Potential Natural Enemies of Stingless Bee in Sleman Hortikultura Plantation, Yogyakarta

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Abstract. Stingless bee is one of the bee species that pollinates many horticultural crops such as chili plants in Sleman plantations. The dominance of the presence of Stingless bee in the environment of chili plantations determines the success rate of chili fruit production. Apart from the fact that the distance of Stingless bee cultivation is still in the plantation environment, there are also factors that affect the Stingless bee population, namely from the variety of plants, fertilizers, planting techniques and how to control pests. There are biotic factors in the form of climatic conditions in the environment, and abiotic factors in the form of natural enemies such as predators and parasitoids. This research was conducted in the horticultural plantation environment of Sleman Regency, Yogyakarta. Found as many as 6 types of predators consisting of: 3 types of Formicidae, 1 type of Coccinellidae ladybug and 2 types of Vespidae and from spiders there are 2 types of Nephila sp. A total of types of wasps (Braconidae 1, Eulophidae 2, Chalcididae 1 and Sphecidae 3). But the potential as a natural enemy of some of these predators and parasitoids still requires more research.

Keywords: Stingless bee · Horticultural · Natural Enemies · Predators and Parasitoids

1 Introduction

Stingless bee (Hymenoptera) known as stingless bee is an ausocial bee. Today more than 400 species are found in the tropics and subtropics [1]. As in other bees, Stingless bees are active in the morning to noon to look for pollen and nectar as a source of feed [2]. In this case, the behavior of bees greatly benefits those farmers who grow flowering plants such as cucumbers, eggplants, peppers and other plants that still need insects as pollinating agents. The symbiotic relationship between bees and plants is the most important thing in natural ecosystems. Bees will act as pollinating agents by helping to accidentally transfer pollen to the pistil. Then the pollen attached to the bees will be combed and put into the pollen basket that is on the bee's limbs and compact. The rest of the pollen comb will fall off and stick to the pistil as the bee flies.

It is known that female plants will produce more nectar and will attract more bees than male flowers. While male flowers will produce pollen [3]. The presence of separate male and female flowers such as cucumber plants will require an agent as pollination

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[4]. The mutual relationship between insects and flowering plants will vary greatly and will have an impact on the natural ecosystem. The role of polynator insects is of great benefit in maintaining the existence of a plant species through the pollination process and to maintain plant genetic diversity in a population.

The interest of many insects as a result of the source of feed from flowering plants will invite many insects to come. In addition to bee bugs, there are insects such as ladybugs that will look for nectar [5]. A wasp insect that also searches for pollen as its main feed. In addition, there are also other insects and animals that come just to prey on more insects whose bodies are smaller so that they are easy to catch and prey on. The insect becomes a predator for bees. Apart from the fact that the distance of Stingless bee cultivation is still in the plantation environment, there are also factors that affect the Stingless bee population, namely from the variety of plants, fertilizers, planting techniques and how to control pests. There are biotic factors in the form of climatic conditions in the environment, and abiotic factors in the form of natural enemies such as predators and parasitoids.

The presence of natural enemies of bees will change the population of bees without a sting so it is feared that it will affect the production of fruits from horticultural plants. Therefore, it is necessary to observe the behavior and diversity of natural enemies of bees without a sting. So far, many studies have examined the diversity of insects in various regions as well as the number of colonies, types of hives and the nature of honey. This research, we explored the diverse species of natural enemies of stingless bees so that it can be a reference and further knowledge.

2 Methods

2.1 Research Location

This research was carried out in the horticultural plantation area of the Caping Merapi Agrotourism milit in Sleman Yogyakarta hich is located 7°44′43.24″S and 110° 26′04.18″ T in Yogyakarta with a altidude of 179 m above sea level (asl). The selection of this site is based on the availability of bee feed whose nature is easier to condition according to the needs of the environment to be carried out. The location used is a production area planted with cucumbers, eggplants, and peppers that are flowering at the same time. The study lasted for 6 months (September 2019 to March 2020).

2.2 Research Procedures

Sampling of natural enemy insects is carried out using several traps in order to find out insects living in the same habitat as bees without a sting.

1. An insect net with a diameter of 30 cm, a cone height of 65 cm, and a jarring stalk length of 150 vm is used to catch flying insects, by swinging jarring in the area of flowering plants that are habitats for natural enemies. After taking using jarring insects are then put into a killing bottle that already contains 70% alcohol moistened in a cotton swab. Insect retrieval is carried out from 06.00–16.00 WIB.

2. Foging traps to catch insects found on the surface of plants or flowers that are blooming. Fumigation with mosquito-killing substances is sprayed on the surface as far as 2 m from the ground surface and accommodated using plastic placed on the basis of plants so that the insects that are the object will fall and then collected into 70% alcohol [6]. Insects that have been caught and collected are then processed for the identification process using reference specimens and supporting literature.

3 Results and Discussion

The natural enemies of stingless bees include predatory insects that prey on the bees. From the results of direct visual observations, 6 types of predators were found consisting of: Formicidae such as Dolichoderus thoracicus, Lasius niger, and Paraponera clavata, Coccinellidae ladybugs such as Coccinella transversalis and Vespidae such as Ropalidia fasciata and Vespa sp and from spiders there are types of Nephila sp and Gasthero cantha. A number of Braconidae wasp species such as Leluthia astigma, Eulophidae such as Tetrastichus inscitus, Chalcididae such as Brachymeria annulata and Sphecidae such as Sphex argentatus, Polistes indicus, and Ropalidia brevita are thought to parasitize and prey on the life of bee larvae.

The entirety of the insects that are suspected to be predators for bee insects, the highest is in the Gasthero canthi spider. The result of the observations made that Gasthero canthi became a predatory animal that preyed heavily on bees [7] Usually Gasthero canthi will be stand by at the base of the flower, twigs near the flower and the base of the flower every morning until evening to wait for bees and other small insects that will visit the flower to find a source of food [8]. When the target to be preyed upon approaches, the predator will act to capture and prey on it. This behavior became a common behavior in spiders to prey on their targets [9] (Table 1).

Based on observations in this study spiders become potential predators. Just like the research of [10] also found a type of spider that has the potential to become a predator on a plantation. Spiders food as predators in the form of bees, flies, grasshoppers and other small animals [11].

Insects found in habitats close to horticultural plantations have a diverse diversity among natural enemies and insect pests. The presence of natural enemy insects indicates a low level of stability of the community. If the abundance of natural enemy insects is low it is due to an unbalanced agroeskosystem [12, 13]. This balance is due to the use of synthetic pesticides in pest control that can also kill the natural enemy insects themselves. The consequences of pesticide use will cause ecosystems in the region. Lowering the number of natural enemies, lowering the number of pests so that natural enemies will consider beneficial insects to be their prey such as stingless bees, so that they are no longer on target in the ecosystem chain cycle [13]. Habitat conditions and environmental conditions are the causes of low natural enemies in a territory. Natural enemies will be related to the presence of pests that exist in the field in relation to the food chain cycle [14].

There are still many insects that have a role as pest control by becoming natural enemies [15]. But nowadays a lot of farmers use insecticides excessively and result in the presence of natural enemies. Insecticides not only kill insect pests but also insects that

Table 1. The diversity of predators Stingless bee and parasitoids on horticultural plantations.

No	Type	Species	Flowers	Type of Natural Enemies	Methods	Potential
1	Formicidae	*Dolichoderus thiracicus*	*Cucumis sativus*	Predator	Sweepeing Pit Fall	*X*
		Lasius niger	*Cucumis sativus*	Predator	Sweepeing Pit Fall	*X*
		Paraponera clavata	*Cucumis sativus*	Predator	Sweepeing Pit Fall	*X*
2	Coccinellidae	*Coccinella transversalis*	*Cucumis sativus*	Predator	Sweepeing Pit Fall	*X*
3	Vespidae	*Vespa bellicosa*	*Cucumis sativus*	Predator	Sweepeing Pit Fall	√
		Vespa affinis	*Solanum melongena*	Predator	Sweepeing Pit Fall	√
4	Nephilidae	*Nephilia sp*	*Cucumis sativus*	Predator	Hand Foging	√
		Gasthero cantha	*Capsinum sp*	Predator	Hand Foging	√
5	Braconidae	*Leluthia astigma*	*Solanum melongen*	Parasitoid	Sweepeing Pit Fall	***X***
6	Eulophidae	*Tetrastichud inscitus*	*Solanum melangena*	Parasitoid	Sweepeing Pit Fall	***X***
7	Chalcididae	*Brachymeria annulata*	*Solanum melangena*	Parasitoid	Sweepeing Pit Fall	***X***
8	Sphecidae	*Sphex argentatus*	*Cucumis sativus*	Parasitoid	Sweepeing Pit Fall	***X***
		Polistes indicus	*Cucumis sativus*	Predator	Sweepeing Pit Fall	***X***
		Ropalidia brevita	*Cucumis sativus*	Predator	Sweepeing Pit Fall	***X***

act as pest control such as natural enemies. This results in the balance of the ecosystem will be disturbed.

4 Conclusion

Horticultar plantations in Sleman planted with various flowering and fruiting plants will have polynator insects, insect pests and natural enemy insects. All three become good ecosystems in nature. Here you can see many natural enemy insects that prey on other insects that are not pests. So this can be detrimental to the ecosystem

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