CHAPTER 5

DISCUSSION

The character analysis showed that each character was significantly different within 12 regions. The differences in characters may be explained by Bergmann's and Allen's rules (Daly, 1985; Ruttner, 1988).

Bergmann's rule is that "smaller sized geographic races of a species are found in warmer parts of the range and the larger sized races in the cooler parts of the range."

Allen's rule is that "protruding body parts are relatively shorter in the cooler parts of the range of a species than in the warmer parts."

The rules explained the animal's thermoregulation of reducing the surface area in the cooler areas, and also explained hydroregulation of the insects in that they reduced the body surface area to preserve water contents in dry climatic zones (Daly, 1985).

The sizes of fore and hind wing were greater in the northern lattitude bee but the fore wing index showed no significant difference in shape within the regions while the hind wing of the southern lattitude bee were more slender. The explanation might be that the northern part of Thailand is relatively cooler and less humid than the southern part of Thailand. The size of the bees, according to Allen's rule, is therefore affected. The longer and broader size of the hind wing resulted in less surface area and helped the northern lattitude bee to reduce body temperature and humidity lost.

Hamuli of the hind wing were significantly lower in the

southern lattitude bee than in the northern lattitude bee. The northern and southern lattitude bees were differentiated by the number of hamuli; and that the Samui Island bee differd from the other two according to the large number of hamuli like northern lattitude bee but the shorter hind wing like southern lattitude bee.

The pattern of wing venations may be used to discriminate the bees. The northern lattitude bee was characterized by larger means of angle 29, 30 and 32 and smaller means of angle 31, 33 and 39. The southern lattitude bee was characterized by smaller means of angle 29, 30 and 32 and larger means of angle 31, 33 and 39. These six angles were intermediate in Samui Island bee. The Samui Island bee was characterized by larger means in angles 40 and 42 and smaller in angle 43.

Hind leg size can not be explained by Allen's rule since the legs were longer in the northern lattitude bee than in the southern lattitude bee. According to Bergmann's rule, leg length in proportion to body size would explain why the larger northern lattitude bee had longer legs. The Samui Island bee showed different hind leg proportions from the northern and southern lattitude bees as it has relatively very small tibia and femur like the southern lattitude bee, but has relatively large basitarsus like northern lattitude bee.

Tongue length is an important character which may depend upon the quantity of nectar and the shape of the flower commonly used in bee breeding (Morimoto, 1968; Mattu and Verma, 1983). Mattu and Verma (1983) suggested that tongue length may be related more to flower morphology than to the geographic conditions. In this study, tongue length could not be accurately measured because of its flexibility and contractibility. However, the length of labial palpi, the chitinous

and rigid mouthparts was used instead of the tongue length.

Labial palpi were longest in bees from region S (Johor) while the labial palpi of bees from the other southern lattiude regions were comparatively shorter than those of the northern lattitude bee and the Samui Island bee. This is because the bee of region S may develope the extra long mouthparts adapted to the physical environments and flora that are unique only to the region S. It showed less possibility that the bees of region S were hybridized with the bees of the different geographic areas. Hence, other characters were not different from those of bees from other southern lattitude regions. The labial palpi index (proximal segment divided by distal segment) of bees from every southern lattitude regions was not significantly different therefore this also applies to bees from region S and Samui Island. The labial palpi of the Samui Island bee was longer than those of the northern and southern lattitude bees (except the bee from region S) which made Samui Island bee different from the bee of the other regions.

The body size of the northern lattitude bee as expressed by the size of sternite 3, was relatively greater. This can be explained by Bergmann's rule in terms of thermoregulation and hydroregulation; the larger sized northern lattitude bee reduced its surface area to minimize temperature and water lost. The tergite 3 and 4, also measured to indicate the body size of the bee, showed the same tendency as the sternite 3 in that the larger bees were found in the northern lattitude regions. However, bees from region S of the southern lattitude regions are of large size like the northern lattitude bee. Region S bee also showed other differences from bees of other southern lattitude regions, such as long labial palpi like the northern lattitude (other southern lattitude bees have shorter labial palpi). From the results, the bee from region S might be the exception among southern lattitude bees.

Samui Island bee was separated from the mainland bees due to continental drift since the end of Pleistocene (8,000 - 12,000 years ago) (Ruttner, 1988). There are two reasons for the differences between Samui Island bee and mainland bees:

1. Samui Island bee was kept inseminated in limited area and so some characteristic traits were still preserved.

2. Samui Island was kept developed a special type during the several thousand years of isolation. The new phenotypic characters evolved from genetics and environmental selection.

In both explanations, the Samui Island bee population have remained unhybridized for several thousand years. The natural race of bees on this Island is the result of selection processes over a long period. The bees developed adaptive traits to the specific environmental conditions and are very important as they are the stock of pure line of the race. The importation of the other bees to the island would endanger the natural race. The knowledge on the race and distribution of the honey bee is the basis for the breeding programmes and preservation of such valuable stock as a genetic resource for the future.

The northern and southern lattitude groups of the honey bees in Thailand were considered to be the geographic types since the canonical discriminant analysis showed the separated groups with no observable overlapping zones. The discriminant analysis in this study confirmed the investigation of Ruttner (1988) which grouped the eastern bees collected in northern Thailand (Chiangmai) into Group III (A. c. himalayana) while the sample from the lowland of Thailand into Group I (A. c. indica) (Ruttner, 1988).

The distribution of the bees showed that there are some differences as shown by some characters. However, some characters

showed some similarity even in different geographic areas. Thailand and Malaysian peninsula may not be large enough to have exact separation in the area. It might be just only the tendency in separation due to geographic and climatic difference of the countries as shown by three groups mentioned earlier.

Clustering analysis showed that the Samui Island bee were clustered with the southern lattitude bee. This may indicate that they were of the same population a long time ago.