octomaculata or *P. fuscipes.* Except for the spider, no predator was cannibalistic. When 1 spider was caged with 10 *C. Iividipennis* and 10 WBPH, *C. lividipennis* had 41% mortality and WBPH only 27%.

We also studied the feeding activity of the predators on WBPH. *L. pseudoannulata* ate the most (5.9) WBPH per day (see table). Feeding rate of the other predators ranged from 1.4 to 2.4 WBPH per day.

These laboratory studies were under conditions that may differ from those in the field, and only adult stages were tested. In the field, it is likely that intraspecific and interspecific predation also occurs at immature stages.

Effect of custard apple oil, neem Oil, and neem cake on green leafhopper (GLH) population and on tungro (RTV) infection

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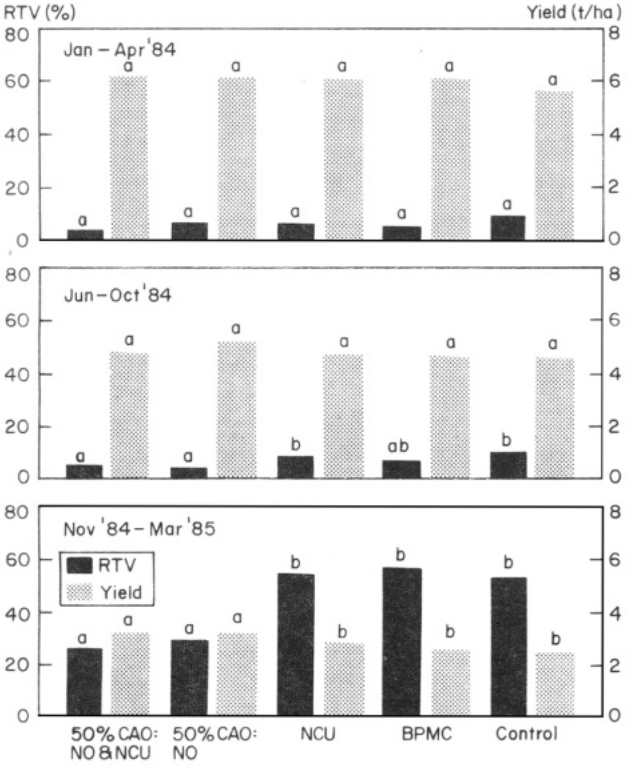
In laboratory studies at IRRI, mixtures of seed oils of custard apple *Annona squamosa* L. and neem *Azadirachta indica* A. Juss were significantly more effective in reducing GLH survival and its transmission of RTV than spray application of individual oils.

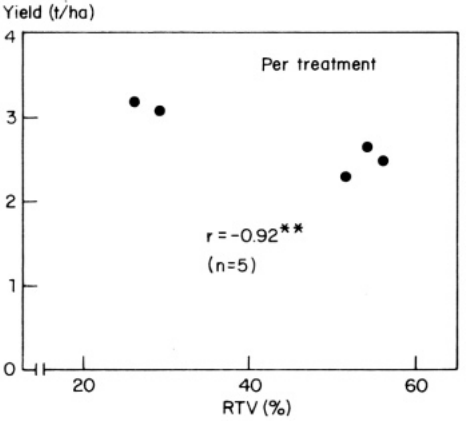
In field trials, we sprayed a 1:4 (vo1:vol) mixture of custard apple and neem seed oils at 50% concentration on RTV-susceptible IR42 plants. The mixture was applied with an ultralow-volume applicator at weekly intervals from seedling to maximum tillering stages at 8 litres/ha. A 3:10 (weight:weight) neem cake-urea mixture also was applied at 60, 30, and 30 kg N/ha at seedling stage, maximum tillering, and panicle initiation. The treated control was sprayed with BPMC at 0.75 kg ai/ha and the untreated control with the emulsifier at weekly intervals from seedling to maximum tillering.

For three consecutive croppings in 1984-85, IR42 treated with the oil mixture alone or in combination with neem cake + urea had relatively low GLH populations, consistently low RTV infection, and high yields (Fig. 1). At 9% RTV infection in Jun-Oct 1985, plants with the oil mixture alone or with neem cake + urea had significantly less RTV infection than the untreated control, but yields were not significantly different.

At ³ = 50% RTV infection in Nov 1984-Mar 1985, test plants yielded significantly higher and had markedly lower RTV infection when they received the oil mixture alone or neem cake + urea than the insecticide-treated and the untreated controls.



1. Comparison of yield and RTV infection in field plots planted to RTV-susceptible IR42 and treated with either custard apple oil and neem oil (CAO:NO), neem cake + urea (NCU), their combination (CAO:NO and NCU), BPMC, or a detergent-water solution (control). Average of 4 replications. Means followed by a common letter are not significantly different at the 5% level by DMRT. IRRI, 1984-85.



2. Correlation between RTV and yield for the Nov 1984-Mar 1985 crop, IRRI.

The positive correlation between RTV infection and yield (Fig. 2) during this cropping period indicates that the level of RTV infection was the major yield determinant and that either the oil mixture alone or oil + neem cake + urea effectively controlled the vector and the disease. Neem cake + urea alone was ineffective.

Activation of prophenol oxidase enzyme by brown planthopper (BPH) in response to insecticide

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It has been proposed that the prophenol oxidase activation system of insects recognizes pathogens such as bacteria and fungi because it is activated by the lipopolysaccharide from bacteria and B-1, 3 glucan from fungus cell walls.

Adult brachypterous BPH *Nilaparvata lugens* were collected from pots and anesthetized with chloroform. Haemolymph was collected in 0.01 M phosphate buffer by pressing the BPH under a cover glass. Clumped cells and plasma were separated and homogenized in 0.01 M phosphate buffer. The homogenate contained prophenol oxidase.

The effect on prophenol oxidase of insecticides BHC and carbaryl and known activator chymotrypsin (Sigma) was observed. We incubated 100 μl of the enzyme source with 100 μl of the insecticides (1 mg/ ml dissolved in 0.01 M phosphate buffer). The reaction mixtures were incubated for 30 min and 100 μl of 10 mM substrate dihydroxy phenyl alanine (Sigma) was added. Enzyme activity was measured at 480 nm after adding 1.7 ml of 0.01 M phosphate buffer. An appropriate blank and control were maintained. BHC, chymotrypsin (1 mg/ml), and carbaryl were tested separately for activation capacity.

BHC had greater activating capacity than carbaryl, and chymotrypsin more than the insecticides (see table). Thus, a preliminary defense mechanism is set up against the stress caused by insecticide application.

Prophenol oxidase activation by carbaryl, BHC, and chymotrypsin, Coimbatore, India.

Activator	Prophenol oxidase activity (OD/mg protein per 30 min)
Carbaryl	0.186
BHC	0.244
Chymotrypsin	0.337

[a] Values were confirmed by 3 different determinations.

Mass rearing *Tyrophagus palmarum*

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Tyrophagus palmarum Oudemans (Acaridae: Astigmata) mite infests rice seedlings and leaf sheaths in the nursery and field. We developed a mass rearing technique to provide enough *T. palmarum* mites for biological studies.

Oatmeal agar (OMA) medium with 4% oatmeal, 2% agar agar, and 2% sucrose was prepared and autoclaved at 15 lb pressure for 30 min. Ten ml of the medium was poured into sterile 5-cm petri plates. Each petri plate was inoculated with *Fusarium moniliforme* and kept at room temperature (26±3°C). When petri plates were covered with fungus mycelia, two newly emerged female mites were released on the fungus and incubated in darkness at 85 ± 3% relative humidity and room temperature 26 ± 6°C. F1 progeny developed after 12 d and adults and juveniles were counted. Two subsequent generations also were counted (see table).

The mite generally reproduces parthenogenetically and produces mostly females. Mite population was highest in the 2d generation and declined thereafter, as more fungus was eaten. The culture can be continued by inoculating freshly prepared fungi in the petri plates.

To select the best growth medium and standardize the rearing technique, we screened 10 culture media: oatmeal agar 2% and 4%, peptone 2% and 4%, malt extract 2% and 4%, potato dextrose agar, nutrient agar, Elliott's agar, and Czapek's Dox agar. Oatmeal agar 4% was the most suitable medium for fungus and mite multiplication. *F. moniliforme* produced higher mite populations than *Curvularia* sp., *Alternaria padwickii, Aspergillus niger,* and *Helminthosporium oryzae.*

Cultured mites were tested for the ability to infest. When adult mites were released on l0-d-old potted Karuna seedlings, symptoms (yellowing and drying) developed 15 d later and were similar to those that developed under natural conditions.

Juvenile and adult populations[a] of *T. palmarum* mite in 3 generations, Cuttack, India.

Generation no.	Eggs (no.)	Larvae (no.)	Nymphs (no.)		Adults (no.)
			Protonymphs	Deutonymphs	
1	36	8	10	24	167
2	153	73	46	96	864
3	28	12[b]	93[b]	641[b]	3

[a] Av of 10 replications. [b] Inactive forms.

Host plant range of the planthopper *Nisia atrovenosa*

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The planthopper *Nisia atrovenosa* lives on weedy bunds of irrigated transplanted rice in Koronadal, South Cotabato, Mindanao. Its host range is unknown; its pest status is not understood. We studied the growth and longevity of *N. atrovenosa* on different weed species and rice. Growth was measured as the percentage of nymphs that reached adulthood and their growth period.

N. atrovenosa has a limited host range. It was successfully reared on *Cyperus rotundus* and *C. iria* (see table). More nymphs reached adult stage on *C. rotundus* than on *C. iria,* suggesting that *C. rotundus* may be the planthopper's main host. Development stopped at the first nymphal instar on *Digitaria ciliaris, Brachiaria distachya, Cynodon dactylon, Leersia hexandra, Paspalum distichum,* and *Leptochloa chinensis,* and at the second nymphal instar on *Fimbristylis miliacea, Echinochloa glabrescens, Eleusine indica,* and *Oryza sativa.* On *C. compressus* and *C. brevifolius,* it developed to a late nymphal stage but did not reach adulthood.

Results suggest that *N. atrovenosa* is not a rice pest. This was further