Pest management and control
DISEASES

The appearance of tungro symptoms in boro paddy in W. Bengal, India

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Serious epidemics of tungro occurred in W. Bengal in 1969 and the disease has occurred sporadically since then. To combat its spread in India, extensive research has been conducted at the All India Coordinated Rice Improvement Project at Hyderabad, the Central Rice Research Institute at Cuttack, the Indian Agricultural Research Institute at New Delhi, and at Bidhan Chandra Krishi Viswavidyalaya (department of plant pathology) in W. Bengal. As a result, adequate cultivation practices were recommended such as removal of the virus sources from fields, growing tolerant or resistant varieties, and judicious pesticide application to control the vector.

Although no serious incidence of tungro has been reported in W. Bengal during the last 3 years, its presence is evident from symptoms in trial plots at the Chinsurah Rice Research Station and at the plant virus experimental fields at Kalyani. Because epidemics of tungro could spread under favorable conditions, rice fields around Kalyani were searched for tungro during the boro season, 1976–77 (the disease was found in a more or less epidemic form in one field).

In the field study at Kalyani, tungro-like symptoms were found in the first week of February 1977 on a few plants of the variety China (imported from Bangladesh) grown in lowland conditions. The leaves turned orange-yellow and the plants became stunted. The height of infected plants was reduced by 15 to 96%.

In transmission studies with TN1 seedlings, typical symptoms developed within 20 days of inoculation. The sweeping technique yielded no leafhoppers. Patches of diseased plants gradually appeared and the disease spread during March. At the end of March, the leafhopper population, primarily *Nephotettix virescens,* was high (12 adults/sweep). During early April, the entire field was diseased, and the leafhopper population remained high. The crop – harvested on 8 April – yielded a low 1.27 t/ha (the expected yield was 5.56 t/ha).

In the adjacent highland situation, Ratna was transplanted in the second week of February. The field remained normal and yields were optimum. Neither the sweeping technique nor the light trap yielded leafhoppers. The macroclimatic situation at Kalyani and that in the field being studied are similar because the two locations are no more than 1 km apart. But the microclimatic situation may differ, resulting in a buildup of hoppers at Kalyani.

In a study of the biology of *Nephotettix virescens,* 33.3% hatching was observed during December-January 1976. It took from 28 to 43 days for molting to be completed (1st-5th instar) and for adults to emerge. From 5 to 19% of the adults appeared.

Alternate hosts of rice tungo virus and its vectors

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Information on the survival of tungro virus and its vectors *Nephotettix virescens* and *N. nigropicrus* during off-seasons is vital to the understanding of its epidemiology. Seventeen wild species of rice, 20 of weeds, and 6 of cereal crops were tested to see if they might support tungro virus and its vectors during off-seasons.

The weed and cereal crop species showed no visible symptoms of tungro, nor did they act as symptomless carriers. But the virus infected and survived on nine of the wild rices: *Orvza glaberrima, O. nivara,* the introgressive form of *Oryza* sp., *O. barthii, O. perennis, O. eichengeri, O. australiensis, O. punctata,* and *O. brachyantha* However, the virus was recovered through back indexing with nonviruliferous *N. virescens* only from the first five species, even though the remaining four were clearly stunted. Some peculiar symptoms not common on rice cultivars were observed in some species, including veinal and interveinal necrosis.

In tests of vectors, plant species on which leafhoppers survived for more than 10 days were considered favorable food hosts; those that supported a complete life cycle were considered reproductive hosts. The most efficient tungro vector, *N. virescens,* had a more limited host range than the inefficient vector *N. nigropictus.*

The reproductive host species of *N. virescens* in order of decreasing favorableness were *O. sativa, O. glaberrima, O. nivara, O. perennis, Paspalum orbiculare,* and *Echinochloa colonum.* Its food hosts were the species *O. barthii, O. perreiri,* and *Eleusine indica.* The reproductive host species of *N. nigropictus* in order of decreasing favorableness were *Leersia hexendra, O. sativa, O. glaberrima, E. colonum, P. orbiculare, O. nivara, O. malampzhuaensis, O. perennis, O. punctata, O. officinalis, Ischaemum indicum, O. eichingeri,* and *O. minuta.* The food host species for this vector in order of decreasing- favorableness were *O. barthii, Eleusine coracana, Hordeum vulgare, Triticum vulgare, Zea mays, O. perreiri, E. indica,* and *O. alta.*

Geographic distribution of tungro virus disease and its vectors in India

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Because the tungro virus syndrome is complex, diagnosis of the disease can be