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FACTORS THAT INFLUENCE SUPPLY OF KELULUT HONEY IN SEGAMAT, JOHOR

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ABSTRACT

The purpose of this study is to observe the factors that influence the supply of Kelulut Honey in Segamat, Johor. The researchers used the seasonal factor, environmental factor, quality of Kelulut Honey and temperature as the independent variables meanwhile supply of Krlulut Honey in Segamat, Johor represents the dependent variable. The researchers used convenience sampling in this study, which involved selecting samples based on the participants' flexibility and willingness to complete the survey. Due to time constraints, the researchers can only gather 31 respondents for primary data. The statistics were derived from a Google Form questionnaire distributed to all areas of society, particularly those living in Segamat, Johor, and those who have tasted the delicacy and authenticity of Kelulut Honey. The researchers then transferred the data to the 27th version of the Statistical Package for Social Science (SPSS) for analysis. In summary, the researchers conducted four analyses: factor analysis, reliability analysis, descriptive analysis for demographic profile, and regression analysis. The reliability analysis revealed that the questionnaire was a reliable tool for measuring the study's goals. Regression analysis, on the other hand, was performed, and the results indicated that all the hypotheses in this study were accepted, where all the dimensions in the factor that influences the supply of Kelulut honey in Segamat, Johor were accepted except the environmental factor.

PROBLEM STATEMENT

Honey is a type of food supplement that can increase the stamina of the human body and be able to cure diseases. Honey is produced naturally by bees that have various species such as stingless bees and honey bees. These two types of bees produce different types of honey with different nutrients (Eteraf-Oskouei, 2013). In Malaysia, several types of Kelulut Honey bees are popular such as Hitama, Bygami, Turasica and so on. Meanwhile, honey bees are popular with the species *Apis florea* and *Apis andreniformis* (Ngalimat et al., 2020). Each honey produced by stingless bees has a variety of nutrients that can provide relief to every disease faced by humans such as gastritis, heart disease, asthma, and so on (Ngalimat et al., 2020). The same goes for honey produced by honey bees, but today's society prefers to practice Kelulut Honey because of its incomparable nutrients and it is more natural.

Nowadays, bee honey is very easy to find and can be obtained at a cheaper price than stingless bee honey. This is because honey bees are very common with people, many suppliers and it is also easier to maintain (Mail, 2014). Stingless bee honey has several things that need to be taken care of to get quality honey and a good environment to increase the production of Kelulut Honey. However, today Kelulut Honey suppliers face challenges in obtaining large quantities of Kelulut Honey in line with the high demand for Kelulut Honey in the market today (Ngalimat et al., 2020).

In addition, there are also some problems faced by the Kelulut Honey market such as Kelulut Honey scams committed by irresponsible suppliers. They sell Kelulut Honey that has been mixed with water, sugar and so on which causes the authenticity of the honey lost. There is also another problem faced by Kelulut Honey suppliers that when the rain continues, the stingless bee cannot produce much honey due to limited movement (Bernama, 2021). Other than that, environmental factors are also one of the reasons why honey bees are not able to produce a lot of quality honey. Stingless bees need a large area and filled with plants that produce flowers or fruits as their food source to get quality and tasty Kelulut Honey. In addition, the ambient temperature is also an aspect that needs to be considered to ensure that the stingless bee is in good condition (Bernama, 2021).

Lastly, due to many challenges faced by Kelulut Honey suppliers in producing quality Kelulut Honey in large quantities, researchers took this initiative to collect more data and information to solve the problems faced by Kelulut honey suppliers, especially Kelulut Honey suppliers in Segamat, Johor. This is to ensure that after the study is conducted, suppliers in Segamat, Johor can produce more high-quality Kelulut Honey and market this Kelulut Honey abroad.

RESEARCH QUESTION

The main objective of the study is to identify what are the factors that affect the supply of Kelulut Honey in Segamat, Johor. This includes:

- Does the quality of Kelulut Honey affect the demand in the marketplace?
- Does the environment influence the quality and the quantity of Kelulut Honey produced by the Kelulut bee?
- What kind of environment is suitable to build up the stingless bee nest?
- What is the suitable temperature to place the stingless bee nest?
- What kind of flower produces lots of honey that can produce more Kelulut Honey?

RESEARCH OBJECTIVE

The overall research objective is to identify the factors that influence the supply of Kelulut honey in Segamat. The specific research objectives are as follows:

- To identify whether the seasonal factors affect the production of Kelulut Honey.
- To analyse whether the surrounding environment of stingless bee nest gives the best supply towards the production of Kelulut Honey.
- To determine Kelulut Honey bee production would produce the high-quality honey.
- The production of Kelulut Honey would be affected if the temperature is high.

LITERATURE REVIEW

Factors that Influence the Supply of Kelulut Honey in Segamat, Johor

According to previous research Wan Iryani Wan Ismail (2016), a problem with queen rearing occurs in bee domestication, resulting in low honey production, inconsistency in quality, and high honey prices, as well as the dumping of adulterated honey on the local market and the lack of a Malaysian honey standard and no existing body or centre to monitor beekeeping development, have become a major challenge. This may affect the supply of honey. The stingless bee population has a lesser dispersion than ordinary honeybee honey due to a lack of awareness about Kelulut Honey, which has resulted in it being less popular in terms of industrial production, shelf life, and quality standard. Because of the entry of phytochemicals from the cerumen and honey production in the pot, as well as the preservation of honey in the cerumen pots, the quality of stingless bee honey is impacted (Abd Jalil et al., 2017). Hence, this show that honey care is very essential to produce a good quality and having a deep knowledge about honey might help honey farmers to overcome the factors that affect the supply of Kelulut Honey.

The Quality of Kelulut Honey Affect the Demand in The Market Place

Generally, the quality of Kelulut Honey does affect the demand in the marketplace. It is because poor quality honey production will affect sales and cause the honey demand to decrease. The research of classification of entomological origin of honey-based on its physicochemical and antioxidant characteristics was published in the International Journal of Food Properties. The researchers found that the Physicochemical and antioxidant properties of raw honey from Malaysia were used as markers for determining its entomological source of bee species of *Apis dorsata*, *Apis mellifera*, *Apis cerana*, or *Heterotrigona itama*. Thus, honey was classified into two major groups from honey bees (*Apis* spp.) and Trigona stingless bees (*Heterotrigona itama*) based on its physicochemical and antioxidant properties using hierarchical cluster and principal component analyses. It turned out that Kelulut Honey produced by stingless bees, *Heterotrigona itama* was different from honey which is the regular honey bee species, *Apis* spp. This resulted in the classification of honey by its entomological origin which helps in honey identification and reduces honey fraudulence (Siok et al., 2017).

According to Zainol et al.'s (2013) study is to look at the antibacterial activity of five different types of Malaysian honey (three monofloral, acacia, gelam, and pineapple, and two polyfloral, Kelulut and Tualang) against *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. Therefore, except for Kelulut Honey, the bactericidal activities of Malaysian honey were found to be one reading greater than their inhibitory effects. At 50% (w/v) concentration of fake honey, all bacteria were inhibited, but no bactericidal action was seen. Phenol standards were shown to successfully inhibit bacterial growth at extremely low concentrations, as low as 0.5% to 1% (w/v), whereas MBC was only 1% to 2% (w/v). The antibacterial potencies of

Malaysian honey were generally comparable to well-known New Zealand Manuka honey, with a close resemblance to Tualang Honey, and the correlations between MIC and EPC value of Malaysian honey were proven to be dependent on bacteria species and honey origin, according to the findings.

The Environment Influences the Quality and Quantity of Kelulut Honey Produced by the Kelulut Bee

Subsequently, in producing good quality and quantity on Kelulut Honey, the environment plays an important role in ensuring that Kelulut Honey is produced in good condition and meets the standards of consumer demand. This includes the processing place, temperature, and ambient humidity. Based on the previous study by Salatnaya et al. (2020) confirms that the environment influences the activity and propolis production of stingless bees. A stingless bee is a cold-blooded insect and sensitive to changes in environmental temperatures. Meanwhile, the flying activity of this bee is influenced by the condition of the inside colony and the environment. Therefore, environmental conditions and colony activity have a significant relationship. It can be concluded that environmental factors (temperature, humidity and light intensity) and time significantly affects the flying activity of *T. laeviceps*.

The Suitable Environment to Build the Stingless Bee Nest

Furthermore, having a suitable environment to build up the stingless bee nest can be taken into consideration in the processing so that the bees can produce better and good quality honey (Salatnaya et al., 2020). Factors of the environment that influence the activities of the bees are temperature, relative humidity, season, light intensity and rainfall. Otherwise, the environment doesn't meet the bee requirement to build up the nest. This might affect the quality of Kelulut Honey as well as the Kelulut Honey production where it can dehydrate the raw Kelulut Honey. This supported the study conducted by Yap et al. (2019). According to the findings, dehydration of Kelulut Honey at 40°C for 36 hours and higher temperatures of between 55°C and 70°C for 18 hours might result in honey with a water activity of less than 0.6 and a moisture content of less than 8%. (dry basis). The loss of water causes a rise in TPC, as well as an increase in HMF, colour intensity, viscosity, hygroscopicity, glass transition temperature, and surface stickiness, all of which are still within permissible limits as determined by the Codex Alimentarius Commission. Kelulut Honey has significant storage issues since it undergoes quick alcoholic fermentation once collected owing to its high water content of over 30%. The presence of osmophilic yeast and heat affects the honey's quality.

The Suitable Temperature to Place the Stingless Bee Nest

Moreover, a suitable temperature must be considered if want to build or place the stingless bee nest. It is because the wrong temperature might affect the content of Kelulut Honey in terms of their concentration, moisture content and sticky nature of the honey. Hence, high temperatures as well as high light intensity, increase the activity of the bees, while high humidity in the monoculture farm decreases the activity of the bees (Salatnaya et al., 2020). To be more specific there is a relationship between the moisture content of honey and the temperature.

Based on the findings of the previous study, an examination was carried out to see how efficient dehumidification and microwave methods are at reducing moisture content in Kelulut Honey. *Trigona* spp., often known as stingless bee honey (Kelulut Honey), is a Malaysian natural product with greater nutritional benefits. However, Kelulut Honey's greater moisture content (usually more than 30%) has impacted its longevity and quality

in terms of the danger of spoiling owing to fermentation. In addition, the brown pigment development of honey samples was measured by measuring the absorbance of diluted honey at 420 nm with a spectrophotometer during the research (SHIMADZU, Japan). The solution was then centrifuged for 15 minutes at 5,000 rpm and filtered through Whatman No. 1 before being carefully diluted to 4 Brix with distilled water using an RX-5000a digital refractometer (Sigma Aldrich, USA) (Atago, USA). Finally, samples from both treatments performed substantially better than untreated samples in terms of total phenolic compound (TPC) and brown pigment, both of which contribute to the quality of stingless bee (Kelulut) honey (p 0.05). Thus, microwave treatment showed a significant technique in boosting total phenolic content at higher power levels (60PL) and longer treatment times (60 s), indicating that it is a dehumidification method that successfully decreased moisture content by up to 45 per cent.

RESEARCH GAP

To sum it up, there is a lot of explanation from the previous study that was done by the past researchers that can help to complete this research study in identifying the factors that influence the supply of Kelulut Honey in Segamat, Johor. The independent variables were the quality of Kelulut Honey, the seasonal demand in the marketplace, the environment and the suitable temperature to place the stingless bee nest meanwhile the dependent variable is the amount of Kelulut Honey supplied by the producers in Segamat Johor.

METHODOLOGY

Research Framework

The theoretical framework for this research is shown in Figure 1, where the independent variables are seasonal, environmental, the quality of Kelulut Honey and temperature are on the left side while for the dependent variable which is the factors that influence the supply of Kelulut Honey in Segamat, Johor represent the dependent variable.

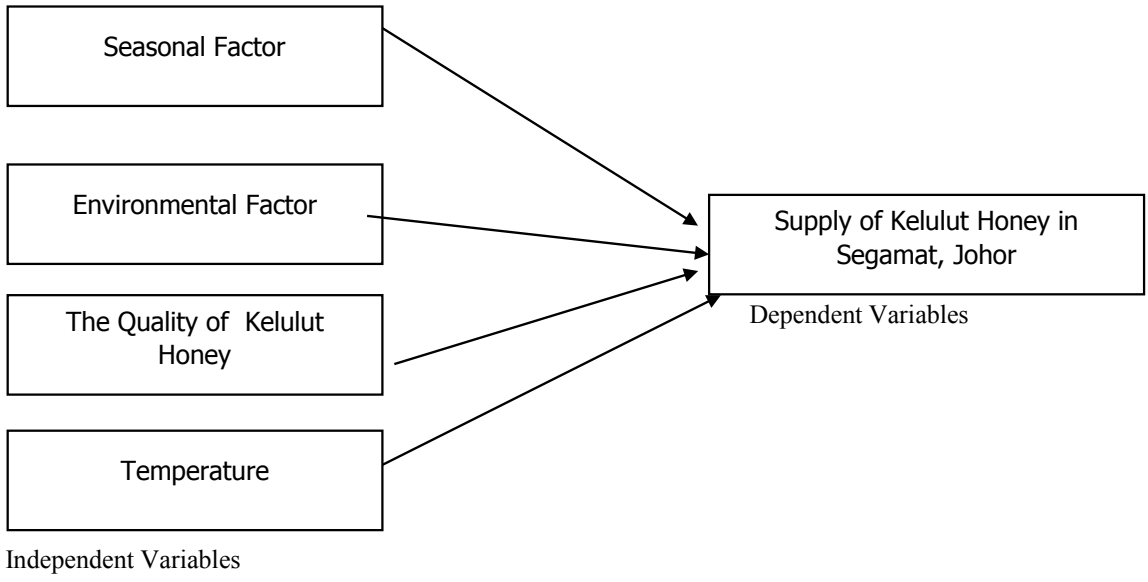

Figure 1 Research framework

RESEARCH DESIGN

Sampling

Convenience sampling is utilized in situations where additional inputs are not necessary for the main investigation. There are no criteria to be a member of this sample. As a consequence, including components into this sample is a breeze. The sample is open to all members of the population, but their participation is reliant on the researcher's proximity. The researcher selects individuals only based on proximity, without regard for whether they reflect the overall population. They can easily observe behaviours, attitudes, and viewpoints using this methodology.

Data Collection Method

In this study, researchers have taken the initiative to collect data from respondents through primary data collection by using online questionnaires using google form. The google form link has been spread to all levels of society, especially those who live in Segamat, Johor and to those who have tasted the deliciousness and authenticity of Kelulut Honey. The collected data will be saved directly into a Google spreadsheet and then exported to Statistical Package for Social Science (SPSS) Version 27 for analysis purposes. Next, secondary data related to this study was collected through journals, papers, articles, books, and past studies.

PILOT STUDY

Factor Analysis Communalities

Factor analysis is a technique for reducing a large number of variables to a smaller number of components. This approach takes all of the variables' biggest common variance and transforms it into a single score. As an indicator of all aspects, this score may be utilized for further research.

Table 1 Total variance explained

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.243	39.021	39.021	6.243	39.021	39.021
2	1.852	11.578	50.599	1.852	11.578	50.599
3	1.700	10.623	61.222	1.700	10.623	61.222
4	1.159	7.246	68.468	1.159	7.246	68.468
5	1.085	6.784	75.252	1.085	6.784	75.252
6	.850	5.314	80.565			
7	.713	4.454	85.019			
8	.640	3.998	89.017			
9	.453	2.831	91.849			
10	.367	2.291	94.139			
11	.315	1.967	96.107			
12	.238	1.489	97.596			
13	.191	1.192	98.788			
14	.122	.760	99.548			
15	.050	.314	99.862			
16	.022	.138	100.000			

Table 1 shows the total variance explained by each component picked out from the responses by the respondents. Since the eigenvalue is set as 1, any component as an Eigenvalue of 1 and above shows the component in the questionnaire can explain the changes in the variance. There are 5 components that have an Eigenvalue of 1 and above. Component 1 explains 39.021%, component 2 shows an explanation of 11.578%, component 3 with an explanation value of 10.623%, components 4 and 5 respectively can explain 7.246% and 6.784%.

Cronbach Alpha

Researchers can use reliability analysis to look at the properties of measuring scales and the items that make up the scales. The Reliability Analysis approach determines the number of commonly used scale reliability measures and provides information on the correlations between specific scale items.

Table 2 Reliability statistics

Table 2 shows the reliability statistics of the questionnaire. The questionnaire was initially distributed to 31 respondents to figure out what affects the supply of Kelulut Honey. The study revealed the Cronbach Alpha of 0.890. The estimated value of Cronbach Alpha is greater than 0.8. Thus, it can be concluded that the questionnaire was a reliable instrument to measure the objectives of this study.

Method of Analysis

The method of analysis used in this study is the quantitative approach. This study approached Kelulut honey breeders who have so much experience in breeding Kelulut bees. This study also uses Kelulut Honey buyers and suppliers who have at least basic knowledge about the special characteristics of Kelulut Honey. Subsequently, statistical regression tests were used to identify and describe the elements that influence the supply of Kelulut Honey. The response was translated into Likert scales.

Hypothesis

Following are the hypothesis tested in this study:

Hypothesis 1: Kelulut bee production is affected by seasonal factors.

Hypothesis 2: Kelulut Honey quality affects the supply of Kelulut Honey production.

Hypothesis 3: Kelulut bees' production requires a large area filled with plants.

Hypothesis 4: Kelulut Honey production is affected by high temperature.

FINDINGS

Characteristics of the Respondents

In this section, the respondents' information and attributes are collected for data observation. In the remainder of this chapter, the characteristics of respondents, such as gender, age, race, social status, and occupation, are discussed in detail.

Table 3 Gender distribution

Gender	Study sample nos. (%)
Male	15 (48.4%)
Female	16 (51.6%)

Table 3 shows that the majority of those who answered the questionnaire consisted of 16 women are 51.6% compared to men 15 people equivalent to 48.4% only.

Table 4 Age group distribution

Age	Study sample nos. (%)
18 – 25	20 (64.5%)
26 – 30	4 (12.9%)
31 – 35	2 (6.5%)
36 – 40	1 (3.2%)
41 – 45	2 (6.5%)
46 – 50	1 (3.2%)
51 – 55	1 (3.2%)
56 – 60	0 (0%)

Referring to Table 4 age group distribution, the data shows that the highest age group to answer this questionnaire is

from 18 to 25 years, which is equivalent to 64.5%. This is a norm when the questionnaire is conducted online. This is because this age group is more skilled in using technology and well versed with gadgets causing the number of respondents aged between 18 to 25 years to be relatively more than the age group between 26 to 30 years (12.9%). The second-lowest age groups to answer this questionnaire are those aged 31 to 35 years and 41 to 45 years, which is equivalent to 6.5% respectively. Finally, the least number of respondents belong to 36 to 40 years old, 46 to 50 years old, and 51 to 55 years old age group, which is represented by one respondent with a percentage of 3.2%.

Table 5 Race dstribution

Race	Study sample nos. (%)
Malay	21 (67.7%)
Chinese	0 (0%)
Indian	0 (0%)
Other	10 (32.3%)

Based on Table 5, the respondents came from different races. The ethnicity in Malaysia consists of Malay, Chinese, Indian and others. The other ethnicity in Sabah and Sarawak are those who consist of Bumiputera Sabah and Sarawak. From the result of the questionnaire, the data collected shows that the majority who answered the questionnaire is around 21 Malay equivalent to 67.7% higher than in other ethnicities, the others consist of Bumiputera Sabah and Sarawak consists of 32.3%.

Table 6 Marital Status

Status	Study sample nos. (%)
Single	20 (64.5%)
Married	11 (35.5%)

Table 6 shows the marital status of the respondents. There are two statuses namely single and married. Based on the data collected, a total of 20 respondents equivalent to 64.5% are single. Meanwhile, 35.5% are married.

Table 7 Occupation distribution

Occupation	Study sample nos. (%)
Student	15 (48.4%)
Working	13 (41.91%)
Housewife	3 (9.7%)
Retired	0 (0%)

Finally, based on Table 7 on the occupation distribution, the data revealed that a total of 15 respondents equivalent to 48.4% are students. Next, 13 respondents equivalent to 41.91% are working and the excess of 9.7% equivalent to 3 people are full-time housewives.

Regression Analysis

Table 8 Model summary of the regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.641[a]	.411	.321	.795

a. Predictors: (Constant), Temperature_factor, Environment_factor, Seasonal_factor, Quality_factor

Table 8 shows the model summary of the R square value of 0.411. The value indicates 41.1 per cent are convinced that the supply of Kelulut Honey is influenced by the quality of the honey, seasonal factors, environment, and temperature while 58.9 per cent was influenced by other factors.

Table 9 Stability of the model used (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.494	4	2.874	4.544	.006[b]
	Residual	16.441	26	.632		
	Total	27.935	30			

a. Dependent variable: Supply_factor
b. Predictors: (Constant), Temperature_factor, Environment_factor, Seasonal_factor, Quality_factor

Table 9 shows the stability of the model used. The estimated F value of 4.544 was significant at a 5 per cent level (Sig = 0.006). Therefore, it can be concluded that the model is stable and the regression can be used for forecasting.

Table 10 Regression result (coefficients)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.218	1.879		-1.713	.099
	Seasonal_factor	1.100	.317	.572	3.473	.002
	Environment_factor	.380	.286	.224	1.332	.195
	Quality_factor	-.458	.231	-.413	-1.979	.058
	Temperature_factor	.599	.259	.410	2.313	.029

a. Dependent Variable: Supply of Kelulut Honey

Table 10 shows the regression result. As discussed earlier, the dependent variable is the supply of the Kelulut Honey, meanwhile, the independent variable is a seasonal factor, environment, quality of the honey and temperature. Since all the questions were revised, it indicates that the seasonal factor showed a negative relationship with the supply of the Kelulut Honey. This means when the seasonal factor is decreased, it means the supply of the Kelulut Honey would be increased. The seasonal factor was found to be significant at a 5 per cent level with an estimated t-value of 3.473 (Sig = 0.002). Thus, hypothesis 1 (H1) which stated that the seasonal factor influences the supply of the Kelulut honey is supported.

Secondly, the regression analysis indicates that the environment factor showed a positive relationship with the supply of the Kelulut honey but it was insignificant at a 5% significance level. When the environmental factor reduces or decreases, it will affect the supply of the Kelulut Honey. The environment factor was found to be insignificant at a 5 per cent significance level with an estimated t-value of 1.332 (Sig = 0.195). therefore, the hypothesis (H2) which stated that the environmental factor is influenced by the supply of the Kelulut Honey is rejected.

Thirdly, the quality of the honey has shown a negative relationship with the supply of the Kelulut honey factor. In this way, when the quality is different, it will affect the supply of the Kelulut honey. Quality was found to be significant at a 5 per cent significance level with an estimated t value of −1.979 (Sig = 0.058). therefore, the hypothesis (H3) which stated that the quality of honey can influence the supply of the Kelulut Honey is accepted.

Lastly, temperature showed a negative relationship with the supply of the Kelulut Honey. In this way, when the temperature is different, it will affect the quality of the Kelulut Honey supplied. The temperature was found to be significant at a 5 per cent significance level with an estimated t-value of 2.313 (Sig = 0.429). therefore, the hypothesis (H4) which stated that the temperature of honey will influence the supply of the Kelulut honey is accepted.

Thus, it can be concluded all the variables were significant in explaining the changes in the supply of the Kelulut honey in Segamat Johor except the environmental factor.

CONCLUSION

Unlike the past researchers, Salatnaya et al. (2020) claimed the environment is the main factor that influences the supply of Kelulut Honey produced, the result in Segamat, Johor did not support the previous study. The only factor under the environment which was the temperature was found to be significant. The environment does not meet the bee requirement to build up the nest. It might affect the quality of honey as well as the honey production. Quality characteristics of dehydrated raw Kelulut Honey, claimed by Yap et al. (2019) causes a rise in HMF, colour intensity, viscosity, hygroscopicity, glass transition temperature, and surface stickiness, all of which contribute to the increase in TPC.

Past researchers like Wan Iryani Wan Ismail (2016) claimed that in bee domestication, a problem with queen rearing occurs which cause low honey in production, inconsistency in the dumping of contaminated honey on the local market, the lack of a Malaysian honey standard, and the lack of an official organization or institute to supervise beekeeping growth have all become important issues. the preservation of honey in the cerumen pots, the quality of stingless bee honey is impacted due to seasonal factors claimed Abd Jalil et al. (2017). As a result, research demonstrates that honey care is critical to producing high-quality honey and that having a thorough understanding of honey may aid honey producers in overcoming the variables that impact Kelulut Honey supply.

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