CHAPTER 5

Apis dorsata F: diurnal foraging patterns of worker bees in Northern Thailand

5.1 Introduction

Nowadays, the number of document studied honey bees is increasing due to the dramatic decrease of both wild and industrial honey bees with unidentified causes. The recent studies further studies on the biology and behavior of already described honey bee species (Potts et al., 2010).However, among *Apis* groups, *Apis dorsata*, the giant Asian honey bee,is the least studied of the other traditionally recognized species and information on its biology is rare and fragmentary because the bee species is very defensive and/or too inaccessible for people to carry out research. In the global awareness of the need for wildlife protection, the conservation of the *A. dorsata* in the tropical forests should be given greater attention.

A dorsata is a species native to the tropical forests of Southeast Asia. It is an important part in the ecology of the forests and the income of the local people in this region.This honey bee builds a large single comb nest from anoverhead substrate such as tree branches, rocks or buildings (Oldroyd and Wongsiri, 2006). The foraging phenology of this species is one of the least studied aspects of colonial life history. Woyke and colleagues observed flight activity of three honey bees (*A. laboriosa, A. dorsata* and *A. mellifera*) in cold climate. This study which focused on *A. laboriosa* foraging in Nepal reported that *A. dorsata* workers commenced foraging at an ambient temperature of 18°C, while *A. laboriosa* commenced foraging at an ambient temperature of 10°C. For *A. laboriosa* the number of foraging bees increased after the first flight in the mid-morning to a peak in the early afternoon dropping sharply thereafter (Woyke et al., 2003).

They only indicated that honey bees startedforaging depended on the temperature. Their evidence showed the high correlation between the temperature and the number of foragers at temperatures below 16°C.However, the average temperature in the tropical areas is different which their conclusion should not be explained the foraging phenomenon in the warm climate.The aimof this study was to describe the diurnal flight activity of *A. dorsata* living in a tropical environment. The research we report here is the first to document *A. dorsata* foraging patterns in Northern Thailand.

5.2 Materials and methods

A. dorsata worker foraging flight activity was observed on four adjacent colonies which were affixed to the top sills of window frames on a commercial residence in metropolitan Chiang Mai, Thailand (18º 58’ N Lat.). This fortuitous situation allowed for very close access to the colonies and an opportunity for longer term observations of flight activity. The four colonies were designated as A, B, C and D. Colonies A and B were observed during the period 12 to 19 January 2011. Colonies C and D were observed from 7 to 12 March 2011. The daytime temperatures during the January observations varied between 17.7°C and 31.1°C. In March the ambient daytime temperatures varied between 27.1°C and 32.5°C.

Colonies A and B were initiated *ca*. late November or early December 2010. Both of these colonies absconded following one week and two weeks of worker flight observation (18 January and 4 February), respectively. The swarm which initiated colony C arrived at the study site on the 13^{th} of February; colony D first appeared as a swarm on the 27^{th} of January. Foraging observations began 23 days post-colony initiation for colony C and 40 days for colony D. Observations of daily forager flight activity began at 06:30 to 19:00. The ambient temperature for the entire daily foraging period was electronically recorded (Hobo Event Recorder, Onset Corp. USA). While we have no direct observations on available forage resources, during the January observation period flowering Lychee was present within a 3 km radius and during the March observation period, Longan was present.

To establish diurnal foraging profiles, the number of outgoing forager bees was recorded for 5 min at half hour intervals for the entire foraging period. Daily flight activity was calculated by determining the percent of flights per five min observation period relative to the total number of recorded flights for all observation periods for the day.

5.3 Results

First flight normally began shortly after the commencement of dawn but before the actual sunrise. The time of the first foraging flight averaged 10.7 ±6.0 min following the commencement of dawn. The average temperature at dawn was 22.2 ±4.6°C; the average temperature at first flight was 23.0 ±4.7°C. Observations on colonies A and B took place in mid-January, a dry and cool period, (avg. diurnal T = 25.1ºC) while observations on colonies C and D took place in the first half of March when the average diurnal temperature was higher (30.1ºC).

For the four colonies (A - D), Figure 5.1 A and B show the highest forager activity occurring in the early morning (06:30 - 09:25). For colonies A and B this 3 h period represents 46.7% of all daily foraging and for colonies C and D, 78.5%. The period 09:50 to 15:25 (5.5 h) possessed 48.6% and 16.8% of daily foraging colonies A and B and colonies C and D, respectively. Worker flight continued to decrease even further from 15:25 to the cessation of flight at dusk (19:00) with 4.7% of all foraging colonies occurring during this 3.25 h interval (Figure 5.1C). Worker foraging was particular robust in the early morning, especially so for colonies C and D.

5.4 Discussion

Our observations revealed the average temperature at flight initiation was 23.0ºC. This study found that the diurnal flight activity was temperature-independent but most certainly dependent on ambient daylight. A study of *A. dorsata* vision showed it has sensitive eyes which allow flight in dim light or during moonlit light (Dyer, 1985; Kelber et al., 2005; Somanathan et al., 2009). Thus, the first flight starting after dawn indicates that the bees require only dim light in order to fly and commence foraging activity.Furthermore, a plausible explanation for the skewed nature of early morning flight would be the availability of foraging resources (pollen and nectar) and to the food source competition. Many flowering species produce nectar at night and bloom in the early morning stimulated by light and temperature. Then the nectar levels are highest in the early morning and subsequently decline through exploitation by floral visitors. *Apis* is often able to outcompete native species by virture of its high ability to detect and harvest resources. Similar foraging patterns have been reported in other *Apis* species (Schaffer et al., 1979; Moore et al., 1989).

The colony conditions for A and B were markedly different from colonies C and D. Colonies A and B were in absconding preparations and had stopped comb expansion; the queens has ceased oviposition; the brood was being allowed to develop and emerge and food stores were being readily consumed, all in preparation for the departure of the adult bees. On the other hand, colonies C and D were in a phase of colony expansion, active brood production and food storage. The foraging profiles for colonies A and B are somewhat different from C and D (Figure 5.1A and B). Obviously, the active colonies need more food to support their activities than the last phase colonies. Interestingly, for the newly established colonies (C and D) the diurnal foraging was even more confined to the early morning period than colonies A and B. Thus, the change in foraging behavior could well represent a change in colony composition.

This study demonstrates that the time of first flight for *A. dorsata* workers is most likely related to an abundant superior food and the active flight activity in early morning should correlate with the food source availability. Because of the warm tropical conditions at the study site, ambient temperature was not a limiting factor for diurnal foraging.

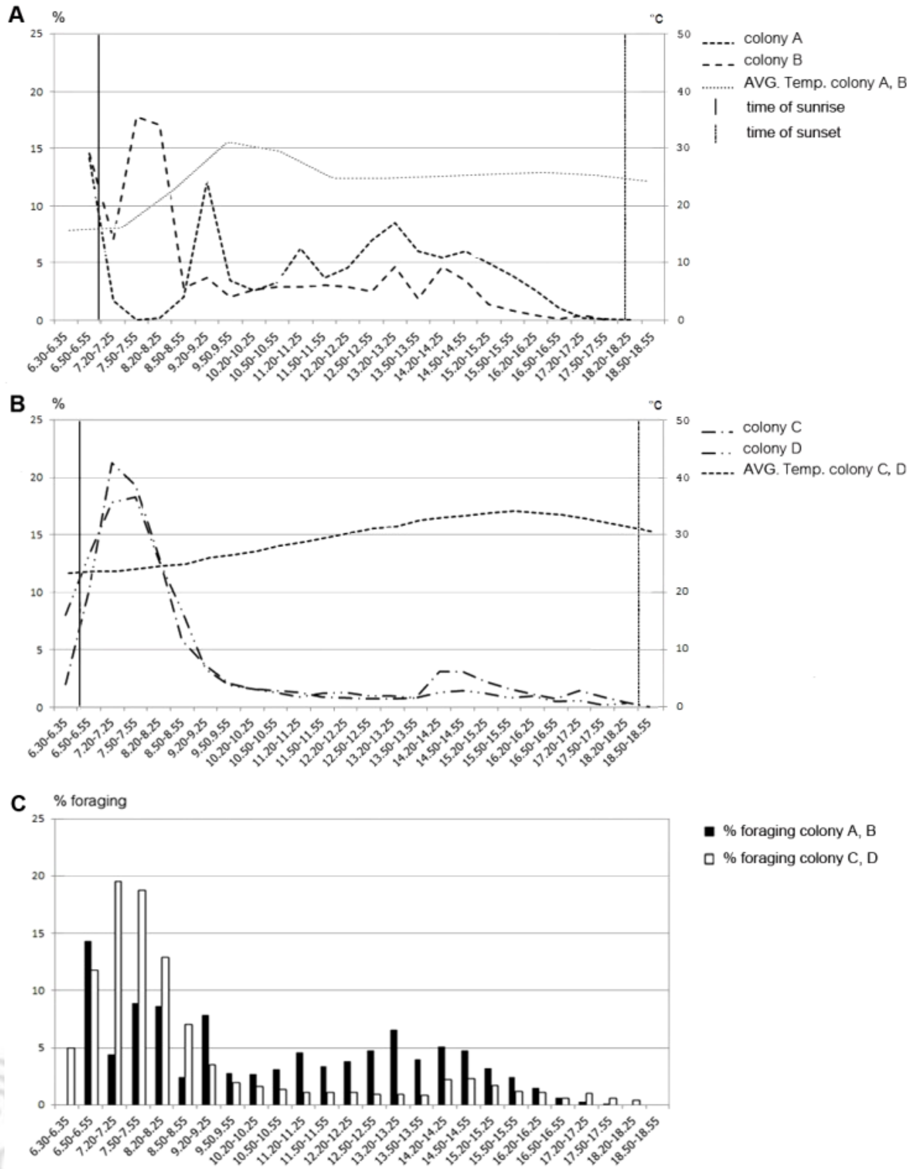

Figure 5.1 Averaged circadian daily flight profile for colonies A and B (A), Averaged circadian daily flight profile for colonies C and D (B), Summed averaged daily flight profile for colonies A and B and colonies C and D (C).