

Information on field infestation also will help determine prophylactic sprays in endemic areas or help in devising an appropriate Angoumois grain moth management system for rice.

We collected 10 panicles/plot at random from 6 fields of sorghum, pearl millet, and maize 1 wk before harvest Jan-Feb 1986. Ten 100-g samples of rice were collected from 12 plots at harvest

and at threshing. Hundreds of panicles of weeds on ricefield bunds were collected from 10 plots. The samples were stored in plastic containers in the laboratory and moth emergence observed after 1 mo.

Field infestation was found in rice, sorghum, maize, pearl millet, and the weed *Echinochloa colona*. The occurrence of *S. cerealella* on pearl

millet and *E. colona* are new records of field infestation.

The number of moths that emerged was highest in pearl millet (26-32/panicle), followed by sorghum (18-20) and maize (6-12). Moth emergence in rice was 3-8/100 g. The lowest number of moths (4/100 panicles) emerged in *E. colona*, and they were very small (1.0-1.5 mm long). □

Susceptibility of field strains of smaller brown planthopper (SBPH) in Taiwan to six insecticides

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Before 1984, only carbofuran was recommended to control SBPH in Taiwan; SBPH had been considered a secondary pest of rice. However, during the last few years, SBPH incidence has resulted in serious damage to rice in central and southern parts of the island. Carbofuran, buprofezin, and flucythrinate have been commonly used for control.

We studied susceptibility of four field strains of SBPH to six insecticides.

An acetone solution of 4-5 concentrations of each insecticide was sprayed onto 4th-instar nymphs. Each concentration had 3 replications; 45 insects were tested. When a synergist was used, the nymphs were sprayed with an acetone solution of the synergist 1 h before insecticide treatment. Mortality was recorded 24 h after treatment.

Flucythrinate and fenvalerate were the most effective insecticides (see table). (Note that both pyrethroids have an α -isopropylphenyl group in their acid moiety.) Cypermethrin exhibited intermediate effectiveness against SBPH, and permethrin was considerably less potent. Carbofuran appeared less toxic than all pyrethroids except permethrin. Malathion was practically useless.

Limited synergism data showed that the toxicity of permethrin could be enhanced about 50 times by tributyl

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Insecticide ^a	Field strain LC ₅₀ ^b (µg/ml)			
	Ping-tung	Tai-chung	Chia-yi	I-lang
Permethrin	1,272	2,531	693	2,093
+ TBPT	25.3 (50)	49.1 (52)	—	—
+ PB	510 (2.5)	212 (12)	—	—
Cypermethrin	25.9	41.7	43.0	13.1
+ TBPT	5.6 (3.6)	14.1 (3.0)	—	—
+ PB	4.8 (5.4)	—	—	—
Fenvalerate	—	7.1	6.0	10.2
Flucythrinate	3.9	55	3.9	15.1
Carbofuran	—	96.9	52.4	61.6
Malathion	3,458	5343	10,129	4,120

^aTBPT = tributyl phosphorotrithioate, at 50 µg/ml. PB = piperonyl butoxide, at 25 µg/ml. ^bFigures in parentheses represent LC₅₀ of unsynergized insecticide/LC₅₀ of synergized insecticide.

phosphorotrithioate, an inhibitor of esterases. Synergism of permethrin by piperonyl butoxide, which inhibits microsomal oxidases, was limited. Synergism of cypermethrin by either synergist was not as significant as that of permethrin.

In view of these results, we suggest that SBPH in Taiwan has become resistant to malathion and permethrin but remains susceptible to fenvalerate, flucythrinate, and cypermethrin.

Resistance to permethrin, and very possibly to malathion, is closely related to hydrolytic degradation by esterases. This resistance mechanism resembles that we found earlier in the brown planthopper (BPH). In BPH, high esterase activity associated with organophosphorus and carbamate resistance may have conferred a major part of the resistance to permethrin and other primary alcohol ester pyrethroids. □

Managing other pests

Ufra - a first report in Orissa, India

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Ufra caused by *Ditylenchus angustus* has been recorded for the first time in

Orissa. It was found on tall indica local variety Rangi in Dapa village, Balasore District, usually a deepwater rice area. However, in 1987 the habitat was atypical, with only a few centimeters standing water in the field because of the unusual drought. Affected plants are stunted with withered boot leaf and sheath. Panicles are very much reduced