Extracting *Apis dorsata Binghamii* Honey using Incision Technique

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Abstract: At the time of the flowering season arrives, honey bee colonies will actively fill the nest with honey, pollen and puppies. Along with the honey gatherers are also actively seeking to take the honey bee hive. Honeycomb (*Apis dorsata Binghami*) which has a hanging nest in trees was often taken by humans in an unproductive ways causing many young bees and hive contents besides honey, often wasted for the next harvest. The purpose of this study was to determine the slicing method honeycomb *Apis dorsata Binghami* in nature, which can speed up the next process in honey harvesting cycle. The sample consisted of eight observations of bee hive of *Apis dorsata Binghami* with four treatments and two replicates. Treatment P1 was slicing across the honeycomb, whereas nP2 treatment was the slicing/take part contains the honey hive, and treatment P3 used slicing whole beehive and later taped the sliced nest. P4 treatment had the honey extracted from the honey productive parts and then taped back the ex- slices from the middle of the nest. The results showed that the fastest time of bee colonies *Apis dorsata Binghami* back to the original nest is P4 treatment for it only took 0.000439 days while P2 took 0.000590 days. On the other hand P1 and P3 treatments took more than 80 days. Extracting just the honey from its nest will accelerate the bee colony reoccupation of their nest, compared with the whole slicing of the beehive. The faster the bee colony occupied the nest will result in quicker repair activities of the hive. The honey will be filled much faster for the next harvest revisits.

Keywords: Slicing; honeycomb; *Apis dorsata*; honey; harvesting

1. Introduction

Efforts for the honey bee extraction development represent one of the potential economic activities in the 193 mil ha of Indonesian forest. If the honey can properly be harvested from the vast area of the Indonesian forest, the apiculture industry can became one of the significant money producing activities for the Indonesian honey hunters. Apiculture industry can also create employment opportunities in supporting the forest plantations and horticulture conservation in the country. For instance, Williams (2002) reported that insect pollinator such as bees have assisted the pollination process to more than 140 species of plantation crops in Europe. This was supported by Satta *et al.* (1998) where he reported that the local bee have assisted the pollination process for flower Sulla (*Hedysarum conorarium* L) in the Mediterranean.

Currently the national honey production has not been able to meet the needs of the market. The ability of the market is only able to meet the 12,000 tons of honey per year from the total national demand of 50,000 tons. As a result, every year Indonesia had to import honey to meet the local demand (Indonesian Forestry Magazine, 2010). Improper honeycomb forest harvesting practices had led to inefficient and wasted of many nests in the forest. Though the nest contains most of the worker bees, drones and queen bees will form a force in the colony. The presence of the worker bees looking for nectar and pollen had resulted in the marriage of queen bees and the queen bees to lay eggs. However, a shortage of individual bees in a bee colony will affect productivity of honey.

Bees build their nests requires great energy because they have to collect as much as 10 pounds of honey to produce 1 kg of beeswax as a base material made of honeycomb. In such process, it took three months to make a perfect nest (Sarwono, 2005). During the process, the honeycomb of *Apis dorsata* was sliced where the honey-filled hive was taken with the nest wasted and left in the forests. As a result, the bee colonies were busy looking for a new place to rebuild their nests. Therefore, the objective of this paper was to determine the best slicing technique of honeycomb (*Apis dorsata*) which is capable of facilitating the return of the former colonies of bees to the original nest. This created the return of the bees to rebuild their nest where the colonies refilled the honeycomb cells and accelerated the next harvest.

2. Materials and Methods

2.1 Method of Bee Hive Slice

The study was carried out in the Forest Complex of Mekongga Kolaka in March to November 2013. Surveillance began in August to November 2013 which included the observation from the fastest time back to the hive bee colonies and the colonies' longest time in rebuilding their nests after their first nests being sliced and harvested.

The determination was based on the location of the observation for bee *Apis dorsata* nests from the ground. A total of eight nests were sampled with four treatments and two replicates, namely: Treatment 1 (P1) sliced whole nest, P2; sliced honey only from

Figure 1. Sliced the whole hive of bees (P1)

Figure 2. Sliced only part of the honey hive containing honey (P2)

Figure 3. Slices whole nest and pasted it back (P3)

Figure 4. Sliced nest that contains part of the honey and pasted ex- sliced parts from the middle of the nest (P4)

the top, P3; sliced the whole nest and pasted back, P4; sliced only part that contained honey and closed ex- sliced parts from the middle of the nest as illustrated in Figures 1 and 2.

2.2 Data Analysis

In order to determine whether any treatment has a significant difference, an Analysis of Variance was performed. If there are a couple of significant differences amongst the treatments, a Least Significant Difference (LSD) was later tested.

3. Results and Discussion

Formation of *Apis dorsata* hive honeybee requires a 3 months' period of time due to the lack of food availability in the form of nectar, pollen and water. This happened because of the decreasing extent of the forest due to illegal logging which cannot be monitored and controlled by the Indonesian authorities. Another critical factor is the harvesting technique of honey bee hive in a way that does not lead to environmentally friendly and sustainable honey bee colonies in the forests.

3.1 The Amount of Re-Colonization Time of an Empty Nest after First Beehive Slicing

The sliced treatment technique of an *Apis dorsata bee* hive will usually result in the bee colony staying away from its hive. However, the bee colony will return again to its hive within different times for each given treatment. Based on the analysis of variance (Table 1), it can be seen that the F count is bigger than the F table (F count > F table) which means that there are at least two pairs of different treatments which are very significant. To know the different treatment, a LSD test (least significant different test) was further conducted.

Based on LSD test (Table 2), P3 treatment was significantly different from P1; P2 was highly significant from P3 and P1. Treatment of P4 was likewise highly significant from P3 and P1, but P4 treatment was not significantly different from P2, although there was a difference of 0.000151 days between P4 and P2. Thus, the treatment method of nest slicing for P4 and P2 was the best method because it gives the fastest time for the bee colonies to return to the original nest at 0.000439 and 0.000590 days. While the P3 and P1 treatment of bee colonies *Apis dorsata* nest was rebuilt after more than 80 days (Figure 5).

Table 2 clearly showed that treatment P4 provide the fastest time than P2, P3 and P1 for the bee to re-colonize. Woyke *et al.* (2012) explained that *Apis dorsata* and *A. laborisa* did migrate if their honeycomb has been disturbed and damaged. They will find a new colony not far from their first next being harvested. According to Robinson (2012), the ability of *Apis dorsata* to migrate far from their original first nest is 200 km away.

Table 1. Analysis of variance from the amount of time of bee colony leaves its hive (days) after nest being sliced (days)

Source of Variation	Degrees of freedom	Sum of Squares	Central Squares	F Count	F Table	
					5%	1%
Treatment	3	11,952.200	3,984.067	3,541.393**	6.59	16
Error	4	4.499	1.125			
SUM	7	16,296.7				

Coefficient of Variance= 2.35%,
**) significant

Table 2. Difference in the average value of each treatment on LSD test

Treatment	Average	Notation ($LSD_{0.05}$: 2.082)	Notation ($LSD_{0.01}$: 3.453)
P1	85.00000	A	A
P3	81.00000	B	B
P2	0.00059	C	C
P4	0.00043	Cd	Cd

Different letter indicates significance level at the 95% confidence and very significant at the 99% confidence.

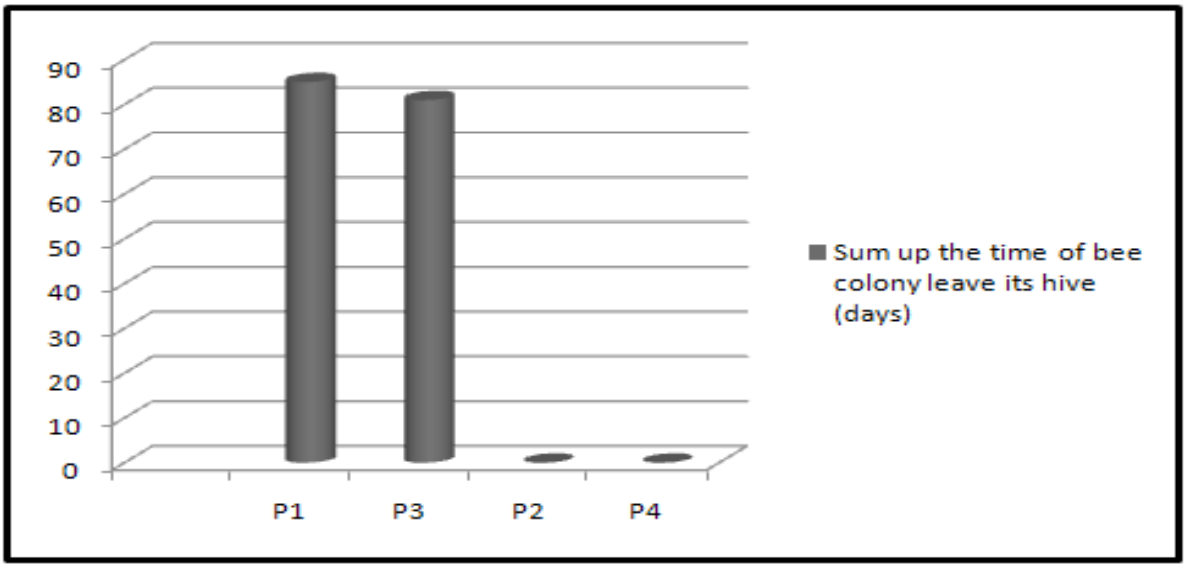

Figure 5. Mean sum up time of bee colony leaving its honeycomb after treatment of beehive slicing (P1, P2, P3, and P4).

3.2 Sum Up Time of Bee Colony Rebuilding its Next Hive

Colony of *Apis dorsata* normally rebuilt their beehive when local environmental condition has been assumed peaceful. Availability of sufficient nectar and pollen will fasten the construction of honeycomb formed from the bee wax with an immediate bee queen laying her eggs with multiple colonies. The faster the bee colony build its hive, the faster the bee hive being filled with honey into its cellular beehive leading to a faster turnaround time for the next harvest of honeybee. According to Sarwono (2005), to yield 1 kg of honey, the bees have to collect 3-4 kg of nectar with a travelling distance of 360,000 - 450,000 km of flying for the nectar and pollen supply. The formation and production of bee wax from pollen and nectar took about 12 days.

Based on ANOVA shown in Table 3, the F_{Count} was bigger than $F_{Table.}$ This implied that there are at least two pairs of different treatments which are highly significant. A LSD test was further performed to test the significance in the mean time (days) used by the honey bees in building their hive as illustrated in Figure 6. It clearly showed that treatments P1 and P3 newly started their activities, while treatments P4 and P2 already started their honeycomb activities much earlier to rebuild their beehives.

Table 4 showed that the treatments were not significantly different between P3 andP1, but P2 was highly significant compared to P3 and P1 treatments. Likewise, P4 was highly significant compared to P3 and P1. P4 treatment was not significantly different from P2. Thus, the treatment method of nest slicing for P4 and P2 is the best because it provided the *Apis dorsata* bee colonies to quickly build their nests and produce the honey from its beehive.

Treatment (P2) with the head sliced honey and treatment (P4) having pasted sliced honey head back, were the recommended method to increase the productivity of *Apis dorsata Binghamii* honey. This slicing method of honeycomb leads to a more environmentally sound and friendly forest.

Table 3. Analysis of variance for the amount of time for bee colony to rebuild its hive

Source of Variation	Degrees of freedom	Sum of Squares	Central Squares	F_{Count}	F_{Table}	
					5%	1%
Treatment	3	13,531.38	4,510.46	3,283.32**	6.59	16.00
Error	4	5.50	1.37			
SUM	7	13,536.87				

Coefficient of Variance= 8%
**) significant

Table 4. Difference in the average value of each treatment on LSD test

Treatment	Average	LSD test ($LSD_{0.05}$: 2.301)	LSD test ($LSD_{0.01}$: 3.816)
P1	0.5	a	A
P3	1.5	ab	Ab
P2	83.5	c	C
P4	83.0	cd	Cd

Different letter notation indicates the significance level at the 95% confidence and highly significant at the 99% confidence level.

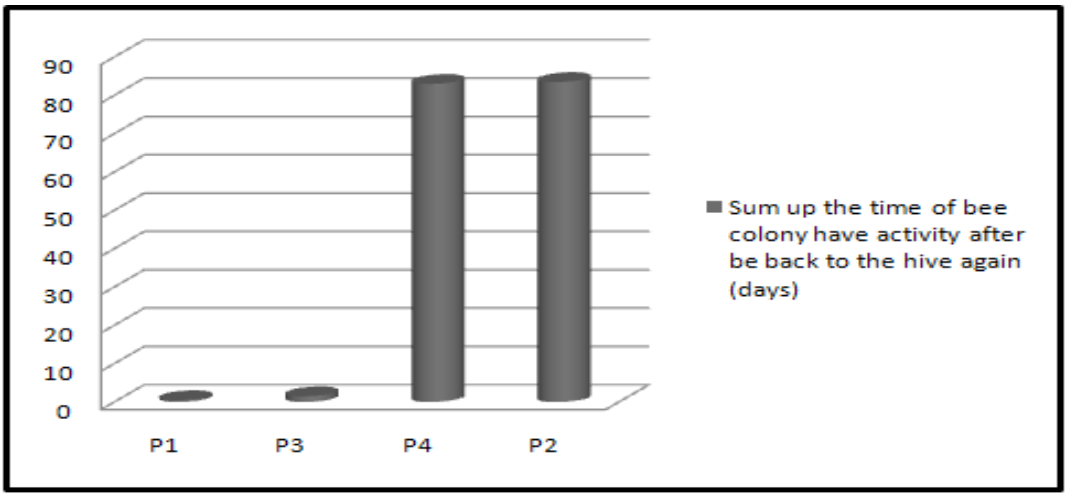

Figure 6. Mean total time of bee colony to be back to the its original beehive

a b c

Figure 7. Treatment P4 (*apis dorsata* bee colony back to the nest within 0.000439 days after extracting part of the honey): a (before treatment), b (after treatment), c (bee colony back to the nest)

a b c

Figure 8. Treatment P2 (*Apis dorsata* bee colonies returning back to the nest within 0.000590 days after harvesting part of the honey), a (before treatment), b (after treatment), c (bee colony back to the nest)

a b

Figure 9. P1 treatment where the honeycomb was re-built starting on day 85. A (slicing of whole beehive), b (days to 85)

a b c

Figure 10. P3 treatment where the honeycomb was re-built only after day 81, a (before treatment), b (after treatment), c (days to 81)

As seen in Figures 7a-7c below, after the bees nest being sliced, colonies of bees were back again into their beehives. Similarly, Figure 8 illustrated that after slicing the nest, the colonies of bees were back into their hives (P2). Both P2 and P4 treatments are no significantly different between each other.

The scenario is different as seen from Figures 9 and 10 where the bee colonies did not immediately occupy the nest once sliced and harvested. It took almost 80 days for the honey bees to build a new nest in the same vicinity where the first nest was built.

The return of the original colonies of bees to their beehives is possible because there was still some honey left that was not picked up at the base of the nest attached to the tree trunk. Honeycomb is still stored on the tree

trunk where honeys for bee's activities were still available. Therefore, honey bee colonies that had been disturbed due to fogging went away only on a temporary basis. Once the curing process was completed, the bee colonies moved back into the nest again. The energy needed to rebuild the same nest was not as much as with the energy to build a new nest. As mentioned by Sarwono (2002), the forest *Apis dorsata bees* require as much as 10-12 kg of honey consumption to rebuild their nests weighing 1 kg. Honey is still available possibly because there is still honey which has not been harvested at the base of the nest which is still attached to the tree trunk.

4. Conclusion

It can be concluded that the best technique to harvest honey from the beehive is to slice the part of the nest that produced the honey (P4 treatment). After, the nest must be reaffixed back by covering the middle of the nest. The bee colony will take possession of the nest by returning back just within 0.000439 days to its hive after the honey being partially harvested.

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