Diversity of Insects in Leweung Buah, Mount Ciremai National Park Area

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Abstract. Insects have both positive and negative sides to humans, both directly and indirectly. This study aims to determine the diversity of insects in Leweung Buah Gunung Ciremai National Park area. Data collection in this study used the sweep net method, food trap and literature study on insect morphology. Data analysis used relative frequency and relative density, while diversity used the Shannon Winner Index and morphological identification using the google lens method, Identification guide for butterflies of West Java: families Papilionidae, Pieridae and Nymphalidae and BugGuide.net 2013, Discoverlife.org. The results showed that Leweung Buah in Gunung Ciremai National Park has 8 orders which include: Araneae, Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Odonata and Phasmatodea. And 39 species with the highest number of species, *Lethe confusa godana*, and the least *Ariadae pravera esra*, *Cupha clagia clagia* and *Delias dorylea dorylea*. The largest relative density is occupied by thespecies *Idea ieuconoe javana* with a percentage of 16.11% and the lowest is in the *Lucilia sericata*, *Apis cerana* and *Appias leptis leptis* species, for the largest relative frequency it is occupied by thespecies *Lethe confusa godana* with a percentage of 13.33%. and the lowest was in the species *appias leptis leptis*, *Ariadae pravera esra* and *Chersonnesia rahria rahria* with a percentage of 1.11%. For the diversity of insects in Leweung Buah, Gunung Ciremai National Park, it is categorized as high and acts as a pollinator that maintains ecosystem stability.

Keywords: diversity, insects, relative density, relative frequency

1. Introduction

Indonesia is a country with a large biodiversity, both flora and fauna, one of which is the diversity of insects which have a total of 250,000 species, or about 15% of the main types of biota known in Indonesia [1].

Insects have both positive and negative sides to humans, both directly and indirectly. For example, insects that are useful as plant pollinators, producers of honey, and natural enemies of pests, as well as insects that have a negative impact such as pests, parasites, and disease carriers [2]. Insect diversity is found in various places, with the lowest diversity found in biomes with extreme environmental conditions such as arid areas and high mountains, while high diversity is found in optimal, fertile, nutrient-rich soils, and mountainous areas [3].

The optimal environment is an environment that is favorable for the growth of insects for both shelter and foraging needs and has environmental factors such as temperature, humidity, wind speed, and optimal light intensity. The optimal temperature for insects is 15-25%, optimal humidity for insects is 50-90%, while wind speed and light intensity have different effects on

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each insect, including insects that are inversely proportional to wind speed, ie if the wind speed is getting stronger. then the number is getting smaller [4].

Gunung Ciremai National Park has a sustainable ecosystem ranging from lowland rain forest (700-1,000 m asl) mountain rain forest (1,000-2,400 masl) and sub-alpine mountain forest (> 2,400 masl) with temperatures around 18°-22 ° [5]. Gunung Ciremai National Park is a potential habitat for insects so that insects are found in almost all ecosystems, the more places with various ecosystems there are various types of insects [6].

Therefore, a study on insect diversity was carried out because this area is one of the mountainous rain forest ecosystems which is an optimal environment for insects and can provide information about what types of insects are present in fruit leweung so that the role of insects in this ecosystem can be known.

2. Methodology

This research was carried out for 1 month, starting in May – June 2021. The location of this research is in Leweung Buah, Gunung Ciremai National Park, Kuningan Regency.

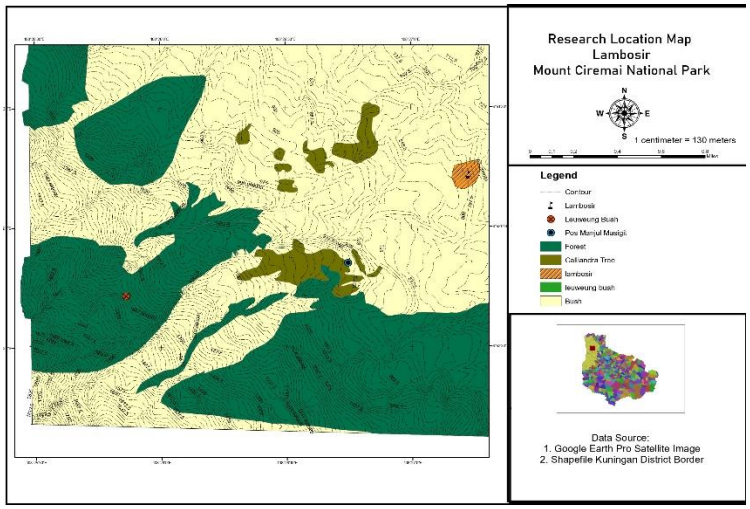

Figure 1. Research Location Map

The tools and materials used in this research are Global Positioning System (GPS), Swipe Net, Plastic samples, Stationery, Tally Sheat, Bananas and urine, food traps, cameras and the object of this research is insects.

Data collection was carried out using the method:

1. **Food Trap**

   Food Trap is a trap made of nylon paranet in the form of a tube that is hung and filled with bait in the form of bananas and urine to attract insects which are then separated and then inserted into the plastic sample.

2. **Sweep Net**

   Sweep net is a trap made of light and strong like gauze, easy to swing and the caught insects can be seen. The captured insects were then collected and separated and then put into plastic samples for identification.

Research data in the form of insects found in all plots at the study site were identified by observing morphological similarities using the identification method [7], Google Lens and BugGuide.net 2013, Discoverlife.org. The identification stage was carried out at the Laboratory of the Faculty of Forestry, Kuningan University. After identification is made in the form of type data that has been collected, it is analyzed tabulated and presented in the form of photos and tables. Further analyzed using the following formula:

1. **Absolute Density**

   Density shows the number of insects found in the habitat expressed in absolute terms [8].

$$KM = \frac{number\ of\ individual\ insect\ species\ caught}{number\ of\ arrests}$$

2. **Relative Density**

   Density shows the absolute density of individual species found in the habitat expressed in relative terms [8].

$$KR = \frac{the\ absolute\ density\ of\ the\ individual\ species}{total\ density}\ x\ 100\%$$

3. **Absolute Frequency**

   Absolute Frequency indicates the number of presence of a particular insect found in the habitat of each observation which is stated absolutely [8].

$$FM = \frac{number\ found\ a\ type}{total\ number\ of\ arrests}$$

4. **Relative Frequency**

   Frequency indicates the Absolute Density of individual species found in the stated habitat relatively [8].

$$FR = \frac{absolute\ frequency}{absolute\ frequency\ amount} x100\%$$

5. **Species Diversity Index**

   To compare the high and low diversity of insect species, namely the diversity of insect pests and natural enemies, the Shanon-Weiner (H) index is used with the formula:

$$H' = -\sum pi\ In\ pi$$
$$Pi = ni/N$$

   Information :

H' = Diversity index
Pi = Comparison of the number of individuals of a species with the whole species
ni = Number of species caught
N = Total number of individuals of all species

With the diversity index criteria are as follows [3] :
Jika H' < 1 : Means Insect Diversity is Low
Jika H' 1-3 : Means Insect Diversity is Medium

Jika H' > 3 : Means Insect Diversity Heigh

3. Result and Discussion

3.1. Number Of Insects

Based on the results of insect observations in Leweung Buah in the Mount Ciremai National Park area, a total of 39 species and a total of 180 individuals were found.

Table.1 Observation of Insects in Leweung Buah

No	Scientific Name	Observation			Number Of Individuals
		1	2	3	
1	*Apis cerana*	9	14	1	24
2	*Apis dorsata*	5	1	0	6
3	*Appias leptis leptis*	0	2	0	2
4	*Ariadae pravera esra*	0	0	1	1
5	*Chersonesia rahria rahria*	2	0	0	2
6	*Cicadidae*	4	0	0	4
7	*Cupha clagia clagia*	0	0	1	1
8	*Cyrestis nivea nivea*	0	2	1	3
9	*Delias dorylea dorylea*	1	0	0	1
10	*Dischopora necho necho*	4	0	1	5
11	*Eurema blanda blanda*	0	1	0	1
12	*Eurema sari sari*	0	2	0	2
13	*Graphium delesserti delesserti*	1	0	0	1
14	*Hypolimnas bolina bolina*	1	0	0	1
15	*Idea ieuconoe javana*	1	0	0	1
16	*Kallima paralecta paralecta*	1	0	0	1
17	*Kaniska Canace Javanica*	3	0	0	3
18	*Laba-laba Sp 1*	0	1	0	1
19	*Laba-laba Sp 2*	0	1	0	1
20	*Lethe confusa godana*	25	4	4	33
21	*Lucilia sericata*	0	6	0	6
22	*Mycalesis horsfieldi horsfieldi*	0	2	0	2
23	*Mycalesis pereseus capheus*	0	6	0	6
24	*Neptis leocoporus aletophone*	0	4	0	4
25	*Ngengat*	0	3	0	3
26	*Ngengat Coklat*	1	0	2	3
27	*Ortherum sabina*	0	4	0	4
28	*Oryctes rhinoceros*	5	7	0	12

29	*Papilio Polythes javanus*	0	2	0	2
30	*Phryganistria sarmentosa*	1	0	0	1
31	*Sarcophaga*	10	4	0	14
32	*Sp 1*	3	0	0	3
33	*Taenaris horsfieldi horsfieldi*	8	0	0	8
34	*Tanacea palguna palguna*	1	0	0	1
35	*Thaumantis odana odana*	0	1	0	1
36	*Troides helena-helena*	1	0	0	1
37	*Ypthima decora decora*	4	0	0	4
38	*Ypthima nigricans*	1	0	1	2
39	*Ypthima pandocus pandocus*	1	6	2	9
	Total				180

3.2. Insect Role

Insects are a class of a large group of animals in the phylum Arthropoda which have a strong outer covering and grooves to form body segments [9]. Insects have 29 Orders. In addition, Insects have 2 subclasses, namely the Pterygota and Apterygota subclasses. Subclass Pterygota is a subclass whose members have wings such as the Order Isoptera (termites) and the Order Diptera (mosquitoes). While the subclass Apterygota is a group of insects that are not winged, for example the Order Thysanura [10]. In this study, 8 orders have been identified, namely: Araneae, Coleoptra, Diptera, Hemiptera, Hymenopetera, Lepidoptera, Odonata and Phasmatodea. With different roles between species.

Table.2. Results of Insect Identification in Leweung Buah

No	Order	Scientific Name	Density	Frequency	H'	Role
1	Hymenoptera	*Apis cerana*	13,333	7,778	0,269	Honey Producer And Pollinator
2	Hymenoptera	*Apis dorsata*	3,333	4,444	0,113	Honey Producer And Pollinator
3	Lepidoptera	*Appias leptis leptis*	1,111	1,111	0,050	Pollinator
4	Lepidoptera	*Ariadae pravera esra*	0,556	1,111	0,029	Pollinator
5	Lepidoptera	*Chersonesia rahria rahria*	1,111	1,111	0,050	Pollinator
6	homiptera	*Cicadidae*	2,222	2,222	0,085	Pest

7	Lepidoptera	*Cupha clagia clagia*	0,556	1,111	0,029	Pollinator
8	Lepidoptera	*Cyrestis nivea nivea*	1,667	2,222	0,068	Pollinator
9	Lepidoptera	*Delias dorylea dorylea*	0,556	1,111	0,029	Pollinator
10	Lepidoptera	*Dischopora necho necho*	2,778	3,333	0,100	Pollinator
11	Lepidoptera	*Eurema blanda blanda*	0,556	1,111	0,029	Pollinator
12	Lepidoptera	*Eurema sari sari*	1,111	2,222	0,050	Pollinator
13	Lepidoptera	*Graphium delesserti delesserti*	0,556	1,111	0,029	Pollinator
14	Lepidoptera	*Hypolimnas bolina bolina*	0,556	1,111	0,029	Pollinator
15	Lepidoptera	*Idea ieuconoe javana*	0,556	1,111	0,029	Pollinator
16	Lepidoptera	*Kallima paralecta paralecta*	0,556	1,111	0,029	Pollinator
17	Lepidoptera	*Kaniska Canace Javanica*	1,667	1,111	0,068	Pollinator
18	Araneae	*Laba-laba Sp 1*	0,556	1,111	0,029	Predators and Pest Control
19	Araneae	*Laba-laba Sp 2*	0,556	1,111	0,029	Predators and Pest Control
20	Lepidoptera	*Lethe confusa godana*	18,333	13,333	0,311	Pollinator
21	Diptera	*Lucilia sericata*	3,333	1,111	0,113	Dekomposer
22	Lepidoptera	*Mycalesis horsfieldi horsfieldi*	1,111	1,111	0,050	Pollinator
23	Lepidoptera	*Mycalesis pereseus capheus*	3,333	2,222	0,113	Pollinator
24	Lepidoptera		2,222	1,111	0,085	Pollinator

		Neptis leocoporus aletophone				
25	Lepidoptera	*Ngengat*	1,667	1,111	0,068	Pollinator
26	Lepidoptera	*Ngengat Coklat*	1,667	2,222	0,068	Pollinator
27	Odonata	*Ortherum sabina*	2,222	1,111	0,085	Predators, Pest Controls and Environmental Indicators
28	Coleoptera	*Oryctes rhinoceros*	6,667	8,889	0,181	Pest
29	Lepidoptera	*Papilio Polythes javanus*	1,111	2,222	0,050	Pollinator
30	Phasmatodea	*Phryganistria sarmentosa*	0,556	1,111	0,029	Helping Ecological Succession
31	Diptera	*Sarcophaga*	7,778	7,778	0,199	Dekomposer
32		*Sp 1*	1,667	2,222	0,068	
33	Lepidoptera	*Taenaris horsfieldi horsfieldi*	4,444	6,667	0,138	Pollinator
34	Lepidoptera	*Tanacea palguna palguna*	0,556	1,111	0,029	Pollinator
35	Lepidoptera	*Thaumantis odana odana*	0,556	1,111	0,029	Pollinator
36	Lepidoptera	*Troides helena-helena*	0,556	1,111	0,029	Pollinator
37	Lepidoptera	*Ypthima decora decora*	2,222	1,111	0,085	Pollinator
38	Lepidoptera	*Ypthima nigricans*	1,111	2,222	0,050	Pollinator
39	Lepidoptera	*Ypthima pandocus pandocus*	5,000	4,444	0,150	Pollinator
	Total		100,000	100	3,070	

Based on the table above, the Lepidoptera Order is the one that is often encountered because the Leweung Buah habitat is at a temperature between 18 ° - 22 ° and is the optimal temperature for the Lepidoptera Order because butterflies and moths are cold blooded animals, their body temperature is influenced by the temperature of their environment. if the air is too hot, the butterfly will seek shelter from the sun, flying in search of humid and cold areas [11]. With the large number of Order Lepidoptera found, the richness of flora will be maintained because almost all or about 90% of the 250,000 plants in their sexual reproduction are very dependent on pollinator insects [12]. The following types of insects are found in Leweung Buah in the Mount Ciremai National Park area:

1. **Laba laba Sp1**

Figure 1. *Laba laba sp1*

Based on observations, Laba laba sp1 species has 4 pairs of hairless legs, the sp1 spider species has a black base color with a combination of green patterns with a small body size with a slender body and acts as a predator for animals smaller than it.

2. ***Laba laba sp2***

Figure 2. *Laba laba sp2*

Laba laba sp2 has 4 pairs of hairless legs with the dominant color being black with a light yellow head with 2 longitudinal stripes on the abdomen. This insect is a predatory insect that preys on animals that are smaller than it.

3. ***Oryctes rhinoceros***

Figure 3. *Oryctes rhinoceros*

Based on observations made by the species *Oryctes rhinoceros*, it has the characteristics of a sturdy body, oval in shape with a relatively small size, black from the head and the body has 1 horn on the head, has 2 pairs of wings , has 3 pairs of legs. Beetle larvae argillaceous not liked the place so can result in damage to the roots, when the adult stage to be a pest for crops and is often a precursor to other pests in crop damage.

4. *(Lucilia sericata)*

Figure 4. *Lucilia sericata*

Based on the observations made the species *Lucilia sericata* have a size between 10-14 mm, metallic green, has a pair of antenna, compound eyes, this species has a role as decomposers that help cycle nutrients back into the ecosystem.

5. *Cicadidae*

Figure 5. *Cicadidae*

Based on observations conducted this species is the nymph of the species Cicadidae which has a characteristic brown feathers on the head and a parasite that take nutrients in the root xylem so that it can cause root damage [20].

6. *Apis Cerana*

Figure 6. *Apis cerana*

Based on observations made the species *Apis cerana* has characteristics of 2 pairs of wings, yellow hairy chest, on the abdomen has a combination of black and yellow colors, has 3 pairs of legs and a pair of antennae p There is a part of this animal's head that acts as a pollinator that helps plants reproduce.

7. *Lethe confusa godana*

Figure 7. *Lethe confusa godana*

Based on observations made by the species, it *Lethe Confusa Godana* has brownish characteristics, the upper wing has a white line and tends to be curved, has a circular pattern, the hind wings have thin lines, a series of black spots and a white dot in the center which is surrounded by a ring. thin brown. The antennae, head, neck, and belly are pale brown; the antennae are light brown at the ends. This species has a role as a pollinator that helps pollinate plants.

8. *Mycalesis perseus cepheus*

Figure 8. *Mycalesis perseus cepheus*

In the species *Mycalesis perseus cepheus* has characteristics of a faded brown color, there is a black pattern with a white dot in the middle. This species has a role as a pollinator that helps plants in pollination.

9. ***Epiphyas postvittana***

Figure 9. *Epiphyas postvittana*

Based on observations, *Epiphyas postvittana* species has a pair of antennae with a brownish black dominant color and has a white jagged pattern on its wings. This species has a role as a pollinator that helps pollinate plants.

10. *Taenaris horsfieldii*

Figure 10. *Taenaris horsfieldii*

Taenaris horsfieldii species has a pair of antennae with black and white underbelly, has a white wing color combined with gray and has a black circle pattern surrounded by orange, this species acts as a pollinator that helps pollinate plants.

11. *Ortherum Sabina*

Figure 11. *Ortherum Sabina*

Based on observations, thespecies *Ortherum Sabina* has a dark green thorax with black stripes on the lateral side and black legs. Abdomen slender with black and white, embelan white and has a wing transparent these species act as predators and also as an indicator of the environment because this species will reproduce only in a clean environment [28].

12. *Phryganistria sarmentosa*

Figure 12. *Phryganistria sarmentosa*

Based on the results of observations made, the Phryganistria sarmentosa species has a twig-like shape as a protection against predators, has 3 pairs of legs, has 2 pairs of antennae and includes herbivorous insects that help in ecological succession.

3.3. Relative Density

Relative density shows the percentage of density types of the density of the entire species. shows that the highest relative density is occupied by the species *Idea ieuconoe javana* with the highest relative density of 16.11% because Lepidoptera likes places that have good humidity, one of which is mountains [30]. And the lowest was in species *Lucilia sericata, Apis cerana, Appias leptis leptis, Chersonnesia rahria rahria, Cyrestis nivea nivea, Delias dorylea dorylea, Dischopora necho necho, Eurema blanda blanda, Graphium delesserti delesserti, Hypolimnas bolina bolina, Yénaris horsimafieldi, decora horsimafieldi Ypthima nigricans* and *Ypthima*

pandocus pandocus by 0.6%. Observations carried out for 3 days with a total catch of 180 people, the number of insects were observed at one observation to as many as 89 kinds of.

3.4. Relatif Frequency

Relative Frequency shows the percentage of times the type of the frequency of all kinds. shows that the highest relative frequency is occupied byspecies *Lethe confusa godana* at 13.33% and lowest in the species *Appias leptis leptis, Ariadae pravera esra, Chersonnesia rahria rahria, Cupha clagia clagia, Delias dorylea dorylea, Eurema blanda blanda, Graphium delesserti delesserti, Hypolimnas bolina bolina, Idea ieuconoe javana, Canacea Java, Kanalecta paralecta spider Sp 1, Spider Sp 2, Lucilia sericata, Mycalesis horsfieldi horsfieldi, Neptis leocoporus aletophone, Moth, Ortherum Sabina, Phryganistra, Tanacea palguna palguna, Thaumantis odana odana, Troides helena-helena* and *Ypthima decora decora*. As much as 1.11%, observations were carried out for 3 days with a total of 180 individuals catching, the highest number of insects was found in the 1st observation as many as 89 species.

3.5. Species Diversity Indeks

Diversity Index (Shannor Weiner) of insects was 3.07. The criteria for diversity index if H' < 1, then diversity is low, H' 1 – 3, then diversity is moderate, and H' > 3, then diversity is high. From these criteria indicate that the insect diversity index in Leweung Buah Gunung Ciremai National Park area has a high diversity value seen from the role of insects which are dominated as pollinators, it will play a role in the balance of the ecosystem in Leweung Buah Gunung Ciremai.

4. Conclusion

National Park area. 8 Orders which include: Araneae, Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Odonata and Phasmatodea. And 39 species with the highest number of species, *Lethe confusa godana*, and the least *Ariadae pravera esra, Cupha clagia clagia* and *Delias dorylea dorylea*. The largest relative density is occupied by the *species Idea ieuconoe javana* with a percentage of 16.11% and the lowest is by species *Lucilia sericata, Apis cerana* and *Appias leptis leptis*, for the highest relative frequency it is occupied by the species Lethe confusa godana with a percentage of 13.33%. and the lowest was in the species *Appias leptis leptis, Ariadae pravera esra* and *Chersonnesia rahria rahria* with a percentage of 1.11%. For the diversity of insects in Leweung Buah in the Gunung Ciremai National Park Area, the category of High with the dominant role of insects as pollinators will play a role in maintaining the balance in the Leweung Buah Gunung Ciremai National Park Area.

References

[1] Teristiandi. N, "Komparasi Kelimpahan Serangga Di Kawasan Rawa Yang Dikonversi Di Jalan Soekarno Hatta Palembang," *J. Biol. Trop.*, vol. 20, no. 1, 2020, doi: 10.29303/jbt.v20i1.1557.

[2] Tutiliana, "Keanekaragaman Serangga Nocturnal Di Kawasan Penyangga Ekosistem Hutan Lindung Lueng Angen Iboih," *Jesbio*, vol. 5, no. 2, pp. 40–43, 2016.

[3] Cholid. I, "Keanekaragaman Serangga Aerial Pada Perkebunan Teh Ptpn Xii Wonosari Kabupaten Malang," Universitas islam negeri maulana ibrahim malang, 2017.

[4] Jumar, *Entomologi Pertanian*. Jakarta: Rineka Cipta, 2000.

[5] Kahono. S, "Kajian Awal Fungsi Gunung Ciremai Sebagai Habitat Penting Bagi

‘Bumblebee’, Bombus rufipes Lepeletier 1836 (Hymenoptera: Apidae),” *J. Biol.*, vol. 5, no. 3, pp. 387–390, 2009.

[6] Imama. H. N and Parwata, “Dampak Sosial Ekonomi Perkebunan Teh Wonosari Terhadap Masyarakat Desa Toyomarto Kecamatan Singosari Kabupaten Malang Tahun 1996-2012 (Socio-Economic Impact of Wonosari Tea Plantation Village District Toyomarto Singosari Malang In 1996-2012),” *Publika Budaya*, vol. 2, no. 2, pp. 10–18, 2014, [Online]. Available: https://jurnal.unej.ac.id/index.php/PB/article/download/1505/1234/#:~:text=Jumlah keseluruhan tenaga kerja yang,orang lainnya adalah pekerja wanita.

[7] Cristian H. Schulze, *Identification guide for butterflies of West Java: families Papilionidae, Pieridae and Nymphalidae*. London: Chapman Hal, 2010.

[8] Purba. G, Marheini. M, and Oemry. S, “Interaksi Trofik Jenis Serangga Di Atas Permukaan Tanah Dan Permukaan Tanah Beberapa Pertanaman Varietas Jagung (Zea Mays Linn.),” *J. Agroekoteknologi*, vol. 3, no. 3, p. 104901, 2015, doi: 10.32734/jaet.v3i3.10717.

[9] Ahdiana. R. A, Hendrayana. Y, and Nurdin, “Keanekaragaman jenis serangga di bumi perkemahan pasir batan blok karangsari kawasan taman nasional gunung ciremai,” in *Prosiding Seminar Nasional dan Call for Papers*, 2019, vol. 083, pp. 66–73.

[10] Aprilya, “Eksplorasi rayap kasta prajurit di pulau handeuleum taman nasional ujung kulon banten,” Universitas Sultan Ageng Tirtayasa, 2015.

[11] Kumala. K. S, “Keanekaragaman Jenis Kupu-Kupu Di Kawasan Wisata Alam Lembah Cilengkrang Taman Nasional Gunung Ciremai,” Institut Pertanian Bogor, 2013.

[12] Amrullah. S, Rusli. R and Hilda, “Identifikasi Lebah Dan Kupu Polinator Di Hutan Billa Battang Kota Palopo,” *J. Din.*, vol. 09, no. 2, pp. 1–12, 2018.

[13] Diniyanti. F, Dahelmi, and Herwina. H, “Laba-Laba Famili Araneidae pada Kawasan Cagar Alam Lembah Anai Kabupaten Tanah Datar, Sumatera Barat,” *J. Biol. Univ. Andalas*, vol. 6, no. 1, pp. 20–28, 2018.

[14] Prakash. S, “Diversity of Spiders (Araneae) From Semi-Arid Habitat of Agra (India),” *Indian Soc. Arachnol.*, vol. 1, no. 2, pp. 66–72, 2012.

[15] Dewi *et al.*, “Kelimpahan Dan Keanekaragaman Predator Laba-Laba Pada Ekosistem Sawah Padi Hitam (Oryza sativa L) Berpupuk Organik,” *Agrikultura*, vol. 30, no. 3, p. 125, 2019, doi: 10.24198/agrikultura.v30i3.25795.

[16] Borror. D. J, *Pengenalan pelajaran serangga*. Yogyakarta: Gadjah Mada University Press, 1992.

[17] Falahudin. I, Rosa. E. P, and Mawar. E, “Identifikasi Serangga Ordo Coleoptera Pada Tanaman Mentimun (Cucumis Sativus L) Di Desa Tirta Mulya Kecamatan Makarti Jaya Kabupaten Banyuasin II,” *J. Biota*, vol. 1, no. 1, pp. 1–8, 2015.

[18] Ulul A. A, “Studi Keanekaragaman Serangga Tanah Di Cagar Alam Manggis Gadungan Dan Lahan Pertanian Desa Siman Kecamatan Puncu Kabupaten Kediri,” Universitas Islam Negerei Maulana Ibrahim Malang, 2016.

[19] Mulia. R. O, “Inventarisasi Keanekaragaman Serangga Pada Lahan Pertanian Padi Sawah Fase Generatif Di Desa Adipuro Kecamatan Trimurjo Lampung Tengah,” Universitas Islam Negeri Raden Intan, 2019.

[20] White. J, Lloyd. M, and Zar. J. H, “Faulty Eclosion in Crowded Suburban Periodical Cicadas: Populations Out of Control,” *Ecol. Soc. amerika*, vol. 60, no. 2, 1979.

[21] Lasalle and Gauld, *Hymenoptera: their biodiversity, and their impact on the diversity of other organisms*. London: C.A.B Internasional, 1993.

[22] Goulet. H and Huber. J, *hymenoptera of the world: an Identification guide to families*.

Ottawa: Agriculture Canada, 1993.
[23] Ikhsan. Z, "Keanekaragaman Hymenoptera Parasitoid Pada Pertanaman Padi di Dataran Rendah dan Dataran Tinggi Sumatera Barat," *J. agro indragiri*, vol. 1, no. 2011, pp. 13–24, 2016.
[24] Helmiyetti, Manaf. S, and Hartaty. K.S, "Jenis-Jenis Kupu-Kupu (Butterflies) Yang Terdapat Di Taman Nasional Kerinci Seblat Resor Ketenong Kecamatan Pinang Belapis Kabupaten Lebong Propinsi Bengkulu," *Konserv. hayati*, vol. 08, no. 01, 2012.
[25] Widianti. R, "Inventarisasi Ngengat (Ordo Lepidoptera) di Wilayah Perkebunan Dataran Tinggi Segamit Semendo Kabupaten Muara Enim dan Sumbangannya Pada Pembelajaran Biologi," Universitas Sriwijaya, 2017.
[26] Herpina. R, Ade. F. Y, and Afnianti. E, "Jenis-Jenis Capung (Odonata : Anisoptera) DI Komplek Perkantoran Pemerintah Daerah (Pemda) Kabupaten Rokan Hulu," *J. Ilm. Mhs. FKIP Prodi Biol.*, vol. 1, no. 1, 2014.
[27] Hanum. S. O, Salmah. S, and Dahelmi, "Jenis-jenis Capung (Odonata) di Kawasan Taman Satwa Kandi Kota Sawahlunto, Sumatera," *J. Biol. Univ. anda\2*, vol. 2, no. 1, pp. 71–76, 2013.
[28] Bagus. I, Suaskara. M, and Joni. M, "Keanekaragaman Jenis Capung Dan Pemanfaatan Nimfanya Sebagai Nilai Tambah Pendapatan Di Bendungan Latu Abiansemal," *simbiosis*, vol. 8, no. 3, pp. 28–33, 2020.
[29] Capinera. J. L, *Encyclopedia Of Entomology*. London: springer, 2008.
[30] Darnilawati, Arifah. N, Al-bariq. H, and Kamal. S, "Pola Distribusi Kupu-Kupu (Lepidoptera) Di Desa Deudap Pulo Nasi Kecamatan Pulo Aceh Kabupaten Aceh Besar," in *seminar nasional biotik 2018*, 2018, pp. 79–85.