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Inventory and Identification of Arthropods on Dates (*Phoenix dactylifera* L.)

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ABSTRACT

Dates (*Phoenix dactylifera* L.) belong to the Arecaceae family of palms. Banjarbaru is one of the areas that started planting date palms in South Kalimantan. The community's knowledge of date pests still lacks. Therefore it becomes a problem for farmers. Before proper control is carried out, it is necessary to understand the types of pests first. Arthropod data on date palms at the Plantation and Livestock Service Office of South Kalimantan Province are not available. Hence, it is necessary to conduct inventory research and arthropod identification. This study aimed to determine the types of arthropods in date palms (*P. dactylifera* L.) in Banjarbaru. The method used was a survey method with purposive sampling carried out by collecting arthropods using swing nets, yellow sticky traps, and directly observation from four different locations. The field observations at four locations found 43 types of arthropods totaling 98 individuals. Twenty arthropods act as pests, 13 individuals as pollinators, and 10 individuals as predators. The arthropods were classified into ten orders and 27 families, with the largest number of individuals coming from the Lepidoptera order.

Keywords: arthropods, Arecaceae, dates, identification, inventory.

1. Introduction

Indonesian people assume that dates can only grow in the desert, but this opinion is refuted over time because farmers in Thailand have succeeded in cultivating dates in tropical climates (Ridlo, 2019). Large-scale date palms in Indonesia have been successfully developed in Pasuruan, East Java, Riau, and Nanggroe Aceh Darussalam (Arifah, 2019). South Kalimantan has also started planting date palm nurseries such as in Batola, Trantang area with an area of 2 ha and in Km 10 trantang 5 ha (Annisa et al., 2020). The Banjarbaru community, especially in the Kelapa Sawit housing Complex, started to plant date palms in their yard on a small scale, some are still saplings, and some are 1, 2, and 3 years old. Large-scale gardens are found in "Himmah Borneo," a cultivation and plantation business, mainly dates, located in Guntung Manggis, Landasan Ulin District, Banjarbaru City, South Kalimantan.

One of the obstacles in date palm cultivation is low production and quality due to biotic, abiotic factors, and unqualified seeds. Biotic factors, such as attacks from insects, mites, birds, and diseases, cause considerable damage to date palms' vegetative and generative stages. Many arthropod species are known as date palm pests (Phoenix dactylifera L.) worldwide (Haldhar at al., 2017). According to Carpenter (1975) in El-Shafie (2012), there is an increase in date palm pests from 54 species of mites and insect in 1978 to 112 species in 2012 (El-Shafie, 2012).

The field survey showed that the lack of knowledge in Banjarbaru about the pests on date palms caused the impede growth and development in dates. Knowledge of the types of pests that attack date palms is necessary before controlling them. Arthropod data on date palms at the Plantation and

Livestock Service Office of South Kalimantan Province are not available. It becomes the background for the researchers to conduct a study on the inventory and identification of arthropods in date palms.

2. Materials and Methods

The method used in this study was a purposive sampling survey by collecting arthropod specimens from four locations. The first location was in the Kelapa Sawit housing complex, Jl. Kelapa Sawit 4, RT 01, No. 59 (-3°27'36'',114°51'2'',96,0 m,27°). The second location was at Jl. Bumi Berkat 1, RT 02, RW 01, No. 17 (-3°27'41'',114o51'4'',93,0 m,69°). The third location was at Jl. Unlam 1, RT 04, RW 02, No. 02, Kelurahan Guntung Pangel, Banjarbaru Selatan, Kota Banjarbaru (-3°26'36'',114°50'18'',76,0 m,131°). The fourth was located at Himmah Borneo, Guntung Manggis, Landasan Ulin District, Banjarbaru City, South Kalimantan (-3°28'0'',114°46'52'',58,0 m,314°). Identification was carried out at the Entomology Laboratory, Department of Pests and Plant Diseases, Faculty of Agriculture, University of Lambung Mangkurat, Banjarbaru. This research was conducted from February to March 2020. The collection of arthropod specimens for observations 1 and 2 was carried out at 07.00-09.00 in the morning. The third and fourth observations were carried out at 15.00-18.00 in the afternoon. Observations were conducted four times with an observation time interval of one week.

Research implementation

Selection of research locations

The research location was based on field observations. The location determination was based on the availability of date palm used as samples. Prior to the research, interviews were conducted with date palm owners to find out cultivation techniques, pest control techniques, the application of pesticides, and maintenance.

Producing yellow sticky traps

Yellow sticky traps were made from used plastic bottles of mineral water (600 ml) yellow painted in colour. The bottle was wrapped in clear plastic, then greased evenly. The plastic was replaced at each observation.

Collection of arthropod specimens

There were three stages of collecting arthropod specimens, namely:

1. Direct collection of arthropods
   The direct collection was carried out to determine which arthropods that attack date palms during the vegetative period. Plants that show signs of an attack were taken and put in clear plastic. If arthropods were found during the observation, they would be collected and stored in a collection container.
2. Insect swing net
   Swing nets collection was carried out with two double swings on all vegetative date palms.
3. Yellow sticky trap
   Yellow sticky traps were placed around the plant canopy at 09.00 am and left for 24 hours. Then the traps were observed.

Observation

Types of arthropods

Large arthropods that were caught were collected dry and then put into a collection box and labeled. Meanwhile, small arthropods were collected in bottles containing 70% alcohol.

Arthropod abundance

The captured arthropods were separated and counted based on the type and the finding location.

Identification

The arthropods identification was carried out using a microscope. Identification was carried out at the family level using the book title Key to Insect Determination by Ed. Christina LS translated by

Subyanto and Achmad, corrected by Siwi, Kanisius Publisher (1991), the book title Introduction to Insect Lessons by Borror, DJ, Triphlehorn, CA & Johnson, NF 1992, and the book title Helpful Insects, Spiders, and Pathogens by Shepard, BM, Barrion AT, and Litsinger JA 1987.

Data analysis

Data were analyzed descriptively and tabulated.

3. Results and Discussion

Field observations at four locations found 43 arthropod species totaling 98 individuals (Table 1). The highest number of arthropods was found at location IV (42 individuals) and the lowest at location III (12 individuals). The arthropods were classified into 10 orders and 27 families, with the largest number of individuals were from the Lepidoptera order.

Table 1. The number of arthropods on date palm from 4 research locations Banjarbaru city

No		Order	Family	Name	Number of individuals at 4 locations				∑
					1	2	3	4	
1		Orthoptera	Acrididae	*Green grasshopper* (*Valanga nigricornis*)	1	1	0	0	2
2				Javanese grasshopper (*Valanga nigricornis*)	0	0	0	1	1
3				*Phlaeoba* sp.	0	0	0	2	2
4			Pyrgomorphidae	Tobacco grasshopper (*Atractomorpha crenulata*)	1	0	1	3	5
5		Coleoptera	*Curculionidae*	*Naupactus minor* Buchanan	1	0	0	1	2
6				yellow weevil	0	0	0	1	1
7			Chrysomeloidea	*Aulocophora similis* oliver	0	0	1	0	1
8			Coccinellidae	Transverse ladybird (*Coccinella transversalis*)	0	0	0	1	1
9		Lepidoptera	Nymphalidae	*Hypolimnas misippus* with white spot	2	0	0	1	3
10				Tawny coster butterfly (*Acraea terpsicore*)	0	0	0	2	2
11				Blue pansy butterfly (*Junonia orithya*)	0	0	0	1	1
12				*Hypolimnas bolina*	0	0	0	1	1
13				*Hypolimnas misippus* orange	0	0	0	1	1
14				Common sailor butterfly (*Neptis hylas*)	0	0	0	1	1
15			Papilionidae	Lime butterfly (*Papilio demoleus*)	2	0	0	0	2
16			Hesperiidae	Moth with the black spot	0	0	1	0	1
17				Moth with white spot	0	1	0	0	1
18			Pieridae	White and yellow butterfly	0	0	0	1	1
19				*Appias libythea*	0	0	0	1	1
20				Kupu-kupu Psyche (*Leptosia nina*)	0	0	0	1	1
21				Three-spot grass yellow (*Eurema blanda*)	0	0	0	1	1
22			Limanthriidae	Larvae of *Dasychira inclusa*	0	0	2	0	2
23			Erebidae	Wasp moth (*Amata huebneri*)	0	0	0	2	2
24			Satyridae	Larvae and pupae of *Melanitis leda* ismene cramer butterfly	5	6	0	3	14
25		Hemiptera	Pentatomidae	Southern green stink bug (*Nezara viridula*)	0	1	0	0	1
26				Kepik-kepik berbau busuk	0	1	0	0	1
27			Alydidae	Rice bug (*Leptocorisa acuta* Thunberg)	0	0	0	1	1
28			Nabidae	Kepik perawan bangsawan	0	0	0	1	1
29			Aradidae	Kepik flat/Kepik-kepik gepeng	1	0	0	0	1
30			Miridae	Kepik-kepik daun/tumbuhan	0	0	0	1	1
31		Homoptera	Pseudococcidae	Mealybug (*Nipaecoccus nipae*)	5	1	6	3	15
32			Aphididae	Aphid (*Toxoptera auranti*)	2	0	0	0	2
33		Hymenoptera	Eumenidae	***Apodynerus troglodytes***	0	0	0	1	1
34			Vespidae	Paper wasp (*Ropalidia* spp.)	0	0	0	1	1
35			Pompilidae	Spider wasp	3	0	0	0	3
36			Formecidae	Ants (*Oecophylla smaragdina*)	0	0	0	1	1
37				Ants	1	1	0	1	3
38		Ordonata	Libellulidae	*Orthetrum Sabina*	0	0	1	6	7
39				Dragonfly (*Diplacodes bipunctata*)	0	0	0	1	1
40		Diptera	Culicidae	Mosquito	3	0	0	0	3
41	Arachnia	Pseudoscorpiones	-	Pseudoscorpion	1	2	0	0	2
42		Araneae	Salticidae	Jumping spider (*Phidippus* sp.)	1	0	0	0	1
43			Oxyopidae	Lynx spider (*Oxyopes javanus*)	0	1	0	0	1
		∑ Ordee = 10	∑ Family = 27	Number of individuals	29	15	12	42	
				Total number			98		98

The number of arthropods at each location were 14, 9, 6, 28 species and 14, 8, 6, 17 families, respectively. The highest number was found in location IV, namely 28 types of individuals and 17 families, while the lowest number was at location III, namely six types of individuals and six families (Figure 1).

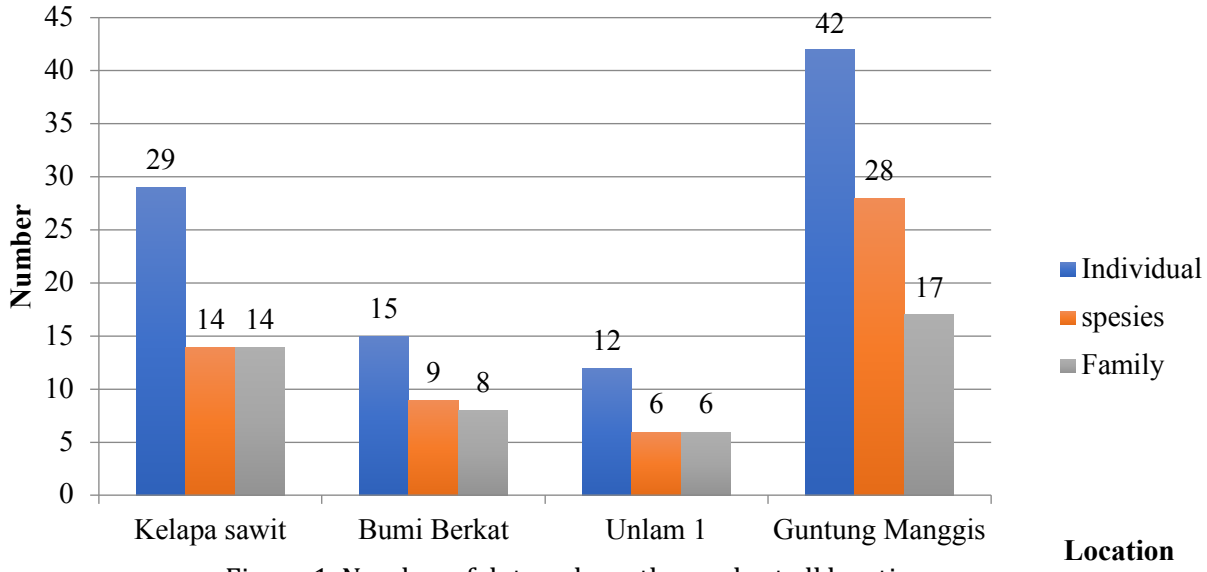

Figure 1. Number of date palm arthropods at all locations.

Mealybug with oval and flattened bodies thought to belong to the family Pseudococcidae was found in all locations (Figure 2). According to Espinosa (2009), Nipaecoccus nipae Maskell can economically damage the palm trees and tropical fruit plants. The Pseudococcidae family is a plant pest, characterized by a waxy body shaped like flour and short fibers around its body, secreted for self-protection (Lilies, 1991).

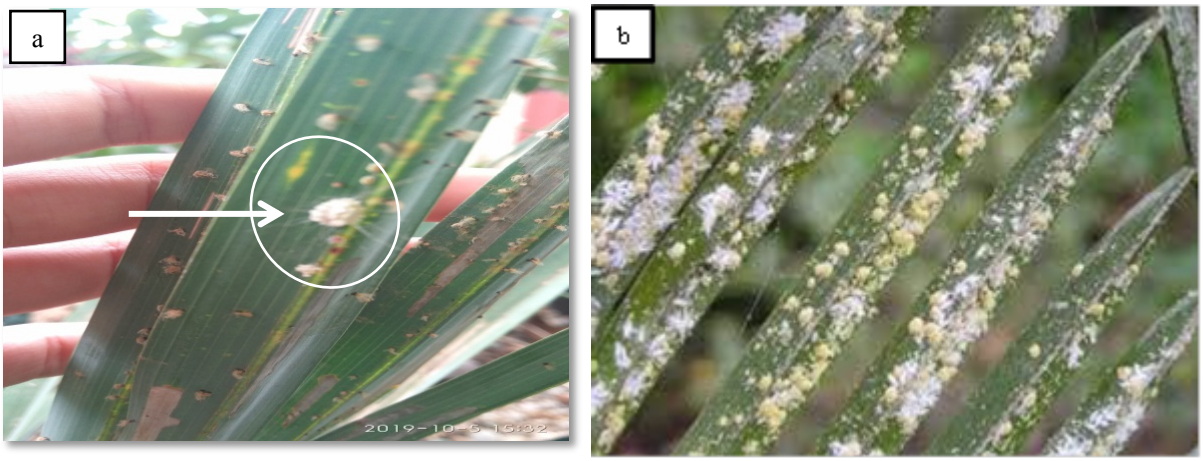

Figure 2. (a) Nipaecoccus nipae in the field, (b) from literature (Source: (a) Personal documentation, 2020), b)http://entnemdept.ufl.edu/creatures/orn/mealybug/coconut_mealybug.htm.

According to Nelson and Mike (2009), the results of mealybugs' activity on dates cause the leaves to become stunted. The sweet dung causes ants to come frequently and a place for sooty fungi to grow. Mealybugs also attack various other types of plants such as oranges, coffee, Leucaena, guava, *Ceiba pentandra*, *Erythrina variegata*, ornamental plants, and rambutan. The spread can be through the medium of wind, rain, and animals (Lilies, 1991).

In each location, there were ornamental plants. Ornamental plants are one of the host plants for mealybugs. In location IV, ornamental plants were planted on the edge of the date palm field, allowing for the spread to date palms. There were large and old rambutan trees at the location I, so it is most likely habitat for mealybugs to breed. Researcher in India found that the most dominant and economically important pests on dates are the types of scales lice (*Parlatoria blanchardii* and *Phenicococcus marlatt*), mealybugs (*Dysmicoccus brevipes*), moths (Coconut caterpillar *Batrachedra amydraula*), and termites (*Psammotermes hypostoma*) (Blumberg, 2008; Chauhan et al., 2015; Haldhar at al., 2015; Haldhar et al., 2017; Rathore & Goyal, 2016; Samadia, 2016). Based on this study and research in India, the mealybug was one of the arthropods in date palms.

The highest number of arthropods was found at location IV, namely 42 individuals. At location IV, the date palm polybags were placed too close. It provided an advantage for insect pests By facilitating their spread. The crowded space will facilitate the transfer of pests from one plant to another. Optimal spacing must be implemented to create a micro-habitat around the plants that is not beneficial for pest to reproduce and live reproduction and life (Fauzi, 2019). This solution is expected to reduce the development of pests.

The development of insects in nature is influenced by two factors, namely internal factors, and external factors. The interaction of these factors affects the level of the population of an insect at a specific time. Internal factors include reproductive ability, self-defense traits, life cycle, imago age, and sex ratio. The external factors include biological and soil factors, host plants, and climate, including temperature, humidity, and rainfall (Jumar, 2000).

Insect specimens were collected in 3 ways: direct colletion, insect swing nets, and yellow sticky traps (Figure 3). The highest number of individuals was found by direct collection (45 individuals) followed by insect swing nets (41 individuals) and yellow sticky traps (12 individuals).

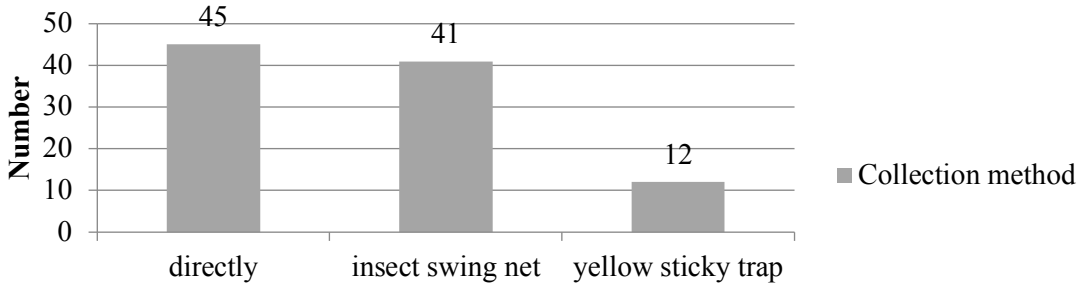

Figure 3. Number of arthropods based on collection technique.

From arthropod identification there was found 20 pests, 13 predators, and 10 pollinators (Figure 4). There were fewer insects that act as predators than those of pests.

In this study, several egg groups were also found, as shown in Figure 5. Most eggs had a round, oval, or elongated shape, like a barrel, and some were disc-shaped. Eggs were enclosed in a shell that varies in thickness, sculpted surface, and color. Many eggs have distinctive ridges, spikes, or other projections, and some have a bright color (Borror et al., 1992).

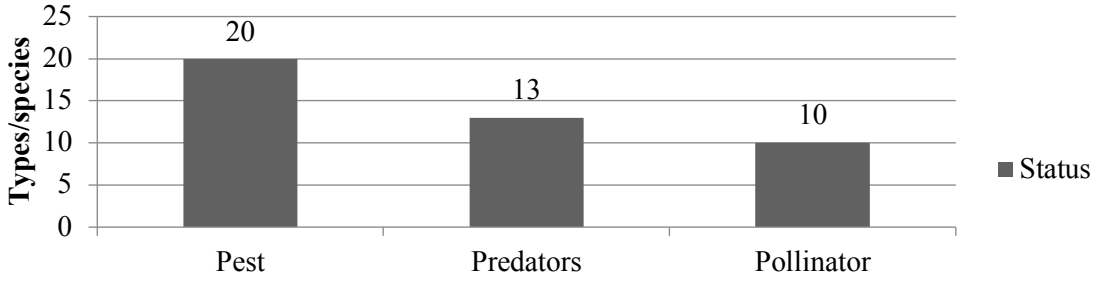

Figure 4. Types of arthropods based on their role in the ecosystem.

The egg group in Figure 5a is considered to be eggs from the Hemiptera order with two rows of eggs lined up in the leaf blade's direction and had a blackish-brown color. According to Feriadi (2015), a group of eggs from the order Hemiptera with the family Coreidae, namely Walang Sangit (*Leptocorisa oratorius*), have a dark-brown color, are oval and flat, placed one by one in 1-2 rows totaling 12-16 eggs. The egg-laying period's length is 57 days, with a total egg production of ± 200 eggs with an egg stage of 7 days.

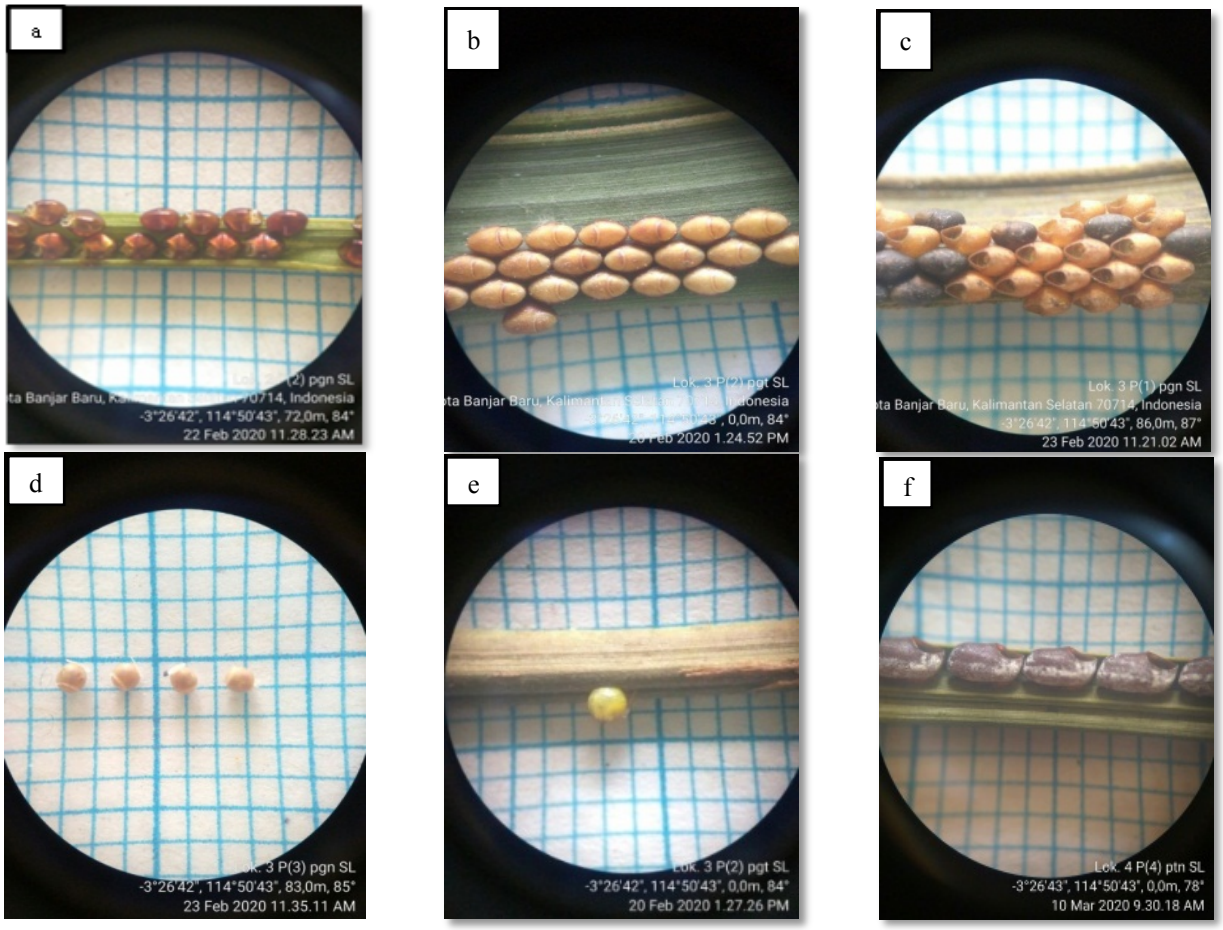

Figure 5. Eggs obtained: (a) Hemiptera, (b) Hemiptera, (c) Hemiptera, (d) Hemiptera, (e) Lepidoptera, (f) Hemiptera.

Figure 5b presents a group of pale-yellow eggs with an arrangement of three lined up in the direction of the leaf blade. In Figure 5c, the egg group is golden-yellow, and some of the eggs are black with three to five lined up in the same direction as the leaf blade. Pitojo (2004) states that eggs that are attacked by parasites change color to black, eggs that will hatch turn brick-red, and sterile (hollow) eggs do not change color. Both (Figures 5b and 5c) have the same shape, oval and flat. This group of eggs is considered to have originated from the Hemiptera order as supported by Feriadi's (2015) opinion that eggs from the Hemiptera order are oval and flat and have neat egg arrangements.

The egg package in Figure 5d is considered to have originated from ladybugs, the Hemiptera order characterized by white eggs. White eggs with a hood indicate that parasites have not attacked the eggs. Eggs attacked by parasites turn to grayish color with irregular egg holes. Parasites generally come from the order of Hymenoptera, the Scelionidae family, the *Telenomos cyrus* (Nixon) species, the wasp species (Shepardet al., 1987).

The eggs in Figure 5e are regarded to be from Lepidoptera order because there is one egg with a greenish-yellow round shape. From a comparison of literature images of Murtadha's (2015) statement, the eggs of the Eastern Tiger Swallowtail butterfly, order Lepidoptera, are shaped like small green pearls. The egg width reaches 1.2 mm, making it one of the largest eggs of the butterfly species.

The eggs in Figure 5f are considered from the Hemiptera order, which has a barrel-like shape and is flat and black and gray, one lined up in the leaf blade's direction. Following Haviland's (2014) statement, a group of eggs from the Hemiptera order, the Coreidae family, namely leaf-footed bugs, are placed from end to end in one strand like a rope stretches along the midrib of a stem or leaf.

It can be concluded that the whole egg group is thought to be from the Hemiptera order except for Figure 5e, which is visually different because it may come from different species. The color of the eggs obtained varied. It may be due to the different maturity levels of the eggs. Based on the laying method, the eggs were laid in a row, but their number was different. It was different from Lepidoptera eggs found in the field. It was not in groups but only one (single).

Melanitis Leda Ismene Cramer butterfly larvae have two pairs of horns, one pair at the tip of the head and one pair at the end of the abdomen (Figure 6). Larvae and pupae were green and were often found above the leaf surface. Leaves that have larvae have been partially torn. The tear seemed deliberately cut, found at locations I, II, and IV. Shepard et al. (1987) suggested that these larvae move like an inchworm, which arches their back when moving. BPTP (2012) suggests that these larvae act as pests that attack in the tillering phase until panicle formation against their host, such as rice. Larvae eat leaves starting from the edge and tip of the leaf.

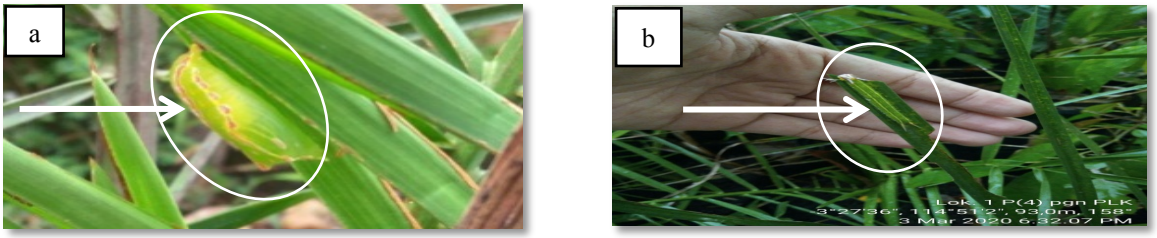

Figure 6. (a) Pupa and (b) larvae of the Melanitis Leda Ismene Cramer butterfly.

At locations I, III, and IV, cocoons from the order Lepidoptera, the family of Nymphalidae, the black and white Towny coster butterfly (*Acraea terpsicore*) were found, their shapes had been cut off because their pupa had come out (Figure 7). According to Gideon et al. (2016), Tawny coster has a white cocoon with thick black lines, red and orange spots.

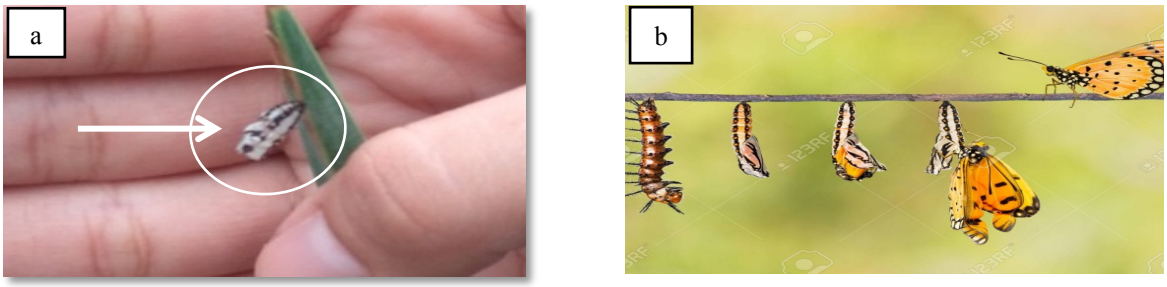

Figure 7. (a) Cocoon and (b) metamorphosis of the tawny coster butterfly (*Acraea terpsicore*) (Source: (a) Personal documentation, 2020), (b) Gideon et al., (2016).

At locations III and IV, eggs were found in an oval shape, white and black, small stalks like hair strands, and the stalks' ends are usually attached to the wood, leaves, or other flat surfaces (Figure 8). These eggs are considered to be from the order Neuroptera. Referring to Lilies' (1991) statement, eggs from the wing nets, family Chrysopidae, order Neuroptera are white or greenish and are laid with smooth stalks on the leaf surface the end of the stalk where the eggs are laid. According to Supeno (2007), the eggs of net flies (Neuroptera: Chrysopidae) are greenish-yellow and have thread-like stalks. The eggs that are parasitized are brown, purple, gray, yellow, and black.

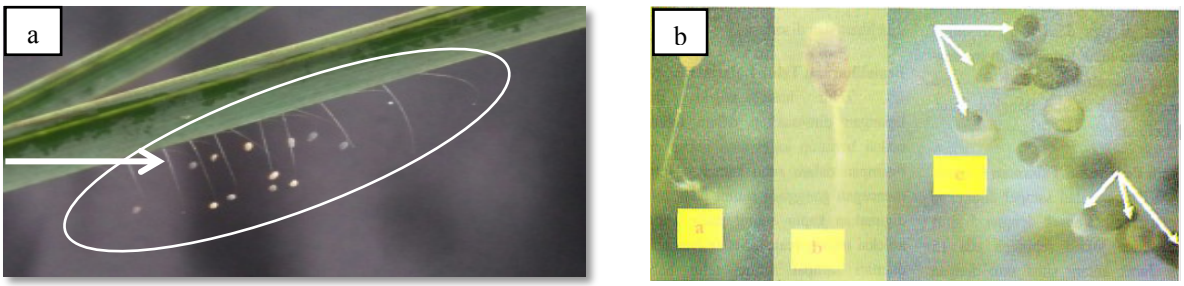

Figure 8. Eggs from the family of Chrysopidae, order Neuroptera (Source: (a) Personal documentation, 2020) (b) Supeno (2007).

At location IV, a wasp nest was found, which is considered to be from the order Hymenoptera, the family Vespidae. This species is often found under the surface of date palm leaves, has a brownish-orange body with yellow and black lines. The nest is grayish, looks like a beehive but smaller (Figure 9). According to Tan et al. (2014), 22 species of paper wasp, genus Ropalidia Guérin-Méneville, 1831, were registered from China, with different characteristics and colors. According to Borror *et al*. (1992), vespid

builds nests using fiber from dead plants, consisting of wood or chewed leaves, then mix with saliva and use the mixture. The nest material has a paper-like structure. This wasp has a role as a natural predator.

Sudarmo (1988) states that one of the host plants of *Valanga nigricornis* is the mango tree. Nymphs and grasshoppers act as pests (Noor et al., 2015). It is supported by Anonymous (2017) that V. nigricornis is a pest that most often appears to eat date palm leaves. At locations I and II, mangoes were found, so there is a possibility that *V. nigricornis* ate the date palm leaves. Observations in the field found leaves with holes in them. According to Shepard et al. (1987), grasshoppers from the species *Euscyrtus concinnus,* family Gryllidae, order Orthoptera also have the status of leaf pests. *E. concinnus* is unique in its eating method, which only eats the middle of the leaf so that it is hollow. However, the leaf edges remain intact (Figure 10). These two species have similar feeding behavior, which are different from other insects.

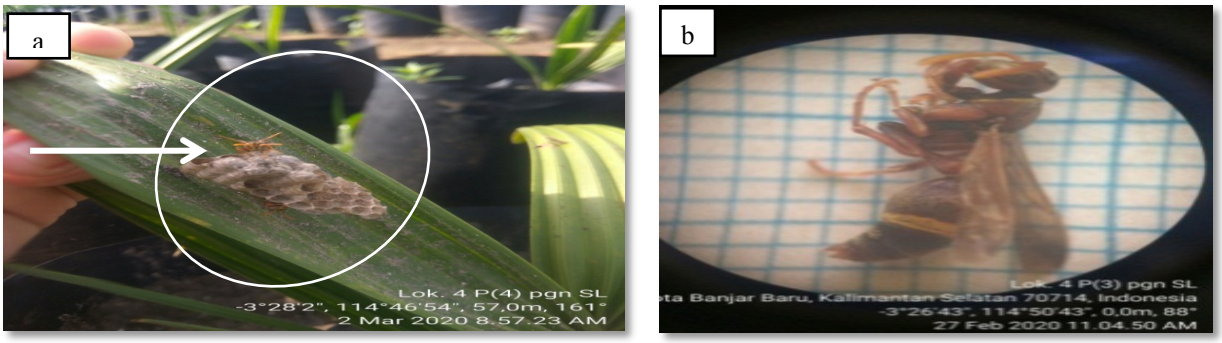

Figure 9. (a) Nest and (b) Paper wasp (*Ropalidia fasciata*).

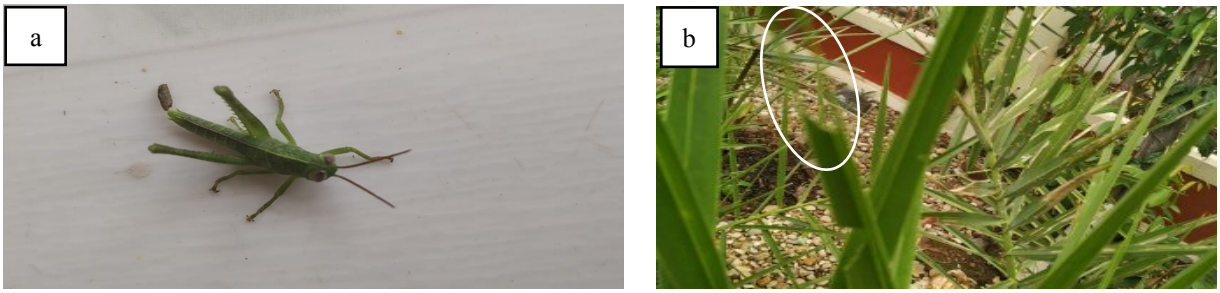

Figure 10. (a) *Valanga nigricornis* found at the observation location, (b) Symptoms of *V. nigricornis* attack on date palm leaves.

4. Conclusions

Based on field observations at four locations, there were 43 species of arthropods totaling 98 individuals. Twenty arthropods act as pests, 13 individuals as pollinators, and ten individuals as predators. The arthropods were classified into ten orders and 27 families, with the largest number of individuals coming from the Lepidoptera order.

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