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To study about the seasonal incidence *Jassid* and *Hadda* beetle of Brinjal (*Solanum melongena* L.)

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Abstract

The Solanaceae family includes brinjal (*Solanum melongena* L.), often known as eggplant, aubergine, garden egg, baingan, vankai, etc. It is one of the most significant main vegetables that is widely grown in tropical and temperate regions of the world (during the summer). India is regarded as the origin and diversification center for brinjal. Individually, brinjal leaves and seeds are also used as stimulants and necrotics. The main commercial vegetable crop grown all year round in India is the brinjal. Weather conditions therefore play a significant influence in the biology of any pest because environmental factors affect the number and dispersion of pests. The most important abiotic factor affecting an insect's pace of growth and development is temperature, which is particularly essential because controlling insects as pests requires precise timing. However, relative humidity and rainfall are also significant factors that have a significant impact on an insect species' activity. The relationship between abiotic conditions and pest activity aids in determining when to apply various management strategies to manage insect pests. Therefore, an effort has been made to evaluate the dynamics of Hadda and Jassid populations at various growth stages and the nature of damage they cause.

Keywords: Seasonal incidence, *Jassid* and *Hadda* beetle, brinjal, vegetable crop

Introduction

In terms of vegetable production, brinjal (*Solanum melongena* L.) ranks third in India. It has 2n = 24 chromosomes and belongs to the Solanaceae family. More than 2000 species in 75 genera make up the family. There are three primary species of "*Solanum*": *escullantum*, which is huge and round, serpentium, which is long and slender, and depressum, which is a dwarf brinjal. Since people on the Indian subcontinent have been growing brinjal for the past 4,000 years, India is where it first appeared. The nightshade known as the brinjal (*Solanum melongena*), sometimes known as the aubergine, is cultivated for its edible fruit. While aubergine is the French word used in British English, brinjal is the common name in North America, Australia, and New Zealand. It is referred to as brinjal in South Asia and South Africa. In tropical and subtropical areas of the world, farmers frequently grow the vegetable brinjal. In the warm regions of the Far East, brinjal is very important, and it is widely grown in India, Bangladesh, Pakistan, China, and the Philippines. It is also well-liked in the US, France, Italy, and Egypt. It is one of the most prevalent, well-liked, and important vegetable crops growing in India, with the exception of higher altitudes. It is a flexible crop that may be grown all year long and is suitable to many agro-climatic areas. Despite being an annual crop, it is perennial in nature. India produces a wide variety of cultivars, with consumer preference based on fruit color, size, and form. The fruit is frequently utilized in cuisine. The vitamin, mineral, and nutrient content of brinjal is principally responsible for its excellent nutritional worth and health advantages. Vitamins C, K, B6, thiamin, niacin, magnesium, phosphorus, copper, dietary fiber, folic acid, potassium, and manganese are all abundant in brinjal. A non-starchy vegetable with few calories and carbohydrates, brinjal. Foods with a low glycemic index don't cause blood sugar levels to rise as quickly as other carb-containing foods. 100 g of brinjal fruit has 92.70 percent moisture, 0.1 g of fat, 5.7 g of carbohydrate, and 1.0 g of protein in terms of nutrition. Numerous vitamins and minerals are also present, including B1, B6, folic acid, copper, manganese (0.25 mg), magnesium (14 mg), potassium (230 mg), and 10% of the recommended daily intake of fiber. It has a higher concentration of anthocyanin, phenols, glycol alkaloids (solasodine), and amide proteins. It also has more free reducing sugars. Due to the presence of saponins and glycol alkaloids, brinjal fruit is bitter.
The vegetable crop brinjal typically self-pollinates.

Cross-pollination is said to occur frequently, with rates ranging from 2% to as much as 48%. Due to the hardiness of the crop, the relatively big size of the blossoms and the greater quantity of seeds in a single fruit, brinjals continue to be a favorite among breeders for the exploitation of hybrids. A significant number of high producing F1 hybrids must also be developed due to regionally varying customer approval.

However, the current productivity and production of brinjal are insufficient to ensure the growing population's nutritional security. Regional preferences for fruit size, shape, flavor, color, and other characteristics also exist since different cultivars of brinjal exhibit quite different variations in these characteristics. Being a significant source of nutrients derived from plants, identifying genotypes with higher nutrient content and better consumer preference may be advantageous for society, especially for low-income consumers. The local genotypes' productivity ranged from 10 to 18 t/ha. Despite being a fairly common crop, only a small amount of research has been done to date in India using local germplasm to develop hybrids and hybrid derivatives with high yield potential and better quality. The phenomena of heterosis in F1 hybrids may also represent the parental lines' general combining capacity (GCA) and specialized combining ability (SCA). The basic tool for increased crop output in the form of F1 hybrids is the capacity for combining.

Brinjal is a top-notch dietary fiber source. In particular, the nasunin contained in brinjal skin, which gives it its purple color, is a powerful antioxidant and free radical scavenger that has been demonstrated to protect cell membranes from damage. Brinjal are high in antioxidants. Nasunin maintains the health of your heart and circulatory system by assisting in the removal of plaque accumulation in the blood vessels. Brinjal is a fantastic food that can aid with weight loss. Brinjal is a low-carb, nutrient-dense, and calorie-poor diet because it has a high concentration of nutrients but little calories or carbohydrates. Only eight grams of carbohydrates-two of which are fiber-make up one cup of brinjal. Their leaves and roots are known to contain the alkaloid solanine. Treatment for diabetes, asthma, cholera, bronchitis, and dysuria are a few of the medical conditions that brinjal is used for. The administration of fruits and leaves lowers blood cholesterol levels. The properties that cause menstruation are more abundant in brinjals. These characteristics of brinjals may also cause abortion. These are also bad because they might lead to acidity issues, so it is advised that pregnant women avoid eating brinjal. However, brinjal on its own is a nutrient-dense food that can supplement your diet with important vitamins and minerals. The method of cooking a brinjal affects its flavor. Its mild flavor is comparable to that of other fruits from the gourd family, such squash, but it also has certain distinctive qualities of its own. Its flavor is a little bit more acidic than squash's. It tastes great in a stew with brinjal, feta cheese, kalamata olives, onion, and tomato.

Research methodology: The incidence of major insect-pests and their natural enemies was recorded at weekly intervals in the first experiment at 15 days after transplanting in respective years till the harvest of the crop. The following methods are adopted for recording seasonal incidence for different insect- pests.

Pesticide Spraying: After one month of seeding, the first spraying was performed, followed by the second, third, and fourth treatments, which were spaced 15 days apart from each other. The impact of pesticides on the main natural enemies and pests of brinjal was researched.

Nimbicidine and *endosulfan* concentrations were measured using a micropipette to determine the appropriate amount of insecticides based on the active in gradient. Water was then added as needed. In plastic containers, the pesticide concentration was prepared for field application. The formulation was only slightly diluted soon before spraying. A hand sprayer with a 2-liter capacity was used for the spraying. According to the plan, the Trichocards (*Trichogramma chilonis*) were planted in the field at a rate of 5 lac eggs/ha.

Results and Discussion

Seasonal incidence

These weekly observations of the seasonal incidence of the following insect pests, which were correlated with the experimental period's average evaporation, rainfall, sunshine hours, temperature, and relative humidity to determine when they were active during various stages of crop growth, are presented here.

Jassid (*Amrasca biguttula* Ishida)

Nymphs and adults in the *A. biguttula* population have been found to act differently in the early life stages. Nymphs and adults are typically located on the lower surface of leaves and harm plants by sucking the cell sap from delicate areas. Furthermore, it is clear that crop early stages are associated with *A. biguttula* infestation. When leaf incidence was only 7.74%, showed that jassid first appeared on Kharif brinjal leaves in the third week of August with an intensity of 0.11 Jassid/leaf. The third week of October saw the highest jassid population, with an intensity of 1.26 jassid/leaf. Infestation levels and intensity decreased steadily throughout November, and there was no jassid damage during the fourth week of November in 2009.

Based on the correlation coefficient values, the influence of environmental factors on the jassid population was calculated. Maximum temperature had a non-significantly positive impact on pest incidence and intensity, while minimum temperature had a considerable negative impact. The infestation of jassid had a negative and substantial connection with relative humidity. Rainfall and jassid infestation were shown to be unrelated.

Jassid is one of the main pests that affect the brinjal crop. From the third week of August to the third week of November, its occurrence on new tender plants was noted. From the third week of October onward, the jassid population gradually grew and remained higher (ranging between 65.33 and 75.55 percent incidence and 1.26 and 1.42 jassid/leaf intensity both years), before gradually declining by the third week of November. Evening relative humidity and rainfall had a very unfavorable impact on the jassid infestation's intensity. These results are consistent with those. Additionally, a maximum of 1.82 jassid/leaf was recorded from mid-October to middle-November, and the dry season (no rainfall) had a significant impact on the jassid population's growth. In the current study, it was discovered that evening relative humidity and rainfall had a considerably detrimental impact on the severity and infestation of the jassid in both years. The population of jassid correlated positively with minimum temperature, RH, and wind speed, but negatively with maximum temperature and wintertime precipitation. Additionally, they noticed a significant negative association with rainfall and a significantly positive correlation between the jassid population and maximum temperature. The conclusions of the current inquiry virtually exactly match those reported above.

Hadda beetle (*E.vigintioctopunctata*)

From the third week of August to the third week of October, the hadda beetle was observed to be active on the crop, with an incidence ranging from 2.19 to 30.00 percent and 0.02-0.35 insects per leaf. There was a lower population at first, but it gradually increased until the second week of September, when there was a 30.00% incidence and a maximum intensity of 0.35 beetles/leaf. Later, the population gradually decreased and kept only a 2.19 percent incidence with 0.02 leaf-eating beetles per leaf up until the third week of October. After the last week of October, when that pest had completely vanished.

Regarding the relationship between the hadda beetle population and the weather, there is a highly favorable relationship between the maximum and minimum temperatures, the minimum relative humidity, and evaporation. Maximum relative humidity was shown to have a non-significant positive connection with rainfall and sunshine hours.

The hadda beetle was shown to be active from the third week of August to the third week of October. The epidermal layer of leaves was where the grubs and adults were discovered eating. In the second week of September, and in the third week of September, the hadda beetle population reached its peak (0.35 beetles per leaf with an incidence of 30%). The infection lasted from the third week of August until the middle of October, with the peak population of 0.22 beetles per leaf occurring in the middle of September. The population progressively decreased until it vanished, most likely as a result of the crop's maturity as well as the drop in temperature and humidity. On crops planted in July, *epilachna* beetle infestation peaked in the months of August through October. The findings on the impact of temperature (maximum and minimum) showing a significantly positive role on fluctuation of incidence of hadda beetle on both years are consistent, findings that population of *hadda beelte* had a positive association with maximum temperature in winter but a negative relationship with maximum temperature in summer. All of these observations are identical to the data gathered during the current inquiry.

Evaluation of IPM modules against major pests

Jassid (*Amrasca biguttula* Ishida)

Almost all of the modules reduced the jassid population more effectively than the control did. These findings indicate that after the first day of spraying, the jassid population in different modules ranged from 3.25 to 15.98 jassid/ten plants. In the endosulfan (M3) module, the jassid population was maintained at a minimum of 6.17. Other modules used on the crop had an intermediary effect on reducing the jassid population, with a range of 6.25 to 14.03 per ten plants. After seven days of the initial spraying, the jassid population, which was about equivalent to control, was unaffected by the Trichogramma (M4)-containing module.

The best result was recorded with endosulfan (M3) at 14 days following the initial spraying, when the jassid population was at its lowest (10.19). The effectiveness of Achook alone or in conjunction with endosulfan on okra was also documented, supporting the current experiment. Endosulfan was used first, then Achook, which effectively controlled the sucking pests (*Aphis gossypii* and *Amrasca biguttula*).

Nimbecidine-endosulfan-Trichogramma (M13), which was similarly effective with module M8 (*Nimbecidine-endosulfan*), recorded a minimum 6.33 jassids per ten plants. After the first day of the second spraying, other modules were also helping to reduce the jassid population, which ranged from 8.07 to 18.15.

The minimum 8.12 jassid was found in the Nimbecidine - Endosulfan (M8) module after 7 days of IInd spraying. Other modules worked well to lower the jassid population, which is better than the control (28.17) and ranges from 8.33 to 22.25. These results are more or less consistent with those, who claimed that endosulfan application followed by Achook or N.S.K.E. application was the most efficient method for lowering the jassid population.

The results of the second round of treatments, which lasted for 14 days, showed that all modules—aside from Trichogramma (M4)—were successful in reducing the number of jasis than the control.

The results from the first day of the third application of treatments revealed that the jassid population was much lower in all modules except Trichogramma (M4). Module B.t. - Nimbecidine - endosulfan (M11), which reported 6.13 jassid/ten plants as opposed to 27.20 jassid in the control, proved to be the most successful module.

When monitored after 7 days of the third application of treatments, the module B.t. - Nimbecidine - Endosulfan - Trichogramma (M14) was shown to be the best, recording the lowest 3.10 jassid/ten plant.

After 14 days of 3rd application of treatments the reduction of jassid population was highest in case of B.t. The jassid population was not suppressed by the endosulfan (M3), nimbecidine (M2), B.t. (M1), or trichogramma (M4) modules, however. Endosulfan (0.07%), Achook (0.07%), and neem seed kernal extract (3%), were applied to effectively suppress jassids. The fewest number of jassid/ten plants was recorded on the first day following the fourth application of treatments (2.10). B.t. - Nimbecidine - endosulfan (M11), B.t. - Nimbecidine - endosulfan - Trichogramma (M14), and then B.t. - Nimbecidine - Trichogramma (M12) and Nimbecidine - endosulfan (M8) all reported 2.10 jassid/ten plants.

The B.t. - Nimbecidine - endosulfan modules performed the best in terms of lowering the jassid population, which was 0.07 jassid/ten plants, after 14 days to the fourth application of treatments.

On the basis of earlier research, who claimed that application of organic pesticide and Dipel 8L was most efficient in lowering the jassid population, the present findings may be contested. An acceptable decline in the jassid population after using 0.07 percent endosulfan as an insecticide for 24 and 48 hours. Three neem product sprays spaced 15 days apart from one another effectively controlled the pest. Azadirachtin at 0.0006% and Bacillus thuringiensis (Delfin 85 WG) at 0.04%, had better results against leaf hopper.

Hadda beetle (*Epilachna vigintioctopunctata*)

When 15 IPM modules, including a control, were evaluated for their effectiveness against the hadda beetle, it was

discovered that endosulfan-Trichogramma (M10) was the best module, followed by endosulfan (M3) and *Nimbecidine-endosulfan-Trichogramma* (M13).
In comparison to the control, all of the modules were successful in lowering the beetle population. In the plot that had been treated with nimbecidine and endosulfan, there were fewer beetles to be seen. However, after the initial 14 days of treatment, the Trichogramma module showed the lowest level of efficacy.
The results regarding first day of 2nd application of treatments revealed that minimum beetle infestation 1.50 beetle/plant was reported in modules. The Trichogramma was subpar, however the *Nimbecidine-endosulfan-Trichogramma* and other modules produced 0.36 to 3.00 beetles/plant after 7 days of the second application of treatments.
The population had been reduced to zero after 14 days of the second application of treatments using the modules B.t. The effectiveness of the remaining treatments ranges from 0.37 to 2.50 beetle plants, with Trichogramma being the least efficient. Overall evaluation of the current experiments revealed that, compared to the control, all modules were successful in reducing the population of beetles. In the plot that had been treated with nimbecidine, endosulfan, and trichogramma (M13), there were at least 2.18 beetles per ten plants. The azadirachtin was much more efficient against E. vigintioctopunctata and B.t. var Kurstaki was least effective against the insect pest of brinjal, may be used to support the current findings.

Conclusion

Important findings about the seasonal occurrence of the main pest insect species, their natural enemies, the impact of insecticides on the main pests, predators, and prarasitoids were gained from the current work. The study of the seasonal occurrence of jassid Amrasca biguttula biguttula first appeared in the vegetative stage of the crop, persisted until it reached maturity, and peaked in the third week of October. Relative humidity and rainfall had a significant negative correlation with the intensity and infestation of jassids throughout both years, whereas sunlight had a significant positive correlation. The seasonal occurrence of jassid was observed, and it was found that the population steadily grows until the third week of October, when it peaks. Additionally, it usually infests crops in their early stages. The relationship between relative humidity and rainfall was noticeably negative. The hadda beetle population peaked in September and was unaffected by rainfall or humidity, but maximum and minimum temperatures unquestionably had a negative impact on the population of this pest. The population of the shoot and fruit borer was found to gradually expand until it peaked in the month of September, according to the data on the shoot. The infection of shoot and fruit on fruit began in the first week of October, peaked in the second, gradually decreased with the onset of winter, and was eradicated entirely by the end of November. The highest temperature and relative humidity in the morning were found to be favorable.

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