Melissopalynological analysis of stingless bee (Tetragonula pagdeni) honey in Eastern Thailand

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ABSTRACT

Melissopalynological analysis of 72 Tetragonula pagdeni honey samples, collected from various locations in Chanthaburi (A) and Trat (B) provinces, Eastern Thailand during March 2015, was performed. Overall, 45 pollen types species belonging to 22 plant families were identified. The predominant pollen type was from Neptunia lappaceum and comprised 48.5% of the pollen in honey from location A2 (Pathavee district) and 45.3% in location B1 (AoYai district). The secondary pollen types, Wodyetia bifurcata and Mimosa pudica, accounted for 20.1% and 17.0%, respectively, in location B3 (Nhongsamed district), while Cocos nucifera accounted for 17.2% in location A2. In addition, pollen types of C. nucifera, M. pudica, N. lappaceum, Asystasia gangetica, Amaranthus lividus, Arcea catechu, Chromolaena odorata and Durio zibethinus were found in T. pagdeni honey from all sampled locations. Furthermore, in the dath period, T. pagdeni foraged food (as in pollen was present) from Musa sp., Acacia mangium and various weed species, such as A. gangetica, A. lividus, Ageratum conyoides, Bidens pilosa, C. odorata, Melampodium divaricatum, Mikania cordata, Merremia umbellata, M. pudica, Pennisetum pedicellatum and Thysonota maxima, from within a 500 m radius around the hive to maintain their colonies.

In the eastern part of Thailand, four species of stingless bee (T. pagdeni, T. laeviceps, Lepidotrigona terminata and L. ventralis) have been kept in small wooden box hives for honey harvesting and agricultural crop pollination, including rambutan, litchi and cashew nut, with T. pagdeni being the dominant and most widely kept species in this area (Sawamyudd, 2004). For example, > 2000 colonies are currently kept in orchards for crop pollination and harvesting of the bees' natural products in Chanthaburi and Trat provinces, Eastern Thailand (Head of Agricultural Occupation Promotion and Development Center, Chanthaburi provincial, Interview, 31 Jan 2018).

Honey is a natural sweet substance produced by honey bees and stingless bees. Stingless bees collect nectar from the nectar glands of flowers and other parts of plants. After collection, the nectar is transformed and stored in honey cells (pots) (Alimentarius, 2001). Different compositions of honey in each area show different tastes as well as medicinal properties depending on the foraged food sources (Al et al., 2009; Anklam, 1998; da C Azeredo et al., 2003).

Melissopalynological analysis has been used to analyze the likely botanical origins of honey, where the identification of the pollen, spores and hyphae contained in the honey, and the pollen sources, provide evidence of the botanical and geographical origin of the foraged nectar.

Introduction

Stingless bee (Apidae: Meliponini) is a common name for all bees without sting, but can defense colony by biting. Stingless bees are comprised of diverse groups of eusocial insects distributed throughout the tropical and subtropical parts of the world (Michener, 2000). In Thailand, there are a greater number of species of stingless bees than honey bees in Thailand, with 33 species from 10 genera of stingless bees being found and widely distributed throughout the region (Boontop et al., 2008; Inson and Malaipan, 2006).

Stingless bees are important insect pollinators for many flowering plants, and are also used for bee keeping because they usually forage for their food source not far from the nest, can collect both pollen and nectar from various plant species, forage throughout the year, pollinate native plants as they are endemic insect pollinators, cannot sting, are of a small size with a long life cycle that is greater than other insect pollinators, and so are easy to handle, propagate and keep in small easily transported hive boxes for crop pollination (Heard, 1999). Moreover, stingless bee hives can easily be transferred to other places for crop pollination. For example, Slaa et al. (2006) reported on the high potential of Tetragonula pagdeni for crop pollination.

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in the honey, and so the plants that the stingless bees visited, as well as the quality of the honey (Louveaux et al., 1978; Vit et al., 2004; Von der Ohe et al., 2004).

Although there has been considerable research on the melissopalynology of honey in Apis species, such as in *Apis mellifera* (El Sohaimy et al., 2015; Kayode and Oyeyemi, 2014; Matos et al., 2014; Taha, 2015), *A. dorsata* (Ibrahim et al., 2012; Raghunandan and Basavarajappa, 2014) and *A. cerana* (Attri, 2010; Bhargava et al., 2009), there has been very few reports on stingless bee honey. Moreover, the available research on pollen in stingless bee honey are largely from only Brazil, Venezuela and Argentina in South America and from Australia (Almeida-Muradian et al., 2013; Barth, 2013; da Silva et al., 2013; de Carvalho et al., 2001; Silva et al., 2013) with very few reports in Southeast Asia including Thailand.

Recently, the numbers of stingless bee keepers in Thailand has increased for the principal purpose of propagating and keeping stingless colonies for economic crop pollination, such as rambutan. Compared to the honey of *A. mellifera*, the market price of stingless bee honey is very high, but the production yield of honey per stingless bee hive is quite low. To promote stingless bee honey as a commercial product it is necessary to know the (preferred) floral origin and food sources of stingless bee to ensure that these are provided within the foraging range of the hive. Hence, by melissopalynological analysis, this research aimed to identify the principal food sources (botanical origin) used by *T. pagdeni* for honey production and, importantly, including within the dearth period when there is no flowering of economic crops.

![Map showing the sampling locations for *T. pagdeni* honey at (A) Chanthaburi and (B) Trat provinces in Eastern Thailand.](image-url)
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