cide was not available, some farmers spot-sprayed with kerosene, petroleum, and diesel oils. Kerosene sprays were reported to have performed better than pesticides. We compared the efficacy of insecticide dusts and kerosene in laboratory tests (Table 2).

One-gram insecticide dust formulation was spread evenly in a 21-cm petri dish and final-instar larvae were released. One millimeter of kerosene was placed in a petri dish of the same size. A 1:4:40 mixture of kerosene, common salt, and water caused larval mortality equal to that with quinalphos (5%) and methyl-parathion (2%) dusts. □

Table 2. Comparative efficacy of kerosene and insecticide dusts against rice ear-cutting caterpillar.

Treatment[a]	Mortality[b] of last-instar larvae at indicated time after treatment (%)		
	15 min	30 min	60 min
BHC 10D	17 c	80 b	97 ab
Carbaryl 5D	20 c	27 c	73 c
Malathion 5D	23 c	77 b	100 a
Quinalphos 5D	77 a	100 a	100 a
Methyl parathion 2D	80 a	100 a	100 a
Kerosene + common salt + water (1:4:40)	83 a	100 a	100 a
Kerosene + water (1:40)	63 b	83 b	90 bc
Common salt + water (1:4)	0 d	3 d	10 d
Water	0 d	0 d	0 d

[a]D = percent dust formulation. [b]In a column, means followed by a common letter are not significantly different at the 5% level.

Insecticide resistance in brown planthoppers of Malaysia

K. L. Heong, Crop Protection, Malaysian Agricultural Research and Development Institute, Serdang, Malaysia

Recent toxicological studies on insecticidal effects of some carbamates commonly used to control brown planthopper (BPH) *Nilaparvata lugens* in Malaysia suggest that insecticide resistance may be developing.

In 1982 BPH were collected from fields of MR1, a local susceptible variety, in Tanjong Karang. They were cultured in the greenhouse on MR1 for 10 to 15 generations. One-day-old BPH adult females from this culture were treated, using a microapplicator, with various concentrations of MTMC diluted with acetone. Before treatment, the insects were anesthetized with CO_2. Treated insects were allowed to recover in a petri dish before being released onto 2-week-old MR1 rice plants in mylar film cages. Mortality was recorded after 24h.

Toxicological studies in 1977 used BPH collected from fields of Mat Chandu, a local susceptible variety in Bumbong Lima. BPH were reared on TNl in the greenhouse for 20-25 generations before the studies were carried out. The same test procedure was used, except that the treated hoppers were released onto 2-week-old TN1 rice plants.

Data from both studies were analyzed by a probit analysis computer program from Imperial College, Silwood Park, which performs independent single analysis and joint analysis with parallel data. If the data do not contradict the hypothesis of parallelism, the program compares effectiveness in terms of relative potencies.

Data show that BPH populations in Malaysia have become more resistant to MTMC between 1977 and 1982. During those years, a relative potency increase of 19.42 has developed, perhaps caused by the increased use of MTMC dust for BPH control. □

Cytogenetic variations between *Nilaparvata bakeri* (Muir) and *Nilaparvata lugens* (Stål) planthoppers

R. C. Saxena, associate entomologist, IRRI, and principal research scientist, International Centre of Insect Physiology and Ecology, P. O. Box 30772, Nairobi, Kenya; and A. A. Barrion, research fellow, IRRI

Populations of planthopper species *N. bakeri* and *N. lugens* recently were found coexisting on a weed grass *Leersia hexandra* (L.) Swartz, which grows abundantly in ditches along rice fields at the IRRI experimental farm, Los Baños. The planthoppers can be distinguished by genitalia. The grass-infesting *N. lugens* is a distinct deviant of the rice-infesting *N. lugens* brown planthopper and is suspected to be another biotype.

Hybridization studies were conducted to determine the genetic proximity between *N. bakeri* and *N. lugens.* Genetic crosses showed minimal compatibility and proved that natural hybridization is impossible. Cytogenetic investigations were made to elucidate specific relationships and observed phenotypic segregations of progenies in reciprocal heterogamic crosses.

Using the technique for preparation of brown planthopper chromosomes, actively dividing testicular cells of newly

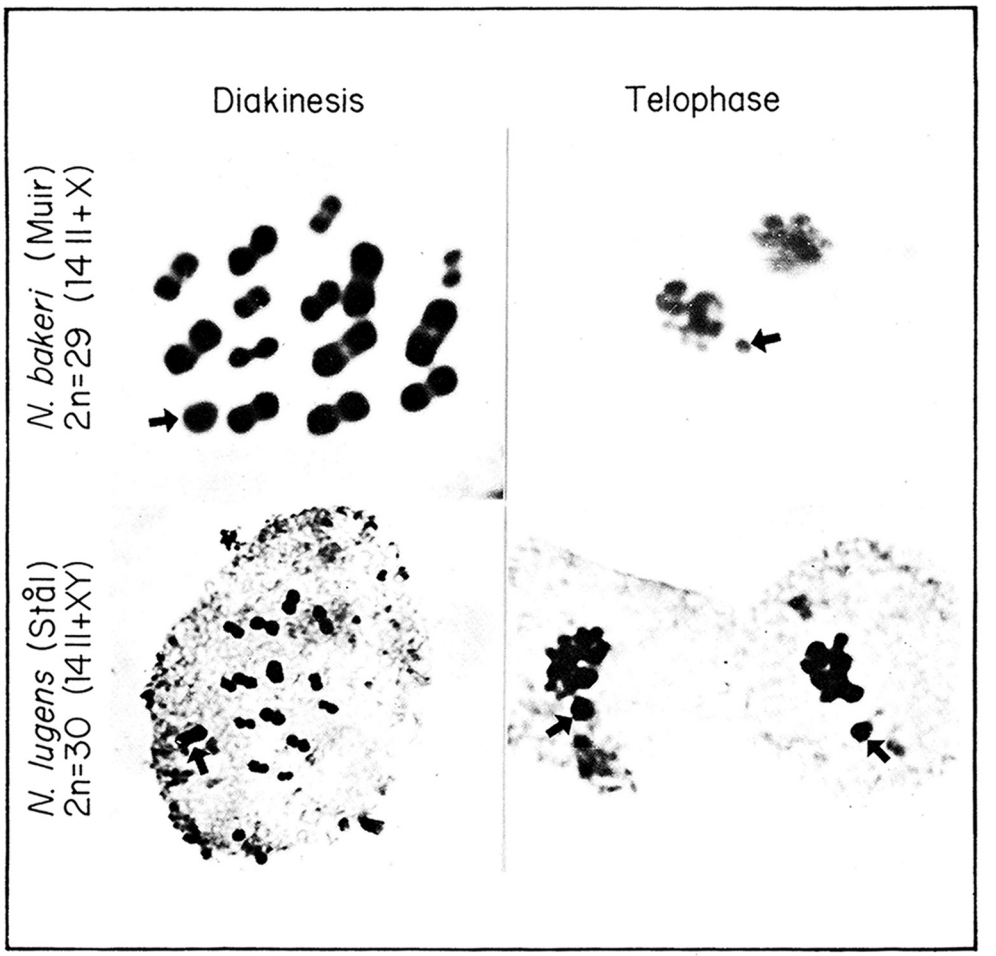
Variations in diploid chromosomal complement and sex-determining mechanisms of *N. bakeri* and *N. lugens.*

Species	Variations		
	Chromosome number (2n)	Sex-determining mechanism	Complete genome and prospective gametes
N. bakeri	Female: 30	XX	14 II + XX → 14 I + X ova
	Male: 29	XO	14 II + XO → 14 I + X sperms
			↘ 14 I + O sperms
N. lugens	Female: 30	XX	14 II + XX → 14 I + X ova
	Male: 30	XY	14 II + XY → 14 I + X sperms
			↘ 14 I + Y sperms

emerged *N. bakeri* and *N. lugens* brachypters were examined. The following variations in karyotypic features were detected:

1. Although females yield only one type of ova and males produce two types of sperm in both species, variations exist in the diploid chromosomal complement and the sex-determining mechanism (see table and figure).
2. In both species, chromosomes in gonial meiosis do not have distinct centromeres because they have diffused kinetochores. The constrictions vital for chromosomal movements and segregations during the meiotic stages are located along the length of the chromosomes. However, *N. bakeri* has relatively longer chromosomes: the shortest and the longest *N. bakeri* chromosomes are nearly 4 times longer than those of *N. lugens*. The nucleolar organizer of *N. bakeri* is its longest (143.50 mm) chromosome. In *N. lugens* it is 20.75 mm long.

These cytogenetic deviations impose pre- and post-mating barriers to effective hybridization between *N. bakeri* and *N. lugens,* and are additional taxonomic indices for differentiating the two species. □



Autosomes and sex chromosomes of planthopper species from Leersia hexandra (L.) Swartz. Sex chromosomes are indicated by arrows.

Incidence of brown planthopper *Nilaparvata lugens* Stål on IR50 at graded levels of fertilization at Aduthurai

S. Uthamasamy, V. Velu, M. Gopalan, and K. M. Ramanathan, Tamil Nadu Rice Research Institute, Aduthurai 612 101, India

IR50 was recently introduced in Tamil Nadu. We studied the response of this variety under graded levels of fertilization and BPH damage in a randomized block design with eight treatments and three replications. BPH population was recorded 80 d after transplanting (see table).

BPH population increased with fertilizer levels. Maximum BPH/hill was 106 when 150 kg N/ha was applied. The BPH population was lowest (5/hill) when no fertilizer was applied. P and K did not significantly influence BPH population.

Incidence of BPH under graded levels of fertilization, Aduthurai, India.

Fertilization[a]			BPH	Yield
N	P	K	(no./hill)	(t/ha)
0	0	0	5	4.1
50	0	0	50	4.7
100	0	0	53	5.5
150	0	0	106	4.6
50	11	21	28	4.7
100	22	42	54	5.4
150	33	62	84	5.0
0	22	42	5	5.0
CD			47.8	1.0

[a]Fertilization: 50% N = basal application, 25% N = topdressing at tillering, 25% N = topdressing at panicle initiation; P and K = basal applications.

At 100 kg N/ha with or without P and K, yield was 5.5 t/ha although the BPH population was above the economic threshold level. □

Effect of carbofuran and nitrogen on leaffolder incidence

P. Balasubramanian, S. P. Palaniappan, and M. Gopalan, Tamil Nadu Rice Research Institute (RRI), Aduthurai, India

The effects of combined application of carbofuran and nitrogen on leaffolder *Cnaphalocrocis medinalis* (G.) incidence was studied at Tamil Nadu RRI Sep 1982-Jan 83. The field trial was in a split-plot design with three replications. Thirty-day-old IR20 seedlings were planted in 20-m^2 plots at 20- × 10-cm spacing. Carbofuran was incorporated at 0.5 and 0.75 kg ai/ha with a basal application of nitrogen as urea at planting. Carbofuran was topdressed at 0.5, 0.75, and 1.0 kg ai/ha with the first topdressing of urea 15 days after transplanting (1 5 DT). N levels 0, 30, 60, 90, and 120 kg/ha were applied