AGRINUS
YAYASAN PENGEMBANGAN DAN PEMBERDAYAAN NUSANTARA
Volume: 01 No: 01 Halaman: 9-17

Diurnal Bettles Around Universitas Muhammadiyah Palembang

Astrid Sri Wahyuni Sumah[1*], Ali Alamsyah Kusumadinata[2]

[1)]Program Pascasarjana Pendidikan Biologi, Universitas Muhammadiyah Palembang
[2)] Universitas Djuanda, Bogor

Article history
Received : 21 Desember 2023
Revised : 1 Januari 2024
Accepted : 20 Januari 2024

***Corresponding author**
Astrid Sri Wahyuni Sumah
Email : astrid.sumah@gmail.com

Abstrak

Keberadaan kumbang bergantung pada ketersediaan energi dan sumber makanan untuk bertahan hidup dan beraktivitas. Keanekaragaman kumbang di suatu habitat dapat dipengaruhi oleh faktor lain, selain energi dan sumber makanan. Faktor tersebut antara lain tipe penggunaan lahan, perbedaan musim dan fragmentasi habitat. Perbedaan kawasan dan tipe penggunaan lahan mungkin tidak selalu mempengaruhi keanekaragaman kumbang. Akan tetapi, perubahan dalam penggunaan lahan yang dapat mempengaruhi keberadaan dan keanekaragaman kumbang. Sehingga, penelitian ini bertujuan untuk mengetahui keanekaragaman kumbang diurnal di sekitar kampus Universitas Muhammadiyah Palembang. Koleksi kumbang diurnal dilakukan dengan purposive sampling menggunakan perangkap jebak (pitfall trap) dan pengambilan langsung di lima titik pengamatan. Hasil penelitian didapatkan bahwa sebanyak 76 individu dari 7 spesies kumbang diurnal yang berhasil diidentifikasi berasal dari ordo Coleoptera. Kumbang *Coccinella transversalis* (famili Coccinellidae) merupakan spesies kumbang terbanyak yang ditemukan (36 individu) dan kumbang *Bradycellus nigrinus* (famili Carabidae) merupakan spesies kumbang paling sedikit (2 individu) yang ditemukan. Dampak dari perubahan penggunaan lahan mempengaruhi kekayaan spesies kumbang diurnal dan juga berdampak pada tumbuhnya vegetasi tumbuhan yang berbeda sebelumnya. Akan tetapi, penyebaran spesies kumbang diurnal menunjukkan hasil sebaran yang merata dan tidak terdapat spesies yang mendominasi.

Kata Kunci: Jumlah spesies, keanekaragaman, kekayaan, kumbang diurnal

Abstract

The existence of beetles depends on the availability of energy and food sources to survive and carry out activities. The diversity of beetles in a habitat can be influenced by other factors, apart from energy and food sources. These factors include land use type, seasonal differences and habitat fragmentation. Regional differences and land use types may not always influence beetle diversity. However, changes in land use can affect the presence and diversity of beetles. So, this research aims to determine the diversity of diurnal beetles around the Muhammadiyah University Palembang campus. Diurnal beetle collection was carried out by purposive sampling using pitfall traps and direct collection at five observation points. The research results showed that 76 individuals from 7 species of diurnal beetles were identified as belonging to the order Coleoptera. The Coccinella transversalis beetle (family Coccinellidae) was the most beetle species found (36 individuals) and the beetle Bradycellus nigrinus (family Carabidae) was the fewest beetle species (2 individuals) found. The impact of changes in land use affects the species richness of diurnal beetles and also impacts the growth of previously different plant vegetation. However, the distribution of diurnal beetle species shows an even distribution and there is no dominant species.

Keywords: Number of species, diversity, richness, diurnal beetles

INTRODUCTION

Insects, in general, have a very important role, especially in the ecosystem, namely as decomposers, pollinators, predators, and parasitoids. There are also insects that are considered neutral or have no direct impact on cultivated plants (Ahmad et al., 2019). Beetles are needed in the ecosystem because they have a very important role, especially as plant eaters, predators, scavengers, and decomposers (Stork, 2018). These beetles are an important pest for plants and can affect the diversity of plant species (Hasanah & Hardiansyah, 2019), while the presence of predatory beetles can affect the existence of insect populations in the surrounding area (Sari, 2015). The beetles play a role in the process of decomposing organic material both on the surface of the soil and in the soil. Beetles also play a role in the sustainability of the surrounding ecosystem, especially in preserving the availability of nutrients in the soil (Hidayatulloh et al., 2018). The ability of ground beetles, for example, can be seen in terms of their ability to destroy or break down organic materials in the soil (Alrazik et al., 2017) as well as their way of transforming minerals into the form of nutrients that can support soil stability (Efendi et al. ., 2018), they can also maintain soil structure and maintain the balance of organisms that live and reproduce in the soil (Ervianna et al., 2020). The plant nutrients obtained from the residue will then be re-decomposed by a decomposition process which requires help from ground beetles so that new humus will be formed and will function as a source of nutrition for plants.

The habitat of beetle diversity is threatened by urbanization and the expansion of agricultural areas. The abundance and density of dung beetle species (Scarabaeidae) is influenced by agricultural land use (Englmeier et al., 2022). Intensification of land use, with more intensive management techniques and the transformation of natural habitats into agricultural and urban areas, has had a negative impact on beetle abundance (Umboh et al., 2018). Changes in abundance, number of species, and community composition can influence network and community stability. Urbanization can cause loss and fragmentation of beetle habitat. Thus, urbanized habitats becoming increasingly dominated by vegetation edges can indicate high levels of change in environmental conditions that can significantly influence the distribution of organisms (Sugiarto & Mersi, 2017), such as ground beetles (Coleoptera: Carabidae) (Cajaiba et al., 2018).

The diversity of diurnal beetles in each location is different, the lowest beetle species are found in environmental communities that have extreme temperatures (Riley et al., 2016), such as in barren areas, poor soil or disturbed land caused by building construction. Meanwhile, the high diversity of diurnal beetles is found in optimum environmental conditions (Kirichenko-Babko et al., 2020), such as in fertile areas and land rich in vegetation. The study of beetle diversity has an important role in the environment (Wagner, 2020). This is related to the food chain and ecological processes such as predation, parasitism, competition, symbiosis and predation which in an ecosystem will become increasingly complex and varied (Lamarre et al., 2018), so that it has the opportunity to create balance and stability. However, the construction of new buildings causes land conversion and will definitely affect the diversity, abundance and dominance of beetles. So, this research needs to be carried out as an effort to record the types and abundance of beetles. Therefore, this research aims to determine the diversity of diurnal beetles found around the Palembang Muhammadiyah University campus.

METHOD

Sample collection

Samples were collected using the Purposive Sampling technique, namely taking samples based on the type of beetle found around the Palembang Muhammadiyah University campus during February-March 2023. Samples were taken indirectly using pitfall traps, where each plot has five traps. . The trap is filled with a sweet solution with a volume of a quarter of the glass volume to trap the beetles. Apart from indirect collection, the beetle collection is carried out directly by hand (mechanical retrieval) around the litter, grass or land where the trap is planted. Traps placed in the morning are taken in the afternoon (15.00 WIB). Sampling was carried out 3 times in each plot. Sample identification using the books of Lawrence and Britton (1994) and Triplehorn and Johnson (2005).

Data analysis

The beetle data obtained were analyzed using the Simpson dominance index (D), Shannon-Wiener diversity index (H'), evenness index (E) and Margalef species richness index (Dmg) following Magurran (2004).

RESULTS AND DISCUSSION

The total number of beetles caught from the five observation points was 76 individuals consisting of seven species (Table 1), where all of the beetles were included in the order Coleoptera. The Coccinella transversalis beetle (family Coccinellidae) was the largest beetle species found (36 individuals). Species Gonocephalum sp. (Tenebrionidae family) is the species with the second highest number of individuals (15 individuals) which can also be found at all observation points. Meanwhile, the beetle Bradycellus nigrinus (family Carabidae) was the fewest beetle species (2 individuals) found. This is because this beetle species is an expert at escaping when it is about to be caught.

Table 1. The type and number of individuals of beetles caught.

Family	Species	Observation points					Entire
		1	2	3	4	5	
Coccinellidae	*Coccinella transversalis*	10	7	9	9	3	38
	Henosepilachna sp.	2	-	-	1	-	3
Scarabaeidae	*Anomali Mongolia*	-	-	-	3	-	3
	Onthophagus sp.	2	-	-	5	3	10
Chrysomelidae	*Altica siasia*	2	1	-	2	-	5
Tenebrionidae	*Gonocephalum sp.*	3	7	2	2	1	15
Carabidae	*Bradycellus nigrinus*	1	1	-	-	-	2
Number of individuals		20	17	11	22	6	76
Number of species		6*	4	2	6*	2	7
Type wealth index		1,67*	1,06	0,42	1,62	0,56	1,39
Evenness index		0,73	0,72	0,80	0,79	1*	0,62
Dominance index		0,31	0,40	0,70*	0,26	0,50	0,31
Diversity index		1,47	1,05	0,47	1,55*	0,69	1,46

Remarks: The highest value is marked with *****

The difference in the number of insects can be seen from their habitat. The high and low number of populations in a habitat is related to the environmental conditions of the habitat concerned (Rocca &; Milanesi, 2022). These environmental conditions can change due to the influence or interference of both external and internal factors (Ervianna et al., 2020). External factors can be due to human activities, and forest fires while internal factors can be in the form of competition and the nature of dependence on components in the habitat environment itself (Nuriyanti et al., 2017) for example the availability of food/feed for insects such as vegetation

or other insects that are smaller in size as prey (Pamungkas &; Ziqri, 2020). The number and type of insects will increase in communities that have the quantity and quality of feed that suits the needs of insects (Lucini et al., 2020). Between vegetation and insects, relationships occur that can stabilize forest ecosystems. When one component is disturbed, it will affect the existence of other components.

The observation points with the highest type richness index were point 1 (vegetation near the greenhouse) (Dmg = 1.67), and point 4 (vegetation near woodpiles used for building materials) (Dmg = 1.62) while the lowest index was at point 3 (small terrace garden) (Dmg = 0.42) (Table 1). Vegetation edge areas tend to have high species richness due to the meeting of two types of vegetation (Lativa et al., 2019), which is proven by the results of the study obtained (Table 1) that there are 37 individuals of diurnal beetle species found, if the two observations are combined. Overall the type wealth index around campus was 1.39. Meanwhile, the evenness index (E) value can be used as an indicator of dominance at the observation point. Overall, the spread of beetles around campus has a fairly even distribution of types (E = 0.62). The value of the evenness index of the type of beetle obtained ranges from 0.72–1. Observation point 5 in the form of an open area near a landfill has the highest evenness index value (E = 1). The smallest evenness was found at observation point 2 in the form of vegetation under trees near the motorcycle parking area (E = 0.72). From the observations at five points, all observation points had an even distribution of species (E≤ 0.50). The higher the evenness index value, meaning that the proportion of individual abundance of a species in a community tends to be the same.

The value of the species richness and evenness index is strongly influenced by the total number of individuals found in a given area. The species richness of beetles around the campus has a lower value due to the high total number of individuals (76 individuals) compared to the number of species obtained (7 species). The level of insect richness in the community will occur if the carrying capacity of the environment is adequate such as nutrients (Alfianingsih et al., 2022) and environmental factors such as temperature, humidity and pH, where the normal threshold of insect temperature in activities has a range starting from temperatures of 27-29oC (Putra et al., 2023). So that the tendency of the spread of beetles with measured temperatures

to plants occurs at low temperature intensity, and the temperature range in insect survival is very large, which is between temperatures of 25-27oC.

The Shannon-Wiener diversity index shows observation point 4 (dense vegetation edge near water body) has the highest diversity index (H' = 1.55) followed by observation point 1 (dense vegetation edge) (H' = 1.47) (Table 1). The values of these two locations are not too different from other locations. Point 3 (path with high canopy) indicates the lowest value (H' = 0.47). Overall, the beetle diversity index around campus was 1.46. Soegianto (1994) stated that a community has high species diversity if the community is composed of many species. Species diversity has a number of components that can react differently to geographical, developmental or physical factors (Valinta et al., 2021). High diversity means having long food chains and more cases of symbiosis (interaction) (Najmi et al., 2018; Riley et al., 2021), greater control for negative feedback control that can reduce distractions, and therefore will increase steadiness (Abdillah et al., 2020).

The dominance index (D) found varies, between 0.26–0.70. Observation point 3 has the highest dominance index value (D=0.70) among the five observation points. The lowest dominance index (D = 0.26) is found at observation point 4 (Table 1). According to Odum (1996), a dominance index of ≤ 0.50 means almost no species that dominate (low), a dominance index value of ≥ 0.50 to close to 0.75 means a medium dominance index, while ≥ 0.75 to close to 1 means a high dominance index. Of the five observation points, it generally shows low dominance, except observation point 3 which has a medium dominance index. The presence of beetles that are tolerant of human disturbances will usually dominate beetles that have high sensitivity and mobility (Rahayu et al., 2017; Rocca &; Milanesi, 2022). Based on the results of this study, all beetle species found are common types that are tolerant so that no type dominates each other. Alternatively, high-sensitivity types were not captured in the study.

CONCLUSION

The University of Muhammadiyah Palembang campus has a diversity and richness of diurnal beetle species that are evenly distributed at five points observed with fairly low species dominance.

REFERENCES

Abdillah, S A M., & Arroyyan, A. N. (2020). Keanekaragaman arthropoda tanah di Gunung Anjasmoro, Desa Carangwulung, Kecamatan Wonosalam, Kabupaten Jombang. Bioma: Jurnal Biologi Makassar, 5 (2), 144–150, doi: 10.20956/bioma.v5i2.10274.

Ahmad, F., Putra, A. H., & Viza, R. Y. (2019). Keanekaragaman Jenis Semut (Hymenoptera : Formicidae) di Hutan Adat Guguk Kabupaten Mrangin Provinsi Jambi Diversity of Ant Species (Hymenoptera : Formicidae) in Hutan Adat Guguk Merangin District Jambi Province. Jurnal Pendidikan Biologi Biosains, 2 (1), 32–42.

Alfianingsih, F., Dirhamzah, & Nurindah. (2022). Identifikasi serangga diurnal di Kawasan Hutan Topidi, Kabupaten Gowa, Sulawesi Selatan. Filogeni: Jurnal Mahasiswa Biologi, 2 (2): 42-46. DOI https://doi.org/10.24252/filogeni.v2i2.29368

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

Cajaiba, R. L., Périco, E., Silva, W. B., & Santos, M. (2018) When to sample ground beetles in the neotropics for biodiversity assessments? A case study in the Brazilian Amazon. Applied Ecology and Environmental Research 16: 7833–7846. https://doi.org/10.15666/aeer/1606_78337846

Della-Rocca, F., & Milanesi, P. (2022). The Spread of the Japanese Beetle in a European Human-Dominated Landscape: High Anthropization Favors Colonization of Popillia japonica. Diversity, 14 (8).

Efendi, S., Yaherwandi, Y., & Nelly, N. (2018). Biologi dan Statistik Demografi Coccinella transversalis Thunberg (Coleoptera: Coccinellidae), Predator Aphis gossypii Glover (Homoptera: Aphididae). Jurnal Perlindungan Tanaman Indonesia, 22 (1), 91.

Englmeier, J., Von, H.C., Rieker, D., Benbow, M. E., & Müller, J. (2022). Dung-visiting beetle diversity is mainly affected by land use, while community specialization is driven by climate. Ecology and Evolution, 12 (10) 1–14.

Ervianna, A. R., Hadi, M., & Rahadian, R. (2020). Kelimpahan Dan Keragaman Serangga OPT (Organisme Pengganggu Tanaman) dan Musuh Alaminya pada Tanaman Jagung dan Padi dengan Sistem Rotasi Tanaman. Bioma : Berkala Ilmiah Biologi, 22 (1), 59– 69.

Hasanah, U., & Hardiansyah, H. (2019). Keanekaragaman serangga diurnal dan potensinya sebagai hama di persawahan Desa Anjir Serapat Barat , Kecamatan Kapuas Timur , Kabupaten Kapuas. Proseding Semininar Nasional Lingkungan Lahan Basah, 4 (3), 540–543.

Hidayatulloh, A. R., Hariani, N., & Trimurti, S. (2018). Kelimpahan serangga arboreal pada padi sawah di Kelurahan Lempake Kota Samarinda Kalimantan Timur. Bioprospek Jurnal Ilmiah Biologi, 13 (2), 49– 53. doi: 10.30872/bp.v13i2.427.

Kirichenko-Babko, M., Danko, Y., Musz-Pomorksa, A., Widomski, M.K., & Babko, R. (2020). The impact of climate variations on the structure of ground beetle (Coleoptera: Carabidae)

assemblage in forests and wetlands. Forests 11: 1–16. https://doi.org/10.3390/f11101074

Lamarre, G.P.A., Hérault, B., Fine, P.V.A., Vedel, V., Lupoli, R., Mesones, I., & Baraloto, C. (2016). Taxonomic and functional composition of arthropod assemblages across contrasting Amazonian forests. Journal of Animal Ecology 85: 227–239. https://doi.org/10.1111/1365-2656.12445

Latifa, H., Atmowidi, T., & Noerdjito, W. (2019). Biodiversitas Kumbang Koprofagus di Lahan Pertanian Organik dan Non-organik. Jurnal Sumberdaya Hayati, 5(2), 52–57.

Lawrence, J. F., & Britton. (1994). *Autralian Beetles*. Melbourne: Melbourne Univ. Press.

Lucini, F. A., Morone, F., Tomassone, M. S., & Makse, H. A. (2020). Diversity increases the stability of ecosystems. PLoS ONE, 15(4) 1–13.

Magurran, A.E. (2004). *Measuring biological diversity*. Carleton (AU): Blackwell Publishing.

Najmi, L., Buchori, D., Triwidodo, H., Noerdjiyo, W.A., & Rizali, A. (2018). Keanekaragaman kumbang curculionid pada berbagai tipe penggunaan lahan di kawasan Hutan Harapan, Jambi. Jurnal Entomologi Indonesia, 15 (2), 65–73. DOI: 10.5994/jei.15.2.65.

Nuriyanti, D. D., Widhiono, I., & Suyanto, A. (2017). Faktor-Faktor Ekologis yang Berpengaruh terhadap Struktur Populasi Kumbang Badak (Oryctes rhinoceros L.). Biosfera, 33(1) 13.

Odum, E.P. (1996). *Dasar-dasar Ekologi*. Edisi ke-3. Yogyakarta: Gajah Mada Universitas Press.

Pamungkas, M. R & Ziqri, I. M. (2020). Faktor-faktor Lingkungan yang Berpengaruh Terhadap Struktur Populasi Kumbang Badak Untuk Meningkatkan Produksi Gula Merah di Kabupaten Cilacap. Mekanika, 2(1) 1–3.

Putra, I. L. I., & Unida, T. (2023). Diversity of Diurnal Beetles from Housing and Non-Housing Areas in Ahmad Dahlan University of Banguntapan, Yogyakarta. Journal of Biology Education, 6 (1): 96-105.

Rahayu, G. A., Buchori, D., Hindayana, D., & Rizali, A. (2017). Keanekaragaman dan peran fungsional serangga Ordo Coleoptera di area reklamasi pascatambang batubara di Berau, Kalimantan Timur. Jurnal Entomologi Indonesia, 14 2), 97–106. doi: 10.5994/jei.14.2.97.

Riley, K. N., Browne, R. A., & Erwin, T. L. (2016). Results from two sampling techniques for carabid beetles (Coleoptera: Carabidae) in temporarily flooded and terra firme rainforest of western Amazonia. Studies on Neotropical Fauna and Environment 51: 78–95. https://doi.org/10.1080/01650521.2016.1164473

Riley, P. K. N., Browne, R. A., & Erwin, T. L. (2021). Carabid beetle (Coleoptera, Carabidae) richness, diversity, and community structure in the understory of temporarily flooded and non-flooded Amazonian forests of Ecuador. In: Spence J, Casale A, Assmann T, Liebherr JK, Penev L (Eds) Systematic Zoology and Biodiversity Science: A tribute to Terry Erwin (1940–2020). ZooKeys 1044: 831–876. https://doi.org/10.3897/zookeys.1044.62340

Sari, M. (2015). Identifikasi serangga dekomposer di permukaan tanah hutan tropis dataran rendah (Studi kasus di Arboretum dan Komplek Kampus Unilak dengan luas 9,2 ha. Bio-Lectura, 2 (2), 140– 149, doi: 10.31849/bl.v2i2.324.

Soegianto. (1994). *Ekologi Kuantitatif Metode Analisis Populasi dan Komunitas*. Surabaya: Usaha Nasional.

Stork, N. E. (2018) How many species of insects and other terrestrial arthropods are there on Earth? Annual Review of Entomology, 63: 31–45. https://doi.org/10.1146/annurev-ento-020117-043348

Sugiarto & Mersi, L. (2017). Keanekaragaman enis Kumbang Berantena Panjang (Cerambycidae) di Perkebunan Kelapa Sawit PT NIKP Kecamatan Rantau Pulung Kabupaten Kutai Timur. Jurnal Pertanian Terpadu, 5 (1) 45–55.

Triplehorn, C. A., & Johnson N. F. (2005). Borror and Delong's Introduction to The Study of Insect 7th Edition. Thomson Brooks/Cole: Belmont.

Umboh, N. T., Pinaria, B. A. N., Manueke, J., & Tarore, D. (2018). Jenis dan Kepadatan Populasi Serangga pada Pertanaman Padi Sawah Fase Vegetatif di Desa Talawaan Kecamatan Talawaan Kabupaten Minahasa Utara. Jurnal Eugenia, 19 (3) 1–9.

Valinta, S., Rizal, S., & Mutiara, D. (2021). Morfologi jenis-jenis serangga pada tanaman padi (Oryza sativa) di Desa Perangai Kec. Merapi Selatan Kab. Lahat. Indobiosains, 3 (1), 26–30, doi: 10.31851/indobiosains.v3i1.4543.

Wagner DL (2020) Insect declines in the Anthropocene. Annual Review of Entomology 65: 457–480. https://doi.org/10.1146/annurev-ento-011019-025151