CHAPTER 1

Introduction

1.1 Principles, Rationale and Hypothesis

Honey is a supersaturated sugar solution; its unique combination of components makes honey a prized addition to the diet. It has been used as a food for at least six thousand years (Ball, 2007). Nearly all honeys are derived from floral nectar. The composition of nectar varies greatly depending on the plant species and the environmental conditions. The majority of past research on honey quality has targeted the European honey bee species (*Apis mellifera* L.). According to the Codex (2001) and International Honey Commission (IHC) (2009), a quality honey is determined by moisture, ash, electrical conductivity, pH, acidity, hydroxymethylfurfural, diastase activity and sugar content. The quality and physicochemical properties of honey are characteristically related to the botanical nectar source, honey maturity, production methods, climatic conditions, as well as processing and storage conditions (Castro-Vazquez *et al*., 2008; Nombre *et al*., 2010).

The physical and chemical properties of different types of honey have been reported by many scientists (Oddo *et al*., 1995). The honey that has undertaken the greatest research effort is that of the western honey bee (*A. mellifera*). During storage, many changes in *A. mellifera* honey composition, nutrition and sensory characteristics are known to occur. Based on the commercial usefulness of honey, studies have been commenced in order to monitor the chemical changes of honey during processing and storage (Castro-Vazquez *et al*., 2008; Moreira *et al*., 2007).

Honey produced from *A. mellifera* is a product known worldwide, which is appreciated due to its flavor and aroma as well as for its nutritional quality. Honey from the other bee species is much less studied and commercial. However, scientific interests in these products are increasing for several reasons. Stingless bees differ from *A. mellifera* at the subfamily level and are in the tribe Meliponini (Michener, 2000) with

an estimated 500 species currently known (Michener, 2013). Stingless bee species are utilized both for their essential pollination value and the production of honey and cerumen. Stingless bees are a taxon of eusocial bees within the family Apidae, and known for honey production. Stingless bee honey differs from that *A. mellifera* in many respects; it is generally less sweet and has a higher moisture content which favors fermentation, which necessitates higher levels of care during harvesting and storage (Ferreira *et al*., 2009). Stingless bee honey is highly prized, but nowhere have honey standards been initiated for stingless bee honey. It is only for honey from *A. mellifera* and *Apis cerana* where international standards exist. Standards for stingless bee honey are urgently required because stingless bee honey has recently entered the international honey markets (Jones, 2013). Menezes, Vollet-Neto, Contrera, Venturieri & Imperatriz-Fonseca (2013) emphasized that it is rather surprising that few data are available on the physiochemical composition of various honey types produced by stingless bees. While there have been limited studies on the basic physiochemical structure of stingless bee honey there are only two studies concerning changes in physicochemical characteristics over time on the two species *Trigona hypogea* and *T. angustula*. Due to the high diversity of stingless bees and limited studies on their microorganisms, the honey maturation process is still not at all well understood. Physicochemical changes in stingless bee honey over the course of time would be great value in understanding the biological and biochemical processes involved in honey storage by stingless bees.

Stingless bee honey is a valuable bee product with a long utilization tradition, to which several medical uses are indicated. Due to insufficient knowledge about the product, stingless bee honey is not included in international standards for honey (Codex, 2001) and no published quality control declarations for consumers. The International Honey Commission aims to establish quality standards of bee products other than western honey bee (*A. mellifera*), including stingless bee honey. National honey standards from Brazil, and Venezuela were established only for *A. mellifera* honey, following the guidelines of international standards of the Codex Alimentarius Commission (Souza *et al*., 2006).

Primarily because of their different nesting habitats not all species can be used for honey and cerumen production, *i.e*., they are not able to accept man-made domiciles

(Souza *et al*., 2006). As stingless bees, as a group, are so biogeographically diverse and so rich in the number of species, the honey maturation processes are still not overly well understood, foremost of which are the changes in honey physicochemistry that take place over time (Menezes *et al*., 2013).

Variations in levels of honey composition during storage are considered to depend mostly on the temperature to which honey is exposed; the period of exposure is also relevant. Changes in the volatile compounds of honey that has been heated or stored can be characterized by two principal causes: compounds that are unstable may be libel to heat deterioration, and volatile compounds produced by non-enzymatic browning (Maillard reaction), which causes considerable change in honey flavor. A long period of storage or high temperatures is known to produce furan derivatives through sugar degradation, furfural and 5-hydroxymethylfurfural (HMF). These compounds are frequently used as indicators of storage or heating of honeys (Gonzales *et al*., 1999).

1.2 Research Objectives

a. To study the physicochemical composition of stingless bee honey across species breadth.

b. To monitor the changes in physicochemistry of *Tetragonula laeviceps-pagdeni* honey (the mostly common managed species) over time and temperature storage.

1.3 Research Scope

In this study, the physicochemical composition of stingless bee honey across species breadth was analyzed and monitoring the changes in physicochemical composition of stingless bee honey (common species *Tetragonula laeviceps-pagdeni*) over time and temperature storage.

1.4 Education/Application Advantage

The physicochemical of stingless bee honey and information about changes produced over time and temperature storage will use to suggest national/international standards for stingless bee honey.

1.5 Research Location

The studies were conducted at 3 research laboratories Postharvest Technology Research Institute Central Laboratory, Faculty of Agriculture and Science and Technology Research Institute, Chiang Mai University respectively.