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IDENTIFICATION AND CHARACTERIZATION OF FEED PLANTS FOR Apis dorsata Binghami IN THE PINABETENGAN FOREST, MINAHASA

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Abstract

Apis Dorsata Binghami is a honey bee that is often found in the forest, which is conserved by the community, but there are also honey bees that are just left alone; the community preserves these honey bees because their honey can be traded and can also be used as medicine. This study aims to determine the plants that are a feed source for Apis Dorsata Binghami in the Pinabetengan Forest, Minahasa Regency. This research was conducted in June-August 2022. The data collected came from field survey data using descriptive methods and identified plant species with values of Reactive Density (KR), Relative Frequency (FR), Relative Dominance (DR), and Index Significant Value (INP). Plant diversity as a food source for Apis Dorsata Binghami has different types of plants based on their habitus or the characteristics of the plants themselves.

Key words: Identification, Characterization, Apis Dorsata Binghami, Forest

INTRODUCTION

Apis dorsata Binghami is an endemic honey bee originating from Sulawesi. Apis dorsata Binghami cannot be bred, so it still lives wild in the forests of Sulawesi. However, Apis dorsata Binghami produces more honey than all honey bees. Furthermore, the diversity of plants as a source of nectar, pollen and plant resins, which are used in the formation of hives and honey, is more than all types of honey bees in the world. Ethnically, the Minahasa people have long used honey nests for degenerative diseases such as hyperlipidemia and cancer. However, no research has been reported on the bioactive content and bioactivity of Apis dorsata Binghami nest extract (Mokosuli et al., 2019).

Forest honey bees, known as giant honey bees, are Asian honey bees that live in forests. However, until now, the development of forest honey bees is still slow compared to other timber forest products because honey bees are classified as wild bees, and people need to understand the potential for their utilization. From forest honey bees, which can be the main source of income.

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Forest honey bees can be said to be the best type of bee in the bee family because apart from being able to make nests with only one comb hanging from the branches and twigs of trees, these bees also have unique behaviour. They closed (Jungle, 2021). North Sulawesi, more specifically the Minahasa region, has many endemic plant species as sources of pollen and nectar for the formation and development of bees. In another study, we found that this plant species is the main food source for Apis dorsata Binghami in various areas in Minahasa, North Sulawesi. Each plant has its secondary metabolite characteristics, including the process and composition of the formed nectar and pollen, which then become honey bee feed ingredients (Mokosuli et al., 2017). The existence of various types of bees in every forest or every area is supported by the availability of various flowering plants, which are a food source for honey bees. For bees, forests also provide a habitat for nesting sites in the form of high-habitus trees (Adalina, 2018).

From various studies, forest honey bees act as pollinators (pollinators) of various forest trees, crops and fruits. Forest honey bees use the forest as a place to live (sialang trees) and a place to find food. So, if one of the components of the ecosystem is lost, the population of forest honey bees will decrease. Garibaldi (2011) reported a decrease in plant diversity and populations of wild bees and pollinating insects caused by the development of modern agricultural systems in various countries. Using herbicides, chemical pesticides, and river pollution contribute to the loss of native plant species, beneficial insects, and important predators for the balance of the ecosystem. Conservation efforts for the habitat of forest bees and sialang trees need more attention to preserve forest honey bees (Enggar W, 2018).

RESEARCH METHODS

This research took place in the Pinabetengan Forest, Minahasa Regency, North Sulawesi. This research was conducted for 3 months, starting from June to August 2022.

RESULTS AND DISCUSSION

From the data that has been collected there are various types of plants that have different features and features. The following is data on the needs of Apis Dorsata Binghami feed plants found at the study site.

1. *Cloves*

Clove plant is a type of spice plant that has many benefits. The part often used from the clove plant is the flower bud. Clove is an ancient spice that was known and used thousands of years BC and is a plantation/industrial plant in the form of a tree with the Family Myrtaceae. The flower buds of this plant are often referred to by the public as cloves (Simbolon et al, 2021). Myrtales Nation, Myrtaceae Tribe, Clan Syzygium, Type Syzygium aromaticum (L.)

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Figure 1. Cloves (personal documentation)

Table 1. Data Collection Worksheet

No.	Plant Name	Latin name	Bee Feed			KR	FR	DR
			N	R	P			
1.	Clove	*Syzygium aromaticum*	√	√		16,15	17,63	33,94
2.	Fern	*Polypodiophyta*	-	-	-	4,79	5,21	2,49
3.	Coconut	*Cocos nuciferja*	√	-	√	13,96	51,00	11,02
4.	Holly	*Ilex opaca*	-	-	-	1,36	2.01	3,51
5.	Banana	*Musa Paradisiaca*	√	-	√	9,17	14,52	11,36
6.	Palm	*Aracaceae*	√	-	√	2,19	5,21	1,66
7.	Keruing	*Dipterocarpus*	√	√	-	5,38	5,21	2,97
8.	chayote	*Sechium edule*	√	-	-	2,19	5,21	2,51
9.	Air Guava	*Syszygium Aqueum*	√	√	√	2,19	5,21	3,86
10.	Ketapang	*Terminalia catappa*	√	-	√	2,19	5,21	2,48
11.	Eucalyptus	*Melaleuca leucadendra*	-	-	√	5,38	5,21	2,59
12.	Gamal	*Gliricidia sepium*	-	-	√	8,58	8,31	10,22
13.	Forest Betel	*Piper betle*	-	-	√	8,58	8,31	10,67
14.	Sweet Berry	*Synsepalum dulcificum*	-	-	-	1,36	2,01	1,02

2. Ferns

Ferns are a type of ornamental plant that grows and develops using spores, so this ornamental plant is different from other plants that grow from seeds. This fern plant has a Latin name with the name

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Polypodiophyta. The cinnamon fern plant is a type of fern plant that can grow and grow large, so it requires a large enough planting area. Unlike other types of ferns, this type of cinnamon fern is extreme because it has a relatively high resistance to heat and sunlight. If you want to plant this type of fern, place it in a hot place.

Kingdom Plantae, Tracheophyta Division, Polypodiophytina Sub-Division, Class Psilotiinae, Lycopodiinae, Equisetiinae, and Filiciinae

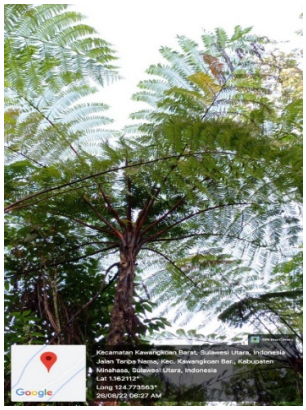

Figure 2. Cinamon fern (personal documentation)

3. *Coconut*

Coconut is a versatile plant, because it has a high cultivar diversity. All parts of the coconut plant (Cocos nucifera L.) are very beneficial for human life. This coconut plant, the fruit from the skin to the coconut water has its own function. Coconut (Cocos nucifera L.) as a species of the genus Cocos is divided into two varieties, namely Deep Coconut (Cocos nucifera L.) and Dwarf Coconut (Cocos nucifera L (Leonarda Gunawati et al, 2018).

Kingdom Plantae, Sub kingdom Tracheobionta, Order Arecales, Genus Cocos

Figure 3. Coconut Tree (personal documentation)

4. *Holly*

The American holly tree can grow to a height of 10-15 meters and forms a large bush with a main trunk reaching 50-60 cm in diameter. The bark is light gray, rough, and many small bumps. The tree is tolerant of shade or shady growing areas. It also forms a thick canopy that offers protection to birds from predators and storms. American holly leaves can be used to make drinks such as tea and do not contain

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caffeine. Kingdom Plantae, Subkingdom Tracheobionta, Class Magnoliopsida, Order Celastrales, Species Ilex opaca var. Arenicola Aiton.

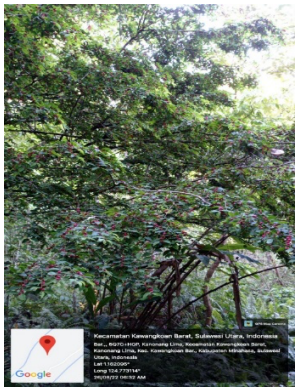

Figure 4. Holly Tree (personal documentation)

5. *Banana*

Banana trees are plants that are very easy to grow in tropical areas like Indonesia and do not require very complicated care. Indonesia has more than 230 types of bananas. Banana trees generally only bear fruit once and if it bears fruit the banana tree will die. Usually the banana tree is only used for the fruit and leaves, while the other parts are only left or cut down and then thrown away. Banana is the general name given to giant terna plants (plants whose stems are soft because they don't form wood) with large, elongated leaves from the Musaceae tribe.

This fruit is arranged in bunches with groups of arranged fingers, which are called combs. Banana plants are large wet-stemmed plants, usually having pseudo-stems composed of leaf sheaths. Banana stem is one of the important components of the banana tree. Banana stems contain more than 80% water and have high cellulose and glucose content, so they are often used by the community as animal feed and as a planting medium for other plants (Rani Rufaidah et al, 2021).

Kingdom Plantae, Sub-kingdom, Tracheobionta, Class Liliopsida, Order Zingiberales, Family Musaceae, Genus Musa.

Figure 5. Banana Tree (personal ducumentation)

6. *Palm*

The shape of a palm tree at a glance is similar to a coconut tree. Not only similar, palm plants are still in the same family as coconut trees. The adaptability of palm plants is quite great, because they are

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able to live in various regions. This plant can grow in fertile soil even though it is arid. Its ability to adapt to various environments makes palm plants often used as ornamental plants. This plant is also quite easy to care for. The beauty of this tree is also used by the community to decorate the yard of the house.

Kingdom Plantae, Subkingdom Tracheobionta, Class Liliopsida, Order Arecales, Genus Leopoldinia, Species Leopoldinia Piassaba Wallace.

Figure 6. Palm Piassava Tree (personal ducumentation)

7. *Keruing*

The Keruing tree is a large, tall tree species whose trunks are often used for timber and construction. Keruing wood from Indonesia is very well known to foreign countries and is widely exported because it has a high selling price. However, because of the large demand for keruing wood, its existence is increasingly worrying and even threatened with extinction. Keruing wood can actually also be used for various needs other than in the carpentry sector.

Kingdom Plantae, Class Magnoliopsida, Order Malvales, Family Dipterocarpaceae, Genus Dipterocarpus.

Figure 7. Keruing Teer (personal ducumentation)

8. *Chayote*

Siamese pumpkin is generally used as a vegetable, and this plant has a long life of more than 2 years. Siamese pumpkin is easy to grow anywhere, both in the lowlands and highlands and does not require much care complicated. In Indonesia this plant has not been cultivated commercially and mostly only as garden plants. Most people think that growing chayote is less profitable, even though chayote

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contains 6.7% pectin (Elvianto Dwi Daryono, 2012).

Kingdom Plantae, Class Magnoliopsida, Order Violales, Family Cucurbitaceae, Genus Sechium, Species S. Edule.

Figure 8. Chayote (personal ducumentation)

9. Air Guava

Guava plant (Syzygium aqueum) is used as a natural medicine that plays a role in healing or improving people's health conditions. Judging from its characteristics, Syzygium aqueum grows to a height of 3 to 10 meters, a trunk diameter of about 30-50 cm with branches and scaly brown bark. The leaves are glossy and opposite in shape, elliptical, oval-shaped, 7.5-10 cm long and 2.5-16 cm wide. The length of the petiole is 0.5-1.5 cm which gives off a distinctive aroma when crushed. The resulting flowers are greenish-white or creamy white with a diameter of 2.5-3.5 cm, a calyx 5 mm long and have four petals with a length of 7 mm, 3-7 flower buds usually emerging from the leaf axils. Syzygium aqueum also has fruit that is pear-shaped, white to bright red in color with a length of 1.5 cm and a width of 2.5 cm1 (Pratiwi Sri Anggrawati et al, 2016). Kingdom Plantae, Class Magnoliopsida, Order: Myrtales, Genus Syzgium, Species Syzgium Aqueum.

Figure 9. Air Guava Teer (personal ducumentation)

10. Ketapang

The Ketapang tree is known as a shade plant or garden decoration plant with the Latin name Terminalia catappa. This plant in Indonesia has various names in each region. For example, ketapang in

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North Sulawesi is known as Talisei, in North Maluku it is known as Tiliho, and in West Papua it is known as the Kalis tree. Ketapang tree is also called a beach plant. Ketapang is one of the flowering plants of the Combretaceae tribe. This tribe has been widely used as a traditional medicine for antibacterial, antifungal and antiviral. However, not much is known about the use of T. muelleri as traditional medicine (Veronika Adelina Hartini et al, 2012). Kingdom Plantae, Sub-kingdom Magnoliophyta, Class Magnoliopsida, Order Myrtales, Genus Terminalia, Species Terminalia catappa.

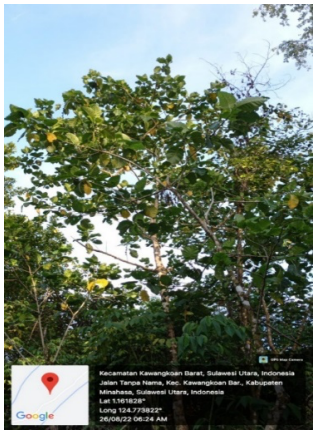

Figure 10. Ketapang Teer (personal ducumentation)

11. Eucalyptus

Eucalyptus plant (Melalauca leucadendron Linn.) is one of the important essential oil producing plants for the essential oil industry in Indonesia. Eucalyptus plants are one of the non-timber forest products producing plants that have good prospects for development. The potential for eucalyptus plants in Indonesia is quite large, starting from the regions of Maluku, East Nusa Tenggara, Southeast Sulawesi, Bali and Papua which are natural eucalyptus forests. Meanwhile, those in East Java, Central Java and West Java are eucalyptus plantations (Rizqi Helfiansah et al, 2013).

A medium sized tree with a height of 15-20m. Occasionally has small buttresses. The thick bark is layered like paper and is not gummy. The fruit is capsule-shaped, brown and hard, while the seeds are small. White flowers grow on the tops of branches. The leaves are opposite each other, with fruit diameters ranging from 2-6 mm.

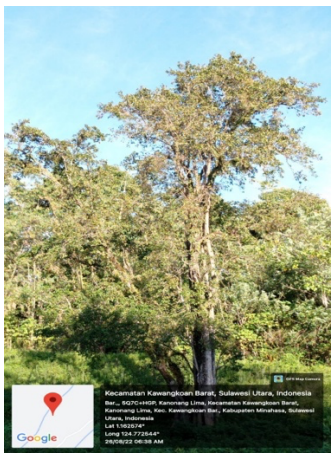

Figure 11. Eucalyptus Teer (personal ducumentation)

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12. *Gamal*

The gamal planting pattern is usually done as a hedgerow, alley cropping, or with a three-strat pattern planted together with perennials in an agroforestry system (Stewart, et al., 1996). Gamal has the ability to grow well in the highlands with sufficient rainfall, but is also able to grow in dry areas in the lowlands such as those in East Nusa Tenggara and is able to bear fruit and produce large amounts of seeds (Muh. Restu et al, 2021).

The stems on this Gamal plant vary, some are single and some are branched, but it is rare to find bushes, the height itself varies from 2 to 15 meters with a stem diameter of 5 to 30 cm. As for the leaves on the Gamal plant, they are slightly pinnate with an oval leaf shape, one leaf and another facing each other with a length of 4 to 17 cm.

Kingdom Plantae, Sub Kingdom Viridiplantae, Class Magnoliopsida, Order Fabales, Family Fabaceae, Genus Gliricidia Kunt, Species : Gliricidia sepium Kunt

Figure 12. Gamal Teer (personal ducumentation)

13. Sirih Hutan

Forest betel (Piper aduncum L.) is a plant whose leaves have potential as a source of vegetable pesticides. Forest betel is a plant whose leaves contain antimicrobial compounds. Piper aduncum contains 0.1% essential oil, monoterpenes, dehydralcones, and 5,7,3,4 tetrahydroxyflavones, benzoic acid derivatives, carboxylic acids and phenolic acids which can be active against microbes such as fungi and bacteria (Yetti Elfina, et al, 2015) .

It grows by spreading to other plants in the area. On the stem there are segments, tendrils with a distance of approx. 5-10 cm and as a location for the growth of new sprouts. The color of this stem is brownish to greenish. Betel leaves are oval or ovoid in shape with a light green to dark green color. This leaf has a width of 2-10 cm and a length of 5-15 cm and on the lower leaf surface is white. The leaf shape generally looks like a heart where the leaf reinforcement is embedded.

Kingdom Plantae, Superkingdom Trachebionta, Class Magnoliopsida, Order Piperales, Genus Piper, Species Piper betle L.

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Figure 13. Forest Betel Teer (personal ducumentation)

14. *Sweet Berries*

Agroecology Synsepalum dulcificum is a lowland tropical plant growing at an altitude of 100-1000 m above sea level. The habitat of this plant is in damp areas, such as along streams and in forests. The leaves are alternately arranged, 5-10 cm long, the underside of the leaf is hairy, has a very short petiole. Creamy white flowers, very small, clustered in the leaf axils. The fruit is dark red, 2 cm long and has a whitish-pink pulp, has a single hard seed and a shiny testa. There is one seed in each fruit, about the size of a coffee bean. Kingdom Plantae, Order Ericales, Family Sapotaceae, Genus Synsepalum, Species S. Dulcificum.

Figure 14. Sweet berries Teer (personal ducumentation)

DISCUSSION

Following Table 1. At the study site, there were 14 types of plants. The same plants produce both nectar and pollen, with different plant characteristics. When cultivating honey bees, the success in developing them is by keeping food from honey bees, especially plants or trees that produce nectar and pollen.

Having food and its availability is one of the keys to the successful management of Trigona sp. honey bees. The presence and availability of feed can be seen from the diversity of feed-producing plant species (pollen, nectar, resin). Availability of feed is one of the factors that influence the success of honey bee cultivation (Doweeks et al., 2019).

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Honey, nectar, pollen, and resin are plant food sources. Nectar is a source of carbohydrates, pollen is a source of protein, fat, vitamins and minerals, and resin becomes propolis (Abrol, 2011). Bee food is necessary to maintain life and maintain the growth and development of bee colonies (Sajjad et al., 2017). Dependence on nectar and pollen makes the development and population of honey bees entirely determined by the availability of plants and the flowering season (Hestia Tahir et al., 2021).

Honey bees' food sources include fruit plants, vegetable plants, industrial plants, and forest plants. The flowers of these plants contain nectar and pollen, which are very influential in the production of honey which honey bees will produce. It is believed that the potential for food plants for honey bees in Indonesia is quite significant, but there needs to be more information about these plants. (Rusfidra, 2006) stated that around 25,000 flowering plants grow and develop well in Indonesia, and the enormous diversity of plant species allows the availability of nectar and pollen throughout the year. Therefore, information about these plants from shrubs, crops, plantation crops, and forestry is needed. The problem in honey bee cultivation is the need for more bee feed plants supporting the bees' survival. (Mulyono et al., 2015).

Plants are in the pollination process needed for regeneration, while bees obtain food from nectar and pollen (pollen). For honey bees, nectar and pollen are exclusive foods that can only be obtained naturally from plants. Nectar is a source of carbohydrates, and pollen is a source of protein, fat, vitamins and minerals (Abrol, 2011). These two types of food are necessary to sustain life and maintain the growth and development of the colony (Sajjad et al., 2017). Dependence on nectar and pollen makes the development and population of honey bees completely determined by the plants' availability and flowering season (Yelin Adalina, 2018)

Plants that are a food source for honey bees include fruit, vegetable, industrial, and forest plants. Nectar and pollen are very influential in the production of honey, which will be produced by honey bees that come from the flowers of these plants. Especially in Indonesia, it is believed that the availability of honey bee food plants is quite large. However, information about these plants is not widely available. Flowering plants that develop very well in Indonesia have reached 25,000. The species and diversity of plant species make it possible to provide nectar. And pollen throughout the year (Rhavy Ferdyan et al., 2021).

CONCLUSION

Various types of plants are a source of food for Apis Dorsata Binghami, which is found in the Pinabetengan Forest, Minahasa Regency. With various forms and different heights of plants, even the classification and characterization of plants that attract bees and serve as a source of food for Apis Dorsata Binghami itself. Carefully use existing formulas to determine the density of these trees. Plants with various shapes and even fruits owned by trees around the bees attract the bees because they have the essence or smell of these plants. In general, bees really like plants with a sweet and refreshing smell, but it depends on the pollen that the tree has. However, apart from having pollen that can attract the attention of bees, nectar and pollen are also needed for the development and resilience of these bees.

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