Rice Ragged Stunt Virus Disease in India

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ABSTRACT

GHOSH, A., and V. T. JOHN. 1980. Rice ragged stunt virus disease in India. Plant Disease 64: 1032-1033.

Rice ragged stunt virus was transmitted by *Nilaparvata lugens* (Stål) after 3 days' incubation in the vector; the transmission pattern was intermittent. Inoculated plants showed disease symptoms after 18 days. Nymphs were more efficient transmitters than adult insects. Rice cultivar Ptb 18 and culture IET 6288 were resistant to the disease.

Rice ragged stunt virus (RRSV) disease was first observed in the Philippines and identified by Ling et al (6,7). Before this, de la Curz (1) and Hibino et al (4) described identical symptomatology and termed the diseases "infectious galls" and "Kerdil hampa," respectively. The disease was reported in India by Ghosh et al (2). Heinrichs and Khush (3) also reported symptoms resembling those of RRSV disease in India and Sri Lanka. *Nilaparvata lugens* (Stål), the brown planthopper, has been reported as the vector of the virus (6). We report results of studies to elucidate vector-virus relationships and to determine sources of resistance to the disease.

MATERIALS AND METHODS

Plants with symptoms of RRSV disease were maintained in the greenhouse of the All-India Coordinated Rice Improvement Project (AICRIP), Rajendranagar, Hyderabad. Eighty laboratory-bred nonviruliferous first-instar nymphs of *N. lugens* were caged and allowed to feed on the diseased plants for 48 hr. Individual nymphs were caged separately on 10- to 15-day-old Taichung (Native) 1 seedlings for an inoculation feeding of 24 hr. Serial inoculations with individual insects continued at 24-hr intervals as long as insects remained alive. Transmission tests with adult insects were conducted similarly.

Seventy-eight rice cultivars and advanced breeding lines were tested under greenhouse conditions for resistance to RRSV disease. Three pairs of male and female adults of *N. lugens* were caged on RRSV-infected Taichung (Native) 1 plants for 72 hr for oviposition and nymphal development. Nymphs in the third instar were removed, caged on 10 test seedlings at the rate of five nymphs per plant for a 24-hr inoculation feeding, and then transferred to other sets of test plants at 24-hr intervals. All seedlings were reinoculated 2 days after the initial inoculation.

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RESULTS

Transmission of RRSV. Transmission began on the 4th day after acquisition

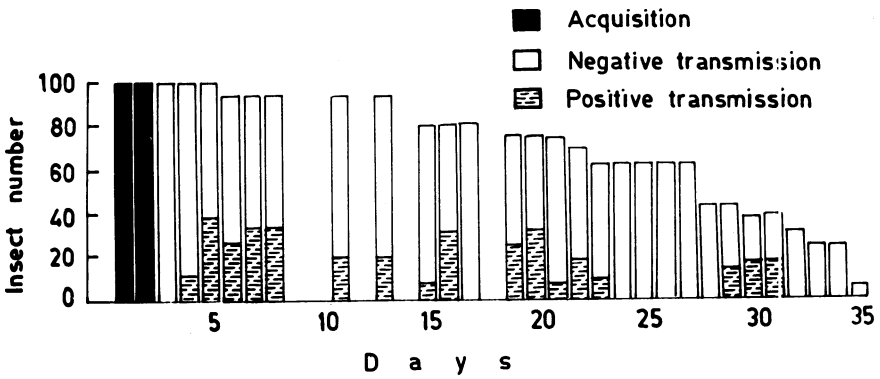

Fig. 1. Daily serial transmission of rice ragged stunt virus by *Nilaparvata lugens*.

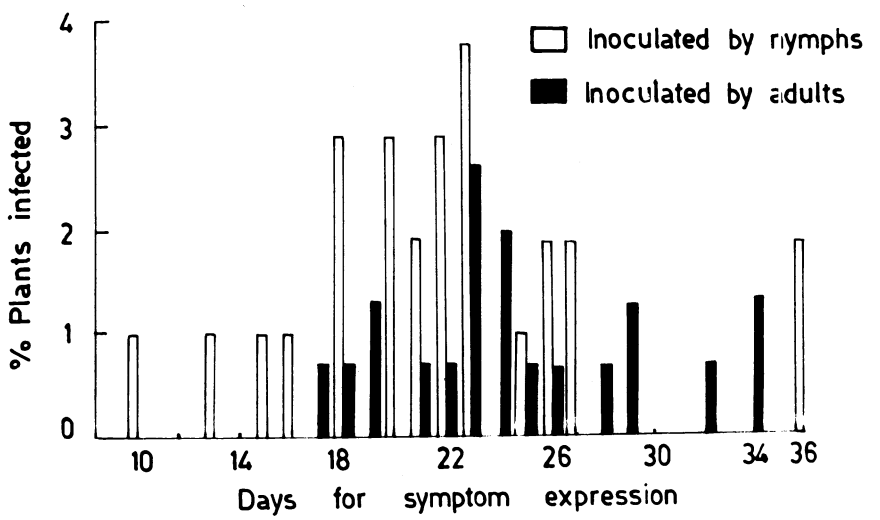

Fig. 2. Incubation period of rice ragged stunt virus in Taichung (Native) 1 seedlings inoculated by nymph and adult *Nilaparvata lugens* (one insect per plant).

Table 1. Transmission of rice ragged stunt virus by nymph and adult brown planthoppers, *Nilaparvata lugens*

Stage	Plants infected/inoculated[a] (no.)	Transmission (%)
Nymph 1st instar	18/93	19.3
2nd instar	16/62	25.8
3rd instar	18/62	29.0
4th instar	16/56	27.6
5th instar	9/42	21.4
Adult macropterous male	9/114	6.2
brachypterous male	20/118	16.9
brachypterous female	16/108	14.8

[a]Taichung (Native) 1 rice seedlings; one insect per plant.

feeding was started and continued through the 31st day (Fig. 1). The inoculation feeding series was terminated after 32 transfers. The highest percentage transmission occurred 5 days after acquisition feeding began. The transmission pattern was intermittent. Virus retention in the insects ranged from 4 to 31 days.

Twisting of the youngest leaves was the first noticeable symptom on most plants, although some plants developed serrated leaf margins. Stunting was rarely observed initially but later became pronounced. No trends in tiller production were observed, although a few plants produced 10–15 more tillers than the healthy controls. Stem galls, twisted leaves, and incomplete emergence of panicles later developed. Flowering was uniformly delayed in diseased plants.

The latent period of the virus ranged from 10 to 36 days in plants inoculated by single viruliferous nymphs and from 18 to 34 days in plants inoculated by adult insects (Fig. 2). Nymphs were more efficient than adults in transmitting RRSV (Fig. 2 and Table 1). Percentage transmission for first to fifth instars ranged from 19 to 29%. Only 6% of the macropterous adults and 17 and 15% of the brachypterous males and females, respectively, transmitted the virus.

Resistance to RRSV disease. All cultivars and advanced breeding lines except Ptb 18 and IET 6288 developed RRSV symptoms after inoculation with the virus.

DISCUSSION

Ling et al (6) reported that some insects became viruliferous immediately after acquisition feeding but in our studies, at least 72 hr were required for completion of virus incubation in the vector. The highest percentage transmission occurred on the 5th day after acquisition feeding started, instead of 9 days as previously reported (7).

Ptb 18 and the line IET 6288 (for which Ptb 18 is one of the parents) were resistant to RRSV disease in this study. Ptb 21 has also been reported to be resistant not only to RRSV but also to the brown planthopper at the International Rice Research Institute (IRRI) in the Philippines (7). Gam pai 30-12-15, also rated as resistant to RRSV at IRRI, was susceptible in our study.

Pathak and Khush (8) indicated that biotypes of the brown planthopper in India and Sri Lanka differ from those at IRRI, and Kalode and Krishna (5) reported that the biotype of the brown planthopper at AICRIP was entirely different from the three biotypes identified at IRRI. Differences in vector biotypes probably explain the differences in transmission and varietal reactions in this study and those at IRRI.

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LITERATURE CITED

1. DE LA CRUZ, C. R. 1977. Infectious gall disease: New threat to rice crops. Greenfields 7:17-18.
2. GHOSH, A., V. T. JOHN, and P. C. REDDY. 1979. Characterization of rice ragged stunt virus disease in India. Curr. Sci. 48:493-494.
3. HEINRICHS, E. A., and G. S. KHUSH. 1978. Ragged stunt virus disease in India and Sri Lanka. Int. Rice Res. Newsl. 3:13.
4. HIBINO, H., M. ROCHAN, S. SUDARISMAN, and D. M. TANTERA. 1977. A virus disease of rice (Kerdil hampa) transmitted by brown planthopper, *Nilaparvata lugens*, in Indonesia. Contr. Ctr. Res. Inst. Agric. Bogor 35:1-15.
5. KALODE, M. B., and T. S. KRISHNA. 1979. Varietal resistance to brown planthopper in India. Pages 187-199 in: Brown Planthopper Threat to Rice Production in Asia. International Rice Research Institute, Manila, Philippines. 369 pp.
6. LING. K. C., E. R. TIONGCO, and V. M. AGUIERO. 1978. Rice ragged stunt, a new virus disease. Plant Dis. Rep. 62:701-705.
7. LING, K. C., E. R. TIONGCO, V. M. AGUIERO, and P. Q. CABAUATAN. 1978. Rice ragged stunt disease in the Philippines. Int. Rice Res. Inst. Res. Pap. Series 16:1-25.
8. PATHAK, M. D., and G. S. KHUSH. 1979. Studies of varietal resistance in rice to the brown planthopper at the International Rice Research Institute. Pages 285-301 in: Brown Planthopper Threat to Rice Production in Asia. International Rice Research Institute, Manila, Philippines. 369 pp.