

I. INTRODUCTION

1.1 Research Background

Insects are the dominant group of animals with almost 80 percent of the total number of animals on earth. Around 751.000 species of insects, about 250.000 species are found in Indonesia. Insects in agriculture are widely known as pests (Kalshoven, 1981). Insects in agriculture are widely known as pests. Some are predators, parasitoids, or natural enemies (Christian & Gotisberger, 2000). Insects can maintain their survival in varied habitats, high reproductive capacity, the ability to eat different types of food, and the ability to save themselves from their enemies (Borror et al., 1981).

Bees are a group of pollinating insects that play an important role in helping the pollination process for various types of plants and wild plants (Heard, 1989; Herwina et al., 2022). The existence of stingless bee in West Sumatra can be found from the lowlands to highlands (Herwina et al., 2021). There have been between 500-600 stingless bee species described from all over the world (Basari et al., 2018; Herwina et al., 2020). One group of bees that has an important role as pollinators is the group of stingless bees. Stingless bees have a very high ecological role. Even stingless bees have become familiar with people's lives and cultures (Reyes-González & Zamudio, 2020). Stingless bees are a group of eusocial insects which plays an important role in the pollination process of plants, especially wildflowers, in most tropical regions of the country (Heard, 1999).

Stingless bees belong to a large and diverse taxon consisting of more than 60 genera (Rasmussen & Cameron, 2010). The stingless bee belongs to the tribe Meliponini of the family Apidae. Worldwide, it is estimated that there are more than 600 described species in about 61 genera. Estimates of the number of species identified so far are 50 in Africa, 300 species in the Americas, 60 in Asia, 10 in Australia and four in Madagascar. However, several studies over the past two decades have used morphological characters (Michener 1990; Camargo & Pedro, 1992) and single mitochondrial DNA gene fragments with limited taxon sampling (34 species) (Costa et al., 2003) resulted in phylogeny.

Stingless bees are a group of social insects belonging to several genera such as *Tetragonula*, *Lepidotrigona*, *Geniotrigona* or *Heterotrigona*; all belong to the tribe Meliponini and the Hymenoptera together with ants, bees and stingers (Sihombing, 2005; Syafrizal et al., 2012). The stingless bee is also known by its local names kelulut, galo-galo, klanceng or teuweul. In addition, stingless bees are also known as 'resin bees' in India and in Karnataka are called 'Musare jenu' (Rasmussen, 2013). Stingless bees visit flowering plants including herbs, shrubs and trees (Rajkumari et al., 2014). In addition, stingless bees are kept in the name of 'Meliponiculture' (Leonhardt, 2017).

Bees have a defense system in the structure of the hive, although natural enemies are still a problem in the cultivation of stingless bees. These natural enemies are referred to as pests on stingless bee colonies. Natural enemies are defined as natural organisms that interfere with or kill other animals such as

predators, parasites, and pathogens (Estes et al., 2001). Predators and parasites can reduce the productivity of bees and honey, affect the structure and composition of the hive, and can cause colony death (Pangestika et al., 2016).

Predators are animals that are carnivorous or prey on other animals. There are several predators that attack bee colonies including wasps, ants, and spiders (Kumar et al., 2012). Forest elephants, chimpanzees, and ferrets, various species of birds, assassin bugs and spiders are also pests for stingless bees (Wattanachaiyingcharoen & Jongjitvimol, 2007; Premila et al., 2013). The centipede *Scolopendra hardwicki* was observed preying on workers and queens of the *Trigona iridipennis* clan in India (Vijayakumar et al., 2012).

In addition, ants are also predators that harm stingless bees outside and inside the hive (Lehmberg et al., 2008). Spiders and ants include carnivorous animals that include predators (Subyanto et al., 1991; Pangestika et al., 2016). Parasites are also classified as pests in stingless bees. Parasites are organisms whose lives depend on other living things. Common parasites found in honeybees (stinging bees) include mites, fleas, moths, and beetles (Strauss et al., 2013). In addition, Pangestika et al., (2018) who conducted research in East Java found several species of pests that attack *Trigona* beehives. Some species of pests that attack *Trigona* bee colonies include: Cockroaches (Blattidae), Histeriidae beetles (*Platysoma leonti*) and Nitidulidae beetles (*Carphophilus* sp.), geckos, lizards, termites, and ants.

All these disturbances caused by different animal species have disrupted the normal survival of stingless bees in different habitats. Therefore,

stingless bees face constant threats both in natural landscape changes and man-made (Gopinatha & Basavarajappa, 2022). Studies conducted in the Kakamega forest, Kenya showed that the brood *Meliponula bocandei* Cockerell, *M. ferruginea* Cockerell (reddish-brown), *M. ferruginea* Cockerell (black), *Meliponula lendliana* Friese and the stingless Magretti bee species were susceptible to invasion of *A. tumida* maggots. He also reported other coleopteran pests such as *Rhizoplatys mucronatus* Beauvois and *Tenebroides mauritanicus*. Based on report by Kiatoko (2012), *Myrmicaria* sp. known as a predator of stingless bee species in Kenya.

The Biological Education and Research Forest (BERF) of Universitas Andalas is a secondary forest with an area of approximately 150 ha located in the Andalas University area, Padang, West Sumatra (Sari, 2015). BERF is located on the western edge of Bukit Barisan which is part of Kamalau Hill (0 '54' S, 100 '28' E). Biological Education and Research Forest has a diversity species of plants, animals, fungi, including species identified as endemic also exists. Species richness is estimated at 530 species of trees dominated by the families Euphorbiaceae, Moraceae, Fagaceae, and Lauraceae (Rizaldi et al., 2018). Insect species has also been reported such as spider (Yanti, 1999), fireflies (Octaria, 2007), butterflies (Firmalinda, 2007), ants (Putri, 2016), fecal beetles (Sari, 2015). In BERF there are several colonies of stingless bees from various genera.

However, there have been no studies on the natural enemies (pests) of the colony. This research is important to find out what animals are disruptors and inhibitors growth and development of stingless insects. This

disorder affects many things, ranging from bee growth, reproduction and breeding, to its ability to produce products in the form of honey. Thus, we can anticipate the presence of pests and carry out early detection of pest attacks. It is expected from this study, in the future colonies in the BERF and EduFarm will increase the productivity of stingless bees.

1.2 Research Problem

Based on the background of the problem above, several problem formulations are obtained as follows:

1. What are pest species of stingless bee colonies found at two sampling locations in the Biological Education and Research Forest (BERF) and Education Farm (EDUFARM) at Universitas Andalas?
2. What is the biological index (biodiversity index, evenness index, and dominance index) between pest species in stingless bee colonies based on the location of the colonies and also method that used?

1.3 Research Objective

The objectives of this study are as follows:

1. To determine the pest species of stingless bee colonies found at two sampling locations in the Biological Education and Research Forest (BERF) and Education Farm (EDUFARM) Universitas Andalas.



2. To determine biological index (biodiversity index, evenness index, and dominance index) between pest species in stingless bee colonies based on the location of the colonies and also method that used.

1.4 Research Significant

The results of this study are expected to provide information about the species of pests found in stingless bee colonies in the Biological Education and Research Forest (BERF) and Education Farm (EduFarm), Universitas Andalas.

