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To cite this article: Zainab Ngaini, Hasnain Hussain, Easter Sirah Kelabo, Rafeah Wahid & Saba Farooq (2023) Chemical profiling, biological properties and environmental contaminants of stingless bee honey and propolis, Journal of Apicultural Research, 62:1, 131-147, DOI: [10.1080/00218839.2021.1948745](https://doi.org/10.1080/00218839.2021.1948745)

To link to this article: <https://doi.org/10.1080/00218839.2021.1948745>



Published online: 20 Jul 2021.



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REVIEW ARTICLE

Chemical profiling, biological properties and environmental contaminants of stingless bee honey and propolis

Zainab Ngaini^{a*} , Hasnain Hussain^b , Easter Sirah Kelabo^a , Rafeah Wahi^a  and Saba Farooq^a 

^aFaculty of Resource Science and Technology, Universiti Malaysia Sarawak, Sarawak, Malaysia; ^bCentre for Sago Research (CoSAR), Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Sarawak, Malaysia

(Received 2 July 2020; accepted 8 March 2021)

Stingless bee honey is a unique edible natural product and has been used by humankind for millenniums for various purposes, mostly as food and for therapeutic uses. The compositions of honey and propolis are varied in different geographical locations which contribute to different pharmacological activities. Many studies reported on the pharmaceutical importance and properties of stingless bee honey or propolis, and the comparative study of either honey or propolis with common honey bee products. However, fewer studies reported on the significant properties of both stingless bee honey and propolis. In this review, three main aspects of stingless bee honey and propolis were discussed: the chemical profiling in terms of chemical and mineral composition, as well as their sugar components; their biological properties, and the environmental contaminants in stingless bee honey and propolis. This review is beneficial in the agriculture sector to improve the quality of honey by providing an appropriate environment for stingless bee farming.



Keywords: Stingless bee; therapeutic; environmental contaminant; biological properties; antioxidant; antimicrobial

Introduction

Honey is a natural sweet substance produced by honey bees from the nectar of blossomed flowers or floral. Ancient Chinese Medicine (200 AD) has practiced honey in many prescriptions and medical indications (Ismail, 2016). Likewise, Ayurvedic medicine in ancient India has prescribed honey for many purposes due to its medicinal benefit. Most of the honey is synonymous with honey bees (*i.e.* *Apis* spp) (Wu et al., 2017). Honey from stingless bees [*i.e.* *Trigona* spp., *Tetragonula* spp. (Kothai, 2015), *Melipona* spp. (Maia-Silva et al., 2016; Silva et al., 2020; Tanaka & Hartfelder, 2009), *Austroplebeia* spp. (M. T. Halcroft et al., 2016)] has become popular nowadays due to its high therapeutic properties and safe for human consumption (Zach et al., 2012). The honey from the stingless bee is claimed to be medicinally more potent compared to honey from other honey bees (Abd Jalil et al., 2017).

Due to these properties, stingless bee honey has become an ethnomedicine among various tribes and ethnic communities around the world to treat various illnesses (Biswa et al., 2017). Stingless bees are generated stingless bee honey and propolis. Stingless bee honey, blonde sugary aqueous material with a specific aroma and delightful taste (Tuksitha et al., 2018). Stingless bee honey possesses a broad spectrum of biological activities such as anti-inflammatory (Biluca et al., 2020), antidiabetic (Ali et al., 2020), antifungal (Hau-Yama et al., 2020), antimicrobial (Boorn et al., 2010; Nishio et al., 2016; Pimentel et al., 2013; Zulkhairi Amin et al., 2019), antioxidant (Krishnasree & Mary Ukkuru, 2015; Tuksitha et al., 2018), anticancer (Borsato et al., 2014) and ameliorating (Mohammad et al., 2020) properties.

Stingless bees are a highly diverse and abundant group of haplodiploid (Hurtado-Burillo et al., 2016) and

*Corresponding author. Email: nzainab@unimas.my