



DIVERSITY AND MANAGEMENT OF INSECT PESTS ASSOCIATED WITH BRINJAL (*SOLANUM MELONGENA* L.) IN NAGAON DISTRICT, ASSAM

POLY BORA ¹ | SEEMA KAUR ² | DR. SEEMASHRI BORA ^{2*}

¹ DEPARTMENT OF LIFE SCIENCES, DIBRUGARH UNIVERSITY, DIBRUGARH

² DEPARTMENT OF ZOOLOGY, PRAGJYOTISH COLLEGE, GUWAHATI-09

ABSTRACT:

Brinjal (*Solanum melongena* L; family- Solanaceae) is an important crop for small-scale farmers however its production is severely affected by infestation from various insect pests. The present investigation was carried out to study the diversity and management practices of insect pest associated with brinjal cultivation in the Sensuwa region of Nagaon District, Assam during the period from February 2022 to March 2023. The study recorded the presence of seven major and four minor pests attacking brinjal at different parts of its body during various growth stage. The major pests recorded were- brinjal fruit and shoot borer (BFSB), hadda beetle, Aphid, white fly, white spotted flea beetle, Corn Earworm, *Spodoptera litura*, and minor pests comprised- Rice ear bug, Cow Bug, Jewel bug and Pod Bug. Among these, Aphids showed the highest level of infestation across most spots, with infestation ranging from 20% to 84%. Farmers in the study area used both traditional pest control methods like ash extract of medicinal plants as well as chemical pesticides to control insect pest population in brinjal crops.

KEYWORDS:

BRINJAL. INSECT PEST, BRINJAL FRUIT AND SHOOT BORER (BFSB), TRADITIONAL PEST CONTROL, ASSAM.

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INTRODUCTION

Brinjal (*Solanum melongena* L; family- Solanaceae) is a popular vegetable among Indians and it is an essential component of different food items (Kumar et al., 2019). The nutritional value of this vegetable constitutes of 92% water, 4% carbohydrates, 2% protein and negligible amount of fat. Brinjals are a rich source of minerals like potassium, iron, calcium, phosphorus, chlorine, and other vitamins essential for healthy growth (Naeem & Ugur, 2019). It contains good amounts of many essential B-complex group of vitamins such as Pantothenic acid (vitamin B5), Pyridoxine (vitamin B6), Thiamine (vitamin B1) and Niacin (vitamin B3) (USDA Nutrient Database, 2018).

Due to its long fruiting and harvesting period, brinjal cultivation can be a good source of income for the farmers. India is the second largest producer of brinjal in the world after China. West Bengal, Orissa, Bihar, Gujrat, Maharashtra, Karnataka, Uttar Pradesh and Andhra Pradesh are the main states of India those produces brinjal in a larger scale (India Horticultural database, 2015). Production of Brinjal in Assam is much lower than the average national production. The main reason for low production is due to insect pest attack and diseases during different stages of crop growth. The extent of losses depends on season, variety, soil and other factors (Dhamdhare et al., 1995, Madhu, 2019).

The major pests of Brinjal are Brinjal fruit and shoot borer

(*Leucinodes orbonalis* Guence), brinjal stem borer (*Euzophera perticella* Rag), hadda beetle (*Henosepilachna vigintioctopunctata* Fabricius), brinjal Leaf roller (*Eublemma olivacea* Walker), Aphid (*Aphis gossypii* Glover), jassid (*Amrasca biguttula biguttula* Ishida), white fly (*Bemisia tabaci* Gennadius); red spider mite (*Tetranychus urticae* Koch) and root node nematodes (*Meloidogyne incognita* and *M. javanica*) (Shivalingaswamy, 2022; Kumari et al., 2023).

However, in Assam, Brinjal fruit and shoot borer (BFSB), hadda beetle, aphid, jassid and white fly cause considerable losses in brinjal (Borkakati et al., 2019). BFSB is considered the most destructive pest that bore into tender shoots and fruits causing fruit damage upto 92% with yield reduction upto 60% (Abhishek & Dwivedi, 2021)

The present study was undertaken to obtain knowledge about insect pest scenario of brinjal and its traditional management practices in Sensuwa Village in Nagaon district of Assam.

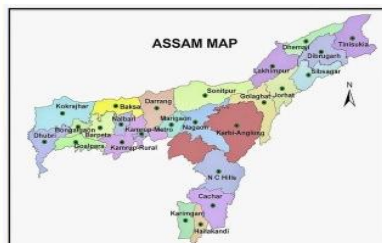
MATERIALS AND METHOD

The present study was carried out in Sensuwa region of Nagaon District from February, 2022 to March 2023. Sensuwa is a Village of Khagarijan Tehsil in Nagaon District of state Assam, India. It is located 2 km from District headquarters of Nagaon and 112 KM from State capital Dispur. The village extends between 26.3371° N

and 92.6673° E

Diversity and abundance of insect pest of *Solanum melongena* was studied in two farms on the study site. Insect pests were collected from 10 numbers of randomly selected plants per 500 square meter area from seven spots of the fields. The collected insects were identified by

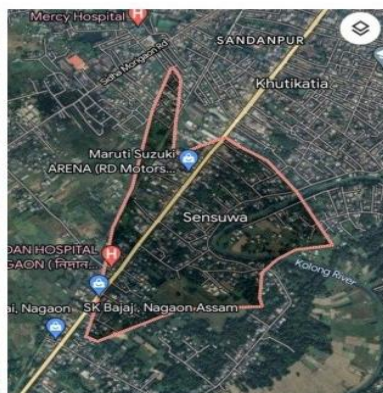
consulting appropriate literature. The observations were made at weekly intervals. To record sucking pests, three leaves from top, middle and bottom canopy of plant were critically observed and counted the total number of sucking pests. Based on this, mean number of each sucking pest per leaf was calculated (Karkar et. al., 2014).



SATELLITE MAP VIEW OF THE STUDY AREA



Map view: The two farms visited



Map view: Sensuwa village, Nagaon.

Infestation was calculated as per the method of Kale et. al., 1986.

Percent infestation of shoots per plant = $\frac{\text{Affected shoots}}{\text{total no. of shoots}} \times 100$

Percent infestation of fruits per plant (number basis) = $\frac{\text{No. of infested fruits}}{\text{Total number of fruits}} \times 100$

To study the traditional management practices against the brinjal pests, the owners of the farms were interviewed.

RESULTS AND DISCUSSION

In the present study, a total of eleven insect pest species were recorded, comprising seven major and four minor pests. The major pests included brinjal fruit and shoot borer (BFSB), hadda beetle, aphids, whitefly, white-spotted flea beetle, corn earworm, and *Spodoptera litura*. Minor pests recorded were rice ear bug, cow bug, jewel bug, and pod bug.

TABLE 1: BRIEF ACCOUNT OF PROMINENT PESTS

| Order | Family | Name | Common name | Feeds on |
|-------------------|---------------|---|-------------------------------|-----------------|
| Major pest | | | | |
| Lepidoptera | Crambidae | <i>Leucinodes orbonalis</i> , Guenee, 1854 | Brinjal fruit and shoot borer | shoot and fruit |
| Coleoptera | Coccinellidae | <i>Henosepilachna vigintioctopunctata</i> Fabricius, 1775 | Hadda beetle | leaves |
| Hemiptera | Aphididae | <i>Aphisgossypii</i> Glover 1822 | Aphid | leaves |

| | | | | |
|-------------------|---------------|------------------------------|---------------------------|------------------------------|
| Hemiptera | Aleyrodidae | <i>Bemisia tabaci</i> , 1882 | White fly | phloem or lower leaf surface |
| Coleoptera | Chrysomelidae | <i>Monolepta signata</i> | white spotted flea beetle | leaves |
| Lepidoptera | Noctuidae | <i>Helicoverpa armigera</i> | Corn Earworm | Flowers and fruits |
| Lepidoptera | Noctuidae | <i>Spodoptera litura</i> | <i>Kathua</i> | leaves |
| Minor pest | | | | |
| Hemiptera | Alydidae | <i>Leptocorisa oratoria</i> | Rice ear bug | |
| | Membracidae | <i>Tricentrus bicolor</i> | Cow Bug | leaf bud and branches |
| | Scutelleridae | <i>Chrysocoris stollii</i> | Jewel bug | Plant shoot |
| | Coridae | <i>Anoplocnemis phasiana</i> | Pod bug | |

The brinjal fruit and shoot borer (BFSB), *Leucinodes orbonalis* is a monophagous pest that feeds only on brinjal (Kumari et al., 2023). BFSB belongs to the family Crambidae under the order Lepidoptera. The caterpillars are creamy white in the early stages and turn light pink at full growth. Fully grown larvae measure about 18–23 mm in length and have a brownish head (Bhoya & Patel, 2018). During the early stages, the caterpillars bore into the stem, causing a condition known as **dead heart**, which leads to withering and drying of the shoots. They also bore into flower buds and developing fruits by making small holes and feed internally, making the fruits unfit for consumption and marketing. Severe infestation results in fruit rotting (Abhishek and Dwivedi, 2021).

The hadda beetle belongs to the family Coccinellidae under the order Coleoptera. It is a polyphagous pest that attacks several cultivated and wild vegetable crops in India. Among the major pests, it is highly destructive and is considered a key pest of brinjal, causing damage from the seedling stage to crop maturity (Kumar et al., 2022). The adult beetles are deep red in colour and bear 7–14 black spots on their bodies. Both grubs and adult beetles scrape the leaf surface and feed on the leaf tissues. As a result, the affected leaves become skeletonised due to the loss of chlorophyll. Severe infestation leads to heavy defoliation and significant yield loss, making the hadda beetle one of the most serious pests of brinjal (Nithish, 2020).

Aphids belong to the family Aphididae under the order Hemiptera. They are small, soft-bodied insects with long, slender mouthparts used to pierce stems, leaves, and other tender plant parts and suck plant sap. Female aphids have an ovoid body measuring about 2 mm in length and are usually green in colour. The legs and antennae are yellow, while the head and thorax are black. The abdomen is yellowish green with black lateral spots. Aphids suck sap from leaves, resulting in leaf curling and yellowing. They are most active during the month of March. Due to their light green colour, farmers commonly refer to them as green flies. Aphids not only damage leaves directly but also attract ants. They are mostly present on the lower side of

the leaf. The aphids are mostly monophagous (Shakeel et al., 2014).

White flies belong to the family Aleyrodidae under the order Hemiptera. The adults are about 0.40–2 mm in length with light yellow bodies and white wings, which is attributed by the secretion of wax across its wings and body. They feed on the host plant by piercing the phloem or lower leaf surface with its mouth and removing nutrients. Affected areas of the plant develop chlorotic spots, wither or drop leaves. Affected plants show yellowing, folding of the foliage, decreased plant development, and disfigured fruit. They cause great damage to the yield and economic losses to the farmers (Rasdi et al., 2009).

Monolepta signata is a pest of brinjal and is also found in many other rabi crops. Minute eggs are laid in soil cracks around the base of the host plant which after hatching gives out minute worm like larva. The larva live in the soil and feed on small plant roots and root hairs. Head, thorax and abdomen are reddish brown or darker in older beetles and much brighter in younger beetles. The adult beetle is a small, dark beetle, about 2–3mm in body length, with two long antennae. The beetle has a dark blackish body with 2–4 white spots on it thereby getting its common name of white spotted flea beetle. The adult beetle feed on the plant leaves resulting in holes on the leaf. (Borkakati et al., 2019)

Helicoverpa armigera is also known as cotton bollworm or corn earworm. It is a major pest in many crops and is polyphagous. The full grown larvae are highly variable and are brownish, reddish, or pale green with brown lateral stripes and a distinct dorsal stripe; larvae are long and ventrally flattened but convex dorsally. The adults are active during the day, but most activity occurs at night starting at dusk. *Helicoverpa armigera* larvae prefer to feed on reproductive parts of hosts (flowers and fruits) but may also feed on foliage. Feeding damage results in holes bored into reproductive structures and feeding within the plant. It may be necessary to cut open the plant organs to detect the pest.

Spodoptera litura is a polyphagous pest. The larval stages do the most damage to the host plants. They vigorously feed on the leaves and often leads to complete destruction of the plant leaves. In later stages, they consume most of the leaf tissues and because of severe attack, the leaves dries up and are greatly damaged. The moths also actively destroy the economically important agricultural crops and thereby reducing the yield. The local farmers, when interviewed about them said that these were one of the most problematic pest as they don't easily get away even after pesticide spray (Calumpang, 2013).

SOME MINOR PESTS OF BRINJAL:

Leptocorisa oratoria, commonly known as rice ear bug, is an insect from the family Aludidae, the broad-headed bugs. The minor pest has a slender body, around 2cm in length, with long legs and a long proboscis. It is yellow-brown in colour and has six legs and two antennae. They are minor pests of eggplants that come to feed on them when their major host plant is not available. They have piercing mouthparts that suck out the nutrient content of the plant causing damage to it. When disturbed, it releases a very unpleasant smell in defense. The infested plant often has a bad odour that makes the crop unfit for consumption and marketing. (Madhu, 2019)

Cow bugs are common tree hoppers. They are somewhat blackish brown in colour. The adults and nymphs of

Tricentrus bicolor were recorded on the branches of eggplant during survey. They suck the sap from leaf bud and branches and secrete honey dew on which ants feed and protect them from predation. Heavy population of cow bug weakens the shoot of the plants. (Kumar and Naidu, 2007).

Scutelleridae is a family of true bugs and are commonly called as jewel bugs due to their brilliant colouration. They are polyphagous and are also found on Ber plants. During the study, they were found on the stems of the Brinjal plant. They cause damage to the plant shoot by sucking the sap and juices from the shoot and leaves. When disturbed, they produce an unpleasant odour. They damage commercially important crops and make them unfit for consumption and reduce the yield. They have metallic shield-like covering on their back.

Pod bugs are larger, blackish-brown, appear as carved wood but are quite engaging creatures. They are long and have antennae. They are a minor pest of brinjal. They are sap sucking insect pests and are a major pest of legumes.

During the survey, the incidents of infestation by Ahid were reported highest followed by BFSB and Hadda beetle. Table 2 shows the percentage infestation of different prominent pests of brinjal in seven different spots of the study area.

TABLE 2: INFESTATION OF DIFFERENT MAJOR PEST OF BRINJAL (%)

| Spot | BFSB | Hadda beetle | Aphid | White Fly | White Spotted Flea Beetle | Corn Ear worm | <i>Spodoptera litura</i> |
|------|------|--------------|-------|-----------|---------------------------|---------------|--------------------------|
| 1 | 40 | 24 | 60 | 26 | 18 | 12 | 20 |
| 2 | 30 | 30 | 44 | 22 | 6 | 20 | 30 |
| 3 | 24 | 18 | 84 | 18 | 14 | 6 | 36 |
| 4 | 36 | 42 | 38 | 26 | 20 | 4 | 22 |
| 5 | 18 | 20 | 30 | 10 | 12 | 2 | 18 |
| 6 | 10 | 22 | 60 | 16 | 8 | 4 | 24 |
| 7 | 16 | 26 | 20 | 14 | 10 | 8 | 12 |

Aphids showed the highest level of infestation across most spots, with infestation ranging from 20% to 84%. The maximum aphid infestation was observed at Spot 3 (84%), followed by Spots 1 and 6 (60% each), indicating that aphids were the most dominant pest in the study area.

The brinjal fruit and shoot borer (BFSB) showed moderate to high infestation levels, varying from 10% to 40%. The highest BFSB infestation was recorded at Spot 1 (40%), followed by Spot 4 (36%), while the lowest was observed at Spot 6 (10%). This suggests uneven distribution of BFSB across the study sites.

Infestation by Hadda beetle ranged between 18% and 42%, with the maximum incidence at Spot 4 (42%).

Moderate levels were recorded at Spots 1, 2, and 7, indicating its widespread occurrence.

Whitefly infestation varied from 10% to 26%, with the highest incidence recorded at Spots 1 and 4 (26%). Similarly, white-spotted flea beetle infestation remained relatively low to moderate, ranging from 6% to 20%, with the highest infestation observed at Spot 4.

The infestation of corn earworm was comparatively low across all spots, ranging from 2% to 20%, with the highest incidence at Spot 2 (20%). In contrast, *Spodoptera litura* infestation showed moderate variability, ranging from 12% to 36%, with the highest infestation at Spot 3 (36%).

MANAGEMENT STRATEGIES

The insect pest infestation in Brinjal significantly affect the fruit quality, rendering the product unfit for marketing and consumption. Pest attack results in reduction of the yield leading to considerable economic losses of the farmers. The farmers in Sensuwa area have adopted a range of strategies for controlling the pests of *Solanum melongena*. The farmers use indigenous technical knowledge as well as chemical control against the pests. Several farmers practice methods such as crop rotation to reduce pest population. The farmers also opt for promptly removing and destroying infested shoots and fruits at regular intervals until final harvest. Farmers also use indigenous preparation such as ash extract of medicinal plants like neem and lime water for controlling the insect pest population. Neem formulations and imidachloprid are applied as soil drench or foliar application to control white fly in Brinjal seedlings. The pest population are also brought under control in some villages by avoiding broad spectrum pesticides which ultimately lead to the flourishing of natural enemy of the pest.

But it was observed that most of the farmers continue to rely on chemical pesticides due to their easy accessibility and rapid effectiveness. Some farmers reported the use of organic pesticides like MULTINEEM for the control of Hadda beetle and NEMAEOL for managing BFSB and Hadda beetle infestation.





The farmers also mentioned about the use of natural enemies of the brinjal pest for its control. Different natural enemies that feed on the pest of brinjal turn out to be useful measure of pest control (Borkakati et al., 2019). During the survey, one of such natural enemies of brinjal

pest was found on the leaves of the brinjal plant, namely *Coccinella transversalis*, also commonly known as the transverse ladybird. These ladybird beetles are predators to major pests of brinjal namely aphids, BFSB etc. They have a black head with bright red or somewhat orange elytra. Farmers noted that although transverse ladybird when disturbed releases an unpleasant odour but since they feed on one of the most dangerous pest, Aphids, they are often seen on the plants with Aphid infestations.

CONCLUSION

The present study highlights a high incidence of pest infestation across the study area, which has led to extensive reliance on chemical pesticides by farmers. Inadequate technical knowledge and improper application practices have resulted in excessive pesticide use, rendering agricultural produce unsafe for consumption and reducing market acceptance. Consequently, farmers experience diminished economic returns despite increased input costs.

The study also documents the use of organic and biological pest management practices, along with the presence of natural pest enemies, indicating the potential for sustainable and eco-friendly control strategies. These findings emphasize the importance of promoting biotechnological and integrated pest management approaches through effective training and guidance from agricultural extension services. Enhancing farmer awareness regarding the judicious use of pesticides is essential to reduce economic losses, improve crop yield, and ensure the production of safe and marketable agricultural products.

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|---|--|
|  |  |
| <p><i>Leucinodes orbonalis</i>(BFSB)</p> | <p>BFSB affected fruit</p> |
|  |  |
| <p><i>Henosepilachna vigintioctopunctata</i></p> | <p><i>Aphisgossypii</i></p> |



Bemisiatabaci



Monolepta signata



Spodoptera litura



Helicoverpa armigera



REFERENCES

1. Abhishek, T. S., & Dwivedi, S. (2021). Review on integrated management of brinjal shoots and fruit borer, *Leucinodes orbonalis* (Guenee). *Journal of Entomology and Zoology studies*, 9(1), 181-189.

2. Agro Atlas, 2009. Interactive Agricultural Ecological Atlas of Russia and Neighboring Countries, Economic Plants and their Diseases, Pests and Weeds. *Helicoverpa armigera* Hbn. - Cotton Bollworm.

3. Aheer, G. M., Ali, A., & Akram, M. (2009). Effect of weather factors on populations of *Helicoverpa armigera* moths at cotton-based agro-ecological sites. *Entomological Research*, 39(1), 36-42.

4. APEDA (2022). Annual report of Other Fresh Vegetables export details. Retrieved from https://apeda.gov.in/apedawebsite/SubHead_Products/Other_Fresh_Vegetables.html.
5. Bajya, D. R., & Monga, D. (2009). Seasonal abundance of *Helicoverpa armigera* (Hubner) on cotton based cropping system in Haryana. *Indian Journal of Entomology*, 71(3), 249-254.
6. Bhoya, K. M., & Patel, C. J. (2018). Biology of Brinjal shoot and fruit borer. *International Journal of Current Microbiology and Applied Sciences*, 7(11), 2605-2612.
7. Bilashini, Y., & Singh, T. K. (2009). Studies on population dynamics and feeding potential of *Coccinella septempunctata* Linnaeus in relation to *Lipaphiserysimi* (Kaltenbach) on cabbage. *Ind. J. Appl. Entomol*, 23, 99-103.
8. Borkakati, R. N., Venkatesh, M. R., & Saikia, D. K. (2019). Insect pests of Brinjal and their natural enemies. *Journal of Entomology and Zoology Studies*, 7(1), 932-937.
9. Calumpang, S. M. F. (2013). Behavioral response of *Spodoptera litura* (F)(Lepidoptera: Noctuidae) to selected herbs and eggplant.
10. Dhamdhree, S., Dhamdhree, S. V., & Mathur, R. (1995). Occurrence and succession of pests of brinjal, *Solanum melongena* Linn. at Gwalior (Madhya Pradesh), India. *Journal of Entomological Research*, 19(1), 71-77.
11. Gaur, R. K., Kumar, M., Sharma, S., & Yadav, B. S. (2020). Survey studies on insects and non insect pest associated with ber crop in South West Haryana. *J. Entomol. Zool. Stud*, 8(2), 856-863.
12. Jayanthi, P. K., & Prakash, G. S. (2012). Tip withering bug, *Anoplocnemisphasiana* (Fab.), halts grape shoots: friend or foe, arrival time explains. *Journal of Horticultural Sciences*, 7(1), 112-113.
13. Jesu Rajan, S., Sree Latha, E., Vijaya Raghavendra, R., & Sreenivasa Rao, C. H. (2018). Biology and feeding potential of *Coccinella transversalis* (Fab.) on cabbage aphid, *Brevicoryne brassicae* (Linn.). *Journal of Entomology and Zoology Studies*, 6(6), 51-56.
14. Jesu Rajan, S., Sree Latha, E., Vijaya Raghavendra, R., & Sreenivasa Rao, C. H. (2018). Biology and feeding potential of *Coccinella transversalis* (Fab.) on cabbage aphid, *Brevicoryne brassicae* (Linn.). *Journal of Entomology and Zoology Studies*, 6(6), 51-56.
15. Kale, P. B., Mankar, S. W., Wangikar, P. D., & Gonge, V. S. (1986). Chemical composition of little leaf disease affected leaves of different genotypes of brinjal. *Veg Sci*, 13, 199-204.
16. Karkar, D. B., Korat, D. M and Dabhi, M. R. (2014). Evaluation of botanicals for their bioefficacy against insect pests of brinjal Karnataka J. Agric. Sci.,27 (2), 145-147
17. Kumar, A., Kumar, P., Mishra, P. K., Rajpoot, P. K., & Mishra, R. (2022). Integrated Approach for Management of Hadda/Epilachna Beetle (*Henosepilachna vigintioctopunctata* Fabricius). *Just Agric*, 3(3), 1-6.
18. Kumar, D., & Naidu, B. (2007). Biocontrol agents and their interaction with agricultural crops. *Herbal Technology: Recent Trends and Progress*, 243
19. Kumari, S., Kataria, S. K., Kaur, G., Singh, A., & Singh, R. (2023). Relative abundance and diversity of insect pests and natural enemies in brinjal ecosystem. *Annals of Entomology*, 41(1).
20. Madhu, N. R. (2019). Study on brinjal insect pests and its management at garden experiment. *Int. J. Adv. Res. Biol. Sci*, 6(2), 256-259.
21. Misra, H. P. (1993). Chemical control of brinjal fruit and shoot borer *Leucinodes orbonalis* (Guen.).
22. Naeem, M. Y., & Ugur, S. (2019). Nutritional content and health benefits of eggplant. *Turkish Journal of Agriculture-Food Science and Technology*, 7, 31-36.
23. Nithish, A. (2020). Study on management of damage caused by *Henosepilachna vigintioctopunctata* in brinjal. *Journal of Pharmacognosy and Phytochemistry*, 9(5), 2874-2881.
24. Rasdi, M. Z., Fauziah, I., Fairuz, K., Saiful, M. M., Jamaludin, M. B., Salmah, C. M., & Jusoff, K. (2009). Population ecology of whitefly, *Bemisia tabaci*, (Homoptera: Aleyrodidae) on brinjal. *Journal of Agricultural Science*, 1(1), 27.
25. Reddy, P. P. (2012). Recent advances in crop protection.
26. Saha, L. R. (1990). *Handbook of plant protection* (pp. viii+-928).
27. Sathe, T. V., Patil, S. S., Bhosale, A. M., Devkar, S. S., Govali, C. S., & Hankare, S. S. (2016). Ecology and control of brinjal insect pests from Kolhapur region, India. *Biolife*, 4(1), 147-154.
28. Shakeel, M., Akram, W., Ali, A., Ali, M. W., & Nasim, W. (2014). Frequency of aphid (*Aphis gossypii* G.) on brinjal (*Solanum melongena* L.) and farming practices in the agroclimatic conditions of Faisalabad, Pakistan. *Int J Agric Innov Res*, 2(5), 841-845.

29. Sharma, A., & Pati, P. K. (2011). First report of *Withania somnifera* (L.) Dunal, as a new host of cowbug (*Oxyrachis tarandus*, Fab.) in plains of Punjab, northern India. *World Applied Sciences Journal*, 14(9), 1344-1346.

30. Shivalingaswamy, T. M., Udyakumar, A., & Mani, M. (2022). Pests and their management in brinjal. *Trends in Horticultural Entomology*, 943-958.

31. Shrinivasan, R. (2009). Insect and mite pests on egg plant. *AVRD, The World Vegetable center*.

32. Sidhu, A. S., & Dhatt, A. S. (2006, December). Current status of brinjal research in India. In *I International Conference on Indigenous Vegetables and Legumes. Prospectus for Fighting Poverty, Hunger and Malnutrition*

752 (pp. 243-248).

33. Tara, J. S., & Sharma, S. O. N. I. A. (2017). Biology and life cycle of *Henosepilachna vigintioctopunctata* Fabricius, a serious defoliator of bitter gourd (*Momordica charantia*) in Jammu region (Jammu & Kashmir) India. *Indian Journal of Science Research*, 13(1), 199-203.