MAXIMUS
Journal of Biological and Life Sciences
E-ISSN : 3021-8195
2026. Volume 4 No 1:30-37

Original Article

OPEN ACCESS

Analysis of Insect Diversity on Pari Island, Kepulauan Seribu

Dwi Sri Wahyuni[1], Yayu Kurniawati[1]*, Alma Mustika Shafi Azzahra[1], Indah Ayu Dwiastuti[1], Salwa Putri Naswati[1], Muhammad Bagir Nurullah[1], Meilisha Putri Pertiwi[1], Lufty Hari Susanto[1]

[1] Universitas Pakuan, Bogor, West Java

*Corresponding email: yayuukurnia@gmail.com

Citation:

Wahyuni, D.S *et al* (2026). Analysis of Insect Diversity on Pari Island, Kepulauan Seribu. *Maximus: Journal of Biological and Life Sciences* , 4(1), 30-37. https://doi.org/10.35472/maximus.v4i1.2701

Abstract:

Insect diversity is an important indicator for assessing environmental conditions in coastal ecosystems. This study compares the structure of insect communities in two different habitats at kepulauan seribu: the homestay area (Location A) and the mangrove coastal area (Location B). Samples were collected using sticky traps, pitfall traps, and direct searches (time searching). Community parameters were analyzed using the Shannon-Wiener diversity index (H'), evenness (E), dominance (D), and the Sørensen similarity index (Cs). The results show that Location A contained 14 individuals from four families, while Location B contained 61 individuals from four families. Both locations exhibited moderate diversity levels, with H' values of 1 in Location A and 1.46 in Location B. High evenness values (E = 0.72 and E = 0.70) indicate a balanced distribution of individuals among families. Dominance was higher in Location A (D = 0.46) than in Location B (D = 0.32), suggesting greater ecological pressure in the residential area. The Sørensen similarity index (Cs = 0.33) reflects low to moderate similarity between the two communities, influenced by microhabitat variation and differences in vegetation structure. Overall, the coastal habitat supported higher insect abundance than the residential area, although both sites showed moderate diversity and high evenness. These findings highlight the important role of microhabitat conditions and human activities in shaping insect community composition on Pari Island.

Keywords: *: insect diversity, coastal habitat, community structure, Pari Island*

INTRODUCTION

Insects are essential components of ecosystems and play a significant role in maintaining ecological balance, particularly in coastal environments. They contribute to various ecological functions, including acting as pests (Fakhrah, 2016), pollinators, predators or parasitoids (Satria et al., 2017), and decomposers (Hasyimuddin et al., 2017). In addition, insects are highly sensitive to environmental changes, making them reliable bioindicators for assessing ecosystem conditions (Rahayu, 2016; McGeoch, 1998). Coastal ecosystems, such as mangrove forests, seagrass beds, and coral reefs, provide diverse habitats that support insect communities (Lee et al., 2014). However, these ecosystems are highly vulnerable to environmental disturbances (Lina et al., 2017). Ecosystem degradation, caused by natural events such as earthquakes and tsunamis, as well as anthropogenic activities, can significantly affect insect diversity and community structure (Alongi, 2008). Changes in environmental conditions may alter habitat availability and resource distribution, ultimately influencing the presence and abundance of insect species in coastal areas.

Vegetation plays a crucial role in shaping insect communities by providing food resources, shelter, and breeding habitats. The composition and structure of plant communities are influenced by environmental factors such as climate, soil characteristics, and herbivory (Dong et al., 2019). In coastal ecosystems, vegetation such as mangroves and other coastal plants creates diverse microhabitats that support insect diversity (Matatula et al., 2019).

Variations in vegetation structure can directly influence the abundance and distribution of insects, as different plant species offer varying resources and environmental conditions. Therefore, vegetation complexity is closely related to insect diversity, where more heterogeneous vegetation tends to support higher insect diversity and more stable community structures (Alrazik et al., 2017; Siregar et al., 2022).

Pari Island, located in the Kepulauan Seribu Regency, DKI Jakarta, Indonesia, is characterized by diverse coastal ecosystems, including mangroves, seagrass beds, and coral reefs. These ecosystems provide a variety of habitats that support insect communities. In particular, mangrove ecosystems offer complex environmental conditions that allow insects to occupy a wide range of niches, from dry to highly humid areas (Zhao & Qin, 2022). Insect habitats are closely related to environmental conditions that enable them to survive and reproduce optimally (Yuliani & Rusli, 2019). Areas with high human activity, such as homestay or tourism zones, may experience environmental changes that affect habitat availability and resource distribution for insects. Anthropogenic activities, including tourism, can influence insect diversity by altering microhabitat conditions and ecological balance within coastal ecosystems.

Studies on insect diversity in the kepulauan seribu are important as they provide insights into ecosystem health and the potential impacts of environmental change (Suhardjono, 2018). Specific data on insect diversity in this region remain limited, highlighting the need for further research (Yuliana & Santoso, 2020). To date, only a few studies have focused on insect diversity on Pari Island, particularly in comparing different habitat types such as mangrove ecosystems and areas surrounding homestays.

Differences in environmental characteristics and levels of human activity between these habitats may influence insect diversity and community structure. This study aims to analyze insect diversity in mangrove and homestay areas on Pari Island and to identify environmental factors that affect their distribution. The findings of this study are expected to contribute to conservation efforts and the sustainable management of coastal ecosystems.

MATERIAL AND METHODS

Research Subject

This study was conducted in Kepulauan Seribu, DKI Jakarta, Indonesia. The research specifically focuses on Pari Island (about 28 km north of Soekarno-Hatta Internasional Airport), where two coastal ecosystem locations were selected for insect diversity analysis.

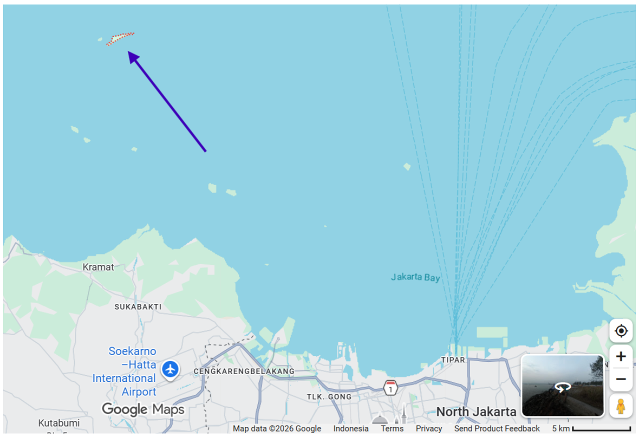

Figure 1. Location of Pari Island in Kepulauan Seribu.

The first location is situated in the homestay area, while the second is located in the mangrove coastal area, which is characterized by more open environmental conditions. Observations were conducted on Sunday and Monday, October 26-27, 2025, from 3:00 p.m. to 7:00 a.m., covering both late afternoon and nighttime periods. This time range was selected to capture insect activity during peak periods, including both diurnal and nocturnal species, as insect activity patterns vary temporally and require appropriate sampling windows (Elnaiem et al., 2020).

Although the sampling duration was relatively short, the use of multiple collection methods, such as sticky traps, pitfall traps, and time searching, was intended to maximize the representation of insect diversity at each site, as combining passive and active sampling techniques is widely recommended in recent ecological studies to improve sampling effectiveness (Lauchande et al., 2024; Dedyukhin et al., 2024).

The sampling locations were selected purposively based on differences in environmental characteristics that were expected to influence the composition of insect communities. Therefore, this study aims to compare insect diversity between the mangrove coastal area and the homestay area on Pari Island, Kepulaun Seribu.

Tools and Materials

This study utilized several tools, including a shovel, an insect net, plastic cups, a tripod, a soil tester, a hygrometer, and a digital camera. The materials used in this study included specimen bags, sticky traps, 70% alcohol, detergent, and plastic ropes.

Research Methods and Design

This study employs a quantitative descriptive approach to examine the structure of insect communities in two habitats with different environmental conditions, thereby providing an overview of the variations in the communities that form. This approach allows for the identification of species composition and the analysis of individual distribution within communities based on field data. The ecological parameters observed include species composition, abundance, diversity, evenness, dominance, and the degree of community similarity between habitats. The data obtained were then quantitatively analyzed using relevant ecological indices to produce a comprehensive picture of the insect community structure in each of the observed habitats.

Data Collection Techniques

Insect data collection was conducted using three trapping methods: sticky traps, pitfall traps, and time-searching with insect nets. This study was conducted at two observation sites, each consisting of three plots (A1-A3 and B1-B3), with a distance of 10 meters between plots to minimize interference between sampling points. Sticky traps, consisting of adhesive yellow paper, were placed at each observation point by hanging them from tree trunks to capture small flying insects. The pitfall trap method involved burying plastic cups containing a preservative solution halfway into the soil (approximately half the container's depth) so that they were level with the ground surface, allowing crawling insects to become trapped inside. Additionally, the time-search method was conducted using an insect net over 10-minute intervals with three repetitions.

The captured insects were then identified using the iNaturalist app down to the family taxonomic level based on observable morphological characteristics. The identification process was conducted by the researchers in this study using available digital databases. Concurrently with insect sampling, environmental conditions such as soil pH and air humidity were measured at each observation point using field testing equipment.

Data Analysis and Interpretation

The research data were analyzed using Density (D) formula, Simpson's Dominance Index (C), Shannon-Wiener Diversity Index (H'), and Sorensen's community similarity index (Cs).

1. *Shannon-Wiener Diversity Index (H')*

$$H' = -\sum p_i \ln (p_i)$$

Description:

p_i : the proportion of the *i*-th species in the total sample

H' : Shannon-Wiener diversity index.

ln : natural logarithm

2. *Simpson's Dominance Index (D)*

$$D = \sum (n_i/N)\ 2$$

Description:

D : dominance

n_i : total number of individuals of species *i*

N : total individuals of all species

3. Evenness Index (E)-Pielou's Evenness

$$E = \frac{H'}{\ln (S)}$$

Description:

E : Evenness index

H' : Shannon-Wiener diversity index

S : total number of species found

In : natural logarithm (base e)

4. Insect similarity index between two plots

$$Cs = \frac{2S}{(A + B)}$$

Description

S : The same number of species (shared species) at both locations

A : Total number of species at Location A

B : Total number of species at Location B

RESULTS AND DISCUSSION

The research results shown in Table 1 indicate that while insect diversity was similar at both observation sites, the number of insects at the two sites differed significantly. Location A only has 14 individuals, while Location B has 61 individuals. This difference shows that the coastal microhabitat conditions at Location B are more supportive of insect activity. More heterogeneous vegetation, food availability, and a more humid environment at 03.00 p.m (87%) can increase insect activity and abundance, consistent with findings that more complex habitats result in higher insect abundance (Siregar et al., 2022).

The results of the study shown in Figure 2 indicate that insect diversity at the two observation sites The results of the study show that insect diversity at the two observation sites, namely site A (Homestay) and site B (Mangrove Coastal Area), had relatively similar Shannon-Wiener index (H') values, namely 1 at site A and 1.46 at site B. Values in the range of 1-3 indicate moderate diversity, signifying a fairly stable insect community that is not dominated by any particular family (Magurran & McGill, 2019). The similarity in H' values indicates that the ecological conditions at the two locations are not drastically different. The evenness index (E) values at both locations were relatively high: 0.72 at location A and 0.70 at location B. Values >0.7 indicate a fairly even distribution of individuals among families, describing a stable community without extreme dominance (Takahashi & Kamimura, 2020). The dominance index (D) shows a different pattern, with location A having a value of 0.46, higher than location B (0.32). The higher dominance at location A comes from the Formicidae family, which makes up the majority of individuals found. This condition is common in environments close to human activity, where ants tend to be the dominant group (Nurdiansyah & Prasetyo, 2021).

Table 1. Insect Observations

Family	Location						M
	A1	A2	A3	B1	B2	B3	
Formicidae	4	3	2	14	1	3	ST, PT, TS
Tephritidae	-	2	-	5	2	-	ST
Oecophoridae	-	-	2	-	-	-	ST
Cicadellidae	-	-	-	18	11	-	ST
Carabidae	-	-	-	1	-	-	ST
Scarabaeidae	1	-	-	-	-	-	PT
Cicadidae	-	-	-	1	-	2	TS
Calliphoridae	-	-	-	-	-	1	TS
Libellulidae	-	-	-	-	-	1	TS
Noctuidae	-	-	-	-	-	1	TS
Total	5	5	4	39	14	8	

Description: A = Homestay; B = Mangrove Coastal Area; 1-3 = Observation plots at each location; M = Method; TS = *Time Searching*; ST = *Sticky Trap*; PT = *Pitfall Trap*

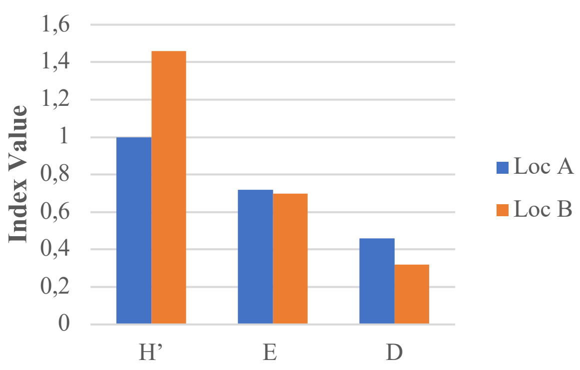

Figure 2. Index Comparison between location

The community similarity index obtained (Cs = 0.33) indicates a relatively low level of similarity (<0.50). This index was calculated using the Sorensen formula, which is based on the presence or absence of families, rather than on the number of individuals. This value indicates that the composition of insect families between the two locations differs quite distinctly.

Based on Table 2, the number of families found at the two locations is not the same. Location A has fewer families compared to Location B. Some families, such as Calliphoridae, Libellulidae, and Noctuidae, were found only at Location B and not at Location A. These differences in the number and composition of families result in a low similarity value because only a portion of the families were found at both locations.These differences in community composition are likely influenced by variations in habitat conditions and environmental characteristics at each location. Although abiotic parameters such as temperature (25-28°C), humidity (81-87%), and soil pH (6.8-7.0) fall within relatively similar ranges, these conditions alone are insufficient to produce high community similarity. This indicates that other factors, such as vegetation structure, food availability, and microhabitat conditions, also influence the presence and distribution of insects at both locations. (Rahmawati et al., 2021).

Table 2. Similarity Index Based on Family

Famili	**Location**	
	A1-A3	**B1-B3**
Formicidae	9	18
Tephritidae	2	7
Oecophoridae	2	-
Cicadellidae	-	29
Carabidae	-	1
Scarabaeidae	1	-
Cicadidae	-	3
Calliphoridae	-	1
Libellulidae	-	1
Noctuidae	-	1
Total	14	61

Description: A = Homestay; B = Mangrove Coastal Area

Some families exhibit a specific distribution at certain locations, with Oecophoridae found only at Location A, while Cicadellidae and Carabidae are found only at Location B. This pattern indicates a preference for different microhabitat conditions at each location. Location A, which is relatively more open and closer to human activity, tends to support the presence of certain families such as Oecophoridae, which are associated with specific organic materials or vegetation. Conversely, Location B, a mangrove area, has higher humidity levels and a more complex vegetation structure, making it more conducive to the presence of families such as Cicadellidae and Carabidae. The abundance of Cicadellidae is known to be closely related to the availability of host plants and humid microclimatic conditions, as reported by Chen et al. (2019); thus, the differences in family composition between the two locations reflect the influence of habitat characteristics on insect distribution.

The family similarity index (SI) between locations A and B falls into the moderate category, indicating that the two locations share some of the same insect families, but their compositions are not entirely similar. This suggests that although the two locations are relatively close, differences in environmental conditions and vegetation still influence the structure of the insect communities. This finding aligns with previous research stating that differences in vegetation structure and microclimate can result in lower levels of insect community similarity (Wulandari et al., 2017; Rahmawati & Gunawan, 2021). These conditions are also related to the sensitivity of insects to environmental changes, which is one of the determining factors for their existence in nature, as insects possess the ability to respond to environmental disturbances in specific patterns (Rahayu, 2016). Thus, the research results from Pari Island indicate that insect communities are quite responsive to habitat variations, even within a relatively small spatial scale.

Measurements of abiotic parameters were conducted to determine the environmental conditions affecting insect life. The results in Table 3 showed that air temperature and humidity fluctuated at each observation time, indicating dynamic environmental conditions during the data collection process.

Table 3. Abiotic Components

Time	Location	Temperature (℃)	Humidity (%)	pH
07.00 a.m	A	26	85	7.0
	B	26	85	7.0
03.00 p.m	A	28	85	7.0
	B	27	87	7.0
11.00 p.m	A	25	81	7.0
	B	25	81	6.8

Measurements of abiotic components at both locations indicate that environmental conditions during the observation period were relatively consistent. Air temperature ranged from 25-28°C, relative humidity ranged from 81-87%, and soil pH was neutral, ranging from 6.8-7.0. These results reflect the characteristics of a fairly stable coastal environment that supports insect life. Temperatures that are not too extreme and a neutral soil pH allow vegetation to grow well, thereby providing food sources and habitats for insects. Additionally, high air humidity plays a role in maintaining insects' physiological activities, such as metabolism and movement. The highest humidity was recorded at Location B at 03.00 p.m (87%), indicating that the mangrove area has a better ability to retain water content compared to the homestay area. In general, the abiotic conditions at both locations are suitable for supporting the presence and activity of insect communities.

These environmental conditions also influence the patterns of insect communities found at both study sites. This is evident from the patterns of community diversity, evenness, and similarity, which indicate differences in characteristics between the sites. Factors such as coastal vegetation type, food availability, and the level of human activity are key determinants of insect distribution and abundance. Locations with more complex vegetation and lower levels of human disturbance tend to support more diverse and stable insect communities. Conversely, more open areas and those closer to human activities exhibit a more limited community composition. These results align with previous studies indicating that habitat characteristics and human activity pressures have a significant influence on the structure of insect communities in small island ecosystems (Putri, 2018; Lestari & Pramudita, 2022).

CONCLUSION

Based on the research findings, the insect communities on Pari Island at both locations exhibited relatively stable conditions, with moderate levels of diversity and a fairly even distribution of individuals. Thus, there were differences in the number of individuals and family composition between the residential and coastal areas, indicating the influence of differing microhabitat conditions. The family similarity index, which falls into the moderate category, also indicates that some families are found at both locations; however, compositional differences persist, likely influenced by variations in habitat and vegetation. In general, the insect communities at both locations are shaped by environmental conditions that do not differ significantly, yet they remain influenced by the characteristics of each respective habitat.

AUTHOR CONTRIBUTION

Conceptualization: Dwi Sri Wahyuni, Yayu Kurniawati, Alma Mustika Shafi Azzahra, Indah Ayu Dwiastuti, Salwa Putri Naswati, and Muhammad Bagir Nurullah
Methodology: Yayu Kurniawati, Alma Mustika Shafi Azzahra, Indah Ayu Dwiastuti, Salwa Putri Naswati, and Muhammad Bagir Nurullah
Investigation: Yayu Kurniawati, Alma Mustika Shafi Azzahra, Indah Ayu Dwiastuti, Salwa Putri Naswati, Meilisha Putri Pertiwi, Lufty Hari Susanto, Muhammad Bagir Nurullah, Lufty Hari Susanto
Data Curation: Yayu Kurniawati, Alma Mustika Shafi Azzahra, Indah Ayu Dwiastuti, Salwa Putri Naswati, Meilisha Putri Pertiwi, Lufty Hari Susanto, and Muhammad Bagir Nurullah
Validation: Yayu Kurniawati, Alma Mustika Shafi Azzahra, Indah Ayu Dwiastuti, Salwa Putri Naswati, Muhammad Bagir Nurullah, Dwi Sri Wahyuni
Visualization: Yayu Kurniawati, Alma Mustika Shafi Azzahra, Indah Ayu Dwiastuti, Salwa Putri Naswati, Muhammad Bagir Nurullah, Dwi Sri Wahyuni
Writing – Original Draft: Dwi Sri Wahyuni
Writing – Review & Editing: Dwi Sri Wahyuni
Supervision: Dwi Sri Wahyuni

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

REFERENCES

Alongi, D. M. (2008). Mangrove forests: Resilience and responses to environmental change. Estuarine, Coastal and Shelf Science, 76(1), 1–13.

Alrazik, M. U., Jahidin, J., & Damhuri, D. (2017). Keanekaragaman Serangga (Insecta) Subkelas Pterygota Di Hutan Nanga-Nanga Papalia. Jurnal Ampibi, 2(1), 1–10.

Chen, Y., Yang, X., & Wu, H. (2019). Habitat

preferences and distribution patterns of insect communities in coastal ecosystems. Journal of Insect Conservation, 23(4), 685–697.

Dedyukhin, S. V., et al. (2024). Assessment of efficiency of pitfall trap method for insect sampling. Journal of Wildlife and Biodiversity, 8(2), 416–433.

Dong, S., Sha, W., Su, X.; Zhang, Y., LI, S., Gao, X.,

Liu, S., Shi, J., Liu, Q., Hao,Y. The impacts of geographic, soil and climatic factors on plant diversity, biomass and their relationships of the alpine dry ecosystems: Cases from the Aerjin Mountain Nature Reserve, China. Ecol. Eng. 2019, 127, 170–177.

Elnaiem, D. E., et al. (2020). Understanding sand fly sampling methods: sticky traps as sampling tools. Parasites & Vectors, 13, 389.

Fakhrah, F. (2016). Inventarisasi Insekta Permukaan Tanah Di Gampong Krueng Simpo Kecamatan Juli Kabupaten Bireuen. Jurnal Pendidikan Almuslim, 4(1), 116881.

Hasyimuddin, Syahribulan, & Usman, A. A. (2017). Peran ekologis serangga tanah di perkebunan Patallassang Kecamatan Patallassang Kabupaten Gowa Sulawesi Selatan. Prosiding Seminar Nasional Biology for Life, November, 70–78.

Lauchande, V. L., et al. (2024). Comparing the effectiveness of pitfall traps and active sampling methods. Bothalia - African Biodiversity & Conservation, 54(1).

Lee, S. Y., Primavera, J. H., Dahdouh-Guebas, F., et al. (2014). Ecological role and services of tropical mangrove ecosystems. Global Ecology and Biogeography, 23(7), 726–743.

Lestari, N., & Pramudita, R. (2022). Insect community structure in small island coastal ecosystems of Indonesia. Journal of Tropical Biodiversity, 10(2), 77–85.

Lina, T. N., Sediyono, E., & Prasetyo, S. Y. J. (2017). Analisis Pemanfaatan Kawasan Wilayah Pesisir Menggunakan Local Indicators of Spatial Association (Lisa) (Studi Kasus : Kabupaten Kulon Progo). Simetris : Jurnal Teknik Mesin, Elektro Dan Ilmu Komputer, 8(2), 781. https://doi.org/10.24176/simet.v8i2.1608

Magurran, A. E., & McGill, B. J. (2019). Biological Diversity: Frontiers in Measurement and Assessment. Oxford University Press.

Matatula.J., Afandi AY., Wirabuana PYAP. 2021. Short communication: A comparison of stand structure, species diversity and aboveground biomass between natural and planted mangroves in Sikka, East Nusa Tenggara, indonesia. Biodiversitas 22:1098-1103. DOI: 10.13057/biodiv/d220303

Matatula J, Poedjirahajoe E, Pudyatmoko S, Sadono R. 2019. Spatial distribution of salinity, mud thickness and slope along mangrove

McGeoch, M. A. (1998). The selection, testing and application of terrestrial insects as bioindicators. Biological Reviews, 73(2), 181–201.

Nurdiansyah, W., & Prasetyo, A. (2021). Struktur komunitas serangga pada lingkungan permukiman dengan tingkat gangguan manusia berbeda. Jurnal Entomologi Indonesia, 18(2), 97–108.

Rahayu GA. 2016. Keanekaragaman dan peranan fungsional serangga pada area reklamasi di berau, Kalimantan Timur [tesis]. Bogor: Institut Pertanian Bogor.

Rahmadian. (2023). Laporan Akhir PKM Pelestarian Mangrove dalam Upaya Pencegahan Abrasi Pesisir Tanjung Palas Utara. Universitas Terbuka Tarakan. file:///C:/anin/LAPORAN%20AKHIR%20PKM%202023%20MANGROVE.pdf

Rahmawati, L., Yusuf, M., & Sari, D. P. (2021). Analisis kesamaan komunitas serangga pada berbagai kondisi habitat di kawasan pesisir. Indonesian Journal of Ecology, 6(1), 55–64.

Rahayu GA. 2016. Insect diversity and functional roles in reclaimed areas in Berau, East Kalimantan [thesis]. Bogor: Bogor Agricultural University.

Satria, R., Viet, B. T., & Eguchi, K. (2017). New synonymy and redescription of Anochetus mixtus Radchenko, 1993, and distinction from the other members of the Anochetus rugosus group (Hymenoptera: Formicidae: Ponerinae). Asian Myrmecology 9(1993). https://doi.org/10.20362/am.009006

Siregar, R., Hutabarat, R., & Simanjuntak, D. (2022). Pengaruh heterogenitas habitat terhadap kelimpahan dan keanekaragaman serangga. Biodiversitas, 23(8), 4121–4129.

Suhardjono, Y. R. (2018). Keanekaragaman serangga dan peranannya dalam ekosistem tropis Indonesia. LIPI Press.

Takahashi, K., & Kamimura, Y. (2020). Evenness indices and their ecological interpretations in insect community studies. Ecological Indicators, 110, 105930.

Wahyuni, D. 2020. Peran masyarakat dalam pelestarian mangrove di kawasan pesisir. Prosiding Seminar Nasional Kelautan dan Perikanan, 3(1): 55–60.

Yuliana, T., & Santoso, D. (2020). Kajian awal keanekaragaman serangga di Kepulauan Seribu sebagai indikator ekologi. Jurnal Biologi Tropis Indonesia, 7(2), 45–53.

Yuliani, S., & Rusli, S. (2019). Formulasi Fly Spray dari Ekstrak Piretrum dan Effektivitasnya terhadap Serangga Rumah Tangga. Pertanian.go.id.

Zhao, C., & Qin, C. Z. (2022). Identifying Large- Area Mangrove Distribution Based on Remote Sensing: A Binary Classification Approach Considering Subclasses of NonMangroves. International Journal of Applied Earth Observation and Geoinformation, 108, 102750