

Basic Knowledge of Beekeeping

Paitoon Seanbualuang

Biology Program, Faculty of Science, Ubon Ratchathani Rajabhat University, Ubon Ratchathani Province, 34000, Thailand.

Corresponding Author. E-mail address: seanbualuang@gmail.com

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Summary

Beekeeping history in Thailand has been recorded since 1940. There are many research institutions that recognize the potential of beekeeping to raise the nation's economy and promote beekeepers incomes. Beekeepers establish honeybee colonies for several reasons such as for a hobby, a sideline, or for commercial purposes. New beekeepers or hobby beekeepers often keep bees using techniques passed down for generations. Many factors influencing beekeeping – diseases, pests, etc., may be more challenging for the new and hobbyist beekeepers. Additionally, awareness of bee biology and beekeeping is limited only to academicians. It is essential to distribute such knowledge to new beekeepers and interested people. The main objective of this paper is to provide basic knowledge about beekeeping and list some research institutions and bee farms where beekeepers can find more information.

Keywords: Beekeeping, bee flora, bee diseases

Introduction

Beekeeping is the establishment and maintenance of honeybee colonies by beekeepers (the person who takes care of bee colonies). The activities which beekeepers have to do are the checking of bee colonies, checking of the presence of the queen, establishment of new colonies, control of the colony's pests and diseases, moving of bee hives to food sources, nourishment of the colonies in spring, maintenance of bee hives, and harvesting of the hive products.

Beekeeping is done with honeybees that build their nest in a hive which traditionally has been made from tree trunks and commercial wood hives. They use mainly the European honey bee *Apis mellifera* and the Asiatic honey bee *A. cerana*.

The first report of beekeeping in Thailand was recorded in 1940 by Professor Supachai Wattana, a professor in biology. He adopted foreign honeybees to study at Chulalongkorn University, Bangkok. In 1953 Professor Saman Worakitta, who at that time served as the Dean of Agriculture, Kasetsart University introduced European honeybees from Australia and raised them on the campus. However, the operation was not successful due to a lack of skills and knowledge to manage the colonies and disruption of the colonies by certain diseases (สิริวัฒน์ และคณะ, 2528). Later, Thailand established a cooperative agreement with Taiwan to exchange and share knowledge in various fields. Taiwan sent bee experts to advise farmers in northern Thailand. However beekeeping was still narrow along with several

limiting factors. Until 1976–1979, private companies hired specialists from Taiwan for management and operation of the companies in Thailand. The companies recruited Taiwanese entrepreneurs to give them instructions so that bee companies could run businesses successfully and they could export bee products worldwide.

Since 1980, the Thai government has recognized the importance of bees to the national economy and has realized that beekeeping can help beekeepers to raise their incomes. The government has a policy to encourage and promote agricultural apiarists. The Ministry of Agriculture and Cooperatives is an agency responsible for promoting and educating farmers on beekeeping. For new apiarists, they can find information about bee keeping from government resources and they can have training courses and advice provided by organizations distributed over the country which include:

1. Department of Agriculture
2. Department of Agricultural Extension
3. Agricultural Extension and Development Center Chiang Mai (Beekeeping)
4. Agricultural Extension and Development Center Phitsanulok (Beekeeping)
5. Agricultural Extension and Development Center Khon Kaen (Beekeeping)
6. Agricultural Extension and Development Center Chanthaburi (Beekeeping)
7. Agricultural Extension and Development Center Chumphon (Beekeeping)

Many universities in Thailand have researchers who have been studying honeybees. They can educate and provide suggestions for beekeepers. Some research units have their own apiary. Others cooperate with beekeepers and local communities. To receive information about bee biology and beekeeping you can go to any of the universities shown below:

1. Bee Biology Research Unit, Department of Biology, Faculty of Science, Chulalongkorn University, Bangkok, Thailand 10330
2. Department of Entomology, Faculty of Agriculture, Kasetsart University, Bangkok, Thailand 10900
3. Department of Agricultural Technology, Faculty of Science, Ramkhamhaeng University, Bangkok, Thailand 10900
4. Department of Biology, Faculty of Science, Burapha University, Chon Buri, Thailand 20131
5. Department of Entomology, Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand 40000
6. Department of Entomology, Faculty of Agriculture, Chiang Mai University, Chiang Mai, Thailand 50000
7. Department of Agricultural Science, Faculty of Agriculture Natural Resources and Environment, Naresuan University, Phitsanulok, Thailand 65000

There also are beekeeper or apiculturist associations with regional and local branches such as the Beekeeper Association of Northeastern Thailand, the Beekeeper Association of Thailand (<http://thailandbee.net>), and the Thai Organic Beekeeper Association (<http://www.thaiorganicbee.net>) which can help beekeepers. Many private bee farms, for example Supha Bee Farm, Chiang Mai (<http://www.suphabeefarm.com>); Thailanna Apiculture, Chiang Mai (<http://www.thailanna.co.th>); Phatthanakit Bee Farm, Chiang Mai (<http://www.phatthanakit.com>); Big Bee Farm, Chon Buri (<http://www.bigbeefarm.com>); and Ladda Honey Farm, Chaiyaphum are good beekeeping resources and the farms have assisted communities and new beekeepers.

For instance, the aims of this article were 1) to provide a brief history of beekeeping in Thailand and beekeeping resources, and 2) to distribute basic knowledge of beekeeping to new beekeepers and interested people.

Beekeeping

Beekeeping is still done chiefly to produce honey,

but there are also other types of operations which include the production of royal jelly and bee wax, establishment of bee colonies and the selling of queens. Other types of beekeeping offer bees to pollinate crops. However, beekeepers may operate either to produce honey or to produce royal jelly on the same farm. Each type of production requires specific experience and management of colonies to control bees in their required task. Furthermore beekeepers have to rear more foragers to produce more honey, or bring up more young house bees to produce royal jelly.

The cavity nesting honey bee *A. cerana* and European hive honey bee *A. mellifera* are the primarily species used for beekeeping. *A. cerana* has been recognized as native to eastern Asia including Laos, Thailand, and Malaysia. Most races of *A. cerana* are slightly smaller than *A. mellifera* and they have smaller colonies. Unlike *A. mellifera*, *A. cerana* provides fewer products for beekeepers. *A. cerana* does not gather propolis and its colony has more ability to resist mites than that of *A. mellifera*. In nature they build their nest in logs or in cavities of many things, for example rock clefts, old wardrobes, or logs. Many local beekeepers construct beehives according to their folk wisdom. They drill out the core of tree trunks and cover both ends with wooden lids. Three to five inches from the bottom of the hive they make a hole for bee entrance. Most honeybee farms use movable-frame hives for *A. cerana*. Management of the colony is easier, but beekeepers have to always feed sufficient food and protect the colony from its enemies (ants, wasps) to minimize absconding by colonies. Though *A. cerana* nests are found distributed throughout the country, a major beekeeping area of *A. cerana* is Southern Thailand including Chumphon, Surat Thani, Nakhon Si Thammarat, Trang, Phattalung, Songkhla, Pattani, and Satun.

A. mellifera is an introduced species and it is the predominant species for beekeeping since *A. mellifera* foragers have high ability to collect nectar. They use a specific chemical called "forage marking pheromone" to communicate to their nest mates. In addition, foragers will mark flowers with the pheromone after they have collected nectar. This will tell other foragers to avoid the flowers and go to other ones.

The number of beekeepers rearing *Apis mellifera* across the country according to information provided by the Agricultural Extension and Development Center is 887 as shown in Table I.

Table 1. Number of beekeepers and honey bee colonies according to center.

Province	No. of beekeeper	Total Colonies	Average
Agricultural Extension and Development Center Chiang Mai			
Chaing Mai	127	31,170	245
Chiang Rai	62	21,270	343
Lamphun	75	18,870	252
Lampang	27	1,510	56
Phayoa	12	6,870	573
Phrae	106	33,450	316
Nan	54	7,000	130
Total	463	120, 140	259
Agricultural Extension and Development Center Phitsanulok			
Chai Nat	1	150	150
Kamphaeng Phet	1	20	20
Nakhon Sawan	1	150	150
Phetchabun	2	1,300	650
Sukhothai	1	100	100
Phichit	12	1,590	133
Phitsanulok	24	6,750	281
Uthai Thani	4	180	45
Uttaradit	55	12,051	219
Total	101	22,291	221
Agricultural Extension and Development Center Khon Kaen			
Khon Kaen	20	2,920	146
Udon Thani	32	5,586	175
Roi Et	4	1,470	368
Nong Khai	3	126	42
Loei	17	3,349	197
Chaiyaphum	6	580	97
Maha Sarakham	4	400	100
Sri Sa Ket	5	420	84
Amnat Charoen	3	510	170
Nong Bua Lam Phu	9	1,468	163
Nakhon Ratchasima	12	1,530	128
Buri Ram	4	160	40
Surin	1	850	850
Ubon Ratchathani	1	88	88
Total	121	19,457	161
Agricultural Extension and Development Center Chanthaburi			
Chanthaburi	18	1,480	82
Sa Kaeo	3	210	70
Saraburi	35	970	28
Lop Buri	27	12,540	464
Kanchanaburi	12	1,180	98
Total	95	16,380	172

Table 1. Continue

Province	No. of beekeeper	Total Colonies	Average
Agricultural Extension and Development Center Chumphon			
Chumphon	24	1,970	82
Surat Thani	21	354	17
Nakhon Si Thammarat	18	323	18
Trang	3	57	19
Phattalung	24	72	3
Songkhla	12	720	60
Pattani	3	255	85
Satun	2	210	105
Total	107	3,961	37

Beekeeping is also done with stingless bees (Apidae: Meliponinae) that are reared for pollinating economical crops; rambutan, zalacca, and durian (*Durio* spp.) in certain areas such as Chanthaburi, Eastern Thailand. Nests of *Melipona* species are built in protective cavities like tree hollows or in the ground. Within the nests, there are two-divisions – brood cell and food storage – clearly separated from each other. Brood cells are oval-shaped, light brown to yellow. Food storage pots contain either honey or pollen, they are generally intermixed in the same area. Most of the honey pots are dark-brown and grouped next to the brood chambers, whereas pollen pots are lighter than those of honey pots as shown in Figure 1.

The nest architecture of stingless bees is fundamentally different from that of honeybee nests. A number of pioneer hives for stingless bees have been reported. These include the ‘Nogueiro-Neto’ hive and the ‘Utrecht University-Tobago Hive’ or UTOB hive (Sommeijer, 1999).



The hives of stingless bees found in Thailand are smaller than those of *Apis* hives. They are composed of base, hive stand, and two hive boxes – the inside one is made from acrylic or clear glass, and the outer bigger one is made from wood. The smaller hive box serves as a place where stingless bees build their nest. It is easier to observe the stingless bee nest, so the transparent materials are used. The clear hive box may be temporarily fixed with the base. The outer one is used to cover the smaller one. A tiny hole at the hive box bottom serves for the nest entrance.

Stingless bees are reared because they help pollinate economical crops. Harvest of honey from the nest is not the main purpose of beekeepers. However, honey collected from stingless bee nests is more expensive than that of honey produced from honeybee nests in the same volume.





Beehive

A beehive is an enclosed structure in which certain honey bee species live and raise their young. Traditionally, the beehive is made from wood. It is generally composed of a base or floor (a bottom board, a hive sits on, a few inches longer than the brood box), a brood box or brood chamber (a bottom box where the queen lays her eggs and young bees are being fed), a honey box (top box where most of the honey is stored),

frames (where bees build combs for egg laying and honey storage, has 4-side bars, may be wooden or plastic), a queen excluder (retains queen in brood nest, flat slotted zinc, plastic or wire that lies on top of the brood chamber), a wax foundation (thin sheet of beeswax about the same size of the frame), an inner cover or crown board (a board placed between the honey box and lid for prevention of the frame sticking on the lid due to propolis), and a lid (top outer roof helps to protect the beehive from rain).

In Thailand however, beehives are built in one piece and never in separated parts. For instance the base, brood box, and honey box are united together. There are 8-9 removable frames each. The bee hive is set on a stand which is usually 1.5 to 2 ft in height to prevent dampness getting into the hive. Stands also keep honey thieves like ants out of the colony by applying lubricant on the stand legs. A hive stand can be made from either wood or metal.

Beekeepers will require some equipment to manage bee colonies. Initially, they will need a hive tool and smoker. The hive tool is a simple metal bar sharpened on either end. This is used to pry apart the frames that have been glued by propolis and to open the lid which is sealed by bees. A smoker calms down bees as smoke in some way disrupts the bee's sensory mechanisms, subsequently reducing aggressive behavior. One other thing is a veil with drawstrings. This is very beneficial for the beekeeper for protection from getting stung by bees.

A honey extractor is a machine utilized to extract honey out of the honey combs by spinning them. It is the fastest and easiest way of getting the honey. They come in many sizes and can be built at home. An uncapping knife is used to remove wax caps from the frames. Knives must be heated before use. Electrical heated knives are also available.

Bee flora

In nature bees visit plants for finding its food, nectar and pollen. Besides getting food for the bees another result of their visit is to pollinate a number of crops. During the cold season (October to January), beekeepers keep bee colonies on the farm and feed them with a sugar syrup and pollen mix. During blooming periods (February to May) bee colonies will be moved to orchards or crop cultivation areas across the country to collect nectar and pollen. Longan (*Dimocarpus longan*) and lychee (*Litchi chinensis*) are both major crop plants. They are subtropical trees from the Sapindaceae family and thought to be native to northern Thailand. The major provinces where the crops are cultivated are Chiang Mai, Lamphun, and Chiang Rai. Rambutan (*Nephelium lappaceum*), the rubber tree (*Hevea brasiliensis*), and zalacca (*Salacca zalacca*) are the main bee flora in the eastern region; Chanthaburi, Rayong, and Trat. Shorea roxburghii, cotton (*Gossypium herbaceum*), and corn (*Zea mays*) are found in the north eastern region; Nakhon Ratchasima, Khon Kaen, Loei, Nong Khai, Nakhon Phanom, and Ubon Ratchathani. Sunflower *Helianthus annuus* L. is the primarily crop grown in the middle; Saraburi, Lop Buri. Siam weed (*Chromolaena odoratum*), sensitive plant (*Mimosa pudica*); a native species to Thailand distributed over many areas are another nectar sources. Sesame (*Sesamum indicum*) and oil palm (*Elaeis guineensis*) are grown in several areas including Lop Buri, Saraburi, Nakhon Sawan, Phetchabun, Samut Songkhram, Kanchanaburi, Sa Kaeo and Nakhon Ratchasima.

Bee diseases, parasites, and predators

Honeybee diseases cause reduction of the hive production. There have not been any reported outbreaks of severe disease among bee farms in Thailand. Though there are several areas where bacterial infections are found which causes European foulbrood and fungi infections which causes Chalkbrood disease in *A. mellifera*

Nosema disease (Nosemosis) is generally considered as one of the most serious diseases of adult bees. Nosemosis is caused by spore-forming microsporidian *Nosema*. It infects the midgut of bees after ingested spores through trophallaxis which cause diarrhea in adult bees. The main destruction of the colony by *Nosema* is the reduction of colony populations, as a result hive production decreases. There have been reported infections of *Nosema* in European honey bees and Asiatic hive honey bees worldwide (Bailey, 1955; Bailey and Ball, 1991; Fries, 1997; Fries et al., 2006; Higes et al., 2006; Chen et al., 2008; Huang et al., 2007). Recently there is a first report of *Nosema ceranae* infection in honeybee workers of *A. cerana*, *A. florum* and *A. mellifera* in Thailand (Guntima et al., 2011).

The predominant problem of beekeeping in Thailand is varroa mites (Wongsiri et al., 1989). Varroa causes injury to honeybee brood by direct feeding on bee blood "hemolymph". Varroa mites may not seriously damage adult bees, if the infestation is not severe. However varroasis is a brood disease. If the female mites infest brood cells the brood deterioration will occur including distorted wings and shortened abdomen. Conventional treatment of the infested colony is fumigation with either scented lemongrass and eucalyptus or organic acids such as oxalic acid, lactic acid, and formic acid. A pad of cotton or other absorbent matter soaked with acid is placed over the top bar of the comb in each hive. For severely infested colonies, burning is usually selected (Jong et al., 1982; Wongsiri et al., 1989).

Ants are the most common predators of honeybees in Thailand. They are highly social insects and will bother the hives all together, to take almost all the appreciated things in the hive; honey, brood, and adults either dead or alive. Among the most frequently found ants are black ants and red ants. Beekeepers can prevent this destruction by searching out the ant nests in the proximity of the apiaries and, when found, burn them. A common method to stop hive devastation from ants is to rub the hive stand posts with engine oil or any lubricant. A more reliable method of defense against ants is to place the hive stand posts in plastic pots or cans filled with either water or oil. Liquids require replenishment regularly and removal of all vegetation which can be the foundations of bridges that can be crossed by ants (Caron, 2000).

Wasps and hornets are also an enemy of a bee colony. They attack a weak colony en masse, using their strong mandibles to bruise the guardian bees at the hive

entrance and then drop the dead and dying bees to the ground. The colony under attack will lose its defenders, hornets then invade the hive and carry away honey and brood to store in their nest. This invasion is common in wasps (Caron, 2000).

Conclusions

Beekeeping basics are the major factor involved in the beehive itself. Over the last seven decades, Thai beekeepers have skillfully enhanced their style in cultivating beehives to acquire more honey painlessly and effortlessly. However, not every beekeeper is successful in their occupation due to a lack of basic knowledge. Some generate beekeeping as their pastime. In addition new beekeepers need more skills and practice to manage beehives. It is necessary to update the beekeeping situation such as honeybee diseases, new markets for bee products, and government policy. For the interested person who will begin beekeeping, there is now an increasingly growing concern about a mysterious shortage of honeybees. The bees are vanishing due to something called colony collapse disorder (CCD). Many publications have claimed the causes of such circumstances are due to pathogens, malnutrition, genetically modified crops, pesticides, viral and fungal combinations, and electromagnetic radiation.

There are several researchers that have reported the finding of a new disease, noseosis, in Thailand, although these findings were only found in some regions and there is no report about the distribution of the disease. Moreover beekeepers do not need to be concerned about an outbreak yet. It is important that beekeepers know about the circumstances and geographic distribution of the disease. Observations and checking nosema from beehives over the country should be investigated as well as finding methods to cure and protect the hive from the disease.

It is markedly noted that there is a well documented beekeeping at regional Agricultural Extension and Development agencies, academic institutions, and other government organizations where supporting materials and technical information is ready to serve.

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