

In addition to these entomopathogens, several other species of fungi have been isolated from the insects, e. g. *Penicillium* sp., *Aspergillus* spp., *Fusarium* spp., *Alternaria* spp., and a *Cladosporium* sp.

However, their entomopathogenic nature has not yet been determined.

The bacterium was identified as *Serratia marcescens*. Preliminary infection tests both in the laboratory and in field

cages show highly promising results. Applying a suspension of conidia of *B. bassiana* on different hopper populations resulted in 60-90% infection 15 d after incubation. □

Efficacy and residues of carbofuran 3G broadcast for yellow stem borer (YSB) control in India

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YSB *Scirpophaga incertulas* (Walk.) is a major rice pest in Punjab, India. We evaluated the efficacy of carbofuran 3G 0.75 kg ai/ha in 1, 2, or 3 applications for YSB control on cultivar PR4141.

Deadhearts and whiteheads were recorded at 20-d intervals after the first insecticide application.

A 50-g grain sample from a 1.5-kg pooled sample drawn from 3 replications was hydrolyzed by refluxing in 0.25 N HCl, extracted with dichloromethane, and analyzed for insecticide residue by a gas chromatograph. Average carbofuran recovery in fortified samples was 87%.

YSB incidence and carbofuran residues in paddy grain samples, Ferozepur, Punjab, India, 1983.^a

Carbofuran application	YSB incidence				Yield (t/ha)	Carbofuran residues (ppm) in paddy grains at harvest
	Deadhearts (%)		Whiteheads (%)			
	50 DT	70 DT	90 DT	110 DT		
30 – –	4.1 ab	8.7 cdef	39.6 cd	55.7 c	0.8	i
– 50 –	13.0 bcde	3.5 b	45.9 de	57.6 c	2.5	fgh
– – 70	8.3 bcde	10.7 efg	10.8 ab	14.2 ab	4.3	bcdef
30, 50 –	3.0 a	2.2 a	40.9 d	56.1 c	3.7	defg
– 50, 70	15.8 e	2.9 b	6.4 ab	8.8 a	5.8 ab	0.036
30 – 70	3.0 a	9.0 def	3.8 a	7.1 a	5.8 ab	0.158
30, 50, 70	5.1 abc	2.4 b	3.5 a	6.9 a	6.9 a	0.100
Control	17.6 de	24.9 h	78.4 f	82.7 d	0.6	i
						0.178

^a In a column means followed by a common letter are not significantly different at 5% level.

Although applying carbofuran 30 and 50 d after transplanting (DT) helped control YSB, application at 70 DT was essential to prevent whitehead damage. Maximum yield of 6.9 t/ha was obtained in plots with 3 applications at 30, 50, and 70 DT (see table).

Maximum carbofuran residue (0.178 ppm) was detected in grain samples from plots with 3 carbofuran applications. The lowest residue (0.036 ppm) was in the 30 and 50 DT treatment. In all treatments, carbofuran residue was below the 0.2 ppm tolerance limit. □

Genetic control of isocitrate dehydrogenase (IDH) and malate dehydrogenase (MDH) isozymes in rice brown plant-hopper (BPH)

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IDH and MDH of BPH are polymorphic, each with at least two electrophoretic variants. We made single-pair crosses of BPH to establish the genetic control of these enzymes.

One hundred pair of BPH biotype 1 were kept in separate test tubes with rice seedlings. The females were all newly emerged. After 3 d, the male parents were collected, frozen, and subjected to starch gel electrophoresis to determine their genotypes. The female parents were trans-

Segregation observed and expected in different crosses made to determine the inheritance of IDH and MDH variation in rice BPH.

Cross	Phenotypes			X ²	
Isocitrate dehydrogenase Idh ¹⁰⁰ × Idh ¹⁰⁰	Idh ¹⁰⁰	Idh ^{93/100}	Idh ⁹³	0.23 ^a	
	Obs.	97	–		
	Exp.	97	–		
	Idh ¹⁰⁰ × Idh ⁹³	Obs.	–		53
	Exp.	–	53		
	Idh ¹⁰⁰ × Idh ^{93/100}	Obs.	37		33
Exp.	35	35	–		
Malate dehydrogenase Mdh ¹⁰⁰ × Mdh ¹⁰⁰	Mdh ¹⁰⁰	Mdh ^{100/109}	Mdh ¹⁰⁹	3.72 ^a	
	Obs.	177	–		
	Exp.	177	–		
	Mdh ¹⁰⁰ × Mdh ^{100/109}	Obs.	39		58
	Exp.	48	48		
	Mdh ^{100/109} × Mdh ^{100/109}	Obs.	24		43
Exp.	22	43	22		

^a Not significant at the 5% probability level.

ferred individually to mylar cages and collected after 10 d, when they were frozen and subjected to starch gel electrophoresis for genotype identification. Newly emerged progenies from each cross

were collected and identified.

The table summarizes the segregation results of the different crosses involving the electrophoretic variants of IDH and MDH. The data are consistent with our

hypothesis that the migration differences observed for both enzymes are each controlled by a single locus with 2 co-dominant alleles. For IDH, these alleles are Idh¹⁰⁰ and Idh⁹³. For MDH, they

are Mdh¹⁰⁰ and Mdh¹⁰⁹. The heterozygotes for the two alleles at the Idh and Mdh loci had an intermediate band in addition to the parental ones, indicating that IDH and MDH isozymes are dimers.

We also noted the presence of other rare variants for IDH and MDH which could be codominant with the other alleles of each enzyme. □

Oviposition of brown planthopper (BPH) on some common weeds, wild rices, and rotation crops

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BPH *Nilaparvata lugens* Stål usually lays its eggs in small groups inside the leaf sheath and midrib of rice plants by making an incision and inserting eggs inside the tissues.

We studied BPH oviposition on 52 common rice weeds, 17 wild rices, and 21 crop plants in no-choice tests. Five pair of 1-wk-old BPH adults were confined on young, potted test plants for 4 d. The test plants were examined for oviposition sites and egg hatching every day for 4 d after the first nymphs hatched. If nymphs did not appear, plants were examined with a microscope for unhatched eggs. We had the following results.

There was no oviposition on weeds *Chrysopogon aciculatus*, *Cynodon dactylon*, *Eleocharis dulcis*, *Fimbristylis bisumbellata*, *F. miliacea*, *Cyperus kyllingia*, *Scirpus articulatus*, *S. supinus*, *Alternanthera sessilis*, *Cleome viscosa*, *Eclipta alba*, *Euphorbia hirta*, *Gomphrena celosioides*, *Marsilea* sp., *Trianthema portulacastrum*, and *Vernonia cinerea*. There was also none on crop plants Indian mustard and East Indian lemon grass.

Oviposition was inside the leaf sheath tissue on the following: weeds *Brachiaria ramosa*, *B. distachya*, *Dichanthium caricosum*, *Digitaria ciliaris*, *Echinochloa colona*, *E. stagnina*, *Eragrostis gangetica*, *E. pilosa*, *E. tenella*, *Leersia hexandra*, *Leersia perrieri*, *Leptochloa panicea*, *Panicum repens*, *Paspalum scrobiculatum*, *Paspalidium flavidum*, *Pennisetum pedicellatum*, *Rottboellia exaltata*, and *setaria pallide-fusca*; wild rices *Oryza alta*, *O. australiensis*, *O. barthii*, *O. eichingeri*, *O. collina*, *O. glaberrima*, *O.*

grandiglumis, *O. meyeriana* ssp. *granulata*, *O. latifolia*, *O. minuta*, *O. nivara*, *O. officinalis*, *O. perennis*, *O. punctata*, *O. ridleyi*, and *O. rufipogon*; and on crop plants wheat, barley, oats, finger millet, foxtail millet, koda millet, proso millet, little millet, and Japanese millet.

Oviposition was inside the stem tissue just below the flower head in the weeds *Cyperus compressus*, *C. difformis*, *C. distans*, *C. iria*, *C. rotundus*, and *C. tenuispica*.

The insect oviposited inside the tender stem tissue of the weeds *Bergia ammannioides*, *Commelina benghalensis*, *Heliotropium indicum*, *Hydrolea zeylanica*, *Ipomoea reptans*, *Ludwigia perennis*, and *Sphenoclea zeylanica*; and on crop plants maize, sorghum, pearl millet, peanut, mungbean, black gram, sunn hemp, and jute.

On crop plants sugarcane and napier grass, oviposition was inside the growing bud tissue.

The insect laid naked egg clusters on the leaf lamina of the weeds *Eleusine indica* and *Dactyloctenium aegyptium*. In these weeds the egg groups were deposited on the external surface of the leaf lamina in groups of 7-12, were visible (see figure), and hatched normally. This unusual behavior resulted in exposed eggs which may be available for predators, or contact with insecticides. Irrespective of the site and method of oviposition, all the eggs laid hatched normally at about the same time. □



BPH egg clusters on leaf lamina of a grass weed.

Occurrence of black bug in Tamil Nadu

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The black bug *Scotinophara lurida* was found in large numbers in 1984 Apr-Jul in Tiruchirapalli District, where about 4,000 ha of rices ADT36, Co 29, and BCPI are grown. There were more black bugs on ADT36 than on Co 29 and BCPI. The bug infested all varieties and caused bugburn in many fields. It infested the crop from 30 d after transplanting to harvest, during which time the population substantially increased. At late flowering stage the population averaged 20 bugs/hill.

Farmers indicated that black bug had regularly infested fields for 3 yr. In Jul-Sep, the insect infested about 800 ha. Farmers often don't see the bug because it lives at the base of the tillers.

Spraying 600 ml fenthion/ha controlled black bug. □

Gall midge (GM) *Orseolia oryzivora* H & G in Zambia

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GM has been reported in eight countries in Africa: Guinea Bissau, Senegal, Mali, Upper Volta, Ivory Coast, Nigeria, Cameroon, and Sudan. It is a localized pest of lowland irrigated rice except in Upper Volta where it is one of the most serious and widespread insect pests in irrigated and rainfed lowland rice.

In Apr 1984 IIRI and IITA organized a monitoring tour in Zambia and Tanzania. The tour group visited five rice projects in Zambia and observed GM in all lowland irrigated rice. GM incidence