

Butterflies' Diversity in Green Open Space of Malang City, East Java Province, Indonesia

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ABSTRACT

Butterflies have some roles in the environment, that is, as pollinator and bioindicator. Habitat is one of important factors to support butterflies' growth. The aim of this research was to describe butterflies' diversity in some green open spaces in Malang, East Java Province, Indonesia. Direct observations of butterflies diversity, vegetation structures and abiotic factors in Brawijaya University, Jalan Veteran, Jalan Jakarta, and Velodrom Green Open Spaces were conducted on June 2012. Sampling took place in each site by using cruising method in three-times observation: at 07.00, 11.00 a.m. and 3.30 p.m. The data were analyzed by statistical descriptive using Microsoft Excel 2007 and PAST. The results showed that the butterflies' composition in all sites were dominated by *Delias* sp., *Leptosia nina*, and *Eurema venusta*. The diversity index of all sites showed moderate rank that indicates community equilibrium in the environments was still good. In this case, Velodrom Green Open Space has the highest diversity index, which is about 2,199. Brawijaya University and Jalan Jakarta Green Open Spaces have a high similarity index based on Morisita Index. The highest abundance of butterflies is observed at 11.00-12.30 a.m. *Delias* sp. and *L. nina* have temporal spread all day long, while *E. venusta* does merely in daylight.

Keywords: *butterflies, green park area, diversity*

INTRODUCTION

Butterflies have important roles in the ecosystem, one of which is pollinator and bioindicator. Butterflies are very sensitive about environmental changing, they are easily affected by even relatively minor perturbations in the habitat. So, the presence of butterflies can be used as an indicator of the environmental quality [1].

Butterflies show distinct pattern of habitat utilization. The nature vegetation is the important factor which determines the dependence and survival of the butterflies in particular habitat [1]. One of butterflies habitat is green open space (GOS), which decreased by the expansion of cities and urbanization. Not only these influence their habitat degradation but also, influence in decreasing of plant species diversity, water quality, and increasing air and soil pollution [2]. In light of these problems, through this research we

aim to describe the relationship between butterflies' diversity and habitat similarity index in some green open spaces in Malang, East Java Province, Indonesia.

MATERIALS AND METHODS

This study was conducted on June 2012 in Brawijaya University, Veteran, Jakarta and Velodrom GOS. Sampling were took place in each GOS using cruising method in three time observation (7.00, 11.00 a.m., and 3.30 p.m). Direct visual observation helped by binocular and identification book or website such as Identification Guide for Butterflies of West Java [3] and Hoskins [4]

The community composition of butterflies was shown by Importance Value Index (IVI) which calculated by adding relative abundance and relative frequency. Species diversity was determined based on Shannon-Wiener Index [5].

$$H = - \sum_1^i P_i \cdot \log P_i \quad \dots(1)$$

Note: P_i : proportion of the i species in the total sample

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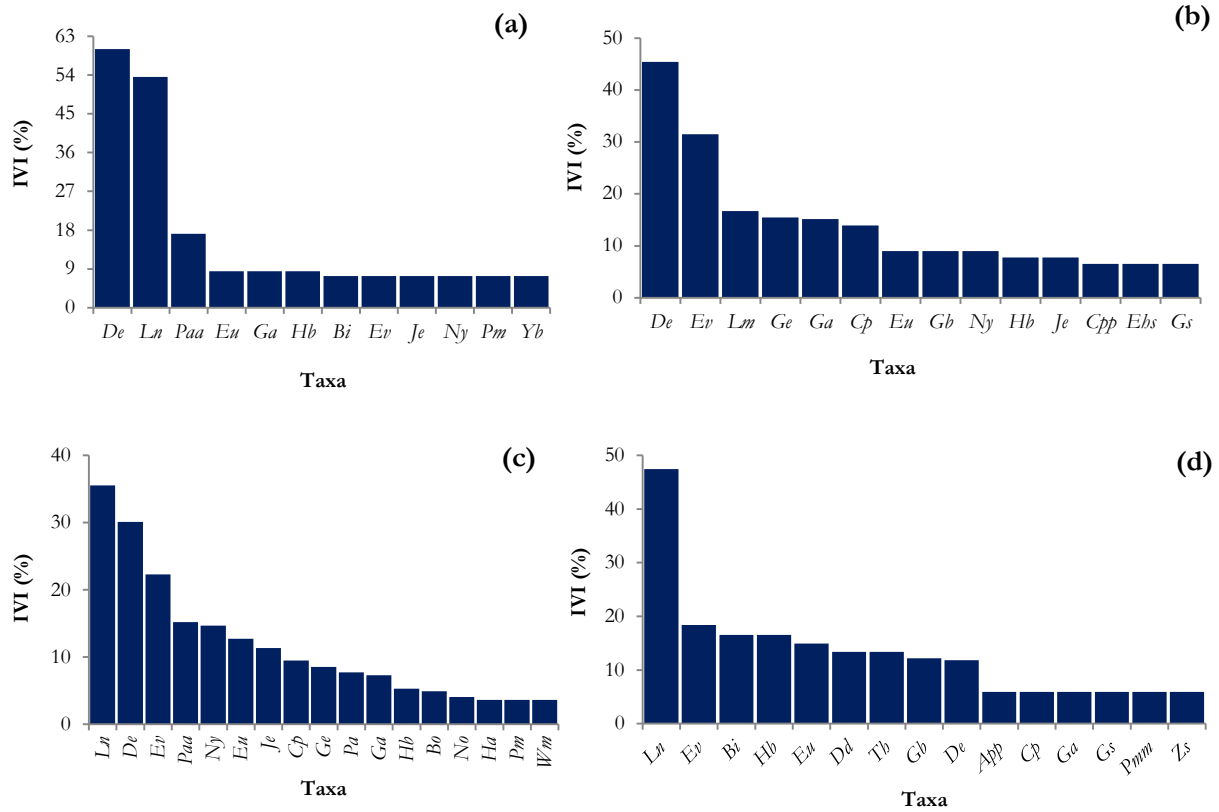


Figure 1. Variation of butterflies community composition in GOS Malang (a) Brawijaya University, (b) Veteran, (c) Jakarta and (d) Velodrom. Note: App=*As. phidippus*, Bi=*Bicyclus* sp., Bo=*Borbo* sp., Cp=*Catopsilia pyranthe*, Cpp=*Catopsilia pyranthe pyranthe*, Dd=*Delias dorylaea*, De=*Delias* sp., Eu=*Euploea* sp., Ehs=*Eurema hecabe sankapura*, Ev=*Eurema venusta*, Ge=*Geometridae*, Ga=*Graphium agamemnon*, Gb=*Graphium bathyeles*, Gs=*Graphium serpedon*, Ha=*Hypolimnas anumala*, Hb=*Hypolimnas bolina*, Je=*Junonia erigone*, Ln=*Leptostia nina*, No=*Noctuidae*, Ny=*Nymphalidae*, Pa=*Pantoparia* sp., Pm=*Papilio memnon*, Paa=*Prioneris autothibse*, Pmm=*Prioneris memnon*, Th=*Troides helena*, Wm=white moth, Tb=*Ypthima baldus*, Zs=*Zebra swallowtail*

Communities similarity was determined by Morisita Index [5].

$$C_H = \frac{2 \cdot \sum X_{ij} \cdot X_{ik}}{[(\sum X_{ij}^2 / N_j^2) + (\sum X_{ik}^2 / N_k^2)] N_j \cdot N_k \dots (2)}$$

Note: CH: Morisita Index
 Xij, X ik: number of species i in community j
 k, Nj: number of species in community j
 Nk: number of species in community k

The Morisita Index ranges from a value of 0, where there is no species overlapping in between the communities, to value of 1, when exactly the same species are found in both communities. All of data were tabulated and compiled by using Microsoft Excel 2007 and analyzed by PAST Program.

RESULTS AND DISCUSSION

Importance Value Index (IVI) indicates the influence of species against their community [6]. The result showed that in all sites there were varied composition of butterflies' communities

which were dominated by *Delias* sp., *L. nina*, and *E. venusta* (Figure 1). This result was supported by the previous study by Kurniawan [7]. *Troideshelena* was found in Velodrom. This species is one of worldwide protected species [8], so their habitat (Velodrom) needs to be conserved in order to support their life.

Respectively, the highest and the lowest butterflies' diversity took place in Velodrom and Brawijaya GOS (Figure 2a). The diversity index in all sites showed moderate rank [9]. It indicates that the community equilibrium in the environment was still good. However, it is necessary to increase the ecosystem diversity quality in all sites to increase their ecological services, too. The higher diversity index, the better the complexity of interaction among species; thus, it may contribute to the community and environment equilibrium.

One of the biotic factors that influence the butterflies' diversity is the vegetation structure. Velodrom has the highest variation of vegetation structure than the others. This area is dominated by trees, which play an important role as the but-

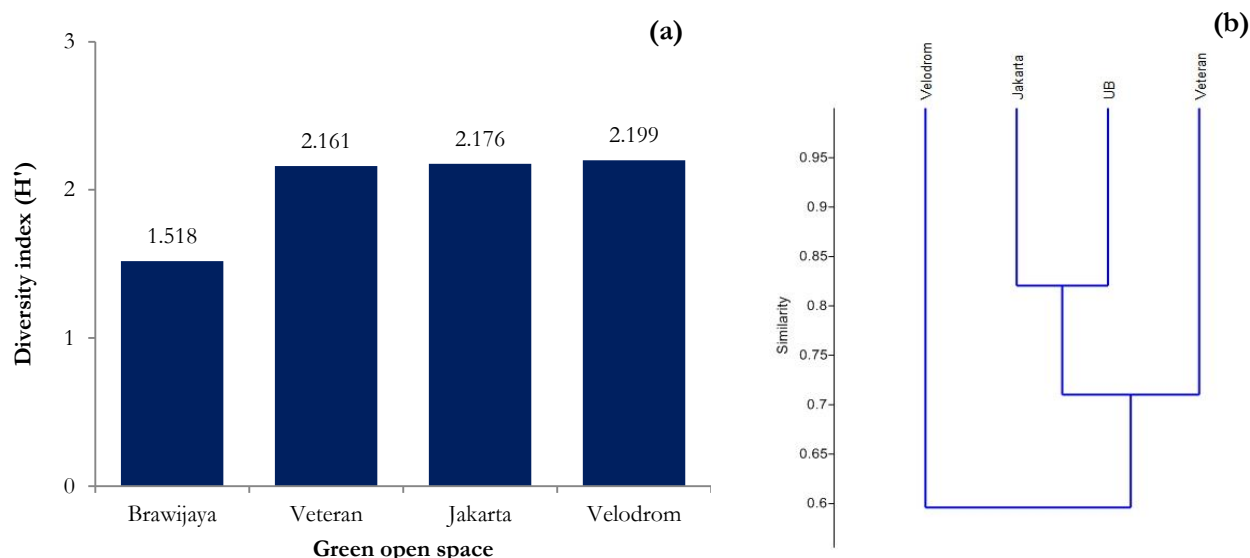


Figure 2. Diversity index (a) and dendrogram (b) of butterflies in four green open space in Malang

terflies' shelter, habitat, and food resource. This result, as well as the previous study in primary forest, the open canopy on the location brings out high butterflies diversity [10].

The important roles of vegetation structures not only influence butterflies' diversity in Velodrom, but also butterflies' community similarity index between Jalan Jakarta and Brawijaya University. The butterflies' community similarity index based on Morisita Index in both areas was high (Figure 2b). The butterflies' abundance in all sites varied based on temporal spread, with relative abundance ranging from 12 to 66 % observed at 11.00-12.30 a.m. The butterflies' activity was predicted to start from 9-11 p.m and it was influenced by light and open space, so their abundance decrease along the time. Beside that, it is the best time to produce nectar in a great volume and precise sugar concentration for the butterflies' requirement. This condition indicates that the variation of quantity and quality of nectar production is heavily influenced by weather and time [11].

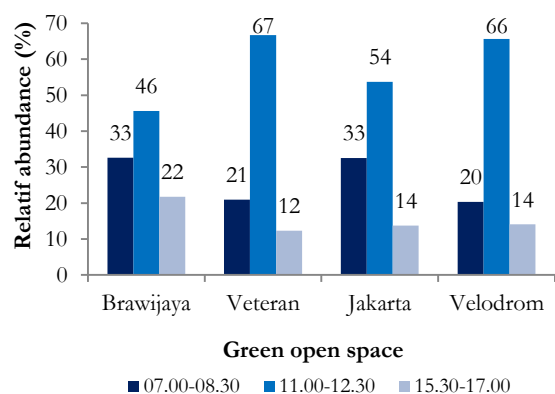


Figure 3. Relative abundance based on temporal spread in four green open space in Malang

CONCLUSIONS

The result showed that butterflies composition in all sites dominated by *Delias* sp., *L. nina*, and *E. venusta*. The diversity index of all sites showed moderate rank that indicate communities equilibrium in environmental was still good. In this case, Velodrom Green Park Area has the highest of diversity index, it was about 2.199. Brawijaya University Garden and Jakarta Green Park Area have high similarity index based on Morisita Index. The highest abundance of butterflies was observed at 11.00-12.30 a.m. *Delias* sp. and *L. nina* has temporal spread all day long while *E. venusta* just in day light.

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REFERENCE

1. Uniyal VP, Mathur PK (1998) Diversity of butterflies in the Great Himalayan National Park, Western Himalaya. *Indian Journal of Forestry* 21 (2): 150-155.
2. Mc Kinney ML (2002) Urbanization, biodiversity, and conservation. *Bioscience* 52: 883-890.
3. Schulze CH (2012) Identification guide for butterflies of West Java. <http://www.scribd.com/>. Accessed date: June 27, 2013.
4. Krebs CJ (2001) *Ecology the experimental analysis of distribution and abundance* 5th ed. Addison Wesley Longman Inc. San Francisco.

5. Hoskins A (2013) The most complete and authoritative guide to butterflies and moths. <http://www.learnaboutbutterflies.com>. Accessed date: June 27, 2013.
6. Osnas OA, Armbrach I, Calle Z (2010) Butterflies and vegetation in restored gullies of different ages at the Colombian Western Andes. *Boletín Científico Museo de Historia Natural* 14 (2): 163-180.
7. Kurniawan L (2012) Diversitas kupu-kupu di Taman Veteran, ruang terbuka hijau (RTH) Jakarta, dan RTH Velodrom. Skripsi. Biology Departement. Faculty of Mathematics and Natural Sciences. Brawijaya University.
8. Majumder, Lodh JR, Agarwala BK (2012) Variation in butterfly diversity and unique species richness along different habitats in Trishna Wildlife Sanctuary, Tripura, Northeast India. *Check-List-Journal of Species Lists and Distribution* 8 (3): 432-436.
9. Henderson PA (2003) *Practical methods in ecology*. Blackwell Publishing. Victoria.
10. Hamer KC, Hill JK, Benedick S, Mustaffa N, Sherratt TN, Maryati M, Chey VK (2003) Ecology of butterflies in natural and selectivity logged forest of Northern Borneo: The importance of habitat heterogeneity. *Journal of Applied Ecology* 40: 150-162.
11. Davies H, Butler CA (2008) *Do butterflies bite? Fascinating answers to questions about butterflies and moths*. Rutgers University Press. New Jersey.