PHYSICOCHEMICAL CHARACTERISTICS OF STINGLESS BEE HONEY FROM *Heterotrigona itama*

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Abstract

Stingless bee honey from *Meliponini* species is less common than honey produced by honey bee from *Apis* species. However, *Meliponini* consists of more than 50 species than *Apis*. This study aims to investigate the physicochemical characteristics of Malaysian stingless bee honey from *Heterotrigona itama* species. The samples of stingless bee honey were collected from UiTM Jengka, Pahang. The honey produced by *Heterotrigona itama* was selectively taken from five different logs. The physicochemical parameters tested were pH, ash content, acidity value, colour intensity, and moisture content. The pH of the stingless bee ranging between 3.32±0.01 to 3.60±0.01. The colour of the honey is in the range of light amber to extra light amber. The ash content and acidity value of the stingless bee honey samples ranging from 0.127±0.061 g/100g to 0.413±0.022 g/100g and 109±7.81 meq/kg to 135±8.66 meq/kg, respectively. The moisture content value ranging from 23±0.50 % to 26.83±0.29 %. Except for the ash content, the physicochemical characteristic result of the honey obtained from different logs was nearly similar.

Keyword: *Heterotrigona itama*, Physicochemical Characteristics, Stingless Bee Honey

Introduction

Honey that is widely available was obtained from honey bee in *Apis* species. Meanwhile, a stingless bee from *Meliponini* species produces stingless bee honey. Interestingly, researchers first discovered *Meliponini* species before realising the existence of *Apis* species. Both species have different properties, however, *Meliponini* has 50 times more species than *Apis*. In general, a stingless bee produces less honey compared to the normal bee like honey bee (Roubik, 2006). This makes it less favourable to a beekeeper. However stingless bee honey is still in demand due to its rareness and unique properties. The completely different setup of stingless bee farm compared to the common honey bee makes the market price for stingless bee honey much higher. Kek et al. (2018) revealed that beekeeper in tropical regions such as Africa, Bolivia, and Columbia demand the price of the stingless bee honey ten times higher than the honey from normal bees.

Moreover, the flavonoids and polyphenols compounds with antioxidant properties that are present in stingless bee honey are much higher than *Apis* species. Stingless bee honey also has higher water content compared to the normal bees (Se et al., 2018). In contrast to the honey from *Apis* species, stingless bee honey has a sour and an acidic taste (Bijlsma et al., 2006).

Currently, there is a growing research interest in stingless bee honey in Malaysia.

Heterotrigona itama is one of the main stingless bee species in Malaysia known for its honey production (Cheng et al., 2019). The composition of honey from stingless bee depends on the type of flowers the bee visited and the condition of the weather in a certain geographical area (Chakir et al., 2016). Therefore, the aim of this study is to determine the physicochemical characteristics of stingless bee honey from *Heterotrigona itama* species at a bee farm in UiTM Pahang, Jengka Campus.

Materials and Methods

Sample collection

The samples of stingless bee honey were collected from a farm located at UiTM Pahang, Jengka Campus. Five different logs of stingless bee from the same species of *Heterotrigona itama* were selected randomly for this study. A syringe was used to extract the honey from the honey pot. The sample was sealed in a glass jar and kept in the fridge for further analysis.

Parameter of study (Physicochemical characteristic of the honey sample)

pH

The pH determination was conducted by following the method previously described by Fatima et al. (2017). The test was done by immersing pH meter electrode in a solution that contains 10 g of the honey sample from *Heterotrigona itama* species dissolved in 75 mL of distilled water. The procedure was replicated three times. A standard buffer solution of pH 4 and 7 were used to calibrate the pH meter before the experiment.

Ash content

The ash content was determined by replicating the method as stated by Chuttong et al. (2016). After a drying process in the oven at 105□ for six hours and the cooling process in the desiccator, the empty crucibles were weighed and data was recorded. Crucibles were filled with 5 g of the sample and placed into the muffle furnace at 550□ for 12 hours. The crucibles were weighed again with ashes in it after the cooling process was done in a desiccator. The procedure was duplicated three times.

Moisture content

A portable handheld refractometer was used to measure the moisture content. Only a few drops of the sample were needed. The procedure was replicated three times.

Colour Intensity

The colour intensity was determined by following the method described by Fatima et al. (2017). The absorbance value of the sample was measured by using Ultraviolet visible spectrophotometer. A 5 g of honey sample was dissolved in 10 mL of deionized water and gently mixed by vortexing the solution. 2 mL of honey solution was transferred into a cuvette. The absorbance at 635 nm was recorded. To determine the colour intensity, a scale called Pfund scale was used. The procedure was replicated three times.

Total acidity

A titrimetric method was applied to determine the acidity of the sample. A 10 g of sample was dissolved in a beaker containing 75 mL distilled water. Titration was done using 0.05 M of sodium hydroxide solution until the pH reached 8.5. 10 mL of 0.05 M of sodium hydroxide solution was immediately added in the titrated solution. The solution was back-titrated using 0.05 M of a hydrochloric acid solution until the pH reached 8.3. The procedure was replicated three times.

Result and Discussion

The results of the tested parameters on stingless bee honey such as pH, ash content, colour intensity, total acidity, and moisture content were tabulated in **Table 1** until **Table 5**.

Table 1 represents the pH value for *Heterotrigona itama* honey. From the table, the range of pH value is from 3.32±0.01 to 3.60±0.01. The highest pH value was recorded from log 4 with 3.60±0.02 whereas log 5 indicates the lowest pH value at 3.32±0.01. The result showed that *Heterotrigona itama* honey was considered as acidic honey. The content of organic acids in the honey could contribute to the difference in pH value as it can reduce the value of the pH. Organic acids are produced by the fermentation of sugars content in the honey (El Sohaimy et al., 2015).

Table 1 pH value of *Heterotrigona itama* honey

***Heterotrigona itama* (Honey)**	**pH value**
Log 1	3.54±0.01
Log 2	3.54±0.01
Log 3	3.38±0.01
Log 4	3.60±0.02
Log 5	3.32±0.01

From the analysis of the ash content of stingless bee honey from *Heterotrigona itama,* less than 1 g/100 g of honey was obtained. From **Table 2**, the ash content was at the range of 0.127±0.061 to 0.413±0.022 g/100g. Log 1 has the highest value (0.413±0.022 g/100g) where as Log 4 shows the lowest ash content (0.127±0.061 g/100g). The ash content mostly associated with the amount of mineral content in the honey. The source of nectar from the plant types and soil area may contribute to the different amount of mineral content in the honey (Nascimento et al., 2015).

Table 2 Ash content of *Heterotrigona itama* honey

***Heterotrigona itama* (Honey)**	**Ash content (g/100 g)**
Log 1	0.413±0.022
Log 2	0.271±0.090
Log 3	0.279±0.027
Log 4	0.127±0.061
Log 5	0.241±0.009

The colour intensity for all sample of stingless bee honey was determined by comparing the absorbance measurement using Pfund scale. **Table 3** shows that the range scale of Pfund readings is between 35-85mm. Log 1, 2, and 3 showed Pfund scale within 51-85 mm, which is classified as light amber. Meanwhile, Pfund scale for Log 4 and 5 was 35-50 mm and considered as extra light amber. The colour intensity of stingless bee honey is affected by the mineral content in the honey in which higher mineral content will give a darker colour to the honey (Nascimento et al., 2015). However, other factors such as the types of flower it harvest and the resin used for the honey pot will also affect the colour of the honey. Therefore, darker honey is not always associated with high mineral content.

Table 3 Colour Intensity of *Heterotrigona itama* honey

***Heterotrigona itama* (Honey)**	**Absorbance**	**Pfund scale (mm)**	**Colour of honey**
Log 1	0.6715±0.008	51 - 85	Light amber
Log 2	1.1836±0.005	51 - 85	Light amber
Log 3	0.6234±0.004	51 - 85	Light amber
Log 4	0.5881±0.009	35 - 50	Extra light amber
Log 5	0.5574±0.002	35 - 50	Extra light amber

Table 4 shows the total acidity of *Heterotrigona itama* honey. The range of the total acidity result was from 109.00 meq/kg to 135.00 meq/kg. Log 2 recorded with the highest total acidity at 135.00±8.66 meq/kg whereas Log 5 shows the lowest value at 109.00±7.81 meq/kg. According to Biluca et al. (2016), the acidity value represents the amount of organic acids present in the honey. There is a slight difference in the total acidity value between the logs. It may be caused by the fermentation process that could occur during the storage period of the honey sample. Acetic acid and lactic acid are the common organic acids produced in the honey fermentation process (Razali et al., 2018).

Table 4 Total acidity of *Heterotrigona itama* honey

***Heterotrigona itama* (Honey)**	**Total acidity (meq/kg)**
Log 1	129.67±4.16
Log 2	135.00±8.66
Log 3	111.67±7.02
Log 4	134.33±1.15
Log 5	109.00±7.81

The moisture content of *Heterotrigona itama* was observed using a handheld refractometer. **Table 5** shows that the moisture content of *Heterotrigona itama* honey is in between 23.33±0.02 % to 26.83±0.01%. Log 4 recorded the lowest moisture content at 23.00±0.29% whereas Log 2 recorded the highest moisture content at 26.83±0.01%. The result obtained is lower compared to the previous studies. Studies by Fatima et al. (2017) and Nascimento et al. (2015) recorded a higher moisture content in the stingless bee with 33.73 % and 36.89%, respectively. The higher moisture content will cause a greater degree of the fermentation process that will affect the quality of the honey (Nordin et al., 2018).

Table 5 Moisture content of *Heterotrigona itama* honey

***Heterotrigona itama* (Honey)**	**Moisture content (%)**
Log 1	23.33±0.02
Log 2	23.00±0.29
Log 3	26.67±0.29
Log 4	26.83±0.01
Log 5	26.67±0.29

Conclusion

The physicochemical characteristic result of the honey obtained from different logs was nearly similar with slight differences except for the ash content value. The result of the pH value and the total acidity showed that the fermentation process may have occurred. This study shows that the quality of the honey from the same stingless bee species in different logs may not be identical.

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Conflict of interests

Authors hereby declares that there is no conflict of interests with any organization or financial body for supporting this research.

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