Evaluation of 26 insecticides for armyworm *Mythimna separata* Walker) control

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Rice is sporadically damaged by *M. separata* larvae, which attack rice at all growth stages but are most damaging during heading, when they cut rice panicles. Insecticides with a high knockdown effect control this insect best.

We evaluated 26 insecticides for *M. separata* control in a contact toxicity test. Larvae were dipped into each insecticide solution for 30 s and then placed on untreated plants. In a foliar spray test, potted rice plants were sprayed with insecticide and infested with untreated larvae 1 d later. Mortality was recorded 48 h after treatment (HT) or infestation (HI), and leaf damage was rated.

Of the 26 insecticides, 17 caused 100% mortality in contact toxicity tests, 13 caused more than 80% mortality in foliar spray tests, and 12 caused 10% defoliation. High mortality did not necessarily correlate with low defoliation (see table).

Twelve insecticides were highly promising and four (U 57770, RH 0994, MTI 500, and MTI 220) were potentially promising. Cypermethrin killed insects and prohibited larvae from feeding (see table).

Toxicity of insecticides to *M. separata*, IRRI.

Insecticide [a]	Formulation	Mortality [b] (%) of 5th-instar larvae		
		Contact toxicity	Foliar spray	Defoliation (%)
Test I				
Methidathion	40EC	100 a	90 ab	10
M 9918	200E	100 a	100 a	10
Cypermethrin †	5EC	97 a	33 a	10
UC SF-1	40F	100 a	70 bcd	10
M 10604	200E	100 a	97 ab	10
UC 54229	100SP	100 a	41 cde	63
RH 0308	48EC	100 a	93 ab	10
UC/MP 19779	48EC	100 a	77 abc	10
Carbosulfan	20EC	97 a	90 ab	10
UC 17867	50WP	100 a	93 ab	10
Monocrotophos	30EC	100 a	100 a	10
Triazophos	40EC	100 a	93 ab	10
Dioxicarb	50WP	73 b	20 ef	63
Methiocarb	50WP	97 a	30 def	63
RH 0994	48EC	100 a	87 ab	11
Dioxathion	96EC	17 c	7 g	83
Check (water)		0 c	10 f	90
Test II				
Phoxim	50EC	100 a	67 b	27
NS 8265	75EC	100 a	0 c	93
Propoxur	20EC	97 a	3 c	90
MTI 500 †	20EC	100 a	90 ab	17
Pirimicarb + pirimiphos methyl	10EC	100 a	10 c	97
Pirimiphos methyl + carbophenothion	20EC	100 a	0 c	93
U 57710	85WP	63 b	87 ab	13
Monocrotophos	30EC	100 a	98 a	10
Triazophos	40EC	100 a	100 a	10
U 56295	85WP	70 b	93 a	10
MTI 220 †	20EC	100 a	83 ab	20
B. thuringiensis ‡		0 e	0 c	91
Check (water)		0 e	0 c	93

[a] Application rate was 0.075% ai in the contact toxicity test, except for the pyrethroids (…), which was 0.005% ai; and 0.75 kg ai in the foliar spray test except for † , which was 0.05 kg ai/ha. For ‡, the rate was 0.4 kg/ha of the formulated product. [b] Av of 3 replications. Mortality was recorded 48 h after treatment in the contact toxicity tests and 48 h after placing the larvae on treated plants in the foliar spray test. Separation of means in a column under each test by DMRT at the 5% level.

A strategic modelling approach to brown planthopper (BPH) management

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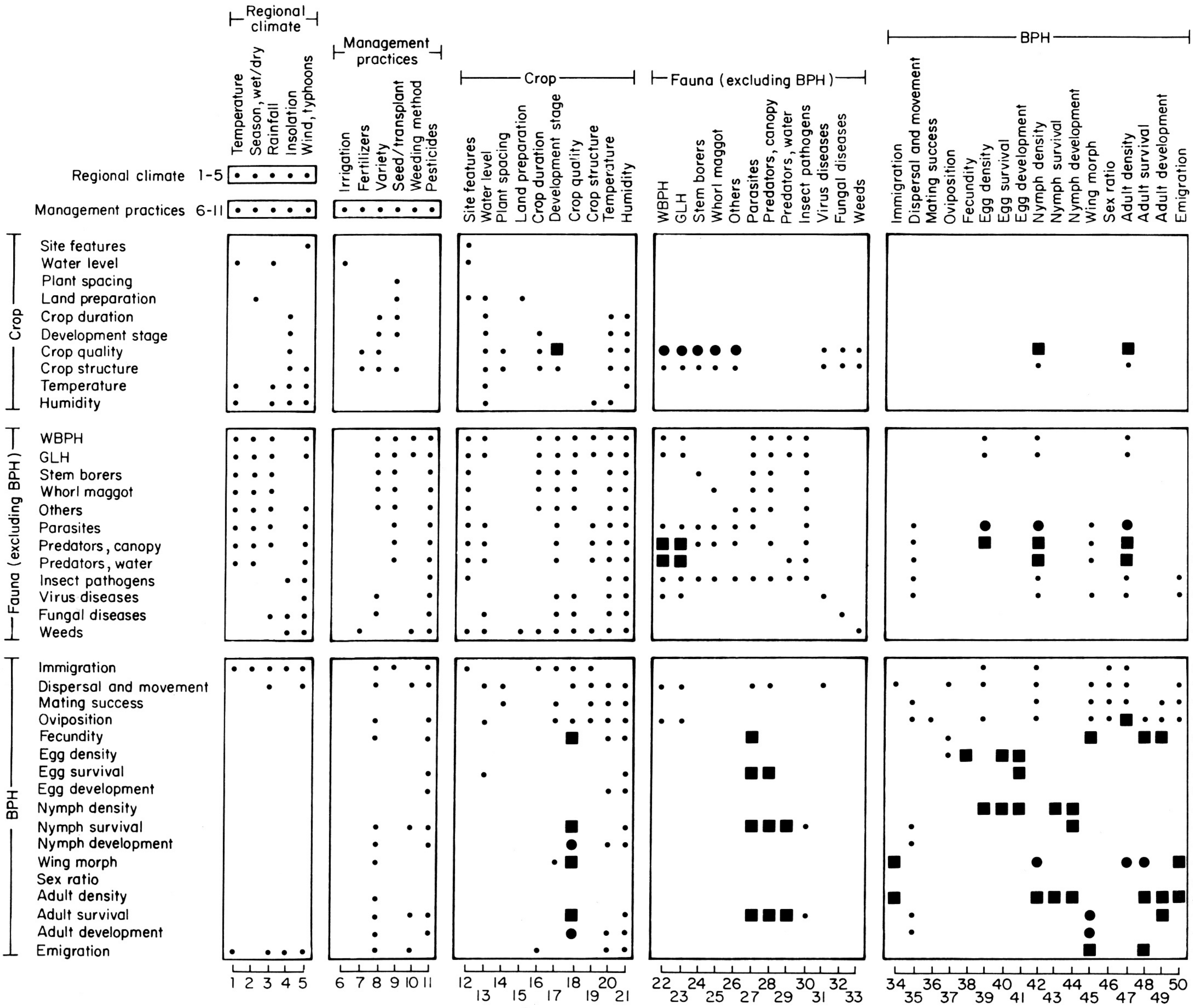
We monitored populations of BPH and associated rice fauna at a field site in Laguna, Philippines, throughout each growing season from 1979 to 1983. These data and other information obtained from the literature are being used to construct a population model to explain BPH population dynamics observed on rice crops at different Philippine sites. The model will subsequently be used to study the impact of BPH on changes in management, including resistant varieties and insecticides, in different climatic zones.

Two modelling techniques are being used. Initially, interaction matrices and other qualitative modelling techniques were used to identify the major relationships between components likely to contribute to BPH population changes.

The interaction matrix is shown in Figure 1. Each cell is concerned with the primary effect of the column component on the row component. Secondary effects can be determined by working



1. An interaction matrix for BPH on a rice crop in the Philippines. Key to symbols: (■) interaction explicitly included in the model; (•) interactions planned for immediate inclusion; (•) interactions for future consideration; ( ) no interaction.

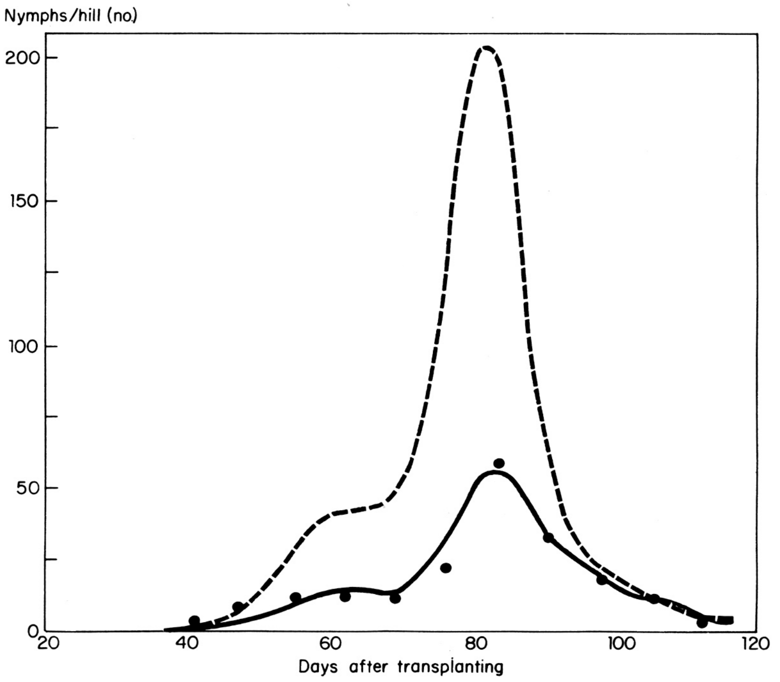
through the matrix. For example, column 11 and row 28 indicate that pesticides affect canopy predators, while column 28 and rows 40, 43, and 48 indicate that predators affect BPH egg survival and adult survival. Thus, the model incorporates the resurgence effect of pesticides caused by predator suppression. The matrix provides an overview of the system and is a valuable tool for problem analysis; we hope that publishing the matrix will stimulate discussion.

The second modelling technique involves computer simulation of BPH population processes. It works on a time-step of 1 d from transplanting to harvest, is written in Pascal, and is being run on a CDC 855 under NOS 2.3 operating system. Initial simulations of the observed changes in BPH populations at one Philippine site have used coefficients and relationships obtained from other sources. The model will be tested using data sets for different sites and seasons.

During the modelling process, possible causes of discrepancies between model simulation and observed data are identified and systematically reviewed before modifying the model. The construction of the initial population model and incorporation of those interactions indicated as (■)in Figure 1 is almost complete. A simulation generated by this model and the observed population curve for the initial data set are compared in Figure 2. The preliminary model has been used to test the hypothesis that polyphagous predators are an important cause of BPH mortality. It was found that a 50% reduction in the attack rates of the major polyphagous predators (spiders, *Microvelia atrolineata,* and *Cyrtorhinus lividipennis*) caused a threefold increase in the peak of the simulated BPH population (Fig. 2).

The role of the model is to formulate explicit hypotheses that describe important parameters affecting BPH population dynamics. These parameters can be used to identify potential strategies for improved BPH management.

Complete slide sets of photos printed in *Field problems of tropical rice,* revised 1983, are available for purchase at $50 (less developed country price) or $60 (developed country price), including airmail postage and handling, from the Communication and Publications Department, Division R, IRRI, P. O. Box 933, Manila, Philippines. No orders for surface mail handling will be accepted.



2. Simulation of BPH population changes at the first test site (–) compared with the observed population (•). Simulation of BPH population when predation is reduced by 50% (----).

Pest Control and Management
WEEDS

Salvinia molesta found in Philippine rice fields

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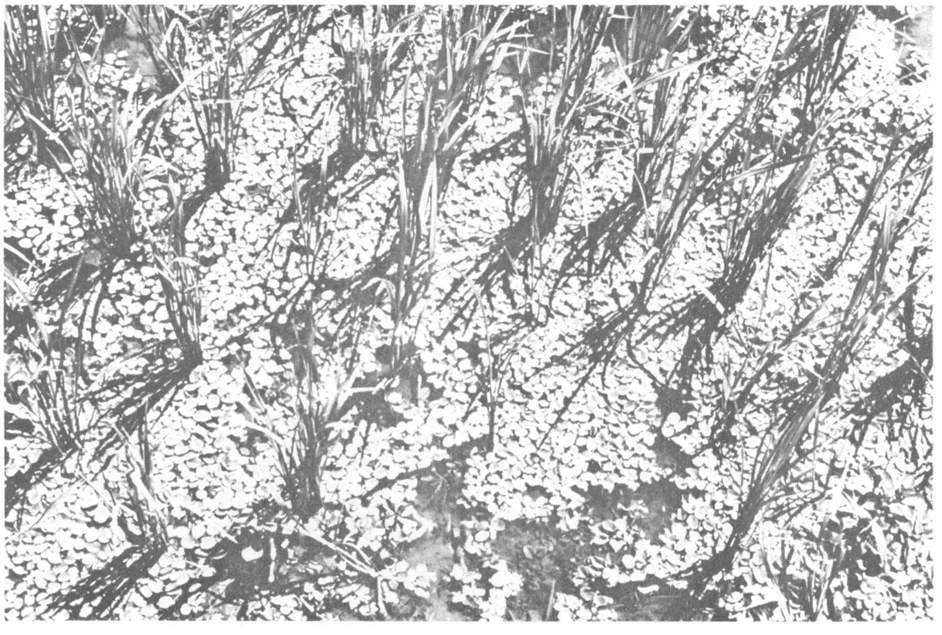
Salvinia molesta D. S. Mitchell, a free-floating, mat-forming, perennial fern, which reproduces vegetatively at an alarming rate, has been found in transplanted rice (Fig. 1) and drainage canals in Iloilo Province, Panay Island, Philippines. *S. molesta* is a native of Brazil and has become a serious weed in most countries where it has been introduced.

Individual plants are up to 30 cm long and have many leaves (Fig. 2). Each node of the slender stem produces three leaves. Two are green and floating and one is brown, root-like, and submerged. The floating leaves of young plants are round to oval, 0.5-2.0 cm long, and lie flat on the water surface. With age and crowding, they become two-lobed, folded sharply along the midrib, 2.0-3.5 cm long, and only the midrib is in contact with the water. The submerged leaf is



1. *Salvinia molesta* growing in transplanted rice in the Philippines.