amount of virus antigen in the extracts was determined by their absorbance at 405 nm after 30-min incubation with the substrate.

Absorbance decreased as extracts were diluted and RSV was detected in the extracts up to 1/400-1-3200 dilution (by weight) (see figure). The relative amount of RSV was shown as absorbance of extracts at 1/200 dilution for the test at 30 and 45 d after inoculation and at 1/160 dilution at 60 d.

The relative amount of RSV in individual plants varied among test varieties. Statistically significant differences in the amount of RSV was shown at 30 d after inoculation, but not at 45 and 60 d. Regardless of the test variety, the amount of RSV was highest at 45 d and declined by 60 d. The relative amount of RSV was less in Ptb 21 and Murungakayan than in the other varieties. There was no significant difference in RSV amount between resistant and susceptible varieties. The results indicate that the resistant varieties tested were resistant to RSV infection but not to virus multiplication. ☐

Rice grassy stunt (GSV) at high altitudes

V. Mariappan and T. B. Ranganathan, Tamil Nadu Agricultural University, Coimbatore, India

The occurrence of GSV and its transmission by the brown planthopper (BPH) *Nilaparvata lugens* were reported in India in 1969. About 100 ha of rice in Tamil Nadu were infected with GSV in 1972, and about 15,000 ha were infested by the virus and its vector in the adjoining state of Kerala in 1973-74.

Since then, the disease has not been observed, despite the presence of large BPH populations. Recently, rice with symptoms similar to those of GSV was found in the Dugalur Valley of the Nilgiris Mountains of Tamil Nadu, where rice is grown on about 3,500 ha. The valley is isolated, and surrounded by 2,000-m-high, densely forested hills. BPH are present in the valley.

Disease symptoms were severe stunting and profuse tillering with narrow erect leaves, but the plants were green because of high soil N in the valley. Infection was less than 3% in Jagannath, IR20, and local varieties on the horticultural farm in Devala.

Transmission tests using BPH nymphs were conducted. Nymphs lived for 10 d on the source plant, then were transferred to 10-d-old TN1 plants for 5-d inoculation access feeding. One month later, inoculated TN1 plants developed GSV symptoms. ☐

Pest management and control INSECTS

Brown planthopper (BPH) resistance to a synthetic pyrethroid

Chih-Ning Sun, and Shu-Mei Dai, Entomology Department, National Chung-Hsing University, Taichung, Taiwan 400, China

As a follow-up of the 1979-80 survey that indicated BPH was resistant to permethrin yet susceptible to fenvalerate, in 1982 we monitored BPH susceptibility to four major synthetic pyrethroids and DDT.

Up to 1,000-fold resistance to permethrin was found while resistance levels to 3 other synthetic pyrethroids were much lower, ranging from 10- to 50-fold (see table). All BPH tested were susceptible to DDT, giving circumstantial evidence that in Taiwan BPH resistance to permethrin is not related to DDT resistance, as it is in insects such as the housefly, mosquito, and diamondback moth. A metabolic mechanism probably has caused the high BPH resistance to permethrin.☐

Susceptibility of a susceptible (S) and 6 field strains of BPH to 4 synthetic pyrethroids and DDT in Taiwan,China.[a]

Strain	Permethrin		Cypermethrin		Deltamethrin		Fenvalerate		DDT	
	LC_{50} (mg/ml)	RR	LC_{50} (mg/ml)	RR	LC_{50} (µg/ml)	RR	LC_{50} (µg/ml)	RR	LC_{50} (mg/ml)	RR
Pingtung	2.53	843	9.17	26	14.6	15	5.32	16	–	–
Meinung	2.38	793	5.53	15	39.2	41	13.22	40	0.121	3.7
Hsinshih	3.27	1090	7.53	21	6.7	7	16.67	51	0.114	3.5
Chiayi	2.15	717	4.00	11	9.1	10	4.70	14	0.112	3.4
Taichung	0.22	73	0.48	1	2.0	2	2.30	7	0.062	1.9
Hsinchu	2.64	880	5.29	15	14.3	15	4.80	15	0.128	3.9
S	0.003	–	0.36	–	0.95	–	0.33	–	0.022	–

[a] Resistance ratio (RR) = LC_{50} of field strain divided by LC_{50} of S strain.

Changing insect pest status in the Imphal Valley

R. N. Barwal, Indian Council for Agricultural Research (ICAR) Complex for NEH Region, Manipur Centre, Imphal 795001, India

Expanding irrigation facilities in the Imphal Valley allow the growing of two rice crops instead of one. But as cropping intensity increased, so have populations of common insect pests and sporadic outbreaks of unusual pests.

In 1979, a dry year, stem borers were major pests (see table), with 9.5% deadhearts at tillering and 16.7% at post-flowering. As rice hectarage increased, populations of other insects such as gall midge, leafroller, leafhoppers, caseworm, grasshoppers, rice bugs, and greenhorned caterpillar increased, and pest problems developed earlier in the season.

Caseworm became a serious problem when main crop transplanting was delayed to mid-Aug, and gall midge became a problem after the last week of Jul. Leafroller and greenhorned caterpillar disappeared late in the main season, and leafhoppers, grasshoppers, and rice bugs continued through harvest. Thrips