Effect of Temperature on the Cohort Life Table of Brown Planthopper (*Nilaparvata Lugens* Stål) (Homoptera: Delphacidae)

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ABSTRACT

Different constant temperatures (24, 28, 32, and 36 °C) and room temperature used as treatments for the experiment done at the JICA-ELB 1 Laboratory, Department of Entomology and Zoology, Yezin Agricultural University from September 2019 to January 2020. This study aimed to investigate the effect of temperature on brown planthopper population dynamics and forecast information to the farmers for BPH outbreak. Test tube for oviposition filled with four gravid females from the colony. Each test tube removed the females after 24 hr. Rice plants with eggs were covered with cotton and placed at different temperatures. Each rice plant has studied for egg hatching. After hatching, the first instars were collected individually with the help of camel hairbrush and transferred to a new test tube with a new rice plant. The later instars were collected and transferred as the same way. The number of hatched and unhatched eggs counted from the old one. The nymphs were monitored daily for life table parameters until the adult emerges and the adult died. In the life table analysis, BPH's highest mortality has occurred in the first nymphal instar, which resulted in type III survivorship curve. However, 100% of mortality has happened in the egg stage at 36 °C. Brachypterous and macropterous forms' life table showed the high net reproductive rate at lower temperature regimes. The growth parameters of BPH have decreased at 36 °C, which reveals that the temperature increase above 32 °C is detrimental to the development of BPH. Results indicated that the egg and nymphal stages were significantly affected by temperature. Eggs hatching also decreased drastically with an increase in temperatures, especially at 36 °C.

INTRODUCTION

Rice is an ideal host for many insect species. All of the plant parts are vulnerable to insect-feeding from sowing to harvest (Grist and Lever, 1969). In Myanmar, the first outbreak of BPH happened in 1970 at the Kyaukse Central Farm (Mandalay Division) and in Upper Myanmar (Myint, 1975). The BPH has since become a major pest of rice in Myanmar. The rice BPH occurs during both dry and wet seasons, and several biotic and abiotic factors affect survival, growth, development, and multiplication. Among the abiotic factors, temperature plays a significant role. Climate change, the significant temperature increase will affect insect physiology, behavior, and development as well as species distribution and abundance. However, there is limited information on the effect of temperature on BPH outbreak in Myanmar.

OBJECTIVE

To investigate the effect of temperature on brown planthopper's life table parameters to support the information to forecast the BPH outbreak

METHODOLOGY

- Prepare each test tube filled with rice plant and four gravid females
- Females were removed after 24 hrs
- Observation done until they hatched
- First instars were collected individually with camel hairbrush and transferred to a new test tube.
- Later instars were collected and transferred as the same way
- No. of hatched and unhatched eggs counts on the old plants

❑ **Study Site** - JICA –ELB 1 Laboratory

Treatments - 24°C, 28°C, 32°C, 36 °C and Control (room temperature)
Data analysis - Mean separation done by LSD (SAS 9.1) Software

BPH rearing

Collection of gravid for oviposition

Data collection

Table 1 Life table of developmental stages of BPH at different temperature

Immature Stages	control	24°C	28°C	32°C	36°C	P- value
	Mean ± SE					
Egg	139.40 ± 3.89	143.00 ± 3.17	113.80 ± 1.11	132.40 ± 1.60	135.80 ± 2.72	<.0001
First nymphal instar	102.40 ± 6.19	137.00 ± 3.16	96.80 ± 1.54	107.40 ± 2.54	0.00 ± 0.00	<.0001
Second nymphal instar	77.60 ± 4.84	112.20 ± 3.08	77.40 ± 1.11	76.60 ± 1.76	0.00 ± 0.00	<.0001
Third nymphal instar	67.40 ± 3.79	99.00 ± 2.63	72.80 ± 0.93	56.40 ± 1.85	0.00 ± 0.00	<.0001
Fourth nymphal instar	57.20 ± 3.11	90.40 ± 2.57	67.20 ± 0.94	44.80 ± 1.34	0.00 ± 0.00	<.0001
Fifth nymphal instar	48.00 ± 2.69	80.00 ± 2.36	64.00 ± 0.79	22.60 ± 1.10	0.00 ± 0.00	<.0001
Adult	36.80 ± 2.38	64.60 ± 2.19	56.00 ± 0.84	0.00 ± 0.00	0.00 ± 0.00	<.0001

RESULTS AND DISCUSSION

- 26.40% of 139.40 BPH eggs at control temperature, 45.17% of 143.00 BPH eggs at 24° C, 49.21% of 113.80 BPH eggs at 28° C successfully emerged as adults
- high mortality occurs during early immature stages, no adults appeared at 32° C and 36° C
- maximum death (135.80±2.72) observed at 36°C in the egg stage
- more dying of first, second, third, fourth, and fifth instar nymph found at 32°C
- at 36°C, none of the nymphal instars survived
- The highest net reproductive rate (175.60) of brachypterous form at control temperature
- (168.20) at 24° C, (166.80) at 28° C, and (74.60) at 32° C
- The lowest net reproductive rate (32.60) at 36° C
- The highest net reproductive rate (204.00) of macropterous at control temperature, followed by 142.60 at 28° C, 102.40 at 24° C, and 93.60 at 32° C
- The lowest net reproductive rate (29.20) at 36° C

CONCLUSION

- Population growth parameters positively correlate with increasing temperature up to 28°C
- At 36°C, all growth stages decrease, temperature increase above 32°C is detrimental to the development of BPH
- Favorable temperature for BPH development is 24°C for every life stage
- Net reproductive rate was higher at lower temperature regimes (control, 24 and 28°C) and lesser at higher temperature regimes

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