CHAPTER - 1

INTRODUCTION

1.1. Background of the study

Apis dorsata (Fabricius 1793) the tropical giant honeybee, is the largest bee in its genus and is found throughout tropical regions of Asia (Ruttner, 1988) ranging from 10-1600 m above the mean sea level in Thailand (Wongsiri et al., 1996a). It is the largest honeybee in terms of nest and body size. In Thailand it is commonly known as "the king of honeybees" (Wongsiri et al., 1996a). *A. dorsata* builds a single comb 1.8-2.0 m wide and 1.0-1.5 m high underneath stout branches of a tall tree or overhanging surfaces of buildings, water towers and cliffs (Roepke, 1923; Fletcher, 1952; Butler 1962; Frisch 1967; Seeley et al., 1982; Crane, 1990; Wongsiri et al., 1996a). Morse and Laigo (1969) have observed *A. dorsata* nests at different heights above the ground in Philippine. The average number of worker bees in a colony ranges from 5,000-70,000 individuals (Seeley et al., 1982; Moritz et al., 1995; Wongsiri et al., 1996a).

1.2. Statement of problems

In Thailand *A. dorsata* is assumed to be a key pollinator of tropical forest ecosystems. It is productive honeybee and is seasonally harvested by burning the whole nest including brood and adult bees (Wongsiri et al., 1996a). The traditional honey harvesting methods is very devastating for the reproduction and survival of the species. Furthermore, land clearing and urban development may force *A. dorsata* to nest on man made structures: buildings and water towers. The resulting combination of destructive harvesting and removal of their natural nest sites has led to an unremarkable decline in populations in Malaysia and Thailand (Mardan, 1989; Wongsiri et al., 1996a).

1.2.1. Colony migration

Migration, one of the most important forms of insect dispersal, is a fascinating phenomenon. The migratory behavior of *A. dorsata* has been well documented in limited number of countries in Asia (Husain, 1938; Lindauer, 1957; Morse and Laigo 1969; Deodikar et al., 1977; Seeley et al., 1982; Koeniger and Koeniger, 1980). In many areas the bees seasonally migrate from plains to hills and *vice versa* from 50-200 km (Lindauer, 1957; Deodikar et al., 1977; Koeniger and Koeniger 1980; Dyer and Seeley, 1994). The most interesting migratory behavior of *A. dorsata* is that they leave their nest sites with empty combs annually in unfavorable conditions and the same nests sites are re-occupied during the favorable conditions (Singh, 1962; Deodikar et al., 1977). It raised a question that whether the colonies occupy a used nest site tend to be related to the previous occupants.

1.2.2. Colony aggregation

En-mass aggregation of many colonies is another significant feature that can be observed only in *A. dorsata* and *A. laboriosa* (another giant single open nest honey bee found at high altitude). When colonies of *A. dorsata* migrate, they usually aggregated en-mass on a single support (Figure 1). Aggregations of *A. dorsata* colonies have frequently been reported (Wallace, 1869; Mjoberg, 1930; Bridgnell, 1946; Butani, 1950; Morse et al., 1967; Deodikar et al., 1977; Koeniger and Koeniger, 1980; Seeley et al., 1982; Wongsiri et al., 1996a) (Table 1).

Figure 1. Sixty-nine colonies of *A. dorsata* on a single bee tree in Mae Sarin waterfall, Mae Hong Son province.

A very large aggregation (>50 nests) are very rare (Table 1). However, large aggregation (>50 nests) is very common on tall water towers. For instance, in 1997, 72 colonies of *A. dorsata* were counted on a water tower of Rampur Campus in Nepal (Thapa and Wongsiri, 1997 unpublished data).

Table 1. Number of *A. dorsata* nests observed (> 50 nests) in Asia.

Authors	Year	Country	Number of nests aggregated on a single support	Nest Site
Butani	1950	India	67	Tree
Lindauer	1957	Sri Lanka	92	Tree
Singh	1962	India	160	Tree
Koeniger and Koeniger	1980	Sri Lanka	60	Tree
Seeley et al.,	1982	Thailand	60	Tree
Wongsiri et al.,	1996a	Thailand	69	Tree
Thapa and Wongsiri	1997	Nepal	72	Water tower

Seeley (1985) has reported that the aggregation of *A. dorsata* nests on a single tree is due to a lack of other suitable nest sites near by. Oldroyd et al., (1995) suggested that aggregation phenomena of many nests on a single support is to facilitate multiple mating (polyandry) and they raised the questions that whether aggregated nests on a single support might be an extended family members. However, it is unknown that whether aggregated nests on a single support are related family (as mother and daughters) or different families. If they are related, then it is hypothesized that swarms prefer nearest nest site. or If they are unrelated, then it is hypothesized that aggregation is a result of lacking of suitable nest sites or to enhance the outbreeding. Therefore, it is interesting to know that why *A. dorsata* usually aggregated on a specific tree (*Kompassia excelsa* Taub.) nest site (Figure 1). Is this an indication that *A. dorsata* is a highly socialized insect? Is it because of cooperative mutual defense or outbreeding or due to a lack of suitable nest sites ?

1.2.3. Nest sites desertion strategies

A. dorsata regularly abandons their nest site. The reasons why bees of *A. dorsata* is being deserted their existing nests are not clearly understood. Is it due to nest predation or parasitism or harsh environmental factors or due to scarcity of floral resources or it is just a hygienic behavior to minimize the parasitic mites pressure? These are opening questions. Again there is no any literature on what factors really cause *A. dorsata* to abandon their nest sites so frequently compared to other cavity nest honeybees; *A. cerana* and *A. mellifera.*

1.2.4. Old nest sites selection/preference strategies

Eventually, colonies of *A. dorsata* regularly return and select the same nest site even through the deserted combs are usually destroyed to a great extent during the absence of the bees. Again, it is unclear what cues help bees to recognize or select the same nest sites. Is it because of value of old existing combs which they can re-used the old remnant combs for constructing a new nest? Is it because of the old nest sites are highly protective? Do existing nest sites have particular good access to floral resources?

1.3. Significance of this research

(i). If the colonies occupied the same nest site found to be unrelated that indicates swarms of *A. dorsata* use old combs to orientate their new nests.

(ii). The significant dimension of this research is to study of migratory behavior of *A. dorsata*. If the aggregated colonies on a single support are found to be related extended family member, it would be the first indication of polydomous (having many nests) life history strategy of *A. dorsata* which might indicate that aggregated strategies have

evolved to promote mutual defense (Koeniger, 1975) and to enhance outbreeding (Oldroyd et al., 1996).

(iii). At a practical level, if the factor (old comb manipulation experiment) that attract swarms to particular nest sites can be elucidated, that means of attracting swarms for honey production may be determined.

(iv). This research may assist in species conservation of *A. dorsata* by providing valuable information on the demography of *A. dorsata* in Thailand. Due to lack of suitable nest sites *A. dorsata* may have forced to construct their nests on smaller trees or on the man made structures where they are more vulnerable to predators. Therefore, this research would help to preserve the tropical giant honeybee; *A. dorsata* by providing the relevant information on suitable nest sites.

1.4. Scope and limitations of this research

The findings of this research can not be generalized for all *Apis* species which are existed in other geographically and physiologically different environment.

In this research samples were not collected from all established nest sites located on man made structures due to unable to get permission from building owners. Therefore, in this study, 5 colonies occupied to the same nest site: the particular window of the health care center building from 1993-1998 (Figure 8) were used to test hypothesis-I: colonies regularly occupying the same nest site are related family members or not.

Similarly, three aggregated colonies on a water tower of the Maejo University (Figure 9), 2 colonies on the health care center building and 2 colonies on a single tree from Mae Tung Ting were used to test the hypothesis-II: aggregated colonies are genetically related family. The aggregated colonies, which nested up high 25-35 m on

small branches of trees and the edges of cliffs were not sampled due to high risk of honey hunter's life.