Increasing Population of *Apis Mellifera* Bees as a Response to the Application of Granulated Sugar

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Abstract. The purpose of the study was to determine the effect of giving granulated sugar on the development of the *Apis mellifera* bee population. This study used a randomized block design with 4 treatments and 3 replications. The research treatments were P0 = control (bee box without added sugar), P1 = bee box plus 0.25 kg sugar/week, P2 = bee box plus 0.5 kg sugar/week, P3 = bee box plus sugar sand 0.75 kg/week. The parameters observed were the development of the bee population, the number of eggs and the number of larvae formed. The data obtained were analyzed for variance, if they were significantly different, further Duncan's distance test was conducted. The results showed that the treatment with granulated sugar significantly increased the *Apis mellifera* bee population ($P < 0.05$). Bee population P1 (6261.17 ± 1193.24) was higher than PO (5964.58 ± 1251.73), lower than P2 (7697.14 ± 993.49) and P3 (7174.78 ± 1361.78). While P2 is no different from P3. The treatment of giving sugar did not affect the number of eggs and larvae produced by bees, but the higher the amount of granulated sugar tended to increase the number of eggs and larvae. The conclusion of the study was that the administration of granulated sugar could increase the Apis mellifera bee population, but did not affect the number of eggs and larvae produced.

Keywords: bees · sugar · larvae · eggs

1 Introduction

Afis Mellifera's honey bee business has grown tremendously in Jambi Province in the last 2 years, especially in oil palm plantations bordering the acacia plantations of PT Wirakarya Sakti industrial forest. The increase in the number of boxes and the high population of honey bees cause problems in cultivation. One of them is a decrease in honey production and a decrease in bee populations per stup.

The results of a survey on honey bee cultivation in Muaro Jambi district, showed a decrease in honey production by 30–40%. This condition is thought to be due to the limited availability of food from nature. So that the development of bees becomes inhibited. According to Blesmeijer and Slaa (2006) [1] that the integration system of bees with plants needs to pay attention to the concept of interspecific competition (competition

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between species) and intraspecific competition (competition within one species), so that it does not have an impact on damage to resources and habitats.

The results of the research that the capacity of bees in coffee plantations is 100 stup per hectare of land [2]. However, there is no research on the availability of feed from acacia plants. In addition, there is no data on the adequacy of granulated sugar to increase bee productivity.

Sugar is a source of energy for bees, especially when the availability of natural food is limited. If not given additional feed, the bee colony will decrease. This additional feed acts as a stimulant for colony development and as the bee's main energy in carrying out its duties [3, 4]. The availability of sufficient food sources greatly affects the development of bee colonies [5, 6]. The development of bees can be known from the bee population, the number of eggs and the number of larvae [4, 7].

Based on the above conditions, a study was conducted on the effect of adding sugar to the increase in the *Apis Mellifera* bee population.

2 Methods

This study used 12 *Apis mellifera* bees stup with 7 frames in each stup. Randomized block design (RAK) was used in this study with 4 treatments and 3 replications. Treatment P0 = bees were not added sugar, P1 = bees were given 0.25 kg sugar/week, P2 = bees were given 0.5 kg sugar/week, P3 = bees were given 0.75 kg granulated sugar/week.

The bees were prepared according to the treatment, then the frame was checked for each colony. Frames are removed and photographed to count the bee colonies, then the number of bees is counted. After that, randomization was carried out according to the design used. Frames are marked for easy identification. Once documented, the frame is put back in its original position. Giving granulated sugar is done for 7 weeks, with giving once a week.

Before observing the frames were removed and fumigated so that the bees were not too aggressive. Each marked Frame is photographed. Calculation of the number of eggs, larvae is done once a week in one stup.

The research parameters were the calculation of the number of bee colonies, the number of eggs, the number of larvae. The development of bee larvae was determined by counting the number of bees, eggs, and larvae formed in each frame.

All data obtained were analyzed by ANOVA. If the effect is real, it is carried out with Duncan's multiple follow-up test [8].

The bee population is the number of bees in a colony. The development of *Apis mellifera* bee population in response to sugar can be seen in Table 1.

Giving sugar can significantly increase *Apis mellifera* bee population ($P < 0.05$). The bee population P1 was higher than P0, P2 and P3 was higher than P1, while between P2 and P3 were not different. This condition is thought to be due to the treatment of P1, P2 and P3 provided granulated sugar as feed in the stup. This result is in line with Rompas (2015) [9] that giving 100 g of palm sugar produces 3.26 g of royal jelly. Naturally, bee feed consists of nectar and pollen (pollen) taken from plant flowers [10, 11]. Nectar is a liquid that contains a lot of sugar and water. This nectar is a source of carbohydrates, water, vitamins and minerals for bees, so that it functions as a source of energy, the raw

Table 1. Bee population, number of eggs and larvae of *Apis mellifera* as the effect of giving granulated sugar

Parameter	Treatment			
	PO	**P1**	**P2**	**P3**
Bee population /stup	5964,58 ± 951,73[a]	6261,17 ± 993,24[b]	7697,14 ± 993,49[c]	7174,78 ± 1361,78[c]
Number of eggs/stup	246,33 ± 79,32	316,36 ± 104,50	329,00 ± 104,49	316,03 ± 43,68
Number of larvae/stup	137,48 ± 72,61a	146,69 ± 60,36a	226,30 ± 26,18b	220,98 ± 38,14b

Note: Different lowercase superscripts on the same line show significantly different ($P < 0.05$)

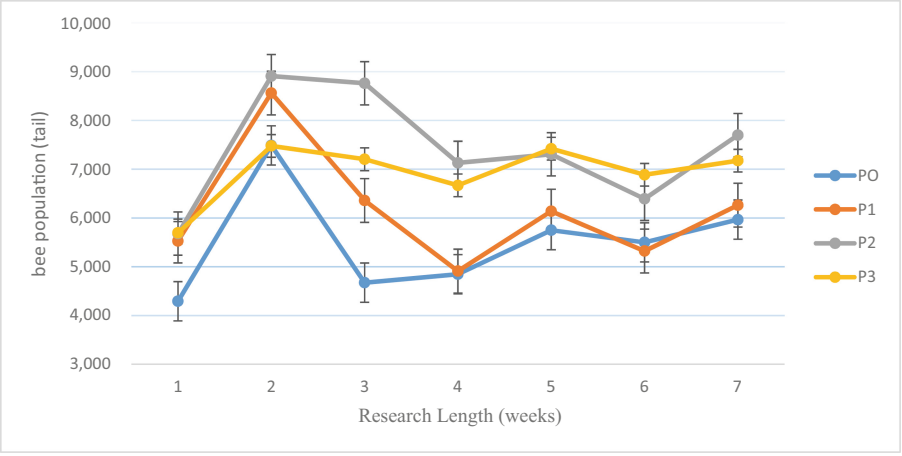

Fig. 1. Population development of Apis Mellifera in response to sugar administration

material for making wax to cover pupa cells. Plant nectar is secreted on the flower or leaf stalk [12].

Crane's research (1985) showed that a dense category of bee colonies consisted of 1 queen and 25,000 foraging worker bees, 25,000 worker bees in a box, a hive of 6000 eggs, 9000 larvae that needed feeding and 20,000 closed larvae. According to Junus (2011) [13] that *Apis mellifera* bee colonies can reproduce well if there is at least one queen bee and 200 workers. According to Gąbka et al. (2011) [14] that the queen bee's egg-laying ability is influenced by the capacity of the ovaries and the volume of the sperm bag (spermate) of its reproductive organs. The development of *Apis mellifera* bee population in response to sugar can be seen in Fig. 1.

Figure 1 shows that the development of the bee population that was given sugar was higher than that without sugar. In general, P1, P2 and P3 produced a higher bee population than PO. Giving sugar in the first week can increase the population well,

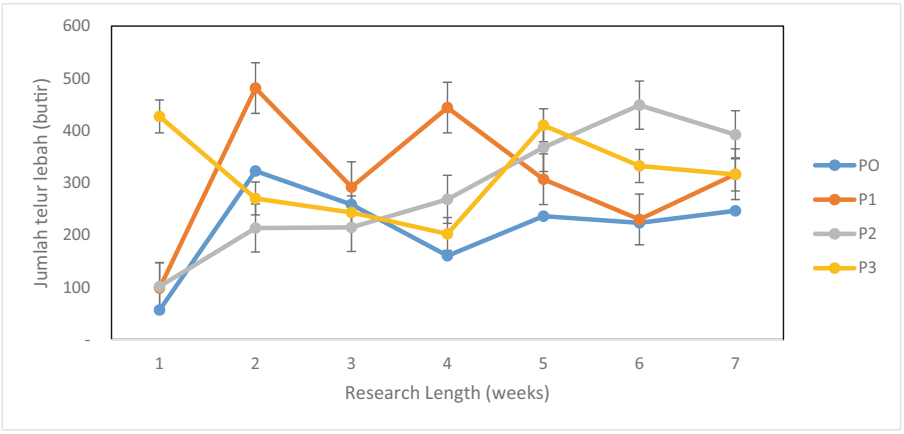

Fig. 2. The number of bee eggs per stup during the study as a response to giving sugar

then fluctuate in the second to seventh week. This fluctuation is thought to be due to weather changes, because at the time of the study it rained more often. Bee development is strongly influenced by weather conditions and feed availability [15, 16]. Bad weather conditions, cloudy and rainy conditions caused the weight of the beehive to decrease and the bees did not go out to look for food [16, 17].

The treatment of giving sugar to bees had no significant effect on the number of eggs produced ($P > 0.05$). The average number of bee eggs was 317.7 ± 137.4 pieces. The development of bee eggs in each box during the study as a response to giving sugar can be seen in Fig. 2.

Figure 2 shows that the administration of granulated sugar to the bee colonies produced increased eggs compared to those without sugar. Bees eggs without sugar tend to be lower than those given sugar bees. These bee eggs will later develop into larvae, the more eggs that are formed, the more larvae will be produced. These larvae will develop into pufa and bees.

Giving granulated sugar to Apis Mellifera bees can significantly increase the number of larvae ($P < 0.05$).

The treatment of P0 and P1 was different from that of P2 and P3. While between PO and P1 are not different, and P2 and P3 are also not different. The more sugar is given the more number of larvae produced. This condition is thought to be because adequate feed will ensure the breeding of bees [4, 18]. An overview of larval development during the study can be seen in Fig. 3.

Figure 3 shows that the administration of granulated sugar as an additional feed resulted in a higher and more stable number of *Apis mellifera* larvae during the study. It can be seen that the treatment without sugar has a lower number of larvae starting from the first week of the study to the seventh week. This condition is thought to be because the bees have more available feed than granulated sugar, so that the bee's breeding becomes more secure.

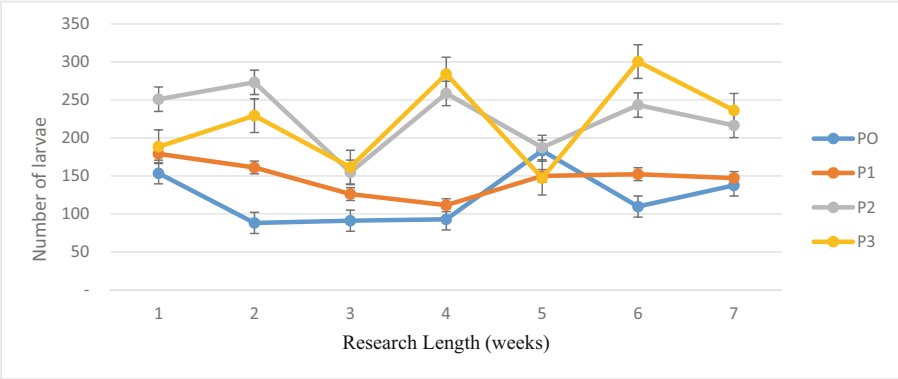

Fig. 3. Number of larvae produced in response to *Apis mellifera* bee sugar administration.

3 Conclusions

Giving granulated sugar as additional feed can increase the number of eggs and the number of larvae of *Apis Mellifera* bees.

References

1. Biesmeijer, J. C. and E. J. Slaa. 2006. The structure of eusocial bee assemblages in Brazil. Apidologie 37: 240-258.
2. Saefudin, R. 2013. The Analisys of Sustainability of Honeybee-Coffee Plantation Integration Model on Improving the Honey and Coffee Bean Product. Jurnal Sain Peternakan Indonesia Vol. 8 (1) : 1-13.
3. Pinto, A., D. Henriques, J. Chavez-Galarza, P. Kryger, L. Garnery, R.V D Zee, B. Dahle, G. Soland-Reckeweg, P.D.L Rua, R. Dall Olio, N.L. Carreck and J. S.Johnston. 2015. Genetic integrity of the Dark European honey bee (*Apis mellifera mellifera*) from protected populations: a genome-wide assessment using SNPs and mtDNA sequence data. Journal of Apicultural Research. 53(2):269-278.
4. Nurohim A. , M. Junus dan S. Minarti. 2018. The Influence Of Adding Feed Stimulants And Frame Partitions Toward The Activity Of The Worker Bees Apis Mellifera Close To Flower Season.
5. Frazier, M., D. Caron, and D. Engelsdorp. 2011. A Filed Guide to Honey Bee and Their Maladies. The Pennsylvania State, Pennsylvania.
6. Gebremariam, T. and Brhane, G. 2014, Determination Of Quality And Adulteration Effects Of Honey From Adigrat And Its Surrounding Areas. International Journal Of Technology Enhancements And Emerging Engineering Research, 2, 2347-4289.
7. Sihombing, D. T. H., 2005, Ilmu Ternak Lebah Madu. Yogyakarta: Gadjah Mada University Press.
8. Steel, R.G.D. and J.H. Torrie, 1993. Principles and Procedures of Statistiks A Biometrical Approach. Second Edition. International Student Edition. McGraw Hill Kogakhusha, Ltd. Tokyo.
9. Rompas. J.F.I., 2015. Tambahan Pakan Buatan (Gula Tebu dan Aren) Terhadap Produksi Royal Jelly Lebah Madu *Apis cerana*. Jurnal LPPM Bidang Sains dan Teknologi: 2(1):62-72.

10. Kuntadi, 2013. Effect of larval ages on the quality of Apis Cerana L. (*Hymenoptera: Apidae*) queens breed in captivity using queen–grafting technique. Jurnal Entomologi Indonesia Indonesian Journal of Entomology. Vol. 10 No. 1, 1–6.
11. Reddy, P.; Verghese, A and Rajan, V.V. 2012 Potential impact of climate change on honeybees (*Apis spp.*) and their pollination services. Pest Manag. Hortic. Ecosyst.,18, 121–127.
12. Soerodjotono dan Kardjono. 1992. Membina Usaha Industri Ternak Lebah Madu Apis mellifera. Balai Pustaka, Jakarta.
13. Junus. 2011. Pengaruh umur lebah ratu, jumlah sisiran eram, dan penyekat ratu terhadap pertambahan bobot anggota koloni lebah Apis mellifera. Junrla Ilmu-Ilmu Peternakan. 21 (3): 1 - 10
14. Gabka J, Ochnio M, Kaminsky Z, and Majewska M. 2011. Effect of age of eggs used for rearing honey bee queens on the number of received queen cells. Journal of Apicultural Science 55:47-53.
15. Khalil, I. M., 2012, Physicochemical and Antioxidant Properties of Algerian Honey. Molecules, 17, 11199-11215.
16. Flores, J.M., S.Gil-Lebrero, V. Gamiz M. I.Rodriguez, M. A.Ortiz, and F.J.Quiles. 2018. Effect of the climate change on honey bee colonies in a temperate Mediterranean zone assessed through remote hive weight monitoring system in conjunction with exhaustive colonies assessment. Science of The Total Environment 653(4). 1111-1119.
17. Bayir, R. and , Albayrak, A., 2016. The monitoring of nectar flow period of honey bees using wireless sensor networks. Int. J. Distrib. Sens. Netw. 12 (11): 1-8.
18. Rochim A, Junus M, Minarti S. 2013. Pengaruh penambahan pakan stimulan dan penyekat sisiran terhadap tingkat kesukaan lebah madu A. mellifera menjelang musim bunga. jurnal. Malang (ID): Universitas Brawijaya.