

Insect pests on main crop and ratoon crop of Intan at Mudigere, India. OHLH = orange-headed leafhopper, WM = whorl maggot, CW = caseworm, LR = leafroller, T = thrips, GM = gall midge, SB = stem borer, GLH = green leafhopper, BPH = brown planthopper.

used. The crop was harvested on 31 Dec 1984 and 25 Nov 1985 leaving 8-cm stubble. The ratoon crop was fertilized with 45 kg urea 30 d after main crop harvest.

Insects were sampled on main crop and ratoon crop using a sweep net. Ten criss-cross sweeps were made at the top of the canopy on each plot and selected species counted. Plants also were examined for noticeable damage. In 1985, natural enemies were also sampled following the same sampling methods.

The ratoon crop recorded significantly higher numbers of orange-headed leafhopper *Thaia subrufa* (Motsch.) and green leafhopper *Nephotettix virescens* (Distant) than the main crop in both 1984 and 1985 (see figure). Brown planthopper *Nilaparvata lugens* (Stål) had significantly higher numbers on the ratoon crop in 1985.

Whorl maggot *Hydrellia griseola* (Fallen), caseworm *Nymphula depunctalis* (Guenée), leafroller *Cnaphalocrocis medinalis* (Guenée), gall midge *Orseolia oryzae* (Wood-Mason), and thrips *Stenchaetothrips biformis*

(Bagn.) did not increase. Stem borers *Scirpophaga incertulas* (Walk.) and *S. innotata* (Walk.) damaged both the main and ratoon crops.

Both main and ratoon crops harbored natural enemies that can play a crucial role in suppressing insect pests.

Six spiders, 2 odonatan, 2 wasps, 1 neuropteran, 16 *Cyrtorhinus* sp., and 12 *Microvelia* sp. bugs were recorded per 10 clumps on the main crop. On the ratoon crop, one spider, two odonatan, one neuropteran, six *Cyrtorhinus*, and two *Microvelia* spp. were recorded. □

Electronically recorded waveforms associated with brown planthopper (BPH) feeding activity

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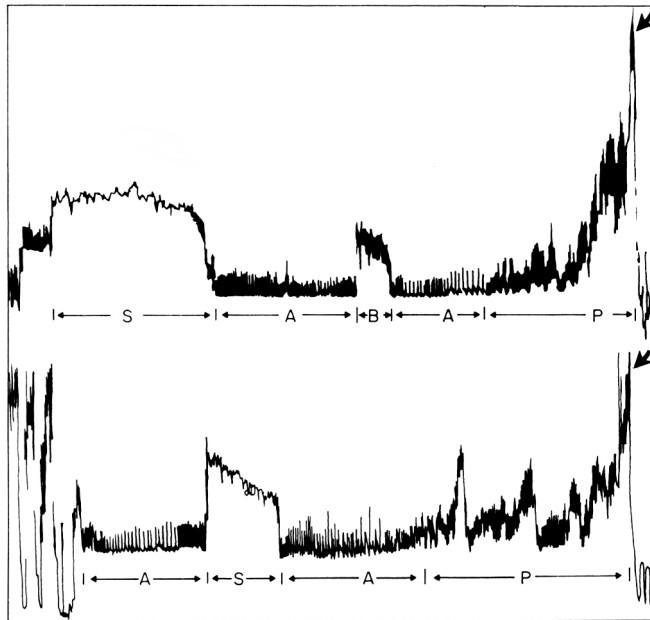
We analyzed the feeding activity of BPH by an electronic measurement system constructed with a power supply unit, variable oscillator, logarithmic amplifier, and stripchart recorder. BPH behavioral components associated with feeding activity were recorded as different voltage fluctuation patterns.

A brachypterous female was tethered with a 10- μ m-diameter gold wire leading to the input of the electric current detection amplifier using electric conductive paint Dotite D-550 and allowed to feed on a potted rice plant electrified by applying a 500 Hz, 5 V alternative current from the oscillator. The plant and BPH were confined in a copper net cage during measurement to shut off electric noise.

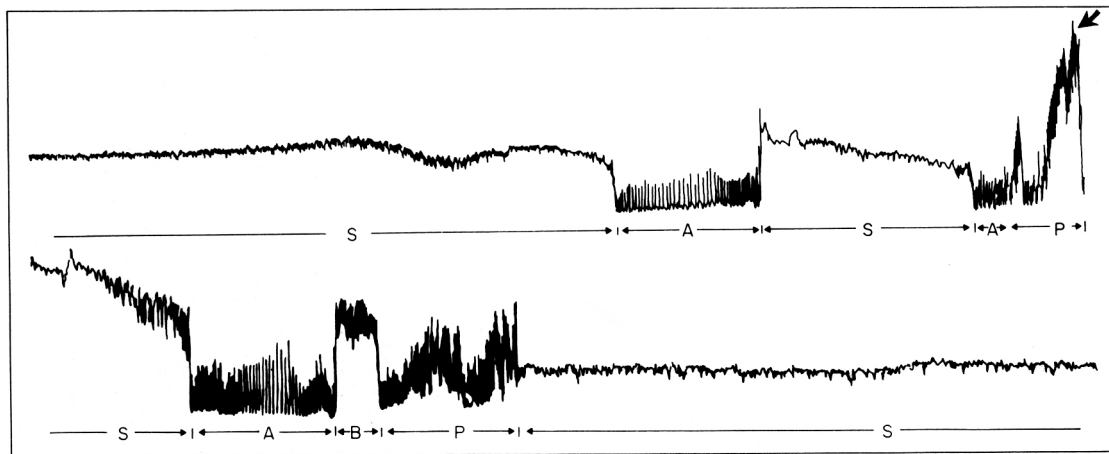
BPH is a phloem feeder, with stylet sheath feeding. Its feeding process consisted of probing and sucking phases that elicited distinct waveforms. When the BPH started to penetrate the plant epidermis, an abrupt upsurge of electric current appeared. This is possibly due to excretion of a bulk of sheath material

on and into the plant tissues. Subsequent stylet probing along with stylet sheath formation produced an irregular jagged pattern with gradual drop of voltage (P).

Once the BPH went into sustained sucking from sieve elements in the phloem, confirmed by excretion of honeydew rich in sucrose, stable voltage output with micro vibrations in amplitude continued (S). Between the probing (P) and sucking (S) waveforms, two types of brief but characteristic waveforms registered: a regular pulsation pattern (A) and a small plateau formed by a vertical rise of voltage (B) similar to an intermittent sucking waveform. The A and B waveforms are possibly related to sensory responses of the BPH for



1. Examples of waveforms produced by biotype I females on resistant variety IR26, Indonesia, 1987. The upper chart shows that sucking from a sieve element after a P-A-B-A sequence was discontinued shortly. The lower chart shows a very short sucking waveform between the A-waveforms.



2. Examples of waveforms produced by biotype I females on susceptible variety Pelita I/1, Indonesia, 1987. The upper chart indicates a process going into a sustained sucking from a sieve element after a sequence of P-A-S-A waveforms. The lower chart shows that a P-B-A sequence occurred during sustained sucking, indicating a change of sucking sites from one sieve element to another without withdrawal of the stylets from the plant. Letters A, B, P, and S indicate A, B, probing, and sucking waveforms, respectively. Arrow indicates a voltage upsurge at time of stylet insertion.

localization of sieve elements within the phloem, such as pulsatory emission of watery saliva for gustatory sensing and trial sucking.

The sequences of waveforms commonly recorded when BPH fed on susceptible rice varieties is P-A-S, P-B-A-S, or P-A-B-A-S. The same waveforms also were produced on resistant varieties.

The sucking waveform appeared only briefly, if at all on resistant varieties (Fig. 1). They lasted for a long time on susceptible varieties (Fig. 2).

This reconfirms that the varietal resistance to BPH is attributed to gustatory blockage of sustained sucking on sieve elements.

Strepsipteran parasites of rice leafhoppers and planthoppers in the Philippines

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Strepsiptera are highly host-specific parasites of auchenorrhynchous Homoptera. Host records can be determined by dissecting specimens. In 1985-86, we collected leafhoppers and planthoppers by D-Vac suction machine from dryland ricefields and adjacent grasslands of Caliraya in Laguna and Claveria in Misamis Oriental and from wetland ricefields in Koronadal in South

Cotabato, Calauan in Laguna, and Zaragoza in Nueva Ecija.

Two new host records for the Philippines were found, bringing the total to six (see table). The earlier record of *Halictophagus yiperi* Bohart on its sole host *Cofana longa* Merino was not detected. *Elenchus yasumatsui* Kifune et Hirashima parasitizes nymphs and adults of brown planthopper *Nilaparvata lugens* and is newly recorded on *N. bakeri*, *H. spectrus* Yang attacks only *Cojana spectra* and *H. munroei* Hirashima et Kifune only green leafhoppers *Nephotettix* spp.

H. bipunctatus Yang, recorded in Japan and China, was observed on *N.*