Study of Bee Forage Based on Bee Bread From 4 Species of Honeybees in Teaching Forest Hasanuddin University

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Abstract. This study was intend to know and to identify bee forage in bee bread from honeybee in Teaching forest Hasanuddin University. Study method used in this study was survey method and identification of plant species were done in Plantation Industry Laboratory. There were 2 stage of the study i.e. collecting sample of bee bread from 4 species of honeybee (\textit{Apis cerana}, \textit{Apis mellifera}, \textit{Apis dorsata} and \textit{Trigona sp}) and identification of pollen in Plantation Industry Laboratory. Study results indicate that there were 20 pollen species i.e. banana (\textit{Musa paradisiaca}), papaya (\textit{Carica papaya}), Mango (\textit{Mangifera indica}) puteri malu (\textit{Mimosa pudica}), eggplant (\textit{Solanum tovarum}), sangitan (\textit{Sambucus javanica}), water apple (\textit{Syzgium aqueum}), candlenut (\textit{Aleurites moluccana}), jatropha (\textit{Jatropha curcas}), euphorbia (\textit{Ephorbia milii}), guava (\textit{Psidium guajava}), Acacia (\textit{Acacia mangium}), sugar palm (\textit{Arenga pinnata}), nusa indah (\textit{Massaenda pubescens}), chili (\textit{Capsicum annum}), puspa (\textit{Schima wallichii}), coconut (\textit{Cocos nucifera}), corn (\textit{Zea mays}), jackfruit (\textit{Artocarpus heterophyllus}), and Piperaceae. The highest bee bread from 4 species of honeybee pollen was sugarpalm (\textit{Arenga pinnata}) with percentage 15.08%. The lowest bee bread was guava (\textit{Psidium guajava}) with percentage 0.09%. The most pollen collecting was \textit{Trigona sp} with 10 plant species.

1. Introduction

Honeybee is an insect producing honey that since long time ago have been known. Since long time ago human hunt honeybee in the cave, the tree hole and other place to take the honey. Honeybee produce the product need of medical world like royal jelly, pollen, bee bread, bee wax and others. Bee forage source consist of nectar and pollen that originated from plant flower.

Bee bread is the one of honeybee product that have multiple use as food and medicine. Bee bread is bee pollen that made naturally by honeybee, collected from male flower mixed with nectar that sucked and honeybee saliva which kept in the pocket between the two legs.

Teaching forest of Hasanuddin University consist of various plant species, fauna, and useful insect. Useful insect that present in Teaching Forest are honey bees. Based on field survey, honeybee found in Teaching Forest is \textit{Trigona sp}, \textit{Apis cerana}, \textit{Apis dorsata}, \textit{Apis mellifera}. The successfull of honeybee production depend on bee forage source that exist. Plant species used by honeybee as bee forage source was various. From many kind of plant that used as bee forage source in Teaching Forest, some of them potentially to produce bee bread and honey bee.

This study was intended to know and identify plant species that exist in Bee bread in Teaching Forest Area. The usefulness of this study was to give information about bee forage source that prefer by honeybee that exist in teaching forest Hasanuddin University related to reforestation plant species choice.
2. Study Method

2.1 Time and Location of The Study
Sample taking of bee bread was done in the area of Forest Teaching Hasanuddin University Maros Regency. The study was held from January to March 2016. Identification of bee forage was done in Laboratory of Industry Plantation Office, Makassar.

2.2 Equipment and Material
Equipment used in this study were writing tools, label, tally sheet, heater, microscope, deck glass, object glass, stryzer, test tube, spatula, pinset, drop pipet, camera. Material used was bee bread from each colony, bee wax, and chemical that consist of 70% gliserin and safranin.

2.3 Study Procedure
a. To take bee brood sample 5 mg from honeybee colony Trigona sp, Apis dorsata, Apis cerana, Apis mellifera
b. To put each of the bee bread in sealed container.
c. To dissolve the 2 mg of bee bread with 2 ml alcohol 70% in the container, to add 1 ml gliserin and 1 ml safranin in 10 minutes.
d. To stir slowly and the to put a little bit the sample with pipet and then to put the sample in object glass.
e. To cut the bee wax in small pieces, and to put in the edge of preparation, to heat until bee wax molten and the close it with deck glass.
f. To observe under the microscope with 100 time magnification
g. To identify the origin of plant species pollen by using pollen identification book

2.4 Variable observed
1. Origin of plant pollen species
2. Amount of plant pollen species in the preparation
3. Amount of pollen type each honeybee species

2.5 Data analysis
1. Amount of pollen in each bee bread
2. Percentage of pollen in each plant in bee bread with the formula :

\[ X = \frac{\sum A}{\sum B} \times 100\% \]

Keterangan X = percentage of pollen amount in each plant in bee bread (100%)
A = amount of pollen in each plant in the preparation
B = amount of pollen in all plant in the preparation
3. Result and Discussion

3.1. Average percentage of the amount of Pollen in Bee Bread

3.1.1. Trigona sp

Based on the study we can get the result in Fig. 1.

![Figure 1. Average percentage of amount of pollen in the bee bread of Trigona sp honeybee](image)

In Figure. 1 we can see source of pollen and bee bread of Trigona sp were banana, papaya, mango, Mimosa, Piperaceae, eggplant, sangitan, water apple, candlenut, jatropha. Plant species most preferred by Trigona sp was eggplant with precentage 38.95% while the less preferred was Piperaceae with percentage 1.05%.

Eggplant dominated because when honeybee collected pollen source coincide with flowering season and distance between honeybee colony and pollen source (eggplant) about 7 meter.

3.1.2. Apis dorsata

In Fig. 2 indicated that source of pollen from bee bread of A. dorsata honeybee was corn, mango, acacia, jatropha, sugar palm, jackfruit. Bee forage plant most preferred was sugar palm with percentage 36.96% while the less preferred was acacia with percentage 2.7%.

Identification of pollen indicated that most collected pollen by A dorsata honeybee was pollen from sugarpalm. Sugarpalm dominated because when honeybee collected bee forage coincide with flowering season and distance between honeybee colony and sugarpalm about 8 metre.
3.1.3. *Apis cerana*

In Figure 3 we can see the source of pollen from bee bread in *A. cerana* colony were *Euphorbia* (*Euphorbia milii*), *Jatropha* (*Jatropha curcas*), *Papaya* (*Carica papaya*), *Guava* (*Psidium guajava*), *Acacia* (*Acacia mangium*), *candlenut* (*Aleuritus moluccana*), *sugar palm* (*A. pinnata*). Bee forage that most preferred by *A. cerana* honeybee was euphorbia with percentage 48.25%, while the less preferred was *acacia* (*Acacia mangium*), *candlenut* (*Aleuritus moluccana*) and *guava* (*Psidium guajava*).

Identification of pollen indicated that most pollen collected by *A. cerana* honeybee was pollen from *Euphorbia* (*Euphorbia milii*). Pollen from *Euphorbia* dominated because honeybee collected the pollen...
coincide with flowering season and the distance between the honeybee colony and euphorbia was 6 metre.

3.1.4. *Apis mellifera*

![Figure 4](image.png)

**Figure 4.** Average percentage of amount of pollen in the bee bread of *Apis cerana* honeybee

In Figure 4, we can see that pollen bee forage from bee bread of *A. mellifera* were mango (*Mangifera indica*), Nusa indah (*Mussaenda pubescens*), acacia (*Acacia mangium*), chili (*Capsicum annum*), puspa (*Schima wallichii*), coconut (*Cocos nucifera*), sugar palm (*A. pinnata*). The most preferred plant by *A. mellifera* honeybee were coconut (*Cocos nucifera*), sugar palm (*A. pinnata*). The most preferred bee forage by *A. mellifera* honeybee was coconut (*Cocos nucifera*) with percentage 41.18%, while the less preferred was mango (*Mangifera indica*) with percentage 1.96%.

Identification of pollen indicated that the most collected pollen was pollen from coconut (*Cocos nucifera*). Coconut dominated because when honeybee collected the bee forage coincide with flowering season while the distance between honeybee colony and the coconut was 50 meter.

3.2. **Average Percentage of Amount Pollen in Bee Bread from 4 species of honeybee**

Based on observation of Bee Bread sample from 4 species of honeybee in teaching forest Hasanuddin University, we found plant species of pollen indicated in Figure 5.
In Figure 5 we can see that there are 20 species of pollen found in bee bread of 4 species of honeybee i.e.: banana (Musa paradisiaca), papaya (Carica papaya), mango (Mangifera indica) puteri malu (Mimosa pudica), eggplant (Solanum tovarum), sangitan (Sambucus javanica), water apple (Syzgium aqueum), candlenut (Aleurites tovarum), jatropha (Jatropha curcas), euphorbia (Euphorbia milii), guava (Psidium guajava), acacia (Acacia mangium), sugar palm (Arenga pinnata), nusa indah (Mussaenda pubescens), chili (Capsicum annum), puspa (Schima wallichii), coconut (Cocos nucifera), corn (Zea mays), jackfruit (Artocarpus heterophyllus), and Piperaceae.

The highest pollen sample of bee bread was sugar palm (A. pinnata) with percentage 15.08% as bee forage source of A. dorsata, A. cerana, A. mellifera. Sugarpalm (Arenga pinnata) was the most preferable plant by honeybee. Beside producing pollen, sugarpalm also produce nectar that was apt to honeybee [4]. Based on pollen identification in Trigona sp honeybee, it was not found sugarpalm (A. pinnata), because body dimension and flying distance of Trigona sp was less compared to A. cerana, A. dorsata and A. mellifera.

Pollen type found in bee bread was various in term of form and dimension. This indicate that honeybee take the pollen not only based on the distance to the colony, but also dimension, flavour, color of the flower.
Honeybee preferred pollen that produced in abundance compared to flower that produced less pollen. In normal condition, honeybee will limit to find nectar and pollen on one plant species on one visiting [1]. The role of Environment factor to pollen collection intensity held direct and indirect. Direct influence by flying activity, consumption pattern, while indirect influence by pollen production. Environment temperature influence the amount of bee forage consumption, so it will influence bee forage collection intensity from the field [2].

Honeybee collect the pollen with unique manner i.e. descent upon flower and attach the body on flower surface so automatically pollen attach to the honeybee body. When in break or flying, pollen collected by using pollen brush and then put into pollen basket located in rear leg. Worker bee then get into the hive and inspect the empty cell to fill with the pollen [4].

When pollen release in the hive comb, pollen will mix with nectar that secrete by bee worker, honey and secretion from bee worker gland. This mixture will put into the cell by bee worker which called bee bread. The composition of bee bread different with pollen. Bee bread have higher nutrient than fresh pollen. Bee bread have lower pH and lower flour [4]. Berside that, bee bread also fermented and enzymatic reaction with the presence of bacteria [5].

The content of bee bread i.e: iron to prevent anemia, nucleic acid to prevent aging, cellulose to prevent constipation, antibiotic to inhibit bacteria activity, hormone for growing.

Bee bread contain 22 kind essential amino acid, essential fatty acid, various vitamin and mineral, various enzyme and hormones needed by the human body for regeneration process of tissue cell, reproduction cell, various alkaloid that have special use in stabilization of cell metabolism and growing.

3.3. Amount of Plant Species in Pollen from Bee Bread of 4 honeybee species

Amount of plant species in pollen from bee bread of 4 honeybee species describe in Figure. 7

![Figure 7](image_url)

**Figure. 7.** Amount of plant species in pollen from bee bread of 4 honeybee species

In Figure 7. Indicate that the amount of plant species from pollen of 4 species honeybee bee bread, dominated by Trigona sp with 10 plant species, this because the amount of Trigona sp honeybee colony have more than the three other honeybee species and it preferred lower level flowering plant. Flying distance of Trigona sp have less radius than the three other honeybee species. One of the factor that Trigona sp get more pollen because the distance between bee forage and the colony was not far.

One of the study said that Trigona sp tend to collect more pollen than other honeybee species because the high concentration and demand of Trigona sp to bee pollen. The high concentration of Trigona sp honeybee to collect pollen because Trigona sp doesn’t produce royal jelly like other honeybee [6].
4. Conclusion and Suggestion

4.1. Conclusion

1. Plant species that source of bee forage pollen from 4 species honeybee were 20 kind of pollen i.e banana (Musa paradisiaca), papaya (Carica papaya), Mango (Mangifera indica) puteri malu (Mimosa pudica), eggplant (Solanum tovarum), sangitan (Sambucus javanica), water apple (Syzgium aqueum), candlenut (Aleurites moluccana), jatropha (Jatropha curcas), euphorbia (Ephorbia mili), guava (Psidium guajava), Acacia (Acacia mangium), sugar palm (Arenga pinnata), nusa indah (Mussaenda pubescens), chili (Capsicum annum), puspa (Schima wallichii), coconut (Cocos nucifera), corn (Zea mays), jackfruit (Artocarpus heterophyllus), and Piperaceae.

2. The highest bee bread from 4 species of honeybee pollen was sugarpalm (Arenga pinnata) with percentage 15.08%. The lowest bee bread was guava (Psidium guajava) with percentage 0.09%.

3. The most pollen collecting was Trigona sp with 10 plant species.

4.2. Suggestion

It need continued study in flowering season and identification of bee forage source in honey.

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