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Identification Of Insect Diversity in Coffee Plants at Various Heights of Citaman Lawang Taji Gunung Karang Pandeglang Plantations.

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Abstract. *Coffee (Coffea sp) is a significant plantation crop in Indonesia. Smallholder farmers grow it using environmentally friendly management systems that keep soil fertile and the biodiversity high. This research utility a quantitative descriptive methodology. We collected data by directly observing the field and using trapping methods. In three different places, they used pitfall traps, yellow pan traps, and light traps. Purposive sampling was used to choose the place where samples would be taken. There were four samples taken, each one a week apart. After identifying and analyzing the insect that had been collected, we used annova with F tables of 1% and 5% to find their diversity, dominance, and evenness indicates. The findings indicated that 6 orders and 21 families were recognized from the three sites. The diversity indices for locations I, II, and III were classified as medium (1.51), low (-0.11), and medium (1.99), respectively. The dominance indices for sites I, II, and III were classified as low (0.44), low (0.11), and low (0.21), respectively. The evenness index for locations I, II, and III was low (0.26), low (-0.02), and moderate (0.44), respectively.*

Keywords: *Identification, Diversity, Insects, Coffee, Diversity, Pandeglang.*

INTRODUCTION

Coffee (*Coffea sp.) is a perennial plant and belongs to the Rubiaceae family*. Coffee is one type of plantation crop widely cultivated in Indonesia. Types of coffee widely cultivated in Indonesia include Arabica coffee, Robusta coffee, and Liberica coffee. Plantations in Indonesia include state-owned plantations, private plantations, and community plantations. Community plantations are small to medium-scale agricultural businesses managed by local farmers. Generally, community plantations are managed traditionally and environmentally friendly. Farmers opt for the use of organic fertilizers and natural pest control, avoiding the use of chemicals. This increases soil fertility and maintains biodiversity (Febriana & Susilastuti, 2024).

There are both pest and non-pest insects on coffee plantations. Insects that aren't pests are very important for keeping the coffee plantation ecosystem in balance. Pollinators, predators, and decomposers are some of the non-pest insects that help produce better and more abundant coffee. When we consider the number of non-pest insects on a coffee plantation, we can also see how healthy the ecosystem is. In order to create a truly healthy coffee ecosystem and prevent overuse of chemical pesticides, a coffee plantation must have a variety of non-pest insects.

In order to ensure sustainable coffee production this is essential for coffee plantations future, non-plant vermin. Crop losses can also be caused by other non-plant pests that harm coffee plants and plantations. In addition, to causing damage to coffee crops, these pests can cause the beans to become bitter or poisonous. Pest attacks on coffee plants can be caused by a variety of factors. These include the age of the plant, the weather the quality of the seed, or the effectiveness of pesticide control, young plants have robust defense systems and are less vulnerable to pest damage. Plants can be of lower quality if they are stressed enough by their environment, do not get enough nutrients, or become sick and stop growing. Coffee plants are more likely to get pests when the weather is bad, like when the temperature is too high or too low, the humidity is too high or too low, or there isn't enough rain (Rahardjo, 2017).

Based on BPS data, the area of smallholder coffee plantations in 2021 was 1,257 hectares, decreasing to 1,246 hectares in 2022. Meanwhile, coffee production in Indonesia in 2021 reached 786.19 thousand tons, decreasing by 1.43% to 774.96 thousand tons in 2022 (BPS, 2023). This impact certainly has a significant impact on farmer income and economic stability in coffee-producing regions. Therefore, research is needed to identify insect diversity, determine the diversity index, dominance index, and evenness index of insects at various altitudes in coffee plantations (*Coffea sp.*) Citaman Lawang Taji Gunung Karang Pandeglang Banten.

RESEARCH METHODOLOGY

This type of research is quantitative descriptive research. This research was conducted in July-August 2025, which took place at the Citaman Lawang Taji Pandeglang coffee plantation. Insect sampling was conducted using purposive sampling at three altitudes: ± 400 masl, ± 500 masl, and ± 600 masl. The tools and materials used include light traps, yellow traps, pitfall *traps*, 16 oz plastic cups, *infra boards* measuring (20 x 20 cm), skewers, 20 diameter plastic containers, sample bottles, USB microscopes, tweezers, sample markers, stationery, scissors, *mobile phones*, altimeter applications, 70% alcohol, water, detergent, and label.

Collection and Identification of Insects

The determination of the research location was carried out using purposive sampling. *Purposive sampling* is a type of selective sampling that involves selecting samples based on specific characteristics, traits, criteria, or properties. Diversity data were collected through three methods: pitfall traps, Yellowpan traps, and light traps. The *pitfall trap method* is used to catch ground insects, including those that burrow in the soil and have a mobilization zone on the soil surface. The *yellowpan trap method* is used to catch insects that are attracted to the color yellow. The light trap method is intended for nocturnal insects that are attracted to light. The yellowpan trap is installed using a 100 cm high wooden pole with a 20 cm diameter plastic container. In comparison, the pitfall trap is made by digging the ground to a depth of 20 cm, placing a plastic cup filled with a 50 ml water and detergent solution, and then covering it using an infra board supported by a skewer. The light trap is installed near the yellow pan trap at the same height and is equipped with an LED light at the top.

Observations were conducted at the Citaman Lawang Taji Gunung Karang Pandeglang Coffee Plantation on a weekly basis for four weeks, with traps left in place 24 hours a day, from 9:00 a.m. to 9:00 a.m. the following morning. The captured insects were placed in sample bottles for laboratory identification. If weather conditions interfered with the observations, repeat observations were conducted the same week. Insect documentation was performed using a mobile phone camera while observing through a microscope.

Insects found on coffee plantations were preserved using the wet method, which involved placing them in collection bottles containing 70% alcohol. Further insect identification was conducted at home using a monocular microscope to determine insect morphology, allowing for grouping of insects down to the species level. Furthermore, through this identification, the role of insect pests found on coffee plantations could also be determined. The identification of insects was carried out using the book "Key to Determination of Insects" by Kanisius (1991), Borror *and* DeLong's *"Introduction to the Study of Insects" by Johnson and Charles (1984), and Google Lens*. Furthermore, after identifying the type of each insect, the role of insects at each height could be determined.

Data Analysis

Insects that have been identified to the species level are then analyzed to determine the diversity index (H'), dominance (D), and evenness (E) at each height using Microsoft Excel. The formula used to determine the diversity index (Shanon-Wiener) is:

$$H' = -\Sigma\,(Pi)(In\,Pi)$$

$$Pi = \frac{ni}{N}$$

where:

H' = Shannon-Wiener diversity
ni = Number of individuals of type i
N = Number of individuals of all species
In = natural logarithm
Pi =proportion of the number of individuals to the total number

The formula used to determine the insect dominance index (Simpson's equation) is:

$$D = \Sigma(\frac{ni}{N})^2$$

where:

D = Dominance index
ni = Number of individuals of type i
N = Number of individuals of all types

The formula used to determine the insect evenness index is:

$$E = \frac{H'}{in\,S}$$

where:

E = Equity Index
H = Shannon's diversity index value
S = Total number of species

After analyzing the three indexes using the formula above, it was continued with the calculation of the nested ANOVA model *using* the F-table test at 1% and 5% levels.

RESULTS AND DISCUSSION

The Self-Help Rural Training Center Garden is located in Sanin Village, Karang Tanjung District, Pandeglang, Banten, in a highland area suitable for coffee cultivation. The approximately 3,000 m² research area is planted with coffee that has entered the generative phase, so the ecosystem is relatively stable and supports the presence of insects. The trap installation point is at an altitude of 400–600 meters above sea level with fertile soil conditions and good drainage. The local climate is considered ideal for coffee, with moderate rainfall (6.87 mm/day), high humidity (84.06%), and an average temperature of 26.34°C (BMKG, 2025). Soil nutrient content varies by altitude, with nitrogen being moderate, phosphorus ranging from low to high, and potassium very high, which also influences the dynamics of insect populations in the garden area.

Based on the results of research and identification of insects in the Citaman Lawang Taji Plantation using *pitfall traps* , *yellow pan traps* , and *light traps* , 6 orders and 21 families were found in the three research locations. The results are presented in **Table 1.** The insect orders found include *Orthoptera, Hemiptera, Lepidoptera, Coleoptera, Hymenoptera, Diptera*, and *Blattodea*. The Orthoptera order consists of the Acrididae and Gryllidae families. The Hemiptera order consists of the Delphacidae and Pentatomidae families. The Lepidoptera order consists of the Pyralidae, Nymphalidae, and Scarabaeidae families. The Coleoptera order consists of the Staphylinidae, Meloidae, Carabidae, Haliplidae, and Cantharidae families. The Hymenoptera order consists of the Ichneumonidae, Formicidae, and Braconidae families. The order Diptera consists of the families Tabanidae, Mycetophilidae, Phoridae, Piophilidae, and Tipulidae. The order Blattodea consists of the family Blattidae.

21 families were obtained and consisted of 8 species acting as pests, namely consisting of *Eyprepocnemis calceat*, *Calliptamus barbarus*, *Nilaparvata lugens*, *Antestiopsis cruciata*, *Plodia interpunctella*, *Quedius tenellus*, *Lissonota semirufa*, and *Diachlorus ferrugatus*. Ten

species as predators consist of *Dolichoderus thoracicus, Nemognatha chrysomeloides, Lasius Fuliginosus, Monomirium pharaonis, Leistus spinibarbis, Solenopsis geminata, Polyrhachis armata, Chelaner edentatus, Camponotus festinus,* and *Odontoponera denticulata*. As pollinators, there are five species: Kallima inachus, Dione juno ssp., Rhagonycha fulva, Saigusaia flaviventris, and Megaselia scalaris. A total of 8 species as decomposers consisting of *Teleogryllus emma, Euselates sp., Cymindis lateralis, Trichonta terminalis, Leia bivittata, Prochyliza brevicornis, Tanyptera dorsalis,* and *Periplaneta americana*. As a bioindicator is *Haliplus obliquus*, and as a parasitoid is *Blacus Tripudians*.

Gambar 1. Stasiun Pengamatan

Order	Family	Species	Role	400 meters above sea level	500 meters above sea level	600 meters above sea level
Orthoptera	Acrididae	*Eyprepocnemis calceata*	Pest	0	1	0
		Calliptamus barbarus	Pest	0	2	0
	Gryllidae	*Teleogryllus emma*	Decomposer	2	2	1
Hemiptera	Delphacidae	*Nilaparvata lugens*	Pest	4	0	0
	Pentatomidae	*Antestiopsis cruciata*	Pest	1	0	0
Lepidoptera	Pyralidae	*Plodia interpunctella*	Pest	17	26	0
	Nymphalidae	*Kallima inachus*	Pollinator	0	8	0
		Dione juno ssp	Pollinator	0	2	0
	Scarabaeidae	*Euselates sp.*	Decomposer	0	1	0
Coleoptera	Staphylinidae	*Quedius tenellus*	Pest	2	1	0
	Meloidae	*Nemognatha chrysomeloides*	Predator	11	0	1
	Carabidae	*Leistus spinibarbis*	Predator	0	3	0
		Cymindis lateralis	Decomposer	0	0	1
	Haliplidae	*Haliplus obliquus*	Bioindicator	0	7	2
	Cantharidae	*Rhagonycha fulva*	Pollinator	0	2	0
Hymenoptera	Ichneumonidae	*Lissonota semirufa*	Pest	0	1	0
	Formicidae	*Dolichoderus thoracicus*	Predator	7	11	3
		Lasius Fuliginosus	Predator	3	8	1
		Monomirium pharaonis	Predator	2	65	38
		Solenopsis geminata	Predator	0	9	2
		Polyrhachis armata	Predator	0	10	1
		Chelaner edentatus	Predator	194	25	10
		Camponotus festinus	Predator	2	21	9
		Odontoponera denticulata	Predator	8	30	7
	Braconidae	*Blacus tripudians*	Parasitoid	18	1	0
Diptera	Tabanidae	*Diachlorus ferrugatus*	Pest	0	1	3
	Mycetophilidae	*Saigusaia flaviventris*	Pollinator	1	6	3
		Trichonta terminalis	Decomposer	16	4	5
		Leia bivittata	Decomposer	0	3	2
	Phoridae	*Megaselia scalaris*	Pollinator	0	5	2
	Piophilidae	*Prochyliza brevicornis*	Decomposer	3	2	1
	Tipulidae	*Tanyptera dorsalis*	Decomposer	0	2	0
Blattodea	Blattidae	*Periplaneta americana*	Decomposer	5	0	0
		Amount		296	259	92
		Total			647	

Insect abundance is an important indicator of the stability and balance of an ecosystem. Their presence is strongly influenced by environmental factors, including altitude, temperature, humidity, vegetation, and the availability of food sources and suitable habitats. Changes in environmental conditions can cause variations in insect abundance at each location. Therefore, an analysis of insect abundance at various altitudes was conducted to understand the relationship between environmental factors and individual abundance and to describe the overall ecological conditions of the study area.

Figure 1 shows the relationship between altitude and the number of insects found. There were 296 insects at 400 meters above sea level, 259 at 500 meters and just 92 at 600 meters. According to this pattern, the insect population decreases with increasing altitude. Environmental factors like temperature humidity and food availability are thought to have an impact on this decline. Because of the high humidity and warm temperatures in the lowlands, insects are able to flourish there. Because of the low temperatures, insects cannot thrive in the highlands. Additionally, the variety of plants at various elevations influences the quantity of insects that inhabit those areas. Because there are fewer food and shelter options and less diversity in highland, vegetation fewer species are able to adapt. The vegetation in lowlands is more varied and offers more options for food and shelter. The idea that environmental factors have a significant influence on the structure of insect communities is supported by the fact that both the number and variety of insects decrease as altitude increases (Permatasari et al., 2024).

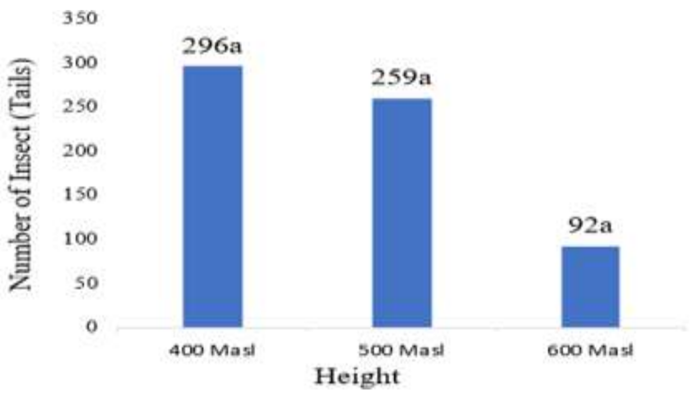

Figure 1. Bar chart of the number of coffee garden insects at each height. Numbers followed by different letters indicate significant differences based on the f table 1%.

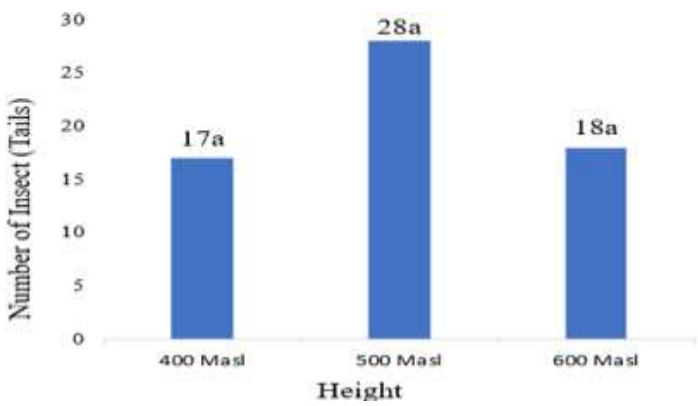

Figure 2. Bar chart of insect numbers based on species at each height. Numbers followed by different letters indicate significant differences based on the 1% f table.

According to the graph, there were more insect species at 500 meters above sea level (28 species), than at 400 meters (17 species), and 600 meters (18 species). This pattern shows that species diversity peaks at mid-elevation altitudes rather than increasing with elevation. This situation is consistent with the idea of a mid-elevation peak, where a higher number of species can exist because the temperature humidity and vegetation are at their ideal levels.

At 400 masl, although the vegetation is more diverse, competitive pressures and human activities, such as agriculture, can reduce the diversity of particular species. Meanwhile, at 600 masl, temperatures are lower and environmental conditions are more extreme, resulting in fewer species being able to adapt. Middle elevations typically have a wider variety of host plants, supporting species from both lowland and highland habitats. Therefore, 500 masl is the optimum zone for insect diversity at this study site.

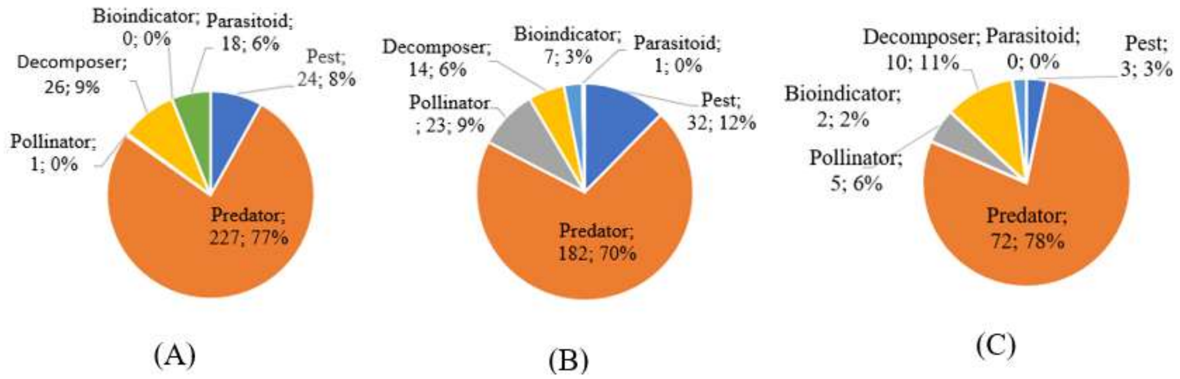

Figure 3. Pie Chart of Insect Roles at Each Height of the Citaman Lawang Taji Plantation. (A) At an altitude of 400 meters above sea level. (B) At an altitude of 500 meters above sea level. (B) At an altitude of 600 meters above sea level.

Figure 3 shows what insects do at each height. At an elevation of 400 meters above sea level, predatory insects prevail, signifying a relatively balanced ecosystem that facilitates the natural regulation of other insect populations. The fact that predators are so common means that there is a lot of food available and the environment is good for them to hunt in. The decomposer group, which has 26 members (9%), is also very important for keeping the soil fertile by breaking down organic matter. Pests (28 individuals; 8%) and parasitoids (18 individuals; 6%) suggest the presence of natural biological control interactions, wherein parasitoids assist in the suppression of pest populations. Predators usually rule lowland ecosystems because there is a lot of prey and a wide range of plants (Dwisatria et al., 2025).

Predatory insects living at 500 meters above sea level are a sign of a healthy ecosystem. Spiders, dragonflies, and beetles are all essential for maintaining the balance of nature. Calm, humid weather keeps them moving and helps them reproduce. Pests (32 individuals, or 12%) and pollinators (23 individuals, or 9%) also play a significant role. Pests indicate the presence of host plants, and pollinators such as bees aid in natural pollination. Bioindicators (7 individuals, or 3%) and decomposers (14 individuals, or 6%) indicate that the habitat is healthy and the ecosystem is still cyclical. Mid-altitude ecosystems typically have a good mix of predators and other insects that perform various functions (Hartoyo and Azizzah, 2024).

Bioindicators (7 individuals; 3%) and decomposers (14 individuals; 6%) signify a robust habitat and an ongoing ecosystem cycle. Mid-altitude ecosystems usually have a good balance of predators and other insects that play different roles (Hartoyo and Azizzah, 2024). Predatory insects still rule at 600 meters above sea level, and cool, humid weather helps them keep other insect populations in check. Decomposers (10 individuals, 11%) are still active in keeping the organic matter cycle going, but there are only a few pollinators (5 individuals, 6%) and bioindicators (2 individuals, 2%). This means that the ecosystem is stable, but it is simpler. There are only three pests, which is 3% of the total, and there are no parasitoids, probably because the temperatures are too low and there isn't much host vegetation.

Insects are less common at higher altitudes, but predators are still the most important part of keeping the ecosystem in balance (Rachmasari et al., 2016). In general, the role of insects in coffee plantations changes with altitude. At 500 meters above sea level, pests are most common; at 400 meters, predators are more common; and they stay high at 500 meters but drop to 72 individuals at 600 meters. At 500 masl, there were 23 pollinators, which was the most. At 400 masl, there were 26 decomposers, which was the most. At 500 masl, there were more bioindicators (9 individuals), but at 400 masl, there were only parasitoids (19 individuals).

Table 2. Analysis of Insect Diversity Index

Height (masl)	Diversity Index (H')	Category
±400 Masl	1.51	Medium
±500 Masl	-0.11	Low
±600 Masl	1.99	Medium

Fenomena tersebut diduga memiliki kaitan dengan kelimpahan tanaman cengkeh di Stasiun I (Kombot Timur) dan Stasiun II (Linawan). Diketahui bahwa *Agrilus* sp. adalah serangga hama yang menyerang pada fase larva dengan menggerek batang cengkeh. Ketika tanaman cengkeh ditemukan berlimpah di wilayah dengan elevasi yang lebih rendah (100-300 mdpl) maka *Agrilus* sp. memiliki kemungkinan untuk melakukan ekspansi habitat ke wilayah tersebut karena adanya ketersediaan inang/makanan. Fenomena ini sesuai dengan prinsip *host-tracking range*. *Host-tracking range* adalah kemampuan suatu serangga herbivora menemukan dan memanfaatkan inangnya (Szyniszewska *et al*., 2024; Wilson *et al.*, 2021). Hama sangat responsif terhadap perubahan kondisi lingkungan disekitarnya dan cenderung akan memilih wilayah yang memiliki ketersediaan inang yang cocok. Hal ini juga sejalan dengan penelitian

Meskipun berada pada elevasi yang lebih tinggi dari Stasiun I (Kombot Timur), Stasiun II (Linawan) memiliki persentase serangan yang paling rendah yaitu 40%. Rendahnya persentase serangan tersebut diduga kuat ada hubungannya dengan kondisi perkebunan cengkeh di Stasiun II (Linawan) yang bersih dan terawat. Sanitasi kebun berpengaruh terhadap dinamika populasi hama. Dengan terpeliharanya sanitasi kebun membuat peluang kehadiran hama menjadi lebih kecil (Abewoy, 2022).

Pada penelitian awal tentang hama kumbang Agrilus sp oleh Watung *et al.* (2020), dilaporkan bahwa persentase serangannya di Kecamatan Pinolosian hanya berkisar s25-26%. Sedangkan pada penelitian ini diketahui persentase serangan *Agrilus* sp. sebesar 40-70%. Hal ini menunjukkan peningkatan serangan dari waktu ke waktu. Peningkatan tersebut menunjukkan adanya preferensi hama di lokasi pengamatan. Selain itu perubahan iklim, dan tidak adanya kegiatan pengendalian (terjadi akumulasi serangan) menimbulkan peningkatan persentase serangan dari hama ini.

Intensitas Kerusakan

Dapat dilihat bahwa intensitas kerusakan menunjukkan nilai rata-rata di angka 27,77% yang dikategorikan sebagai kerusakan sedang. Intensitas kerusakan tertinggi terdapat pada Stasiun III (Kombot) yaitu 50,83% dengan kategori kerusakan berat. Pada Stasiun I (Kombot Timur), intensitas kerusakan hanya mencapai angka 20,00% yang dikategorikan sebagai kerusakan ringan. Sedangkan angka intensitas kerusakan terendah terdapat pada Stasiun II (Linawan) yaitu 12,50% yang dikategorikan sebagai kerusakan ringan. Tingginya intensitas kerusakan pada Stasiun III (Kombot) dengan elevasi 420-490 mdpl diduga karena lokasi tersebut terletak pada elevasi yang ideal sebagai habitat bagi pertumbuhan populasi *Agrilus* sp.

Tabel 3.2 Data Intensitas Kerusakan Agrilus sp. di Kecamatan Pinolosian

Stasiun	Lokasi	Koordinat	Elevasi (mdpl)	IK (%)	Kategori Kerusakan
I	Kombot timur	N 00°24’25.2” E 124°10’28.1”	110-270	20,00	Ringan
II	Linawan	N 00°24’16.4” E 124°03’30.0”	300-365	12,50	Ringan
III	Kombot	N 00°25’05.3” E 124°10’30.1”	420-490	50,83	Berat
Rata-Rata				27,77	Sedang

The Shannon-Wiener diversity index (H') value of 1.51 shows that there is a moderate level of diversity at an altitude of about 400 meters above sea level. This means the insect community in the area is highly diverse, with individuals of various species evenly distributed. Insects can flourish in warm weather, stable humidity, and an abundance of vegetation. However, the insect community can still become less stable as a result of human activities like intensive agriculture and changes in land use.

At a height of about 500 meters above sea level, the studys findings indicated a negative diversity index value (-0.11). This runs counter to the fundamental tenet of the Shannon-Wiener index, since a negative value is mathematically impossible. This is probably because one species predominates, or there is a lack of data which could distort the computation results. To guarantee the accuracy of the studys findings, it is crucial to verify the data and procedures used twice.

At a height of about 600 meters above sea level, a diversity index value of 1.99 is likewise regarded as moderate. This graph shows that the local insect population is fairly stable with individuals dispersed equally and no dominant species. A peaceful humid setting with natural vegetation can provide food and shelter for a wide range of insects. This shows that the ecosystem is healthy and operating properly. Additionally, the moderate diversity at this altitude shows that crucial ecosystem functions like decomposition, pollination, and natural pest control, are still strong. An index value of 1.99 means that the ecological potential is steady and hasnt changed much as a result of things like pollution or deforestation. If we manage the environment well over time more insect species may still exist in this area.

Overall, the studys findings lend credence to the theory, that altitude has a significant impact on the structure of insect communities. Abiotic variables that alter with altitude and affect species distribution and diversity include temperature humidity, light intensity, and resource availability (Rachmasari et al., 2016). It is essential to perform additional statistical analyses, increase the accuracy of taxonomic, identification, and repeat sampling in order to get more accurate results, account for biodiversity dynamics and ecological changes caused by climate and anthropogenic influences.

Table 3. Analysis of Insect Dominance Index

Height (masl)	Dominance Index (C)	Category
±400 Masl	0.44	Low
±500 Masl	0.11	Low
±600 Masl	0.21	Low

At roughly 400 meters above sea level, the dominance index is 0.44. Although it is a small number, it shows that some species are marginally more prevalent here than elsewhere. This might be because human activities like farming and home building, make the lowland environment more vulnerable to changes. One or a few species may be able to dominate the community as a result of this kind of environmental pressure since fewer species may be in competition with one another (Mahendra et al., 2021).

On the other hand, at approximately 500 meters above sea level, the dominance index value drastically decreases to 0.11. This suggests that there is no dominant species in the insect community at this altitude, indicating a good species balance. Very low dominance values could suggest that the insect population is evenly distributed, but the number of species is small or only occurs in small groups, even though low diversity values have previously been noted here. This may be a sign that the ecosystem is recovering or it may be the result of external factors like habitat fragmentation.

At a height of about 600 meters above sea level, the dominance index value slightly increased to 0.21, but it remained low. This suggests that there is no overdominance of any one species in the insect community, which is fairly stable. This equilibrium may suggest that the habitat has favorable environmental conditions and is primarily natural. The insect community can grow more evenly at this altitude, because there are more plants and fewer people (Rachmasari et al., 2016).

Overall, the findings from each of the three elevations show that no particular insect species predominates in any community. High dominance typically signals environmental issues like pollution, habitat fragmentation, or the introduction of non-native species, so this is a positive outcome for conservation. Because of their low dominance values the ecosystems in these three locations are still able to sustain stable communities. But its crucial to keep in mind that a high diversity index does not always follow from a low dominance index. The biodiversity index value is actually negative (-0.11) in Table 2, above despite the dominance being extremely low (0.11). This implies that low dominance is still possible in communities with a small number of species. This implies that dominance values must always be connected to other ecological factors. We must monitor the dominance index over an extended period of time and Integrate it with other environmental data, such as temperature humidity and vegetation structure, in order to optimize its use for conservation planning. The habitat must remain natural, humans must restrict excessive activity within it and new species that could change the community structure must not be permitted to enter in order to maintain a low dominance index.

Table 4. Insect Evenness Index Analysis

Height (masl)	Equity Index (E)	Category
±400 Masl	0.26	Low
±500 Masl	-0.02	Low
±600 Masl	0.44	Medium

At approximately 400 meters above sea level, an evenness index value of 0.26 is regarded as low. The distribution of insects in the area is not uniform and certain insect species may be more prevalent than others according to this figure. This condition can be caused by a number of environmental factors. Community structure for instance, may be impacted by interspecific competition and higher population density in lowland areas (Ferdianti et al., 2022).

At an altitude of about 500 meters above sea level, the evenness index value is -0.02, which is unusual because the evenness index should always be positive. This negative value might suggest that the sample data is not representative or that there was a calculation error. It might also mean that the insect community is extremely unbalanced or that ecological disruptions are having a big impact on how individuals are distributed among species. For accurate results data at this altitude must be carefully examined (Basna et al., 2017). However an evenness index value of 0.44 is regarded as moderate at an altitude of about 600 meters above sea level. Compared to other altitudes, this figure shows that human distribution among insect species is more uniform. This could be because there are more natural areas and less human activity, which allows a variety of insect species to flourish in harmony (Taradipha, 2019). This implies that this altitude may have more stable biodiversity. Maintaining ecosystem balance is also aided by moderate evenness at elevations of about 600 meters above sea level. Because, they are less reliant on one or a small number of dominant species insect communities with high evenness are better equipped to adapt to changes in their surroundings (Hawa et al., 2025).

Pollination and decomposition are two ecosystem processes that can be improved by a comparatively, even distribution of humans which is beneficial to the general health of the environment. The composition of insect communities in this area can be greatly impacted by land use change, pesticide use, and pollution as evidenced by low evenness index values at elevations of ±400 meters above sea level and negative values at ±500 meters above sea level. The ecosystems ability to function can be affected by the existence or extinction of dominant species. The ecosystem services, that the insect community provides may also be diminished as a result. The evenness index shows, the health of the ecosystem when it is regularly monitored. A community that is balanced and operating at its best is indicated by a high evenness index (Permatasari et al., 2024). Therefore, in order to ensure a more even distribution, it is essential to manage and protect habitats effectively particularly in areas where species are distributed unevenly.

The findings of an analysis of the insect evenness index, can also be used to determine how species distribution is being impacted by climate change in the area. The quantity and activity of insects in an area can be greatly impacted by variations in temperature and humidity at a particular altitude. The communitys levelness may then change as a result (Karmana, 2024). Plans to address and mitigate local climate change can be created using this information. Altitude-dependent evenness index values show that every altitude needs a different conservation management strategy that considers the particular ecological conditions there. To preserve insect diversity and balance over time, disturbed areas require different conservation strategies than pristine areas (Chaidir et al., 2023.

The studys overall findings show, that altitude significantly affects how evenly insect communities are distributed. Around 600 meters above sea level, there are more insects in a given area than anywhere else. This suggests that the ecosystem is more robust and healthy. Monitoring and enhancing habitat quality at various altitudes is crucial to maintaining insect diversity and even distribution which is a key indicator of ecosystem health.

CONCLUSION AND RECOMENDATIONS

The study found that the total number of insects and the number of species found at three different altitudes of coffee plantations (Coffea sp.) in Citaman Lawang Taji Pandeglang were pretty similar. They found six orders and 21 families of insects. The insect diversity index was in the middle range at altitudes of about 400 masl and 600 masl, but it was low at an altitude of about 500 masl. The dominance index for all three altitudes was low, which means that there are no species that really dominate the insect community in the plantation area. The insect evenness index, on the other hand, showed low numbers at altitudes of ±400 masl and ±500 masl, and a medium category at an altitude of ±600 masl. This shows that the distribution of individuals between species was more stable at higher altitudes.

Consequently, additional research is advised to enhance comprehension of the ecological function of insects in the Citaman Lawang Taji Gunung Karang Pandeglang coffee plantation, encompassing environmental variables that affect the low species dominance. Habitat conservation at an elevation of around 600 meters above sea level necessitates vigilance, as the moderate diversity classification signifies an unstable ecosystem; thus, preserving the equilibrium among species is essential. Moreover, subsequent research ought to examine seasonal variables and microclimatic conditions to yield more thorough insights into insect distribution and evenness.

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