Diversity of Insects in Tundung Musuh Conservation Area, Tasikmadu Village, Palang District, Tuban Regency

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Abstract

Mangrove forest is a typical ecosystem in the coastal areas which is influenced by the tides of sea water. And its existence become a habitat for various types of insects. The diversity of insects is influenced by several factors, one of them is the habitat where the insect are located. The Tundung Musuh area is one of the places for preserving mangrove forests in Tasikmadu as a habitat for several types of insects and existence of insect diversity in this area has not been widely studied. The aim of this research was do identify the diversity of insects in the Tundung Musuh Conservation Area at Tasikmadu Palang Tuban and used descriptive approach, with observation as the main data collection technique. The data showed that there were seven types of insect diversity, such as : *Oncopeltus fasciatus* family Lygaedae, *Coccinella transversalis* family Coccinellidae, *Apis cerana* family Apidae, *Valanga nigricornis* family Acrididae, *Apias nero* family Pieridiidae, *Sanurus indecora* family Flatidae, and *Plantala flavescens* family Libelludidae. Based on the data analysis, it can be seen that the value of insect diversity was 1.66 which means medium, the uniformity value was 0.31, which means low and the dominance value was 0.3332 which means low. Based on this, it can be concluded that Tundung Musuh isquit stable, which means that the Conservation Area is quite stable, which means that there is no striking dominance of certain species and is good enough for the growth of Insects.

***Keywords**:* mangrove conservationt, insects diversity, tundung musuh coast, insect habitat

1. Introduction

Insect comes from the Greek language, namely in which means "in" and sect which means "piece", so Insect can be interpreted as a body piece or segmentation (Agesti, 2018). Insects are animals with a characteristic number of six legs (hexapods) (Purwantiningsih et al. 2012). Insects are one of the biological components of the mangrove ecosystem (Farihah 2016). The mangrove forest ecosystem is a system consisting of organisms (vegetation, animals, and microorganisms) that interact with their environmental systems in a mangrove forest habitat (Lose et al.). At the same time, mangroves are receiving greater recognition for their role in food protection, coastal protection (e.g., from major storms), biodiversity reserves (Malik et al. 2015). Insect diversity is an important factor in balancing environmental conditions (Yi et al. 2012). Insects are also a component of biodiversity which have an important role in the food chain as carnivores, herbivores and detriors (Semiun et al. 2020). Insects are very important because of their diversity, their ecological and agricultural roles, human health and also their natural resources (Premalatha et al. 2011). Insects are also part of

the biodiversity of the agroecosystem and play an important role in maintaining soil structure and fertility, decomposing organic matter, spreading seeds, controlling plant moisture and soil pests (Provost & Pedneault 2016). Efficient metabolism of Insects, enabling them to convert the organic waste they eat into high quality protein, which in turn can be used as feed (Vantomme et al. 2014). Predatory Insects are a very important group of natural enemies of pests, and their community structure and composition have a major influence on the effectiveness of biological control (Griffin et al. 2013) (Rusch et al. 2015).

Some types of Insects use many plants as part of their life cycle (e.g for food, breeding, or protection) (Kallio 2014). Insects can roost on plants, in the soil, in haystacks, in water, in rice storage, even in manure (Nani et al. 2019)(Nani et al. 2019). Insects can live in different environmental conditions, have a fast reproductive process, exhibit high growth rates, high feed conversion rates and they have a low ecological footprint for their entire life cycle (Van Huis 2013). A large number of Insects undergo long-distance air migration to escape deteriorating habitats and seek a more suitable environment, using the Kennedy / Dingle definition of migration, this movement is defined as continuous, straight movement, undisturbed by reverse cues (Dingle 2014). Many Insects use the Kennedy/Dingle definition of migration to escape from degraded habitats and undertake air migrations in search of a better environment (Oktavia, 2018). At a certain temperature, the life activity of Insects is high (optimum), while at certain temperatures the activity of Insects is low (minimum), basically, Insects are active at temperatures above 15° C, but there are some species that can still live actively above the freezing point of water (Waskita, 2018). Insect survival in an ecosystem is determined by physical environmental factors as well as interacting insect factors, different types of insects, so the organism's ability to survive in accordance with environmental conditions is different (Hamama & Sasmita 2017). Within the range of these zones, the Insects have the optimum temperature, the small size of the Insects Within the range of these zones, Insects have the optimum temperature, the Insects are small in size and do not carry out special migrations which can present other challenges (Chapman et al. 2015). The bound Insect does not support its own body mass and this can cause unnatural flight behavior and inaccurate reflection due to natural flight performance (Snelling et al. 2012).

Insect and biomass abundance has decreased dramatically in recent decades over large areas of forest and land (Wesche et al. 2012) (Jokela et al. 2018). The abundance of Insect biodiversity is an important aspect (Lyashevska & Farnsworth 2012). The presence of Insects is often correlated with the abundance, diversity and quantity of vegetation (Soliveres et al. 2016). Although much research has been conducted in northern forests, it is generally recognized that insects are affected by management-related changes in forest structure (Jokela et al. 2018). Lack of habitat and resources can reduce valuable biological control services and increase the likelihood of pest outbreaks (Meehan et al. 2011). The condition of higher insect diversity is found in heterogeneous forests when compared to the lower level of homogeneous forest diversity (Sari 2015). The difference in the diversity of Insects is caused by differences in climate, season, altitude and type of food (Mutiara & Putri 2020).

Like the abundance that occurs in the enemy's Tundung area, the abundance of biodiversity includes mangroves, Insects, and various kinds of other animals and plants. The Tundung Musuh area is one of the places for the preservation of mangrove forests

in Tasikmadu as a habitat for several types of Insects and the existence of Insect diversity in this area has not been studied much and information on this enemy tundung is not yet available even though the tundung musuh is a conservation area. So it is necessary to do research with the aim of identifying the diversity of Insects in the Tundung Musuh Conservation Area, Tasikmadu Village, Palang District, Tuban Regency. So that it can provide an overview of the types of Insects.

2. Research Method

Descriptive method is a method used in this research, which is a research method by describing the conditions collected at a certain time in the field with the aim of obtaining information directly (Kurniawan, 2019), the description referred to in this study is the diversity of Insects found in the Tundung Enemy Area in the hope of obtaining useful information for Insect conservation. This research was conducted during January 2021 in the Tundung Musuh conservation area located in Tasikmadu Village, Palang District, Tuban Regency with coordinate points. $6^{o}35'45"S$ $112^{o}06'29"E$ can be seen in Fig 1.

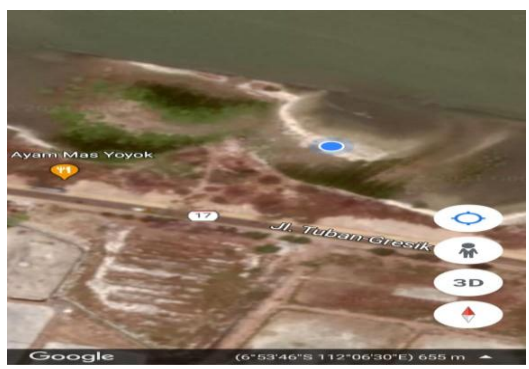


Figure 1. Research locations in the Tundung Musuh Conservation Area
Source: Personal Documents

The tools used in this study include: 1) writing instruments, 2) handbooks of various kinds of Insects, 3) camera. Then the objects in this study are various types of insects found in the Tudung Enemy Conservation Area.

2.1 Data Collection Technique

Data collection techniques used in this study were observation and documentation techniques (Dzulfikar & Sari 2019), namely through direct Insect observations carried out in the Tundung Musuh Conservation Area located in the village of Tasikmadu. The data obtained after making observations (direct observation) is finding various types of Insects, counting the number of Insects found and identifying the Insects in Tundung Musuh. The data that has been found is subsequently photographed and documented as evidence of the discovery of Insect species. This data collection is used to determine the number of Insect species as well as their diversity as seen based on the Diversity Index,

Uniformity Index, and Dominance Index which are analyzed as follows:

2.2 Diversity Index Data Analysis

A high diversity value indicates a stable environment, while a low diversity value indicates an unstable and changing environment (Puspitasari, 2017). The diversity index shows the relationship between the number of individuals that make up a community and the number of species the diversity of Insect species in the Tundung Musuh Conservation Area, Tasikmadu Village, Tuban Regency This can be determined using the Shannon-Wienner Species Diversity Index formula (Ariani et al. 2016) as follows:

$$H' = -\sum_{i=1}^{S} \left(\frac{Ni}{N}\right) \ln \left(\frac{Ni}{N}\right) \qquad (1)$$

Information :
H '= Shannon-Wienner diversity index.
Ni = Number of individuals of one kind.
N = total number.
Based on the species diversity index according to Shannon-Wienner is defined as follows:
a. The value of H '> 3 indicates that diversity is high.
b. The value of H '1 ≤ H' ≥ 3 indicates that diversity is moderate.
c. The value of H '<1 indicates that the diversity is little or low

2.3 Analysis of Uniformity Index Data

To determine the uniformity of distribution using the number of individuals of each type, the uniformity index was used, namely by comparing the diversity index with its maximum value. The more uniform the distribution, the better the balance between populations and ecosystems between species. The uniformity index is determined based on the equation (Ludwig and Reynolds, 1988) (Kelautan et al. 2015) by using the following formula:

$$E = \frac{H'}{H'max} \quad \text{dimana } H'max = \ln S \qquad (2)$$

Information :
E: uniformity index
H ': diversity index
H'max: maximum diversity index
S: the number of types
The ranges for the uniformity index are as follows:
a. 0 <E ≤ 0.5: The ecosystem is under stress and uniformity is low
b. 0.5 <E ≤ 0.75: The ecosystem is in a less stable condition and moderate uniformity
c. 0.75 <E ≤ 1.0: The ecosystem is in a stable condition and high uniformity

2.4 Dominance Index Data Analysis

According to Odum in (Agustini et al. 2016) community condition status can be determined using the dominance index using the formula:

$$D = \sum_{i=1}^{S} \left[\frac{Ni}{N}\right]^2 \quad (3)$$

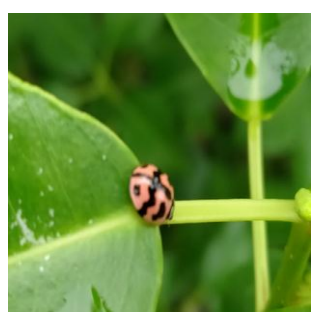
Information :
E: uniformity index
H ': diversity index
H'max: maximum diversity index
S: the number of types
Dominance index range in (Kelautan et al. 2015) as follows:
a. 0 <C ≤ 0.5: Low dominance (there are no species that dominate the other species), the environmental conditions are stable, and there is no ecological pressure on the biota in the location
b. 0.5 <C ≤ 0.75: Moderate dominance and fairly stable environmental conditions
c. 0.75 <C ≤ 1.0: High dominance (there are species that dominate other species), there is an ecological pressure and unstable environmental conditions.

3. Result and Discussion

3.1 Result

Based on the types of Insects found in the Tundung Musuh Conservation Area, it is presented in Fig 2 which consists of the following species: a). *Oncopeltus fasciatus,* b). *Coccinella transversalis.* c). *Apis cerana,* d). *Valanga nigricornis,* e). *Appias nero,* f). *Sanurus indecora,* f). *Plantala flavescens.* While the results of the analysis of Insect data that were found in the Tundung Musuh Conservation Area with a total number of 1,199 individuals consisting of 7 species from 7 families are presented in Table 1. And the results of the analysis of total species and diversity data based on the Diversity Index, Uniformity Index, and Dominance Index are presented in Tables 2, 3, and 4.


(a)


(b)


(c)


(d)


(e)


(f)

Fig 2**.** Types of Insects found in the Tundung Musuh Conservation Area
a). *Oncopeltus fasciatus,* b). *Coccinella transversalis.* c). *Apis cerana,* d). *Valanga nigricornis,* e). *Appias nero,* f). *Sanurus indecora*
Source: Personal Documents

Tabel 1. The results of the identification of Insect species found in the Tundung Musuh Conservation Area

No.	Famili	Spesies	Number of Species
1.	Lygaedae	*Oncopeltus fasciatus*	476
2.	Coccinellidae	*Coccinella transversalis*	341
3.	Apidae	*Apis cerana*	79
4.	Acrididae	*Valanga nigricornis*	124
5.	Pieridae	*Appias nero*	99
6.	Flatidae	*Sanurus indecora*	105
7.	Libellludidae	*Plantala flavescens*	75
Total number			1.199

Tabel 2. Data Analysis of the Insect Diversity Index in Tundung Musuh

No.	Famili	Spesies	Number Of Species	H’
1.	Lygadae	*Oncopeltus fasciatus*	476	0,36
2.	Coccinellidae	*Coccinella transversalis*	341	0,35
3.	Apidae	*Apis cerana*	79	0,16
4.	Acrididae	*Valanga nigricornis*	124	0,23
5.	Pieridae	*Appias nero*	99	0,20
6.	Flatidae	*Sanurus indecora*	105	0.20
7.	Libelludidae	*Plantala flavescens*	75	0,16
Total number			1.199	1,66

Tabel 3. Data of Analysis of the Uniformity Index of Insects in Tundung Musuh

No.	Famili	Spesies	Number of Species	E
1.	Lygaedae	*Oncopeltus fasciatus*	476	0,06
2.	Coccinellidae	*Coccinella transversalis*	341	0,06
3.	Apidae	*Apis cerana*	79	0,03
4.	Acrididae	*Valanga nigricornis*	124	0,05
5.	Pieridae	*Appias nero*	99	0,04
6.	Flatidae	*Sanurus indecora*	105	0.04

7.	Libelludidae	*Plantala flavescens*	75	0,03
		Total number	1.199	0,31

Tabel 4. Analysis of the Insect Dominance Index Data in Tundung Musuh

No.	Famili	Spesies	Number of Spesies	D
1.	Lygaedae	*Oncopeltus fasciatus*	476	0,1568
2.	Coccinellidae	*Coccinella transversalis*	341	0,0806
3.	Apidae	*Apis cerana*	79	0,0042
4.	Acrididae	*Valanga nigricornis*	124	0,0106
5.	Pieridae	*Appias nero*	99	0,0067
6.	Flatidae	*Sanurus indecora*	105	0,0705
7.	Libelludidae	*Plantala flaescens*	75	0,0038
		Total number	1.199	0,3332

3.2 Discussion

Based on Table 1 shows that the types of insects found in the conservation area of Tasikmadu Village, Palang District, Tuban Regency with a total of 1,199 species, namely 7 species from 7 families, namely Oncopeltus fasciatus family Lygaeidae, Coccinella transversalis family Aleyrodidae, Apis cerana family Pentatomidae, Valanga nigricornis family Coccinellidae, Appias nero, family Libelludidae, Sanurus indecora family Pieridae and Plantala flavescens family Acrididae. Chapman in Kubis (Kubis) reported that eggs of Oncopeltus fasciatus at 13 ° C hatched. Cocinella transversalis, which is one of the predatory beetles that has a characteristic reddish yellow elitra with a length of about 6 mm. On the elitra there are spots and thick black lines (Herlinda et al. 2009). Lygaedae is a pest that attacks plants by sucking the liquid on the pulp of the plant, both young and almost ripe, as a result of this pest attack, causing the plant pulp to become hollow or empty (Manueke et al. 2018). Most of the leaves on plants in the Tundung area have holes due to these pests. Pests of Coccinellidae damage plants such as causing shoots and leaves of plants to wrinkle and leaves to grow abnormally (Ira 2016) (Erin 2016). Apis cerana or Apis Indica is a honeybee native to Asia with a smaller body size (Injaya 2017). Valanga nigricornis This pest attacks the leaves on plants, usually in the form of uneven leaf edges due to its bite (Rahman et al. 2018). Appias nero, the orange albatross, is a butterfly belonging to the Pieridae family, namely yellow and white. This species lives from northern India to the Sunda Islands, the Philippines, Sulawesi and to the east (Evans 1932). Sanurus indicora is a nymph that attacks plants by piercing and sucking the shoots, stalks and flowers (Teloelas 2011). Libellulidae eggs or larvae are very susceptible to pH changes at a too high pH increase which can cause the death of insect larvae (Yuliani et al. 2017). The Tundung Enemy area is full of insects, one of the largest predators is Oncopeltus fasatus, as many as 476 individuals, this species in habits the most mangrove forests. Insect abundance is influenced by meteorological factors, food sources, and population density (Basna et al. 2017). In certain ecosystems, Insects can avoid the extreme conditions of an environment and Insects have the ability to adapt to their environment (Siregar et al. 2014).

Based on Table 2, it shows that the value of the insect diversity index in the

Tundung Musuh conservation area, Tasikmadu village, Palang sub-district, Tuban district is 1.66 which indicates that the insect diversity index there is moderate. This is because the environmental conditions have a variety of species that lead to good and it means that the environmental conditions in the enemy's Tundung conservation area are quite stable/balanced. According to the opinion of Shanon-Wienner diodum (1993) in Cahyono (Cahyono et al. 2018) which states that a group has a high level of species diversity if H 'reaches> 3.0.
As stated by Indriyanto (Arisandy & Triyanti 2020) If the community consists of many species, then the species diversity is high. Conversely, if a community consists of several species and only a few dominant species, the species diversity of the community is low. According to Krebs, 1989 in Manikome (Manikome 2019) that the diversity of species gives a picture of changes in the community in each type, these changes occur in a community due to competition for food (resources), as well as space and describe the distribution pattern of the individuals of its kind. This diversity is closely related to the pattern of insect activity in conditions of attachment to environmental factors. According to Kamal (Kamal et al. 2011) Menurut Kamal (Kamal et al. 2011) melaporkan bahwa yang dapat mempengaruhi kelimpahan dan keanekaragaman Insekta pada suatu tempat adalah komponen lingkungan (biotik dan abiotik), To assess the quality of a habitat can analyze the high abundance and diversity of individuals for each species. Aditama's opinion (Aditama & Kurniawan 2013) He revealed that abiotic factors or climatic elements as components of an ecosystem which include temperature, light intensity, humidity, are the influence of the existence of insects in nature.

Based on Table 3, it shows that the Insect in the Tundung Musuh conservation area of the village of Tasikmadu, Palang District, Tuban Regency shows a number of 0.31 which suggests that the uniformity of the Insect there is low / small. This is because the number of each insect species is different. Diversity index with low category indicates low insect uniformity, low ecosystem productivity, low ecosystem stability (Rasiska & Khairullah 2017). The high and low diversity can also be caused by habitat that is less supportive and stressful conditions for each species that occupy the location and vice versa if the uniformity is close to one, it can be said that the uniformity between species is evenly or the same. (Arisandy & Triyanti 2020) (Abdillah et al. 2019) (Nurjannah & Irawan 2013).

Based on Table 4, it shows that the insect in the Tundung Musuh conservation area of Tasikmadu village, Palang sub-district, Tuban Regency shows a number of 0.3332 which indicates that the dominance of insects is low, it can be interpreted that the ecosystem/community has a tendency to dominate certain species, this shows that there is no ecological pressure on the insect and the environmental conditions in the location are stable, so that the insect can grow and develop properly. In line with research reported by Sidik (Sidik et al. 2016) in the Susoh River-southwest Aceh which is classified as low dominance (C <0.36). According to Ridwan [56] Dominance is expressed as the balance of the number of individuals of each type and the richness of a community. According to Purwowidodo's statement (Purwowidodo 2015), that the dominance that does not stand out due to good habitat conditions at each station has the availability of sources of life such as food, host plants, shelter, and quite varied breeds. Based on this, it can be concluded that the Conservation Area is quite stable, which means that there is no significant dominance of certain species and is good enough for the growth of Insects.

4. Conclusion

Types of insects found in the conservation area of Tasikmadu Village, Palang District, Tuban Regency with a total of 1,199 species, namely 7 species from 7 families, namely *Oncopeltus fasciatus* famili Lygaeidae, *Coccinella transversalis* famili Aleyrodidae, *Apis cerana* famili Pentatomidae, *Valanga nigricornis* famili Coccinellidae, *Appias nero* famili Libelludidae, *Sanurus indecora* famili Pieridae dan *Plantala flavescens* famili Acrididae. Based on the data analysis, the value of Insect diversity is 1.66 which means moderate, the uniformity value is 0.31 which means low, and the dominance value is 0.3332 which means low. Based on this, it can be concluded that the Conservation Area is quite stable, which means that there is no striking dominance of certain species and is good enough for the growth of Insects.

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