The Diversity of Odonata in Parangkusumo Sand Dune Yogyakarta, Indonesia

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Abstract. Parangkusumo sand dune is a one of unique eolian ecosystem in Yogyakarta. The study on the species diversity of dragonflies in this habitat is still limited. The main purpose of this research was to observe the dragonflies species diversity in Parangkusumo sand dune, Yogyakarta, Indonesia. The collection of dragonflies was done by aerial collection using sweep net. The specimens identification was done in Entomology Laboratory, Faculty of Biology, Universitas Gadjah Mada based on the morphological characters of the adult stage. The results showed that there were 22 species of Odonata, including 17 dragonflies (Anisoptera) and 5 damselflies (Zygoptera). The diversity index (H’) was 2.51 which inferred medium diversity. Several species such as Anax guttatus, Lestes praemorsus and Tramea transmarina were found to be endemic species. The highest relative abundance of the species was Orthetrum sabina (21.79%) and lowest abundance of species is Orthetrum chrysis (0.14%). Parangkusumo sand dune has medium dragonfly diversity, thus it is recommended this habitat need to be conserved.

Key words. diversity, Odonata, sand dune

1. Introduction

Dragonflies are insect which belongs to the Odonata order. As an insect, dragonflies have a high abundance in number and can be found in an extensive ecological diversity [1]. They live in water. Adult dragonflies will lay their eggs into a plant material above or below the surface of the water so their nymph will stay in the water [2]. Dragonflies have a diverse benefits to the ecosystems such as environmental bioindicators, pest predators, pollinators in the process of pollinating flowers, and biological agent of insect pests [1].

Since half of dragonfly’s life cycles are in the water surface, they can be used to determine the quality of an environment. Their population can be found abundantly around in a clean fresh water environment. In contrast, dragonfly populations will be difficult to find in a surface of polluted water Due to its characteristics, dragonflies can be used as an indicator of water quality [3].

Parangkusumo sand dune is the only geospatial region with barchan type that found in Southeast Asia [4]. Sand dune is the result of natural phenomena that is formed through a long time which then resulted to the formation sand dune around the coastal area [5]. The process of sand dune formation in Yogyakarta Parangkusumo was formed by the presence of southeast monsoon winds that carried sand grains of the southern coast area. Turbulence generated by the wind power results into the formation of a deflation hole (blowout) which will get deeper along the time [6]. Parangkusumo sand dune is located
in Parangtritis, Kretek, Bantul Regency, Special Region of Yogyakarta. Parangkusumo sand dune is the only type of sand dune that has a distinctive shape like a crescent moon, so it is known as a barchan sand dune. Sand dune in this region is a tropical sand dune that has a large size with a height of 15 meters. Some types of vegetation growing in this region are Ipomea per-caprae, Spinifex littoreu, Cyperus sp., Callotropis gigantean, and Glyricidae sapindas [7]. Parangtritis-Parangkusumo region has two distinct seasons, it is rain season and dry season. The dry period occurs in the southeast monsoon season which blows around April to September which causes sand material along the coast will have a long dry period, while in October to March, the dune slacks in the sand dune area will be filled with rainwater due to rainfall in high intensity. This causes the area to be flooded, called as wet dune slacks [8]. The deflation hole will generate a new ecosystem during the rainy season. The formation of wet dune slacks in the Parangkusumo sand dune during the rainy season becomes an appropriate habitat to support the development of aquatic organisms such as insects.

![Figure 1. Parangkusumo sand dune](image)

Based on that background, Parangkusumo sand dune is an unique area for dragonflies. This study aimed to determine the diversity of dragonflies, Zygoptera and Anisoptera, found in the Parangkusumo sand dune Yogyakarta. The study is expected to provide a preliminary data for biodiversity conservation in Parangkusumo sand dune.

2. Methods
The study was conducted from January - June 2019. Data collection was performed at Parangkusumo sand dune, Bantul, Yogyakarta, Indonesia. The observation was performed purposely by finding the Odonata that perch at Gumuk pasir sand dune.

Pictures of dragonflies were taken for identification. The observation time was done at 7-10 AM and 2-6 PM since Odonata were active during these time. The collection of the Odonata was carried out by using a cone-shaped net insect (h: 60 cm, d: 30 cm) and 1 m wooden stick. The specimens identification was done in Entomology Laboratory, Faculty of Biology, Universitas Gadjah Mada based on the morphological characters of the adult stage by using determination key [9-10].
Figure 2. Sampling location in Parangkusumo sand dune (8°00′54″S 110°18′56″E 1,82 km) 
(Source: Google Earth)

The data of diversity of the species (H') was determined by the Shannon Wiener Index [11] with this calculation:

$$H' = - \sum_{i=1}^{n} (p_i) \ln(p_i)$$  \hspace{1cm} (1)

H’ = Shannon –Wiener Index
N = Total individuals of population sampled
ni = Total individuals belonging to the i species

3. Result and discussion

A list of Odonata that found in Parangkusumo Sand Dune is presented in Table 1.

Table 1. Odonata species found at Parang Kusumo Sand Dune with their relative abundance (%) and 
diversity index (H')

| No | Species          | Family      | Number of Individuals | Pi ln Pi | Relative Abundance |
|----|------------------|-------------|-----------------------|----------|--------------------|
| 1  | Anax guttatus    | Aeshnidae   | 25                    | -0,12    | 3,56               |
| 2  | Brachythemis contaminata | Libellulidae | 4                    | -0,03    | 0,57               |
| 3  | Crocothermis servilia | Libellulidae  | 56                   | -0,20    | 7,98               |
| 4  | Diplacodes trivialis | Libellulidae  | 16                   | -0,09    | 2,28               |
| 5  | Gynacantha sp.    | Aeshnidae   | 6                     | -0,04    | 0,85               |
| 6  | Gynacantha subinterrupta | Aeshnidae  | 10                   | -0,06    | 1,42               |
| 7  | Lathrecista asiatica | Libellulidae | 61                   | -0,21    | 8,69               |
| 8  | Neurothemis ramburii | Libellulidae  | 91                   | -0,26    | 12,96              |
| 9  | Orthetrum chrysis | Libellulidae | 1                    | -0,01    | 0,14               |
| 10 | Orthetrum sabina | Libellulidae | 153                  | -0,33    | 21,79              |
| 11 | Orthetrum testaceum | Libellulidae | 5                    | -0,04    | 0,71               |
| 12 | Pantala flavescens | Libellulidae | 50                   | -0,19    | 7,12               |
| 13 | Potamarcha congener | Libellulidae | 42                   | -0,17    | 5,98               |
A total of 702 individuals of 22 species representing 4 families of Odonata had been successfully recorded in this study. They are 546 individuals of Anisoptera (17 species; 2 families) and 156 damselflies (5 species; 2 families). In this field study Libellulidae was the most dominant family and considered as the most widespread family. It was similar with many previous studies. Some strong species of this family are the most common, they spend much time perching under the sun (Wahizatul-afzan et al., 2006).

In this study, species abundance were classified into three categories: (i) Abundant (> 50 individuals); (ii) Common (25-49 individuals) and (iii) Rare (< 24 individuals). Orthetrum sabina was the most abundant species as they contributed 21.79% of the total individuals (153 individuals), followed by Neurothemis ramburii (91 individuals), Ischnura senegalensis (75 individuals), Crocothermis servilia (56 individuals), and Agriocnemis pygmaea (51 individuals). The ability of O. sabina and N. ramburii to fly will lead to their survival. Moreover, they have high tolerance, wide distribution and can be found every year [12]. Thus, they became the most abundant species. The common species are Anax guttatus, Pantala flavescens, Potamarcha congener and A. femina. While the others are rare species. The most rare species is Orthetrum chrysis, only 1 individual. The diversity index (H') is 2.51, therefore the species diversity in this area considered as medium diversity [13].

In this study, suborder Anisoptera was found more abundant than suborder Zygoptera. It might be happened due to the Zygoptera are very sensitive to environmental conditions. They preferred vegetated and shaded areas. In other words, there was ability limitation for them to spread [12]. Meanwhile, the condition in sand dune area is dry with sparse vegetation. In this study there were some unique species to be found at sand dune ecosystem, including Lestes praemorsus, Tramea transmarina, and Anax guttatus.

Lestes praemorsus is belonging to Lestidae family. Java Island only have two species of this family [14]. It was the second record of this species in Yogyakarta. This species generally prefer shallow marsh habitats. They can inhabit wide habitat, from pristine alluvial forest and verges of peat swamp forest to open drains and permanent ponds [15]. Previous record of Lestes praemorsus and Tramea transmarina is located at Paliyan Wildlife Reserve. Paliyan Wildlife Reserve has similar condition with sand dune, thus those species can be found at both places. Meanwhile Anax guttatus is top predator among other dragonflies with their large bodies comparing with other species.

Pujiastuti et al. [12] stated that the existence of Odonata is influenced by many factors, including the habitat condition. Sand dune has periodic pond, only found in the end of rain season. It is lead to the
dynamic abundant of Odonata population. During dry season, the number of species and individuals might be less than during the rain species. Moreover, it will be difficult to observe the existence of Odonata, especially damselflies, during the dry season. In conclusion, Parangkusumo sand dune is a unique ecosystem for Odonata and has medium Odonata diversity. Based on such condition, it is important to preserve sand dune ecosystem in order to maintain this unique habitat as well as dragonfly diversity.

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