Diversity of dragonflies and damselflies in lakes of Universitas Indonesia, Depok, West Java

L A Akbar and A Basukriadi
Department of Biology, Faculty of Mathematics and Natural Sciences (FMIPA), Universitas Indonesia, Depok 16424, Indonesia
Corresponding author’s email: basukriadi@sci.ui.ac.id

Abstract. We investigated the diversity and distribution of Odonata inhabiting lakes at Universitas Indonesia, Depok, West Java in November 2017. The study aimed to characterize the lakes based on the occurrence of some Odonata species. There were six study sites: Lake Agathis, Lake Kenanga, Lake Mahoni, Lake Puspa, Lake Salam, and Lake Ulin. Species of Odonata encountered within the study sites were caught using sweep nets, photographed and then released. A total of 16 species of Odonata were found including 12 dragonflies and 4 damselflies. The dragonflies were represented by two families. Of the 12 species of dragonflies recorded, 11 were from the family Libellulidae and 1 was from the family Gomphidae. Brachydiplax chalybea and Orthetrum testaceum (Fam. Libellulidae) were the most widely distributed species. However, the abundant species were O. testaceum and Zyxomma obtusum. Damselflies were poorly represented, with only four species from two families, Coenagrionidae and Platycnemididae. Based on the species composition of Odonata from six lakes at Universitas Indonesia we conclude that most species are eurytopic or generalist that are widespread and tolerant to a wide range of environmental variables. In the current study, we consider that all lakes at Universitas Indonesia are disturbed habitats which are generally unsuitable for specialist or stenotopic species.

Keywords: Odonata, diversity, species composition, disturbed habitats, Universitas Indonesia

1. Introduction
Dragon flies (suborders Anisoptera) and damselflies (suborder Zygoptera) are belong to order Odonata. Odonata is a well-studied insect Order [1] due to their relatively small number of species (barely more than 6000) and relatively easy identification at species level [2]. The adults are large, conspicuous, easily identifiable components of the aquatic fauna. The Odonata are well suited to biotope characterization and environmental monitoring, because they occupy a wide spectrum of aquatic habitats [3]. They are widely used in biodiversity studies [4]. Their presence or absence could also be an indication of the condition of a freshwater environment [5].

Species of odonata can be divided into two groups: eurytopic and stenotopic. Eurytopic are generalist species that more widespread and tolerant to wide range of environment. Stenotopic are specialist species which have more narrow range of tolerances in environment [6]. Degraded habitats have fewer stenotopic species and are notably dominated by Anisoptera [7]. On the other hand, the Zygoptera comprise more specialist species [8].
Information on Odonata community at Campus of Universitas Indonesia is scarce. This study will provide information on the faunistic composition of Odonata from six lakes in the study area. Except Kenanga, other lakes are connected. The study of Odonata community in the area of Universitas Indonesia is necessary in an attempt to provide data for aquatic environmental monitoring of the campus, especially the environment of the lakes. The species composition of Odonata occurring at lakes Kenanga, Agathis, Mahoni, Puspa, Ulin, and Salam could indicate the current condition of their habitats.

2. Method
Sampling of adult Odonata was carried out in November-December 2017. Sampling exercise was usually done between 07.30–09.00am and 03.30–05.00 pm under favorable conditions. Species of Odonata encountered within the study sites were sampled using sweep nets. The specimens caught were photographed and then released. Identification of Odonata was based on book by Susanti [9], Orr [10], Sigit et al. [11] and Orr et al. [12].

3. Results and discussion
A total of 16 species of Odonata were found from six Lakes at Universitas Indonesia including 12 dragonflies (10 genera) and 4 damselflies (4 genera). The dragonflies (suborder Anisoptera) were represented by two families (Gomphidae and Libellulidae). Of the 12 Anisoptera species recorded, 11 were from the family Libellulidae and 1 was from the family Gomphidae (table 1 and figure 1). Some faunal studies have found species of Gomphidae to account for only 5 % or less of the total Odonata species richness sampled, while species belonging to Libellulidae generally dominated [13]. According to Pilgrim et al. [14], Libellulidae is by far the largest of the dragonfly families, with over 1000 species in approximately 140 genera. Meanwhile, the dragonflies from the family Gomphidae are known as rare species [15]. Our study showed that Ictinogomphus decorates (Fam. Gomphidae) was only found at Lake Salam with 5 individuals. Of the total species of Odonata found in this study, species from the family Gomphidae was only 6 %.

Most species from the Libellulidae are heliothermic and thus depend on direct sunlight for thermoregulation and flight behaviour. Heliothermic species directly affected by forest cover removal as well as interspecific competition where they more superior in degraded habitat, interspecific competition [16]. The conditions of lakes at Universitas Indonesia, which are mostly open areas and have no vegetation cover, are more suitable for the heliothermic and generalist species from the Family Libellulidae.

The largest number of 7 Anisoptera species were recorded at Lakes Salam, while the least number of 2 species were recorded at Lake Kenanga. Other lakes were occupied by 4–6 species of Anisoptera. This result is not surprising due to the connectivity between the five lakes (Agathis, Mahoni, Puspa, Ulin, and Salam) and the isolation of Lake Kenanga. It was previously stated that the species richness was affected by the distance and the connectivity of the water bodies [17]. This study showed that the connected lakes were occupied by more species than the isolated one such as Lake Kenanga. Brachydiplax chalybea and Orthetrum testaceum (Fam. Libellulidae) were the most widely distributed species at the lakes of Universitas Indonesia. These two species were found in the most lakes (five). Orthetrum sabina and Zyxomma obtusum (Fam. Libellulidae) was recorded at four lakes. We observed that O. testaceum and Z. obtusum were abundant in the lakes where they were found. Other species of Anisoptera were found at three lakes or less. The distance and the connectivity of the five lakes have made the dispersal of most Anisoptera species between lakes easier.
Table 1. Species of Odonata found at the lakes in Universitas Indonesia.

| Suborder/Family/Species | Lakes | | | |
|-------------------------|-------|-------|-------|-------|
|                         | Agathis | Kenanga | Mahoni | Puspa | Salam | Ulin |
| Suborder Anisoptera     |       |       |       |       |       |       |
| Family Gomphidae        |       |       |       |       |       |       |
| 1. Ictinogomphus decorates |       |       |       |       |       |       |
| Family Libellulidae     |       |       |       |       |       |       |
| 1. Brachydiplax chalybea | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |
| 2. Brachythemis contaminata | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |
| 3. Crocothemis servilia | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |
| 4. Neurothemis terminata | -   | -   | -   | ✓   | ✓   | ✓   |
| 5. Orthetrum abina      | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |
| 6. Orthetrum testaceum  | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |
| 7. Pantala flavescens   | -   | -   | ✓   | -   | -   | -   |
| 8. Rhyothemis phyllis   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |
| 9. Tholymis tillarga    | -   | -   | -   | ✓   | ✓   | ✓   |
| 10. Zyxomma obscura     | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |
| 11. Zyxomma petiolatum  | -   | -   | -   | -   | ✓   | ✓   |
| Number of Species       | 6   | 2   | 5   | 5   | 7   | 4   |
| Suborder Zygoptera      |       |       |       |       |       |       |
| Family Coenagrionidae   |       |       |       |       |       |       |
| 1. Agriocnemis femina   | -   | -   | -   | ✓   | ✓   | ✓   |
| 2. Ischnura senegalensis| -   | -   | ✓   | ✓   | -   | ✓   |
| 3. Pseudagrion microcephalum | ✓   | -   | -   | -   | -   | -   |
| Family Platycnemididae  |       |       |       |       |       |       |
| 1. Copera marginipes    | -   | -   | -   | ✓   | ✓   | ✓   |
| Number of Species       | 1   | 1   | 3   | 2   | 2   | 3   |
| Total of Species        | 7   | 2   | 6   | 8   | 9   | 7   |

The damselflies (suborder Zygoptera) were also represented by two families, Coenagrionidae and Platycnemididae. Zygoptera was poorly represented at the lakes of Universitas Indonesia, with only four species recorded during the study (figure 2). Agriocnemis femina and Ischnura senegalensis (Fam. Coenagrionidae) and Copera marginipes (Fam. Platycnemididae) were found at three lakes, while Pseudagrion microcephalum (Fam. Coenagrionidae) was only recorded at Lake Agathis, and no species of Zygoptera was found at Lake Kenanga. The damselflies have limited dispersal ability [15]. We observed that each species of damselflies was represented by less than ten individuals in the lakes where it was encountered.

Based on species of Odonata found at lakes Kenanga, Agathis, Mahoni, Puspa, Ulin, and Salam, we propose that most species are eurytopic or generalist species that are widespread and tolerant to a wide range of environmental variables. Generalist species usually colonize open and lentic habitats [15], and are notably dominated by Anisoptera [7]. Furthermore, generalist dragonflies are usually opportunistic in occupying disturbed or degraded habitats. According to Corbet [18], some of eurytopic Odonata are early-colonizers inhabit succession. So, a correlation clearly exists between certain habitat types and species of Odonata. In the current study, we consider that all lakes at Universitas Indonesia are disturbed habitats which are generally unsuitable for specialist or stenotopic species.
Brachydiplax chalybea  Brachythemis contaminata  Crocothemis servilia  Neurothemis terminata

Orthetrum sabina  Orthetrum testaceum  Pantala flavescens  Rhyothemis phyllis

Tholymis tillarga  Zyxomma obtusum  Zyxomma petiolatum  Ictinogomphus decorates

Figure 1. Species of Dragonflies (subordo Anisoptera) found at the lakes in Universitas Indonesia.

Agriocnemis femina  Ischnura senegalensis  Pseudagrion microcephalum  Copera marginipes

Figure 2. Species of Damselflies (subordo Zygoptera) found at the lakes in Universitas Indonesia.

4. Conclusion
Based on the species composition of Odonata from six lakes at Universitas Indonesia it is concluded that most species are eurytopic or generalist that are widespread and tolerant to a wide range of environmental variables. In the current study, we consider that lakes at Universitas Indonesia are disturbed habitats which are generally unsuitable for specialist or stenotopic species.

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