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BIOLOGY OF SUGARCANE LEAFHOPPER UNDER LABORATORY AND FIELD CONDITIONS

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ABSTRACT

There are several sugarcane insects in which Pyrilla perpusilla recently emerged as a challenge for farmers and researchers to control infestation in sugarcane fields. This pest causes stunted growth and also loss of sugar content in infected fields. The pest biology showed different periods in laboratory and field conditions during study period. This comparative study in laboratory and natural condition showed that field conditions are more favorable to their reproduction, growth and survival.

Key Words: Pyrilla perpusilla, endemic, survival, incubation, larval stages

INTRODUCTION

The Sugarcane leaf-hopper, *Pyrilla perpusilla* Wlk. (Lophopidae: Homoptera) has recently become an endemic pest and is posing a great threat to the sugar industry in India. *Pyrilla perpusilla* is a serious pest of the sugarcane where both nymphs and adults, feed on it as well as on other secondary host plants, by sucking the cell-sap that extensively affects its production (Kumar and Sharma, 2008). The pest remains active throughout the year with 3-4 numbers of generations with optimum activity from July to September and survives on wheat, barley and oat etc. during winter (Shah and Saleem, 2002) .

The adults as well as the nymphs inflict a heavy damage to the plant and excrete a thick transparent liquid, which ultimately makes a medium for black mould. *P. perpusilla* causes direct and indirect losses. The cane juice becomes high in glucose, tunes insipid and if used, for making gur, gives a soggy mass, which does not solidify properly (Chaudhry and Ansari, 1988). An early infestation during the grand growth period of cane adversely affects the yield while the late-infestation from September onwards mostly affects the sucrose

content of sugarcane (Puri and Sidharth, 2001).

The biology and the behaviour of *P. perpusilla* were first described by Fletcher (1914) in Bihar, India. A large number of workers have recorded basic biological data on *P. perpusilla,* but many studies are incomplete and of little general applicability. For instance, studies of the insect's development rate have been made under semi-controlled temperature conditions and humidities (sometimes without the temperature/humidity range being given) and the sugarcane cultivar used is often not stated (e.g. Gupta & Ahmad, 1983; Dhaliwal *et al.*, 1987).

METHODS AND MATERIALS

The first instar hatched from each egg cluster was transferred to potted plant placed inside cage. These nymphs were left undisturbed to feed and eventually metamorphose into adults. The adults were carefully observed and sexed using morphological features. The pre-oviposition, oviposition and post-oviposition periods were studied under laboratory conditions.

The adult males and females were collected from the rearing cages within 24 hours of last moult. Batches of the three males and a female were placed separately in twenty rearing jars (10cm dia x21cm height). A 2.5cm thick layer of plaster of pairs was laid at bottom of each jar in order to provide sufficient moisture for sugarcane leaf from wilting. The mouth of each jar was covered with a muslin cloth allowing aeration to the adults. Fresh leaves were supplied daily while removing the old leaves. Insects in the rearing jars were monitored daily until all the insects died. The pre-oviposition, oviposition and post-oviposition periods were recorded. In another separate experiment, newly emerged adult males (n=20) and females (n=20) were collected from the rearing cages and places separately in rearing jars described earlier with 10-12cm long piece of sugarcane leaf and monitored daily until all the insects died in order to determine the longevity of adults.

The sex ratio, mating and oviposition behavior of the *P. perpusilla* were studied under both laboratory and field conditions. To determine the sex ratio, adult *P. perpusilla* present on every plant under experimental plot were sexed and counted once a week. Sex ratio of adults was determined using x^2-test.

Preliminary observations of mating and egg laying behavior were carried out in the field. Focal animal sampling was applied. The total number of egg clusters found on the adaxial and abaxial surfaces of leaves in each plant in the experimental pest was counted once a week. At the same time, the total numbers of egg clusters found on the luxuriant plants and scraggy plants were also recorded. Data were analyzed using simple t-test for oviposition site selection.

RESULTS AND OBSERVATIONS

The biology and reproductive behavior in Sugarcane leafhopper were studied under both laboratory and field conditions. There was no evidence that any life stages of *P. Perpusilla* were present on the stem of sugarcane rather than leaves. The experimental plot was the result of the buildup of naturally available population of this insect.

P. perpusilla was established throughout the study period since there was no use of insecticides, herbicides or fungicides. Subsequntly, *P. perpusilla* found in the experimental plot were identified by comparing their morphological characters with voucher specimens from the laboratory. Newly emerged adult female were ready to mate two days after emergence from the fifth nymphal instar males and females began to copulate about two days after their last moult and mating occureed usually during the day males and female mated multiple times usually with different partners with each mating episode lasting 1-2 h female typically mated multiple times during a 1week period before starting to oviposit mating continued throughout the oviposition period

Female carried an egg cluster for about 60-90 min at the tip of their abdomen before depositing it on a leaf. The females oviposit mainly during the day however, in same cases it was observed that females oviposit even at night. The female have a pre- oviposition period which range from 7-11 days, with a mean of 8.8±1.0 days. The maximum,

minimum and mean values for the oviposition periods are 22, 10 and 15± 1.4 days, respectively while the same values for post-oviposition phases are 8, 2 and 5±2.0 days respectively (Table 1).

Table 1. Duration of various life parameters of *Pyrilla perpusilla* during study period.

Life History Parameters	Laboratory (Days)	Field (Days)	Average (±SD)
Pre-oviposition Period	7.85	9.40	8.20±1.00
Oviposition Period	16.30	19.70	16.00±1.40
Post-oviposition Period	4.30	7.50	5.00±2.00
Male Longevity	27.40	30.85	25.00±3.10
Female Longevity	31.20	35.70	33.10±1.80
Incubation Period (In Lab)	7.30	8.50	6.80±0.81
First Instar Nymphs	9.40	11.30	9.50±1.60
Second Instar Nymphs	8.60	10.80	10.91±1.06
Third Instar Nymphs	7.80	10.60	8.26±1.03
Fourth Instar Nymphs	9.20	12.20	12.26±0.80
Fifth Instar Nymphs	9.50	12.40	11.20±0.95

A female during her lifespan produces 2-5 egg clusters with an average of 3.3±1.1.the number of eggs in a cluster obtained from rearing cage ranged from 17-56 with mean of 33.0±10.3 while eggs in a cluster obtained from the experimental plot ranged from 18-57 with mean of 32.0±10.8 the difference in means between eggs in a cluster laid in rearing cages and in the experimental plot is not statistically significant (t-test, $p>0.05$) the total number of eggs laid by a female during her lifetime ranged from 47-200 with a mean of 133±10.2.

DISCUSSIONS

Under laboratory conditions the incubation period ranged from 6-8 days with a mean of 6.8±0.81 days and under field conditions it ranged from 6-9 days with a mean of 6.9±0.87 days (Table-1) the difference between incubation period under laboratory and field condition is not significantly difference (t-test:$p>0.001$) Egg viability recorded from egg clusters collected from the rearing cages was found to be 89.79% while that of egg clusters collected from experimental plot was 87.22% there was no significant difference between viability of eggs laid in rearing cages and in the experimental plot (t-test; $p>0.001$). Kumarasinghe and Ranasinghe (1985) have stated that the mean number of eggs in an egg cluster of *P. perpusilla* in kantale (in dry zone) Srilanka was 35. The mean number of eggs in a cluster at kelaniya (in field) was found to be 33.05± 10.39 Despite the differences in climatic conditions between Kelaniya and kantale the mean number of eggs in a cluster in both places is approximately the same this indicated that the number of eggs in a cluster is an inherent trait unaffected by climatic differences which exist.

Longevity of the adult females was significantly greater (t-test; $p< 0.01$) than that of the males female lived for 31-37 days with a mean of 33.15±1.81 days, whereas the longevity range of the males was 21-31 days with a mean of 25±3.13 days (Table 1). The viability of eggs appears to be affected by the ambient relative humidity especially when it shows drastic fluctuations (Mogal et al, 1983). They reported that the viability of eggs was 49% at 7.03% Rh and it gradually increased with increasing relative humidity reaching a maximum of 92% at 82.26% Rh meteorological data recorded during this study showed that the relative humidity at Gopalganj had a narrow range of fluctuation between 70 and 87% with a mean of 81±3.2% and that the viability of eggs remained high throughout the study period since the mean viability of eggs recorded in the study (89.74%) is very close to the maximum percentage viability (92%) recorded by Mogal et al (1983). It is likely that the range of relative humidity prevailing at Kelaniya is optimal for the hatching of *P. perpusilla* eggs.

Records of adult males and female counted in the field showed that there is no appreciable departire from the male: female ratio of 1:1(Chi^2 test $p>0.05$) Absolute counting of males and female was carried out this sex-ratio study. Sampling of an animal population is necessary only when the population is large since counting of individuals is time consuming and costly. However when a population is small and individuals could be conveniently counted a census of the population may be carried out this gives a true value of the absolute population size within limits of human error and wherever possible is preferable to sampling. It was observed that a low population level of *P. perpusilla* remained throughout the study period in the study area Principle factors responsible for a

low level of abundance of *P. Perpusilla* in the wet zone of Sri Lanka have been described by Ganehiarechchi and Fernando (2000)

There was no overlap of adults of different generations of *P. perpusilla* during the present study since the maximum lifespan of adult female was much shorter than the developmental period from egg to adult and there were no other sugarcane fields in the neighborhood, the study plot was sufficiently isolated and immigration was unlike.

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