# Abstract

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**Project Title:** Migratory behaviour of rice planthoppers response to climatic variations

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**Abstract :**

Migratory insects adapt to and exploit the atmospheric environment to complete their migration and maintain their population. However, little is known about the mechanism of insect migration under the influence of weather conditions. The rice planthopper (RPH) infestation is considered one of the most serious disasters in rice production in Asia and their main ecological features are the high migratory ability. However, studying the effects of climatic changing on movement capability and behaviour of RPHs is difficult because of their small size. The answer came with the new design of temperature gradient tunnel suitable for close up observation of small insect behaviour under the gradient temperature conditions which full tunnel construction is described in this report. To gain insight into how insects move within confined spaces, the flight activity of unmated brown planthopper (BPH) and white-backed planthopper (WBPH) was investigated by video-recording. The ability of RPHs to move and movement activity pattern were assessed including resting, walking, jumping and flying. The results revealed that when the coiled spring was pulled down and released, both BPH and WBPH respond to a stimulus by jumping away from the platform. The mean jump distance (±SE) were 98.5±2.8, 96.1±3.2, 97.5±3.1 and 108.7±4.3 cm for BPH female, BPH males, WBPH females and WBPH males respectively with jump distance ranges of 56.2-157 cm, 65.5-129.8 cm, 51.5-137 cm, and 68-184 cm for the two insect species and sexes. From the two way ANOVA analyses, there was no significantly difference in mean jump distance between BPH and WBPH, nor between the sexes. There was, however, significant difference in mean jump distance between the interaction of insect species and sex. The mean movement durations were significantly different among age groups of macropterous WBPHs. By contrast, statistical analysis indicated that there was no difference in movement duration between age group, nor bewteen the wing form in BPHs. The results also revealed that movement activities of both sexes of BPH and WBPH responded to temperature gradient in a similar manner. The RPHs could migrate in both directions of the tunnel without any specific response to the temperature gradient, but RPHs preferred the moderate temperature region of the tunnel in the 25 to 30$^{o}$C than the warmer boundary of distribution as they did not move very much. It was also found that RPHs that were 48 to more than 96 h old exhibited the all movement activity pattern. Whilst, the newly emerged adult RPHs that were 12-24 h old showed less activity patterns than those groups within these environments. The critical information derived from this study is that

RPH flight behaviour was affected by the age. After the age of 24 h, they displayed flying activity in the temperature gradient tunnel and they could fly to the end of tunnel. Moreover, males were more active than female RPHs. This study will play a significant role in the development of ideas concerning the interaction between dispersal related to changing climate topic. Knowledge about their movement potential is very important for designing and applying measures targeted to reduce the negative effects from these pests. Many interesting points elucidated during experimenting for example elastic operation of their legs may be important to reproduce the basic dynamics in walking and jumping, what is the movement principle to clarify the walk-jump transition? A special form of motion, locomotion might allow the insects to change place is essential for example for foraging, escape and courtship. However, there is long way to go and discover in RPH movement behavioral research in truly understanding their flight performance and movement mechanism.

Keywords: Rice planthopper, *Nilarpavata lugens*, *Sogatella furcifera*, temperature gradient tunnel, movement behaviour