Virus recovery from tungro-susceptible *Oryza* spp. Cuttack. India

Oryza spp.	% viruliferous insects					
	Days after inoculation					
	15	30	45	60	75	90
O. australiensis	0.0	6.7	10.0	0.0	0.0	0.0
O. harthii	8.3	10.0	20.0	50.0	35.0	14.3
O. brachyantha	0.0	1.6	0.0	0.0	0.0	0.0
O. eichingeri	0.0	0.0	0.0	13.8	5.2	0.0
O. glaberrima	43.5	61.9	66.7	54.5	79.3	38.9
O. nivara	55.0	33.3	46.1	65.4	39.1	60.0
O. perennis	0.0	6.6	0.0	0.0	0.0	0.0
O. punctata	0.0	11.1	0.0	0.0	0.0	0.0
O. sativa	73.1	68.2	63.3	71.4	47.4	53.3

survival and propagation of tungro virus in the semidwarfs, their stubble, and in wild rice. Some weed hosts such as *E. colonum* might also act as link hosts between two crops, especially in places where a single crop is grown per year.

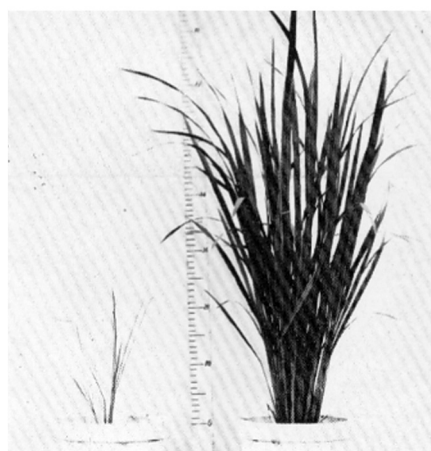
Although both species of tungro vectors are found together in the paddy ecosystem, they differ in preference for survival and multiplication. It has been found that rice is a preferred host for *N. virescens* over weeds, whereas *N. nigropictus* prefers weeds (e.g. *L. hexandra)* to rice. Thus, in areas where cropping systems overlap, *N. virescens* might be playing a greater role in tungro perpetuation. In single cropping areas, *N. nigropictus* might transmit tungro virus among weeds or wild rices during the off-season. ■

Rice wilted stunt in Taiwan

C. C. Chen, Taichung District Agricultural Improvement Station. Taichung 400: and R. J. Chiu. Council,for Agricultural Planning and Development, Taipei 107, Taiwan, China

A rice disease characterized by extreme plant stunting, narrow leaves, and, often. premature death of infected plants was first found in paddy fields of Tungshih, central Taiwan in 1977 (see photo). Leaf wilting usually occurred first in the outer, older, leaves, and gradually proceeded to the upper leaves, resulting in plant death at later tillering stages. The disease was transmissible by the brown planthopper *Nilaparvata lugens,* the vector of rice grassy stunt and rice ragged stunt. The frequently lethal symptoms appear to distinguish the disease from grassy stunt and ragged stunt. The disease was named rice wilted stunt and is possibly a new virus disease of rice (see photo).

In greenhouse tests, seedlings of Tainan 5, a japonica, produced rusty yellowish leaves at about 10 days after inoculation. Young leaves twisted and turned pale green. Because the diseased plants seemed weak and usually had fewer tillers than normal, they appear similar to plants infected with rice transitory yellowing virus. Yield losses for Tainan 5 were 95, 78, 73, 65, and 40% when the disease symptoms were first expressed at 21-30, 3 1-40, 41-50, 51-60, and 61-70 days after transplanting. The yield reduction was 97, 82, and 77% for Taichung sen 3, an indica, when the symptoms were first expressed at 21-30, 31-40, and 41-50 days after transplanting. Infection at younger stages of rice growth resulted in complete yield loss.



Rice wilted stunt on Taichung Sen 3. Healthy (right) and infected (left) plants, 60 days after inoculation.

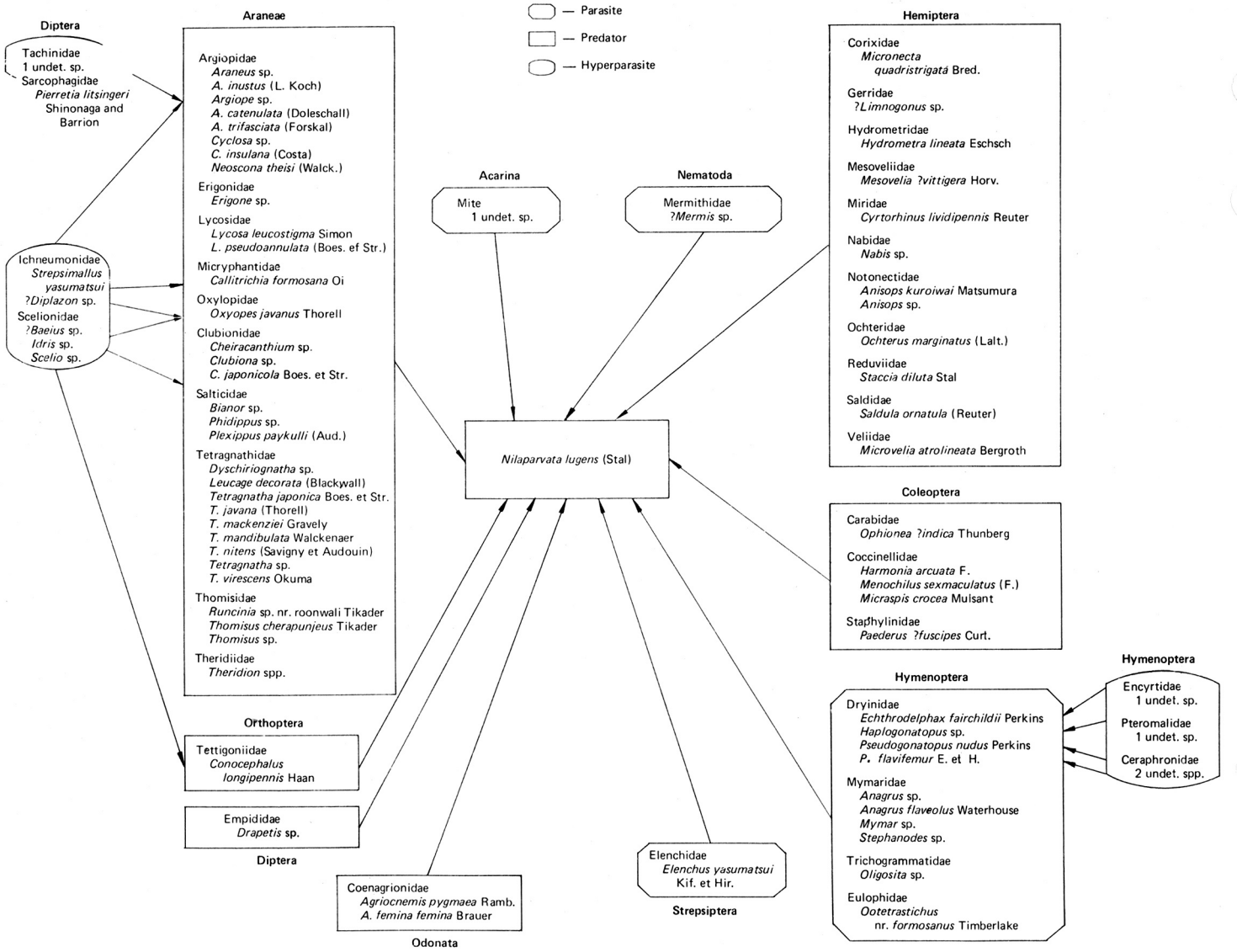
The brown planthopper transmitted the disease with a latent period of 7 days (range, 3-14 days) at 28-30° C, and infectivity persisted throughout the insects' life. The active transmitters ranged from 22 to 64%. The shortest acquisition access time was 2 hours and the shortest inoculation access time was 30 minutes. Among other Homopteran rice pests so far tested, none transmitted the disease. The disease was not transmitted through rice seeds or by mechanical means. ■

Food web of the rice brown planthopper in the Philippines

A. T. Barrion, P. C. Pantua, J. P. Bandong, C. G dela Cruz, F. A. Raymundo, and M. D. I.umaban, research assistants: R. F. Apostol. research aide; and J. A. Litsinger, entomologist, Entomology, Department. International Rice Research Institute

The natural enemy relationships (food web) for the brown planthopper *Nilaparvata lugens* (BPH) were determined to learn more about the biological control possibilities against that pest. Records of predator-parasite relationships representing 74 taxa were determined over a 2-year period (1977-79) from 4 Philippine provinces representing different rice environments: Los Baños, Laguna (irrigated wetland); Tanauan, Batangas (dryland); Oton, Iloilo, and Manaoag, Pangasinan (rainfed wetland). Parasites were reared on BPH, and predator records of field observations or cage studies were obtained. Specimens were sent to taxonomists worldwide for species confirmation. A list of the specialists is available on request.

Five egg parasites belonging to Mymaridae and Trichogrammatidae were recorded (see figure). *Anagrus,* a mymarid species, was the most common. *Gonotocerus,* a mymarid egg parasite of BPH recorded elsewhere in Asia, is host to the green leafhopper *Nephotettix* spp. and was never reared from BPH eggs.



Food web of the rice brown planthopper in the Philippines.

Only one egg predator, the mirid bug *Cyrtorhinus lividipennis* was found.

BPH nymphs and adults are attacked by relatively fewer parasite species than predators. Four species of dryinids, one strepsipteron, one undetermined mite, one nematode, and one eulophid were recorded. The dryinids and the eulophid are both parasitic and predatory in their habits.

Predators make up the majority of natural enemies attacking the BPH nymphs and adults. Spiders are the most numerous natural enemies (48% of the recorded species), and 31 representing 10 families have been found.

Spider species show some preference of rice environment. *Tetragnatha mandibulata* is most common in dryland rice fields. It is followed in number by *Oxyopes javanus, Lycosa leucostigma,* and various argiopids. *Tetragnatha javana* and argiopids predominate in rainfed wetland environments. Irrigated wetland rice fields are inhabited mostly by *Callitrichia formosana* and *L. pseudoannulata* during the vegetative stage and by *Tetragnatha* spp. after maximum tillering.

Theridion preys upon BPH in weedy rice bunds but has never been found in a rice field. Twelve species of true bugs (Heteroptera), five beetles (Carabidae. Coccinellidae, Staphylinidae), two damselflies (Coenagrionidae), a katydid (Tettigoniidae), and a dance fly (Empididae) compose the rest of the predators.

Secondary natural enemies complete the food web. Four hyperparasitic wasps (Ceraphronidae, Encyrtidae, and Pteromalidae) attack all four dryinid species, and a scelionid wasp parasitizes the eggs of *Conocephalus.* Two egg parasites, *Baeius* (Scelionidae) and *Strepsimallus yasumatsui* (Ichneumonidae), were reared from *Oxyopes* and *Clubiona* spider egg masses, respectively. Additional spider egg parasites *Caenopimpla arealis* (Ichneumonidae) from *Oxyopes* and an undetermined sarcophagid fly from

Argiope were reared, Spiders are highly cannibalistic and readily devour one another when other prey is not available. This behavior is a mechanism that regulates their number.

We conclude that rice agroecosystems are rich in species of natural enemies that attack BPH. The apparent lack of hyperparasites in the Philippines is an encouraging indication that natural enemies can be directly manipulated. ■

Yield loss due to leaf scald disease

S. Srinivasan. Paddy Experiment Station, Aduthurai 612101, Tamil Nadu, lndia

Leaf scald disease was initially observed in the 1977 samba season in Tanjore district, Tamil Nadu. During the 1978 thaladi season, the disease was seen in all cultivars raised. In the 1979 thaladi the disease incidence was severe (up to grade 8) in the culture AS2887. Yield losses were assessed. For each disease grade, 100 uniform clumps were harvested and the yield was recorded. The yield loss was worked out in comparison with the yield obtained in 100 healthy clumps of the same variety. The particulars on the percentage loss in the yield is given below.

Disease grade	1	2	3	4	5	6	7	8
% yield loss	–	–	–	–	2.5	7.9	16.1	23.4

Leaf scald disease up to grade 4 caused no yield loss in AS2887; loss was maximum, 23.4%, at disease grade 8. ■

Pest management and control INSECTS

Efficacy of chlorpyrifos (Coroban) 5 & 10 G against two major rice pests in Tamil Nadu

A. Abdul Kareem and T. Visvanathan, Entomology Department, Coromandel Indag Products (CIP) Research Farm, Padappai 601301 Tamil Nadu, India

A field trial on control of leaf roller *Cnaphalocrosis medinalis* and stem borer *Tryporyza incertulas,* major rice pests in Chingleput District, Tamil Nadu, with the rice variety Ponni was conducted by the entomology department at CIP (P) LTD Research Farm during the 1979-80 samba season (Oct-Jan). The study evaluated the efficacy of chlorpyrifos (Coroban) as 5 and 10 G formulated in the chemistry department of the Farm.

Five treatments, each on a 20-m^2 plot, were replicated 4 times. The granules were broadcast into 2.5-cm paddy water 10 days after transplanting (DT). Chlorpyrifos (Coroban 20 EC) at 500 ml/ ha was foliar sprayed twice at 3-week intervals, starting 40 DT to all treatments including the check.

Observations of the cumulative incidence of leaf rollers (leaf damage) and stem borers (deadhearts) were made at 2-week intervals. Grain yields were also recorded.

Chlorpyrifos granules 5 and 10 G were as effective as carbofuran 3 G and quinalphos 5 G against the two pests (see table). All insecticide treatments yielded significantly more than the control. The highest grain yields from plots treated with chlorpyrifos 10 G were significantly greater than yields from plots treated with carbofuran. ■

Relative efficacy of chlorpyrifos 5 and 10 G against rice leaf rollers and yellow stem borers. CIP Research Farm, Tamil Nadu, India. [a]

Insecticide	Leaf roller incidence[b]		Stem borer deadhearts (%)		Yield (t/ha)
	15 DT	30 DT	15 DT	30 DT	
Chlorpyrifos 5 G	2.5 a	1.8 a	3 a	8 b	4.45 ab
Chlorpyrifos 10 G	1.5 a	3.8 b	2 a	5 ab	4.85 a
Quinalphos 5 G	2.5 a	4.0 b	11 b	5 ab	4.40 ab
Carbofuran 3 G	2.8 a	2.8 ab	6 a	3 a	4.15 b
Control	14.0 b	15.3 c	14 b	16 c	2.85 c

[a] Av of 4 replications. In a column, means followed by a common letter are not significantly different at the 5% level. DT = days after transplanting. [b] Number of damaged leaves in 10 randomly selected and marked hills.

Studies on a new insecticide of a novel class of chemical thiocyclam hydrogen oxalate for the control of rice insects

Chih-Chen Shang, Institute of Elemento-Organic Chemistry, Nankai University Tienjin, China; and Shin-Foon Chiu, Plant Protection Department, South China Agricultural College, Kwangchow (Canton) China

In China, a large quantity of insecticides are used annually for control of rice insect pests. Most of these insecticides are γ-BHC and methyl parathion. Because of the development of resistance by rice stem borers and other species to these organochlorine and organophosphate chemicals and because of residue hazards to the environment, it has become necessary to search for insecticides of different structures and action.

Results of laboratory and field experiments (1977-79) showed that thiocyclam hydrogen oxalate (Evisect) developed in China from an annelid worm is effective as a spray or root-zone application against striped stem borer, the yellow stem borer, the leaf folder, and rice thrips. Evisect has systemic properties. When used in combination with carbofuran it can control most of the potential insect pests in rice fields.

Another related insecticide, dimehypo (S, S[dimethylamine] trimethylene dithiosulfuric acid ester, is also being evaluated in China. ■