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ECOLOGY OF THE WHITE BACKED PLANTHOPPER, *Sogatella furcifera* IN RICE

K.GUNATHILAGARAJ
Department of Environmental Science
Agricultural College and Research Institute
Tamil Nadu Agricultural University
Coimbatore 641 003

ABSTRACT

Field populations of *S. furcifera* (Horvath) at Coimbatore was generally very low and there was not much difference in the population level between the cultivars, Jaya and IR 36. Crops sown in the months of August to November harboured more hoppers. The population caught in the light traps was high during 1979-80 and very low during 1981-82. During the year there were three peaks of population. Only four weather parameters *viz*., maximum temperature, relative humidity (evening), sunshine hours and wind velocity contributed significantly to the population of *S. furcifera* attracted to the light trap and none contributed significantly to the field population.

KEY WORDS : *Sogatella furcifera*, Ecology, Rice.

Variations in climate are probably the commonest disturbing factors in population systems (Varley, 1963; Southwood, 1967, Richards and Southwood, 1968). Some of the factors or processes which must be considered in discussing localised infestation and general outbreaks of rice planthoppers include the amount of rainfall, the type of cultivation, the age of the rice crop, the species composition of the planthopper populations and the relative abundance of egg sucking mirids (Hinckley, 1963). The role of all these factors has already been studied and documented in many of the Asian countries (Mochida, 1982) except in India. Hence, the present investigation was taken up to study the ecology of the whitebacked planthopper (WBPH), *Sogatella furcifera* (Horvath) (Delphacidae : Hemiptera) through monthly plantings and light trap catches at the Paddy Breeding Station, Coimbatore.

MATERIALS AND METHODS

The effect of seasons was studied by measuring the population development of WBPH on unprotected crops planted every month. The cultivars IR 36 (moderately susceptible) and Jaya (highly susceptible) were used in these studies. Sowings were made at monthly intervals commencing from May 1979. The seedlings were transplanted 30 days after sowing in the experimental plots (5 x 5 m) at the rate of one seedling per hill adopting a spacing of 20 x 10 cm. No insecticide was applied throughout the course of experimentation. Forty hills were selected at weekly intervals beginning from 15 days after planting.

Observations were recorded at weekly intervals in each of the sowings. The total number of insects counted during a complete crop period was compared with the numbers from other periods. Population of WBPH was monitored for a period of three years from November 1979 to October 1982. A modified Robinson light trap stationed in the Paddy Breeding Station, Coimbatore with a light source of 125 watt mercury vapour lamp was used for this purpose. The light trap was operated for 12 h from 6 p.m. to 6 a.m and the WBPH population was recorded in the following morning.

Interrelationship between the data collected on the population of WBPH during different stages of crop growth from monthly sowing experiments for a period of two years, the data on weather elements for the corresponding period recorded at the Meteorological Station, Tamil Nadu Agricultural University, Coimbatore and the data on the light trap catches was studied through multiple regression analysis.

RESULTS AND DISCUSSION

Seasonal effect on the population of WBPH in the field

The population of WBPH on cultivars, Jaya and IR 36 planted at monthly interval for two years is presented in Table 1. The total number of insects recorded during a complete crop period in 1 observations was compared with the population from other periods. The population of WBPH was observed throughout the cropping periods in both the years. There was not much difference on the population level between the cultivars. The mean population per hill varied significantly in different sowings and it ranged from 0.47 to 1.86. The population of WBPH was high during the first sowing (September 1980) which gradually declined in the successive monthly sowings to reach the minimum level in May 1981. Subsequently, population increased slowly again reaching the maximum in the September-sown crop. It was apparent that the crop sown in the months of August, September, October and November harboured high population of the hoppers as compared to the crop sown during March, April and May, not withstanding the fact that the population in general was very low.

Table 1. Field population of the WBSH as monitored on Jaya and IR 36

Crop period	No. of insects/40 hills		Population/ hill[1]
	Jaya	IR 36	
Sep-Dec 1980	906	880	1.86g
Oct-Jan 1981	442	493	0.98ef
Nov-Feb 1981	320	271	0.62abc
Dec-Mar 1981	308	317	0.65abc
Jan-Apr 1981	319	351	0.70abcde
Feb-May 1981	267	260	0.55ab
Mar-Jun 1981	252	213	0.49a
Apr-Jul 1981	252	211	0.48a
May-Aug 1981	238	216	0.47a
Jun-Sep 1981	305	281	0.61abc
Jul-Oct 1981	439	390	0.85cdef
Aug-Nov 1981	480	468	0.99f
Sep-Dec 1981	545	488	1.07f
Oct-Jan 1982	485	445	0.97def
Nov-Feb 1982	463	444	0.99f
Dec-Mar 1982	417	401	0.85cdef
Jan-Apr 1982	388	370	0.79bcdef
Feb-May 1982	342	318	0.69abcd
Mar-Jun 1982	347	308	0.68abc
Apr-Jul 1982	310	307	0.64abc
May-Aug 1982	287	264	0.58abc
Jun-Sep 1982	338	312	0.68abc
Jul-Oct 1982	399	378	0.81bcdef
Aug-Nov 1982	512	482	1.04f

1 Mean of 12 abservations
In a column, cropping periods with the same subscript letter(s) do not differ significantly (P=0.05) DMRT

Population assessment of WBPH in light trap

Light trap data at the Paddy Breeding Station, Coimbatore (Table 2) revealed that WBPH catches were generally very low during 1981-82 and high during 1979-80. But the highest population of WBPH was observed during the month of December 1980. Comparison of two year data (1979-80, 1981-82) revealed that there were three peaks of WBPH population: November-January, April-May and August-September. Analysis of weekly means of light trap catches indicated significant differences between months during the three years. During 1979-80, the low population was during June andJuly and the maximum catch was during January 1981 whereas it was in May and December respectively during 1980-81. Scrutiny of the mean data for three years revealed

Table 2. Population of the WBPH as monitored in light trap

Month	Mean population/week			Mean
	1979-80	1980-81	1981-82	
November	6.08bcd (40.99)	3.97bcd (15.96)	3.28abc (11.25)	4.44cde (22.73)
December	5.42abcd (30.77)	8.92c (91.82)	2.31abc (5.54)	5.55e (42.71)
January	17.32cd (56.05)	5.77d (37.47)	3.26abc (10.93)	5.30de (34.82)
February	6.41bcd (43.32)	2.60abc (7.32)	1.90ab (4.07)	3.64abc (18.24)
March	6.78cd (46.13)	3.10abc (10.18)	1.63a (2.68)	3.84abc (19.66)
April	7.55d (58.46)	3.05abc (9.43)	2.08abc (4.90)	4.22bcd (24.26)
May	7.34cd (55.68)	1.75a (4.32)	3.34abc (11.22)	4.15abcd (23.74)
June	3.72a (15.97)	1.91ab (4.22)	3.17abc (10.15)	2.93a (10.11)
July	3.52a (13.93)	2.71abc (7.68)	3.06abc (9.46)	3.09ab (10.36)
August	3.91a (21.88)	3.05abc (9.54)	4.07bc (16.57)	3.67abc (16.00)
September	5.21abc (28.18)	3.30abc (10.93)	4.17c (17.51)	4.23bcd (18.87)
October	4.53ab (20.92)	4.15cd (17.53)	4.13bc (17.38)	4.27bcde (18.61)
Mean	5.65c	3.69b	3.03a	

Figures in parentheses represent actual number of *S. furcifera*
In a column, months with the same subscript letter(s) do not differ significantly (P=0.05) DMRT

that the catch was very low during June-July which increased gradually during intervening months to reach the maximum in December and thereafter the population was intermediate till May.

Influence of weather parameters on WBPH population

The results of multiple regression analysis involving eight weather parameters as independent variables and the population of WBPH in light trap catch and field as dependent variables are set out in Table 3.

Among the eight, weather parameters, only four viz.,maximum temperature, relative humidity (evening), sunshine hours and wind velocity [illegible] significantly to the population in the [illegible] catches and none contributed significantly [illegible] population. The cumulative contribution [illegible] parameters for light trap catch was [illegible] (R^2 = 0.5082) and for field population was [illegible] cent (R^2 = 0.3829). Data from the light trap catches revealed three distinct peaks of WBPH population during the year and the population was very low during 1981-82. Highest population was observed during the month of December 1980 and the mean of three years revealed that the maximum catch was during the month of December and the minimum during June-July. The mean of four weather parameters which contributed significantly to the light trap population viz., maximum temperature, relative humidity, sunshine hours and wind velocity during the peak period were 27.0-30.5°C,45-74 per cent, 3.1-9.9 h and 3.5-7.7 miles/ha respectively. Studies of the seasonal effect on the population of WBPH revealed that the crop sown in the months of August-November harboured high populations as compared to the crop sown during March-May. Even though the light trap data indicated a peak population of WBPH during the months of April and May, crops planted during those months harboured very low population. The weather parameters did not contribute significantly to the field population as the field population on the whole was very low throughout the period of observation.

In the rice infesting plant and leafhoppers, notably WBPH, there is a marked phenomenon of explosive mass flight toward a light trap. It happens suddenly in that a vast number of insects, which occasionally reaches to several thousands are attracted to a light trap during a singlenight. Seunaga and Nakatsuka (1958) suggested that such an explosive mass flight would be evoked under a combination of definite condition of weather and the changed physiology of the insects. It should be considered, therefore, that the phenomenon of massive flight is not always related directly to the population density of the insect. And this means the annual total of planthoppers caught by a light trap would often give an erroneous image as to the

Table 3. Multiple regression analysis of the WBPH population with weather parameters (n=24)

Variable	Light trap catches		Field population	
	Partial regression coefficent	SE(b)	Partial regression coefficent	SE(b)
Maximum temperature	-7.3414**	2.4068	-0.1754	0.1339
Minimum temperature	4.1727	2.0356	0.1223	0.1133
Relative humidity (morning)	0.0803	0.6368	-0.0043	0.0354
Relative humidity (evening)	-1.4709*	0.5816	-0.0142	0.0323
Rainfall	-0.7262	0.4905	-0.0390	0.0273
Rainy days	4.1470	5.4273	0.6280	0.3020
Sunshine hours	-4.9483*	2.2475	0.0144	0.1250
Wind velocity	-2.7269*	1.1522	-0.0339	0.0641
R^2	0.5082		0.3829	
Constant term A	285.7195		5.1287	

** Significant at 1% level

* Significant at 5% level

prevalence of the species in that year, for it is quite possible that a marked increase in the total amount is brought about by a few occurrences of the 'burst flight' during the year. The populations of WBPH caught in this study was neither large nor outbreak proportion warranting any definite conclusion; nor is any generalisation possible for forecasting the planthopper outbreak as the weather parameters contributing significant to the light trap catches showed wide range.

Field population of WBPH was very low throughout the period of experimentation. The experiments were conducted in a continuous cropping programme and the nursery was also raised throughout the year. Given the choice WBPH was found more in the seed bed than in the transplanted crop. This observation corroborated with the findings of Hinckley (1963) who during his survey in Fiji observed that on any given date during the rice season, WBPH was the common species on young rice and *Nilaparvata lugens* (Stal.) onorder rice. Then the process of transplanting rice generally has an adverse effect on the population of *S. furcifera* (O'Connor, 1952). Since the transplanted seedlings often remained wilted for a week, nymphs hatching out from eggs within the stems presumably could not obtain sap and died of starvation. Among the planthoppers that infest rice and other cereal crops or other gramineous weeds, WBPH seems to have the highest migratory ability. Immigrant masses of WBPH some times invade fields of young seedlings and injure them seriously but their off spring rarely cause damage later as the adults are not sedently enough to build up population that injure rice as does *N. lugens* (Kisimoto, 1979). Hence the low population of WBPH in the experimental field could be attributed to the age of the crop and migratory nature of the adults.

Influence of weather factors on the biology and the field population was studied by several workers in several countries and the conclusions were as varied as the climatic conditions of different countries. Pathak (1968) noted that in Philippines, in general, leafhoppers and planthoppers were more abundant during the dry season than in the wet season. However, Alam (1971) from both the light trap and field collection data showed that the wet season often had as high a population as or higher than the dry season. Also, he found that an insect resistant variety apparently could eliminate seasonal effects. Nasu (1967) discussed reports from Vietnam and India wherein certain climatic conditions were considered responsible for the pest outbreak. Pathak (1968) reported that when exposed to sunlight at 22°C the nymphs of WBPH died while the adults survived.

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