until panicle initiation.

Varieties VHC 1253, Lengkwang, Hawang Haedo,VL 206, L 105-8, VLK39, and Himdhan had poor early seedling growth but recovered rapidly when the temperature rose above 25°C. They reached a par in vigor with the earliest varieties in both years.

A similar set of varieties was evaluated under controlled conditions. Twenty-five seeds of each were placed in petri dishes containing a mixture of sand, soil, and water. The same set of 10 varieties that performed well in the first experiment had more than 80% germination at 11 °C.

The third experiment had 16 varieties planted in pots. At booting stage, one set of pots was transferred to 2,400 m altitude where night temperatures were 10° to 5 °C. Another set was maintained at 1,600 m altitude where night temperatures were 18° to 12 °C. Only L 62G, Khonorullo, L 62-2A, UPRH299, and L 12-1A had good spikelet fertility and leaf color at 2,400 m altitude. Olbyed, Gangweondo, JC99, and Nancee had normal leaf color. □

Pest Control and Management

DISEASES

Effect of urea foliar spraying on rice tungro virus (RTV) infection

P. Lakshmanan, T. Manoharan, and N. T. Jagannathan, Tamil Nadu Agricultural University Research Centre, Vellore 632001, Tamil Nadu, India

In Mar-May 1984 there was a severe outbreak of RTV on several rice varieties in North Arcot District, Tamil Nadu. We tested a 1% foliar spraying of urea for RTV control on susceptible IET1722 at different sites. Disease incidence was measured at first spraying (20 d after transplanting [DT] and 20 d before harvest, using the Standard evaluation system for rice.

At first spraying 5-10% RTV infection was recorded. Foliar application of 1% urea at 20, 30, 40, and 50 DT + phosphamidon (85% EC) 320 ml/ha at 20 and 35 DT effectively controlled RTV up to 10% infection. In phosphamidon-treated and control fields, disease spread was 41 and 72% with a corresponding yield reduction (see table). □

Effect of foliar application of urea on RTV infection, Tamil Nadu, India.

Treatment	Disease incidence (%)		Mean yield (t/ha)
	20 d after transplanting	20 d before harvest	
1% urea sprayed at 20, 30, 40, and 50 d + phosphamidon (85% EC) at 20 and 35 d after transplanting	7 - 8	7 - 10	4.2
Phosphamidon (85% EC) sprayed at 20 and 35 d after transplanting	6 - 7	38 - 41	2.4
No treatment control	5 - 9	60 - 72	1.2

New rice grassy stunt virus (GSV) strain in Thailand

Dara Chettanachit, Methi Putta, Wichuda Balaveang, Junya Hongkajorn, and Somkid Disthaporn, Rice Pathology Branch, Department of Agriculture, Bangkhen, Bangkok, Thailand

Rice plants with symptoms of an unknown disease and other virus diseases were collected at several sites in Thailand and tested for virus presence by immune electron microscopy (IEM) and the dipping method. For IEM, grids were treated with an antiserum to rice tungro spherical virus (RTSV) or rice tungro bacilliform virus (RTBV) at 1 : 1000 dilution. After incubation with sap of plant samples, grids were floated on anti-

Table 1. Detection by IEM technique and dipping method of viruses from rice plants with different virus symptoms. [a]

Variety	Symptoms (visual assessment)	Virus particles detected by dipping	Reaction of extracts in IEM to antiserum against	
			RTSV	RTBV
Kaimukdum pl. no. 1	RSV	RSV	−	−
Kaimukdum pl. no. 2	RSV	RSV	−	−
Kaimukdum pl. no. 3	RTV	RTSV	+	−
Kaimukdum pl. no. 4	RTV	RTBV	−	+
Kaimukdum pl no. 5	RTV	RTSV, RTBV	+	+
Kaimukdum pl. no. 6	RSV	RSV	−	−
Kaimukdum pl. no. 7	RSV, unknown	RSV	−	−
Kaimukdum pl. no. 8	unknown	−	−	−
Apple Thong pl. no. 1	unknown	−	−	−
Apple Thong pl. no. 2	unknown	−	−	−
Number 20 pl. no. 1	unknown	−	−	−
Number 20 pl. no. 2	unknown	−	−	−
Number 20 pl. no. 3	unknown	−	−	−

[a] + and − indicate positive and negative reactions. RSV = rice ragged stunt, RTV = rice tungro virus.

sera at 1:10 dilution for decoration. The grids were stained with 2% uranyl acetate and examined under an electron microscope (Table 1). Results showed that the unknown disease was not caused by tungro infection.

Small leaf specimens (2 × 2 m^2) were collected from field plants with disease symptoms and crushed with 0.1M Tris-HCL buffer (pH 7.2) containing 0.02% PVP in test tubes using glass rods. Two drops of latex suspension sensitized with antiserum were added to the test tubes and they were shaken for 30 min, then left for 2 h before reaction reading. The latex particles formed aggregates in the positive reaction and remained a milky suspension in the negative reaction. All samples reacted to GSV antiserum (Table 2).

Table 2. Reaction of the unknown virus disease to antisera against GSV, RTBV, and RTSV by latex agglutination test.

Infected variety	Reaction to given antiserum			
	Buffer	GSV	RTSV	RTBV
RD7	−	+	−	−
RD23	−	+	−	−
IR46	−	+	−	−
BKNBR1141-4-2-4-2-2-2-1	−	+	−	−
TN1	−	+	−	−
Healthy TN1 control	−	−	−	−

Of 1,179 seeds collected from rice plants infected with the unknown disease, 1,091 germinated and grew as normal, healthy plants, indicating that the disease is not transmitted through seed. Four rice insects — *Nephotettix nigropictus, N. virescens, Recilia dorsalis,* and *Nilaparvata lugens* — were tested for disease transmission.

Only *N. lugens* transmitted the disease (38% of the time [367 infected plants/970 tested plants]). Disease incubation took 7-14 d. Forty-two to 70% of *N lugens* were transmitters. Shortest acquisition and inoculation feeding periods were 30 and 5 min. The vectors transmit the unknown disease persistently. Relationships between the unknown disease and *N. lugens* were similar to those of GSV and related viruses. The results indicate that the unknown disease is caused by a strain of GSV. □

Reaction of IR varieties to rice tungro virus (RTV) complex under greenhouse and field conditions as detected by latex test

R. D. Daquioag, P. Q. Cabauatan, and H. Hibino, Plant Pathology Department, IRRI

The reactions of 26 IR varieties to rice tungro virus complex were serologically analyzed using antisera against rice tungro bacilliform virus (RTBV) and rice tungro spherical virus (RTSV). A seedling in a test tube was inoculated for 1 d by an adult *Nephotettix virescens* that had been exposed to doubly infected (RTBV-RTSV) or singly infected (RTSV) TN1 plants. Using the latex test, inoculated seedlings were tested for the presence of RTBV, RTSV, or both viruses 30 d after inoculation. Leaf samples from each variety also were taken from the IRRI RTV nursery and tested for the virus particles.

When doubly infected plants were the virus source, infection percentage was 0-53 for RTBV-RTSV, 21-86 for RTBV, and 0-12 for RTSV (see table). Varieties with less than 10% RTBV-RTSV infection were IR20, IR26, IR28, IR29, IR30, IR34, IR40, IR50, IR52, IR54, IR58, and IR60. However, infection with RTBV-RTSV and RTSV in almost all the IR varieties was higher under field conditions than in the greenhouse test, probably because the plants were continuously exposed to viruliferous vectors and because RTSV exists as an independent disease at the IRRI farm. When RTSV alone was the virus source, percentage infection ranged from 0 to 12 in the greenhouse and 0 to 37 in the field. IR20, IR26, IR30, and IR40 were highly resistant to RTSV but were susceptible to RTBV. They all have TKM6 as a parent. □

Reaction of 26 IR varieties to RTV complex by test tube and field inoculation as detected by latex test, IRRI.

Variety	Greenhouse[a]						Field[b]			
	RTBV-RTSV source				RTSV source		Hills tested (no.)	With RTBV-RTSV (%)	With RTBV (%)	With RTSV (%)
	Plants tested (no.)	With RTBV-RTSV (%)	With RTBV (%)	With RTSV (%)	Plants tested (no.)	With RTSV (%)				
IR5	49	29	43	0	56	45	108	74	4	22
IR8	47	11	72	0	47	32	89	96	1	3
IR20	28	0	86	0	55	0	102	12	78	4
IR22	56	46	45	0	56	82	105	86	1	12
IR24	55	13	49	0	59	20	103	32	47	1
IR26	55	2	80	0	58	0	108	3	60	0
IR28	51	6	47	0	55	29	103	44	16	15
IR29	49	6	49	0	58	21	104	27	23	7
IR30	45	0	61	0	56	4	98	13	61	4
IR32	38	32	26	8	57	53	107	78	5	13
IR34	45	7	36	2	54	31	104	68	14	11
IR36	33	12	45	3	57	47	99	72	1	20
IR38	41	32	39	12	54	52	106	69	15	7
IR40	50	0	66	2	46	0	95	6	77	2
IR42	51	29	45	0	58	53	106	96	0	4
IR43	47	11	49	0	58	29	100	79	12	1
IR44	52	31	31	2	43	56	86	86	0	9
IR45	53	11	45	2	53	28	89	90	2	8
IR46	32	53	25	6	32	78	87	97	1	2
IR48	48	44	21	4	42	57	87	94	0	6
IR50	56	9	29	5	56	43	107	33	20	16
IR52	46	4	28	4	51	24	89	46	16	28
IR54	48	6	29	2	54	33	97	30	19	24
IR56	58	16	24	3	50	52	99	43	7	7
IR58	51	4	31	4	49	27	78	29	2	37
IR60	57	4	37	2	49	29	90	19	20	19

[a] 1 insect/seedling in test tubes for 3 trials. [b]RTV nursery, 1983 wet season and 1984 dry season, IRRI.