CHAPTER 1

INTRODUCTION

At present, pesticides are widely used in public health, industry and agriculture. Thailand is an agriculturally-based country, and the livelihood a large percentage of population depends heavily on agriculture. More than 30 % of agricultural products have been damaged and losses due to infestation caused by insect pest (Napompetch, 1981). Pesticides proved to be effective in controlling the infestion of many insect pest species, and this has led to the popular use of pesticides to control pests in order to increase crop productivity.

The import of pesticides in Thailand increased annually between 1981 to 1990, and the value of pesticides used is more than 1,500-3,000 million Bahts per year (Agriculture Department, 1993). Thai farmers are therefore faced with the high cost of pesticide application. The pesticide problem is now becoming very serious and difficult to manage. Particularly in developing countries, the basic problem is the lack of information and awareness about the appropriate pesticide application. This has consequently resulted in adverse effects on living organisms and the environment. They also represent a hazard to human health. Farmers are especially at risk because they are constantly exposed to pesticides they use to control insect pests in the field. Similarly,

domestic consumers use pesticides to control house-hold pests. Humans are at risk because they consume pesticide residues with their food and crops. Crops tainted with pesticide residues are not suitable for export what represents a big problem to Thailand. Pesticide residues in soil, water and air affect the environmental safety, ecological balance, and the wildlife. The detrimental effects of pesticides on the ecosystem are already well-demonstrated. The beneficial insects, predators and parasites are often destroyed while the targeted pests themselves survive by the better developing resistance against the pesticides used (Tayaputch, 1991).

An important consideration when using any agricultural chemical is its effect on the non-target species. Only about 4 % of all insects are pests of economic importance, the problem of pesticide toxicity to beneficial insects, particularly pollinators, is world-wide (Johansen, 1979). Honey bees are beneficial insects and major pollinators of many crops ; they greatly increase the yield and quality of these crops (Real, 1983). Approximately one-third of the food we consume comes from insect-pollinated plants (Levin, 1986 ; Vaissiere, 1992). Honey bees are useful for man, agriculture and environment. Man has used honey bees products such as honey, bees wax, pollen, royal jelly, propolis, bee venom, bee brood (used as food) for a long time. Bradbear (1992) said that forest and bees are interdependent. Their relationship has been perfected over the last 50 million years, literally millions of

years before man appeared on the earth. Trees do not just need bees to ensure their own reproduction, but to ensure the regeneration of the whole system within which the trees exist. Honey bees are good pollinators for many wild flower plants in the forest (Pyramarn and Wongsiri, 1986). Bryndum and Hedegart (1989) found that honey bees are better pollinators for teak trees than the wind. The interest was again focused on the honey bees as environmental indicators of chemical and electromagnetic pollution (Celli et al.,1985 ; Carlson et al., 1985). Honey bees have been used as monitors of environmental contaminants because they show a low tolerance to many toxic chemicals. Therefore, they can be used as a potentially sensitive indicator (Giordani et al., 1992).

The insecticides used in pest control programme, particularly on flowers, vegetables, and fruit trees which are the main sources of pollen and nectar, represent a serious threat to beekeeping, and they can be very dangerous to the natural honey bees in the country (Areekul, 1992). Moreover, the widespread use of pesticides has increased the potential residue-accumulation of these chemicals in honey and hive products (Gillium and Argauer, 1981). While attempts have been made to minimise and regulate the use of pesticides to protect humans and animals, very little has been done so far to safeguard the natural honey bee against the pesticides' toxicity.

To solve this problem, interests in insecticidal botanicals have grown rapidly during recent years. This is because these compounds have

renewable character and they provide products which are safer to humans and the environment. These compounds are also rapidly photo- and biodegradable. Insecticides from pyrethrum and neem have attracted the special interest of entomologists and phytochemists all over the world. They have widely studied the efficiency of these substances when applied to insect pest species. They found that these substances can control many pest species. Neem seed extract in particular, is a substance with high potential for controlling insect pests. It leaves no residues in agricultural products because of its short persistance and biodegradability. Furthermore, the tendency of the insects to become resistant to this substance is less. The main advantage of neem is that it is cheap and widely available in this country. Instead of using expensive chemical insecticides, the cost of production can be much lower. Presently, botanical insecticides have been increasely used to control many insect pests. Before these botanicals can be widely used as insecticides,their impact on the non-target organisms like honey bees must be assessed and studied.

There are comparatively more research data about the toxicity of insecticides to *A. mellifera.* However, very little has so far been done to investigate the comparative toxicity and residual effects of neem extract and cyhalothrin to *A. florea* and *A. cerana*, which are two of the native species of Thailand. The research project described here is aimed specifically at addressing this particular deficiency. It is hoped

that this research could subsequently lead to the accumulation of basic data to determine the correct formulation and concentration of the insecticides against the target pests. In this way, the hazards of insecticide poisoning to the honey bees could be drastically minimised what could lead to the preservation of the biodiversity of these very useful insects.

Objectives

The objectives of this research were :

1. To compare the toxicity of Thai neem extract and cyhalothrin on *A. florea* and *A. cerana.*

2. To study residual effects of Thai neem extract and cyhalothrin on *Antigonon leptopus* plots to *A. florea* and *A. cerana.*

Scope of this research

The comparative studies of the toxicity of Thai neem extract and cyhalothrin on *A. florea* and *A. cerana* were carried out by topical application and by feeding method. The mortality rates of the treated bees and the LD_{50} toxicity values (the amount of a pesticide that will kill 50 percent of the bees contacted or fed) were determined 24 hours after treatment.

The residual effects of Thai neem extract and cyhalothrin on *Antigonon leptopus* plots to *A. florea* and *A. cerana* were studied by

first spraying Thai neem extract and cyhalothrin on *Antigonon leptopus* plots. The pesticide residues were then bioassayed by collecting the flowers from plots. The residue was tested on the bees by topical application and by feeding methods. The mortality of the bees in the cages was determined 24 hours after treatment. A series of bioassays of the pesticide residue found on flowers was made periodically after the treatment, until no further bee was observed to be killed. At this point, it was assumed that the pesticide residue was no longer toxic to bees.

Applications

The results of this research have several potential applications:

1. They can provide basic data on toxicity of Thai neem extract and cyhalothrin to *A. florea* and *A. cerana* .
2. They can be used as guidelines for formulating proper pesticide application strategy which is compatible with environment and living organisms.
3. They can promote the use of botanical insecticides to control pests in bee hives that are safe for honey bees and the consumers since these compounds do not leave residues in bees products.
4. They can help promote widespread use of botanical insecticides in the future.