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## A Comparative Characterization of Physicochemical and Antioxidants Properties of Processed Heterotrigna itama Honey from Different Origins and Classification by Chemometrics Analysis

By: [Shamsudin, S](#) (Shamsudin, Sharina)<sup>[1,2]</sup>; [Selamat, J](#) (Selamat, Jinap)<sup>[1,3]</sup>; [Sanny, M](#) (Sanny, Maimunah)<sup>[1,3]</sup>; [Bahari, ARS](#) (Bahari, Shamsul A. R.)<sup>[4]</sup>; [Jambari, NN](#) (Jambari, Nuzul Noorahya)<sup>[1,3]</sup>; [Khatib, A](#) (Khatib, Alfi)<sup>[5]</sup>

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### Abstract

Stingless bee honey produced by Heterotrigna itama from different botanical origins was characterised and discriminated. Three types of stingless bee honey collected from acacia, gelam, and starfruit nectars were analyzed and compared with Apis mellifera honey. The results showed that stingless bee honey samples from the three different botanical origins were significantly different in terms of their moisture content, pH, free acidity, total soluble solids, colour characteristics, sugar content, amino acid content and antioxidant properties. Stingless bee honey was significantly different from Apis mellifera honey in terms of physicochemical and antioxidant properties. The amino acid content was further used in the chemometrics analysis to evaluate the role of amino acid in discriminating honey according to botanical origin. Partial least squares-discriminant analysis (PLS-DA) revealed that the stingless bee honey was completely distinguishable from Apis mellifera honey. Notably, a clear distinction between the stingless bee honey types was also observed. The specific amino acids involved in the distinction of honey were cysteine for acacia and gelam, phenylalanine and 3-hydroxyproline for starfruit, and proline for Apis mellifera honey. The results showed that all honey samples were successfully classified based on amino acid content.

### Keywords

**Author Keywords:** [stingless bee honey](#); [physicochemical characteristics](#); [antioxidants properties](#); [free amino acids](#); [partial least square-discriminant analysis \(PLS-DA\)](#); [chemometrics analysis](#)

**KeyWords Plus:** [STINGLESS BEE HONEY](#); [FREE AMINO-ACIDS](#); [AVERRHOA-CARAMBOLA L.](#); [BOTANICAL ORIGIN](#); [PHENOLIC CONTENTS](#); [CHEMICAL-COMPOSITION](#); [UNIFLORAL HONEYS](#); [PROFILES](#); [IDENTIFICATION](#); [CHROMATOGRAPHY](#)

### Author Information

**Reprint Address:** Selamat, J (reprint author)

+ Univ Putra Malaysia, Fac Food Sci & Technol, Serdang 43400, Selangor, Malaysia.

**Reprint Address:** Selamat, J (reprint author)

+ Univ Putra Malaysia, Inst Trop Agr & Food Secur, Food Safety & Food Integr FOSFI, Serdang 43400, Selangor, Malaysia.

### Addresses:

+ [ 1 ] Univ Putra Malaysia, Fac Food Sci & Technol, Serdang 43400, Selangor, Malaysia

+ [ 2 ] Univ Putra Malaysia, Persiaran MARDI, MARDI, Food Sci & Technol Res Ctr, Serdang 43400, Selangor, Malaysia

+ [ 3 ] Univ Putra Malaysia, Inst Trop Agr & Food Secur, Food Safety & Food Integr FOSFI, Serdang 43400, Selangor, Malaysia

+ [ 4 ] Univ Malaysia Terengganu, Sch Food Sci & Technol, Kuala Terengganu 21030, Malaysia

+ [ 5 ] Int Islamic Univ Malaysia, Fac Pharm, Pharmacognosy Res Grp, Kuantan 25200, Pahang, Malaysia

**E-mail Addresses:** [sharina@mardi.gov.my](mailto:sharina@mardi.gov.my); [sjinap@gmail.com](mailto:sjinap@gmail.com); [maimunah@edu.upm.my](mailto:maimunah@edu.upm.my); [shamsul@umt.edu.my](mailto:shamsul@umt.edu.my); [nuzuljambari@gmail.com](mailto:nuzuljambari@gmail.com); [alfikhatib1971@gmail.com](mailto:alfikhatib1971@gmail.com)

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1. **Stingless Bee Honey, the Natural Wound Healer: A Review** Times Cited: 13  
By: Abd Jalil, Mohd Azri; Kasmuri, Abdul Razak; Hadi, Hazrina  
SKIN PHARMACOLOGY AND PHYSIOLOGY Volume: 30 Issue: 2 Pages: 66-75 Published: 2017
2. **Physicochemical, Biochemical, Minerals Content Analysis, and Antioxidant Potential of National and International Honeys in Pakistan** Times Cited: 12  
By: Ahmed, Mahmood; Shafiq, Muhammad Imtiaz; Khaleeq, Anum; et al.  
JOURNAL OF CHEMISTRY Article Number: 8072305 Published: 2016
3. **Antioxidant activities and total phenolics of different types of honey** Times Cited: 286  
By: Al-Mamary, M; Al-Meeri, A; Al-Habori, M  
NUTRITION RESEARCH Volume: 22 Issue: 9 Pages: 1041-1047 Article Number: PII S0271-5317(02)00406-2 Published: SEP 2002
4. **Botanical discrimination and classification of honey samples applying gas chromatography/mass spectrometry fingerprinting of headspace volatile compounds** Times Cited: 70  
By: Aliferis, Konstantinos A.; Tarantilis, Petros A.; Harizanis, Paschalis C.; et al.  
FOOD CHEMISTRY Volume: 121 Issue: 3 Pages: 856-862 Published: AUG 1 2010
5. **Evaluation of the phenolic contents and antioxidant capacities of two Malaysian floral honeys** Times Cited: 150  
By: Aljadi, AM; Kamaruddin, MY  
FOOD CHEMISTRY Volume: 85 Issue: 4 Pages: 513-518 Published: MAY 2004
6. **Apis mellifera vs Melipona beecheii Cuban polifloral honeys: A comparison based on their physicochemical parameters, chemical composition and biological properties** Times Cited: 18  
By: Alvarez-Suarez, Jose M.; Giampieri, Francesca; Brenciani, Andrea; et al.  
LWT-FOOD SCIENCE AND TECHNOLOGY Volume: 87 Pages: 272-279 Published: JAN 2018
7. **Antibacterial and Antioxidant Potency of Floral Honeys from Different Botanical and Geographical Origins** Times Cited: 43  
By: Alzahrani, Hasan A.; Alsabehi, Rashid; Boukraa, Laid; et al.  
MOLECULES Volume: 17 Issue: 9 Pages: 10540-10549 Published: SEP 2012
8. **Therapeutic Properties of Stingless Bee Honey in Comparison with European Bee Honey** Times Cited: 1  
By: Amin, Z.; Aina, F.; Sabri, S.; et al.  
Adv. Pharmacol. Sci. Volume: 2018 Pages: 6179596 Published: 2018  
[\[Show additional data\]](#)
9. **A review of the analytical methods to determine the geographical and botanical origin of honey** Times Cited: 521  
By: Anklam, E  
FOOD CHEMISTRY Volume: 63 Issue: 4 Pages: 549-562 Published: DEC 1998
10. Title: [not available] Times Cited: 63  
Group Author(s): AOAC  
Official method of analysis Issue: Washington DC Published: 2012  
Publisher: Association of Official Analytical Chemists
11. **Total phenolic contents and antioxidant activities of Korean domestic honey from different floral sources** Times Cited: 5  
By: Baek, Youngsu; Kim, Young Jun; Baik, Moo-Yeol; et al.  
FOOD SCIENCE AND BIOTECHNOLOGY Volume: 24 Issue: 4 Pages: 1453-1457 Published: AUG 2015
12. **Sugar profile, physicochemical and sensory aspects of monofloral honeys produced by different stingless bee species in Brazilian semi-arid region** Times Cited: 30  
By: Batista de Sousa, Janaina Maria; de Souza, Evandro Leite; Marques, Gilmares; et al.  
LWT-FOOD SCIENCE AND TECHNOLOGY Volume: 65 Pages: 645-651 Published: JAN 2016
13. **Physicochemical profiles, minerals and bioactive compounds of stingless bee honey (Meliponinae)** Times Cited: 33  
By: Biluca, Fabiola Carina; Braghini, Francieli; Gonzaga, Luciano Valdemiro; et al.  
JOURNAL OF FOOD COMPOSITION AND ANALYSIS Volume: 50 Pages: 61-69 Published: JUL 2016
14. Title: [not available] Times Cited: 26  
By: Bogdanov, S.  
Harmonised Methods of the International Honey Commission Published: 2009  
Accessed 05/05/2010  
URL: <https://www.bee-hexagon.net/en/network.htm>
15. **An investigation of Turkish honeys: Their physico-chemical properties, antioxidant capacities and phenolic profiles** Times Cited: 121  
By: Can, Zehra; Yildiz, Oktay; Sahin, Huseyin; et al.

16. **Physical properties, antioxidant content and anti-oxidative activities of Malaysian stingless *Kelulut (Trigona spp.)* honey.** Times Cited: 4  
 By: Chan BoonKeng; Hasnah Haron; Ruzita Abdul Talib; et al.  
 Journal of Agricultural Science (Toronto) Volume: 9 Issue: 13 Pages: 32-40 Published: 2017
17. **Physicochemical profiles of stingless bee (Apidae: Meliponini) honey from South East Asia (Thailand)** Times Cited: 44  
 By: Chuttong, Bajaree; Chanbang, Yaowaluk; Sringarm, Korawan; et al.  
 FOOD CHEMISTRY Volume: 192 Pages: 149-155 Published: FEB 1 2016
18. Title: [not available] Times Cited: 2  
 Group Author(s): Codex Alimentarius Commission  
 Draft Revised Standard for Honey (at Step 10 of the Codex Procedure) Volume: 25 Pages: 19-26 Published: 2001  
 Publisher: Codex Alimentarius Commission, FAO, Rome, Italy
19. **Identification of traceability markers in Italian unifloral honeys of different botanical origin.** Times Cited: 3  
 By: Colucci, G.; Vito, V. de; Varricchio, E.; et al.  
 Journal of Nutrition and Food Sciences Volume: 6 Issue: 1 Pages: 462 Published: 2016
20. **Identification of sugar, amino acids and minerals from the Pollen of jandaira stingless bees (*Melipona subnitida*)** Times Cited: 17  
 By: da Silva, G. R.; da Natividade, T. B.; Camara, C. A.; et al.  
 Food and Nutrition Sciences Volume: 5 Issue: 11 Pages: 1015-1021 Published: 2014  
[\[Show additional data\]](#)
21. **Honey: Chemical composition, stability and authenticity** Times Cited: 222  
 By: da Silva, Priscila Missio; Gauche, Cony; Gonzaga, Luciano Valdemiro; et al.  
 FOOD CHEMISTRY Volume: 196 Pages: 309-323 Published: APR 1 2016
22. **Efficiency of the FT-IR ATR spectrometry for the prediction of the physicochemical characteristics of *Melipona subnitida* honey and study of the temperature's effect on those properties** Times Cited: 11  
 By: de Almeida-Muradian, Ligia Bicudo; Stramm, Klaus Martin; Estevinho, Leticia M.  
 INTERNATIONAL JOURNAL OF FOOD SCIENCE AND TECHNOLOGY Volume: 49 Issue: 1 Pages: 188-195 Published: JAN 2014
23. **Screening for quality indicators and phenolic compounds of biotechnological interest in honey samples from six species of stingless bees (Hymenoptera: Apidae)** Times Cited: 5  
 By: de Oliveira, Rosane Gomes; Jain, Sona; Luna, Alexandre Candido; et al.  
 FOOD SCIENCE AND TECHNOLOGY Volume: 37 Issue: 4 Pages: 552-557 Published: OCT-DEC 2017
24. **Honey: A Novel Antioxidant** Times Cited: 109  
 By: Erejuwa, Omotayo O.; Sulaiman, Siti A.; Ab Wahab, Mohd S.  
 MOLECULES Volume: 17 Issue: 4 Pages: 4400-4423 Published: APR 2012
25. Title: [not available] Times Cited: 196  
 By: Eriksson, L; Byrne, T; Johansson, E; et al.  
 Multi- and megavariable data analysis: basic principles and applications Published: 2013  
 3rd revised ed  
 Publisher: MKS Umetrics AB, Malmo  
[\[Show additional data\]](#)
26. **Traditional and Modern Uses of Natural Honey in Human Diseases: A Review** Times Cited: 91  
 By: Eteraf-Oskouei, Tahereh; Najafi, Moslem  
 IRANIAN JOURNAL OF BASIC MEDICAL SCIENCES Volume: 16 Issue: 6 Pages: 731-742 Published: JUN 2013
27. **Composition and antioxidant activity of honey from Africanized and stingless bees in Alagoas (Brazil): a multivariate analysis** Times Cited: 10  
 By: Fernandes Duarte, Alysson Wagner; dos Santos Vasconcelos, Maria Raphaella; Domarques de Menezes, Adriana Pereira; et al.  
 JOURNAL OF APICULTURAL RESEARCH Volume: 51 Issue: 1 Pages: 23-35 Published: 2012
28. **Honey of Colombian stingless bees: Nutritional characteristics and physicochemical quality indicators** Times Cited: 1  
 By: Fuenmayor, C.A.; Diaz-Moreno, A.C.; Zuluaga-Dominguez, C.M.; et al.  
 Pot-Honey: A Legacy of Stingless Bee Published: 2013  
 Publisher: Springer, London, UK New York, NY, USA  
[\[Show additional data\]](#)
29. **Simultaneous determination of 5-hydroxymethylfurfural and patulin in apple juice by reversed-phase liquid chromatography** Times Cited: 85  
 By: Gokmen, V; Acar, J  
 JOURNAL OF CHROMATOGRAPHY A Volume: 847 Issue: 1-2 Pages: 69-74 Published: JUN 25 1999
30. **Comparative analysis of antioxidant activity of honey of different floral sources using recently developed polarographic and various spectrophotometric assays** Times Cited: 51  
 By: Gorjanovic, Stanislava Z.; Alvarez-Suarez, Jose Miguel; Novakovic, Miroslav M.; et al.

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