**Wild hosts of the rice BB pathogen. Coimbatore, India.**

| Host tested | Infection[a] |
|---|---|
| *Oryza sativa* L. | +++ |
| *Eleusine coracana* (L.) Gaertn. | – |
| *Paspalum scrobiculatum* L. | + |
| *Setaria italica* Beauv. | – |
| *Echinochloa colona* (L.) Link | – |
| *Echinochloa crus-galli* Linn. | ++ |
| *Cyperus rotundus* L. | + |
| *Leersia hexandra* S. | ++ |
| *Cenchrus ciliaris* L. | ++ |
| *Chloris gayana* Kunth | – |
| *Brachiaria mutica* Stapf | ++ |
| *Brachiaria ramosa* Stapf | – |
| *Panicum maximum* Jacq. | ++ |
| *Pennisetum pedicelatum* Trin. | – |
| Bajra-napier hybrid (BN2) | ++ |

[a]+++ = high infection, ++ = moderate infection, + = slight infection, – = no infection.

hosts were not infected (see table).

Reisolation of the pathogen and back inoculation to rice confirmed pathogenicity.

This confirms the susceptibility of hosts (*P. scrobiculatum, C. rotundus,* and *L. hexandra*) reported earlier and identifies susceptible species *Cenchrus ciliaris,* BN2, *E. crus-galli, B. mutica,* and *P. maximum.* □

# Insect management

## Larvicidal activity of neem seed bitters (NSB) against *Culex quinquefasciatus* in flooded ricefields

*D. R. Rao and R. Reuben, Centre for Research in Medical Entomology, Madurai 625003, India; and R. C. Saxena, IRRI*

Standing water in ricefields supports breeding of *Culex tritaeniorhynchus* and related species, which have been incriminated as vectors of Japanese encephalitis in Southeast Asia. Growing awareness of the adverse effects of synthetic insecticides on nontarget organisms in ricefields has led to a search for alternative pest control measures.

We evaluated different dilutions of NSB against *Cx. quinquefasciatus.* Although it does not normally breed in ricefields (unless they are contaminated with sewage), no difference in susceptibility to natural products has been reported between this species and the culicine vector species that breed in ricefields.

NSB dilutions of 2000, 1000, 500, 250,125, and 62.5 ppm in acetone-water (5:995 parts vol/vol) were dispensed at 125 ml/200-ml glass beaker. Freshly molted 4th-instar mosquito larvae were released at 25/ beaker and allowed to develop at room temperature.

After 24 and 48 h exposure to 2000 ppm NSB, 42 and 62% larvae died. Full mortality required 72 h, particularly at lower NSB doses. The $LD_{50}$ value for 72 h was 914 ppm with fiducial limits 349.8 ppm (lower) and 2386.6 ppm (upper). □

## Gall midge (GM) outbreak on dry season rice in West Godavari District, Andhra Pradesh (AP), India

*P. R. M. Rao, Agricultural Research Station, Maruteru, AP; and P. S. Prakasa Rao, Central Rice Research Institute, Cuttack, India*

Rice GM *Orseolia oryzae* Wood-Mason (Diptera:Cecidomyiidae) is normally a serious pest in the wet season. Light to moderate infestations in endemic pockets have been occurring in dry season (rabi) rice since the 1970s, especially in years of unseasonable intermittent cloudy or rainy weather that creates high microrelative humidity within the crop.

A severe incidence of GM in West Godavari in 1989 rabi affected 1,000 ha of late-planted IR64. About 100 ha in Mamuduru village of Enumantra Mandal, 50 ha in Vadali village of Penugonda Mandal, and 25 ha in Dagguluru village of Palakonda Mandal were severely damaged, with total yield loss. An additional 800 ha suffered 25-80% silvershoots and 20-60% yield reduction.

In the total rabi rice-cropped area of 0.2 million ha in the district, about 53% was planted to IR64. Other varieties were IET1444, BPT1235, and MTU7014.

Early and timely planted crops (up to the end of Dec 88) suffered no or less than 10% silvershoots with higher than expected (5-8 t/ha) yields. IR64, planted late (5-20 Jan) because of late canal irrigation water availability in the three villages, suffered severe GM attack. Other varieties, especially BPT1235, although also planted late were not attacked.

The factors that appear to have caused the outbreak were late planting of a susceptible genotype and unusually heavy mist every day 5-30 Feb, coinciding with early tillering. The result was high relative humidity in the crop's microclimate. □

## Acoustical analysis of brown planthopper (BPH) courtship signals

*B. T. Yin, Applied Acoustics Research Institute, Hanghou; Z. T. Zhang and W. Z. Kong, China National Rice Research Institute, Hangzhou, China; and R. C. Saxena, IRRI*

BPH males and females communicate sexually through acoustical signals produced by dorsoventral abdominal vibration (AV), which causes the abdominal sclerite (AbS) to rub against the coxata. The friction between the abdominal stridulating surface (AbSS) and the coxatal stridulating surface (CoSS) causes the coxata to vibrate, thereby emitting signals.

BPH signals are amplitude modulated waves. AV produces modulating signals, the stridulation between AbSS and CoSS generates the carrier wave. The stridulatory sound is a quasiperiodic sinusoid. Its frequency is Fo. The amplitude and dynamics of AV determine the depth of modulation; in the extreme, it produces discrete pulses. We analyzed-BPH signals by the demodulation approach,

to get the pulse envelope (waveform of AV). Then, pulse repetition frequencies (PRF) were calculated.

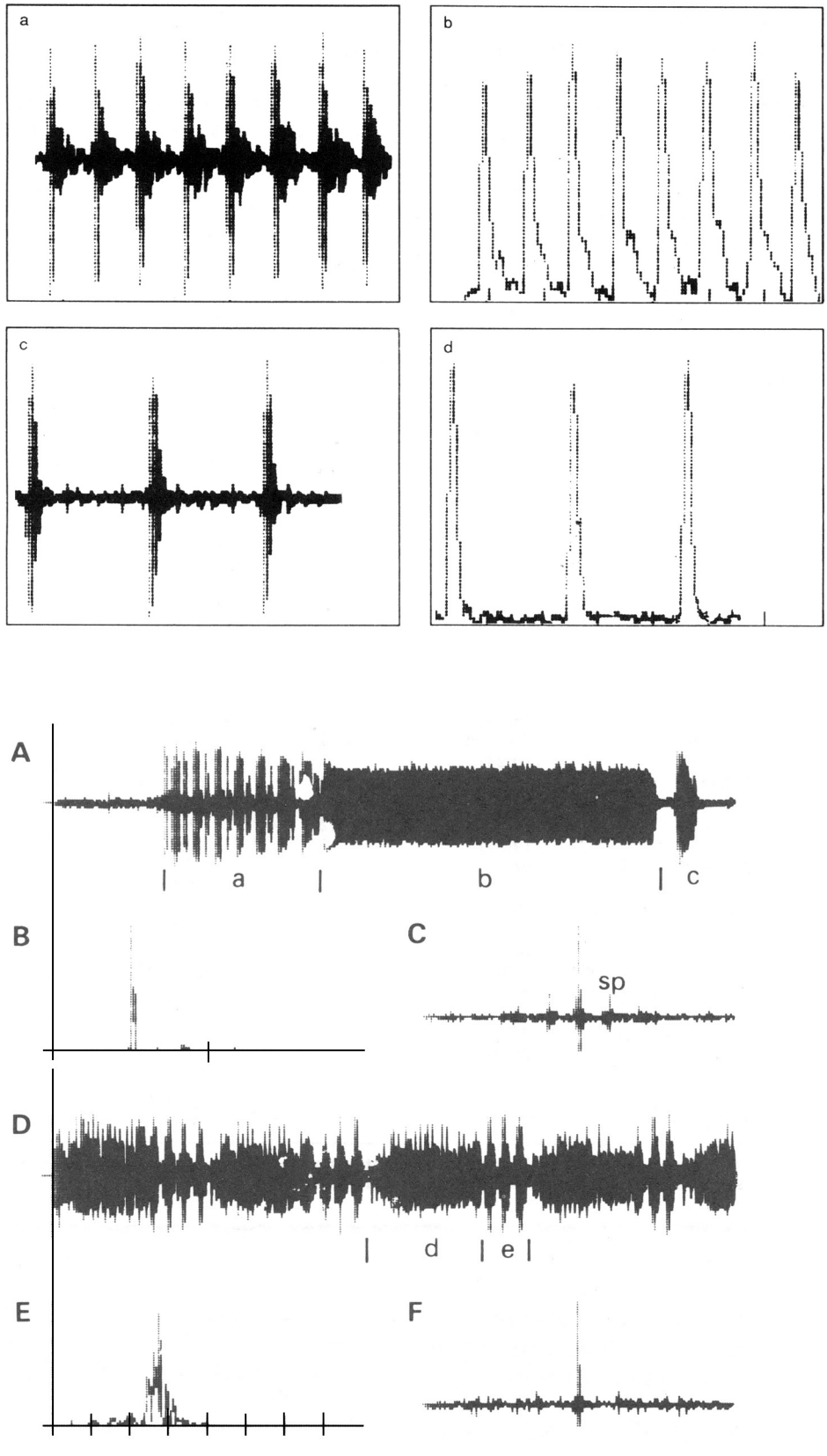
Female signals are series of simple discrete pulses. Figure 1 shows PRF of female signals of rice-infesting BPH biotype 1 and *Leersia*-infesting BPH. PRF in *Leersia*-infesting females (6.4 ± 0.9 HZ) are lower than in rice-infesting biotypes 1, 2, 3, and the Mindanao BPH (19.4-19.9 HZ). Thus PRF of signals can characterize BPH biotypes.

Males produce two types of signals: 1) signals with 3-10 sound pulses at the beginning (Fig. 2Aa) and 1-5 pulses at the end (Fig. 2Ac), the middle being continuous (Fig. 2Ab); 2) signals with only 2-3 sound pulses at the end (Fig. 2De); pulses at the beginning and the middle are continuous (Fig. 2Dd). The average of sound rhythm period (To), calculated from signal waveform, was 4-6 s in the first type and 0.5-0.7 s in the second.

We used fast fourier transform (FFT) to estimate the frequency of the quasiperiodic sinusoid. The frequency with the highest power was the main vibration frequency (MVF) (Fig. 2B, 2E).

In rice-infesting BPH biotypes, MVF was 196.4-333.9 HZ for female signals and 209-388.7 HZ for male signals (Fig. 2Ab). MVF for *Leersia*-infesting females (285.2-347.7 HZ) and males (271.5-677.7 HZ) were significantly higher ($P$ = 0.05) than for rice-infesting biotypes. MVF could also characterize BPH biotypes.

Some small peaks (SP) in the cepstrum of acoustic signals indicated voicing (Fig. 2C). The pitch period was about 12.66 ms. The first type of BPH male signal resembled voiced sound in human speech. The cepstrum (Fig. 2F) lacked small peaks, indicating that the second type of signals of males of rice- and *Leersia*-infesting BPH have unstable pitch period modes. Both rice- and *Leersia*-infesting BPH females call in stable pitch period modes. □




**2.** Acoustic analysis of courtship signals of *N. lugens* males. A, B, C = waveform, spectrum, and cepstrum of first type, respectively; D, E, F = waveform, spectrum, and cepstrurn of second type, respectively. IRRI, 1989.