CHAPTER 1
INTRODUCTION

Chilli (*Capsicum* spp) is one of the most widely grown spice vegetables in Thailand and it is a high-value crop. It is considered one of the most important vegetables in Thailand because of its wide usage in traditional Thai food. Even though local consumption is high, there are many major constraints in chilli production in Northern Thailand. The most serious problem is pest infestation, especially chilli thrips, aphids, mites, chilli pod borer, white flies and other diseases, such as anthracnose, in the growing season.

1.1 General background of Chilli Thrips

There are more than 5000 species of thrips described in the literature, but approximately 1% are considered serious pests (Morse and Hoddle, 2006). According to the scientific literature on the economics of thrips species , the most important four species of thrips are *Thrips tabaci* Lindeman, *Frankliniella occidentalis* (Pergande), *Scirtothrips dorsalis* Hood and *Thrips palmi* Karny (Morse and Hoddle, 2006). The chilli thrips, *Scritothrips dorsalis* Hood (Thysanoptera: Thripidae) is also a major threat to chilli production in Thailand. It is a native species of southern Asia (Kumar, 2012), a polyphagous pest and most commonly found in horticultural crops in the tropic, sub-tropic and temperate regions of the world (Ananthakrishnan, 1993). The thrips cannot be identified and monitored easily in the field or within the plants because of their small and cryptic size. The infestation of the plant may occur in the field at any time during the growing season starting from the seedling stage and continuing until the last harvest of the crop.

Infestation causes leaf curling, twisting, stunting, bunching, scarring and finally loss of leaves and crop yield. There have been some reports of success to control thrips, *Ceratothripoides claratris* Shumsher, which is a major threat to tomato plants. It also affects other horticultural crops such as chilli, melon, pumpkin, cowpea and yard long bean (Murai et al., 2000; Premachandra et al., 2004). The use of botanical pesticides such as neem products, entomopathogenic fungi, or biorational pesticides (e.g.,

spinosyns or avermectin) has proven to be successful in the control of this pest (Premachandra et al., 2005b; Kumar and Poehling, 2006; Thoeming and Poehling, 2006; Panyasiri et al., 2007). Various control measures such as chemical control, biological control and host plant resistance have been used to control chilli thrips. These control measures are not sufficient to prevent thrips penetration and spread within netted greenhouse constructions and subsequent virus transmission. However, the common control measure of chemical insecticides to control chilli pests has adverse effects on humans and the environment such as toxicity, chemical residues and pesticide resistance.

1.2 Protected cultivation in the tropics

Improved protected cultivation in the tropics using greenhouses may lead to a more desirable sustainable agricultural system. Although protected cultivation systems in the tropics can protect some pests entering the greenhouse from outside by using different kinds of nets, there are problems preventing thrips penetration. The subsequent spread within netted greenhouse constructions by vectoring virus transmission can destroy the entire crops in a short time. An example of small-sized thrips, *Ceratothripoides claratris* Shumsher (Thysanoptera: Thripdae), which can scatter across every fine porous nets of the greenhouse, is a major threat to greenhouse tomato (*Lycopersicum* spp) production in Thailand (Premachandra et al., 2004).

1.3 Insect and the nature of UV light

The plants in nature are exposed to light with different intensities of UV (ultraviolet). The wavelength of light between 290 nm and 320 nm may have an effect on the interaction of some plant pathogens (Honda, 2000; Kumagai, 1988; Tan, 1978). The UV light has the effect of preventing the immigration of economically important small-sized insects across the nets in the greenhouse. Some herbivorous insects are sensitive to UV perception because of the photoreceptors in their compound eyes. UV perception in the range of 350-390 nm is the most important for insect orientation and host location (Briscoe and Chittka 2001, MÖller 2002, Raviv and Antignus, 2004). Many insects when given a choice during flight prefer higher UV intensities compared with UV deficient environments.

(Costa and Robb, 1999; Costa et al. 2002; Kigathi, 2005; Mutwiwa et al., 2005; Doukas and Payne, 2007). *Ceratothripoides claratris* Shumsher, an example of major threat to greenhouse tomato production in Thailand (Premachandra et al, 2004) always preferred the environment with higher UV intensity (Nguyen et al., 2009).

1.4 The scope of the experiments

There were two experiments; Experiment (I) conducted in the greenhouse and Experiment (II) conducted in the laboratory and in the outside environment. For the purpose of this experiment, we have chosen one variety of local Capsicum cultivars, commonly called Black Devil. Both experiments tested various light intensities. Experiment (I) tested the effect of UV light on the thrips of red devil capsicum cultivar in the UV opaque greenhouse, the UV open greenhouse and open field conditions. Experiment (II) tested the responses of the chilli thrips to three different light conditions in the laboratory and in the outside environment. There were three treatments for the greenhouse experiment which was experiment (I). They were as follows:

1. the UV opaque greenhouse
2. the UV open greenhouse and
3. the outside condition as an open field natural environment.

The experiment (II) included the preference of the thrips for the variation of the three different light conditions in the laboratory and in the outside environment. We intended to show that it is possible to solve the insect pest problems in the controlled environment of the greenhouse cultivation system in Northern Thailand. There is little information about modern method to control chilli thrips, *Scirtothrips dorsalis* with local Capsicum cultivar, and red devil variety in greenhouse studies in Northern Thailand. Hence, in this study, we investigated how the three different environmental conditions affected the local Capsicum cultivar, red devil chilli variety. We compared the responses of the chilli thrips *Scirtothrips dorsalis* to the UV opaque greenhouse, the UV open greenhouse and in open field natural environment conditions.

1.5 Rationale and Hypothesis

The chilli thrips, *Scirtothrips dorsalis* is the most commonly occurring pest of chilli production in Thailand. Very little information is available about the control of chilli thrips in the greenhouse cultivation system in Thailand. Feeding by nymphs and adults causes serious damage and the vectoring of some viruses to the crops in a short time. Currently growers in region use various kinds of chemical insecticides to control chilli thrips in the field which is harmful to humans and the environment. Research must be conducted to develop modern technology such as protected agricultural systems in the tropics that can detect and manage this pest in a timely and efficient manner.

Based on this study, the effect of the UV light from two different greenhouses on thrips of red devil chilli cultivar will provide information about how to control this pest in the greenhouse. The results will indicate the effective use of UV plastics in the greenhouse to control the intensity of infestation of red devil chilli cultivar. This experiment proposes to show the most efficient technique of UV light conditions in order to reduce the thrips infestation on red devil chlli cultivar. Also the experiment will show that the chilli thrips prefer one of three different types of light in the controlled environment.

1.6 The objectives of research

The specific objectives in this experiment are:

(1) to determine the influence of two different types of UV plastic on the infestation of chilli thrips of local capsicum cultivar red devil variety,

(2) to identify the response of chilli thrips on local capsicum chilli cultivar, red devil variety under the greenhouses and open field natural environmental conditions and

(3) to study the preference of chilli thrips in three different light intensity choices in the laboratory and outside environment