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Identification of Arthropod Diversity in The Cemara Beach Mangrove Ecosystem

[1]Yulianti, [1]Munawir Sazali*
[1]Instansi IPA Biologi, FTK, Universias Islam Negeri Mataram, Indonesia

Korespondensi: sazali.bio@gmail.com

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ABSTRACT

Mangrove ecosystems play an important role in maintaining the balance of the coastal environment and become a habitat for various types of fauna, including arthropods. This study aims to identify the types of arthropods and determine the level of diversity in the mangrove ecosystem of Cemara Beach, West Lombok Regency. The method used is an exploratory survey method with sampling techniques using Hand Collecting and Sweep Netting in several mangrove vegetation zones. The presence of these arthropods suggests that the mangrove ecosystem in Cemara Beach still supports the life of various small organisms, although some environmental changes, such as deforestation and increased garbage are beginning to affect the presence of some species. Therefore, the results of this study can be the initial basis for sustainable mangrove conservation and management efforts, while affirming the importance of the role of arthropods in maintaining the balance of coastal ecosystems.

INTRODUCTION

Diversity is the variation and also variability of life on earth. According to Baderan (2016), diversity is a difference in characteristics between communities. Diversity in living things can occur due to differences in texture, color, size, number, and shape, which are biological characteristics to express the structure of their communities (Kristanto et al., 2008). Biodiversity is the diversity of living things that includes the whole or totality of genetic variations, species, and ecosystems in an area. Diversity encompasses living things as a whole, among which any type of flora or the world of plants, including plants of the tribe Piperaceae (Baderan et al., 2022).

Mangrove forests, on an ecological scale, are very important ecosystems, especially because of their carrying capacity for the stability of coastal ecosystems. The stability of mangrove ecosystems will have a very wide influence on the sustainability of coastal areas. Mangroves as forest ecosystems, have very distinctive properties and characteristics, growing on muddy beaches and river mouths(Konseptual & Karminarsih, 2007). Arthropods are the largest types of animals in forest and agricultural areas, and have an important role in an ecosystem. Soil arthropods play a role in the decomposition of soil organic matter for the provision of nutrients. Arthropods are invertebrate animals that have bodies and legs that are segmented or jointed, and Arthropods are divided into several classes, namely, Crustaceans, Arachnida, Myriapods, and Insecta (Arief, 2001; Basir Abdussamiul, 2017)

Arthropods are animals with segmented, segmented and segmented legs. The term Arthropod comes from the Greek language which consists of two words, namely arthro which means segment and podos which means legs. Arthropods are symmetrical tripoblastic and bilateral animals. The body of an arthropod consists of a head, chest, and abdomen that are entirely wrapped in chitin and an outer skeleton (exoskeleton). Generally, among the segments there are parts that do not have chitin so that these segments are easy to move. At certain times, the skin and body of Arthropods undergo skin changes (exdisis). Arthropods are the largest phylum of the animal kingdom (Sazali, 2017). The number of species in arthropods is more than all species of other phylum. Arthropods are the dominant animals in this world. Arthropods are the largest phylum so they are everywhere, be it in forests, lowlands or highlands. One of the classes of anthrophoda that is often encountered is the insects (insects) Arthropods can live in freshwater, land, sea, and air (Setiawan & Maulana, 2019)

Cemara Beach is a tourist attraction located in Cemara Hamlet, South Lembar Village, West Lombok Regency, is a leading tourist attraction visited by many domestic and foreign tourists. Visitors who visit the Cemara Beach tourist attraction can see the natural beauty, see the sunset, the ferry that passes from the port of Lembar to the Bai Bali, and can enjoy the culinary offered by the traders along the coast of Cemara Beach(Rispawati, 2018)

The community in Cemare Hamlet, South Lembar Ecotourism Area, West Lombok, West Nusa Tenggara actively participates in the management of the potential of the South Lembar ecotourism area by developing the mangrove area for a place of business as well as they maintain the mangrove, the use of the management they carry out is to protect the beach from all forms of coastal pollution, sell food and munuman and rent boats to go around the mangroves, This is a tradition that has been preserved from generation to generation, such as the obligation to maintain mangroves so that they thrive and clean beaches. The active participation of the Cemare Hamlet Community in all management activities of the South Lembar Ecotourism Area starting from the participation of time, thoughts, energy, money, skills to their possessions(Fitra, 2022)

Community participation in helping to develop Cemara Beach tourism which is considered less effective because it causes Cemara Beach not to develop immediately, currently there are tourism awareness groups (Pokdarwis) that can help manage Cemara Beach tourist attractions. Groups like these play a very important role in managing and advancing a tourist attraction in a sustainable manner. The role of the community with the awareness of Cemara Beach tourism is considered less because only a small part of the community helps manage the tourism. The concept of Community Base Tourism (CBT) is a concept of tourism development by prioritizing community participation and active role. The implementation of community-based tourism is considered to be able to provide various benefits for the community, namely improving welfare, protecting the environment, and protecting their social and cultural lives.(Sudarjah et al., 2021)

The lack of studies on arthropods in the Cemara Coast mangrove ecosystem has led to a lack of understanding of the community structure and ecological potential of this group. In fact, the existence and types of Arthropods can be used as indicators of environmental quality and the success of mangrove ecosystem rehabilitation. Therefore, an in-depth study focused on identifying and describing the diversity of Arthropods in the region is needed. (Saratoga et al, 2015)(Made et al., 2021).

This study aims to identify the types of arthropods found in the Pantai Cemara mangrove ecosystem and describe their ecological role. The results of this study are expected to provide preliminary information on the condition of Arthropod fauna diversity in the region, which is useful as a basis for sustainable mangrove management and conservation, as well as enriching the scientific literature related to Indonesia's coastal biodiversity.Pendahuluan harus berisi (secara berurutan) latar belakang umum, kajian literatur terdahulu (*state of the art*) sebagai dasar pernyataan kebaruan ilmiah dari artikel, pernyataan kebaruan ilmiah, dan permasalahan penelitian atau hipotesis. Di bagian akhir pendahuluan harus dituliskan tujuan kajian artikel tersebut. Di dalam format artikel ilmiah tidak diperkenankan adanya tinjauan pustaka sebagaimana di laporan penelitian, tetapi diwujudkan dalam bentuk kajian literatur terdahulu (*state of the art*) untuk menunjukkan kebaruan ilmiah artikel tersebut.

METHODS

This study uses a descriptive qualitative approach to identify the diversity of Arthropods in the mangrove ecosystem of Cemara Beach, West Lombok. Observations were carried out directly in the field in a simple way for 2 months, namely in April-May in the spruce beach mangrove area. The tools used in data collection are only insect nets to catch insects that fly or move actively, as well as direct hand-picking for arthropods that are on surfaces such as leaf litter, tree trunks, or mangrove roots. Each specimen that was successfully collected was visually observed, and its morphological features, location of discovery, and visible activity were recorded. The data obtained were analysed descriptively to classify the types of Arthropods based on their physical characteristics and ecological role in mangrove ecosystems. The results of the research are presented in the form of narratives, type identification tables, and photo documentation as support for field information.

Research Instruments. This research consists of several simple tools that support data collection directly in the field, namely insect nets, notebooks, mobile phones, specimen bottles, 70% alcohol. Work Procedures. The work procedure of this research begins with the preparation stage, namely determining the observation location in the Cemara Beach mangrove ecosystem and preparing the necessary tools such as insect nets, notebooks, and cameras. Walking along several points in the mangrove area. At each point, the researchers used insect nets to catch flying or fast-moving insects, as well as directly capture arthropods that are on the surface, such as leaf litter and tree trunks. Each specimen obtained was observed and

recorded for its morphological characteristics, location of discovery, and activity. Specimens are also documented with cameras to facilitate the identification process. Once the data collection is complete, all information is analysed descriptively to classify and describe the diversity of Arthropods found. The results are then compiled in the form of a report containing a narrative, a type table, and visual documentation.

RESULTS AND DISCUSSION

The results of the research are presented in the form of tables, images (including graphs), or descriptive while still providing analysis and interpretation sentences before conducting discussions. The presentation of the image and the table are presented in the middle and the writing is that the table title is located above the table and the image title is located below the image as seen in the following table and image:

Research entitled "Identification of Arthropod Diversity in the Mangrove Ecosystem of Cemara Beach, West Lombok" use Descriptive qualitative research methods. The research was conducted through Direct observation in natural habitat, namely mangrove areas, using simple tools in the form of insect netting and direct capture by hand. This approach allows researchers to observe, record, and describe the diversity of Arthropods based on their natural body shape, behavior, and location. Mangroves are coastal organisms that have great benefits for society. Mangroves are a group of plants that consist of plant types that have taxonomic relationships up to taxa (unrelaten families) but have morphological and physiological adaptations to habitats influenced by tides. Bioecologically, mangrove forest ecosystems play a role as a provision of organic matter, nursery ground, spawning ground, shelter for various marine life, and as a protector of beaches from wave activities (Dahuri, et al., 2004)(Fitra, 2022).

Arthropods are animals that are more commonly found on the earth's surface. Arthopods are the dominant animals in this world. According to Jumar (2000) almost 90% of all types of animals known to people are Arthropods. If the number of species is a criterion, then the phylum Arthropoda is the largest, more than 765,000 different species of Arthropods have been identified. Arthropods have special characteristics, namely a body and legs that are segmented, the body walls are khitin, the oral apparatus is dilated and the body cavity is a blood cavity. The phylum Arthropod is the largest phylum that exists in animal societies and is the most important phylum for humans. More than 75% of the animals that live on earth belong to the phylum Arthropods. The animals included in the phylum Arthropoda have jointed limbs or extreminas based on this the name of the phylum (arthres = joints, podes = legs) (Radiopoetra in Hanafi, A. 2020). Nowadays the phylum Arthropoda has the largest number, both species and individuals. The number of these types and phylame is greater than the number of types of all other phyla. Arthropods can live in various places, such as in the sea, freshwaters, deserts, grasslands and others.(Nisa et al., 2023)

Mangrove forests are a type of forest that grows in tidal areas (especially on protected beaches, lagoons, river estuaries) that are inundated at high tide and free from inundation at low tide, where plant communities are tolerant of salt (Kusmana et al. 2005). There are three million hectares of mangrove forests in Indonesia that grow along 95,000 kilometers of coastal areas. This number represents 23% of the world's entire mangrove ecosystem. Mangrove forests in Indonesia are mostly found in the regions of Papua, Kalimantan, and Sumatra (Giri et al. 2011). Mangrove forests have ecological, economic, and social functions. The economic function of mangrove forests is to produce household needs, produce industrial needs, and produce seeds, while the ecological function of mangrove forests is to protect coastlines, prevent seawater intrusion, and as an area to shelter, nest, and breed for various types of wildlife (Kustanti 2011).(Haneda et al., 2023)

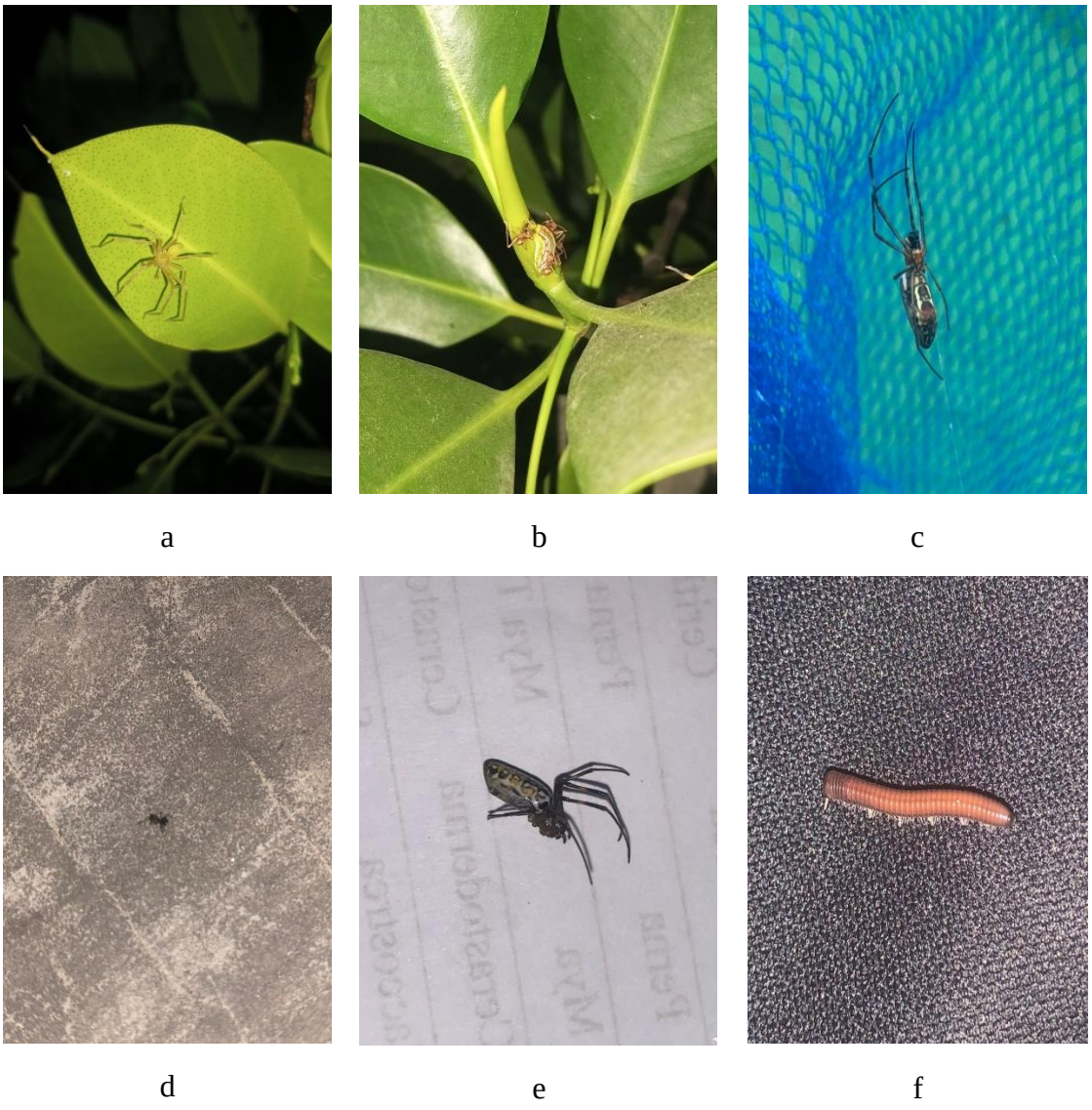

Figure 1. Species *of arthropods found on cypress beach, west Lombok. (a). Micrommata virescens, (b). Oecophylla smaragdina, (c). Leucauge argyra, (d). Neriene radiate, (e). Trigoniulus corallines, (f). Dolichoderus thoracicus.*

The results of the research conducted in Cemara Beach, West Lombok, succeeded in identifying several species of arthropods that show biodiversity in the coastal ecosystem. Species found include *Micrommata virescens*, a green spider that is generally active during the day and is known as a small insect predator. In addition, it was also found *Oecophylla smaragdina*, rangrang ants that form large colonies and have an important role in pest control naturally. Species *Leucauge argyra* and *Neriene radiata*, both of which are web-weaving spiders with roles as predators of flying insects, were also found, suggesting that the habitat on Cemara Beach supports the presence of arboreal arthropods (Prastiyo et al., 2016). Next *Trigoniulus corallinus*, a type of soil centipede that feeds on organic matter, indicates the presence of detritivor organisms that play a role in decomposition. Finally, the existence of *Dolichoderus thoracicus*, an ant species that is often found in the tropics and has a symbiotic relationship with aphids, enriching the dynamics of ecological interactions in the area (Sazali & Rizki, 2017). These findings reflect the environmental conditions of Cemara Beach which

are relatively supportive of the life of various types of arthropods, as well as the importance of conserving coastal areas as natural habitats for biodiversity.

Micrommata virescens is one of the spider species found in the Cemara Beach area, West Lombok. This species is known for its bright green body, which allows it to camouflage effectively among the foliage and coastal vegetation. As a predator, *M. virescens* plays an important role in maintaining the balance of the ecosystem by preying on small insects, thus helping to control pest populations naturally. Its presence on Cemara Beach indicates that this area still provides a supportive habitat for carnivorous arthropods, particularly those that depend on vegetation cover. The findings also suggest that relatively well-preserved coastal vegetation could be an ideal habitat for species such as *Micrommata virescens*, which prefer a natural environment and minimal human disturbance.

Oecophylla smaragdina is characterized by a large elongated body size, reddish-brown or green in color, and no sting. These ants are social insects, living in a society called colonies. The Oecophylla colony consists of reproductive and non-reproductive castes. The queen and the male are members of the reproductive caste. Queens are 15 - 16 mm long and males are 8 - 10 mm, both of which have wings. Workers are non-reproductive caste females, without wings and 5 mm in size (Kalshoven, 1981 in Ariska, 2018)(Dian, 2022) Rangrang ants (Oecophylla smaragdina (Fabricius)) are carnivorous insects and play a role as biocontrol agents in agriculture. The foraging strategy of O. smaragdina has a specific sequence, but it can change due to environmental influences.(Rezki et al., 2023)

Leucauge argyra is one of the spider species of the family Tetragnathidae known for its ability to create spiral-shaped webs and its symmetrical structure. Spiders belong to the phylum Anthrophoda, the class Arachnida, and the Order Araneae.(Fauzi et al., 2022) These spiders are commonly found in tropical and subtropical regions, including Southeast Asia. Leucauge argyra has a small, slender body with a shiny greenish silver color, which helps them camouflage in foliage environments. One of the distinctive features of this species is its unique resting position, where it hangs upside down in the center of its webs. In addition to its role as a natural predator of small insects, Leucauge argyra has also attracted the attention of scientists due to its ability to produce strong, elastic silk. The resulting nets are not only effective for catching prey, but also demonstrate efficient biological design and have the potential to inspire innovation in the field of material technology.

Neriene radiata is a species of spider in the family Linyphiidae, also known as sheet web spiders. This species is typically found in temperate regions, such as North America and parts of Europe, and often lives in forests, shrubs, or grasses. The distinctive feature of Neriene radiata is the unique pattern on its abdomen which is blackish-brown with white stripes, as well as its relatively small size. This spider makes a horizontal sheet-shaped web with an irregular structure at the top that serves to drop prey on the surface of the web. Despite its small size, Neriene radiata plays an important role in ecosystems as a population controller of small insects. In addition, its behavior and web structure are interesting to research in the fields of ethology (animal behavioral science) and biomimetics, as they can provide insight into the efficiency and complex natural design.

Trigoniulus corallinus is a species of ground centipede of the class Diplopoda, better known as the millipede. The species is widespread in tropical and subtropical regions, including South Asia and Southeast Asia. Trigoniulus corallinus has a long cylindrical body with many segments, each equipped with a pair of legs, so its total legs can reach hundreds. Its body color is usually reddish-brown or purplish, which gives it a striking appearance but also serves as a warning to predators. Unlike predatory insects, Trigoniulus corallinus is detritivore, which feeds on decaying organic matter such as deciduous leaves and plant residues. Its ecological

role is very important because it helps the process of decomposition and fertilization of the soil. Although harmless to humans, these centipedes can spiral their bodies when they feel threatened as a form of passive defense. Its presence in the natural environment indicates healthy soil conditions and rich in organic matter.

Dolichoderus thoracicus is an ant species that is also found in the Cemara Beach area, West Lombok. These ants are known to be highly adaptive species and are often found in tropical environments, both in natural habitats and areas affected by human activities. *D. thoracicus* has a significant ecological role, especially in its interactions with other organisms such as aphids, where it establishes a mutualistic relationship by protecting aphids from predators in exchange for the sweet liquid (honeydew) it produces. Its presence on Cemara Beach shows that the region has resources and vegetation structures that support the life of this ant colony. In addition, *D. thoracicus* also plays a role in seed dispersal and decomposition of organic matter, making it an important part of ecological processes in coastal ecosystems. The discovery of this species confirms the importance of the conservation of the coastal environment as a place where various complex biological interactions take place.

Table 1. The number of arthropod species found on the cypress beach, West Lombok is 6 species, such as Micrommata virescens, Oecophylla smaragdina, Leucauge argyra, Neriene radiate, Trigoniulus corallines, Dolichoderus thoracicus.

Last Name	Genus/Species Name	Local Name/Indonesia	Quantity Found
Sparassidae	*Micrommata virescens*	Green Hunter Spider	2
Formicidae	*Oecophylla smaragdina*	Squirrel Squirrel	6
Tetragnathidae	*Leucauge argyra*	garden spider	1
Linyphiidae	*Neriene radiata*	spider web sheet	1
Trigoniulidae	*Trigoniulus corallinus*	as a thousandfoot	1
Formicidae	*Dolichoderus thoracicus*	Black Ant	2

Table 2. Community Interview Observation Table – The Emergence of Arthropods & Environmental Changes

Name	Local name	Suspected species/family	Time to appear	Environmental changes observed	Influencers on the presence of arthropods
Mr. Bejo	Rice Crab	*Sesarma* sp. / Grapsidae	All year round (morning/evening)	Tree felling, mud drying out	Starting to decrease in open areas
Pak spell	Big Black Ant	*Camponotus* sp. / Formicidae	Dry season	Decrease in vegetation cover	Population decline
Mom fit	Sea Dragonfly	*Orthetrum* sp. / Libellulidae	Rainy season (afternoon)	Increased waterlogging	Population stable, remains visible

Mr. Idir	Spider Tree	*Nephila* sp. / Araneidae	All year round	Slight disturbance, vegetation is still quite dense	Relatively stable population
Mrs. Siti	Forest mosquitoes	*Aedes* sp. / Culicidae	Rainy season (night)	Lots of puddles and garbage	Population is increasing

Based on interviews and field observations around Cemara Beach, West Lombok, various types of arthropods were found that are known locally by the community, showing a close relationship between coastal ecosystems and the activities of these species. One of them is the rice field crab (*Sesarma* sp., family Grapsidae) which is known by residents as an animal that appears throughout the year, especially in the morning and evening. According to Pak Bejo, the existence of this species began to decrease in open areas due to tree felling and the drying of mud, which is their main habitat. Furthermore, the great black ant (*Camponotus* sp., family Formicidae) reported by Pak Eja, showed a decline in the population during the dry season, along with reduced vegetation cover as a nesting place and food source.

The sea dragonfly (*Orthetrum* sp., family Libellulidae) which is often observed by Mrs. Fit in the rainy season in the afternoon, shows a relatively stable population. This is most likely due to the increase in standing water that corresponds to the reproductive needs of this species. Meanwhile, tree spiders (*Nephila* sp., family Araneidae), according to Mr. Idir, can still be found throughout the year and the population is relatively stable, because the vegetation at the observation site is still quite dense and there is minimal human disturbance. On the other hand, Mrs. Siti reported an increase in the population of forest mosquitoes (*Aedes* sp., family Culicidae) during the rainy season, driven by the abundance of standing water and garbage as breeding grounds. These findings show that environmental changes, both due to natural factors and human activities, have a direct influence on the dynamics of arthropod populations in Cemara Beach.

CONCLUSION

Based on the results of research conducted for two months in the mangrove ecosystem of Cemara Beach, West Lombok, it can be concluded that this area has a fairly high diversity of arthropods, with various species that have important ecological roles such as predators, pollinators, detritivores, and indicators of environmental conditions. Direct observation methods and visual morphological identification have allowed the discovery of species such as *Micrommata virescens*, *Dolichoderus thoracicus*, as well as various types of spiders, ants, dragonflies, and mosquitoes. The presence of these arthropods suggests that the mangrove ecosystem in Cemara Beach still supports the life of various small organisms, although some environmental changes such as deforestation and increased garbage are beginning to affect the presence of some species. Therefore, the results of this study can be the initial basis for sustainable mangrove conservation and management efforts, while affirming the importance of the role of arthropods in maintaining the balance of coastal ecosystems.

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