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Arthropod Daily Visits to *Zinnia elegans* and *Ruellia tuberosa* in Megaluh District

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ABSTRACT
Arthropod daily visits were seen from how often the Arthropod family visited the refugia plants of Zinnia elegans and Ruellia tuberosa species which were determined based on the Arthropod average per hour observed. This study aims to (1) find out what arthropods are found in Zinnia elegans and Ruellia tuberosa in Megaluh District, (2) find out the frequency of daily visits of arthropods to Zinnia elegans and Ruellia tuberosa plants in Megaluh District. This research is an exploratory descriptive study with a quantitative approach. This research was conducted in February 2021. Determination of the sampling point (sampling) was determined using the purposive sampling technique. The technique of collecting data is by collecting data using the visual control method at a distance of 2 meters at 06.00-07-00, 11.00-12.00, and 16.00-17.00. The data analysis technique was using SPSS paired t-test (pair-sample t-test). The results showed 22 families were found consisting of Paradoxosomatidae, Calliphoridae, Formicidae, Salticidae, Muscidae, Pentatomidae, Apidae, Vespidae, Flatidae, Gryllidae, Chrysomelidae, Crambidae, Hesperiidae, Stratiomyidae, Oxypidae, Coenagrionidae, Mantidae, Alyphecidae, Coccinellidae, Coccinellidae. , Pieridae. The highest average daily visitation frequency for Zinnia elegans was the Formicidae family with an average daily visit frequency of 8.5556 individuals/hour, while the highest family Ruellia tuberosa was also the Formicidae family with an average of 14.3333 individuals/hour. In Zinnia elegans and Ruellia tuberosa based on t-test, the significance level (2-tailed) was significant in the Pentatomidae family with a significance value of 0.003.

***Keywords**: Arthropoda; Daily Visits; Megaluh District; Ruellia tuberosa; Zinnia elegans.*

INTRODUCTION
Megaluh District is a sub-district located in the western part of Jombang Regency, part of which is crossed by the Brantas River and has an alluvial soil type that contains relatively high nutrients so it is suitable for agricultural land, although it has good soil for agricultural land, the average productivity of farmers in Megaluh District still low. This can occur due to many factors such as production costs, farmer experience, land area and excessive use of pesticides, and so on (Bakhri, 2016). Excessive use of pesticides can harm humans themselves, such as poisoning humans and animals, poisoning organisms that are useful for plants such as (natural enemies of pests, pollination aids insects), can pollute the environment with pesticide residues, causing new pest strains that are resistant to pesticides. , causing a secondary pest population explosion, and can lead to pest resurgence or an increase in pest populations after being given pesticides (Hidayah, 2018).

Rice is the main food commodity for Indonesian people. The increasing population makes the demand for rice needs from year to year even greater. The government's efforts to increase rice production are increasingly being carried out and have obtained positive results in recent years (Nurhadi et al, 2020). One effort to increase rice production is to develop good and correct cultivation techniques, as well as innovations in controlling and maintaining cultivated plants and the environment by utilizing natural plant components (Erdiansyah & Putri., 2018); (Hakim et al, 2020).

An agricultural system that develops environmentally-based pest control techniques, one of which is by utilizing refugia plants which are expected to maintain the sustainability of agroecosystems in the field, by adhering to the principle of Integrated Pest Management (IPM). Refugia is a wild plant, both plants, and weeds that grow around cultivated plants, and has the potential as a microhabitat for natural enemies, both predators, and parasitoids (Allifah AF et al., 2019). The types of plants that have the

potential as refugia in Megaluh District that are effective for microhabitat are *Zinnia elegans* and *Ruellia tuberosa* because their numbers are quite dominating and the flowers are attractive enough to invite the presence of Arthropods (Nasirudin & Yuliana, 2020). Arthropods can be defined as animals that have clawed feet, and have the general characteristics of a body covered by a cuticle, an exoskeleton made of chitinous layers of protein and polysaccharides. The cuticle is thick and hard or thin like paper and is flexible in its body segments (Campbell, 2008).

METHOD

This type of research is descriptive exploratory research with a quantitative approach. This research was conducted in February 2021 in the rice field area of Dempok Hamlet, Sidomulyo Village, Megaluh District for the *Zinnia elegans* plant, while for the *Ruellia tuberosa* plant in Candi Hamlet, Sidomulyo Village, Megaluh District. Determination of the sampling point (sampling) is determined by using the purposive sampling technique. Sampling points were taken directly at the population in question, in this case, the researchers took two different study points of refugia plants, namely, *Zinnia elegans* (±2 m from the highway) and *Ruellia tuberosa* (± 7 m from the highway). The tools used in the process of collecting data in this study were stationary and notebooks, camera phones. Data retrieval using the visual control method developed by Frei and Manhart 1992 in (Wulandari, 2016) which has been modified by remote observation to observe directly Arthropods that visit *Zinnia elegans* and *Ruellia tuberosa* plants at a distance of two meters carried out at 06.00-07.00, 11.00-12.00, and 16.00-17.00. The data analysis technique in this study used SPSS which was described descriptively. The data obtained were processed using inferential statistics with a parametric paired t-test (pair-sample t-test).

RESULT AND DISCUSSION

In the results and discussion of this research, it will be explained about the findings of the Arthropods that have been found along with the documentation of the pictures of the arthropods that have been found and the daily visitation frequency of Arthropods on refugia *Zinnia elegans* and *Ruellia tuberosa* in Megaluh District.

Result

Based on the results of research that has been carried out, the Arthropoda families found in *Zinnia elegans* and *Ruellia tuberosa* in Dusun Dempok and Dusun Candi, Sidomulyo Village, Megaluh Subdistrict, were 22 families consisting of Paradoxosomatidae, Calliphoridae, Formicidae, Salticidae, Muscidae, Pentatomidae, Apidae, Vespidae, Flatidae, Gryllidae, Chrysomelidae, Crambidae, Hesperiidae, Stratiomyidae, Oxypidae, Coenagrionidae, Mantidae, Alydidae, Coccinellidae, Acrididae, Sphecidae, Pieridae can be seen in Table 1 as follows

Table 1. The Family Found in Refugia *Zinnia elegans* and *Ruellia tuberosa* in Megaluh District

No	Family	Photo	Role
1	Paradoxosomatidae		Decomposer
2	Calliphoridae		Pathogen
3	Formicidae		Predators

No	Family	Photo	Role
4	Salticidae		Predators
5	Muscidae		Pathogen
6	Pentatomidae		Pest
7	Apidae		Pollinator
8	Vespidae		Pollinator
9	Flatidae	 (Source: Supeno, et al, 2010)	Pest
10	Gryllidae		Pest
11	Chrysomelidae		Pest

No	Family	Photo	Role
12	Crambidae	 (Source: Hasbi, et al, 2016)	Pest
13	Hespiridae		Pollinator
14	Stratiomydae		Decomposer
15	Oxypidae		Predators
16	Coenagrionidae		Predators
17	Mantidae		Predators
18	Alydidae		Pest
19	Coccinellidae		Predators

No	Family	Photo	Role
20	Acrididae		Pest
21	Sphecidae	 (Source: Demetriou et al., 2021)	Predators
22	Pieridae		Pollinator

Based on the results of the calculation of the pair-sample t test using SPSS, the average daily visitation frequency of Arthropods on refugia plants of *Zinnia elegans* and *Ruellia tuberosa* species in Megaluh District can be seen in Table 2 as follows.

Table 2. Average Frequency Daily Visits of Arthropods in *Zinnia elegans* and *Ruellia tuberosa* in Megaluh District

Family	Average Frequency of Arthropods Daily Visits to Plants	
	Zinnia elegans	***Ruellia tuberosa***
Paradoxosomatidae	0,0000 individual/hour	0,5556 individual/hour
Calliphoridae	0,1111 individual/hour	0,4444 individual/hour
Formicidae	8,5556 individual/hour	14,3333 individual/hour
Salticidae	1,2222 individual/hour	1,6666 individual/hour
Muscidae	0,2222 individual/hour	0,1111 individual/hour
Pentatomidae	0,0000 individual/hour	4,0000 individual/hour
Apidae	1,0000 individual/hour	1,1111 individual/hour
Vespidae	0,0000 individual/hour	0,1111 individual/hour
Flatidae	0,1111 individual/hour	0,0000 individual/hour
Gryllidae	0,0000 individual/hour	0,1111 individual/hour
Chrysomelidae	0,1111 individual/hour	0,6667 individual/hour
Crambidae	0,0000 individual/hour	0,3333 individual/hour
Hesperiidae	0,4444 individual/hour	0,4444 individual/hour
Stratiomyidae	0,1111 individual/hour	0,8889 individual/hour
Oxypidae	0,0000 individual/hour	0,1111 individual/hour
Coenagrionidae	0,0000 individual/hour	0,1111 individual/hour
Mantidae	0,0000 individual/hour	0,1111 individual/hour
Alydidae	0,1111 individual/hour	0,1111 individual/hour
Coccinellidae	0,5556 individual/hour	0,5556 individual/hour
Acrididae	0,1111 individual/hour	0,0000 individual/hour
Sphecidae	0,0000 individual/hour	0,3333 individual/hour
Pieridae	0,4444 individual/hour	0,0000 individual/hour

Data based on t-test, significance level (2-tailed) if the value of sig <0.05 and the difference is not significant if the value of sig> 0.05. Based on the results of the pair-sample t-test using SPSS, it was found that the family Paradoxosomatidae with a significance value of 0.179, Calliphoridae 0.081, Formicidae 0.012, Salticidae 0.466, Muscidae 0.347, Pentatomidae 0.003, Apidae 0.813, Vespidae 0.347, Flatidae 0.347, Gryllidae 0.347 , Chrysomelidae 0.095, Crambidae 0.081, Hesperiidae 1,000, Stratiomyidae 0.023, Oxypidae 0.347, Coenagrionidae 0.347, Mantidae 0.347, Alydidae 1,000, Coccinellidae 1,000, Acrididae 0.347, Sphecidae 0.081, and Pieridae 0.225. There was a significant difference between Arthropods that visited the refugia plants of *Zinnia elegans* and *Ruellia tuberosa* species, namely in the Pentatomidae family with a significance value of 0.003.

Discussion

Based on observations of the research location, the rice fields in Sidomulyo Village, Dempok Hamlet, and Candi Hamlet, Megaluh Subdistrict, which is the research area, have high humidity around the land. The wind was blowing quite hard because there were no protective trees or barriers around the area. This affects the frequency of Arthropods in the area.

Based on the daily visitation frequency of Arthropods on refugia plants, *Zinnia elegans* and *Ruellia tuberosa* species in Megaluh District, 22 family were found consisting of Paradoxosomatidae, Calliphoridae, Formicidae, Salticidae, Muscidae, Pentatomidae, Apidae, Vespidae, Flatidae, Gryllidae, Chrysomelidae, Crambidae, Hesperiidae, Stratidae, Oxypidae, Coenagrionidae, Mantidae, Alydidae, Coccinellidae, Acrididae, Sphecidae, Pieridae. Each Arthropod has its own role which acts as a predator, pest, pathogen and pollinator, and decomposer. Family that has a role as predators are the Formicidae, Salticidae, Oxypidae, Coenagrionidae, Mantidae, Coccinellidae, and Sphecidae families. According to Mudjiono, 2013 in (Adnan & Wagiyana, 2020) predators are organisms that throughout their life are free to kill them both at the larval and imago stages and are usually larger than their prey. The family that has a role as pests are the Pentatomidae, Flatidae, Gryllidae, Chrysomelidae, Crambidae, Alydidae, Acrididae, and Pieridae family (if in the form of caterpillars). Pests are defined as insects that disturb or damage plants either economically or aesthetically (Meilin, 2016). The family that have a role as pathogens are the Calliphoridae and Muscidae family. Pathogens are living organisms that are micro and capable of causing disease in plants (Sopialena, 2017). Family that have a role as pollinators are family Vespidae, Apidae, Hesperiidae, and Pieridae (if in the form of butterflies) in this study found the Pieridae family in the form of butterflies. According to Hadi, 2009 in (Allifah, et al, 2020) Pollinator insects are insects that play a role in pollination, namely intermediaries for pollinating plants. The family that have a role as decomposers are the Paradoxosomatidae and Stratiomyidae family. Decomposers are organisms that act as decomposers of substances contained in dead living things (Sodikin, 2016).

Based on the results of pair-sample t-test calculations using SPSS, the average daily visitation frequency of Arthropods on refugia plants of *Zinnia elegans* and *Ruellia tuberosa* species in Megaluh District, the highest frequency of daily visits is the Formicidae family with an average daily visitation frequency of 8.5556 individuals/hour on *Zinnia elegans*, while the highest family of *Ruellia tuberosa* was the Formicidae family with an average visit frequency of 14.3333 individuals/hour. Based on the opinion of Van Mele and Cuc, 2004 (Wulandari, 2016) stated that the Formicidae family likes fresh air, likes environments with temperatures between 26-34 °C and relative humidity between 62 to 92%. This is in accordance with the conditions at the time of observation. The Formicidae family is a natural enemy because it can disturb, hinder or prey on various types of pests such as green ladybugs, leaf-eating caterpillars, and fruit-eating insects. The lowest average daily visit frequency for *Zinnia elegans* plants is the family Paradoxosomatidae, Pentatomidae, Vespidae, Gryllidae, Crambidae, Oxypidae, Coenagrionidae, Mantidae, Sphecidae with an average daily visit frequency of 0.0000, while in *Ruellia tuberosa* plants are families Flatidae, Acrididae, Pieridae with the average frequency of daily visits is 0.0000.

In the *Zinnia elegans* and *Ruellia tuberosa* plants based on the t-test, the significance level (2-tailed) there was a significant difference in the Pentatomidae family with a significance value of 0.003, where the Pentatomidae family visited the *Ruellia tuberosa* plant more than the *Zinnia elegans* plants because based on research results (Kirana, 2015) regarding the spatial distribution of arthropods in wild plants in the biology garden of the Faculty of Mathematics and Natural Sciences, State University of Malang, stated that the Pentatomidae family was found on the edge of the road and deeper than the road, caused by disturbance factors that insects might get when approaching wild plants can be human

interference. This is in accordance with what has been experienced by researchers in the field, where the location of the *Ruellia tuberosa* refugia plant on the side of the road is deeper than the road so that quite a lot of the Pentatomidae family is found, than in the *Zinnia elegans* plant, while in family other than There is no significant difference in the Pentatomidae family, this can happen because based on Rianti's 2009 statement in (Resti, 2015). Arthropoda visiting behavior is influenced by competition between Arthropods in getting food, so that a low population of certain Arthropods can increase the frequency of visits to other Arthropods, and vice versa. In this study, the Gryllidae family was found to be active during the day, while in general the Gryllidae family was active at night. This can happen because of the rainy season, so it has an impact on the existence of this family. In accordance with the opinion of Hasyimuddin, et al, 2017 in (Pariyanto, et al, 2019) which states that theoretically animals will actively move from one environment to another, if there is a temporary environmental change, for example rain.

CONCLUTION

The conclusion from the study of the frequency of daily visits of arthropods on refugia plants of *Zinnia elegans* and *Ruellia tuberosa* in Megaluh District is that 22 families have been found consisting of Paradoxosomatidae, Calliphoridae, Formicidae, Salticidae, Muscidae, Pentatomidae, Apidae, Vespidae, Flatidae, Gryllidae, Chrysomelidae, Crambidae, Hesperiidae, Stratiomyidae, Oxypidae, Coenagrionidae, Mantidae, Alydidae, Coccinellidae, Acrididae, Sphecidae, Pieridae. Based on the results of the pair-sample t-test using SPSS, the family Paradoxosomatidae with a significance value of 0,179, Calliphoridae 0,081, Formicidae 0,012, Salticidae 0,466, Muscidae 0,347, Pentatomidae 0,003, Apidae 0,813, Vespidae 0,347, Flatidae 0,347, Gryllidae 0,347, Chrysomelidae 0,095, Crambidae 0,081, Hesperiidae 1,000, Stratiomyidae 0,023, Oxypidae 0,347, Coenagrionidae 0,347, Mantidae 0,347, Alydidae 1,000, Coccinellidae 1,000, Acrididae 0,347, Sphecidae 0,081, and Pieridae 0,225. This research is expected to provide insight to the wider community, especially the people of Megaluh District so that the community can use the refugia plant species *Zinnia elegans* and *Ruellia tuberosa* to control pests and as an alternative way to replace pesticides in increasing farmer production and maintaining ecosystem stability and this research can also be used as a reference for similar research, for example, temporal distribution, spatial distribution and so on.

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