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Studies on the Incidence of Rice-Tungro Virus (RTV) and Population Dynamic of its Predominant Vector

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A B S T R A C T

Rice tungro virus (RTV) is a complex disease caused by RTBV (rice tungro bacilliform virus) and RTSV (rice tungro spherical virus). In West Bengal, it is transmitted by different species of green leafhopper (GLH) like *Nephotettix virescens, Nephotettix nigropictus* and Zigzag leafhopper (ZLH) *R. dorsalis.* The present investigation was made to observe the incidence of RTV and the population dynamic of its predominant vector green leafhoppers (GLH). Survey on incidence of the disease under field condition revealed that tungro virus was present in almost all the varieties under study, however Taichung native 1 (TN1) was found to be highly susceptible variety to the virus followed by IET 4786, IR 64, IET 1444, IR 36 and IR 62. Regarding the population dynamic of GLH, it was found that GLH was present in the rice as well as some weed host and the population was found to increase from the month of June to October and after that it started decreasing. It was also observed that highest population of GLH was at maximum tillering stage irrespective of varieties followed by flowering stage, panicle initiation stage and seedbed. The study revealed that the high rate of incidence of RTV at the late stage of crop was related with the high population of tungro vector in the field as well as availability of sufficient amount of virus source.

Introduction

Rice (*Oryza sativa* L.) a member of family Gramineae, is one of the most important cereal crops grown throughout the world. After China, India is the second largest producer of rice in the world. Rice is s. In India rice is grown in three seasons namely '*Aus'* (Pre-monsoon), '*Kharif*' or '*Aman'* (main crop in the monsoon season) and '*Boro*' (summer crop). West Bengal is the largest rice producing state in India which accounts for 95% of the total food grain production in the state, compared to 54% for India as a whole (Saha *et al.*, 1996). Rice tungro is a complex disease caused by RTBV (rice tungro bacilliform virus) and RTSV (rice tungro spherical virus) (Hibino *et al.*, 1978; Omura *et al.*, 1983). This disease caused severe outbreak periodically in many rice growing countries including India. In India RTV is most predominant in *kharif* season. One estimate of global economic impact of this disease is that it may cause average yield loss

upto $ 1.5 x 10^9 (Herdt, 1988). The major outbreak of RTV has been noticed from different countries of south east Asia that include Philippnes, Thailand, India, Malaysia, Bangladesh, Srilanka and many other countries (Anjaneyulu *et al.,* 1994).

Although the detailed information on the estimate of crop loss from India is not presently available, but from West Bengal (Chowdhury, 1997) estimated a crop loss which exceeds more than 10 crores due to the wide spread incidence of RTV in various districts of the state during 1996.

Tungro in West Bengal is a very common disease and incidence and spread of the disease mostly depends on the availability of virus source, vector and presence of abundant RTV susceptible varieties. The most important vector for RTV under West Bengal situation are different species of green leafhopper like *Nephotettix virescens* and *Nephotettix nigropictus* (Mukhopadhyay and Chowdhury, 1970). Population of rice green leafhopper is abundant during kharif season which appears from the month of July and increased gradually in September to October and declined from the beginning of December. In extreme cold and in hot summer they are almost absent (Mallik and Chowdhury, 2000). This is probably one of the reasons for high incidence of RTV during kharif season. Considering the importance of RTV in West Bengal this study was undertaken to find out incidence the of RTV and the population dynamic of green leafhoppers like *Nephotettix virescens* and *Nephotettix nigropictus*.

Materials and Methods

The present investigation was made at Regional Research Station (OAZ), UBKV, Majhian, Dakshin Dinajpur, West Bengal during 2015-16 using six rice varieties viz., IR – 36, IR – 62, IR – 64, IET 1444, IET 4786 and TN1 (Taichung Native 1). Per cent disease incidence of RTV was calculated by using the standard formula.

$$\text{Percent Disease Incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Data on percent disease incidence (PDI) from all the varieties in the month of August, September, October and November during kharif season of 2015 were recorded at periodic interval. Data on average population of GLH in different month, at different stage of crop growth in different variety under study and also on weed host were noted. Average population of GLH was taken from June-December, 2015 by hand sweeping. Green leafhoppers (GLH's) were sweeped at weekly interval and average population from 10 sweeps were taken into consideration to estimate the population. The population of green leafhopper (GLH) was recorded in different varieties like IET4786, IET1444, MTU7029 and IR36 at different crop stages namely seedbed, maximum tillering stage, flowering stage and panicle formation stage. Population of green leafhopper (GLH) was measured on rice and weed host during the period from March to June, 2015. Sweeping was made from the different rice varieties as well as on weed host.

Results and Discussion

Incidence of Rice tungro virus (RTV) disease under natural condition in different months during *kharif* season

Incidence of tungro disease under natural condition in the month of August, September, October and November during kharif season of 2015 were recorded at periodic interval and the result on the percentage of infection are presented in table.1 and fig.1 Based on the incidence percentage it appears that highest tungro infection was observed in TN1 irrespective of month of observation. In the

month of August, a minimum incidence of 4.34% was recorded in IR62 and IET1444 followed by 4.95%, 8.8% and 9.37% respectively on IR36, IR64 and IET4786.

In all the varieties percentage of RTV infection increased when the observation was made in the month of September. A highest incidence up to 21.53% followed by 19.79, 16.80, 13.91, 13.22 and 10.86 were observed on TN1, IET4786, IR64, IET1444, IR36 and IR62 respectively. Almost similar trend on the increase of infection was observed both in October and November months observation. Maximum and minimum incidence up to 36.45% and 19.56% were recorded in TN1 and IR62 respectively. IR64 and IET1444 had almost similar percentage of tungro infection in the month of November. Based on the overall disease situation on these popular rice varieties it can be concluded that all the varieties showed susceptibility to tungro infection. IET4786 is one of the popular varieties widely cultivated for several years and it appears that the variety become susceptible to tungro virus.

Rice varieties differ in their susceptibility to RTV and such resistance or susceptibility may be due to viruses or vectors (Hibino *et al.*, 1987). The present investigation showed the variation on the incidence of tungro under similar situation in different months during *kharif* season. Such variation may be due to susceptibility of the variety to both virus and vector.

The varieties IET4786 and TN1 recorded high percentage of infection probably due to susceptibility of the varieties to both the virus and the vector. Rate of increase of disease in later stage may be due to presence of sufficient number of efficient vector and the source plant in the field of observation or nearby fields.

Population of green leafhopper (GLH) in different months during *kharif* season

Average population of GLH was recorded from June-December, 2015 by hand sweeping. Green leafhoppers (GLH's) were sweeped at weekly interval and average population from 10 sweeps was taken into consideration to estimate the population and data are presented in table 2 and figure 2. From the result it observed that green leafhoppers (GLH) were present in the rice field in all the month of observation. The population presented in the table 6 and figure 3 included the catches obtained from seedbed, maximum tillering stage and flowering stage. No restriction was made on the specific varieties but mostly they were collected from the high yielding varieties (HYV's) grown in the research farm. GLH were present in all the month but number of the GLH from August-December was higher.

A highest number of the GLH population (38.5/sweep) was obtained in the month of October followed by 35.5, 28.5, 22.7, 11.4 and 3.5/sweep in the month of November, September, August, December, July and June, 2015 respectively. From the data of monthly catch, it revealed that the population of GLH was more from August-December. In the month of June and July, population of GLH was recorded from the seedbeds. Similar reports of population of GLH in different months in West Bengal was thoroughly studied by Mukhopadhyay and Chowdhury (1973).

Population of green leafhopper (GLH) at different stages of plant growth in four rice varieties

The population of green leafhopper (GLH) was recorded in different varieties like IET4786, IET1444, MTU7029 and IR36 at different crop stages namely seedbed, maximum tillering stage, flowering stage and panicle formation stage.

Table.1 Incidence of Rice-tungro virus (RTV) disease in different rice varieties under natural condition at different months during *kharif* season of 2015

Variety	*Percentage of infection at different time after transplanting*											
	August			**September**			**October**			**November**		
	Total no. of plants	**No. of infected plants**	**Percentage of infection**	**Total no. of plants**	**No. of infected plants**	**Percentage of infection**	**Total no. of plants**	**No. of infected plants**	**Percentage of infection**	**Total no. of plants**	**No. of infected plants**	**Percentage of infection**
IR – 36	121	6	4.95	121	16	13.22	121	21	17.35	121	28	23.14
IR – 62	92	4	4.34	92	10	10.86	92	13	14.13	92	18	19.56
IR – 64	125	11	8.8	125	21	16.80	125	28	22.40	125	31	24.80
IET – 1444	115	5	4.34	115	16	13.91	115	19	16.52	115	28	24.34
IET – 4786	96	9	9.37	96	19	19.79	130	39	30.00	130	43	33.07
TN1	130	19	14.61	130	28	21.53	96	31	32.29	96	35	36.45

Table.2 Average population of Green leaf hopper (GLH) sweeped at weekly interval; average of 10 sweep in different month during *kharif* season of 2015

Month	No. of GLH / Sweep
June	3.5
July	11.4
August	22.7
September	28.5
October	38.5
November	35.5
December	19.6

Table.3 Average population of Green leaf hopper (GLH) at weekly interval in different stages of plant growth in four rice varieties during *kharif* 2015

Stages of plant growth	Variety			
	IET 4786	IET 1444	MTU 7029	IR 36
Seed bed	**8.5**	**5.5**	**2.5**	**3.5**
Maximum tillering stage	**28.75**	**25.5**	**25.25**	**26.75**
Flowering stage	**19.5**	**16.75**	**19.5**	**21.5**
Panicle formation stage	**15.75**	**13.75**	**16.75**	**18.5**

Table.4 Average population of Green leafhopper (GLH) on rice and weed host during March to June by sweeping method

Month	On rice	On weed
March	4.0	0.15
April	5.5	0.51
May	7.5	1.52
June	8.5	2.1

Fig.1 Incidence of Rice tungro virus (RTV) disease in different rice varieties under natural condition at different months during *kharif* season of 2015

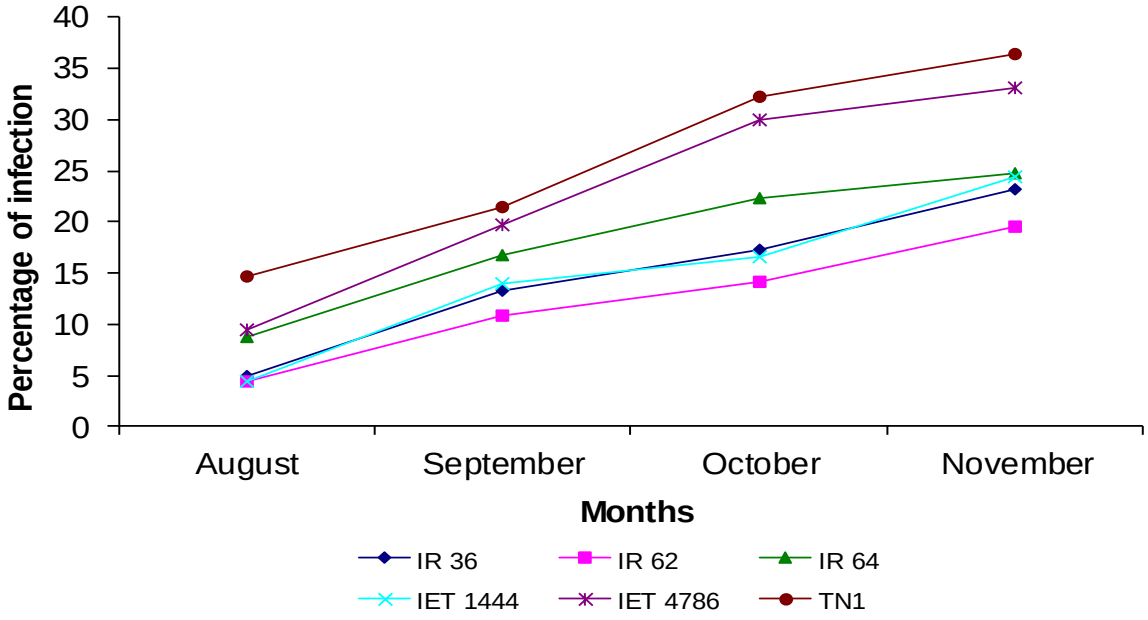


Fig.2 Average population of green leafhopper (GLH) in different months during *kharif* season of 2015 (Sweeped at weekly interval; Average of 10 sweeps)

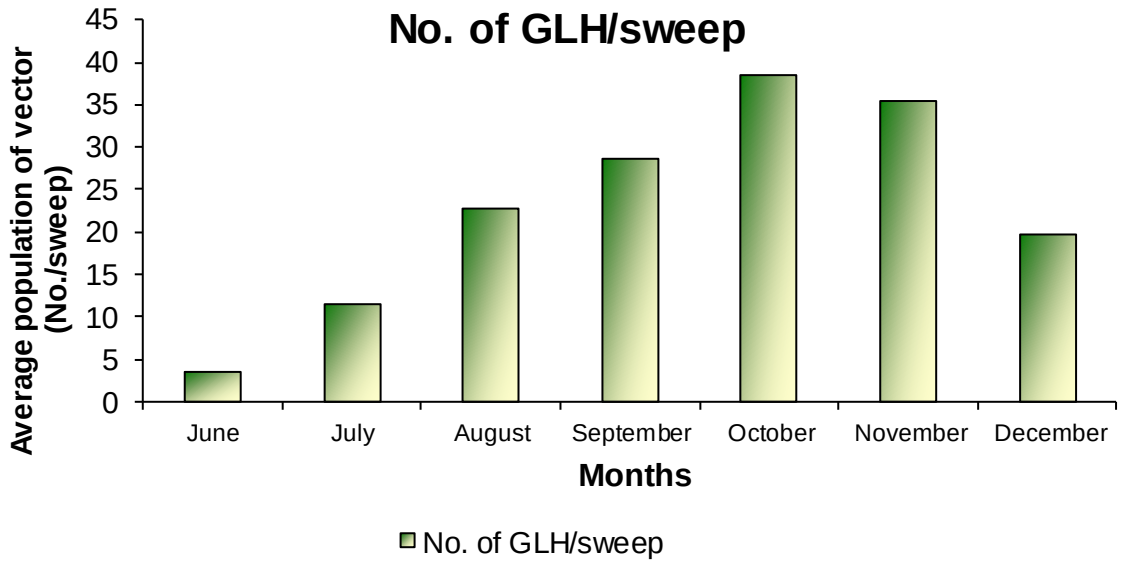


Fig.3 Average population of green leafhopper (GLH) at weekly interval in different stages of plant growth in four rice varieties during *kharif* season of 2015

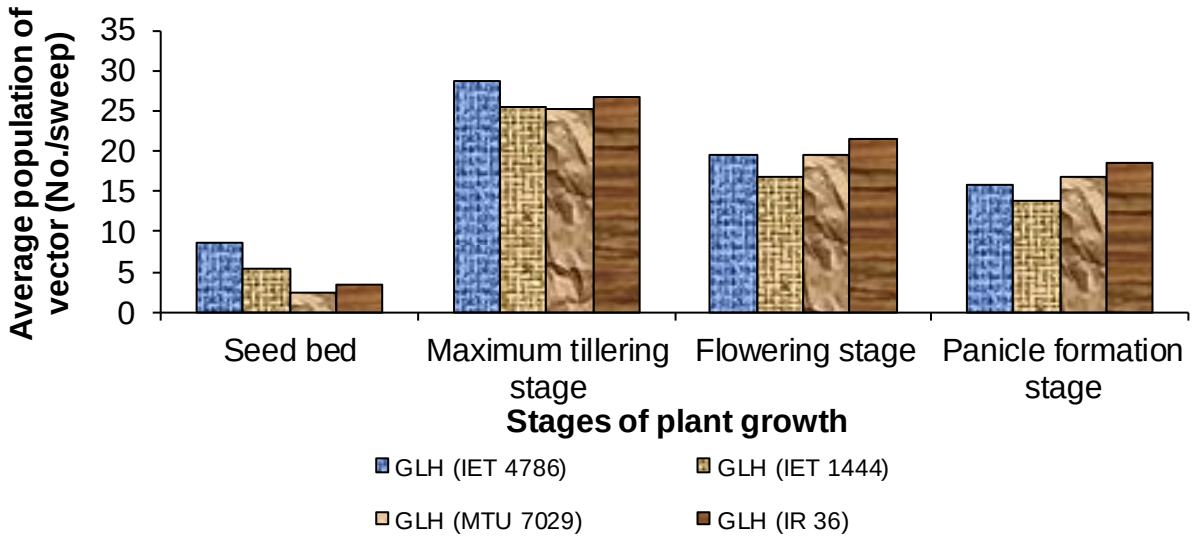
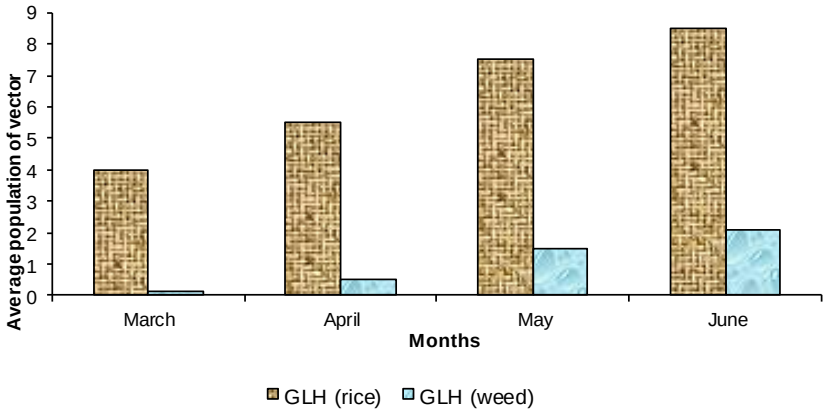


Fig.4 Average population of green leafhopper (GLH) on rice and weed host during March to June by sweeping method



The result is presented in the table 3 and figure 3 shows highest population of GLH at maximum tillering stage irrespective of varieties followed by flowering stage, panicle initiation stage and seedbed. A population of 28.75 in IET4786, 25.5 in IET1444, 25.25 in MTU7029 and in IR36 26.75 were recorded.

Population of green leafhopper (GLH) on rice and weed host during March to June

Population of green leafhopper (GLH) was measured on rice and weed host during the period from March to June, 2015. Sweeping was made from the different rice varieties as

well as on weed host and the results are presented in table.4 andfig.4 In general, the result showed that the population of GLH was more in rice than the weed host.

GLH population on rice in the month of March, April and June were 4.0, 5.5, 7.5 and 8.5 respectively while on weed on respective months they were 0.15, 0.51, 1.52 and 2.1.

Information on the population dynamics of GLH has been studied in detail under West Bengal situation. The green leafhopper, *Nephotettix virescens*, the primary vector of tungro virus, is mostly monophagus. However, some weed hosts such as *Echinochloa colonum, E. crusgalli, Leersia hexandra, Ischne globosa* etc. on which leafhoppers fed and survive (Viswanathan and Kalode, 1975, 1981). In West Bengal some weeds have been identified which grow in rice field like *Cyperus rotundus, Cynodon dactylon, E. colonum* and *Ischaemum rugosum* act as reserviors of tungro virus.

In West Bengal during March-April standing boro crop and early kharif seedbed can be found in the month of June. During May boro rice stubbles and voluntier seedlings could be found in irrigated areas. Such rice plant includes standing crop, voluntier seedlings and regenerated ratoon act as a reservoir for the virus as well as for the vector. This studies on GLH population clearly indicate that GLHis present during the month of March-June. During summer month population of GLH declines due to unsuitable environmental condition as well as non-availability of good rice host. Although boro rice may be present during March-April but most of them are in mature stage usually not favoured by GLH. Delacruz and Litsinger (1986) examined the susceptibility of ratoon rice as a host for *Nephotettix virescens* and showed that survival and development of insect on ratoon crop were similar to transplanted rice. The present studies clearly indicate that there is a great role of the weed host on the population buildup of tungro vectors.

From the result it may be concluded that the TN1 is the most susceptible variety followed by IET 4786, IR 64, IET 1444, IR 36 and IR 62 and the GLH is the main vector of RTV which can survives on rice as well as weed host. The high rate of incidence at the late stage of crop is related with the high population of tungro vector in the field as well as availability of sufficient amount of virus source.

References

Anjaneyulu, A., Satapathy, M.K. and Shukla, V.D. 1994. Rice tungro (India: Oxford and IBH publishing Co. Pvt. Ltd.).

Chowdhury, A. K. 1997. Rice tungro virus disease and its vector in West Bengal. In: *The proceedings of "Pest Management in Changing Agricultural Situation*".

Delacruz, C. G., and Litsinger, J. A. 1986. Suitability of ratoon rice as host to insects. *Int. Rice. Res. Newl.*, 11 (5), 27.

Herdt, R. W. 1988. Equity considerations in setting priorities for third world rice biotechnology research; Department; Seeds of Change. 4: 19-24.

Hibino, H., Roechan, M., and Sudarisman, S. 1978. Association of two types of virus particles with penyakit habang (tungro disease) of rice in Indonesia, *Phytopathology*, 68: 1412-1416.

Mallick, S. C., and Chowdhury, A. K. 2000. Population dynamics of zigzag leafhopper in rice ecosystem and its role on carry-over of the tungro viruses. *J. Mycopathol. Res.*, 38 (2): 71-74.

Mukhopadhyay, S., and Chowdhury, A. K. 1973. Some epidemiological aspects of tungro virus disease of rice in West

Bengal *Int. Rice. Comm. Newsl.*, 22: 44-57.

Mukhopadhyay, S., and Chowdhury, A. K., 1970. Incidence of tungro virus of rice in West Bengal. *Int. Rice. Comm. Newsl.*, 19 (2): 9-12.

Omura, T., Saito, Y., Usagi, T, and Hibino, H. 1983. Purification and serology of rice tungro spherical and rice tungro bacilliform viruses. *Ann. Phytopath. Soc.*, Japan, 49: 73-76.

Saha, N. K., Bardhan, S.K., Ghosh, S.K., and Hossain. 1996. In *Rice Research in Asia*, *Progress and Prirulies* (Evanson, R.E., Herdt, R.W. an Hossain, eds.) CAB International, IRRI pp.131-43.

Viswanathan, P. R. K., and Karode, M. B. 1981. Studies on varietal resistance and host specificity of rice green leafhoppers. *Int. Rice. Res. Newsl.*, 6 (3): 7-8.

Viswanathan, P. R. K., and Kalode, M. B. 1975. Host specificity in rice green leafhoppers, Nephotettix, *virescens* and Nephotettix *nigropictus. Rice Entomol. Newsl.*, No. 2, 42.

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