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Morphological Variation of Cultivated and Wild *Apis cerana* Honeybee from the Highland and Lowland in Yogyakarta

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Abstract: *Apis cerana* honey bees in Yogyakarta have a high potential. There has been no research on the morphology of cultivated and wild *Apis cerana* honeybees from the highlands and lowlands in Yogyakarta. The purpose of this study was to compare the morphology of cultivated and wild *Apis cerana* honeybees from the highlands and lowlands in Yogyakarta. Cultivated and wild *Apis cerana* honeybees from the highlands and lowlands of Yogyakarta were taken by 20 individuals each as samples. Wild honeybees are taken using sweep net while cultivated honeybees are taken using plastic. Honey bees are further preserved and observed morphologically. The main characters observed as many as six characters and the total morphological characters were 51 characters. The main character is analyzed with an average different test and a BNT test, while the grouping uses 51 characters analyzed with dendrogram creation. The results showed that there was a significant difference in the character of proboscis length: front wing length of the cultivated *Apis cerana* honeybee from the highlands which show the highest value. Honeybees from lowlands both cultivated and wild have the highest similarity (dissimilarity value of 1,549) compared to honeybees from the highlands. Wild honeybees from lowlands and highlands also have high similarity (dissimilarity value 1,762). It can be concluded that proboscis length: front wing length is an important distinguishing character for determining the habitat of *Apis cerana* honeybees.

Keywords: *Apis cerana*, morphological characters.

Introduction

In the world, there have been found 9 species of honeybees, and 5 species are native to Indonesia. They were *Apis andreniformis* Smith 1858, *Apis dorsata* Fabricius 1793, *Apis nigrocincta* Smith 1861, *Apis koschevnikovi* Enderlein 1906, and *Apis cerana* Fabricius 1793.

Apis cerana is a honey bee that produces honey and is commonly better known as the local honey bee. A year can produce 5-10 kg of honey for each colony. The body size is medium, similar to two other honeybee species, *Apis nigrocincta* and *Apis koschevnicovi*. The original distribution area of *Apis cerana* is an archipelago west of the Wallace line, but today this species has been widespread to Papua.

Previous research conducted by Novita et al. (2013) on morphometric analysis of worker honey

bees *Apis cerana* in Bengkulu mentions that the weight and length of the femur of the hind limbs of worker honeybees in high altitudes and lowlands in cultivated and wild bees are significantly different.

Mattu and Verma (1984) have researched the morphology of *Apis cerana* honey bees in Kashmir, India at two different altitudes shows that the size of hind limbs, front wings, tergite and sternite abdomen bees at 600-1700 mdpl was smaller than bees at 2000-3000 mdpl.

Apis cerana honey bees in Yogyakarta have a high potential. But there has been no research about *Apis cerana* in Yogyakarta before.

5 Materials and Methods

The study area

This research was conducted from December 2018 to May 2019. Sampling was carried out at the *Apis cerana* Nglipar cultivation area, Gunungkidul and Sewon, Bantul, as well as around the cultivation site for sampling in its natural habitat (Figure. 1). Morphological observations were carried out at the Biology Laboratory of Ahmad Dahlan University.



Figure 1. Research site map (Google Earth).

Procedures

Honeybees Sampling

Cultivated and wild *Apis cerana* honeybees from the highlands (Nglipar, Gunungkidul) and lowlands (Sewon, Bantul) of Yogyakarta were taken by 20 individuals each as samples. Wild honeybees are taken using sweep net while cultivated honeybees are taken using plastic.

Observation

Honey bees are further preserved and observed morphologically. The main characters observed as many as six characters. There were probosis length, hind femur length, fore wing length, and 4th tergite longitudinal size, and total morphological characters were 51 characters.

Data analysis

Data analysis using ANOVA for six basic morphometric characters with comparisons,

namely Probosis Length: Rear Femoral Length, Probosis Length: Forewing Length, Rear Femur Length: Fore Wing Length, 4th Tergite Longitudinal Size: Rear Femur Length, Longitudinal Size of the 4th Tergite: Forewing Length, and Longitudinal Size of the 4th Tergite: Proboscis Length. If there is a significant difference, then the BNT test is continued. A total of 51 distinguishing characters will be made a similarity dendrogram using Excel and SPSS.

Results and Discussion

Main Character

Based on the results of the 6 different main characters of *Apis cerana* honey bee, it was found that the homogeneity test had a significant value of the six basic morphometric characters > 0.05 , which means that the data was normally distributed. The results of the ANOVA test showed that of the six basic morphometric characters, the significantly different values were in the characters of Proboscis Length: Forewing Length and Rear Femur Length: Forewing Length.

The results of the BNT test showed that the cultivated upland STO was significantly different from the natural highland, cultivated lowland, and natural lowland STO on the characters of Proboscis Length: Forewing Length, and there was no significant difference in the other STOs (Table 1). While the character of Rear Femur Length: Fore Wing Length there is no significant difference in each STO.

Table 1. BNT Test Results 2 Basic Morphological Characters.

PL: FWL		FHL: FWL	
STO	Average	STO	Average
High, Cul	0.23 ^b	High, Cul	0.21 ^a
High, Wild	0.20 ^a	High, Wild	0.19 ^a
Low, Cul	0.20 ^a	Low, Cul	0.19 ^a
Low, Wild	0.20 ^a	Low, Wild	0.19 ^a

The results also showed that honeybees from lowlands both cultivated and wild have the highest similarity (dissimilarity value of 1,549) compared to honeybees from the highlands.

The similarity of honeybees in lowlands is due to similar environmental conditions, was the height of the place in the lowlands.

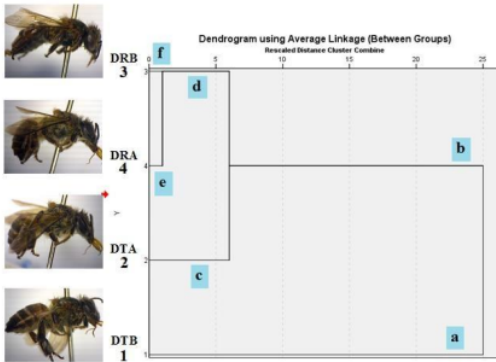


Figure 2. Genetic Similarities between the 4 STOs of *Apis cerana* Honeybees (Personal Documentation).

Wild honeybees from lowlands and highlands also have high similarity (dissimilarity value 1,762). The similarity due to foraging distance from bees *Apis cerana* honey is almost the same, which according to Kevan et, al., (1995) the mileage of *Apis cerana* honey bees foraging is 200-500 m.

Table 2. *Apis cerana* honey bee similarity and dissimilarity index.

Proximity Matrix				
Euclidean Distance				
Case	Indeks Similaritas (IS)			
	1: Dataran Tinggi Budidaya	2: Dataran Tinggi Alami	3: Dataran Rendah Budidaya	4: Dataran Rendah Alami
1: Dataran Tinggi Budidaya		3.305	3.960	3.540
2: Dataran Tinggi Alami	3.305		2.287	1.762
3: Dataran Rendah Budidaya	3.960	2.287		1.549
4: Dataran Rendah Alami	3.540	1.762	1.549	
Indeks Disimilaritas (ID)				

Conclusions

From the results of the study, it can be concluded that the Proboscis length: front wing length is an important distinguishing character for determining the habitat of *Apis cerana* honeybees.

Conflict of Interest: The authors declare that there are no conflicts of interest concerning the publication of this article.

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