Propolis, Pollen, and Honey Production on Two Different Agroecosystem

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Abstract

Trigona spp. is a stingless bee which is not cultivated yet, because it produced less honey than other genus but Trigona is a good propolis producer. The aim of this study was to study propolis, pollen, and honey production in two different Agroecosystem. Six colony were cultivated in two Experimental Plantation (Cicurug Monoculture Agroecosystem) and Community Plantation (Cijeruk Polyculture Agroecosystem), and directly observed for propolis, pollen and honey production. The results showed that propolis produced at monoculture agroecosystem is 27,79 g, and 48,80 g at polyculture agroecosystem. Pollen that produced at monoculture agroecosystem is 30,20 g and at polyculture agroecosystem is 43,25 g. Trigona at monoculture agroecosystem produced honey 7,58 g, but at polyculture agroecosystem only 0,70 g. The products that produced by Trigona at two different agroecosystem, influence by flowering season, distance between plant and the colony, and environment.
Keywords: agroecosystem, honey, pollen, propolis, trigona

Introduction

Trigona spp. is a stingless bee with a body size between 3 – 8 mm and very dynamic. *Trigona* can be detected by their way of life, outside and inside the nest. *Trigona* is less cultivated than other genus.. Stingless bee contributes to preservation of biodiversity by conserving populations of rare plants species. The colonies rarely abscond and resistant to the diseases and parasites of honey bees (Heard, 1999). Honey bee can be breed productively throughout the year in tropic area because plants as food sources are available continously. Beekeeping should be close to the flowering plants such as plantations or forests to gain higher productivity. *Trigona* and *Apis* are opportunist organisms, so all kinds of plants can be used as their food sources. Pollen is rich in proteins, vitamins and minerals and provides these nutrients to the bees. Pollen may be packaged and used as food supplements and also added to infant food, also used in many cosmetics preparations. *Trigona* honey difficult to extract, but it produces more propolis (Singh, 1962; Kwapong *et al.,* 2010). *Trigona* propolis frequently used as natural medicine for healthcare and body resistance. Propolis is the resin collected by honey bee from plants bud and broken branch, mixed with enzyme from bee saliva and used to protect their nest from contamination of bacteria, virus and fungi (Ghisalberti 1979; Gojmerac 1983; Marcucci 1995; Popova *et al.* 2005; Chen *et al.* 2008). The aims of this study was to analyze the production of propolis, pollen and honey which were cultivated in two different Agroecosystem.

Materials and Methods

Three colonies of *Trigona* spp. cultivated in monoculture agroecosystem and three colonies in policulture agroecosystem. Each colony consisted of ± 300 bees, including one queen, few drones, and hundreds of workers cultivated in stup made of wood. There were 437 nutmeg trees (*Myristica fragrans* Houtt) in monoculture agroecosystem. 10 nutmeg trees, 1 white leadtree, 1 dogfruit tree, 1 lengkeng tree, 2 mango trees, 4 the rambutan trees, 2 rose apple trees, 3 pineaplle trees, 1 passion fruit tree, 2 guava trees, 1 ambarella tree, 3 durian trees, 5 papaya trees, 41 banana trees, 1 mangosteen tree, and 3 jackfruit trees in polyculture farm.

Stups made of jengjeng woods with of 25x15x15 cm^3 and were numbered at the front side, then weighed for the empty weight. All the brood, food, and bee colony were moved from the bamboo into the stup and also propolis from the old entrance onto the new entrance. The stup filled with the colony were weighed, then placed at the old site for about 3 days for adaptation and cultivated for 3 months. After that, the colony were moved to the research location.

The method used in this study was direct observation on production of *Trigona* cultivated at two different agroecosystem. The purposive sampling were used to determine the location based on the potential of *Trigona* plant, i.e. Experimental Plantation (Cicurug Monoculture Farm) built by BALITRO which is a nutmeg unit production at 550 m above sea level on A climate zone. Community Plantation (Cijeruk Polyculture Farm) with various food potential at 400 m above sea level and A climate zone.

The observed variables were the propolis, pollen and honey production. After cultivated, the whole harvested products were weighed, then we separated honey, pollen and propolis. Each type of product (Propolis, Pollen and Honey) were weighed separately. The resulting datas of the research would be descriptively explained using tables and figures.

Results and Discussion

Productivity of Colony

The colonies initial weight in polyculture was havier than monoculture, but after one week, the colonies in monoculture were always havier than in polyculture (Figure 1). The t-test showed that average colony weight gain in two agroecosystem were significantly different ($P<0,05$) with score $95,5 \pm 10,8$ in monoculture and $61,3 \pm 11,7$ in polyculture. The variety of colony weight was infected by flowering season and environment.

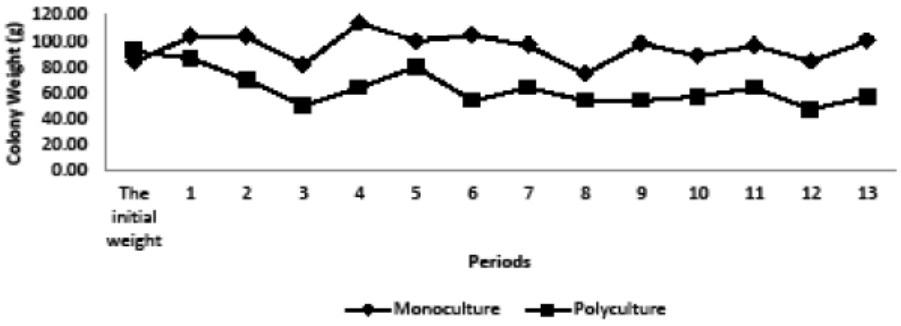

Figure 1. Trigona spp. Colonies Weight in Two Agroecosystem Farm

The flowering period coincides with the research period, thus results in colony growth. Honey bee needs food to fulfill their needs and colony growth. At the end of research period, the colony weight in monoculture was 299 g and polyculture 170 g. However, after harvesting, it turned out that *Trigona* in monoculture only produced 21, 93% from their colony weight, and 54, 56% on polyculture. The highest product of *Trigona* at monoculture was pollen, and propolis at policulture (Table 1). Perum Perhutani (1986) said, while building a nest, the bees will be very active to manufacture the cells as long as the forage and environments are in good condition, especially on flowering season. The weight gain in Monoculture was 80 % for brood cell and the product only 20%. Honey, Pollen and Propolis lower because they used to build the brood cell. The weight gain in Polyculture was lower but pollen, honey and propolis is 50% of the weight gain. Sihombing (1995) said, the presence of the queen affects pollen collecting through the egg-laying activity that will hatch. The smell of hatch will stimulate pollen collection. It will last simply untill the maximum need of the colony fullfilled, so the storing of pollen in the nest will not exceed the colony needs for a certain period. Honey bee eats pollen as protein and fat source, also to nurse the brood hence the lower pollen production in monoculture. Kwapong *et al.* (2010) said, that stingless bees use cerumen (a mixture of wax and plant resin) in the construction of the brood cells and storage pots.

Nutmeg (*Myristica Fragrans* Houtt) is the plant that flowering throughout the year in Monoculture, but the high flowering period is on April and May. Colony growth at polyculture agroecosystem was less than at monoculture, but they made higher amount of product. It happened because during the research, flowering seasons only occured on few plants, i.e. 10 nutmeg trees, 1 lamtoro tree, 3 jackfruit trees, 3 pineapple trees, 5 papaya trees, and 2 guava trees. Based on Siregar *et al.* (2011), *Trigona* needs the environment with vegetation that provide natural pollen and natural nectar in order to breed and produce a variety of bee products, such as honey, pollen and propolis. Allegedly, the amount of food collected in

two agroecosystem were used for colony growth, but the colony was not grow rapidly during the research, affected by unsupported environmental condition due to weather changes, that the rain is more often than the heat. The rainfall was high in March and decresed on April. On May, the rainfall raised up which greatly affected the colony growth. Sommeijer *et al.* (1983) said, foraging dan food resources was kept by the rain, because pollen resources was postponed by the rain in the morning and the continous rainfall will decreased foraging activitiesr because light intensity also decresed.

Table 1. Harvesting of 6 colony *Trigona* spp. on Monoculture and Polyculture Nutmeg Plantation

Agroecosytem	Final Colony Weight (g)	Harvest (g) /(%)	Propolis (g) /(%)	Pollen (g) /(%)	Honey (g) /(%)
Monoculture	299	65,57/(21,93)	27,79/(9,29)	30,20	7,58
Policulture	170	92,75/(54,56)	48,80/(28,71)	43,25	0,70

Source: Primary Data, 2012

Colony growth in monoculture were different from polyculture agroecosystem as shown in Figure 2. It showed that in the beginning of research, food supplies cells and brood cells in monoculture were nearly balanced, but after 3 months the colony were grown and the food supplies were low (Figure 2A - 2B). Otherwise, Figure 2C showed that food supplies and propolis were plenty than brood cells in polycultutr colonies at the beginnings, but after 3 months, the food supplies and brood cells were almost balance (Figure 2D).

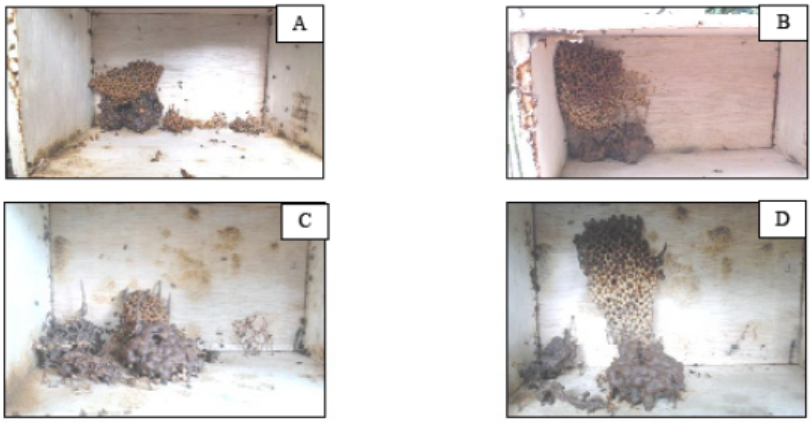

Figure 2. Colony Growth of Trigona spp. Two Agroecosystem. A). Colony of Trigona at Monoculture Agroecosystem on the begining; B). Colony of Trigona at Monoculture Agroecosystem at the end of research; C). Colony of Trigona at Polyculture Agroecosystem on the begining; D). Colony of Trigona at Polyculture Agroecosystem at the end of research

Conclusion

Colony cultivating in two agroecosystem produced different amount of product. Colony in Monoculture produced 27,9 g Propolis and 48, 80g at Polyculture. Pollen produced in Monoculture is 30, 20gr and 43, 25 gr at policulture. Honey in Monoculture is 7,58 g, while Policulture is 0,70g

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