tested in three replications: chaff, straw, husk, grain, dust, sawdust, WA, PDA, End 1:l mixtures of chaff + grain and chaff + agar.

R. solani grew rapidly in PDA and WA (Table 1), but mycelial density was very low in WA. After 48 h, growth in the PDA and grain media did not significantly differ. Growth on chaff + grain, agar + chaff, chaff, rice, dust, and straw was moderate, and was very low on sawdust and husk. Grain medium produced the most (more than 3,000) sclerotia (Table 2). Chaff + grain produced 490 sclerotia.

Mycelial growth in grain and PDA did not significantly differ, but grain produced more sclerotia. The grain has more surface area on which *R. solani* can grow.

After the first experiment, grain and PDA were compared to quantify disease development. Equal amounts of the media were placed within the sheaths of potted rice plants or spread on water around the plant, and disease development was recorded. Treatments were thrice replicated.

Disease development was affected by inoculation method, but not by the media. When media were placed within sheaths, ShB symptoms developed in 4 d; when spread on water, symptoms developed after 6 d.

Grain media perform well for field inoculation of *R. solani.* It also is easily available, inexpensive, and simple to prepare.

Pest Control and Management
INSECTS

Spider mortality implicated in insecticide-induced resurgence of whitebacked planthopper (WBPH) and brown planthopper (BPH) in Kedah, Malaysia

W. T. Vorley, postdoctoral fellow, School of Biogical Sciences, University Saints Malaysia, Pulau Pinang, Malaysia

We studied the effect of two widely used carbamate insecticides (carbofuran and BPMC) and two pyrethroids (cypermethrin and cis-2-cypermethrin [formerly alphamethrin]) on WBPH, BPH, other rice pests, and planthopper enemies.

Seribu Gantang was transplanted in 10-m^2 plots at 20 × 20 cm in a randomized block design with 4 replications. Each plot was surrounded by an earth boundary and a 1 -m alley. Insecticides were applied at 20, 40, and 63 d after transplanting (DT). Foliar sprays from a shoulder sprayer were directed at the plant canopy and applied at 400 litres/ ha. Carbofuran granules were broadcast onto field water.

Planthoppers and spiders were sampled using boards consisting of 25- × 18-cm perspex sheets covered with Gumbug sticky material. The boards were held horizontally beside the rice hill to be sampled. The hill was struck firmly three times so that hoppers and other arthropods fell onto the board. Twenty hills were sampled each week, with extra

Table 2. Spider densities and number of WBPH and BPH nymphs per spider early in the population growth of the 2 planthopper species,[a] Kedah, Malaysia.

Treatment	WBPH				BPH			
	48 DT		55 DT		64 DT		69 DT	
	Spiders/ hill	N:S	Spiders/ hill	N:S	Spiders/ hill	N:S	Spiders/ hill	N:S
Carbofuran	0.55 ab	11	1.22 ab	33	2.32 ab	2.5	3.17 b	2.0
BPMC	0.24 bc	45	0.92 bc	23	1.92 b	0.7	2.59 b	0.8
Cypermethrin	0.06 c	249	0.21 d	547	0.34 c	13	0.37 c	40
Cis-2-cypermethrin	0.18 c	95	0.31 cd	352	0.34 c	106	0.18 c	371
Untreated control	0.73 a	26	1.62 a	40	3.05 a	4.7	4.97 a	6.1

[a]All figures are av of 4 replications, corrected for sampling efficiency. Means followed by a common letter are not significantly different by Waller-Duncan K-ratio t-test. N:S = no. of hopper nymphs/ spider. DT = days after transplanting.

Table 1. Populations of WBPH and BPH, percentage hopperburn, and yields in carbamate- and pyrethroid-treated plots, [a] Kedah, Malaysia.

Treatment	WBPH/hill		RR^b	BPH/hill		RR	Total hopperburn (%) 103 DT [c]	Grain yield [d] (t/ha)
	55 DT	69 DT		76 DT	90 DT			
Carbofuran 2G, 600 g ai/ha	40.2 a	39.0 a	0.43	16.9 a	39.1 a	0.22	0 a	5.9 a
BPMC EC50, 0.1%	21.3 a	87.6 a	0.93	16.3 a	55.1 a	0.31	0 a	5.6 ab
Cypermethrin EC150, 35 g ai/ha	98.5 c	240.4 b	2.54	37.9 a	101.6 a	0.56	0 a	5.0 b
Cis-2-cypermethrin EC100, 15 g ai/ha	151.2 d	257.1 b	2.86	176.4 b	313.9 b	1.68	19.6 b	3.8 c
Intreated control	70.2 b	89.8 a	–	44.9 a	180.4 a	–	3.2 a	5.3 ab

[a] All figures are av of 4 replications, corrected for sampling efficiency. Means followed by a common letter are not significantly different by Waller-Duncan K-ratio t-test. DT = days after transplanting. [b] Resurgence ratio (RR) = treated/control. [c] Analysis on arc sine transformed values. [d] corrected from 19% to 14% moisture content.

samples 1 d before and after insecticide application. Each board was examined under a dissecting microscope.

Cypermethrin and cis-2-cypermethrin caused WBPH resurgence. Cis-2-cypermethrin caused BPH resurgence and hopperburn, and reduced yield 28% below that of the unsprayed control (Table 1). Carbofuran and BPMC gave good control of both planthoppers.

When changes in populations of spiders, Coleoptera, mirid predators, and egg parasitoids were considered, the decline in spider populations was closely related to WBPH and BPH resurgence. Both pyrethroids were highly toxic to spiders, contributing to high hopper nymphspider ratios early in the period of hopper population increase (Table 2).

Carbamates were less toxic to spiders and other natural enemies. Carbofuran and BPMC gave moderate or poor control of most other rice pests. Both pyrethroids gave excellent control of other rice pests and tested doses were not toxic to fish.

Gall midge (GM) activity and parasitization by *Platygaster oryzae* in Jaya stubble and wild rice at Bhubaneswar, India

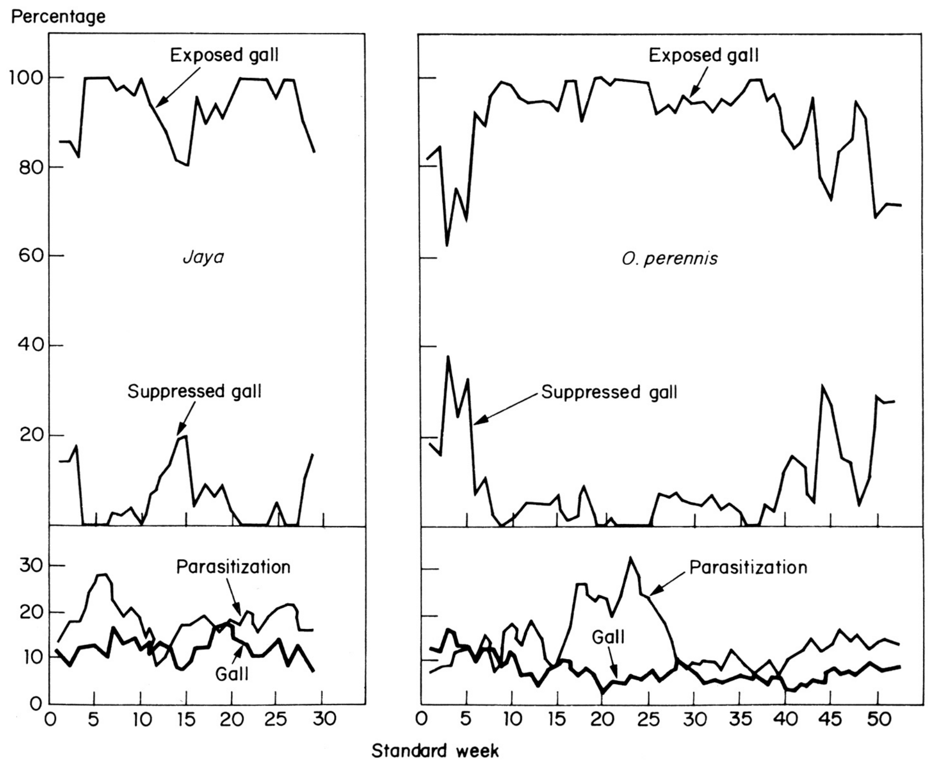
B. C. Jena, entomologist, Regional Research Station, Semiliguda (Sunabeda), Koraput, Orissa; and N. C. Patnaik and N. Panda, Entomology Department, Orissa University of Agriculture and Technology (OUAVT), Bhubaneswar, India

GM *Orseolia oryzae* (Wood-Mason) breeds in Jaya rice stubble during the off-season (Jan-Jun) and also in wild rice *Oryza perennis* (Moench). GM-infested tillers turn into silvershoots or galls which protrude from the leaf whorl (exposed galls). In unproductive and late formed tillers, many galls do not protrude from the leaf whorl and remain hidden in the culm (suppressed galls).

We studied GM abundance, activity, and parasitization due to *Platygaster oryzae* (Cameron) in Jaya rice stubble and in wild rice at OUAT in 1982.

Stubble was left in unsprayed fields planted to Jaya after harvesting the wet season crop (Jul-Dec). It was occasionally irrigated to encourage ratoon growth. Fields were divided into four quadrats and each quadrat into five subplots. From each subplot, one hill was uprooted at random at weekly intervals. In the laboratory, silvershoot infestation was recorded and the exposed and suppressed galls were dissected to determine parasitization. Twenty randomly selected hills of wild rice were collected weekly from swamps adjoining the Jaya fields and examined for midge attack and parasitization.

Gall midge was prevalent in Jaya stubble throughout the off-season, peaking at 17 wk (23-29 Apr). Parasitization peaked at 5 and 6 wk (29 Jan-11 Feb). Suppressed galls were maximum at 15 wk (9-15 Apr) (see figure).



Exposed and suppressed galls and parasitization of Jaya stubble and *O. perennis,* Bhubaneswar, India.

O. perennis also harbored GM throughout the year, but infestation was lower than in stubble. Parasitization, however, was higher. Gall occurrence was highest in the 3d (15-21 Jan) and 46th wk (12-18 Nov) and most galls were suppressed. GM infestation and parasitization followed a wax and wane cycle.

Stem injury in deep water rice as a guide for determining stem borer (SB) infestation at different growth stages

S.K. Datta, D. Konar, S.K. De, and P.K. Banerjee, Operational Research Project, Pandua, Hooghly, West Bengal, India

SB *Scirpophaga incertulas* infestation generally is high in deep water rice. We studied SB infestation at different internodes of deep water rice plants at harvest. Water level, plant height, stem elongation, internode formation, and growth phase were considered.

A 0.2-ha deep water field was planted to photoperiod-sensitive Jaladhi 1 in early Jun 1983. Soil was a clay loam with pH 7.0-7.5. At land preparation, 10 t farmyard manure/ha was applied. Standard cultivation methods were