CHAPTER I

INTRODUCTION

Honey is a sweet food and a complex mixture of substances produced by bees. Bees use nectar from flowers as source to produce honey. To make honey, workers bees need to forage the nectar from many flowers (millions). However, bees must perform several different and distinct dances to communicate the location of the source of nectar (Nicola, 2009). Honey can be obtained from sting bee of genus *Apis* or from stingless bee of genus *Trigona.* Stingless bees, like the honey bees of the genus *Apis*, live in tropical area with many individuals in a nest where the honey is processed and stored, but the amount of honey is generally smaller than in the nest of honey bees (about 1-2 liters per year). People have used stingless bee honey as food and as treatment for ailment. Nowadays, it is realized that these bees are important to produce a special type of honey (Marinus, 1999).

Honeys have a strong relationship and a long history of human consumption that are linked to their health benefits. These benefits may be derived from the structure and composition of the sugar present. Others may be derived from the presence of other materials such as phenolic compounds and flavonoids. In recent years, researches have been increased to understand the scientific basis of many potential benefits of honeys. In addition, the health benefits of honey are linked with folk remedies and alternative medicines, for instance, honey is effective in the treatment of stomach ulcers, to treat wounds and burns. Honey is applied directly to the area, and covered with clean gauze or cloth. Other health benefits of using honey include fight acne, combat infection, clear bladder infection, fight colds, aide digestion, cholesterol reduction, recede arthritis pain, sooth toothache, clear sinuses and help fertility (Sampath *et al*., 2010; Noori and Al-Waili, 2004).

Honeys produced by bees have distinctly different properties. Honey bees (sting bee and stingless bee) transform the collected nectar into honey by a process of regurgitation followed by evaporation (Deb *et al*., 2011). The physical properties of honeys; such as color, viscosity and flavor are determined by various plant species visited by the bees and the storage conditions. However, cultivated plants that are

grown for other purposes can provide an important source of nectar. Common nectar sources include agricultural crops, small fruits, tree fruits, ornamentals, and wild flowers. Honey is widely used as a food and as a source of sugar to make honey wines and beers, and there are several secondary products made of honey, such as, breakfast cereals, bakery good, and a multitude of other value-added product. Honey has a value of energy of about 3,040 kcal/ kg, and the sugar content is about 80% (Codex, 2002). Honey has the ability to fight and inhibit the microorganisms such as pathogenic bacteria, spoilage fungi, yeast and viruses. The antimicrobial effect of honey in particular against Gram positive bacteria is well documented (Molan, 1999; Bogdanov, 2014). The antibacterial capacity of honey was first reported in 1980, it can affect about 60 species of Gram positive bacteria and Gram negative and many species of fungi (Lim *et al*., 2014).

The usage of honey as a treatment was first mentioned some 2000 BC, and honey used for healing wounds was probably the first usage of honey for human health. Honey has been included in about 147 prescriptions in external use as reported in Ebers papyrus (1550 BC) for instance "Mix honey, red ochre, powdered alabaster to cure spotted baldness". Healing application in the treatment of wounds, burns and infections was reviewed by Molan (1999) and Bogdanov *et al*. (2008). Application of honey for treating wounds after surgery reduced the inflammation (Bogdanov *et al*., 2014). In ancient India ayuruvedic treatment using honey for many purposes; honey can be used as a medicine against many illnesses, e.g. healing and cleaning infected wounds, against different internal and external infections. In modern science, honey has been used for the treatment for burns, cataracts, skin ulcers and to heal wounds, because it exerts soothing effects when directly applied to open and infected wounds (Alvarez *et al*., 2014).

The physical and chemical properties of honey vary depending on the type of honey used, for example Manuka is honey derived from the tea tree. Cutting and Bogdanov (2014) reported that Manuka honey has "very special healing properties" and it was described as "the best natural antibiotic in the wide world". Some of the bioactivity of honey are (a) prevention of cross-contamination, this may related to the viscosity of honey that provides a protective barrier, (b) managing the infection where the antiseptic properties of honey are found to be effective against a range of microorganisms including multi-resistant strains and, (c) provides a moist wound

healing conditions because of the osmolarity that draws fluid from underlying tissues (Cutting & Bogdanov, 2014).

Dustman (1979) has suggested that the antimicrobial capacity of honey may be responsible for the action of the hydrogen peroxide and the non-peroxide activity. However, research indicated that the antimicrobial action of honeys is related to the presence of the components that have antimicrobial properties against pathogenic microorganisms, among them, the presence of hydrogen peroxide which is produced enzymatically during the production of honey. The high osmolarity of honey/low water activity was suggested to inhibit microbial growth (Nagaraj *et al.,* 2012). The chemical components present in honey differ with types of honey, thus their ability to combat the micro-organisms are different. Pimental *et al.* (2013) reported the presence of rutin in honey from stingless bee (*Melipona compressipes*) and commercial honey which may be responsible for the antimicrobial activity.

The emergence of antibiotic resistance strains of food borne pathogens has created concern to food and human safety. There is a need to search for alternatives that could inhibit the growth of these antibiotic resistant microorganisms. While most published work reported on the antimicrobial capacity of honey from the *Apis* bee species, little information is available on the antimicrobial activity of honey from stingless bee have been published, particularly in Malaysia.

The purpose of this study was to evaluate the antibacterial activity of species of stingless bee honey (SBH) available in Malaysia against selected pathogens. Therefore, the objectives of this study were:

i. To determine the physiochemical properties of honey samples from stingless bees available in Malaysian.

ii. To determine the antimicrobial activity of honey from stingless bees available in Malaysian markets against *Escherichia coli* (ATCC 25922), *Bacillus subtilis* (ATCC 21332), *Serratia marcesence* (ATCC 13880), *Staphylococcus aureus* (ATCC 25923), *S.* Typhimurium (ATCC 13311) and *Proteus vulgaris* (ATCC 8427).