Eco-friendly Management of Brown Plant Hopper (Nilaparvata lugens) in Rice (Oryza sativa L.) Crop

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OPEN ACCESS

Keywords

BPH, Eco-friendly, ETL, *Oryza sativa.*

How to cite this article

Verma, S. K., Mishra, P. K., Kushwaha, D., Aman, A. S. and Jaiswal, S. 2023. Eco-friendly Management of Brown Plant Hopper (*Nilaparvata lugens*) in Rice (*Oryza sativa* L.) Crop. *Vigyan Varta* 4(2): 26-29.

ABSTRACT

Oryza sativa L. is the largest food crop in the world. About 4 billion people depend on rice for their daily subsistence, and rice is a common diet in South East Asia. Unfortunately, the main biotic pressures that considerably reduce rice output are insect pests and pathogens. The significant disappointment that biotic stress factors are responsible for a 60% loss in rice output. Brown Plant Hoppers (BPH) are the main problem among the biotic stress factors and this destructive insect pests cause significant crop loss. Economic threshold level (ETL) for Brown plant hopper 5 to 10 insect/hill. To combat this pest, farmers mostly use traditional chemical pesticides; nevertheless, indiscriminate chemical use results in the problems of insecticide resistance and environmental damage.

INTRODUCTION

Rice is successfully grown in tropical and subtropical region; it is thought to be connected with moist, humid climates. India is an important centre of rice cultivation. The rice is cultivated on large scale in India. According to historians, the *japonica* variety of rice was domesticated from wild rice in southern China that was introduced to India, whereas the *indica* variety was first domesticated in the region covering the foothills of the Eastern Himalayas (i.e., north-eastern India) stretching through Burma, Thailand, Laos, and Southern China. In Assam and Nepal, perennial wild rice is still grown. For the four billion people on the planet, rice (*Oryza sativa* L) is one of the most vital food crops. In South East Asia, Indo-China, and the Pacific Islands, the Brown plant hopper

Nilaparvata lugens (Stal) is a significant commercial pest of rice (*Oryza sativa* L.). It is a monophagous pest that damages the rice crop by directly feeding on it by depleting the plant's nutrients. They lead to "Hopper burn," which is characterized by noticeable circle patch, wilting, and browning of the damaged crops and causing more circle impacts. BPH is a vector for different rice viruses including the grassy stunt and ragged rice stunt virus. These combinations significantly reduce rice crop yields up to 60% in cultivars that are vulnerable. Indeed, insecticide revival is likely to have had a significant role in *Nilaparvata lugens* rise to prominence as a serious rice pest over the past ten years. The combination of biopesticides has made controlling BPH easier in the presence of potent natural enemies and their production techniques. These combined biopesticides serves as an insect repellent, anti-feedant, and is safe for the environment. The resistance of rice pests to even recently introduced agro-chemicals is already emerging, which is causing synthetic chemicals to be detected at a slower rate than in the past. Natural pesticides are given more attention in this era of environmental consciousness because they are biodegradable and less destructive to the environment. Thus, farmers are made aware towards eco-friendly management and eco-friendly approach has been adopted all over the world.

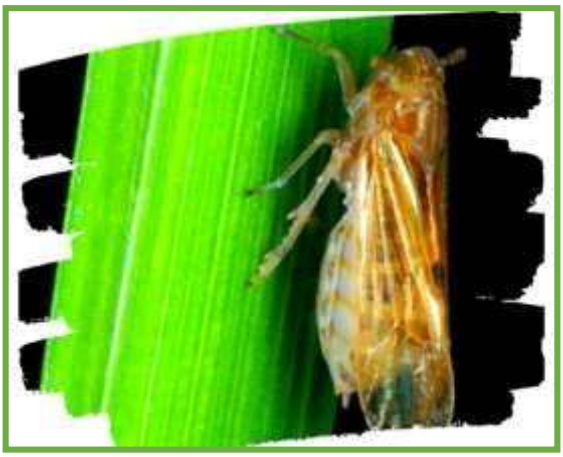

Fig: 1 Adult of Brown plant hopper

Brown Plant Hopper

Scientific name: *Nilaparvata lugens*

Taxonomic position

Class: Insecta

Order: Hemiptera

Family: Delphacidae

Genus: *Nilaparvata*

Species: *lugens*

Host plant and distribution: BPH exclusively eats rice and is a monophage (*Oryza sativa* L.). BPH is also survive on finger millet, sugarcane, maize, sorghum, wheat and also on weed hosts like *Echinochloa, Cyperus*. It is primarily present in Uttar Pradesh, Madhya Pradesh, Chhattisgarh, West Bengal, Andhra Pradesh, Karnataka, and Tamil Nadu, among other states in India.

Identification: The 4.5 to 5.0 mm length adult hopper ranges in colour from yellowish brown to dark brown. There are two kinds of BPH that stand out brachypterous (short-winged) and macropterous (long-winged). The length of mature nymphs is about 2.99 mm. The adult male measures 3.80 to 4.12 mm, while the adult female ranges from 4.2 to 4.5 mm.

Life cycle: White eggs are laid as they approach hatching, they turn darker. The female can lay eggs ranging between 100 and 500 eggs. The egg stage lasts between 7 and 11 days. There are 5 nymphal instars and they all are fed by the host plant's phloem sap. The heads of the nymphs are triangular with a pointed vertex. The body is a creamy white in colour with a faint hint of brown. The colours of the adults range from yellowish brown to brownish black. Adult life span ranging from 10 to 20 days period of time, 18–24 days from June to October, 38 to 44 days from November to January and 18-35 February to April.

Fig: 2 Life cycle of Brown plant hopper

Nature of Damage: In cases of severe infestation, the infected plants' leaves initially turn yellow, then brown, and eventually dry out and die. Both the nymph and the adult gather above the water at the base of the plants to ingest plant sap. Conidia of *Alterneria brassicae*, known as "Hopper burn." Conidia, develop as the crop dries up in these damaged patches, giving it a burned appearance.

Fig: 3 Damaging symptoms of Brown plant hopper

Management Practices:

Pre-planting practices:

- Maintain field hygiene. It is important to keep main fields and bunds weed free that support the BPH population.
- It is not recommended to continuously grow susceptible types in the same location. A non-host crop other than a member of the rice family should be used in their place. Don't plant the "Swarna" cultivar in BPH-prone areas.

Nursery to transplanting stage:

- Maintaining a rice-free time and synchronised planting (planting adjacent fields within three weeks of one another) are excellent BPH management strategies.
- In endemic areas, creating alleys every eight to ten rows in an east-to-west orientation reduces population density and creates a congenial habitat for BPH.

Vegetative to harvesting stage:

- It is advised to alter the micro-climate of the rice plant through alternate wetting and drying technique (There should not be standing water for long time). The field should be atleast drained for 3-4 days when heavy infestations occur.
- High dosages of nitrogenous fertilizers increases plant hopper population. Hence, split application of nitrogenous fertilizer along with split application of appropriate dose of potassium fertilizers should be followed to reduce chances of plant hopper out breaks.

Biological Control:

- In situ conservation and enhancement of natural enemies, (a) *Cyrtorhinus lividipennisis*,(b) *Lycosa pseudoannulata* (c) *Microvelia douhlasi*, (d) *Paederus sp.* *(e) Tytthus sp* (f) *Ophionea sp.*

Fig: 4 Biological control of Brown plant hopper

Trap methods

- Use yellow pan trap during day time
- Installation of light trap with incandescent light at 1-2 m hight @ 4/ acre to monitor the population.

Fig: 5 Different management approach of Brown plant hopper

Chemical Control:

- Use any of the following CIBRC-recommended insecticides if the bug has reached ETL *viz:* 93.75 g/ha of Ethiprole 40% with Imidacloprid 40% WG, Chlorantraniliprole 18.5 SC @ 150 g/ ha, Fipronil 5 % SC @ 1000-1500 ml/ha, Imidacloprid 70 % WG @ 30-35 kg/ha, Thiamethoxam 25 WG @ 100 g/ha any one of the insecticides specified at Sl. nos. 3, 5, 6, and 8 may be alternated and administered in endemic regions as needed.
- The crop's base should get the foliar spray, which must be repeated every 7 to 10 days depending on the situation. For hand sprayers and power sprayers, the recommended spray fluid rates per hectare are 500 lit. /ha and 200 lit. /ha respectively.

CONCLUSION:

The Brown plant hopper (*Nilapervata lugens)* is a monophagous species. Effective control is not possible without the knowledge of this pest's biology and life cycle. Integrated pest control measure including cultural practices, biological control and valid use of chemical insecticides are effective in reducing the pest infestation and increasing the production of rice.

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