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Incidence of White Backed Plant Hopper on Rice and its Predators under Rainfed Ecosystems and their Correlation with Weather Parameters

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ABSTRACT

Survey was carried out to know the incidence of white backed plant hopper (WBPH), *Sogatella furcifera* (Horvath) and its predators during *kharif* in different paddy ecosystems of Uttara Kannada district (Karnataka). The incidence of WBPH commenced from September and reached to a peak during November (865 nymphs and adults/ hill) in Mundgod, followed by Sirsi (854) and Banavasi (678.60). The WBPH predating spider population was recorded and its population was maximum during November in Mundgod (3.60/ hill), followed by Sirsi (3.40) and Siddapura (2.86). The mirid population was highest during November in Sirsi (15.75 nymphs and adults/ hill), followed by Mundgod (14.20) and Banavasi (10.40). The correlation studies made on WBPH population revealed negative and significant relationship with maximum temperature while positive and significant relationship with minimum temperature, morning and evening relative humidity. Whereas, significant and positive relationship was obtained with spiders and mirids.

Key words: White backed plant hopper, *Sogatella furcifera*, Spiders, Mirids

Rice (*Oryza sativa* L.) is the most important staple food crop for more than two third of the population of India and more than 65 per cent of the world's population (Mathur *et al*. 1999). Karnataka occupies a prominent place in India accounting for nearly 1.40 million hectares area producing nearly 3.45 million tonnes (Anonymous 2009). Rice is the major cereal crop of Uttara Kannada district covering as much as 83,000 hectares with an average productivity of about 3.5 tonnes per hectare. Among various constraints of rice production, damage due to insect pests is substantial and needs regular attention. White backed plant hopper (WBPH), *Sogatella furcifera* (Horvath) is one of the most important rice pests. It feeds on the phloem and causes decrease in leaf area, plant height, dry weight, leaf and stem nitrogen concentration, chlorophyll contents and photosynthetic rate (Rubia-Sanchez *et al*. 1999, Watanabe and Kitagawa 2000), which subsequently results in yield losses. In addition, both adults and nymphs while sucking the sap inject their toxic saliva into the plant which produces "hopper burn" resulting in drying of leaves. Therefore, the present investigation was carried out to know the status of WBPH and their predators in different paddy ecosystems.

MATERIALS AND METHODS

A roving survey was conducted during *kharif* season (June to December) of 2009 in three different paddy ecosystems of Uttara Kannada district of Karnataka. The ecosystems consisted of upghat drill sown paddy, upghat transplanted paddy and coastal transplanted paddy. Looking to the specific condition of Uttara Kannada district the survey was restricted to two taluks in each ecosystem and in each taluk two villages/ places and in each village five locations of one acre land were selected. In each field, five spots (each of $16m^2$ area) were selected diagonally. The observation on insect pest occurrence was recorded on randomly selected 10 hills in each spot. Observations on the incidence of WBPH and its predators viz spiders and mirids were recorded by following standard procedures (Anonymous 2007). The sample of insect pest and predators were collected with five double sweeps and number of adult populations per unit area was counted for predators like spiders and mirids. Weather parameters like maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall recorded in meteorological observatory, ARS (Paddy), Sirsi were used for the studies. Correlation analysis was carried out to study the nature of relationship of WBPH and their predators with weather factors. The significance of correlation was tested at five per cent probability levels.

RESULTS AND DISCUSSION

In upghat drill sown paddy, the WBPH population in Mundgod varied from lowest of 4.00 nymphs and adults per hill recorded during September to highest of 865 nymphs and adults per hill during November month. At Banavasi area of Sirsi taluk highest WBPH population of 678.60 nymphs and adults per hill was recorded during November month and it varied between 2.50 to 678.60 nymphs and adults per hill, lowest being

Fig 1 Nymphs and adults of *Sogatella furcifera*

in the month of September (Table 1). In upghat transplanted paddy, the WBPH population was in the range of 5.00 to 854 nymphs and adults per hill highest being in November month and lowest during September month in Sirsi. Siddapura also recorded highest WBPH population of 64.40 nymphs and adults per hill during November month and lowest of 2.00 nymphs and adults per hill during September month. In coastal transplanted paddy, the WBPH population was highest of 25.40 nymphs and adults per hill recorded during November and lowest in the month of September with 1.20 nymphs and adults per hill recorded in Kumta. At Honnavar, the WBPH population was absolutely zero throughout the cropping period. The outbreak of WBPH during current season in farmer's field may be due to change in cultivation practices (thick sowing), wherein practice of double or continuous cropping, lack of natural enemies and congenial microclimates (high temperature with rainfall) were observed. The present findings on the occurrence of WBPH are in close agreement with the observations made by Surendranath Reddy *et al.* (1983), Nagangoud *et al.* (1999) who reported the pest occurrence after 60 days of transplanting. The sudden decline at the later part of the growth stage may be attributed to the loss of succulence in the plant as crop moved towards senescence. A similar trend of decrease of population was also recorded by Ngoan (1972).

Table 1 WBPH outbreak in different ecosystems of Uttara Kannada district during *kharif*, 2009

S. No.	Location	Number of WBPH nymphs and adults per hill					
		Aug	Sept	Oct	Nov	Dec	Mean
	Upghat drill sown paddy						
1	Mundgod	0.00	4.00	43.60	865.00	150.00	213.32
2	Banavasi	0.00	2.50	33.10	678.60	121.00	167.04
	Upghat transplanted paddy						
3	Sirsi	0.00	5.00	48.30	854.00	145.35	210.53
4	Siddapura	0.00	2.00	15.70	64.40	23.50	21.12
	Coastal transplanted paddy						
5	Kumta	0.00	1.20	8.00	25.40	8.00	8.52
6	Honnavar	0.00	0.00	0.00	0.00	0.00	0.00

Few predatory spiders were recorded on rice insects and the species identified in upghat drill sown paddy included *Pardosa pseudoannulata* (Boesenberg and Strand), *Tetragnatha* sp. and *Tibellus pashanensis* (Tikader). The population of 3.60 and 2.70 spiders per hill was recorded, reached its peak during November month in Mundgod and Banavasi, respectively. However, the overall population was 2.06 and 1.47 spiders per hill was recorded in Mundgod and Banavasi, respectively (Table 2). Species identified in upghat transplanted paddy included *P. pseudoannulata, Pardosa heteropthalmus* (Simpn.), *Tetragnatha* sp., *Argiope bruennichi* (Walckenaer) and *Leucauge decorate* (Blackwall). The population was 3.40 and 2.86 spiders per hill which reached its peak during November month in Sirsi and Siddapura, respectively. However, the average population during the cropping season was 2.13 and 1.34 spiders per hill in Sirsi and Siddapura, respectively. Species identified in coastal transplanted paddy included *P. pseudoannulata*, *Tetragnatha* sp. and *L. decorate*. The population was 1.20 spiders per hill and reached its peak during November in Kumta. Whereas, 1.40 spiders per hill was recorded during October month in Honnavar. However, the overall population of 1.02 and 0.92 spiders per hill was recorded in Kumta and Honnavar, respectively. Among the different species recorded the spider, *P. pseudoannulata* was dominant in all the locations. The present findings on the activity of spiders are in agreement with the observation made by Venkateshalu (1996), who reported most of the dominant species of spiders were observed throughout the crop growth

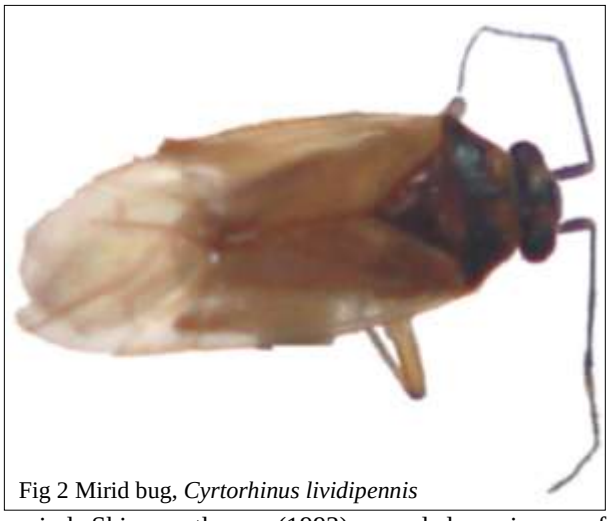

Fig 2 Mirid bug, *Cyrtorhinus lividipennis*

Fig 3 Wolf spider, *Pardosa pseudoannulata*

period. Shivamurthappa (1993) recorded maximum of 8.1 spiders per hill during first fortnight of November. At International Rice Research institute, Philippines peak spider population was recorded in mid-late October (Anonymous 1985). Okuma *et al*. (1978) reported spider fauna as relatively poor in the early period of crop growth (July) and from August onwards, spider fauna became rich. (Mohan 2000) reported peak population of spiders during tillering stage.

The mirid species encountered during the study were identified as *Cyrtorhinus lividipennis* (Reuter) and *Tythus* sp. which were feeding on WBPH and BPH. Among these *C. lividipennis* was the predominant species. The mirids started appearing from the second fortnight of September with a population of 14.20 and 10.40 nymphs and adults per hill and reached a peak during November in Mundgod and Banavasi, respectively. However, the mirid population gradually decreased during harvest time. The average population of mirid was 6.01 and 4.31 nymphs and adults per hill was recorded in Mundgod and Banavasi (upghat drill sown paddy), respectively (Table 3). Whereas, the population of 15.75 and 9.40 nymphs and adults per hill were recorded and reached peak during November in Sirsi and Siddapura, respectively. The average mirid population of 6.07 and 3.57 nymphs and adults per hill were recorded in Sirsi and Siddapura (upghat transplanted paddy), respectively. However, the population of 4.40 nymphs and adults per hill was recorded and reached peak during November in Kumta. The mirid population was zero in Honnavar throughout the cropping period (coastal transplanted paddy). This might be due to the advancement of the crop in coastal paddy ecosystem which escaped the incidence of WBPH. Hence, the mirid population was also low as they are host dependent. The mirid population followed the similar trend as that of its host WBPH, as they are density dependent and host specific in nature. The present findings are in agreement with the report of Chiu (1979).

Table 2 Predatory spider situation in relation to WBPH outbreak in different ecosystems of Uttara Kannada district during *kharif*, 2009

S No.	Location	Number of spiders per hill					
		Aug	Sept	Oct	Nov	Dec	Mean
	Upghat drill sown paddy						
1	Mundgod	1.10	2.00	2.40	3.60	1.20	2.06
2	Banavasi	1.00	1.33	1.64	2.70	0.70	1.47
	Upghat transplanted paddy						
3	Sirsi	1.20	2.20	2.60	3.40	1.25	2.13
4	Siddapura	0.70	0.94	1.50	2.86	0.68	1.34
	Coastal transplanted paddy						
5	Kumta	1.12	0.84	1.36	1.20	0.60	1.02
6	Honnavar	0.66	0.86	1.40	1.32	0.40	0.92

The results of the correlation studies on WBPH population revealed negative and significant relationship with maximum temperature (r = -0.870*) and positive and significant relationship with minimum temperature (r = 0.927*) (Table 3). Similarly, positive and significant relationship with morning relative humidity (r = 0.994**) and evening relative humidity (r = 0.841*) was observed (Table 4). Whereas, positive and non-significant relationship with average rainfall (r = 0.629) was evident. The present findings are in agreement with the reports of Barwal and Rao (1986) who reported negative relationship between *Nilaparvata*

lugens (Stal) and temperature, Narayansamy *et al.* (1979) who reported positive correlation with relative humidity. The present findings also corroborate with results of Srinivasa (1984) who reported significant and negative correlation between trap catches and maximum temperature in WBPH but disagree with the reports made by Jayarama (1981) who reported negative correlation between trap catches and rainfall. There was significant and positive correlation with spiders per hill (r = 0.926**) and mirids per hill (r = 0.906*). The present findings are in conformity with Lua (1985) who reported density of spiders (theridiids, erigonids and lycosids) in the field was positively correlated with that of *N. lugens* population. The fluctuation of plant hoppers and leaf hoppers population in the rice fields was closely correlated to that of the spiders (Heong and Rubia 1990).

Table 3 Predatory mirid bug situation in relation to WBPH outbreak in different ecosystems of Uttara Kannada district during *kharif*, 2009

S. No.	Location	Number of mirid bugs (nymphs and adults per hill)					
		Aug	Sept	Oct	Nov	Dec	Mean
	Upghat drill sown paddy						
1	Mundgod	0.00	1.00	11.60	14.20	3.25	6.01
2	Banavasi	0.00	0.90	8.20	10.40	2.05	4.31
	Upghat transplanted paddy						
3	Sirsi	0.00	0.70	10.30	15.75	3.60	6.07
4	Siddapura	0.00	0.00	6.70	9.40	1.75	3.57
	Coastal transplanted paddy						
5	Kumta	0.00	0.00	2.00	4.40	0.90	1.46
6	Honnavar	0.00	0.00	0.00	0.00	0.00	0.00

Table 4 Correlation coefficient values between paddy insect pests and their natural enemies in Sirsi taluka during *kharif*, 2009

WBPH and its predators	Temperature (°C)		Rainfall (mm)	RH I (%)	RH II (%)	Spiders	Mirids
	Maximum	Minimum					
WBPH	-0.870*	0.927**	0.629	0.994**	0.841*	0.926**	0.906*
Spiders	-0.808	0.843*	0.687	0.886*	0.699	-	0.961**
Mirids	-0.800	0.919**	0.634	0.884*	0.568	0.961**	-

** Significant at p = 0.05; * Significant at p = 0.01 level

The correlation studies on spider population revealed negative and non-significant relationship with maximum temperature (r = -0.808), whereas, positive and significant relationship with minimum temperature (r = 0.843*) and morning relative humidity (r = 0.886*) (Table 4). Similarly positive non-significant correlation was evident with average rainfall (r = 0.687) and evening relative humidity (r = 0.699). The present findings are in agreement with correlation studies made by Venkateshalu (1996), Vijaykumar (2002), Mohan (2000) during *kharif* season in Karnataka and Andhra Pradesh, respectively. There was negative non-significant correlation between mirids per hill and maximum temperature (r = -0.800) (Table 4). Similarly, positive and significant correlation with minimum temperature (r = 0.919**) and morning relative humidity (r = 0.884*), whereas, positive and non-significant relationship with evening relative humidity (r = 0.568) and average rainfall (r = 0.634) existed. These findings are in close agreement with Vijaykumar (2002) who reported positive correlation with average rainfall, morning and evening relative humidity. However, the spiders showed significant relationship with mirids (r = 0.961**) and mirids also showed significant relationship with WBPH (r = 0.906*).

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