The Effect of Forests on Insect Diversity on Agricultural Land in Karangsari Village

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Abstract. Agricultural land in Karangsari Village is close to the Mount Ciremai National Park (MCNP) conservation area. Vegetable production fluctuates every season, its can be caused by the presence of insects, both pollinators, pests and predators. The purpose of the study was to determine the effect of the forest on the diversity of insects. Exploration method was used to identify insect species by installing traps using a swip net, pit fall trap, and yellow trap at 5 horticultural land locations with an interval of 100 m. Each observation point was repeated 3 times in the form of an observation path. The distance between the observation lines is 100 m. Observations and trapping were carried out for 7 consecutive days. The results of the study found 10 orders and 57 species with a value of H'= 3,42. There are 10 orders and fifety seven (57) species insects are found.The total number of individuals is five hundred and seventy three (573) with Value of H'= 3.285 (High diversity). There is no correlation between the distance of forest and agricultural land on insect diversity (sig.=0.376), while in the number of species to the population there is a significant correlation (sig.= 0.01)

Keywords*:* agricultural, diversity, forest, insects, populations

1 Introduction

Agricultural land in Karangsari Village is close to the Mount Ciremai National Park (TNGC) conservation area. However, vegetable production fluctuates every season. One of the causes of ups and downs in vegetable production is the presence of insects, both pollinating insects (pollinators) and insects that are pests and predators. Based on this, it is necessary to conduct research on the influence of the forest on the presence of insects in that location.

Insects have an important role in human life, especially in agriculture. The anthropocentric view of insects often sees insects as a group of organisms that do more harm than good to human life. In fact, directly or indirectly insects play a role in the life of other living things, both beneficial and harmful. Insects that are beneficial for example as plant pollinators, producers of honey, and also as natural enemies of insect pests, while insects that harm humans such as insect pests, parasites, transmitting diseases and so on. The presence of insects in an agricultural habitat is influenced by several factors, including cultivation techniques, monoculture and polyculture [1], use of insecticides and the presence of natural habitats [2]. Natural habitat around agricultural land is defined as an area that has a minimum area of 0.5 ha in which there are various types of annual plants and is not used for plant cultivation [3].

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Forests are the natural habitat of insects. Natural habitats can provide important resources for insects, providing resources, such as food, alternative hosts, and shelter. However, the richness and abundance of insect species in an agricultural habitat is influenced by the distance of the natural habitat from agricultural land [4]. Several studies have shown that the diversity and abundance of insects is higher in forest ecosystems or agricultural land adjacent to forest areas compared to monoculture farms. The close proximity of natural habitats from agricultural land can increase the diversity and species richness of flower-visiting insects [5][6]. In addition, land use types, seasonal differences, and regional differences also affect insect diversity [7].

The purpose of this study was to determine the diversity of insects on agricultural land adjacent to the forest area (TNGC) and to determine the relationship between the distance of agricultural land and forest to insect diversity.

2 Methodology

The research was carried out in August – September 2020 on the agricultural land of the Karangsari Village community, Darma District, Kuningan Regency with an agricultural area of 203.9 ha. The tools used are: thermometer, insect trap (yellow trap, light trap, and swip net), GPS, plastic container, stationery, and tallysheet.

The research method used is an exploratory method, by installing traps at 5 points of horticultural land locations with an interval of 100 m. Each observation point was repeated 3 times in the form of an observation path. The distance between the observation lines is 100 m. Thus there are a total of 15 observation points. Daytime observations were carried out at 09.00-10.00 WIB and 17.00-18.00 WIB using a swip net, pit fall trap, and yellow trap. For the night, light traps are installed throughout the night starting at 18.00 WIB. Observations and trapping were carried out for 7 consecutive days. The insects found were identified by observing morphological similarities using the identification methods Borror [8], Suin [9], BugGuide.net 2013, and Discoverlife.org. The identification stage was carried out in the laboratory of the Faculty of Forestry, Universitas Kuningan. The variables observed were insect species, number of species, functional groups and total population.

Species diversity was determined by calculating the diversity index using the Shanon Wienner H' formula referring to [10], with the formula:

$$H' = \sum_{i=1}^{N} pi \ln pi$$

Information :
H' = index of species diversity
S = number of species
pi = total sample proportion calculated from the i-th species = 1
pi = ni/N
ni = number of individuals of the i-th species
N = total number of individuals caught from all species

Product Moment Pearson correlation analysis was used to determine the relationship between the distance of agricultural land and forest to insect diversity.

3 Results and Discussion

3.1. Diversity of Insects

The types of insects found were classified into 10 orders with a total of 50 species and a total number of 573 individuals (Table 1). Functionally, the insects found were classified into 6 groups, namely: pests, soil fertilizers, natural enemies, pollinators, decomposers, and neutrals. Meanwhile, 4 individual insects were not identified so that the functional group could not be identified. According to their functional groups in the ecosystem, the most common insects found were pests, natural enemies, pollinators, decomposers, neutrals and soil fertilizers, respectively (Figure 1).

Table 1. Types of insects found

No.	Order	Local name	Scientific name	∑ Individual	Functional group
1	Coleoptera	Kumbang daun	*Aulacophora*	1	Pest
		Kumbang kotoran	*Canthidium*	2	Soil fertilizer
		Kumbang macan	*Cicindela aurulenta*	1	Natural enemies
		Kumbang boleng	*Cylas formicarius*	4	Pest
		Kumbang klik	*Elateridae*	6	Pest
		Kumbang lembing	*Heteroneda reticulata*	5	Natural enemies
		Kumbang lembing	*Henosepilachna viginitioctopunctata*	12	Natural enemies
		Tomcat	*Paederus littoralis*	2	Natural enemies
2	Dermaptera	Earwig hitam	*Chelisoches morio*	3	Natural enemies
		Earwig	*Labidura riparia*	61	Natural enemies
3	Diptera	Lalat kosmopolitan	*Dolichopus urbanus*	14	Natural enemies
		Lalat tentara hitam	*Hermetia illucents*	15	Decomposer
		Lalat bangau	*Nephrotoma flavipalpis*	1	Neutral
		Lalat daging	*Sarcophaga carnaria*	5	Neutral
		Lalat bunga	*Syrphus ribesii*	4	Pollinator
		Lalat perampok	*Zosteria sp*	4	Natural enemies
4	Hemiptera	Kepik sejati	*Deraeocoris*	10	Pest
		Serangga benih	*Kleidocerys resedae*	17	Pest
		Walang sangit	*Leptocorisa acuta*	8	Pest
		Kepik hijau	*Nezara viridula*	5	Pest

		Serangga berpunggung patah	*Taylorilygus apicalis*	20	Pest
5	Hymenoptera	Tawon laba laba	*Pompilidae*	3	Pollinator
		Lebah	*Campsomeris plumipes fossulana*	17	Pollinator
		Tawon ikhneumon	*Netelia ephippiata*	9	Natural enemies
		Semut perangkap rahang	*Odontomachus sp*	4	Natural enemies
		Semut	*Pachycondyla sp*	13	Natural enemies
		Tawon mason	*Pison spinolae*	54	Pollinator
		Tawon predator asia	*Vespa velutina*	9	Natural enemies
		Tawon parasitoid	*Xanthocryptus novozealandicus*	9	Natural enemies
		Lebah kayu	*Xylocopa*	2	Pollinator
6	Lepidoptera	Ngengat	*Anisota virginiensis*	5	Pest
		Ngengat	*Arna pseudoconspersa*	2	Pest
		Skiper	*Erynnis tages*	12	Pollinator
		Ngengat bertanduk panjang	*Lecithoceridae*	1	Pest
		Ngengat putih marsin	*Nyctemera adversata*	3	Pest
		Ngengat tineid	*Tineola sp*	58	Pest
		Kupu kupu	*Vanessa sp*	2	Pollinator
		Belalang sembah coklat	*Archimantis latistyla*	1	Natural enemies
7	Mantodea	Belalang sembah	*Hierodula patellifera*	1	Natural enemies
		Lacewing mata emas	*Chrysopa oculata*	66	Natural enemies
8	Neuroptera	Capung	*Orthetrum sabina*	1	Natural enemies
9	Odonata	Belalang pocong	*Atractomorpha crenulata*	12	Pest
10	Orthopetra	Belalang padi	*Dichormorpha viridis*	10	Pest
		Belalang kembara	*Locusta migratoria*	1	Pest
		Jangkrik semak	*Meconema meridionale*	6	Pest
		Belalang kayu	*Melanoplus cinereus*	1	Pest
		Kriket pohon	*Neoxabea sp*	5	Pest
		Belalang antena pendek	*Pezotettix giornae*	1	Pest

		Cihcir	*Tettigonia viridissima*	5	Pest
		Belalang kayu	*Valanga nigricornis*	2	Pest
		Lalat kadis	*Limnephilus sp*	43	Pest
		Ngengat	Not Known (sp 37)	11	Pest
11	Tidak diketahui	Tidak diketahui	Not Known (sp 38)	3	Not Known
		Kumbang	Not Known (sp 47)	1	Not Known

The number of insect pests found can be caused by the use of inappropriate or excessive insecticides in crop cultivation practices. The use of insecticides, especially at sublethal doses, can have an impact on insect pest resurgence [11].

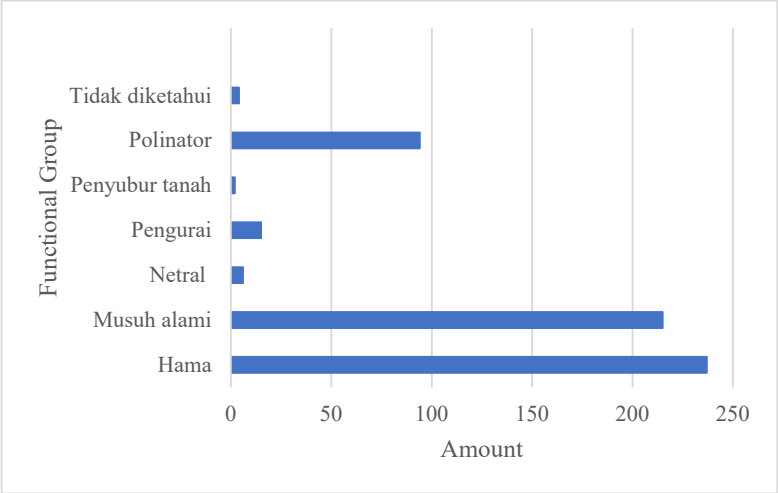

Figure 1. functional Group of Insect

The diversity of insects in all ranges of distances from agricultural land to forests is included in the high category (H'>3). The highest diversity of insects was found at a distance of 400 m (H'=3.682) and the lowest diversity was found at a distance of 500 m (H'=3.175). This is thought to be caused by differences in vegetation where the vegetation at a distance of 400 m is planted with coffee, wildflowers and chili plants. Meanwhile, at a distance of 500 m, the vegetation is dominated by non-flowering weeds and weeds. Vegetation, TSP concentration in the air, canopy cover, light intensity, and wind speed are the factors that most influence the presence of insects [12]. In addition, this difference can be caused by differences in climate, season, altitude, and type of food [13]. At the time the research was carried out, the temperature ranged from 19-21℃ with humidity 88-90%, thus making insects feel comfortable. At a higher temperature of 24.75℃ and humidity of 79.14%, insect diversity is in the moderate category [14].

Table 2. The Diversity Index of Insects

Distance (m)	*Shannon-Wiener* Diversity Index
100	3,189
200	3,551
300	3,506
400	3,682
500	3,175

From these criteria, it shows that the insect diversity index at each distance and on the agricultural land of the Karangsari Village community has a high diversity value. The greater the number of species and the more evenly the distribution of species in abundance, the higher the diversity of the community. In a community with high diversity, a population of a particular species cannot be dominant [15]

3.2. The Effect of Forests on the Presence of Insects on Agricultural Land

The results showed that there was no correlation between the distance between forest and agricultural land on the number of species (sig.=0.1), the number of individuals (sig.=0.078), and insect diversity (sig.=0.736). A significant correlation occurred in the number of species to the number of individuals (sig.=0.001). This can be caused because the distance interval used in the observation is too close. So that at the furthest distance (500 m), the insects found are relatively the same type. [5] classifies close distances to natural habitats (less than 200 m) and far from natural habitats (more than 1000 m). The results showed that the difference in the distance between natural habitat and agricultural land affected the diversity of flower-visiting insect species, but had no effect on their abundance. This is in accordance with research [16] which states that the number of individual pollinating insects visiting strawberry and tomato plants decreases as the distance from the forest boundary increases.

The theoretical and practical implications of the research are as follows: 1) Selection of the right method to reduce the pest population, namely by reducing the use of unwise insecticides because it causes the natural enemies of pests to decrease while the pests themselves increase or resurgence, namely, the emergence of a population explosion of a certain pest after receiving treatment. Pesticides [17], 2) For methods of developing pollinator insect conservation, namely by increasing the number and abundance of flowering plants as a source of food, maintaining suitable habitats that are able to provide nesting places and availability of feed throughout the year [18].

4 Conclusion

1. There are 10 orders and fifety seven (57) species insects are found.The total number of individuals is five hundred and seventy three (573) with Value of H'= 3.285 (High diversity)
2. There is no correlation between the distance of forest and agricultural land on insect diversity (sig.=0.376), while in the number of species to the population there is a significant correlation (sig.= 0.01)

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