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Insect pests in smallholding coconut plantation in Marga Sungsang Village, Banyuasin Regency, South Sumatra, Indonesia

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Abstract. Coconut (*Cocos nucifera* L.) is one of the plantation crop commodities from the Palmae family that is widely cultivated in almost all regions in Indonesia, especially in South Sumatra. Insect pest attack is the main problem faced by farmers. Coconut farmers face this problem in Marga Sungsang Village, Banyuasin II District, Banyuasin Regency, South Sumatra Province. Therefore, this study aims to determine the insect pests that attack coconut plants. The research was conducted in May 2023 with field observations and interviews with coconut farmers. Observations were made through direct observation of pests on coconut plants owned by farmers covering an area of 4 hectares. Observations were made on infested plants by observing the types of pests and symptoms of attack. Meanwhile, interviews were conducted to find out the cultivation techniques used by farmers. The results showed that insect pests found in coconut smallholding plantations (*C. nucifera* L.) in Marga Sungsang Village, Banyuasin Regency are six species with 2.114 individuals consisting of orders namely Hemiptera, Orthoptera, Lepidoptera, and Coleoptera. There were six insect pests: *Auloracanthus* sp., *Aleurodicus* sp., *Trilophidia* sp., *Phlaeoba infumata*, *Pteroma* sp., and *Oryctes rhinoceros*.

Keywords: Insect pests, Coconut plantations, *Cocos nucifera*

1. Introduction

The coconut (*Cocos nucifera* L.) is a plantation plant from the palmae family with stems that grow upright and do not have branches. It is often found in tropical areas and can grow in low and highlands. Coconut plants can grow in the lowlands, which have a height of 0-450 meters above sea level, and in the highlands, which are 450-1000 meters above sea level [1]. The coconut plant is also one of the primary commodities in the Indonesian economy because it plays a massive role in the source of income and industrial raw materials. After all, all parts of the coconut can be used for human benefit [2].

Therefore, coconut plants have become one of the widely cultivated commodities.

Coconut plants are widely cultivated in almost all regions of Indonesia, such as in South Sumatra. In South Sumatra, coconut plants are a commodity with many roles, one of which is increasing sources of income and opening up employment opportunities for farmers [3]. South Sumatra has succeeded in



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becoming one of the regions developing the potential of coconut plantations, especially in Banyuasin. The abundant production of coconuts is from the smallholding farmers in Banyuasin, South Sumatra. In Marga Sungsang Village, Banyuasin Regency, the farmers planted the coconut tree with the red coconut. Even though its utilization has been carried out very well, the farmers of the smallholding coconut plantation in South Sumatra have problems such as attacks of insect pests, which can hinder the cultivation of coconut plants. The attack of insect pests can cause losses because they can attack part of the growing point of the plant; later, further attacks can cause plant death, inhibit the plant metabolic process, and reduce production yields in terms of quality and quantity of coconut plants.

The insect pests attacking smallholding coconut plantations in Banyuasin Regency, especially in Marga Sungsang Village, have not yet been recorded. Therefore, this study aimed to inventory the insect pests in smallholding coconut plantations. The insect pest species that attack coconut trees can be recorded by conducting inventory studies. With this knowledge, precise pest management strategies can be tailored to control the insect pests and later prevent or mitigate the coconut losses.

2. Methods

2.1 Location

This research was conducted in Marga Sungsang Village, Banyuasin II District, Banyuasin Regency, South Sumatra Province. The collected insect pests were carried out to the Entomology Laboratory, Department of Plant Pests and Diseases, Faculty of Agriculture, Sriwijaya University, Indralaya. The observation in the field was carried out once a month from July until September 2023.

The method used in this research was directly observing the smallholding coconut plantation and taking insect samples purposive sampling on coconut plantation land in the determined research area, namely in Marga Sungsang Village. Then, the data consists of primary data obtained from observations at predetermined land locations.

2.2 Data collection

Data collection was initially carried out by determining three coconut plantations as objects of observation, and then these plantations were observed. Data was collected using the purposive sampling method by making direct observations and using traps such as yellow and light traps. Three sites have been utilized to set up lights and pheromone traps at one sampling site (subdistricts). A total of 30 coconut trees were observed in one subdistrict for insect nets and direct observations. Sampling was done by collecting insects directly, either during direct observation or in traps. Documentation was carried out to strengthen and support the data obtained in the observation area. Documentation was carried out in the form of photographs of insects found on coconut plants and wild plants around the coconut plants. Identification of insects found is done by examining insects that are common and have been studied previously. The things studied were similar in color, shape, size, and morphological characteristics of the insects found.

2.3 Data Analysis

Data analysis was analyzed by using Ms. Excel. Data was collected using the diversity, dominance, and evenness indexes. A formula was used to determine the diversity index (Shannon-Wiener index):

$$H' = - \sum P_i \ln P_i \text{ with } P_i = n_i / N \quad (1)$$

H' is the diversity index; n_i is the number of individuals in species i , and N is the total number of individuals. The criteria for the Shannon-Wiener diversity index value H' : $H' < 1$ is categorized as Low diversity, $1 < H' < 3$ is categorized as moderate diversity, $H' > 3$ is categorized as high diversity.

A dominance index was used to determine the dominance of an organism. The Dominance Index value was calculated using the Simpson dominance formula [4].

$$D = \sum (P_i)^2 \quad (2)$$

An explanation of the formula: D is the dominance index, P_i is n_i/N, and N is the total individual. The Criteria for the dominance index are 0-0.50 for low dominance, 0.5-0.75 for moderate dominance, and 0.75-1 for high dominance.

The evenness index can be calculated by following the formula:

$$E = H' / \ln S \quad (3)$$

H' is diversity values, and S is the total individuals observed. The value from the calculation based on the formula matched with the value at the index explained below. 0 < E < 0.4 is categorized as small evenness or depressed community. 0.4 < E < 0.6 is categorized as moderate evenness, unstable community. 0.6 < E < 1.0 is categorized as high evenness or stable community.

3. Result

The results of this research are presented based on the total number of insect pests associated with coconut (*Cocos nucifera* L.) in Marga Sungsang Village, Banyuasin District (Table 1). The research showed 2,900 individual pest insects from 6 species and four orders. The insect pests species found in the research location are presented in Table 1.

Table 1. Number of insects found on coconut plants (*Cocos nucifera*) in Marga Sungsang Village, Banyuasin II District, Banyuasin Regency

No.	Order	Species	Types of Traps		
			Survey (Total Individual)	Yellow sticky trap (Total Individual)	Light traps (Total Individual)
1.	Hemiptera	<i>Aleurocanthus</i> sp.	1201	-	-
2.	Hemiptera	<i>Aleurodicus</i> sp.	820	-	-
3.	Orthoptera	<i>Trilophidia</i> sp.	15	-	-
4.	Orthoptera	<i>Phlaeoba infumata</i>	13	-	2
5.	Lepidoptera	<i>Pteroma</i> sp.	34	-	-
6.	Coleoptera	<i>Oryctes rhinoceros</i>	29	-	-

Insects that have the potential to become pests were obtained using survey methods, yellow sticky traps, and light traps on coconut plants (*Cocos nucifera* L.) in Table 1. The most significant number of insect species obtained using the survey method was 2088 individuals; 2 individual insects were obtained using the light trap, and no individual insects were obtained using the yellow sticky trap. The insect species with the highest population are *Aleurocanthus* sp. and *Aleurodicus* sp.

An insect found on coconut plantations was *Aleurocanthus* sp., with 1,201 individuals due to abundant hosts and food. Based on the calculation results obtained from this research, which are shown in Table 2, Marga Sungsang Village, Banyuasin 2 District, Banyuasin Regency, has a diversity of insect pest types in the coconut plantation area of 0.884, so it can be interpreted that the level of diversity of insect pests in the area is classified as low category because it is



followed by the presence of dominant pest species and the number of pest insects in each type is very different. The distribution of individuals within a species is relatively different so that one type is dominant over another. A community with high species diversity comprises many species with the same or almost the same abundance [5].





Table 2. Shannon-Weiner Diversity Index, Dominance Index, and Evenness Index of insects found in coconut plants (*Cocos nucifera*) in Marga Sungsang Village, Banyuasin II District, Banyuasin Regency

Time of observation (month)	Community characteristics	Hemiptera	Orthoptera	Lepidoptera	Coleoptera
Juli - September	Number of individuals	2.021	30	34	29
	Diversity (H')	0,84	0,57	0,78	0,64
	Dominance (D)	0,23	0,29	0,31	0,38
	Evenness (E)	0,28	0,24	0,27	0,29

The insects pest found on coconut plantations (*C. nucifera* L.) in Marga Sungsang Village, Banyuasin 2 District, Banyuasin Regency, consisting of 4 orders and six species (Table 3).

Table 3. Insects pest found on coconut plants (*Cocos nucifera*) in Marga Sungsang Village, Banyuasin II District, Banyuasin Regency

No.	Species	Morphology	Role
1.	<i>Aleurocanthus</i> sp.	 <p>The genus <i>Aleurocanthus</i> is most readily recognizable in the field because immature stages are dark brown to black with a fringe of short wax filaments [6].</p>	Pest
2.	<i>Aleurodicus</i> sp.	 <p>All stages of the pest secrete a copious amount of white, waxy, flocculent substance easily dispersed by wind and causing annoyance [7].</p>	Pest

No.	Species	Morphology	Role
3.	<i>Trilophidia</i> sp.	The coloration of the basal disc of the hind wing can be used to identify the <i>Trilophidia</i> sp. [8] taxonomically.	Pest
			
4.	<i>Phlaeoba infumata</i>	<i>Phlaeoba infumata</i> are similar to <i>Valanga nigricornis</i> [9]. <i>P. infumata</i> is small to medium-sized, with short ensiform antennae, a straight lateral carinae pronotum, and a dark brown body color [10].	Pest
			
5.	<i>Pteroma</i> sp.	The bagworm of <i>Pteroma</i> sp. (1–1.5 cm) hanging on thin thread [11].	Pest
			
6.	<i>Orytes rhinoceros</i>	The <i>O. rhinoceros</i> can be identified based on the horn. <i>Caput</i> of <i>O. rhinoceros</i> has one small protruding horn or horn. The wings of this species are glossy black or dark brown [12].	Pest
			

4. Discussion

Abiotic and biotic factors could influence the high and low number of insect species and diversity [13]. The exact needs in the same place can cause competition, both among species

and between different species [14]. So, the availability of food of suitable quality and sufficient quantity for an organism is critical because it affects insect populations [15].

In our observation, *Aleurocanthus* sp. preferred younger plants over older palms. The population of *Aleurocanthus* sp. was so large that infested young plants were stunted, and spindle leaves choked. Also, phoretic ant species are present in an *Aleurocanthus* sp. colony. Aphid infestation severely reduces the ability of palm trees to photosynthesize [16]. Whiteflies in the genus *Aleurodicus* sp. are found on coconut trees. *Aleurodicus* sp. is a tiny insect that causes damage to plants. *Aleurodicus* sp. consumes the sap from the leaves of coconut trees, which eventually weakens and restricts the tree's growth [17]. When whiteflies are present in significant enough quantities, their adults and nymphs can cause leaf fall and direct feeding on plant sap, but even severe infestations cannot destroy the plants [18]. In India, *Aleurocanthus* sp. and *Aleurodicus* sp. were detected as invasive insect pests [19].

This study found two grasshopper species: *Trilophidia* sp. and *Phlaeoba infimata*. The grasshopper has a biting-chewing mouthpart. Consequently, the symptoms of a locust infestation on a coconut are typically the same, appearing in the young sections of the leaves, and the midribs of the older leaves are consumed, leaving behind sticks that give the impression that the midribs of the leaves are withering [20]. The physical symptoms of *Pteroma* sp. attacks caused by bagworms are leaf damage due to larval bites (eating leaves) on the lower epidermis layer and mesophyll tissue; therefore, the remaining upper epidermis then dries out and leaves the dead leaves [21]. The *O. rhinoceros* beetle damages plants by boring through the base of the stem to the growing point, with symptoms of coconut plant damage caused by the V-shaped [22]. *O. rhinoceros* is a major pest of coconut palm in Indonesia [23].

5. Conclusion

Insect pests found in coconut smallholding plantations (*C. nucifera* L.) in Marga Sungsang Village, Banyuasin Regency are six species with 2.114 individuals consisting of orders namely Hemiptera, Orthoptera, Lepidoptera, and Coleoptera. There were six insect pests: *Auloracanthus* sp., *Aleurodicus* sp., *Trilophidia* sp., *Phlaeoba infumata*, *Pteroma* sp., and *Oryctes rhinoceros*.

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