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The *Trigona incisa* honey quality of apisilviculture system

Budiaman^{1,2}, Y Yusran², S Paembonan², and I Gautama²

¹ College Student of Sekolah Pasca Sarjana, Hasanuddin University, Makassar 90245, Indonesia

² Faculty of Forestry, Hasanuddin University, Makassar

E-mail: Budiaman@yahoo.com

Abstract. The population of *Trigona incisa* honey bees is abundant in the agroforestry region and potential to produce 13 kinds of high-value products required by the food industry, beverage, pharmaceutical, and beauty, which is the main raw material derived from plants such as flower nectar and pollen (anthers/pollen), and parts of plants other than ekstrakuticular flower nectar is a sweet liquid that comes from the fruit, shoots, buds, leaves, stems, branches, and twigs. This study aims to determine the quality of *Trigona incisa* honey production from the apisilviculture system. The experiment was conducted by using the survey method and laboratory testing with the following stages: The *Trigona incisa* honey bees which maintained by apisilviculture farmers harvested using 100 mesh sieve and packed. Furthermore, tests will be carried out in the laboratory with test procedures and standard of SNI (Indonesian National Standard) 01-3545-2004. The test results will be analyzed by comparing with several standard test values. The results showed that the parameters of *Trigona incisa* honey quality that meet quality requirements of SNI 01-3545-2004 there are 7 parameters namely: ash content, solids that are not soluble in water, Hydroxymethylfurfural (HMF), Sucrose, Lead, Cuprum, and Arsenic metal contamination, while the parameters that do not meet the standards there are 4 parameters, namely water content, acidity, reducing sugar, and activity of diastase enzyme.

1. Introduction

Integration of honey bees and flowering vegetation is an abundant potential natural resource, and untapped optimal agroforestry areas are mostly located in rural areas. Billions fall useless plant flowers every day, while on the other hand, the local *Trigona incisa* honey bees are available and relatively abundant in various regions of agroforestry [1]. The *Trigona incisa* honey bee is a good type of bees, do not sting, so it is more easily manipulated and controlled, compared with other types of bees and abundant populations in various regions of agroforestry in rural areas and can produce 13 kinds of products of high economic value. With the success of this study, the farmer/manager of agroforestry is expected to include *Trigona* spp honey bees, in addition to other intensification efforts in an attempt to convert an existing interest in the agroforestry region into high-value products, such as pollen, royal jelly, propolis and wax which is industrial raw materials and export.

The *Trigona incisa* honey bees have a special honey production regarding price and efficacy compared to other types of honey bees [2], but until now has never been analyzed, whether appropriate the industry quality standards (Indonesian National Standard/SNI). Also, the propolis production is high enough at a high price, which is around Rp. 750,000 to Rp. 1,500,000 per kg or Rp. 80,000 per



gram after extracted, because it is one of the main raw material of pharmaceutical and cosmetic industries

2. Material and Method

2.1. Equipment and Materials

The tools and materials used in this study are as follows:

The hive and colonies of *Trigona incisa* bees, digital scales, extractor wax and propolis, container production shelters, refractometer, sieve honey, furnaces, cup aluminum, oven, glass crucible, water bath, platinum cup/porcelain, water bath, spectrophotometer, pumpkin Erlenmeyer.

Ingredients are solvent of concentrated HCl, olive oil, distilled water NaOH, PH meter, Ki solvent, ether, K₂SO₄, KCl; I'd stock, NaCl solvent, Sodium Acetate Solvent, Starch Solven, Pb Acetate Solvent, a solution of Na-Phosphate, Luff Solvent.

2.2. Implementation Procedures

The implementation of this study using survey methods and laboratory testing with the following stages: The *Trigona incisa* honey bees which maintained by apsilvikultur farmers harvested using 100 mesh sieve and packed. Furthermore, the test will be carried out in the laboratory with test procedures and standard of SNI 01-3545-2004. The test results will be analyzed by comparing with some default values, namely honey quality standard of 18 developed countries.

3. Results and discussion

The *Trigona incisa* quality honey produced from agroforestry systems are analyzed based on standard and procedures test of SNI 01-3545-2004, as compared with some quality standards in international trade, can be seen in Figure 1. Both this data shows that the value of the quality parameter is very prominent from the *Trigona incisa* honey bees is the water content and acidity, while the other parameters are relatively the same.

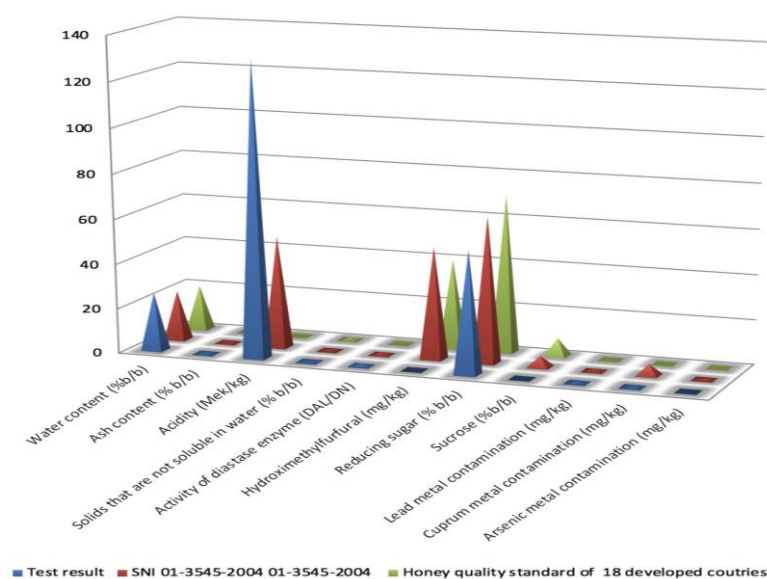


Figure 1. The comparison of *Trigona incisa* honey quality parameters with SNI.01-03545-2004 and honey quality standard of 18 developed countries

3.1. Water content

The water content of the *Trigona incisa* honey bees quite high compared to the value of SNI.01-0354-2004, honey quality standards of 18 developed countries, forest honey *Apis Bingham*, *Apis mellifera* L. honey farm, SII.0156-77, SII.0156-86, SNI.013545-1994, and RSNI.95. This is caused by biophysical conditions tropical countries like Indonesia that tend to damp, in this case, the hygroscopic properties of honey tend to absorb water from the surrounding environment, but it can also be caused by early harvest time. The same case is seen in other Indonesian tropical honey (*Apis binghamii*) also has a high water content that is on average 25.8%, while the water content of the *Trigona incisa* honey in Europe ranged 31- 42% [3]. The lower the water content of honey, honey the better quality and more resistant to be saved, because the high water content (over 17%) of honey will ferment faster [4], except that the higher the water content, the lower the value of reducing sugar [5].

3.2. Ash content

Ash content of *Trigona* spp. Honey bees were 0.42%, in this case, lower than the maximum value required by SNI.01-0354-2004, SII.0156-86, SNI.013545-1994, and RSNI.95, but still higher than the maximum value of the standard 18 developed countries. According to [2], ash content in honey is determined by the types of materials collected by bees while foraging, honey derived from the nectar has a low ash content (0.6%), while the honey from honeydew (dew soot), usually contain high ash content (1.0%).

3.3. Acidity

Figure The acidity of *Trigona* spp honey bees is very prominent (131.32 milliequivalents per 1 kg) compared with the standard test of SNI.01-0354-2004, SII.0156-86, SNI.013545-1994 and RSNI.95, which is only about 10-50 milliequivalent value per 1 kg, whereas 18 developed countries do not require the acidity parameters. He also explained that the honey acid levels above 40 milliequivalents per 1 kg, which is already considered fermented honey [2]. Value of high acidity caused by fermented honey and this occurs as a result of the high content of water content [5]. Acidity affects the taste and aroma of honey and stability of microorganisms in honey [2]. He also explained that gluconic acid is a type of acid that is found in most portions of honey produced by the activity of enzymes in the honey [6]. Other organic acids are formic, acetic, butyric, lactic, oxalic, citric, succinic, tartaric, maleic, malic, pyroglutamic, pyruvic, a-ketoglutaric, glycolic, A or B glycerophosphate and glucose-6-phosphate [2].

3.4 Solids not soluble in water

Solids that are not soluble in water data can be seen in Figure 9: The data indicate that the solids that are not soluble in water than the *Trigona* spp honey bees have of all values under standard test: SNI.01-0354-2004, SII.0156- 86, SNI.013545-1994 and RSNI.95, namely 0.39 ml NaOH 1 N. This suggests that honey is very clean and apisilvikultur results meet the standards in this international. That caused by harvesting techniques performed by the farmers is good, because it has been using 100 mesh sieve. [1], explains that the material is not soluble in water usually consists of some pieces of wax, insect body parts, dirt vegetables, bee pollen, and bee bread, the lower the value of insoluble solids, the cleaner the honey. The solids are contaminants that can damage the honey [4].

3.5 Diastase Enzyme activity

Enzyme diastase activity of *Trigona incisa* honey bees does not meet the SNI.01-0354-2004 (Indonesian National Standard) value below 1 DN, in this case, 18 developed countries do not require this parameter. According to [5], if the activity of the enzyme diastase 0 or negative, the possibility of the honey has not been fresh or honey ever gets heat treatment or the possibility of fake honey.

3.6 Hydroxymethylfurfural (HMF)

Levels of HMF in *Trigona incisa* honey is negative (mg/kg), and its value under standard test: SNI.01-0354-2004, the standard of 18 developed countries, *Apis mellifera* L. honey farm, SNI.013545-1994, and RSNI.95, so it can be concluded that the quality of *Trigona incisa* honey is quite good [7].

3.7 Reducing sugar

Reducing sugar in *Trigona incisa* honey is 54.52%, and its value under standard test: SNI.01-0354-2004, the standard of 18 developed countries, *Apis mellifera* L. honey farm, SNI.013545-1994, and RSNI.95, so that this is never the parameters can meet the standards. This is due to the high content of water content in *Trigona incisa* honey, in this case, the water content is usually inversely proportional to reducing sugar content, the higher the water content, the lower the value of reducing sugar [5].

3.8 Sucrose

Sucrose content of *Trigona incisa* honey relatively very low, when compared to another test standard maximum value, is 1.17%. SNI.01-0354-2004 have maximum terms of 5%, while the 18 standards of developed countries require a maximum of 8%, so it can be assumed that the sucrose of *Trigona incisa* honey have levels meet the criteria in the trade. Honey that has a high sucrose level exceeded the maximum rule or test mentioned above is considered to have mixed with sucrose sugar that is not a major component of natural honey [5].

3.9 Harmful metal contaminants

Value of hazardous metal contamination of *Trigona incisa* honey which include lead (Pb), cuprum (Cu), and arsenic (As) has a value below 1 mg/kg, whereas SNI.01-0354-2004 requires each to a maximum of 1.0 lead 0.5 to cuprum 0.5 arsenic and remedy, while the standard of 18 developed countries requires negative for the three types of metal contamination. In this case, the parameters can be concluded that for metal contamination of *Trigona incisa* honey can meet national quality standards, but for the standard of 18 developed countries are not eligible.

Honeybees can adsorb pollutants through, (hair) into the respiratory or digestive body during the process of foraging bees in the field. In this case, the heavy metals in the atmosphere can be collected by the fur/hair enveloping and transporting bees body together pollen into their hive, or the honey bees adsorb together with nectar obtained from flowers of plants, or through water, or the dew of honeydew. He also explained that in plants, naturally from the nectar of flowers and honeydew with a morphology that is open, allowing more exposed to pollutants [8].

4. Conclusion

The honey quality parameters of *Trigona incisa* that meet quality requirements SNI (Indonesian Nasional Standard) 01-3545-2004 there are 7 parameters namely: ash content, solids that are not soluble in water, hydroxymethylfurfural (HMF), sucrose, harmful metal contaminants of lead, arsenic, and cuprum. Parameters do not meet the standards SNI (Indonesian Nasional Standard) 01-3545-2004 there are 4 parameters, namely water content, acidity, reducing sugar, and the activity of diastase enzyme

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