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TEMPORAL DISTRIBUTION OF ARTHROPODS IN *Heliotropium indicum* IN JOMBANG DISTRICT AS E-CATALOG DEVELOPMENT

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ABSTRACT

Arthropods have an important role in the rice field ecosystem, namely as natural enemies (predators, parasitoids, and control pathogens) that can be used as pest control efforts. The diversity of natural enemies can be seen from his visits to the flowering plant (refugia) namely Heliotropium indicum in Jombang Regency by looking at the temporal distribution of each observation. The purpose of this study was to determine the distribution of daily temporal visits of arthropods on Heliotropium indicum in Ploso and Plandaan sub-districts and to be used as material for developing e-catalogs. This research was conducted in February 2021 using the visual control method by observing 3 replicates at 06.00-07.00 am, 11.00-12.00 noon, and 16.00-17.00 pm, the data obtained were analyzed descriptively by calculating the average frequency each time. observations (hours). The results of the study on the temporal distribution of arthropods on the Heliotropium indicum plant can be found that certain arthropods are often found at certain hours, namely, the arthropods that are active in the morning and evening are the Pentatomidae and Muscidae families, the arthropod families that are active during the day are Mantidae and the arthropod families that are active throughout the day are Formicidae, Acrididae, and Coccinellidae. The results of the research were developed into learning media in the form of an e-catalog. The developed e-catalog contains images of arthropods visiting the Heliotropium indicum plant, their classification, and a description of their morphology.

Keywords : arthropods, e-catalog, Heliotropium indicum, temporal distribution

INTRODUCTION

Ploso and Plandaan sub-districts are sub-districts located north of the Berantas river. In the area of the Ploso and Plandaan sub-districts are very suitable for farming because the soil is fertile and humus. In this area there are several agricultural products such as tobacco, corn, rice and secondary crops. Therefore, most of the residents work as farmers. In general, farmers eradicate pests using chemical pesticides. The continuous use of chemical pesticides has an impact on the reduction of organisms that are useful for plants such as natural enemies of pests. In essence, natural enemies can control pests naturally where the surrounding environment allows for the development of these natural enemies (Sitepu, 2018). Rice field ecosystems in tropical Indonesia actually have many types of natural enemies that can effectively suppress pest populations (Sitepu, 2018). The existence of various kinds of pests has an impact on the number of arthropods in the rice field ecosystem (Sakir et al., 2018).

Research studies related to arthropods include research from Wulandari (2016) on the temporal distribution of arthropods in the wild plant Borreria repens DC. and Setaria sp. In the tea garden area of Wonosari Singosari, Malang Regency,

where the research results show that the arthropod families that are active in the morning and afternoon are Cicadellidae. The Arthropoda families that are active in the aftrenoon are Dolichopodidae and Syrpidae. Arthropods that are active throughout the day are family of Coccinellidae, Formicidae, Lycosidae, Oxyopidae, Geometridae and Mantidae.

Another study from (Wardani et al., 2013) stated about the effect of refugia block (*Ageratum conyzoides, Ageratum houstonianum, Commelina diffusa*) on the pattern of Arthropoda visits in the apple plantations of Poncokusumo Village, Malang. The results of the study showed the abundance of Arthropods amounted to 1424 individuals consisting of 8 orders with 28 families. The 5 highest families is Aleyrodidae, Syrphidae, Pieridae, Tabanidae 1 and Formicidae 2 with the highest INP is Aleyrodidae accounting for (33.95%). The high of Arthropod diversity is with a value of 2-3. The average similarity of Arthropod compositions shows a moderate level of similarity. The refugia block used has an influence on Arthropod visits. Blocks 1,2 and 4 show a high level of attraction to attract Arthropods. Therefore, it can be recommended between blocks 1 and 2. The functional status of Arthropods consisted of herbivores accounting for (54.14%), pollinators accounting for (28.72%) and predators at (17.13%). Temperature and light intensity affect the abundance of arthropods.

Another arthropod research is from Fitria (2013). The study is about arthropod diversity on intercropping agricultural land for an inventory of biological control predators in Bumiaji District, Batu City. The results of the study showed that 19 species of arthropods were identified as predators. The diversity index value was at 2.73 which is included in the medium category. An evenness index is accounting for 0.82 which is close to the value of 1 which means it has even distribution and is in stable condition; and a wealth index of 4.72. There is a relationship between abiotic factors and the number of predatory arthropod species that is at a significant level of R2 total of 20.3% and the most influential are soil temperature and wind speed.

The study from Zulhariadi (2016) is about the temporal and spatial distribution of arthropods in *Wedelia trilobata*, *Vigna Sp.* and *Heliotropium indicum L*. The observation results show that in spatial distribution, the high diversity of arthropod species, that is *Vigna sp*. and *Heliotropium indicum* L., each of which has 16 species and is ±20m from the main road, while in *Widelia trilobata* flower is 14 species and is ±15m from the road. In the temporal distribution, the abundance of arthropods in the morning measurement was highest on *Wedelia trilobata* plants of 16.66 individuals/m2, in the afternoon measurements the highest on *Wedelia trilobata* plants of 9.77 individuals/m2, and in the afternoon measurements the highest on *Wedelia trilobata* and *Vigna sp.* of 1.22 individuals/m2.

Biological control of pests can be done by preserving arthropods that act as natural enemies including predators (predators), parasitoids, and pest pathogens (Wulandari, 2016). Compared to the use of chemical pesticides, the use of natural enemies is effective, inexpensive and does not cause negative side effects on health and the environment. The diversity of natural enemies due to the presence of flowering plants (refugia) will lead to the formation of a more stable ecosystem, which in turn will maintain a balance of ecosystem components. According to Addina et al (2013) the presence of wild plants is proven to be able to attract arthropod visits, especially those that act as natural enemies, so that it is a potential effort to increase the number of visits by natural enemies in agricultural land.

Research studies related to biological control include research (Amrullah, 2019) on biological control (Biocontrol): the use of predatory insects as natural enemies for insect pests (a review). In fact, the research results show that insects as the organism that owns the most species on Earth have different roles in nature, some

are detrimental and some are beneficial. One of the groups of harmful insects is insect pests, consisting of herbivorous insects that attack cultivated plants also known as Plant Pest Organisms (OPT). While the group of beneficial insects, one of which is predatory insects, which become predators of other insects. The use of predatory insects to control insect pest populations is known as biological control (biocontrol). Biocontrol has been widely used in various regions in Indonesia to support Integrated Pest Management (IPM) policies that are environmentally sound, but specifically in South Sulawesi, its application is still very minimal.

Research from (Herlinda, 2019) is on the development of biological control of oil palm and pajale pests. That research results show that the development of biological control in oil palm plantations is currently dominated by the conservation of predatory arthropods and parasitoids by utilizing refugia plants. The most widely used refugia plants are Turnera subulata, Turnera ulmifolia, Antigonon leptopus, and Cassia cobanensis. In addition to refugia, in oil palm plantations, entomopathogens have been widely used, both entomopathogenic fungi and entomopathogenic viruses. The entomopathogenic fungi that have been widely developed are Metarhizium anisoplia, Metarhizium majus, and Cordyceps militaris, while the entomopathogenic viruses used are for example Rhabdionvirus oryctes. The use of parasitoids in oil palm plantations is not as intensive as the use of entomopathogens and the use of refugia. The development of biological control in rice, corn, and soybeans (pajale) is generally more of a natural enemy conservation approach that prioritizes habitat management, for example intercropping which is able to provide habitat and niches for predators and parasitoids. The use of entomopathogens for pest control in Pajale is less developed because it is constrained by the less than ideal microclimate of Pajale, fluctuations in temperature and relative humidity are more pronounced than in the oil palm ecosystem. The dominant predator in the pajale is a group of hunting spiders, for example Pardosa pseudoannulata, while the dominant sedentary parasitoid is a larval parasitoid that behaves in an oligophage or polyphagous manner. Thus, it can be concluded that the development of biological control in oil palm and pajale is slightly different, in oil palm natural enemies are easier to settle because the ecosystem is stable, while in Pajale natural enemies of entomopathogenic groups are less able to settle.

Research from (Henuhili & Aminatun, 2013) is on the conservation of natural enemies as biological control of pests by managing the rice field ecosystem. The results showed that (1) the types of natural enemies found in the Surjan rice field ecosystem were more abundant than the nonsurjan rice field ecosystem (sheet); (2) the rice field ecosystem management system that tends to conserve natural enemies is a mixed cropping pattern cropping system carried out on surjan rice fields (multicropping).

Refugia is thought to be a plant that can provide shelter, food sources, or other resources for natural enemies such as predators and parasitoids (Sakir et al., 2018). The diverse functions of paying attention to refugia plants are very important in conserving natural enemy populations in agricultural ecosystems that are dominant with rice plants (Sakir et al., 2018)

Skepticism or rattail (*Heliotropium indicum*) is a species of flowering plant of the genus Heliotropium. This plant is a weed that grows wild and can be found in the agricultural area of Jombang Regency. In addition to being used as traditional medicine, the large number of Heliotropium indicum refugia plants that grow in rice fields can also be used as a microhabitat to attract visits by natural enemy arthropods.

Arthropods include insects that must be preserved from extinction or a decrease in species diversity (Suterisni et al., 2018). Arthropods have different temporal distributions that follow a

biological clock that shows the activity of organisms at certain times and zones (Zulhariadi, 2016). The results of the distribution temporal will be developed as an e-catalog development material. E-Catalog is an online media that contains images and information as a tool or prop.

RESEARCH METHOD

The research location was conducted in the agricultural area of Ploso and Plandaan Districts, Jombang Regency. This research was conducted in February 2021. The population of the study was all arthropod populations in the agricultural area, Ploso and Plandaan sub-districts. While the samples in this study were all arthropods that were observed in each Heliotropium indicum plant.

The tools used in this study are writing instruments and cameras. The observation method used was the "visual control" method developed by Frei and Manhart (1992) in (Wulandari, 2016) which had been modified. This method is a remote observation method by observing directly by arthropods visiting *Heliotropium indicum* plants with a distance of 2 meters and carried out at certain times.

Arthropods were observed 3 times with duration of 1 hour/per replication. The Heliotropium indicumarthropoda plants were observed at 06.00-07.00 am, 11.00-12.00 noon, and 16.00-17.00 pm. Data on the temporal distribution of arthropods were analyzed descriptively by calculating the average frequency of each observation time (hours). The development of the e-catalog was designed with reference to the types of arthropods found, and described based on the classification and morphological description.

RESULTS AND DISCUSSION

The temporal distribution shows that certain arthropods are more frequently found at certain hours and zones. The types of arthropods found in the *Heliotropium indicum* plant were found in 6 families consisting of Muscidae, Formicidae, Acrididae, Coccinelidae, Petatomidae, Mantidae in Ploso District, while there was no found Mantidae family in Plandaan District.

Table 1. Average on Temporal Distribution of Arthropods on *Heliotropium indicum* in Ploso districts.

Family	Observation time		
	06.00-07.00	11.00-12.00	16.00-17.00
Formicidae	5,3	2	1,6
Muscidae	1,6	0,3	0
Acrididae	2,6	3,3	1,6
Coccinellidae	1,6	1	1
Pentatomidae	0,3	0,3	0,3
Mantidae	0	0,3	0

Based on Table 1 above, it can be seen that the Formicidae family in the *Heliotropium indicum* plant in Ploso District in the morning amounted to an average of 5.3 individuals/hour. In the afternoon accounted for 2 individuals/hour, and in the afternoon accounted for 1.6 individual/hour. The Muscidae family in the morning amounted to an average of 1.6 individuals/hour. In the afternoon accounted for an average of 0.3 individuals/hour, and in the afternoon no Muscidae family was found during the study. The Acrididae family in the morning amounted to an average of 2.6 individuals/hour. In the afternoon average number was 3.3 individuals/hour, while in the afternoon there were 1.6 individuals/hour. The Coccinellidae family in the morning amounted to an average of 1.6 individuals/hour. In the afternoon acoounted for an average of 1 individual/hour, and in the afternoon accounted for 1 individual/hour. The Pentatomidae family was found in the morning, afternoon and evening with an average of 0.3 individuals/hours. The value is consistent. The Mantidae family in the morning and evening were not found during the study, while in the afternoon the Mantidae family was found to have an average of 0.3 individuals/hour.

Table 2. Average on Temporal Distribution of Arthropods on *Heliotropium indicum* in Plandaan District

Family	Observation time		
	06.00-07.00	11.00-12.00	16.00-17.00
Formicidae	6,6	3,6	0,6
Muscidae	1	0	0
Acrididae	3,3	2,6	2,3
Coccinellidae	0,6	3	1
Pentatomidae	0,3	0,3	1

Based on Table 2 above, it can be seen that the Formicidae family of *Heliotropium indicum* plants in Plandaan District in the morning amounted to an average of 6.6 individuals/hour. In the afternoon accounted for an average of 3.6 individuals/hour, and in the afternoon there were 0 ,6 individuals/hour. Muscidae family in the morning amounted to an average of 1 individual/hour, in the afternoon and evening no Muscidae family was found during the study. The Acrididae family in the morning amounted to an average of 3.3 individuals/hour. In the afternoon average number was 2.6 individuals/hour, while in the afternoon there were 2.3 individuals/hour. The Coccinellidae family in the morning amounted to an average of 0.6 individuals/hour. In the afternoon, it accounted for an average of 3 individuals/hour, and in the afternoon 1 individual/hour. The Pentatomidae family in the morning amounted to an average of 0.3 individuals/hour, during the day the average number was 0.3, and in the afternoon the average number was 1 individual/hour.

The spread of the temporal distribution of Arthropoda visits on *Heliotropium idicum* can be seen in the following graph:

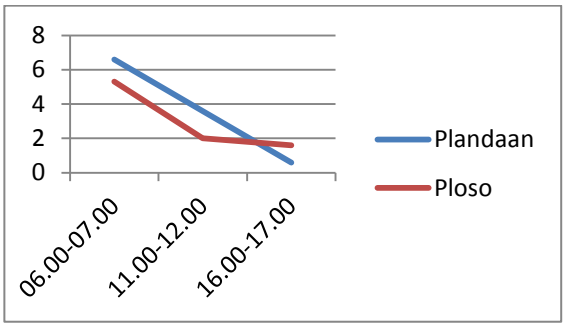

Figure 1. Temporal distribution of family Formicidae (natural enemies) in *Heliotropium indicum* in Ploso and Plandaan.

The temporal distribution of the Formicidae family which acted as a natural enemy on *Heliotropium indicum* plants in Ploso District in the morning was accounting for an average of 5.3 individuals/hour. In the afternoon, the average of number was 2 individuals/hour and in the afternoon decreased by an average of 1 ,6 individuals/hour. Meanwhile, in Plandaan Subdistrict, in the morning there were an average of 6.6 individuals/hour. In the afternoon, the average of number was 3.6 individuals/hour and in the afternoon there was an average decrease of 0.6 individuals/hour. Possibly the Formicidae family likes environments with temperatures between 26-34°C. This showed that its activity throughout the day was in accordance with the opinion (Wulandari, 2016) that the Formicidae family likes fresh air, relative temperature and humidity.

The results of research was conducted by Wulandari (2016), at the Wonosari Tea Garden, Singosari, Malang Regency in 2016. The results were found to be the same that the Formicidae family was found to be active throughout the day. The Formicidae family is a natural enemy in tea plantations because it can disturb, deter or prey on various types of pests such as green ladybugs, leaf-eating caterpillars, and fruit-eating insects. A high population can reduce pest problems.

The results of research conducted by (Resti, 2015) in the garden, that the highest Formicidae activity started at 07.00-08.00 WIB then decreased during the day and the least in the afternoon. This may be due to the temperature and intensity being too hot. Therefore, the ants took shelter. This was seen starting to decrease in activity from the second observation during the day until the afternoon.

The Formicidae family includes animals that have a high level of adaptation to the surrounding environment and are numerous in number. Therefore, they were found everywhere (Rahmawaty, 2004) in (Resti, 2015). This is because the Formicidae family is a soil insect that is always present in every habitat and is a

predator that can prey on anything. Therefore, there is no difficulty in finding food so that the population is very large. The Formicidae family was found in the leaves and stems of the Heliotropium indicum plant. And it was also found in flowing waters with light intensity and found in lush plants (Asyik et al., 2019). The Formicidae family was actively looking for food on the Heliotropium indicum plant in that part of the plant and actively looking for food on the ground. Active Formicidae moveed quickly while looking for food or a place to find a nest.

The characteristics of the Formicidae family are the mesosoma that is attached to the abdomen through a single segment called the petiole. This does not have a sting. At the end of the abdomen there is a secondary or semi-surcular hole (acidopore). At the edges there are short hairs. Formicidae have one petiole with 8-12 antenna segments. The body shape of the Formicidae family is that it has no bones in its body, but the body of the Formicidae family is wrapped with a layer of hard skin. Like other insects, the body of the Formicidae family consists of three parts; head, thorax and abdomen. At the head of the Formicidae family there are many sensory organs, including the antennae, antennal scrobe, eyes, clypeus, frontal carina, mandible and palp formula. The role of the Formicidae family in nature can have a negative and positive influence on animals, humans, and plants. The positive benefits are that humans can become predators, decompose organic matter, and as pest control.

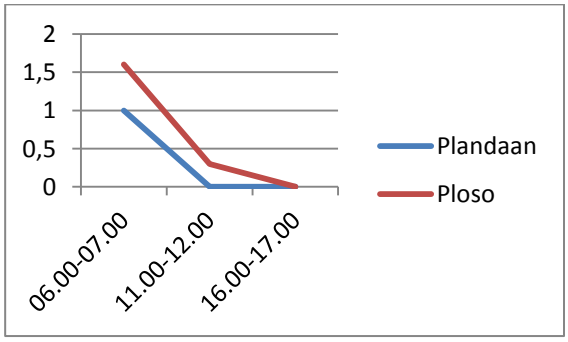

Figure 2. Temporal distribution of family Muscidae (natural enemies) in *Heliotropium indicum* in Ploso and Plandaan.

The temporal distribution of the Muscidae family acted as a natural enemy on *Heliotropium indicum* plants in Ploso District. In the morning, it was found the number of visits of the Muscidae family to an average of 1.6 individuals/hour. In the afternoon it was decreased by an average of 0.3 individuals per hour and in the afternoon there were no visits by the Muscidae family on Heliotropium indicum plants during observation. While in Plandaan District in the morning it was found that the Muscidae family visited an average of 1 individual/hour, in the afternoon and evening there were no visits by the Muscidae family to the plants of *Heliotropium indicum* at the time of observation. This is probably because the Muscidae family requires light, temperature and appropriate humidity to find food. Insects are very dependent on the quantity and quality of food. If sources of food needs are available in large quantities, the insect population will increase. However, if the food sources are few, the insect population will decrease. This is in accordance with the opinion of Sari et al. (2017) stating that the existence of an organism is influenced by environmental factors and the place where food is available.

The Muscidae family was found in the leaves and stems of the *Heliotropium indicum* plant. The Muscidae family measures 7 mm, on the wings larger than the thorax and on the head there are hairs. On the legs there are fine hairs with a length of 3 mm. The Muscidae family is able to reproduce in feces. The morphological signs of Muscidae are blackish gray body color. On the abdomen it is yellow to orange and the tip is blackish brown. On the upper surface of the thorax there are 4 black lines. The head is large, dark brown, and the eyes are large, prominent and separate. The wings are thin and translucent, and the base is yellow. The Muscidae family has a complete metamorphosis with egg, larva, pupa, and adult stages with an average reproduction of 7-22 days depending on environmental factors.

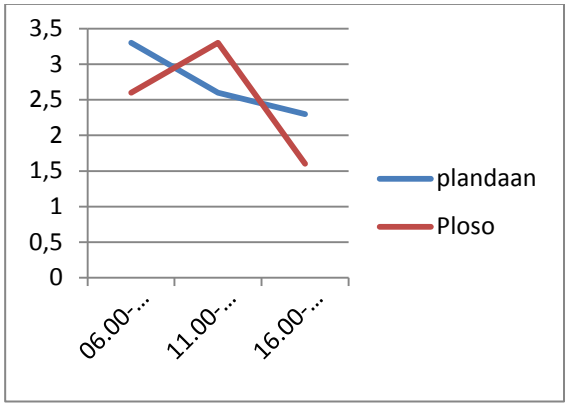

Figure 3 Temporal distribution of family Acrididae (pests) in *Heliotropium indicum* in Ploso and Plandaan.

The temporal distribution of the Acrididae family which acts as a pest on the *Heliotropium indicum* plant in Ploso District in the morning found the number of visits to an average of 2.6 individuals/hour. In the afternoon, there was an average increase of accounting for 3.3 individuals/hour, while in the afternoon decreased by an average of 1 individual / hour. This may be due to the fact that during the day when the weather was unfavorable (drizzle). While in Plandaan District in the morning it was found that the average number of visits was 3.3 individuals/hour, during the day there was an average decrease of 2.6. individuals/hour and afternoon decreased by an average of 2.3 individuals/hour. This was due to environmental factors that affected the number of visits by the Acrididae family. This is in accordance with the opinion of Pariyanto, et al (2017) which states that humidity affects insect activity. It can be seen that the visit of Acrididae occurred during the observation time. It is possible that the Acrididae family was looking for food. The Acrididae family can live in groups or alone, when there are enough Acrididae, they can live in agricultural land, shrubs, plantations and grasslands (Sari, 2018). Temperature, humidity, and light intensity will affect insect activity, such as jumping, and evaporation, as well as body fluids (Irwanto & Gusnia, 2021). According to (Irwanto & Gusnia, 2021) high humidity also affects the distribution of insects.

It was compared with research conducted by (Prakoso, 2017), in the ecosystem of rice fields (rice fields), Rabi and Kharif, City of Uttar Pradesh, India during 2010-2011. The results found almost the same that the abundant diversity of the Acrididae family was followed by the Pyrgomorphidae. This is because species from the subfamilies Acrididae Oxyinae and Truxalinae easily get food sources in the form of grass (Das and Ray, 2013).

The family Acrididae was found on the leaf surface of the *Heliotropium indicum* plant. This family of Acrididae belongs to the order Orthoptera with a total of 20,000 species (Sugiarto, 2018). The family of Acrididae was not randomly distributed in the different environments in which they are located. The family Acrididae has a distribution pattern related to the availability of food in various types of vegetation, anthropic factors, the amount of light and shade. According to (Sugiarto, 2018), this Acrididae has short antennae. The Acrididae family is a pest on agricultural crops. This was supported by (Sugiarto, 2018), the Acrididae family acts as a herbivore in the ecosystem. In addition to the bright green Acrididae family, there was also a yellowish brown color with transparent black stripes on the wings. The wings were leathery and small in size from the green Acrididae species.

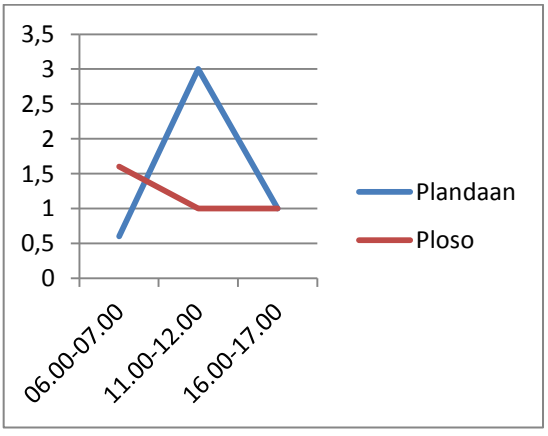

Figure 4. Temporal distribution of family Coccinelidae (natural enemies) in *Heliotropium indicum* in Ploso and Plandaan.

The temporal distribution of the Coccinelidae family which acts as a natural enemy in *Heliotropium indicum* plants in Ploso District. In the morning

amounted to an average of 1.6 individuals/hour. While in the afternoon and evening, it was decreased by an average of 1 individual/hour. This was probably due to it rained during the afternoon and evening, while in Plandaan District in the morning it was found that the Coccinellidae family amounted an average of 0.6 individuals/hour. In the afternoon there was an increase in the number of visits by an average of 3 individuals/hour. While in the afternoon there was an increase in the number of visits by 3 individuals/hour. Meanwhile in the afternoon, it was decreased by an average of 1 individual/hour. It is possible that the Coccinelidae family is an insect species that has tolerance to changes in environmental factors and insects that are active throughout the day (Wulandari, 2016).

At certain temperatures, insect activity increased, but at other temperatures it decreased. Sari, (2018) stated that the effective temperature range for insects is a minimum temperature of 15 °C, an optimum temperature of 25 °C and a maximum temperature of 45°C. The Coccinellidae family has a broad body, oval to nearly round. The whole head is on the pronotum. The antennae are short, 3-6 segments brightly colored with black spots. The Coccinellidae family is often found in half parts or plant crowns of wet and dry habitats.

The diversity of predatory Coccinellidae has previously been studied in West Sumatra by (Efendi et al., 2019). That the diversity of predatory Coccinellidae in organic and inorganic chili plants is 17 species and 14 species, respectively. Based on the results of research conducted (Efendi et al., 2019). The results showed that 9 predatory Coccinellidae species were found with biodiversity levels ranging from 0.98 - 2.36 in vegetable crops in Padang City.

The diversity of predatory Coccinellidae has previously been studied in Three Districts of Kuantan Singingi Regency by (Aprila et al., 2019). The number of predatory Coccinellidae found is 146 individuals consisting of 11 species, predatory species found in chili plantations are *Chilocorus melanophthalmus, Coccinella repanda , Coleophora maculata, Coleophora inaequalis, Illeis cincta, Menochilus sexmaculatus, Ropaloneda decusata, Verania dicolor, Viranea lineata*, Species that have good potential to control aphids in chili plantations.

Adults of the Coccinellidae family will quickly distance themselves from the plant or fly away if disturbed. Some of the Coccinellidae families act as predators by preying on egg-adult pests.

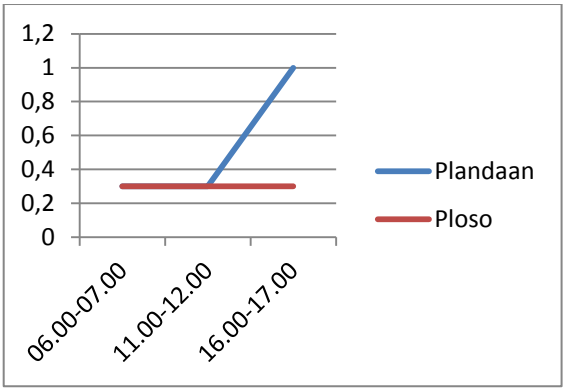

Figure 5 Temporal distribution of family Pentatomidae (pests) on *Heliotropium indicum* in Ploso and Plandaan.

The temporal distribution of the Pentatomidae family which acted as a pest on Heliotropium indicum in Ploso District during the observation of the number of visits by the Pentatomidae family is consistent with the average value of 0.3 individuals/hour. While in Plandaan Subdistrict, the number of visits of the Pentatomidae family in the morning and afternoon amounted to an average of 0.3 individuals/hour. Then in the afternoon, it was increased by an average of 1 individual/hour. It is the possible availability of many preys or foods. According to Samad (2013), Pentatomidae are animals that are relatively unaffected by extreme conditions. Another factor that influences the existence of the Pentatomidae family is the availability of food or prey. The higher the prey population, the higher the population of the Pentatomidae family.

The length of the family Pentatomidae

is 16 mm. The eggs are on the leaf surface. The eggs after 6 days of hatching will become young ladybugs, which are black and white. In the morning it is on the leaf surface. While when the sun is shining it drops down. The Pentatomidae family produces a foul odor.

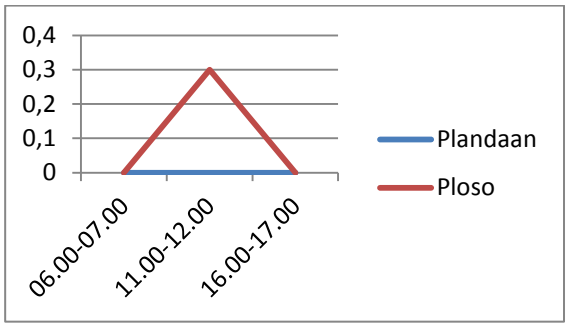

Figure 6 Temporal distribution of family Mantidae (natural enemies) in *Heliotropium indicum* in Ploso and Plandaan.

The temporal distribution of the Mantidae family which acts as a natural enemy was only found in *Heliotropium indicum* in Ploso District. The number of Mantidae families in Ploso District increased during the day, while in Plandaan District there were no Mantidae families found during the study. It was possibly due to competition between existing predators (Wulandari, 2016).

Research conducted by (Sugiarto, 2018) on data on praying mantis (Mantodea) in Serdang Menang Village in 2005 showed that only 1 species was found, namely Hierodula formosa. The length of the study period and the determination of the sampling location were estimated to affect the number of species found. According to Dwari and Amal (2018) in Sugiarto (2019), stated that the Mantidae family is able to control the population of harmful insects, praying mantis, including predators for grasshoppers, aphids. The praying mantis has the characteristics of a large body. It has small triangular-shaped eyes that are free to move. Short antennae, long and strong forelegs function to catch prey (Fitriani, 2018).

Research on the temporal distribution of arthropods was used for the development of the e-catalog. The designed e-catalog cover contained the title, author's name, logo and campus identity. It uses a green background because green has a natural meaning. It is refreshing and reflects the natural environment such as the observation location where there are many rice plants in the agricultural area of Plandaan and Ploso Districts.

The content of the e-catalog learning media contains pictures of arthropods visiting the Heliotropium indicum plant along with their classification and morphological descriptions (**Figure 7**). The developed of e-catalog contains pictures of the families Muscidae, Formicidae, Acrididae, Coccinelidae, Pentatomidae, and Mantidae. The e-catalog is then made using Flipbook application.


KUMBANG KOKSI (Famili Coccinellidae)

Klasifikasi		Gambar
Kingdom	: Animalia	
Phylum	: Arthropoda	
Kelas	: Insecta	
Ordo	: Coleoptera	
Famili	: Coccinellidae	
Genus	: Epilachna	
Spesies	: *Epilachna admirabilis*	

Deskripsi Morfologi

Kumbang koksi memiliki tubuh berbentuk bulat dengan sayap keras di punggungnya yang disebut dengan elitra. Elitra berwarna oranye ditambah dengan pola seperti totol-totol berwarna hitam yang bervariasi pada tiap individu, memiliki kaki yang pendek, pada kakinya terdapat rambut-rambut halus berukuran mikroskopis, rambut ini menghasilkan cairan yang lengket sehingga kumbang koksi bisa berjalan dan menempel ditempat-tempat yang licin.

Figure 7. The display contents of the e-catalog

It is chosen flipbook application because there are several advantages including. It can present learning material with words, sentences and pictures, can be equipped with colors. therefore, it attracts the attention of readers. Flipbook can convert pdf files into magazines,

digital magazines, digital catalogs, company catalogs, and other digital catalogs. Making it very easy, can increase reading interest so that it is not monotonous. This application is not only focused on text but can also insert images, graphics, sounds, links. Therefore, the E-Catalog using a flipbook maker does not have to cost money because it is in the form of a soft file and is accessed online. Research by (Rahmawati et al., 2017) shows that diving using flipbook learning media learning activities has increased.

The contents of the e-catalog are designed with normal margins, using the Comic Sans font size 12 with 1.5 spacing. The content section of the e-catalog describes the name of the arthropod (name of language and family), classification and description of morphology. The contents of the e-catalog are also complete with pictures of arthropods obtained from the documentation in the form of photos during the research.

CONCLUSION

The results of the study on the temporal distribution of arthropods on the Heliotropium indicum plant in the Agricultural Area of Jombang Regency, indicate that certain arthropods are often found at certain hours. Those are the arthropod families that are active in the morning while in the afternoon are Pentatomidae and Muscidae. Those that are active in the afternoon are Mantidae. And the arthropod families that are active active throughout the day are the Formicidae, Acrididae, and Coccinellidae. The results of the research were then developed into an e-catalog describing the types of arthropods in the Heliotropium indicum plant which consisted of 6 families including Muscidae, Formicidae, Acrididae, Coccinelidae, Pentatomidae, and Mantidae, along with their classification and morphological descriptions. The e-catalog was developed using the Flipbook Maker application.

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