



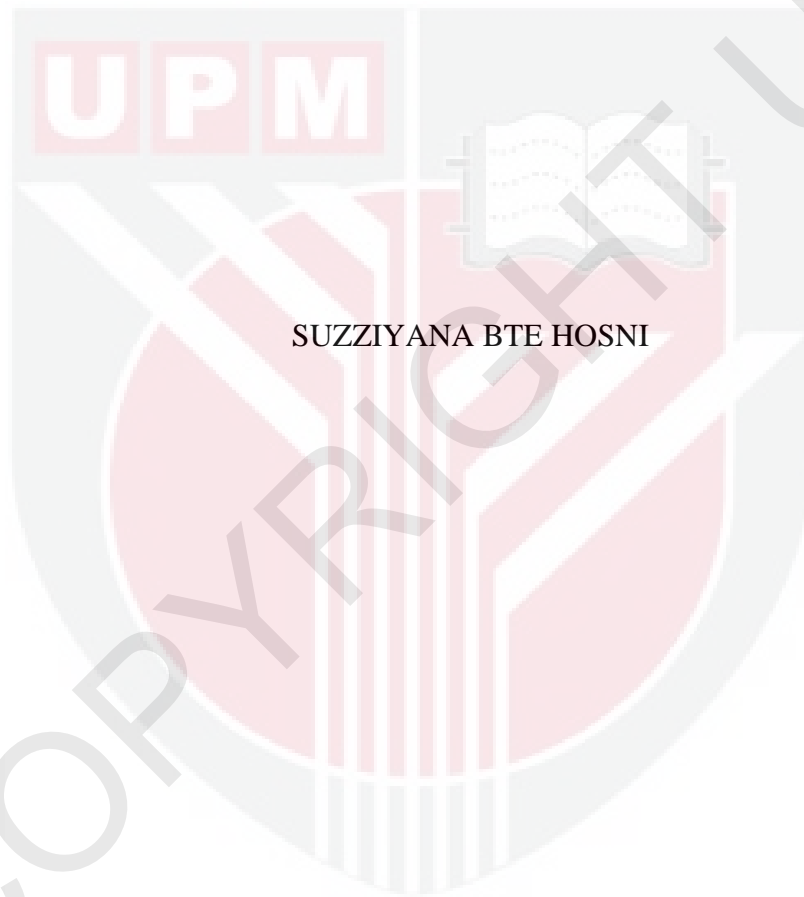
UNIVERSITI PUTRA MALAYSIA

**EFFECT OF HIGH TEMPERATURE AND RELATIVE HUMIDITY ON HOST
- PEST INTERACTION**

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EFFECT OF HIGH TEMPERATURE AND RELATIVE HUMIDITY ON HOST -
PEST INTERACTION



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EFFECT OF HIGH TEMPERATURE AND RELATIVE HUMIDITY ON HOST-PEST
INTERACTION

BY
SUZZIYANA BTE HOSNI

A project report submitted to Faculty of Agriculture,
Universiti Putra Malaysia, in partial fulfillment of the requirements of PRT4999
(Final Year Project) for the award of the Degree of Bachelor of Horticultural Science.

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ENDORSEMENT

This project entitled as 'Effect of High Temperature and Relative Humidity on Host-Pest Interaction' prepared by Suzziyana Bte Hosni and submitted to the Faculty of Agriculture in partial fulfillment of requirement of PRT4999 (Final Year Project) for the Degree of Bachelor of Horticultural Science.

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ABSTRACT

Environmental stress such as extreme temperature and relative humidity affect growth and development in plants as well as biotic interactions. In leafy vegetable such as green mustard (*Brassica rapa var. parachinensis*, 'sawi hijau'). High temperature and low relative humidity subjected the vegetable plants vulnerable to grasshopper infestation. Grasshoppers are expected to respond more than other organisms because these are ectoderms. Grasshopper exacerbate the already damage crop due to changes in morphology, biochemistry and physiology in plants caused by extreme abiotic factors. This study aims to understand the mechanisms that are driving the population dynamics of green grasshopper (*Caelifera* spp.) on green mustard. Specifically, (i) to study the impact of high temperature on plant growth and development; (ii) to observe the insect pest behavior and their habit in high temperature and humid environment; (iii) to determine the host – pest interaction under high temperature and low relative humidity. Insects were introduced in each plant in the simulation chambers in order to observe their relation to plant response under high temperature and low humidity. T-test analyse were used to observe the comparison between interactions of host – pest on two different temperatures. Plant parameters such as transpiration rate, leaf area, plant height, plant development stage, and weight were measured every two days whilst insect pest behavior, feeding habit, development and survival rate were recorded. From the analyses obtained, temperature induces changes in host plant suitability to insect herbivores on account of significant effect on mass of dry matter, plant height and number of leaves. The higher temperature resulting higher pest infestation on vegetable cultivation in

various ways. Thus the changes lower the food value, causing insect pest consume more on the plant to meet their nutritional needs.



ABSTRAK

Tekanan persekitaran seperti suhu yang melampau dan kelembapan relatif memberi kesan kepada pertumbuhan dan pembesaran dalam tumbuh-tumbuhan dan juga interaksi biotik. Dalam sayur-sayuran berdaun seperti sawi hijau (*Brassica Rapa var. Parachinensis*). Suhu tinggi dan relatif berkelembapan rendah menyebabkan tanaman sayur-sayuran terdedah kepada serangan belalang. Belalang bertindak balas dengan lebih daripada organisma lain kerana belalang adalah ektoderm. Belalang memburukkan lagi tanaman yang telah dirosakkan disebabkan oleh perubahan dalam morfologi, biokimia dan fisiologi dalam tumbuhan yang disebabkan oleh faktor-faktor abiotik yang melampau. Kajian ini bertujuan untuk memahami mekanisme yang memandu dinamik populasi belalang hijau (*Caelifera* spp.) pada sawi hijau. Secara khusus, (i) untuk mengkaji kesan suhu yang tinggi kepada pertumbuhan tumbuhan dan pembangunan; (ii) untuk memerhatikan tingkah laku serangga perosak dan tabiat mereka dalam suhu yang tinggi dan persekitaran yang lembap; (iii) untuk menentukan interaksi perumah - perosak di bawah suhu yang tinggi dan berkelembapan relatif rendah. Serangga telah diperkenalkan pada setiap pokok dalam kotak simulasi untuk memerhatikan hubungannya dengan tindak balas tumbuhan di bawah suhu yang tinggi dan berkelembapan rendah. Ujian-T menganalisis telah digunakan untuk melihat perbandingan antara interaksi perumah - perosak pada dua suhu yang berbeza. Parameter tumbuhan seperti kadar transpirasi, luas daun, ketinggian, peringkat pembangunan, dan berat diukur setiap dua hari manakala tingkah laku serangga perosak, tabiat makan, pembesaran dan kadar kemandirian telah direkodkan. Daripada data yang diperolehi, suhu mendorong perubahan dalam kesesuaian tumbuhan perumah kepada serangga

herbivor disebabkan kesan yang besar ke atas jisim bahan kering, ketinggian dan bilangan daun. Suhu yang lebih tinggi menyebabkan serangan perosak yang lebih tinggi terhadap penanaman sayur-sayuran dalam pelbagai cara. Oleh itu perubahan menurunkan nilai makanan, menyebabkan serangga perosak mengambil lebih banyak pada tumbuhan untuk memenuhi keperluan pemakanan mereka.



CHAPTER 1

INTRODUCTION

Climate change may be a trigger in changing pattern of various climatic parameters such as temperature, rain fall, relative humidity, gas composition in the air, etc., and in properties over a longer period of time and in a wider geographical area. It can also be referred to as any change in climate over time, whether due to natural variability or as a result of human activity. As been stated by Schneider *et al.*, (2007) vulnerability of any system to climate change is the degree to which these systems are susceptible and unable to survive with the adverse impacts of climate change. They also explained the concept of risk as which combines the magnitude of the impact with the probability of its occurrence, captures uncertainty in the underlying processes of climate change, exposure, impacts and adaptation. At present due to anthropogenic activities like industrialization, deforestation and automobiles etc. changes in the climate are being taken place, which will again turn detrimental to life (Rakshit *et al.*, 2009). The changes in climate may include fluctuations in temperature, increase in soil salinity, water logging, high atmospheric CO₂ concentration and UV radiation. High temperature is due to the increased amount of greenhouse gases like CO₂ and CH₄ in atmosphere, which is commonly known as global warming or greenhouse effect.

All living things are marked by their ability to adapt to the environment. Those who cannot adapt will eventually die out. Insects are living things and because of this, they follow the same rules. Some of the factors that impact how living things adapt are food supply, temperature, water supply, and population. Some of these things are

relative to each other, which mean that they have an impact on each other. For instance, a change in the population of flowers will result in a reduced population of bees in the area.

The heat itself may not impact insects the way it does human beings. Insects do not sweat, but they do respond to the heat. This can be proved by listening to the buzz of bees' wings inside the hive as they use their wings to try to cool the hive. Some insects actually thrive on the heat. For instance, we might notice that flies are more visible in warmer areas. Just like population of arthropod is noticeably getting more and more during this time. Insects may have to adjust to the heat, but it is more the impact that the heat has on the environment than on the insects themselves which will cause a change in their behaviors.

Started a few years ago, increase in temperature in Malaysia has been almost intolerable, and to make matters worse, there has been very little rain. The impact of these can be seen all around as we observe some horticultural crops that have been impacted by the combination of lack of water and high temperature. Insects are resourceful enough to go where they must and modify their eating habits to adapt in a food scarce environment. Some insects die while others, particularly insect pest thrive.

Environment influences plants' growth and development. Environmental stress causes injury in plants which limit the normal production of secondary metabolites. This study aim to observe the impact of high temperature on plant physiology and chemistry, growth, and development.

Plant stress is either abiotic or biotic. Abiotic alters the physicochemical properties in plants. Extreme temperature and moisture deficit or excess. On the biotic primarily influence by the presence of insect herbivores. Whether biotic or abiotic, these stresses can reduce the performance of the plant. When the plant is under stress, the suitability of the plant as host to herbivorous insects may be altered.

The general objectives for this project are to study the impact of high temperature on plant growth and development as well as to observe the insect pest behavior and their habit in high temperature and humid environment in order to determine the host – pest interaction under high temperature and low relative humidity.

In the following chapters, I will discuss the effect of high temperature and high humidity on growth and development in *Brassica rapa* var. *parachinensis*, on phytophagous insects' behavior and feeding habits, and on the interaction between the two taxa.

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