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Brown Planthopper: A Threat to Rice Cultivation in India

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Abstract

Brown planthopper, *Nilaparvata lugens* is an economically important insect pest of rice, causing crop losses of upto 60 % in favourable microclimatic conditions. In this article, the insect life cycle is described with all the life sstages. The management measures which can be adopted for controlling the pests in the field condition are also described.

Introduction

Rice is the primary food source for more than three billion people worldwide. Rice was grown on 45.07 million hectares in 2020–2021, producing 122.27 million tonnes at a productivity of 2,713 kg per hectare (https://eands.dacnet.nic.in). According to Dhaliwal *et al.* (2010), insect pests in rice are thought to cause a yield loss of about 25%. Biotic stresses on crops have become more problematic as agriculture has become more intensive, and rice is no exception. Twenty of the approximately 100 insect species that are known to infest rice are said to cause economic harm (Krishnaiah *et al.,* 2008) reported that the main cause of India's low rice productivity**.**

Distribution:

Among the major rice pests, BPH is the most economically significant planthopper in Asia. The insect is distributed in South and Southeast Asia and Oceania. It is also been recorded in Australia, Fiji, Guam, Federated States of Micronesia, New Caledonia, Northern Mariana Islands, Palau and Papua New Guinea, and. The insect causes significant crop losses of up to 60% (Srivastava *et al.,* 2009).

Damage symptoms:

It is a highly destructive pest in all rice-growing areas of India; both nymphs and adults feed by sucking the phloem sap from the basal portion of plant, clustering at the base of the rice clump and causing rapid wilting and drying of the plant and ultimately causing 'hopper

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burn' (Bottrell and Schoenly 2012; Bao and Zhang 2019). Plants that are severely damaged do not produce any grains. The symptoms include premature yellowing of leaves and drying of plants in isolated circular patches, drying of plants spreads in a circular fashion, sooty mould, exuviae at the base of plants, and affected stems turn soft and are unfit for use as straw.

BPH is also reported as the grassy stunt and ragged stunt virus vector. The pest is serious from panicle initiation to booting till post-flowering. Higher doses of nitrogen and high plant density per unit area invite the pest problem. Thick vegetation and direct sown rice are preferred.

Hopper burn in patches

Sooty mould development

Honey dew

Life history:

The life cycle of BPH depends on the environmental conditions. From June- September, the life cycle takes 18-24 days, in November to January, 38-44 days, and from February to April, 18-35 days.

Following adult emergence, the female copulates and deposits eggs the following day. The eggs are pushed into the plant tissues in bunches of three to ten, along with the middle of the leaf sheath and the middle rib of the leaves. Between 200 and 250 eggs are typically deposited by a female each time. The eggs are white, long, and have a curved appearance. The

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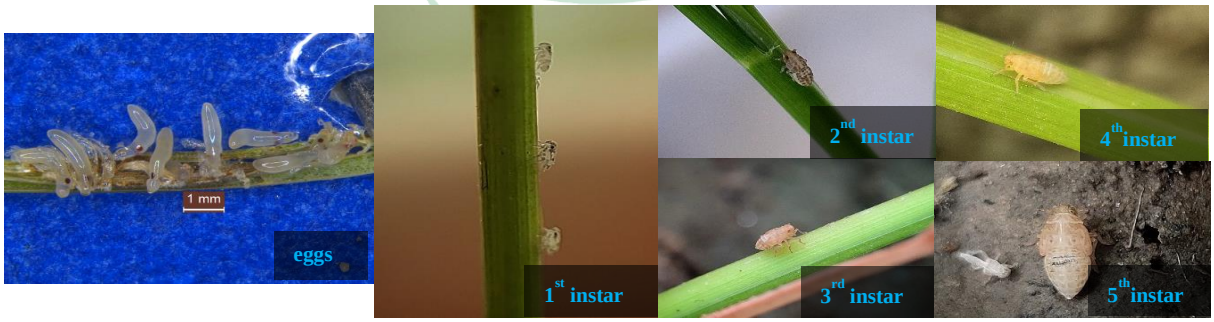
eggs will get hatched in 8-10 days, according to the environmental conditions. The nymph goes through five instars in 15-20 days, and the entire life cycle takes between 20 and 25 days, with differences between the sexes. Males have 15–20 days, while females have a 15–30 days lifespan. The ideal humidity and temperature for nymph development and survival are around 30 °C and 70-90%, respectively. The detailed life history of each life stage is described below.

- **Egg:** Crescent shape (0.99 mm), whitish, and on average 0.99 mm long eggs are thrust within parenchymatous tissues of the plant along the midrib of leaves in bunches of 2-12 eggs. They lay 200-250 eggs. Macropterous females lay fewer eggs. Two rows of white, translucent, slender, curved, and cylindrical eggs are thrust together in a straight line. From the plant surface, only the tips of the eggs are only visible. Eggs hatch in 6 -9 days. The pre-oviposition period ranges from 3-8 days.
- **Nymph:** Freshly hatched nymph is cottony white, and later turns brown, in the fifth instar. A prominent median line from the base of the vertex to metathorax is visible.
- **1st instar**: Newly hatched nymph is cottony white in colour with 0.6 mm in size.
- **2nd instar:** Within four days, the first instar moults to 2nd instar, with light brown patches all over the body.
- **3rd instar:** Within four days, insects get moulted to 3rd instar. There is an increase in size and a decrease in brown patches that turn entirely brown.
- **4th instar:** Within the next six days, insects get moulted to 4th instar, with the development of wing pads, and slight enlargement of the abdomen.
- **5th instar:** The insect gets moulted to the 5th instar within three days, and complete development of wing pads, enlargement of the abdomen with precise segmentation is being observed.



It takes 15-18 days to become an adult as the process depends on the availability of the food, density during development, and other environmental factors, including temperature and

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humidity. Depending upon the length of the crop and based on varieties, the number of generations varies.

- **Adult:** Within four days, the fifth instar nymph becomes a fully developed adult. These are ochraceous brown dorsally and deep brown ventrally; adult emergence begins at dawn and continues for 4-5 hrs. It takes place at the basal part of the host plant. Adult insects are dimorphic; macropterous males and females and brachypterous females are prevalent. Adults always prefer to stay on the upper portions of the stem; the adult female measures from 4.2 to 4.5 mm, and the male 3.80 to 4.12 mm, wedge-shaped and brown in color in adults. The adult's range in colour from brownish black to yellowish brown. A distinct white band on the mesonotum with dark brown on the outer sides. Long-winged adults have normal fore and hind wings, whereas short-winged forms have stunted hind wings, The wings are also normally shorter in males than in females. There is a noticeable tibial spur on the hind leg.
- **Female**: It is about 5mm long; it exits in 2 forms the fully winged, macropterous and the truncated winged brachypterous, with fully developed and enlarged abdomen *i.e.*, gravid female.
- **Male**: It is about 4.5 mm long, winged, and colour polymorphism has also been observed. Continuous cultivation of susceptible varieties, closer planting, use of high doses of nitrogenous fertilizer, etc. causes the build-up BPH population to build in favourable microclimate. The macropterous winged insects migrate from endemic and new areas.

Management of Planthoppers in Rice

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- Use of resistant cultivars: This eco-friendly method protects the crop from insects. For example, in Kerala state Bhadra and Uma are developed for BPH resistance; In Orissa Pratap and Tara; In Tamil Nadu ASD18, ASD19.
- Healthy seedlings should be planted in a row-to-row and plant-to-plant spacing of 20 and 15 cm. Leaving an alley of 0.3 m across the field at every 3 m of planting. After every 15 planting rows, one row may be skipped to form the alleyway.
- Periodic surveillance/ monitoring should be done in the field for the pest population, once a week or ten days (Walk diagonally across the field and examine one hill every 5 m for presence of planhoppers)
- Do alternate wetting and drying in the field to reduce plnathopper population.
- Chemical management: Effective chemicals may be used at recommended dosage in the field when the BPH population is in Economic threshold level (ETL- 5-10 hoppers/hill). Direct the sray fluid at the base of the plants where the planthoppers generally feed. Continuous use of the same group of insecticides to be avoided in the field.

Table 1: Chemicals for management of planthoppers in field (Source: CIBRC, as on 01/06/2023)

Insecticide/biopesticide	**Dosage**	**Waiting period**
Azadirachtin 0.15% EC (Neem Seed Kernel Based)	3-5 ml/l	5
Acetamiprid 20% SP	1-1.6 g/l	7
Dinotefuran 20 % SG	0.3-0.4 g/l	21
Etofenprox 10 % EC	1-1.2 ml/l	15
Fipronil 5% SC	2-3 ml/l	32
Fipronil 18.87% SC	0.5 ml/l	46
Fipronil 3% GR	16.67-25 kg/ha	32
Flonicamid 50% WG	0.3 g/l	36
Flupyrimin 2% GR	5-7.5 kg/ha	77
Flupyrimin 10 % SC	1.5-2 ml/l	7

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Imidacloprid 30.5% SC	0.12 ml/l	37
Imidacloprid 17.8% SL	0.2 ml/l	40
Thiamethoxam 25% WG	0.2 g/l	14
Ethiprole 40 %+Imidacloprid 40% WG	0.3 g/l	15
Triflumezopyrim*	0.47 ml/	-
Flupyrimin20 % Sc	1.5-2 ml/l	-

Conclusion:

Monitoring brown planthopper is challenging since by the time plant damage is visible, a significant yield loss has already taken place. For the farmer, it is a hidden enemy, and timely detection and efficient management depend on frequent pest monitoring. Early detection of pest infestation can help manage the pest cost-effectively, thereby reducing food production costs and avoiding environmental hazards.

Reference

Bottrell, D. G., & Schoenly, K. G. (2012). Resurrecting the ghost of green revolutions past: The brown planthopper as a recurring threat to high-yielding rice production in tropical Asia. Journal of Asia-Pacific Entomology, 15(1), 122-140.

Dhaliwal, G. S., Jindal, V., & Dhawan, A. K. (2010). Insect pest problems and crop losses: changing trends. Indian Journal of Ecology, 37(1), 1-7.

https://eands.dacnet.nic.in/PDF/Agricultural%20Statistics%20at%20a%20Glance%20%2020 21%20(English%20version).pdf Access on 11/8/2022

Krishnaiah, K., & Varma, N. R. G. (2011). Changing insect pest scenario in the rice ecosystem—A national perspective. Rice Knowledge. Management. Portal, 1-28.

Srivastava, C., Chander, S., Sinha, S. R., & Palta, R. K. (2009). Toxicity of various insecticides against Delhi and Palla population of brown plant hopper (Nilaparvata lugens). Indian Journal of Agricultural Sciences, 79(12), 55-58

Yy, B., & Zhang, C. Xi. 2019. Recent advances in molecular biology research of a rice pest, the brown planthopper. J Integrative Agric, 18(4), 716-728.