

Common insect pests of rice and their natural biological control

An illustrated guide to the insect pests that feed on rice plants and the organisms that feed on and control those pests.

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About 187 species of insects have been recorded on rice (Yunus and Ho, 1980), but few have ever become serious pests. WHY? Because the pests of rice are themselves fed upon by parasitoids (insects that live part of their life cycle inside their prey), pathogens, and predators. According to Yunus and Balasubramanian (1981) the major insect pests of rice (paddy) are:

- a) Four species of rice stem borers, with *Chilo polychrysus* as the main species
- b) The rice armyworm, *Spodoptera mauritia*
- c) The Malayan black bug, *Scotinophora coarctata*
- d) The caseworm, *Nymphula depunctalis*
- e) The rice leaf folder, *Cnapalocrocis medinalis*
- f) The green leafhopper, *Nephotettix virescens*
- g) The rice ear bug, *Leptocorisa oratorius*
- h) The rice brown planthopper, *Nilaparvata lugens*
- i) The white-backed planthopper, *Sogatella furcifera*

To this list, Ooi (1988) has included *Recilia dorsalis* (Motschulsky) (Hemiptera: Cicadellidae), and Khoo et al. (1991) have included *Locusta migratoria manilensis*. In this paper, nine species are illustrated. A more complete account of rice-feeding insects may be obtained from Shepard *et al.* (1995).

The rice stem borers

Rice stem borers like the most common rice insect in Malaysia, *Chilo polychrysus* (Meyrick) (Lepidoptera: Pyralidae), bore into the rice stems, usually killing the stems. However, rice plants usually compensate by producing more tillers (new stems) and usually no yield loss is registered at low levels of attack e.g. 1% of tillers. This has been determined in extensive surveys conducted in major rice growing regions in Malaysia.



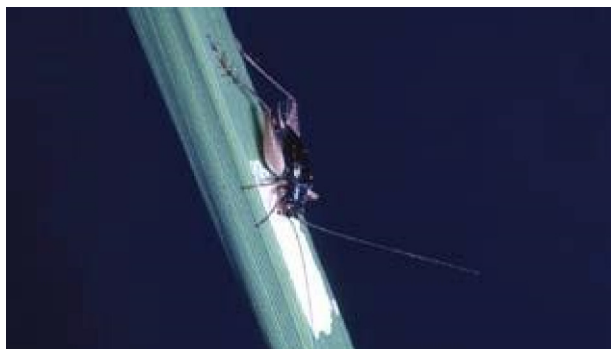
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When rice plants reach seeding stage, symptoms of damage by rice stem borers are visible as white heads. Eggs of the moth are laid on the leaves. Many eggs are laid in one batch. The egg stage lasts 4 to 7 days. The caterpillar completes its larval stage in 23 to 34 days in 6 instars. A full-grown caterpillar may measure 22 cm long and then it pupates within the damaged stem and the pupal stage lasts 6 to 9 days.



Nature has a way to keep populations of rice stem borers low and these natural enemies include the egg parasitoid *Tetrastichus schoenobii* Ferriere (Hymenoptera: Eulophidae) a small wasp no longer than 2 mm.

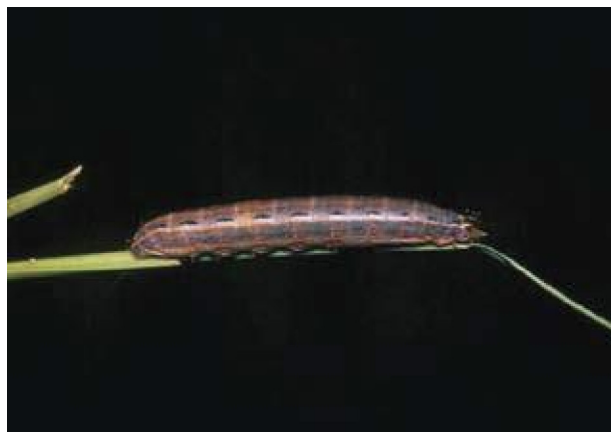
Also, ladybird beetles (Coleoptera: Coccinellidae) feed on the eggs laid by rice stem borer moths.



Eggs of rice stem borers also serve as food for crickets (*Anaxipha longipennis* (Serville) left and *Metioche vittaticollis* (Stål) - right) (Orthoptera: Gryllidae).

The rice armyworm, *Spodoptera mauritia* (Boisduval) (Lepidoptera: Noctuidae)

A full grown caterpillar of the rice armyworm, *Spodoptera mauritia*. The caterpillars often occur in low populations in the rice field. A major reason could be that many of these caterpillars die from infection by a fungus.



An adult moth resting on rice plants. Each female moth lays a mass of about 200 eggs that develop into caterpillars in 2-3 days and start feeding on rice plants. The caterpillar stage lasts about 34 days and the caterpillars pupate in the soil in the rice field.



The Malayan black bug, *Scotinophara coarctata* (F.) (Hemiptera: Pentatomidae)

Adults of the Malayan black bug (*Scotinophara coarctata*) are usually detected when they gather around street lights and interact with humans in their houses. They emit a nasty smell when disturbed. In the field they tend to congregate and feed by sucking the sap of the rice plants. Eggs of the bugs are laid in batches on the rice plant leaves. The egg stage takes about 4-7 days while the nymphs (immature black bugs) take about a month to develop into adults.



Many natural enemies attack and kill adults and nymphs of the Malayan Black Bug. These include fungal infections such as *Paecilomyces* (in the picture) and *Metarhizium anisopliae*. Two egg parasitoids are also known.



The caseworm, *Nymphula depunctalis* (Guenée) (Lepidoptera: Pyralidae)



Caterpillars of this insect hide inside a self-made tube of parts of rice leaf. While protected inside the case, the caterpillar feeds by scraping on the rice leaves.



Usually low numbers of the caseworm are found in rice fields. This situation has been attributed to the action of natural enemies.

Symptoms of attack are untidy damaged leaves, usually on young plants.



The rice leaf folder, *Cnaphalocrocis medinalis* (Guenée) (Lepidoptera: Pyralidae)



The caterpillars of this insect fold rice leaves and feed inside the folded portion. Folded rice leaves are commonly found in the early stages of establishment of the rice plants

Despite protection within a folded leaf, many natural enemies can discover the caterpillar. Some are parasitoids that feed within the body of the caterpillars. However, a predaceous larva of a carabid beetle (Coleoptera: Carabidae) is able to go inside the folded leaf and feed on the caterpillar. The actions of these natural enemies help keep the populations of the rice leaf folder at low levels



The green leaf hopper, *Nephotettix virescens* (Distant) (Hemiptera: Cicadellidae)

This insect is notorious in being a vector of tungro or as Malaysians call it, “penyakit merah”.



The symptoms of “penyakit merah” are red rice leaves on stunted plants. The disease requires two forms of the virus to exhibit the symptoms. Outbreaks of “penyakit merah” are infrequent and are dependent on the build-up of the vector, the green leaf hopper, *Nephotettix virescens*..



Populations of the green leaf hopper are often kept in check by natural enemies such as damselflies (Odonata: Coenagrionidae) and a fungal disease of the hopper.

The rice ear bug, *Leptocorisa oratorius* (F.) (Hemiptera: Alydidae)



Adult *L. oratorius* (left) and *nymph* (right) feed on developing rice grains resulting in no-fill (empty grains). The insect is recognized by the bad smell it exudes when disturbed.



A string of eggs laid by a rice ear bug that serves as food for the long-horn grasshopper, *Conocephalus longipennis* (de Haart) (Orthoptera: Tettigonidae)



A



B

The orb spider, *Argiope* sp. (Araneae: Araneidae) has a voracious appetite for the rice ear bug (A). It keeps the bug all tangled up in its web and slowly feeds on it by sucking up the body fluid. One may also find rice ear bugs covered in fungal mycelia. The entomogenous fungus attacks both nymphs and adults.

The rice brown planthopper, *Nilaparvata lugens* (Stål) (Hemiptera: Delphacidae)

The rice brown planthopper (BPH) usually exists in two forms at the height of an outbreak, namely the long-winged form or macropterous form and the short-winged or brachypterous form. The rice field is first invaded by the macropterous form and if younger rice plants exist, the next generation will be largely brachypterous. As the BPH are small (about 5 mm long) and feed near the base of the rice plant, they often escape detection. If the field is regularly sprayed with insecticides, the result is often more BPH and hopperburn, a symptom associated with BPH outbreaks, as observed in the picture below.



Eggs of BPH inside rice stem dissected to show what they look like (less than 1 mm long)



Hopperburn - the result of severe dehydration caused by hundreds of BPH feeding on the rice plants. Notice the BPH long-winged adults on the flag leaf of a rice plant ready to fly and invade new plantings.



A



B



C

Natural enemies like *Pardosa pseudoannulata* (A) (Araneae: Lycosidae) and the ectoparasitoid, *Pseudogonatopus* sp.(B) (Hymenoptera: Dryinidae) and the entomogenous fungus, *Hirsutella* sp. (C) normally keep populations of BPH at low levels. However, regular use of insecticides reduces the effectiveness of the natural enemies and this leads to outbreaks of the insect pest.

The white-backed planthopper, *Sogatella furcifera* (Horvath) (Hemiptera: Delphacidae)



Like BPH, the white-backed planthopper (WBPH) exists in two forms depending on the state of the food plant, rice. The long winged-form (left picture) invades rice fields and the next generations are short-winged forms that reproduced at a faster rate (right picture).



Eggs of the white-backed planthopper are similar to that of BPH



Hopperburn caused by WBPH

Many of the natural enemies that prey on BPH also attack WBPH and outbreaks are reduced if there is less use of insecticides in rice fields.

Conclusions:

Most of the insect pests of rice in Malaysia are kept at low populations by their natural enemies such as damselflies, dragonflies, spiders and mirid predators. Indeed, such predators reduce the risk of outbreaks of rice pests and their presence indicates the health of the rice field. The use of chemical insecticides may remove the general predators and damage this rich ecosystem.



Besides hoppers, the damselfly, *Agriocnemis* sp. (Odonata: Coenagrionidae) feeds on moths in the rice fields.



The dragonfly, *Diplacodes* sp. (Odonata: Libellulidae) a common insect in rice fields.



Entomogenous fungi keep many herbivore populations in check.



Spiders often eat other insects when pest species are not available.

Bibliography

- Balasubramaniam, A. and Ooi, P. A. C. 1977 Status of rice stem-borers following double cropping in Krian, Malaysia. *Malaysian Agricultural Journal* 51: 54-61.
- Joshi, R. C., Barrion, A. T. and Sebastian, L. S. (Eds.) 2007. *Rice black bugs Taxonomy, Biology, and Management of Invasive Species*. Philippines Rice Research Institute, Philippines. 793 pp.
- Khoo K. C., Ooi, P. A. C. and Ho, C. T. 1991. *Crop Pests and their management in Malaysia*. Tropical Press Sdn. Bhd., Kuala Lumpur, 242 pp.
- Lim G. S. Ooi, A. C. and Koh A. K. 1978. Outbreak and control of the rice brown planthopper (*Nilaparvata lugens* Stal) in Tanjung Karang, Malaysia, In: "Proceedings of the Plant Protection Conference 1978. Pp 193-213.
- Ooi, P. A. C. 1974. A padi stem-borer survey in the Muda Scheme, Kedah. *Malaysian Agricultural Journal* 49: 525-531.
- Ooi, P. A. C. 1976. Assessment of incidence of rice stem-borer in Tanjung Karang, Malaysia. *Malaysian Agricultural Journal* 50: 314-321
- Ooi, P. A. C. 1984. Insecticides disrupt natural control of *Nilaparvata lugens* in Sekinchan, Malaysia. In: "Biological Control in the Tropics" (Eds. Hussein, M. Y. and Ibrahim, A. G.) pp. 109-120.
- Ooi, P. A. C. 1988. *Insects in Malaysian Agriculture*. Tropical Press Sdn. Bhd. Kuala Lumpur. 106 pp.
- Ooi, P. A. C. 1992. Biology of the brown planthopper in Malaysia. *Journal of Plant Protection in the Tropics* 9: 111-115.
- Ooi, P. A. C. 2005. Some nonpesticide methods for managing crop insect pests - present status, issues and strategies. In: *Nonpesticide Methods for Controlling Diseases and Insect Pests*. APO Tokyo (Editor Ooi, P. A. C.) pp 15-23
- Ooi, P. A. C. 2010. *Rice Plant Hopper Outbreaks: A man-made plague?* PAN AP Rice Sheets 12 pp. Pesticide Action Network Asia and Pacific, Penang, Malaysia.
- Shepard, B. M. Barrion, A. T. and Litsinger, J.A. 1995. *Rice-feeding insects of Tropical Asia*. International Rice Research Institute, Manila, Philippines. 228 pp.
- Tiongco, E. R., Angeles E. R. and Sebastian, L. S. (Eds.) 2008. *The Rice Tungro Virus Disease. A Paradigm in Disease Management*. Philippines Rice Research, Philippines 262 pp.
- Yunus, A. and Balasubramanian, A. 1981. *Major crop pests in Peninsular Malaysia*. Bulletin No. 138 Agriculture Division, Ministry of Agriculture, Malaysia. 190pp. 2nd
- Yunus, A. and Ho, T. H. 1980. *List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978)*. Bulletin No. 153, Ministry of Agriculture, Malaysia 538 pp.