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Seasonal and Diurnal Flight Activity of *Nilaparvata lugens* STAL (Hemiptera: Delphacidae) on Guadalcanal

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An account is given of catches of macropterous brown planthopper adults on grease traps placed around rice crops.

Between December 1965 and November 1966 flight activity was recorded in each month. There was no difference between mean monthly catches of the southeast wind season (April–October) and the northwest wind season (October–April) which had higher rainfall.

For a twenty-four hour period in October flight activity peaked around sunset.

INTRODUCTION

The brown planthopper, *Nilaparvata lugens* was the major pest of rice on Guadalcanal in 1965 (MACQUILLAN, 1974 a, b, 1975). In attempts to control a pest account should be taken of its ecology (RIPPER, 1956; VAN DEN BOSCH and STERN, 1962). The ecology of *N. lugens* had been the subject of intensive study in Japan (NASU and SUENAGA, 1958; KISIMOTO, 1959; TAKEZAWA, 1961; ITO et al., 1962; SUENAGA, 1963, MOCHIDA, 1964) and much of this data was relevant to understanding *N. lugens* on Guadalcanal. However, the climate of Guadalcanal, a tropical island, is vastly different from Japan. It therefore appeared necessary to investigate the seasonal and diurnal flight activity of *N. lugens* on Guadalcanal.

Flight was expected throughout the year with a higher intensity in the half of the year with greater rainfall. With diurnal periodicity of flight it was the intention of the author to record the pattern and indicate likely influences.

The climate of Guadalcanal is influenced by the mountain range, which rises to 2440 metres above sea level, and by the northwest (October–April) and southeast (April–October) winds. The 1959–64 mean annual rainfall recorded at Ilu, the site of the rice field experiment station, was 1957 mm with rain falling throughout the year but the greater proportion falling in the October–April season. The 1959–64 mean maximum and mean minimum temperatures recorded at Honiara twenty kilometres northwest of Ilu were 34°C and 19°C respectively; there is no seasonal variation in mean maximum and mean minimum temperatures. Day length varies from 12 hours 42 minutes in January to 11 hours 33 minutes in July.

From December 1965 till November 1966 sticky traps were used to record flight activity of *N. lugens* at Ilu on Guadalcanal. During the year, with a high frequency of recording over twenty-four hours, the diurnal periodicity of flight was noted.

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MATERIALS AND METHODS

Cylindrical sticky traps of a modified Broadbent type (Southwood 1966) were used. A trap consisted of two 0.15 m lengths of iron piping (outer diameter 50 mm). The pipes were on stake at heights of 0.15 m and 1 metre above the ground. Each pipe was covered with Shell Retinax A multipurpose grease.

For the seasonal study, twenty traps were placed around a paddy of the 1966 first and second irrigated rice crops. The first crop was direct-seeded in December 1965 and the second in June 1966. The grease was replaced every two weeks or when necessary. Records were made every day at 11 a.m. except Sundays. Following recording all insects were removed.

The data were analysed by omitting records for the season change-over months of April and October and using the t-test to assess the significance of the difference between the mean captures per month for the five months of the northwest wind season and the southeast wind season.

In the investigation of diurnal flight activity records were made over a twenty-four hour period about four weeks before harvest. The paddy had been drained three days previously. In the period of observation (October 15–16, 1966), records were made every two hours. Trapped insects were removed. Records at night were made in red light. Temperature was recorded every two hours at 1.2 m above the ground in the crop (0.4 m above the crop) using a thermister and meter. Wind was noted to be present or absent every two hours.

RESULTS

Flight occurred throughout the twelve months of trapping. Only macropterous adults were found on traps, that is, no brachypterous adults were recorded. During the months of the season of the northwest winds 1280 mm of rain fell whereas in the months of the season of the southeast winds 477 mm of rain was recorded. Nevertheless there was no significant effect of season on flight activity (Table 1).

Of the ninety-seven adults caught during the twenty-four hour period, sixty-five percent were recorded at 1900 hours (Table 2). Sunset was at 1815 hours.

Of the ninety-seven Brown Planthopper adults trapped during the twenty-four hour period, sixty-one percent were male. Twenty percent of total males trapped were recorded at 1700 hours and sixty-nine percent at 1900 hours whereas seventy-six percent of total females trapped were recorded at 1900 hours. Only at 1900 hours were any adults recorded at 1 m above ground and of these sixty-nine percent were female whereas of those trapped 0.15 m above ground at 1900 hours thirty-eight percent were female.

Temperature recorded ranged from 33°C at 1300 hours to 21°C at 0300 hours. Wind was recorded at 1300, 1500, 0900 and 1100 hours but was absent throughout the late afternoon, night and early morning.

DISCUSSION

KISIMOTO (1956) noted that the macropterous adult was the form adapted to unfavourable conditions for the species and played an important role in finding new

Table 1. EFFECT OF SEASON ON FLIGHT ACTIVITY OF *N. lugens* AT ILU GUADALCANAL FROM DECEMBER 1965 TO NOVEMBER 1966

Month	Adults/20 grease traps
December	495
January	1710
February	846
March	1003
April	5795
May	2894
June	612
July	924
August	840
September	735
October	1508
November	2144
Mean in northwest season ^a	1201 ^b
Mean in southeast season ^a	1239.6 ^b

^a Season change-over month omitted. Northwest season (October–April). Southeast season (April–October).

^b Means are not significantly different ($P > 0.05$).

Table 2. DIURNAL FLIGHT PERIODICITY OF *N. lugens* AND METEOROLOGICAL FACTORS AT ILU, GUADALCANAL 15TH–16TH OCTOBER, 1966

Time	Adults/20 grease traps	Temperature °C	Wind	Light
1300	1	33	+	
1500	2	32	+	
1700	11	26	—	
1900	63	24	—	Sunset 1815
2100	5	23	—	
2300	0	23	—	
0100	2	23	—	
0300	2	21	—	
0500	0	22	—	
0700	6	23	—	Sunrise 0600
0900	1	30	+	
1100	4	32	+	

habitats for population growth whereas the brachypterous form adapted to rapid population growth under favourable conditions. In studies on Guadalcanal (MACQUILLAN, 1974b), flight of *N. lugens* was recorded in the fallow area every month from September 1965 to January 1967, however, peak flight activity was recorded in November 1965, April 1966 and November 1966. Peak acreage harvested occurred in the following month on each occasion. The flight activity in the crop area, reported here, has similar peaks but is much greater in the other months. This can be explained by the crop husbandry practices which led to *N. lugens* becoming a severe pest at Ilu between 1960 and 1966 (MACQUILLAN, 1974b). In the two irrigated rice

crops a year system at Ilu rice was grown in every month of each year from 1960 to 1966. Overlapping of an extended period of harvesting of one rice crop with an extended period of planting of the next resulted in high densities of *N. lugens* appearing on young rice crops. Insecticides applied to control rice planthoppers on young crops and close cutting of paddy bunds severely reduced mirid and spider predators of *N. lugens*. *N. lugens* surviving insecticidal applications and macropterous adults arriving from rice not sprayed with insecticides and from crop residues were able to reproduce unchecked resulting in severe damage to highly susceptible sowings of 90 kg per ha in rows eighteen centimetres apart unless further insecticidal applications were made.

So imminent harvest was the major factor influencing flight. However, the favorable conditions created by crop husbandry practices continually induced high densities of *N. lugens*. These incessantly created unfavorable conditions resulting in a continually high level of flight activity.

Diurnal flight activity of *N. lugens* on Guadalcanal peaked around sunset when there was no wind and the temperature was 23–26°C. The more intensive study of OHKUBO and KISIMOTO (1971) have established this diurnal periodicity of flight also occurs in *N. lugens* in Japan.

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