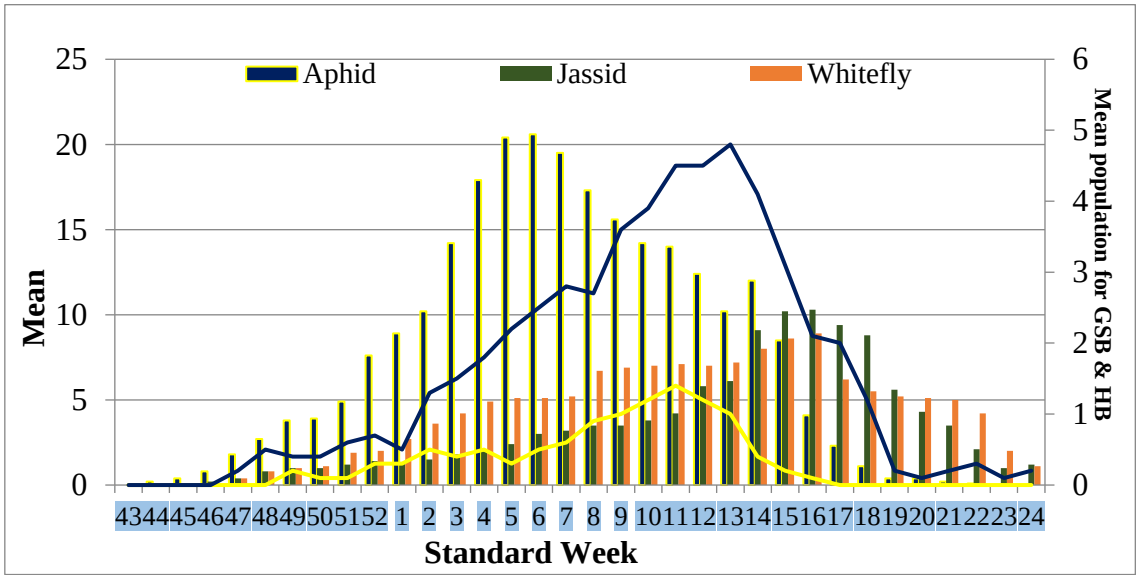

Fig. 2. Seasonal incidenceof insect pest of brinjal crop during 2021-22

The activity of *N. viridula* was recorded from 51st SMW to 14th SMW during 2020-21 and 49th SMW to 16th SMW during 2021-22. The peak activity of pest was recorded in March month during the both the years whereas the first appearance of green stink bug on brinjal was observed at 44th SMW and 43rd SMW during Rabi season 2020-21 and 2021-22 by Chaukikar et al., [35].

The *E. vigintioctopunctata* population was initiated during, vegetative, flowering and fruiting stages of brinjal crop during study period 2020-21 and 2021-22. However, similar results were also reported by Jaiswal et al. [36] who noticed activity of *E. vigintioctopunctata* from the vegetative to the maturity stages of the brinjal crop.

The insect activity was observed from first appeared at 2nd SMW to 15th SMW during 2020-21 and 4th SMW to 25th SMW during 2021-22. The maximum shoot infestation was recorded from 8th (18.9%) and 9th (15.2%) SMW during

2020-21 and 2021-22, respectively. The present finding is also following the result of Kumar and Singh [37]; Kumar et al. [38] noticed the activity of shoot and fruit borer throughout the cropping season, whereas Shaik [39], Devi [40], and Deole [34] recorded maximum shoot and fruit infestation during April to May.

4. CONCLUSION

A total of six insect pest species *viz*., *A. gossypii*, *A. biguttula biguttula*, *B. tabaci*, *N. viridula* , *E. vigintioctopunctata* and *Leucinodes orbonalis* and were recorded the peak population of aphid was recorded during winter season during both the years and it was contributed 44.1% and 40.6% to total insect population during respective years. The maximum population of *B. tabaci* and *A. biguttula biguttula* was recorded around 14th SMW and 16th SMW during both the years and it contributed 19.2% & 22.7% and 22.2% and 17.7% to the total insect pest population during 2020-21and 2021-22, respectively. The peak activity of *N. viridula* was recorded in March month and it contributed 1.1% and 1.8% to the total population during 2020-21and 2021-22, respectively. The peak population of *E. vigintioctopunctata* was recorded on 11th SMW (2020-21) and 13th SMW (2021-22). The maximum fruit infestation activity of *L. orbonalis* was recorded at 9th SMW (2020-21) and 18th SMW (2021-22). A significant negative correlation was calculated between the *B. tobaci* population and abiotic factors such as minimum temperature, wind speed, and rainfall. The *E. vigintioctopunctata* population was founded significant negative correlation with minimum temperature, maximum & minimum RH and rainfall.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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