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Variation on the susceptibility of rice tungro virus components in respect to variety and vector *Nephotettix virescens*

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Some of the widely cultivated rice varieties of West Bengal have been tested to see their reaction on the rice tungro virus components (i.e. RTBV – Rice tungro bacilliform virus and RTSV – Rice tungro spherical virus) both under field and glass house conditions. In all the experiments Taichung Native – 1 (TN 1) susceptible to viruses and leafhopper vector (*Nephotettix virescens*) was used as a check variety. In the field trial IR-36 showed moderate level of tungro infection (17.88%) whereas IR-56 and IR-50 exhibited very low infection of 4.05 and 6.90% respectively. The average leafhopper catches were found to be very low in all varieties in respect to TN 1 which ranged from 4.05 to 7.42 per sweep. In transmission test the infection by the tungro components (RTBV and RTSV) jointly and / or singly varied amongst the varieties. Presence of RTBV and RTSV were tested in some of the promising varieties commonly grown in West Bengal and that included Khitish, IR-56, IET-1444, Ratna and Masuri. Infection percentage of RTBV and RTSV on the test varieties varied from 16.5 to 27.0%, of which Khitish showed high infection (27.0%) and IR-56 was very low (2.0%) by both the virus components. Whereas, varieties like Ratna, Masuri, IR-56 and IET-1444 showed proportionately high infection by RTBV singly than by the combined infection by RTBV and RTSV. The variety IR-56 did not show any plant, infected with RTSV singly.

With the variation of the viruliferous vector pressure under glasshouse condition, infection by both the component RTBV and RTSV and / or singly greatly varied in the test varieties and was directly proportional to the increase of number of vectors per plant of IR-50 and IR-36. virus retention by tungro vector was judged by daily serial transmission and it was observed that the leafhopper vector fed on susceptible varieties retained virus for 4 days and 1-2 days with resistant varieties.

Key words : Rice tungro virus components, rice varieties, vectors, susceptibility, virus retention.

INTRODUCTION

Rice tungro disease (RTD) is considered as one of the most important diseases of rice in South and South East Asia and in India this disease has been occurring mainly in Aman rice several out breaks in various states including West Bengal have been reported. It appears as a sporadic manner and causes reduction in yield if disease appear at early period of growth phase. Rice tungro virus comprises of two morphologically and serologically distinct virus components which are rice tungro bacilliform virus (RTBV) and rice tungro spherical virus (RTSV) (Hibino, *et al* 1991, Omura, *et al.* 1983 and Jones, *et al.* 1991). In the field when susceptible varieties of rice become infected by both these components, show typical 'tungro' symptoms with severe stunting and orange yellow colour. The rice plants also get infected singly either by RTBV and RTSV, but plants infected with RTBV alone cause mild tungro symptoms whereas RTSV infected plants do not show clear symptoms except mild stunting (Hibino, *et al:* 1990). Both the components, RTBV and RTSV are transmitted mostly by green leafhopper (GLH) *Nephotettix virescens* (Distant) and some other leafhopper species (Ling 1972; Hibino *et al.* 1983). Transmission and retention of rice tungro virus by its vector is related with the rice cultivars and type of tungro particles (Chowdhury *et al.* 1990, Dahal *et al.* 1990).

It is now accepted that both the virus components cause infection jointly or singly and GLH could acquire and transmit the viruses individually or simultaneously (Cabautan and Hibino 1985). Generally tungro outbreak is endemic in nature and has been found to occur in a cyclic pattern in India as well as in other Asian countries. The most possible factors associated with the tungro are growing of susceptible varieties, coincidence of sufficient tungro vectors, presence of abundant quantity of tungro sources. In the recent studies, on the molecular characterization of tungro virus components of different geographic origin reveals that Indian isolates differ in molecular level to the Philppines isolates (Dahal, *et al:* 1992). Presently,

traditional tall India varieties are being replaced by introducing high yielding varieties taking a major role of outbreak of tungro disease. In our present studies some selected and high yielding varieties of rice cultivated in West Bengal have been tested both in the field and glasshouse condition with the objective to see their reaction to RTD and its vector GLH. Such information will help to understand the host-virus interaction which is necessary to develop tungro resistant rice varieties.

MATERIALS AND METHODS

To evaluate some varieties against tungro virus infection and FLH population under natural condition, the experiments were conducted for three consecutive years in the experimental field of Bidhan Chandra Krishi Viswavidyalaya, West Bengal. The seedlings of the test varieties were transplanted during mid-August as such to coincide with natural appearance of GLH vector. Each variety had 10 rows of 5 meters length following one row of susceptible TN 1 check to develop uniform spread of GLH and RTD. The RTD incidence was recorded by visual symptoms and the GLH catch was recorded by sweeping method with 30 cm diameter net at a regular interval.

The infection by the RTD component viruses in the test varieties was conducted in glasshouse condition by artificial transmission with GLH vector. The adult vectors *N.virescens* were exposed for acquisition feeding on TN 1 plants infected with both RTBV and RTSV. After completions of 3-days acquisition feeding the viruliferous GLH were released on the test varieties kept in the test tube with plastic cap for 1 day inoculation feeding and the inoculated plants were planted in earthen pots filled with paddy field soil and kept in the net house for symptom development. Three weeks after inoculation, the second youngest leaves were collected from each inoculated variety, homogenized and detected the presence of RTBV and /or RTSV by serology. The respective antisera of the two component viruses were obtained from the International Rice Research Institute (IRRI), Philippines.

Influence of insect pressure on the transmission of RTBV and RTSV was evaluated in four varieties including TN1 as check. The experiment was conducted by test tube inoculation method under glasshouse condition. The viruliferous insect ranging 1-5 were released per seedling for inoculation feeding taking at least 25 seedlings of each variety with respective number of insects. Three weeks after inoculation the test seedling were tested by ELISA to detect the presence of RTBV and RTSV. In separate glasshouse experiment the retention of virus by the GLH vector was detected. The viruliferous insect was used for serial transmission in the seedling of four varieties. Seven days old seedlings were placed individually in each test tube and allowed to feed upon by one viruliferous insect for one day. On the second day the seedlings were removed by placing of another set of healthy seedlings and the process was continued for 4 successive days. The inoculated seedlings were transplanted to the pots and the RTD infection after three weeks was assessed.

RESULTS AND DISCUSSION

Field Incidence

Tungro incidence in 4-IR rice varieties having different degree of resistance to tungro virus and its GLH vector have been evaluated under field condition (Table 1). Average vector population

Table 1. Incidence of GLH population and rice tungro disease in some IR varieties under field condition

Variety	Mean GLH population (No. per sweep)	Mean tungro incidence (%)
IR 36	6.77	17.88
IR 50	7.42	6.90
IR 56	4.05	4.05
IR 72	5.97	4.05
TN 1	17.5	32.77

varied from 4.05 to 17.5 per sweep, but a low population was found in all the test IR varieties. A highest disease incidence upto 32.77% was found in TN 1 while lowest upto 4.05% recorded in IR56 and IR72. IR36 showed moderate incidence of tungro (17.88%) in the field. It is evident from the results that IR varieties showed apparently a low population of GLH as well as tungro incidence in the field condition.

Reaction to RTSV and RTBV in some rice varieties

Some of the rice varieties were tested for the presence of RTBV and/or RTSV components under glasshouse conditions. The ELISA test

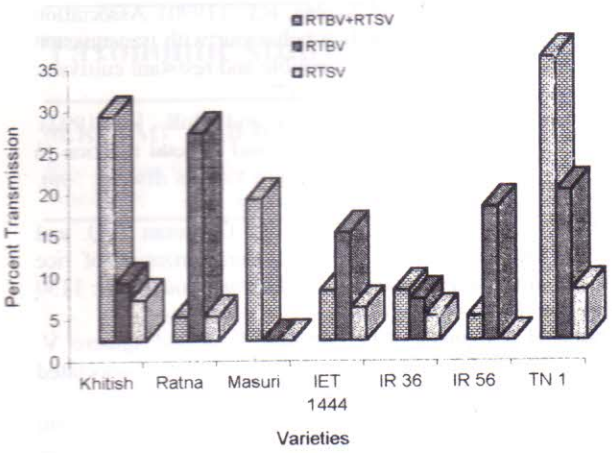

Fig 1. Transmission of rice tungro virus component in different varieties of rice by artificial inoculation

revealed the highest extent of variation in respect to the transmission of RTBV and RTSV either singly or jointly in the test varieties (Fig 1). The varieties like Khitish and TN1 (check) showed very high level of infection of (27% and 35%) jointly by RTBV and RTSV. Whereas, Ratna had highest infection of 25% by RTSV only followed by TN1, Masuri, IR56, IR36 and IET 1444 which ranged from 12.0% to 19.0%. Masuri and IR56 were free from the infection by RTSV alone and such variation in the transmission of RTBV and/or RTSV is probably related to the host resistance to GLH vector. In leafhopper resistant varieties the spread of RTD depends upon the frequency of the movement of GLH in the respective variety (Tarafdar and Chowdhury, 1997), besides leafhopper resistant varieties are predominantly infected with RTBV alone than by joint infection by RTBV and RTSV (Hibino *et al* 1987, Tiongco; *et al*, 1986).

Influence of GLH presence on RTD incidence

The percentage of infection of RTD was found to be directly proportional to the increasing number of viruliferous GLH per seedling but the rate of increase was not same for all the varieties. When the rice seedlings were allowed to feed by 1-5 viruliferous GLH per seedling of 4 varieties, TN1 and IR 36 showed very high level of infection jointly by RTBV and RTSV (Fig 2). Furthermore it was noted that very high percentage of RTBV infection alone in all the test varieties, but rate of increase of RTBV infection was very low with the increase of number of GLH. In IR-50 there was no infection by RTSV alone whereas in other three varieties there was no consistency to RTSV infection alone. Increase of vector number in the plant or in a host population may shift the varietal reaction from resistance to susceptible or intermediate type and has been reported earlier (Cabunagan *et al*., 1984).

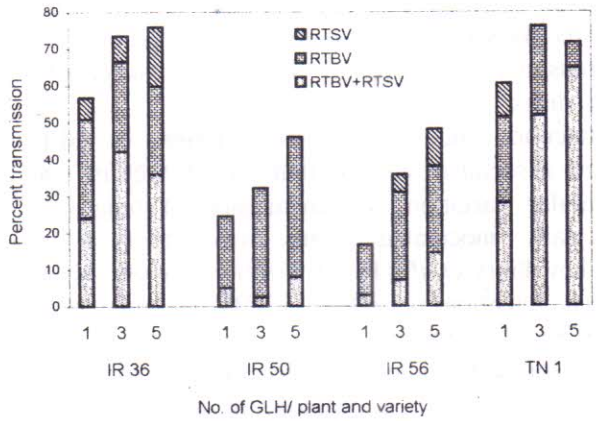

Fig 2. Effect on the number of GLH vector on the transmission of tungro virus components

Rice varieties, resistant to RTD and non-preference to GLH vector show generally low level of infection in the field. Our study suggested that if the vector population is increased to a certain level in the field, a resistant variety might be showing high extent of infection. Such breakdown of resistance is one of the major problems for RTD disease management and it emphasized the need for an integrated management of tungro control.

Serial transmission of RTD in different rice varieties

Tungro viruliferous GLH was given one day inoculation feeding individually for 4 successive days by serially transforming the GLH on 7 days

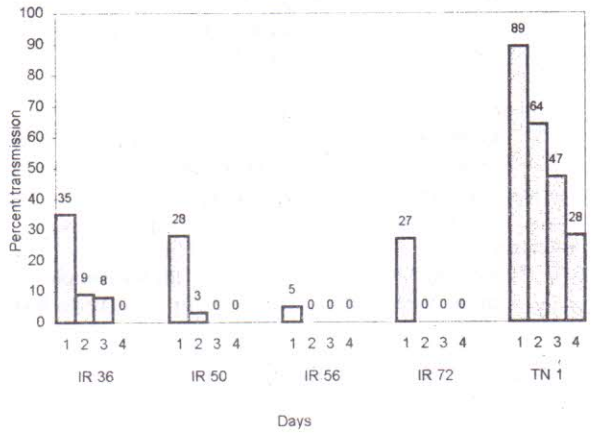

Fig 3. Retention and serial transmission of rice tungro virus by GLH vector

old seedlings of IR 36, IR 50, IR 56 and TN 1 as check to observe the retention of virus transmission by GLH (Fig 3). It is evident from the result that there was a gradual decrease in transmission of RTD with increase of successive days. GLH retained only one day in IR 50 and three days in IR 36, but in TN 1 the GLH could transmit the RTD till 4 days of successive feedings.

Retention and transmission of tungro by GLH are associated with a number of factors and similar variation of transmission of tungro in serially inoculated plants was observed by Chowdhury *et al.* (1990). Further they also noted that retention period of RTBV is more than RTSV by leafhopper vector.

The present studies indicated that the spread of RTD with its two components depend upon a large number of factors associated with the host resistance, vector pressure and capability of the vector to retain the virus by feeding on a particular host variety. In GLH resistant varieties infection of RTBV is most predominant and RTBV infected plant do not play a direct role, as a source of tungro spread, as RTSV infected host is necessary for the spread of the disease. These studies emphasized some of the factors related to the resistant and susceptibility of RTD and this information will help to select the rice varieties for tungro management particularly in tungro prone areas.

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