CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Conclusions.

The study of toxicity of Thai neem extract and cyhalothrin on *A. florea* and *A. cerana* has arrived at the following conclusions :

1. The LD_{50} values of cyhalothrin by topical application on *A. florea* and *A. cerana* at 95 % confidence interval were 0.0003 (0.0002-0.0004) and 0.0034 (0.002-0.0075) µg/bee respectively.

2. The LD_{50} values of cyhalothrin by feeding methods on *A. florea* and *A. cerana* at 95 % confidence interval were 0.0005 (0.0002-0.0033) and 0.018 (0.014-0.023) µg/bee respectively.

3. Cyhalothrin was found to be more toxic by contact than by oral route to *A. florea* and *A. cerana*.

4. The LD_{50} values of Thai neem-seed crude extract by topical application on *A. florea* and *A. cerana* at 95 % confidence interval were 1318.4 and 376.0 µg /bee respectively.

5. The LD_{50} values of Thai neem-seed extract by topical application on *A. florea* and *A. cerana* at 95 % confidence interval were 129.5 and 67.4 µg/bee respectively.

6. Oral toxicity of Thai neem-seed crude extract and neem-seed extract by feeding methods on *A. florea* and *A. cerana* were fluctuating.

7.The LD_{50} values of neem-leaf extract by topical application on *A. florea* and *A. cerana* at 95 % confidence interval were 2021.4 and 3779.6 µg/bee respectively.

8. The LD_{50} values of neem-leaf extract by feeding methods on *A. florea* and *A. cerana* at 95 % confidence interval were 3779.6 and 2021.4 µg/bee respectively.

9. The LD_{50} values of neem oil by topical application on *A. florea* and *A. cerana* at 95 % confidence interval were 325.7 and 380.3 µg/bee respectively.

10. The LD_{50} values of neem oil by feeding methods on *A. florea* and *A. cerana* at 95 % confidence interval were 2110.4 and 4420.5 µg/bee respectively.

11. The LD_{50} values of Margosan-O ® by topical application on *A. florea* and *A. cerana* at 95 % confidence interval were 13619.0 and 5365.2 µg/bee respectively.

12. The LD_{50} values of Margosan-O ® by feeding methods on *A. florea* and *A. cerana* at 95 % confidence interval were 17435.9 and 1788.4 µg/bee respectively.

13. The LD_{50} values of Neemix ® by topical application on *A. florea* and *A. cerana* at 95 % confidence interval were 2099.0 and 789 µg/bee respectively.

14. The LD_{50} values of Advantage ® by topical methods on *A. florea* and *A. cerana* at 95 % confidence interval were 12899.0 and 1621.0

µg AZ/bee respectively.

15 Oral toxicity of Neemix ® and Advantage ® to *A. florea* and *A. cerana* were fluctuating.

16. *A. florea* was found to be more susceptible to cyhalothrin than *A. cerana* but *A. cerana* was more susceptible to neem extract than *A. florea*.

17. The LD_{50} of various neem extracts ranged from 0.12 to 2.97 µg azadirachtin /bee for *A. florea*.

18. The LD_{50} of various neem extracts ranged from 0.05 to 0.37 µg azadirachtin/ bee for *A. cerana*.

The study on the residual effect of Thai neem extract and cyhalothrin on *Antigonon leptopus* to *A. florea* and *A. cerana* has arrived at the following conclusions:

1. No residual effect was detected by topical application and feeding methods on *A. florea* 48 h and 12 h respectively after cyhalothrin application.

2. No residual effect was detected by topical application and feeding methods on *A. cerana* 6 h and 1 h respectively after cyhalothrin application.

3. No residual effect was detected by topical application and feeding methods on *A. florea* 3 h and 1 h respectively after neem extract application.

4. No residual effect was detected by topical application and feeding

methods on *A. cerana* 6 h and 1 h respectively after neem extract application.

5.Cyhalothrin exhibited more potent residual toxicity than neem extract. However, both of cyhalothrin and neem extract exhibited minimal residual toxicity on honey bees.

6. Cyhalothrin exhibited a significantly higher repellant effect than the neem extract to honey bees ($p \leq 0.05$)

Thus, although cyhalothrin exhibited higher residual toxicity than the neem extract on honey bees, its repellent effect on honey bees makes it safer to use in conjunction with other pesticides.

For the study of a field trial to assess the effect of neem extract on *A. cerana*, it can be concluded that the condition within the beehive (weigh, egg, brood, adult, nectar and pollen collection) treated with neem extract was not significantly different from that of a control hive. But, there was a significant effect on the number of larvae in the ninth week. Absconding also occured in some neem extract test cages.

The effect of neem extract on larvae of *A. cerana* was also investigated, and the results showed that the % abnormal larvae in the treated group (neem extract) was significantly higher than that of the control group ($p < 0.05$).

From the results of the research described here, it is concluded that the neem extract is relatively non-toxic to honey bee and it exhibited practically little residual activities on the insects.

On the other hand, the toxicity and residual effects of cyhalothrin on honey bees are rather high. Cyhalothrin can effectively control many pest species that attack crops during the flowering stage, and although they have been proven to be highly toxic to honey bees in laboratory tests, they are still being commonly used in the field because they present little or no hazard when used at recommended rates of application. Farmers should therefore be advised to apply cyhalothrin in proper concentrations and take precautions when spraying the blooming flowers.

Recommendations.

1. The study of toxicity of other pesticides on *A. cerana*, *A. florea*, and *A. dorsata* should be investigated, so that their safe applications on bee habitats can be formulated.
2. Neem derivatives are promising pest control materials, but just how they work on various species is a topic deserving much greater attention. More research is required in the future to study the effects of neem extracts on hormone regulation and hormone receptors.
3. The research on the use of neem extract to control the pests of honey bee such as mites or wax moths should be carried out and intensified in the future.

The studies and research recommended above could support the

use of botanical insecticide in agricultural area. Neem extract is an especially suitable insecticide for our country. Thai neem trees are found easily in many parts of Thailand. The Forestry Department has decided to use neem trees in its reforestation programme.

Neem is a tree for solving global problem. It is a fascinating tree and it is one of the most promising of all plants which may eventually benefit every person on this planet. Probably no other plant yields as many strange and varied products or has as many exploitable by-products as the neem tree. Indeed, as foreseen by some scientists, this plant may usher in a new era in pest control, provide millions with inexpensive medicines, cut down the rate of human population growth, and perhaps even reduce erosion, deforestation, and the excessive temperature of our overheated globe.