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Effect of weather parameters on population dynamics of green leaf hopper and white backed plant hopper in paddy grown in middle Gujarat region

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ABSTRACT

Nephotettix virescens Distant and *Sogatella furcifera* (Horv) commonly known as Green leaf hopper (GLH) and White backed plant hopper (WBPH) respectively. These are the serious pests of *kharif* paddy all over the world causing extensive losses. The population dynamics of Green leaf hopper and white backed plant hopper for ten consecutive years (1994 to 2004) except for 1997 were correlated with the weather parameters like maximum and minimum temperature, rainfall, relative humidity and bright sunshine hours. The results revealed that the bright sunshine hours had a positive significant correlation (r=0.166) with the population dynamics of GLH. The correlation between WBPH peak population and bright sunshine hours also showed positive significant correlation (r=0.269), while maximum temperature, minimum temperature, rainfall and relative humidity showed non-significant effect on population build up of both GLH and WBPH. Green leaf hopper attained peak population during 43rdstandard meteorological week; whereas white backed plant hopper reached peak population during 39th standard meteorological week and decreased considerably thereafter.

Key words: Polyphagous, photoperiodism, population dynamics, and weather parameters

The effect of changing weather parameters on agriculture is very significant. As weather affects many aspects of crop productivity and insect-pest biology, the effects of weather elements will significantly affect the productivity in agriculture (Dhaliwal *et al.*2004). *Nephotettix virescens* (Distant) and *Sogatella furecifera* (Horv.) are commonly known as Green leaf hopper (GLH) and White backed plant hopper (WBPH) are among the serious pests of *Kharif* paddy in rice growing countries. The pest activity is maximum in July-August and decreases considerably after a heavy rain. These hemipteran pests are polyphagous in nature and hosts of these are paddy, millet and some grasses. Both nymphs and adults suck the sap from leaf sheath and blade leading to browning and known as hopper burn (Panwar, 1995).

MATERILS AND METHODS

A field experiment was conducted during *kharif* seasons for ten consecutives years from1994 to 2004, except in 1997 at Main Rice Research Station, Nawagam, Anand Agricultural University (Gujarat) located at 22º48'N latitude, 71º38'E longitude and 32.4 m altitude above the MSL. The population build up of GLH and WBPH was monitored throughout the season. Light traps were fixed in the field and the insects catch/trap was counted daily and weekly mean was calculated. The weekly meteorological data during the period of experiment were collected from the meteorological observatory located adjacent to the field for studying the effect of various meteorological parameters *viz*; maximum and minimum temperature, rainfall, relative humidity and bright sunshine hours on population build up of GLH and WBPH.

RESULTS AND DISCUSSION

The correlation between weakly mean population of GLH and meteorological parameters was worked out by pooling the data from1994 to 2004 except for 1997. The same method was used in the case of WBPH also. Based on the overall pooled results it seems that there was a significant positive correlation between peak population of GLH and bright sunshine hours (r=0.166), while other weather parameters *viz*, maximum temperature, minimum temperature, rainfall and relative humidity showed non-significant effect on population build up of GLH (Table1). Similarly, the correlation between WBPH population and bright sunshine hours also showed significant positive correlation (r=0.269), while maximum temperature, minimum temperature and rainfall showed non-significant effect on population build up of WBPH (Table 2). Green leaf hopper attained peak population during 43rd standard meteorological week, whereas white backed plant hopper reached peak population during 39th standard meteorological week and decreased considerably thereafter (Fig.1 and 2). Significant positive correlation between bright sunshine hours and population dynamics of both these pests describe the existence of photoperiodism nature. As the crop was irrigated *kharif* paddy high and consistent relative humidity during crop season showed non significant effect of both relative humidity and rainfall on population build up of these pests.

Table 2: Correlation between population dynamics of green leaf hopper (*Nephotetix virescen*) with weather parameters

Weather parameters	1994	1995	1996	1998	1999	2000	2001	2002	2003	2004	Pooled
MAX. TEMP.(^{O}C)	-0.052	0.066	0.056	-0.125	-0.114	0.210	-0.518	-0.149	0.102	-0.042	0.006
MIN. TEMP.(^{O}C)	-0.267	-0.159	0.192	-0.617	0.222	0.251	0.387	0.186	0.070	-0.557	-0.128
R.F. (mm)	-0.118	-0.174	0.424	-0.350	-0.136	-0.205	0.317	0.488	-0.192	-0.187	-0.089
R.H. (%)	-0.101	-0.110	0.281	-0.501	0.322	0.232	0.471	0.703	0.177	-0.478	-0.047
BSSH	-0.341	0.270	-0.214	0.450	0.035	0.276	-0.552	-0.376	0.216	0.354	0.166
*	0.442	0.373	0.495	0.403	0.403	0.442	0.403	0.403	0.403	0.403	0.129

Table 2: : Correlation between population dynamics of white backed plant hopper (*Sogatella furcifera*) with weather parameters

Weather parameters	1994	1995	1996	1998	1999	2000	2001	2002	2003	2004	Pooled
MAX. TEMP.(^{O}C)	0.227	0.101	0.120	-0.142	-0.002	0.237	0.522	0.176	0.108	-0.076	-0.080
MIN. TEMP.(^{O}C)	-0.430	-0.097	0.030	-0.562	0.038	0.103	-0.042	0.005	0.024	-0.321	-0.057
R.F. (mm)	-0.267	-0.199	-0.302	-0.326	-0.168	-0.131	-0.298	0.066	-0.184	-0.278	-0.121
R.H. (%)	-0.400	-0.083	0.100	-0.406	0.094	0.094	0.007	0.379	0.259	-0.128	0.019
BSSH	0.498	-0.275	0.562	0.460	0.206	0.427	0.377	0.246	0.260	0.431	0.269
*	0.442	0.373	0.495	0.403	0.403	0.442	0.403	0.403	0.403	0.403	0.129

MAX.TEMP=Maximum temperature MIN.TEMP=Minimum temperature R.F=Rainfall
R.H=Relative humidity BSSH=Bright sunshine hours * =Critical value: 2 tail

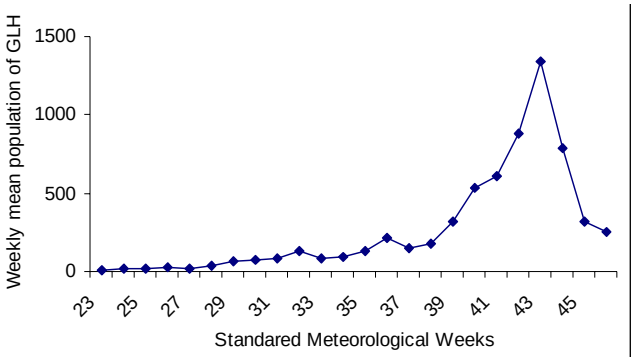

Fig. 1: Weekly mean polulation dynamics of GLH during paddy crop season for ten years

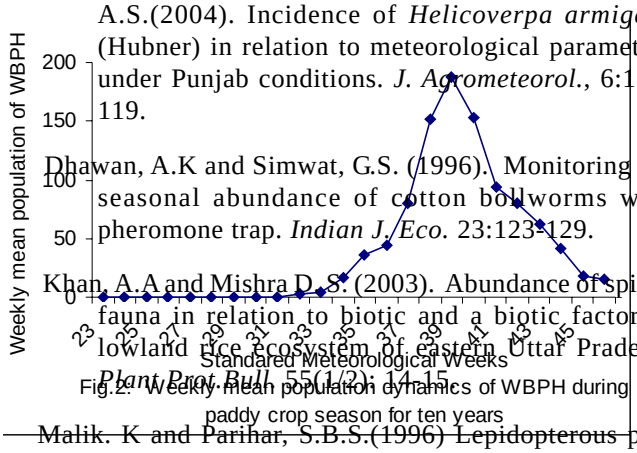

Fig.2: Weekly mean population dynamics of WBPH during paddy crop season for ten years

Similarly, Choudhari *et al*. (1999) reported a positive correlation between *Helicoverpa armigera* (Hubner) population and bright sunshine hours, but negative association with rainfall, wind speed, minimum temperature, mean relative humidity and mean vapour pressure. Balasubramanian *et al.* (1982) also reported that the incidence of boll worm in relation to weather parameters indicated a significant positive correlation with the bright sunshine hours (r=0.52) and maximum temperature (r=0.742), whereas Dhaliwal *et al.* (2004) reported negative correlation between peak population of *H. armigera* and sunshine hours (r=-0.33). Nandgopal *et al*.(2006) and Dhawan and Simwat (1996) also reported significant positive correlation between bright sunshine hours and population build up in case of cotton bollworms and lepidopteron pest, respectively. Khan and Mishra (2003) reported that the sunshine hours, relative humidity and temperature positively regulated the abundance of both spider and hopper densities. Anuj and Saxena (1999) reported that GLH had a significant correlation with bright sunshine hours and maximum temperature while negative correlation with minimum temperature, evening relative humidity and rainfall. They also reported similar results for *Nephotetix nigropictus.* Stat.

Considering the activities of these sucking pests, appropriate spray applications can be made to prevent further build up of hoppers infesting paddy.

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