Production of Stingless Bees (*Trigona* sp.) Propolis in Various Bee Hives Design

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ABSTRACT: *Trigona* sp. is a group of stingless bees that live socially and in colony at the trunk of trees or woods, bamboo hole, sugar palm stalk and in soil hole. Variation in the habitat causes these bees colonies cannot be well-grown and reduce the propolis production. The aim of the research was to determine the production of stingless bees (*Trigona* sp.) propolis in various bee hives design. This research was started from September to October 2014 in Papak, Genggelang Village District of Gangga, North Lombok Regency West Nusa Tenggara Province. Material of the research was stingless bees (*Trigona* sp.) as much as 25 colonies taken from sugar palm stalks. Transfer of stingless bees colonies from the stalks to 5 bee hives design (35 x 17.5 x 13.5 cm; 35 x 20 x 15.5 cm; 35 x 20 x 17.5 cm; 37.5 x 20 x 20 cm; 40 x 20 x 20 cm) was performed at night and placed on the nest for about 2 months of the beekeeping process. The research result showed that production of stingless bees (*Trigona* sp.) propolis in various bee hives design are 20.40 ± 2.07 g; 19.00 ± 2.92 g; 30.80 ± 14.62 g; 21.80 ± 6.30 g and 18.20 ± 7.29 g respectively and did not significantly different (P>0.05). Production of stingless bees (*Trigona* sp.) propolis is not affected by the bee hives design but affected by the productivity of bee queen, population of workers bee, colony size of bees, activity exit and entrance hives of workers bee. It can be concluded that design 35 x 20 x 17.5 cm resulting higher production of propolis than the other design.

Keywords: Stingless bees of *Trigona* sp., production of propolis, bee hives design

INTRODUCTION

Trigona sp. is a group of stingless bees that live socially and in colony at the trunk of trees or woods, bamboo hole, sugar palm stalks and in the soil (Michener, 2007; 2013; Erwan and Yanuartati, 2012). The habitat 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 stingless bees of *Trigona* sp. are not widely known by general societies especially beekeepers because the limitation of science and knowledge, so the mastery of beekeeping process, transfer and multiple of colonies was very low. It has an impact on difficulty of controlling colony health and development, difficulty of harvesting propolis and damage the hive structure, so causes reduce the propolis production.

Trigona sp. a produces small amount of honey, but it produces propolis in higher quantity than the other bees or genus *Apis* (Michener, 2007; 2013). Propolis (bee glue) is a sticky dark colored material or resinous substance collected by honeybees from living plants, mix with wax and used in construction their nest (Bankova *et al*., 2000). Resin is used by female bees primarily during nest construction, often serving both as protection and a building material, as well as a biologically active compound (Roubik, 1989). Utilization of propolis by stingless bees *Trigona* sp.

to construct the entrance to protected from pests, bacteria and viruses.

Production of propolis stingless bees of *Trigona* sp. affected by activity exit and entrance hives of workers bee, productivity of queen bee, availibility resin from plants and bee hives design. The solution for the problems in the native habitat by modifying the bee hives design using dry wood boards. The bee hives design that was used to provide comfort the stinglees bees of *Trigona* sp. to produce propolis, so to increasing the production of propolis. Information of propolis production on the stingless bees of *Trigona* sp. especially in various bee hives design is still very less. The aim of the research was to determine the production of stingless bees *Trigona* sp. propolis in various bee hives design.

MATERIALS AND METHODS

This research was done from September to October 2014 in Papak, Genggelang Village District of Gangga, North Lombok Regency West Nusa Tenggara Province. Material of the research was stingless bees of *Trigona* sp. as much as 25 colonies taken from sugar palm stalks. The bee hives design made from dried wood boards of borok (local name) that box shaped, while the nest made from the bamboos which consists of five racks with the size was 250 x 250 x 300 cm. In addition, the nest was direction to the source of food, so easier the worker bees to taken a food.

This research using complete randomized design with five treatments bee hives design and five replications (number of bee hives design). The bee hives design size are 35 x 17.5 x 13.5 cm as a control (Erwan and Yanuartati, 2012), 35 x 20 x 15.5 cm, 35 x 20 x 17.5 cm, 37.5 x 20 x 20 cm and 40 x 20 x 20 cm.

Transfer of stingless bees *Trigona* sp. colonies form the stalks to five bee hives design performed at night to avoid stress, so easier to transfer process. The colonies that the transfer was queen bee, five tablespoon of brood contain eggs and larvae, drones, and bee workers. The bee hives has been filled by stingless bees colonies placed randomly in the nest for about two months the beekeeping process. In addition, during the beekeeping process will be controlling once a week from pests especially ants.

The dependent variable was production of propolis, while the independent variables are activities exit and entrance of worker bees, temperature and humidity environment. Porduction of propolis was measured after two months of beekeeping process and taken from honey wrap and on the wall of bee hives. Propolis to be measured was raw propolis and not yet extraction. Production of propolis weighed on digital scales Shuma brand with a precision 1 gram which is expressed in unit of gram. For the activities exit and entrance of workers bee was count for 5 minutes every bee hives at Monday, Wednesday, and Friday which start at 08.00 to 11.00 am and 14.00 to 17.00 pm. The activity calculation using the two hand counters at a distance 1 meter from the entrance, so that the bee workers can be seen clearly. For the temperature and humidity environment was measured using thermo-hygrometer every Monday, Wednesday, and Friday which start from 08.00 am to 18.00 pm.

Data of propolis production, activities exit and entrance of workers bee was analyzed using 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 with descriptive analysis.

RESULTS AND DISCUSSION

Propolis (bee glue) is a sticky dark colored material or resinous substance collected by honeybees from living plants, mix with wax and used in construction their nest (Bankova *et al*.,

2000; Tautz, 2008). Resin is used by female bees primarily during nest construction, often serving both as protection and a building material, as well as a biologically active compound (Roubik, 1989). Stingless bees of *Trigona* sp. utilization of propolis are to construct the nest, entrance to protected from pests, bacteria and viruses, honey and pollen wrap. Production of propolis, activities exit and entrance of worker bees *Trigona* sp. research result can be seen in Table 1.

Table 1. Production of propolis, activities exit and entrance workers bee of *Trigona* sp.

Parameters	Bee hives design (cm)				
	35x17.5x13.5	35x20x15.5	35x20x17.5	37.5x20x20	40x20x20
Production of propolis (g)^{ns}	20.40±2.07	19.00±2.92	30.80±14.62	21.80±6.30	18.20±7.29
Activities exit workers bee (times/5 minutes)^{ns}	37.76±16.40	42.51±15.77	48.62±18.24	43.27±16.58	45.77±17.80
Activities entrance workers bee (times/5 minutes)^{ns}	38.96±14.20	43.97±15.91	50.14±18.37	46.16±16.30	47.56±18.03

Stingless bees of *Trigona* sp. workers to collect resin from plants start at the first day after the colonies transfer from sugar palm stalks to bee hives design. The resin collecting by workers bees used to produce propolis as honey and pollen wrap, construct the nest and entrance. It was shown by the activities of workers bee was very active in covering gaps on the bee hives design using propolis and can be enclosed with a week. The covering of gaps is aimed to create the comfort condition in bee hives, so expected improve the production of propolis. The research result showed *Trigona* sp. was started to collect resin in out the nest for about 06.00 to 06.15 am with temperature about 23 to 34^{o} C and humidity about 68%. The *Trigona* sp. incoming or entrance to the bee hives for about 18.00 to 18.15 pm with temperature about 29 to 30^{o} C and humidity about 54%. It indicates that the activity for collect resin from plant by workers bee was requirement 12 hours.

The research result showed that production of propolis, activities exit and entrance stingless bees of *Trigona* sp. in various bee hives design was varies, but did not significantly different ($P>0.05$). It was showed that production of propolis was not affected by the bee hives design, but affected by activities exit and entrance of worker bees, productivity of queen bee and availability of resin from plants. The higher activities from the workers bee showed higher production of propolis in bee hives or otherwise. Production of propolis that higher to be found on bee hives 35 x 20 x 17.5 cm with mean 30.80 ± 14.62 g, while the lower production to be found on bee hives 40 x 20 x 20 cm with mean 18.20 ± 7.29 g.

The high of production propolis in bee hives 35 x 20 x 17.5 was caused by activities exit and entrance workers bee that higher with mean are 48.62 ± 18.24; 50.14 ± 18.37 times per bee hives for 5 minutes, respectively. It indicates that the exit activities of worker bees to collect the resin from plants and incoming into the colony to produce propolis, so improving production propolis than other bee hives design (Table 1). The lower production in bee hives 40 x 20 x 20 cm was caused activities of workers bee preoccupied by creating and caring for eggs as a candidate for a new queen bee, though the activities exit and entrance bee hives that higher than other design (Table 1). It condition was caused by queen bee in the bee hives was fled and occur in the first weeks after transfer colonies from stalks to bee hives.

The production of propolis was optimal because supported by temperature for about 26 to 35^{o}C with humidity about 46 to 60%, so this condition was comfort zone for improving the production of propolis. Tautz (2008) explained that honeybees keep the temperature of the brood combs containing the pupae at about 35^{o}C, so improve the growth and development of bees. The

entrance activity of workers bee indicates the amount of resin can be collecting from plants, while the exit activity indicates the number of workers bee to collect resin and the colored materials. Sihombing (2005) explained that production of propolis affected by productivity of queen bee, population of workers bee, and resin source of plants.

CONCLUSIONS

The conclusion of the research that bee hives design 35 x 20 x 17.5 cm resulting production of propolis, activities exit and incoming of worker bees higher than the other design with average 30.80 g, 48.62 and 50.14 times per 5 minutes, respectively.

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