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Abundance and species composition of rice green leafhopper (Hemiptera: Cicadelladae) in different ecosystems

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Abstract

The abundance, incidence pattern and species composition of green leafhopper (GLH) in seedbed, rice field and light trap were studied in three rice growing seasons in Bangladesh during 2004 and 2005. Five species of GLH were recorded. These were *Nephotettix virescens*, *N. nigropictus*, *N. malayanus*, *N. parvus* and *N. cincticeps*. The first two species were most important as their presence were higher in number almost all the year round. More GLH was observed in 2005 compared to 2004 in all habitats. The GLH population was higher in seedbed than transplanted rice. Seedbed of both the year prevailed highest number of GLH than transplanted rice. Among 5 species of GLH *N. nigropictus* was found higher in summer and winter rice seedbed during 2005. *Nephotettix virescens* was dominant in summer rice seed bed in both the year and transplanted monsoon rice field in the year 2005. The number of other 3 species of GLH was comparatively low in all the season and habitats. Temperature and rainfall influenced the population of GLH. The fluctuation of GLH population in the rice field did not always represent the fluctuation of light trap catches. The abundance of 5 GLH species in the order of *N. virescens*> *N. nigropictus*> *N. malayanus*> *N. cincticeps* > *N. parvus*.

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Introduction

The rice green leafhoppers (GLH), *Nephotettix* spp. (Hemiptera, Cicadellidae) are one of the most devastating rice pests throughout the rice growing areas of Asia (Razzaque *et al.*, 1985; Heinrichs *et al.* 1986). Both nymphs and adults of the green leafhopper feed on rice by sucking the plant sap and plugging the vascular bundles with stylet sheaths. They cause damage to the rice crop by either directly sucking the sap or indirectly by transmitting virus diseases such as dwarf, transitory yellowing, tungro, yellow dwarf and yellow-orange leaf (Dale, 1994). Feeding by GLH is confined mostly to the leaf and leaf sheath of rice plant. Mild infestations may reduce the vigor of the plants and the number of productive tillers. Heavy infestation cause withering and complete drying of the crop. *Nephotettix* spp. were known only as minor pests in Bangladesh until 1955. But since mid 1960s, 50 to 80% damage has been reported from different regions of the country (Alam and Islam, 1959). The emergence of GLH into a major pest has been commonly attributed to the introduction of high yielding rice cultivars and the accompanying high N application (Karim and Pathak, 1979). Among the diseases transmitted by *Nephotettix* spp. tungro is the most destructive. Tungro is important disease of rice because of its damages and it causes an explosion if occurred in the early vegetative stage (Hasanuddin, 2002).

Although GLH is one of the important pests of rice, the ecology and seasonal abundance of GLH are little known. The present study is aimed to investigate the abundance of GLH in different habitats, species composition of GLH and abundance pattern in successive crop seasons.

Materials and methods

Light trap collection

The GLH population was monitored daily using a light trap. The light trap device was permanently set up at the rice farm of Bangladesh Rice Research Institute

(BRRI), Gazipur (24°0'0″N, 90°25'48″E). A 100 WATT white fluorescent bulb was set up for lighting and it was put on 12 hr, from dusk to dawn, then next morning, dead/killed arthropods were collected, identified and counted under microscope at the Laboratory of Entomology Division. To kill the arthropods insecticides were sprayed in the metal box which set up under the trap. Monthly GLH catches from January to December in 2004 and 2005 were calculated for light trap study.

Field collection of GLH

Field collection of GLH was made by 100 complete sweep- net (30 cm diameter, double stroke) for two years (2004, 2005) covering Boro rice (winter rice), Aus (summer rice) and Aman rice (monsoon rice) seasons on weekly basis. Week number was denoted after Lews & Taylor (1967). Two rice ecosystems (seed bed, rice field) were used in this study. Sampling was done from four fields, (field size about 700 m^2, seedbed size 1X 32 m^2) each field represents a replication. GLHs were collected from whole field randomly by hand sweep net on rice canopy of each field. Furthermore, rainfall (mm), temperature (maximum and minimum in °C), relative humidity data were collected from Plant Physiology Division of BRRI.

Results and discussions

Fluctuation in abundance of GLH species in light trap

Five species of GLH were observed from light trap catches. They were, *Nephotettix virescens*, *N. nigropictus*, *N. malayanus*, *N. parvus* and *N. cincticeps*. The number of last two species was very low all over the year. Therefore only three species have been included in this report. Population of GLH in the light trap revealed that the pest was trapped throughout the years and it was more during April, May, October and November (Table 1). Catches were low in January and February. The species composition of GLH from light trap catches indicated that

the population of *N. virescence* was more than other 4 species indicating the dominance of *N. virescence*.

From monthly pooled of light trap data we found that highest number of *N. virescence* was observed in October (8902) and April (8589) during 2004 and 2005 respectively. Highest number of *N. nigropictus* was caught during May (8300) in 2004 and in 2005 it was April (6079) Table 1.

Table 1. Light trap catches of two major GLH species during 2004-2005, BRRI, Gazipur.

Month	2004		2005	
	N. virescence	*N. nigropictus*	*N. virescence*	*N. nigropictus*
January	10	8	38	13
February	41	25	249	17
March	640	235	658	438
April	4068	3404	8589	6079
May	8596	8300	4441	3508
June	801	442	373	325
July	415	207	116	144
August	1465	1380	254	423
September	1735	1538	2927	1510
October	8902	1029	6910	5212
November	3249	3162	7641	6045
December	1413	1217	167	89
Total	31335	20947	32363	23803

Weekly leafhopper data from light trapping between 2 years, 2004 to 2005 showed a variation in their species caught and population peaks. In 2004, *N. nigropictus* and *N. malaynus* were first appeared in the 8th week that was 2nd week of February. In the later year *N. malaynus* was first appeared in the 6th week among five species of GLH. In 2004 a large peak of *N. virescens* was observed during 16th week (April). At the same time the peak of other two species was found but *N. virescens* was higher in number (92). In 2005, *N. virescens* was also dominant species and peak (120) was observed in 38th week (September). In 18th week similar peak of *N. virescens* and *N. nigropictus* was occurred. Another small peak in 40th and 44th week (57 and 47) was also observed in *N. virescens* and in *N. nigropictus* respectively (Fig. 1). No catches or very few were found during winter month of December to 1st week of February when the temperature was low. In the light trap sampling leafhopper abundance was higher during wet season than dry season.

Temperature is an important factor for abundance of insects as well as GLH. The favorable temperature for GLH development is 25-30 °C. From December to February average minimum temperature was from 9.2-16.8 °C in Bangladesh. So no GLH was caught at that time. This result supports the result of Dahal *et al* (1997). They found that, the light trap data from rice fields at low altitude (250 m) showed that both *N. virescens* and *N. nigropictus* were caught throughout the year, with few or none caught during winter (December -February). The abundance of these two insects increased from April- May with a small peak in early July and a larger peak during September-October. Dahal *et al* (1997) also showed that in trap data, *N. virescens* was more dominant (80%) in rice fields from low altitude (< 500 m) and *N. nigropictus* was predominant (95%) in rice fields from high altitude (> 1000 m). In other temperate regions of southeast Asia, *N. nigropictus* was dominant, while in the tropical regions, *N. virescens* was more common (Inoue, 1986). A 26 years light trap catch study of the green leafhopper, *Nephotettix virescens* in India revealed that there was one peak catches during first fortnight of August in the *kharif* (main) season of rice crop (Rai and Khan, 2002). These results disagree with the present study.

Fluctuation in abundance of GLH species in rice field

Abundance of GLH species in seedbeds

In seedbed same species of GLH were found. Summer rice seedbed prevailed higher number of *N. virescens* both the year (140 and 164 GLH/ 100 sweep) and *N. nigropictus* in 2005 (Figure 2). *N. nigropictus* showed its higher presence in 20th week (172 / 100 sweep) but after that it decreased drastically. Monsoon rice seedbed had less population of all kinds of GLH both the year. Winter rice seedbed of 2004 showed higher number of *N. virescens* but the following year the presence of two major species was similar, *N. malayanus* was also found in considerable number (50) in 2005.

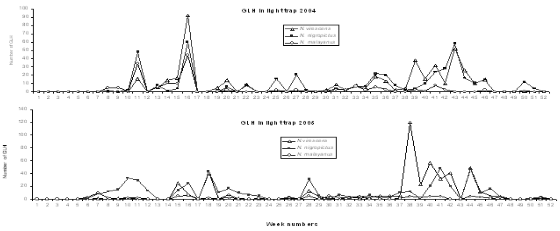

Fig. 1.

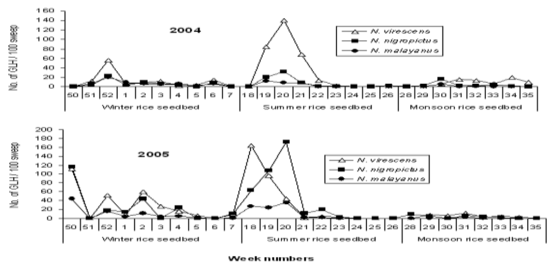

Fig. 2. Seedbed population of GLH species in three different seasons, 2004-2005 BRRI, Farm, Gazipur.

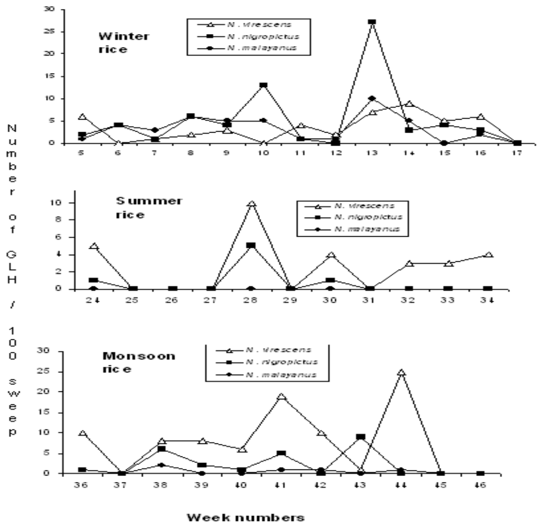

Fig. 3. Incidence pattern of GLH species in winter, summer and monsoon rice seasons 2004, BRRI Farm, Gazipur.

Abundance of GLH species in transplanted rice

The abundance of *N. virescens*, *N. nigropictus* and *N. malaynus* during 2004-2005 in three seasons (winter, summer and monsoon rice) were presented in Figure 3&4. During 2004 the highest abundance of *N. virescens* (25) was observed from summer and monsoon rice season but *N. nigropictus* was predominant in winter rice season in both the year. In 2005 *N. virescens* was also higher in monsoon rice season (26). The overall population of GLH were less in transplanted rice field compared to seedbed.

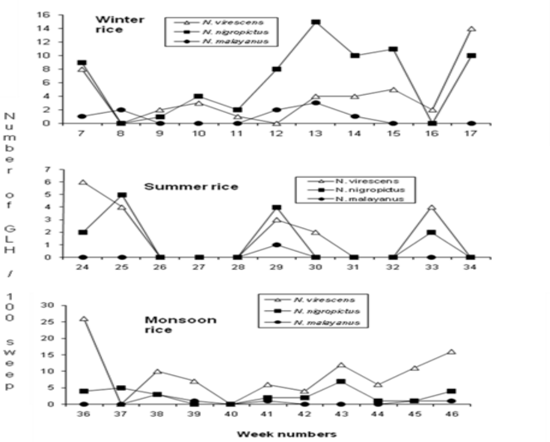

Fig. 4. Incidence pattern of GLH species in winter, summer and monsoon rice seasons 2005, BRRI Farm, Gazipur.

The population densities and abundance of *Nephotettix* spp. varied due to the flight activity of *Nephotettix* which is influenced by seasonal and meteorological factors and their relationship varies depending upon the location (Chancellor and Cook, 1995). Numbers of *N. virescens* were much greater than those of *N. nigropictus* in rice field of Nepal (Dahal and Neupane, 1990). Populations of *N. virescens* increased sharply in August-September, peaked during October-November, and declined sharply in December. But present study in Bangladesh represent that peaked of *N. virescens* in May, summer seedbed (20th week) and December, winter rice seedbed (50th week). Seedbed is more preferable than transplanted rice. But monsoon rice seedbed prevailed less no GLH may be due to rainfall. Because other weather parameters like temperature, relative humidity was almost same except rainfall (Appendix 1) during those periods. Pest appearance depends upon the availability of choice food, but the peak number depends upon the availability of choice food with the climatic factors (Rai and Khan, 2002).

References

Alam MZ, Islam A. 1959. Biology of the rice leaf hopper. *Nephotettix bipunctatus* Fab. In East Pakistan. Pakistan Journal of Science and Industrial Research **2,** 20-28.

Dahal G, Neupane FP. 1990. Species composition and seasonal occurrence of rice green leafhoppers (GLH) in Nepal. International Rice Research Newsletter 15- 22.

Dahal G, Shrestha RB, Thapa RB. 1997. Species composition and relative abundance of rice green leafhoppers (*Nephotettix* spp.) in different altitudinal regions of Nepal. International Journal of Pest Management. **43,** 49-58.
http: //dx. doi**:** 10.1080/096708797228988

Dale D. 1994. Insect pests of the rice plant-their biology and ecology. In: E.A. Heinrichs, ed. Biology and Management of Rice Insects. IRRI (Philippines) and Wiley Eastern Ltd. New Delhi, 779 p.

Hasanuddin A. 2002. Pengendalian Penyakit Tungro Terpadu: Strategi dan Implentasi. Orasi Pengukuhan Ahli Peneliti Utama. Puslitbang tanmonsoon rice pangan. Badan Litbang Pertanian.

Heinrichs EA. 1979. Control of leafhopper and planthopper vector of rice viruses. In: Maramorosch, K and K.F. Harris, ed. Leafhopper Vectors of Plant Disease Agents. Academic Press, Inc., New York, 529-556 p.

Heinrichs EA, Rapusas HR, Aquino GB, Palias F. 1986. Integration of host plant resistance and insecticides in the control of *Nephotettix virescens* (Homoptera: Cicadellidae) a vector of rice tungro virus. Journal of Economic Entomology **79,** 437-443.

Inoue H. 1986. Biosystemic study of the genus *Nephotettix* occurring in Asia. Bulletin of Kyushu National Agriculture Experimental Station **24,** 149 - 237.

Karim ANMR, Pathak MD. 1979. An alternate biotype of green leafhopper in Bangladesh. International Rice Research Newsletter **4,** 7-8

Karim ANMR. 1992. Integrated pest management in Bangladesh. Pp. 16-26. In: Proc. First Biennial Conference Bangladesh Entomology Society. 16 January 1992. BARI, Gazipur.

Kobayashi T. 1961. The effect of insecticide applications against the stem borer and the leaf hopper populations. Ministry of Agriculture and forest Paper No. 6 (Japanese with English summary) 26p.

Lewis T, Taylor LR. 1967. Introduction to experimental ecology. Academic Press Inc., New York.

Rai AK, Khan MA. 2002. Light Trap Catch of Rice Insect Pest, *Nephotettix virescens* (Distant) and its Relation with Climatic Factors. Annals of Plant Protection Sciences **10,** 17-22.

Razzaque QMA, Heinrichs EA, Rapusas HR. 1985. Mass rearing technique for the rice green leafhopper. *Nephotettix nigropictus* (Stal). Philippine Entomologist **6,** 398-404.

Reissing WH, Heinrichs EA, Lishinger JA, Mooders K, Fleidler L, Mews TW, Barrion AT. 1985. Illustrated guide to integrated pest management in rice in tropical Asia. IRRI. Philippines 79 p.

Appendix 1. Weather data of different seasons of rice field, BRRI Gazipur.

Winter rice seedbed 2004

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
Dec'03	26.20	14.93	5.20	77.23
Jan	24.00	12.67	2.67	80.77
Feb	28.57	14.46	Nill	72.23

Winter rice seedbed 2005

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
Dec'04	27.20	14.96	Nill	73.17
Jan	24.87	13.03	2.93	72.90
Feb	29.20	16.97	0.03	68.80

Summer rice seedbed 2004

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
May	35.3	26.06	49.73	73.63
June	32.37	25.06	170.0	81.53

Summer rice seedbed 2005

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
May	32.83	23.43	51.13	78.60
June	33.33	26.77	40.53	81.27

Monsoon rice seedbed 2004

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max.	Min		
Jul	31.73	26.06	111.87	81.20
Aug	32.47	26.60	49.17	77.60
Sep	30.77	25.46	236.47	84.10

Monsoon rice seedbed 2005

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
Jul	31.57	26.07	141.4	83.30
Aug	32.63	26.80	67.47	83.47
Sep	32.20	25.95	168.67	79.57

Winter rice 2004

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
Feb	28.57	14.46	Nill	72.23
Mar	32.70	21.43	2.47	75.30
Apr	32.40	23.50	46.07	78.93

Winter rice 2005

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
Feb	29.20	16.97	0.03	68.80
Mar	32.23	21.16	38.4	75.97
Apr	33.80	23.37	28.13	76.97

Summer rice 2004

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min.		
Jun	32.37	25.06	170.00	81.53
Jul	31.73	26.06	111.87	81.20
Aug	32.47	26.60	49.17	77.60

Summer rice 2005

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
Jun	33.33	26.77	40.53	81.27
Jul	31.57	26.20	141.4	83.83
Aug	32.63	26.73	67.47	83.47

Monsoon rice 2004

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min.		
Sep	30.77	25.46	236.47	75.43
Oct	31.47	23.13	58.00	68.50
Nov	29.60	17.63	Nill	73.17

Monsoon rice 2005

Month	Temperature (°C)		Rain fall (mm)	Relative humidity (%)
	Max	Min		
Sep	32.20	24.46	168.67	79.57
Oct	30.30	23.73	113.87	80.97
Nov	29.53	16.93	1.73	76.13