FACULTY OF NATURAL SCIENCES
INSTITUTE OF PLANT DISEASES AND PLANT PROTECTION

Impact of climate change on insect pest: A case study of effects of high temperature pulses and drought stress on the diamondback moth *Plutella xylostella (Lepidoptera: Plutellidae)*

By

ROBERT J. M. WACHIRA

Thesis submitted in partial fulfillment of the requirements for the award of Master of Science (M.Sc.) in Horticulture, Major Entomology and Phytopathology

SUPERVISORS:
Prof. Hans-Michael Poehling
Dr. Rainer Meyhöfer
Prof. Grote

September, 2009

ABSTRACT

Climatic changes have continued having a great impact on the plant-pest-environment interactions. These changes include among others the rise in global surface temperatures, rise in carbon dioxide concentration and a general rise in drought-stress due to increased evapo-transpiration brought about by a rise in temperatures and a decrease in precipitation. More specifically, there will be notably seasonal extremes in weather changes in different regions. It is therefore expected that these seasonal changes brought about by a dynamic climate will consequently affect development and behavior of various insect pests and their effects on the natural ecosystems.

We therefore investigated effects of pulses of four temperatures of 8hrs per day i.e., 24, 28, 32 and 36 °C and drought stress on herbivores i.e., *Plutella xylostella* on Brussels sprouts plants. Contrary to studies done in constant temperatures, it was found that at these short periods of extremes in temperature mortality was below 40 % even at pulses of temperatures as high as 36 °C. Significantly short durations of development were experienced at these pulses.

There was a faster trend of development on the drought stressed plants compared to regularly watered plants. Likewise, extreme temperatures significantly reduced the time for development from egg to pupation. With high temperatures and drought stress there was further an accumulation of L3 and L4 larval instars at the apex part of the plants. This was critical as the quality of the sprouts is reduced should these parts be destroyed by chewing herbivores. The pupae obtained from the mentioned treatment factors were of lighter in weight at the higher temperature pulses that at the control constant temperatures of 24 °C.

The oviposition and longevity of adults were highly affected by short periods of high temperature. Although fecundity and longevity were significantly reduced on drought stressed plants and with increase in temperature pulses, *P. xylostella* still managed to lay eggs through out their lifetime. This is not possible in constant temperatures above 33 °C. The findings in this study need to be further compared with semi-field in order to be useful in devising measures that can be incorporated in an integrated pest management program (IPM) to facilitate preparedness for farmers in a changing climate.

KEY WORDS: climate change, extreme temperatures, drought stress, *P. xylostella,* developmental rate, oviposition.