Population Dynamics of Canopy Arthropods On Chili With Organik Treatment Plant

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Abstract
This research aimed: (1) to study the type of canopy arthropods on chili plant with organic treatment, (2) to study population dynamics of canopy arthropods on chili plant with organic treatment. This observation was carried out for 14 weeks and data retrieval once every two weeks. This research used scan sampling at every plot. Data of canopy arthropods classified into several types based on food source. Collected data were analyzed with descriptive analysis which diversity index, relative abundance, and cluster analysis. The result showed population dynamics of canopy arthropods on chili plant with organic treatment were fluctuated. Fluctuated happened every niche of arthropods herbivore, carnivore and saprophagous. At the vegetative phase canopy of chili dominated by arthropods herbivore like a Aphis, but at the generative phase canopy of chili dominated by arthropods herbivore and arthropods carnivore which acts as insect pollination and predator for pest.

Keywords: Population dynamics, canopy arthropods, chili plants

1. Introduction

The growth of chili pepper in Indonesia is uncertain, it can be influenced by various things such as OPT (Organisme Penggangu Tanaman), irrigation, improper seed selection, adequate land availability, bad weather and not As well as pest and disease attacks [6]. One of the most common forms of interference comes from pest (plant destruction organisms). Pests can be derived from arthropods around the planting area that could damage the plant. Arthropods become one of the factors affecting the surrounding crops, it is due to the existence of arthropods visiting the chili pepper to bring negative impacts and positive impacts. Negative impacts such as the presence of viruses in chili pepper transmitted by insects, while the positive impact is arthropods can become pollinators on flowering process until fertilization [1]. Arthropods are derived from the Greek, that is *arthos* which means hinge and *podos* that mean legs, so the main characteristic of this animal is the legs that are composed of the segments.

Arthropods have very various types. Versatility reached 800.000 species, and had habitats that were both at sea and land [3]. According to [1], the grouping of arthropods based on the type of food is divided into 3

which include: herbivorous arthropods, carnivorous and saprophagous. The process of growing chili plants will be followed by other changes occurring in the environment, such as the existence of living creatures that are changing because of the changing food sources.

Population dynamics is an ecological study that can be used in studying insect populations as well as regeneration of insects. According to Emden and Harrington, (2007) The population dynamics is used to gain the knowledge of the theory and practice of pest control. The occurrence of the population dynamics process is due to fluctuations in a population over a long span of time.

This research is using organic land as a medium to grow chili plants. The treatment is given because conventional agricultural systems that use synthetic pesticides have a negative impact in the form of pollution on land environment as well as resistance to pests and the loss of natural pests in chili plants. According to Widiarta, (2006:61) that the use of organic treatment makes stability in the ecosystem and demonstrates an increase in the diversity of netral arthropods, so the selection of treatment organically is expected to have an impact on plants, soils, and for animals in these land environments, and are expected to provide environmentally friendly impacts and can create a natural ecosystem [9].

This research aims to find out the type of arthropods on chili pepper plants with organic treatment as well as to find out the population dynamics of canopy arthropods.

2. Research Methods

The research location was at the UNY Biology Garden. Observations were made on 10 plots, and each plot consisted of 4 pots of chili plants. The chili used is cayenne pepper (*Capsicum frutescens*) variety is ORI 212 with organic treatment. Data collection begins at the age of chili which has entered 2 MST, and ends at 14 MST. Observation is only limited to arthropods found in the canopy of chili plants. Observations begin at 08.00 pm until 11.00 pm.

a. Types of research

This research is an observational study by observing canopy arthropods directly on chili plants. This study uses a qualitative descriptive statistical approach. This study was carried out for 4 months, starting from August-November 2018 at the UNY Biology Garden.

b. Research subject

The subjects in this study were canopy arthropods found in chili plants, which were found in 10 plots and in each plot there were 4 chili plants. The data collection technique is quantitative by counting the number of arthropod individuals who visit the canopy.

c. Research procedure

The study began on chili plants that were 2 MST. Data retrieval is done by direct observation or scan sampling on each plot. Canopy arthropods are identified by taking pictures using a DSLR camera. Climatic factor measurements are carried out 2 weeks together with data collection of canopy arthropods. Identification of arthropods was carried out using the Key Insect Determination guidebook belonging to the National Program for Training and Development of Integrated Pest Management, Entomology Edition Three (Cedric Gillot, 2005), The Pets of Crops in Indonesia (Kalshoven, 1981) and other books.

d. Data analysis technique

The arthropods that have been obtained were analyzed using Relative Abundance and Clustering Analysis based on Bray Curtis's similarity index.

3. Research Results And Discussion

The arthropods that have been obtained are divided into 3 nisia according to the type of food namely: herbivore arthropods, carnivore arthropods and saprophagous arthropods.

Table 1. Diversity of arthropods of chili plant roots

Nisia	Genus	Family	Ordo	Total
Herbivore	Acanthocoris	Coreidae	Hemiptera	30
	Aphis	Aphididae	Hemiptera	21
	Apis	Apidae	Hymenoptera	9
	Atractomorpha	Pyrgomorphidae	Orthoptera	5
	Bactrocera	Tephritidae	Diptera	4
	Crysosoma	Dolichopopidae	Diptera	30
	Culex	Culicidae	Diptera	3
	Euricania	Ricaniidae	Hemiptera	1
	Junonia	Nymphalidae	Lepidoptera	1
	Lasioglossum	Halictidae	Hymenoptera	6
	Lawana	Flatidae	Hemiptera	3
	Nezara	Pentatomidae	Hemiptera	6
	Parnara	Hesperiidae	Lepidoptera	1
	Planoccocus	Pseudococcidae	Hemiptera	1
	Potantus	Hesperiidae	Lepidoptera	1
	Pyrgomorpha	Pygomorphidae	Orthoptera	1
	Trigona	Apidae	Hymenoptera	34
		Sub Total		157
Carnivore	Agriocnemis	Coenagrionidae	Odonata	1
	Camponotus	Formicidae	Hymenoptera	25
	Oxyopes	Oxyopidae	Araneae	4
		Sub Total		30
Saprophago	Hermetia	Stratiomydae	Diptera	11
us	Hydrotaea	Muscidae	Diptera	5
	Lucilia	Calliphoridae	Diptera	2
	Mydidae	Mydidae	Diptera	2
	Sarcophaga	Sarcophagidae	Diptera	2
		Sub Total		22
		Total		209

Based on Table 1, it is known that the most commonly found herbivore arthropods are herbivore arthropods, with a genus of 17 genera. Most herbivore arthropods are found because there are many food sources in the area in the form of plants. The role of herbivore insects can also be pests that eat leaves. In the study of Musyafa (2008) [3], explaining that herbivore type arthropods in Wanagama forests act as pests that eat leaves, the presence of attacks in the form of pests does not cause death in plants.

However, it is undeniable if the population of herbivore arthropods is excessive, it can cause death in plants. According to [1], it was mentioned that herbivore type arthropods besides eating leaves, this type of arthropod also ate plants by sucking liquids on plants in plants. As a result, many leaves turn curly and brown until they eventually wilt. This damage can occur due to arthropods taking fluid in plants and making damage to plant tissue. As for the existence of Aphis pests that damage plants to suck liquids that are inside cells, and can be vectors for several types of viruses [7].

Herbivore arthropods found with the most number of individuals are the genus Trigona as many as 34 tails. The Genus Trigona is one of the arthropods, based on chili pepper. According to Widhiono, 2015, it is said that Trigona had a meal influenced by the availability of food in nature, but Trigona's visit was influenced by environmental factors including: humidity, Light intensity, weather humidity and wind speed [7]. Trigona is most commonly found in the generative phase and the production phase of chili plants.

The production phase begins when the plant grows the first flower and ends when the plant has not been able to bear fruit normally [7]. In the vegetative phase the most individual number of herbivore arthropods

found is the genus Acanthocoris. The existence of this genus potentially as pests in chili plants. The genus Acanthocoris known to put his eggs on the leaves of the chili pepper, in addition it is known that the genus Acanthocoris also take liquids that reside in the young stems of chili pepper plants, while seeking shelter then the genus Acanthocoris Use under planting area (under pot) or to bushes located around the planting area of chili peppers.

In the most abundant quantities of carnivore arthropods are in the family Formicidae or ants. Family Formicidae live in groups. The existence of family Formicidae or ants on the header of chili plants is possible due to food sources, as well as habitats suitable for living ants. It is known that the role of ants is symbiotically with pests in chili pepper plants in the form of Aphis that is often found in the leaves of chili pepper. Symbiotic is shown in the form of ants taking part of the Honey Dew which is the result of excretion from Aphis, and Aphis benefit from being protected from other predators [8].

Arthropods of saprophagous that have the most number are Hermetia, with a total number of 11 individuals. Hermetia originated from the order of Diptera. Hermetia is often found in humid situations and has a lot of nutrients. Nutrients can be derived from organic waste that has undergone a process of decay [2]. It is according to the condition of observation in the field that there are various leaves from plants around the land and the existence of other crops such as the presence of jackfruit trees (*Artocarpus heterophyllus*), *Morus* sp., *Annona* sp., and *etc*.

Based on the results of the calculations shows that the population dynamics of arthropods with relative abundance calculations on each of the nisia arthropod of chili pepper, according to the growth phase of chili plants ranges from 0%-96.0%. The relatively high abundance of herbivorous arthropods on the first observation with a relative abundance of 96.0%.

The population dynamics of arthropods according to calculation of relative abundance fluctuation, both on each observation and on herbivorous arthropods, carnivorous arthropods and saprophagous arthropods. When viewed from all observations, the existence of herbivorous type arthropods always have the highest value of abundant abundance, it occurs because the availability of the needed food sources is fulfilled. The presence of chili pepper producers is always growing at all times, so that the food needs of herbivorous arthropods can be fulfilled.

The presence of herbivore arthropods shows fluctuations, both in the vegetative and generative phases. In the vegetative phase the abundance of herbivore arthropods is dominated by genus which has the potential as a pest for chili plants, such as the genus Aphis and genus Acanthocoris, whereas in the generative phase, the dominant arthropods are neutral arthropods which act as pollinator insects on chili flowers.

The highest abundance value of carnivore arthropods is found in the 7th observation that is influenced by the abundance of the family Formicidae or ants. Ants love the soil area that has a soil temperature that is not too cold, so that the individual ants become abundant in each ecosystem [10], so that many family Formicidae found in the area under the pot planting chili. Abundance arthropod saprophagous in the vegetative phase and the generative phase indicate the presence of differences. Differences in the abundance of saprophagous arthropods in the vegetative phase and the generative phase of chili plants, due to the participation of human intervention in the process of cleansing litter around the chili plantation. Arthropod saprophagous liked the area that had many sources of nutrients to sustain his life. In addition, the accumulated and moist litter condition can be used as a shelter.

The above is in accordance with the theory that, saprophagous arthropods can be found in the region of chili planting because of the number of litter that has been decaying. Nutrients for the food sources of arthropods come from the organic waste that has undergone a process of decay [2], so that the saprophagous arthropods can be fulfilled the food needs.

The results of the arthropods on each observation were then grouped *using Bray Curtis ' similarity index* based on the number of individuals of carnivorous and herbivorous arthropods.

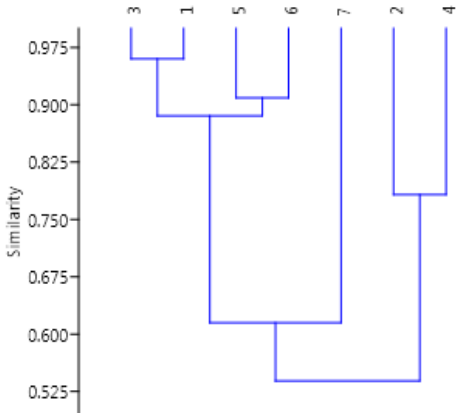

Figure 1. Dendogram of arthropods herbivore and carnivore in every observation

Based on the dendogram graph, it was found that the grouping was divided into 5 groups, consisting of group I, consisting of the 3rd and 1st observations, group II consisting of the 1st observation, 3rd observation and 5th observation, for groups III consists of the 3rd, 1st, 5th and 6th observations, group IV consists of the 2nd and 4th observations. Group V consists of the 3rd, 1st, 5th, 6th and 7th observations.

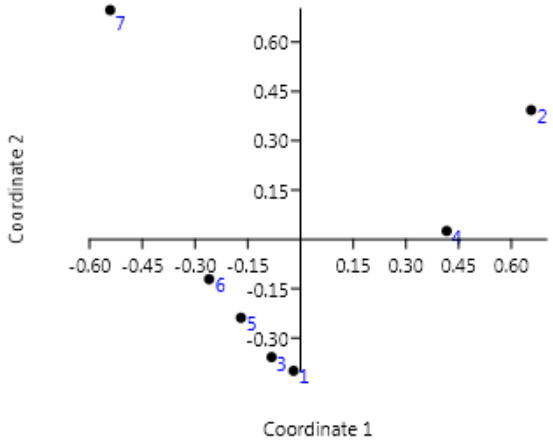

Figure 2. Coordinates of Carnivore and Herbivore Type Arthropods in Each Observation

Figure 2 shows the grouping of carnivore and Herbivore types of arthropods in each observation grouped in 3 coordinate parts using ordination Principal Coordinates (PCoA). Similarity indexes are grouped into 3 quadrants. The first group is in observations 1, 3, 5, and 6 of the second group in observations 2 and 4, and in the third group is the 7th observation. The difference in the location of similarity index points in each coordinate is based on the number of individuals obtained.

Based on Figure 1 and Figure 2, grouping occurs is possible because the environmental conditions and also the food source in each observation are almost the same, thus indicating the number of adjacent arthropods.

However, the 7th observation was found on the quadrant itself. this happens because the similarity index value in the 7th observation is different and has the greatest value when compared to other observations. This phenomenon can occur because at the 7th observation the condition of chili plants is already harvesting, so that there is a change in the condition of the chili plants in the form of reduced fruit and chili flowers.

.According to Ma'ruf, 1997 diversity and species abundance occur based on the development of the phase of plant growth as its habitat.

4. Conclusions

The type of arthropod obtained as many as 25 arthropod genus consisting of 22 families, and 7 orders. The diversity of the genus of arthropods is dominated by herbivorous arthropods. The population dynamics occurring in the heading arthropods of chilli plant for 14 weeks showed a fluctuation in both herbivore, carnivore and saprophagous arthropods. In the vegetative phase, the title of chili plant is dominated by the potentially as pests such as Aphis and Acanthocoris, while in the generative phase of chili plants dominated by herbivorous arthropods that act as arthropod pollinators Like the genus Lasioglossum, Trigona and Apis and is dominated also by carnivorous arthropods such as the family Formicidae.

5. References

[1] Borror, Donald J., Charles A. dan Norman F. Johnson. *Pengenalan Serangga* Edisi Keenam diterjemahkan oleh drh. Soetiyono Partosoedjono. Yogyakarta: Gadjah Mada Press.

[2] Egga, D. P. R. (2017). Pengaruh Penggunaan Bahan Cair Larva Lalat Tentara Hitam (*Hermetia illucens*) pada Pertumbuhan Tanaman Cabai. *Skripsi*. Bogor: Institut Pertanian Bogor.

[3] Kastawi, Yusuf, dkk. (2005). *Zoologi Avertebrata.* Malang: UM Press.

[4] Musyafa, S., Ananto Triyogo. (2008). *Laporan Penelitian Peranan Serangga Herbivora dalam Proses Suksesi di Hutan Pendidikan Wanagama*. Lab. Perlindungan dan Kesehatan Hutan Fakultas Kehutan. Universitas Negeri Gadjah Mada.

[5] Nawangsih, A. (1999). *Cabai Hot Beauty*. Jakarta: Penebar Swadaya.

[6] Noviyanti A, , D., Eko W., dan Suwasono Heddy. (2017). Pengaruh Naungan pada Pertumbuhan dan Hasil Tiga Varietas Cabai Rawit (*Capsicum frutescens* L.). *Jurnal Produk Tanaman*. *Vol. 5 No. 1. Hal: 1755-1761*.

[7] Rezi, Y.A., Jasmi, dan Nursyahra. (2017). Aktivitas Kunjungan Lebah *Trigona* sp. Pada Tanaman Mentimun (*Cucumis sativus* L.) di Dua Ketinggian di Sumatera Barat. STKIP PGRI Sumatera Barat.

[8] Suriana, Neti. (2013). *Budidaya Cabai di Lahan yang Sempit*. Semarang: Intra Pustaka.

[9] Widiarta, I, Kudiaman D, dan Suprihanto. Keragaman Artropoda pada Padi Sawah dengan Pengelolaan Tanaman Terpadu. *Jurnal Tropika. Vol. 6. No. 2. Hal: 61-69.*

[10] Yuniar, N., Noor F.H. (2015). Keanekaragaman Semut (Hymenoptera: Formicidae) pada Empat Tipe Ekosistem yang Berbeda di Jambi. *Prosiding Seminar Nasional Masy. Biodiversitas.Vol. 1. Hal. 1582-1585*.