

The Effect of Daily Activities Stingless Bees of *Trigona* sp. on Honey Production

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ABSTRACT

Trigona sp. is a group of stingless bees that including one of the indigenous bees from Indonesia and the bees without sting that live colonies in the trunk of trees or woods, bamboos, sugar palm stalks and on the ground. The habitat causes different daily activities in the hive, so affected production of honey. The aim of the study was to determine an effect of daily activities the stingless bees worker of *Trigona* sp. on the production of honey in the various bee hives design. This study was conducted from 16 July to 22 September 2016 in Ngrandu Katongan Village, Sub-District of Nglipar Gunungkidul, Yogyakarta. The material of research were stingless bees *Trigona* sp. was obtained from the bamboos in the KTH Madusari beekeeping. Sixty colonies were transferred to four bee hives design (35x20x15.5; 35x20x17.5; 37.5x20x20; 40x20x20 cm) with fifteen replications (number of bee hives design). Transfer of colonies was performed at night to avoid the stress that consists of the queen bee, eggs, worker bees and drones, pollen as a source of protein in the hive and placed on the nest for about two months of the beekeeping process. The research results showed that production of stingless bees *Trigona* sp. honey in various bee hives design were 62.20±20.32; 66.60±26.60; 60.60±16.53; 49.20±32.72 ml respectively that did not significantly different ($P>0.05$) in the daily activity. In addition, the entrance and exit hives by bees worker at 08.00 to 10.00 am and 02.00 to 04.00 pm did not significantly different. Thus, production of honey was dependent on the daily activity of bees worker especially entrance and exit hives to collect nectar as raw material to the production of honey. It can be concluded that bee hives design 35x20x17.5 cm resulting higher production of honey and daily activities than the other design.

Keywords: Stingless bees, *Trigona* sp., Daily activities, Indigenous bee and honey

INTRODUCTION

Trigona sp. is a group of stingless bees that included one of the indigenous bees from Indonesia that live permanently as a colony in the trunk of trees or woods, bamboo hole, sugar palm stalks and in the soil (Agussalim, 2015; Michener, 2007; 2013). Furthermore, stingless bees occur in several continents, mainly in tropical and subtropical regions, and are adapted to different types of vegetation including forests, savannas, fields, marshes, and mountains (Bath, 2013). The habitat of bees has been described in the Qur'an Surah An-Nahl verse 16:68, which means "and your Lord inspired to the bees, "take for yourself among the mountains, houses, and among the trees and (in) that which they construct". The variation of

habitat causes the *Trigona* sp. have different daily activities, so impact on the production of honey. *Trigona* sp. has the length about 2 – 4 mm (Michener, 2007; 2013), so impact on the produced honey in the small amount, but it produced propolis in higher quantity than the other bees (Agussalim, 2015).

Honey is a sweet viscous substance made by worker bees use a nectar from the flowers (floral) and extrafloral nectar of plants (Sihombing, 2005; Barth, 2013; Agussalim, 2015). The honey from *Trigona* sp. have the unique taste compared to honey produced by other bees, have a taste sweet mixed with acid (Agussalim, 2015). Production of honey affected by the availability of nectar from flowers of plants, the activity of bees, temperature, and humidity (Sihombing, 2005; Agussalim, 2015). The exit and entrance activity of bees aimed for collect the nectar and pollen as a raw material for producing honey and bee pollen for the sustainable of colonies in the hive (Abrol, 2011). The aimed of research was to investigate the effect of daily activities of bees *Trigona* sp. on the production of honey.

MATERIALS AND METHODS

This study was conducted from July 16 to September 22, 2016, in Ngrandu, Katongan Village, Sub-district of Nglipar Gunungkidul, Yogyakarta. The materials of research were stingless bees *Trigona* sp. as much as sixty colonies were obtained from the bamboos in the KTH Madusari beekeeping. The bee hives design were made from dried wood boards of mahogany that box shaped, while the nest was made from the bamboos which consist of four stacking racks with the size was 250x250x300 cm. In addition, the nest was directed to the source of food, so easier the worker bees to take a nectar and pollen as a food. The study was using complete randomized design with four bee hives design (35x20x15.5; 35x20x17.5; 37.5x20x20; 40x20x20 cm) and fifteen replications (number of bee hives design).

The colonies were transferred to four bee hives design were performed at night to avoid the stress that consists of the queen bee, five table spoons of brood contain eggs and larvae, worker bees and drones, pollen as a source of protein in the hive and placed on the nest for about two months of the beekeeping process. The number of worker bees and drones were not counted because the difficulty to differentiate between the both at night. The bee hives have been filled by *Trigona* sp. colonies placed randomly in the nest for about two months the beekeeping process. In addition, during the beekeeping process will be controlled once a week from pests especially ants.

The variables of the study were the production of honey, entrance of hive and exit of the hive as the daily activities, the types of plants as a source of nectar as raw material for the production of honey. In addition, the ambient temperature and humidity were measured using thermo-hygrometer. The production of honey *Trigona* sp. was measured after two months of beekeeping process. The honey was harvested with cut the propolis attached to the bee hives, then entered use needles and allowed to drip on plastic cups. The honey production was measured using measuring glass and was expressed in a milliliter. Furthermore, for the daily activities was showed by an exit and entrance hives by worker bees were counted for five minutes every bee hives at Monday, Wednesday, and Friday was started at 08.00 to 11.00 h. The daily activity was calculated by two hand counters at a distance 1 meter from the entrance so the worker bees can be seen clearly. For the temperature and humidity environment was measured using the thermo-hygrometer every Monday, Wednesday, and Friday was started from 08.00 to 18.00 h.

The data of production of honey and daily activities of bees *Trigona* sp. was analyzed by variance analysis (Steel and Torrie, 1993) with the help of Statistical analysis software

(SAS Inc. 2000), while the data of temperature and humidity environment was analyzed by descriptive analysis.

RESULTS AND DISCUSSION

Honey is a sweet viscous substance made by worker bees use a nectar from the flowers (floral) and extrafloral nectar of plants (Sihombing, 2005; Abrol, 2011; Barth, 2013; Agussalim, 2015). Honeybees visit flowers to collect pollen and nectar, the former being the principal source of protein, fats, vitamins, and minerals, which are essential for honeybees growth and development, repairing of worn out tissue and stimulating the development of hypopharyngeal glands. Nectar consists of the carbohydrates, mainly sucrose, fructose, and glucose, and is the raw material of honey (Abrol, 2011). Honey is produced by honeybees have a chemical composition or nutrients of honey is carbohydrates consists of monosaccharides, fructose, glucose and disaccharides, maltose and sucrose. Furthermore, honey contains amino acids, vitamins consists of Vitamin B, pyridoxine (B6), ascorbic acid (C), niacin (B3), folic acid (B9), pantothenic acid (B5), phylloquinone (K), minerals, iron, zinc, antioxidants and polyphenols (Ball, 2007; Buba *et al.*, 2013; Bogdanov, 2016). Thus, the honey nutrients can support the development and sustainability of bees colonies.

The result of research showed in Ngrandu, Katongan Village has a temperature about 23.8 to 32.7°C with the humidity about 78 to 84%. The temperature is normal for growth and development of *Trigona* sp., so given the comfort condition for bees to produce honey, pollen, propolis and royal jelly. According to Tautz (2008), honeybees can activity normally at the temperature about 18 to 35°C, so when the condition above and below the temperature causes the disrupted activity of honeybees. The optimum temperature for honeybees is 26°C. Agussalim (2015) reported the temperature is about 26 to 35°C with humidity about 46 to 60% for stingless bees of *Trigona* sp. can create the comfortable conditions for bees so production of honey, pollen dan propolis were optimum. Furhermore, Abrol (2006) report that the bee of *Apis florea* was found started the activity in the morning with the temperature about 19.4 to 25°C. In addition, the bee of *Apis florea* showed the highest activity for collect the nectar or pollen in the temperature about 25 to 38°C and decrease activity at temperature more than 38°C. Sihag (1984) cited by Abrol (2011) states the bee of *Apis dorsata* the flight activity decrease at temperature below 16.5°C and above 38°C. Production of honey and daily activities of stingless bees *Trigona* sp. can be seen in Table 1.

The research result showed that production of honey, activities exit and entrance stingless bees of *Trigona* sp. in various bee hives design were varied, but did not significantly different ($P>0.05$). The exit activity indicates the number of worker bees for collect food as like nectar, pollen, and water, while the entrance activity indicates the number of worker bees that enter carrying foods such as nectar and pollen collected from plants as raw materials for producing honey, pollen, and royal jelly.

Table 1. Production of honey and daily activities of stingless bee *Trigona* sp.

Parameters	Bee hives design (cm)			
	35x20x15.5	35x20x17.5	37.5x20x20	40x20x20
Production of honey (ml) ^{ns}	62.20±20.32	66.60±26.60	60.60±16.53	49.20±32.72
Activity exit worker bees (times/5 minutes) ^{ns}	37.00±11.93	43.00±15.50	40.00±16.62	43.00±19.60
Activity entrance worker bees (times/5 minutes) ^{ns}	38.00±10.62	44.00±15.52	44.00±20.14	46.00±19.73

Production of a honey dependent of the amount of nectar can be collected by worker bees from the plants. Production of honey by *Trigona* sp. higher was showed by bee hives design size 35x20x17.5 cm with the average about 66.60 ml, but the lower was showed by size 40x20x20 with average 49.20 ml/two months beekeeping process. In addition, production of honey also causes by an availability of source nectar from plants in the around the location of beekeeping. The plants as the source of nectar in Ngrandu consists of coconuts (*Cocos nucifera*), rambutans (*Niphelium lappaceum*), bananas (*Musa paradisiacal*), mangoes (*Mangifera indica*), starfruit sweet (*Averrhoa carambola*), cherry (*Muntingia calabura*), and acacia (*Acacia* sp.).

The higher production of honey on design 35x20x17.5 cm is may be caused by worker bees more active collecting nectar that showed by exit and entrance activity higher i.e. 43 and 44 times per five min, respectively. While the lower production of honey on design 40x20x20 cm is may be caused by worker bees more active to construct the hive, transport out the waste from the hive and the main factor is the low productivity of queen bee to produce eggs as worker bees, although the daily activity was same with design 35x20x17.5 cm. Furthermore, Abrol (2011) explained that foraging labor is also divided such that some individuals forage for nectar, some for pollen, some carrying both and fewer with water. Thus, the daily activity of worker bees in the hive or outside effect on the production of honeybees products.

In the two months for *Trigona* sp. beekeeping is the time needed by bees for growth and development colonies. Thus, after two months show the *Trigona* sp. the good development such as the number of eggs and worker bees are an increase, worker bees more active to collect a nectar and pollen as a raw material for the production of honey and bee-pollen. While our research starts from the transfer of colonies from the natural to the bee hives boxes and two months beekeeping process, so not yet getting the maximum information about the bees of *Trigona* sp. In the future, needed research how the effect of beekeeping time on the production of honey, bee-pollen, and propolis by bees *Trigona* sp. which started after two months beekeeping to six months. In addition, the measuring of volume the nectar and weight of pollen can be collected by worker bees are important, so can predict the production of honey and bee-pollen in the season especially when the rich and the lack of food.

CONCLUSIONS

The conclusion of the research that bee hives design 35x20x17.5 cm resulting the higher production of honey with average 66.60 ml and daily activities (exit or entrance) with average 43.00 or 46.00 times per five minutes, respectively compared other design. In the future, needed research about the volume nectar and the weight of pollen has been collected by worker bees, so can predict honey and pollen production in the colonies or every season.

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