Mites, Pests and Beekeeping With *Apis cerana* and *Apis mellifera* in Thailand

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Introduction

THE FIRST description of honey bees in Thailand appeared about 700 years ago, describing a swarm of bees seen at a certain pagoda in Sukhothai province (Anonymous 1984). An inscription about honey bees from the Suknothai Dynasty (1238-1438) was found at Srichum monastary (Fig. 1). There are two illustrations of native honey bees in the Natural Museum of Thailand, showing presumably a giant honey bee, *Apis dorsata* and a colony (Wongsiri and Tangkanasing 1986a). Some ancient medicinal recipes were inscribed in stone during the reign of King Jayavarman VII (1181-1215) in Surin province, telling of the use of medicinal plants mixed with honey as well as the use of beeswax for candles and cosmetics (Kaewklai 1985). A description of using honey was also found at Angkor Wat in Cambodia (Giteau 1976). The raising of honey bees, *A. cerana*, began over a hundred years ago in Thailand when villagers started to keep bees in coconut plantations on Samui Island (Areekul 1979).

Modern beekeeping in Thailand started in the early 1940's. European honey bees in moveable frame hives were introduced at Chulalongkorn University for research, but they did not survive (Wanitwattana 1944). The second introduction of *A. m. ligustica* was made by Saman Watanakit in 1953 at Kasetsart University, but it was also unsuccessful. Subsequent introductions were made, however, beekeeping did not succeed as an industry until the early 1970's. Table 1 and Fig. 2 show the changes in the number of beekeepers and of their colonies between 1975 and 1986. There was a boom in beekeeping after 1980, due to the low honey production from the native bees. The number of colonies has increased ever since (Fig. 2).

Present beekeeping

At present, four species of honey bees are present in Thailand: the giant honey bee, *A. dorsata;* the little honey bee, *A. florea;* the Asian hive bee, *A. cerana* and the European honey bee *A. mellifera*, which includes Italian bees, *A. m. ligustica*, and Carniolans *A. m. carnica*. The biology of honey bees in Thailand has been studied by Akratanakul (1976), Areekul (1979), Seeley et al. (1982) and Wongsiri and Tangkanasing (1986b).

Based on discussions with beekeepers and a review of the statistical records of the Thai Department of Agriculture, we estimate that there are now 46,000 colonies of honey bees maintained in hives, of which about 38,000 are *A. mellifera* and 8,000 are *A. cerana*. There are also many wild *A. cerana* colonies throughout the country.

Beekeeping with *A. cerana* in Thailand has not advanced to the same level as presently found in China (Wongsiri et al. 1986) and India. In most cases the colonies are wild colonies transferred to modern hives. These bees can produce 5-10 kg. of honey per year (Wongsiri and Tangkanasing 1986a). They are very prone to swarming and absconding, their egg laying rate is lower than *A. mellifera*, and no method of queen rearing is practiced except in research (Annual Report 1986).

The method for rearing queens of *A. mellifera* (Laidlaw 1979) was applied to *A. cerana* queen rearing at the Chulalongkorn Univ. Bee Biology Research Station in Samut Songkram province, where up to 50% of the grafted larvae were accepted (Fig. 3).

Mites

The most feared enemies of the honey bee (*A. mellifera*) are the exoparasitic mites *Varroa jacobsoni* and *Tropilaelaps clareae* which attack bees all year around. *Tropilaelaps* is un-

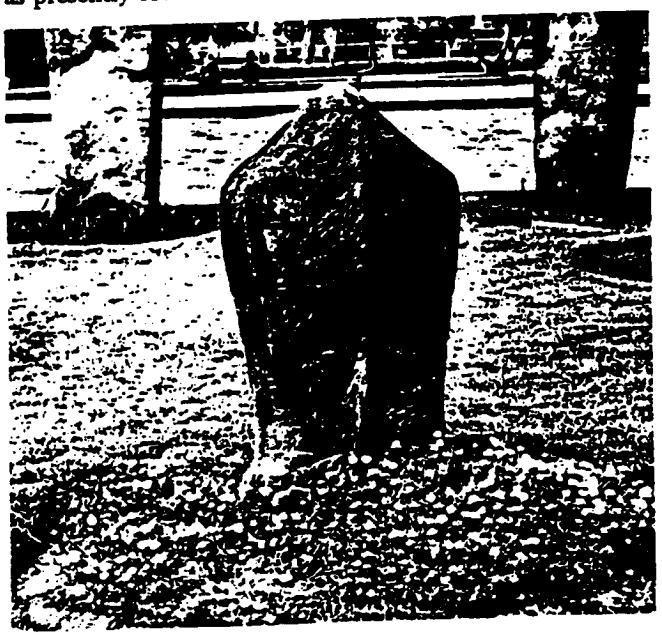

Figure 1. The inscription about honey bees from Sukhothai Dynasty (1238-1438). National Museum, Bangkok.

doubtedly the most serious pest. It reproduces more quickly than *Varroa*, is smaller, and thus is less likely to be identified as the cause of problems. In some ways it suppresses the reproduction of *Varroa* in a simultaneous infestation (Burgett et al. 1983, Burgett and Akratanakul 1985). These mites, especially *Tropilaelaps*, are almost surely the main cause of the failure of the earlier introductions of *A. mellifera* into Thailand, and probably in other Asian countries also. However, the use of various methods of mite control has now made possible the successful introduction of European honey bees. Relatively few acaricides are harmless to bees, but toxic to mites. Two exceptions are amitraz[2] and coumaphos,[2] based on observations in northern Chiang Mai, where beekeepers treat their colonies up to 7 times over 21 days. There is no doubt that continuous use of chemicals can give rise to resistant strains of mites; for example, powder of sulphur with naphthalene that was used before amitraz and coumaphos is no longer effective for mite control in some apiaries in northern Thailand. A few chemicals such as Asuntol[2] (coumaphos) and Perizin[2] (coumaphos) are effective for *V. jacobsoni*, but not for *T. clareae;* amitraz and powder of sulphur with naphthalene are effective on *T. clareae*, but mites in some colonies have developed resistance to amitraz (Wongsiri et al. 1987). Research on combinations of two different control methods led to a method for protecting bees from the mites. This integrated control method is based on 1) caging the queen, and 2) chemical control. Caging the queen involves enclosing the queen in a small cage made from queen excluder. This allows the queen to interact with the colony, but prevents her from laying eggs. Two methods of caging age: 1) caging the queen for 9 days and moving all sealed brood to other hives, or 2) caging the queen for 21 days; the absence of developing brood can disrupt the life cycle of the mites. The results of the caging methods show that *Tropilaelaps* cannot survive due to a lack of their food source (haemolymph of honey bee larvae). *Varroa*, however, are able to survive since they feed on adult bees. Combined with the use of the chemical coumaphos (Asuntol[2] : 0.8 gm/liter of water, sprayed inside the hive 2 times 3 days apart[3]) the results indicate that this integrated management program is effective in controlling more than 95% of both *Varroa* and *Tropilaelaps* (Tangkanasing et al. 1987).

Mites do not appear to be a problem with *A. cerana*. We, as well as other scientists, have never seen mites or symptoms of their damage on worker bees (Koeniger 1985; van Heemert and Siebenga 1986; Wongsiri et al. 1986).

Table 1. Number of *Apis mellifera* and *A. cerana* colonies in Thailand (Thai Department of Agriculture 1986)

Area	*Apis mellifera*		*Apis cerana*	
	No.Beekeepers	Colonies	No.Beekeepers	Colonies
North	612	28,800 2,000*	50	310
North East	182	2,500	62	620
Central	81	1,600	51	90
East	54	1,490	40	201
West	41	630	311	810
South	31	1,300	312	5,920
Total	1,001	38,320	826	7,951

*Non-members of the Northern Beekeepers Association

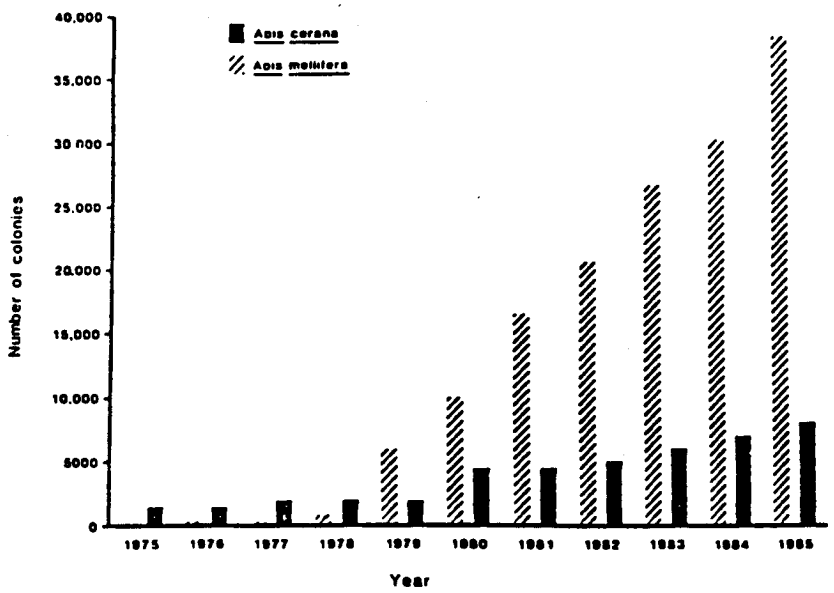

Figure 2. Number of *Apis mellifera* and *A. cerana* colonies in Thailand

Koeniger et al. (1981) reported that the reproductive female *Varroa* enters both worker and drone brood cells but lays eggs only in the latter. As yet, the mechanism of mite resistance in *A. cerana* is not fully understood (Koeniger 1985).

Some very promising recent research by Peng et al. in China (1987a) has shown that *A. cerana* possesses a behavioral and physiological resistance mechanism to *Varroa*. There is a detectable physiological response of worker bees to the presence of mites on their bodies, self and group cleaning behavior, mite removal from brood, and mite killing. The European bees show this behavior at very low frequency. We have also observed that *A. cerana* rapidly detect, bite, kill and remove mites from their colonies. Peng et al. (1987b) also report related research studying the responses of *A. cerana* colonies to *A. mellifera* brood infested with *Varroa*. This is one aspect of the intriguing possibility of using two-species colonies to control *Varroa* (Fig. 4). However, other important behavioral and ecological considerations as well as problems with maintaining two-special colonies are discussed in this report.

The selection of strains of *A. mellifera* having behavioral resistance or transferring such resistance from *A. cerana* by genetic engineering may be a solution to the *Varroa* problem in *A. mellifera*, which would be of great value to beekeepers throughout the world. Whether selection of European bees, or genetic engineering, will be the answer to the *Varroa* problem depends on a much better understanding of *Varroa* resistance in *A. cerana* and whether resistance can be found or developed in *A. mellifera*.

Other Pests

Wasps and bee-eating birds are also significant enemies of *A. mellifera*, and are more easily identified and controlled (Wongsiri et al. 1985).

A. cerana does not seem to have enemies which cause problems comparable to those found with *A. mellifera*. However, we have found that both wax moths, *Galleria mellonella* and *Achroia grisella* are problems in managed colonies and a cause of absconding in *A. cerana*.

Figure 3. A cell bar frame with one cell bar (I) and 8 queen cells from 10 grafted larvae of *A. cerana* were accepted (II).

Controlling external honey-bee mites with in terspecies mingling

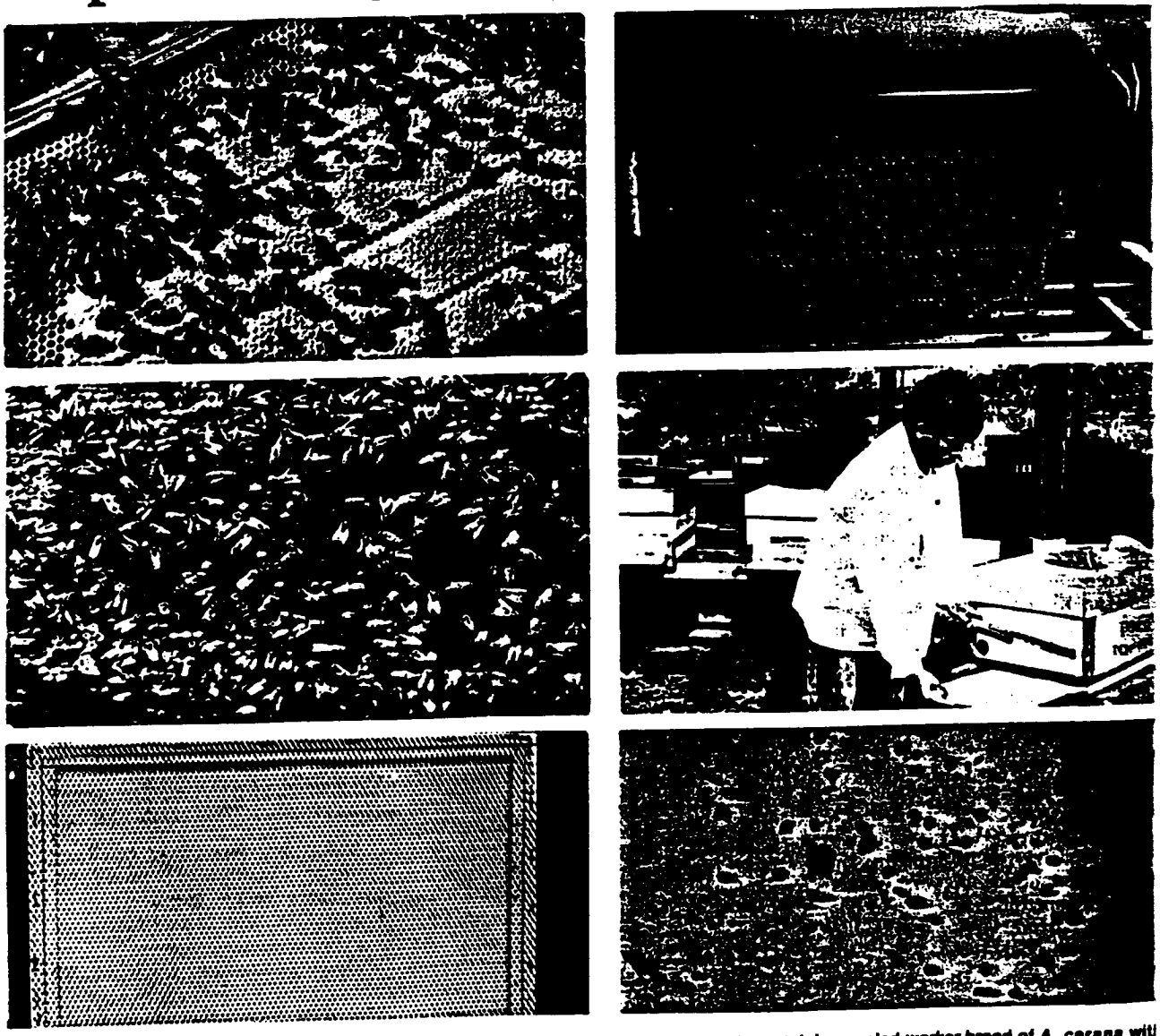

Figure 4. Using two-species colonies to control Varroa: (I) selecting a healthy comb containing sealed worker brood of *A. cerana* with any drone brood because the mites usually infest drone brood, (II) placing the frame (1) into an *A. mellifera* mite infested colony, (III) the spe live together and *A. cerana* help to clean, bite and remove mites from *A. mellifera* which are bigger than *A. cerana*, (IV) a mite checking in (VI) abnormal dead mites were found on a mite checking insert.

Conclusion

Beekeeping in Thailand, especially with *A. mellifera*, has increased greatly in the last few years and is now an established industry. Recognition of parasitic mites as a problem and development of methods for their partial control has contributed greatly to this expansion. Important problems still remain to be solved in beekeeping in Thailand, especially regarding parasitic mites on *A. mellifera* and the development of efficient beekeeping practices for *A. cerana*. Nevertheless, these problems are amenable to research and training efforts. While the basic biology of *A. cerana* has been under investigation by other scientists and our colleagues in the Bee Biology Research Unit, Chulalongkorn University, *A. mellifera* will probably remain the favored species of honey bees for commercial beekeeping. *A. cerana* may become the favored species for small-scale beekeeping where a low capital investment is critical, especially if the problems of queen rearing and absconding can be solved.

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FOOTNOTES

[1]In cooperation with Louisiana Agricultural Experiment Station.

[2]Mention of a commercial or proprietary product does not constitute an endorsement by the USDA.

[3]Mention of this method does not necessarily constitute an endorsement by the USDA.

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