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## SHORT COMMUNICATION

# Dragonfly Diversity (Insect: Odonata) in Asem Binatur River, Pekalongan, Indonesia

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### ABSTRACT

Dragonflies have an essential role in the aquatic ecosystem. The nymph phase lives in water and is sensitive to environmental changes. The reduced number of dragonflies in an area can be an indication of changes in the quality of water and environmental health. This research was conducted in the Asem Binatur River, Pekalongan, Indonesia, from November 2018 to April 2019. The purpose of this study was to determine species diversity, the index value of the Pekalongan River dragonfly diversity by using the point count method. Long hand high net, wrapping paper/papilot and camera were used to catch and observe the dragonflies. The Shannon-Wiener species diversity index was calculated. Seven species of dragonflies were recorded from Asem River. There were *Orthetrum sabina*, *Diplacodes trivalis*, *Neurothemis ramburii*, *Crocothemis servilia*, *Pantala flavescens*, *Neurothemis stigmatizans* and *Orthetrum chrysis*. The Shannon-Wiener diversity index analysis was ranged from 0 to 0.31, indicating low diversity. Abiotic parameter measurements showed the humidity was 67.17%, the soil pH was 7.11, the light intensity was 46310 lux and the temperature was 30 °C. The analysis of the dragonfly diversity index was correlated with the poor water quality status in Asem Binatur River, Pekalongan.

Keywords: Asem Binatur, dragonflies, diversity, Pekalongan

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The species number of dragonflies in Indonesia are around 750 species. It is considerably high for a tropical climate that has variety of habitats (Susanti, 1998; Rohman, 2018). Dragonflies from the karst area are represented by 18 species (Rohman, 2012). In the Kandi Wildlife Park, West Sumatra, there are 91 species documented (Hanum *et al.*, 2013). Dragonflies have an essential role in the aquatic ecosystem (Lampthey *et al.*, 2013; Hart *et al.*, 2014). The nymph phase, living in water, can act as a bio-indicator of water quality and environmental monitoring. The availability of food sources and optimal ecological conditions affect the number of dragonflies living in a habitat (Bun *et al.*, 2010).

Asem Binatur River passes through Medono and Pasirsari villages in West Pekalongan District. River is the primary water source for consumption, irrigation, industry, and others. The level of river pollution that crosses the threshold can adversely affects the life of the biota and the health of the

community around the river (Monografi Kelurahan Medono, 2016). The increasing development of convection industry in Pekalongan City has reduced the environmental quality. Unfortunately, the level of awareness to protect the river is still very low in the community and business people. For instance, batik entrepreneurs dispose batik production wastes directly into the river without any pretreatment is polluting the river (Monografi Kelurahan Medono, 2016).

Based on data from the Environment Agency of Pekalongan City in 2014 and 2016, approximately 73,878 m<sup>3</sup> of liquid waste from Batik industry was disposed into the river (Badan Lingkungan Hidup Kota Pekalongan, 2014; 2016). According to the government regulation of the Republic of Indonesia Law No. 32/2009 article 59, any person or company that issues externalities must carry out B3 waste management (Undang Undang Republik

Indonesia, 2009)

The indicators of a river water quality include physical, chemical and biological parameters (Mukono, 2006). Biological indicator can be measured by looking at the existence of a group of guide organisms that live in the water. Plankton, benthos, nekton and nympha Odonata can estimate the water quality. Refer to the water quality involving physical and chemical changes within a specified time interval (Rahayu *et al.*, 2009).

Dragonfly is a good indicator for climate change (Ott, 2010). Apart from that, it is the most visible bio-indicator of environmental health because nympha, Odonata is sensitive to environmental changes. The reduced number of Odonata in an area can be an indication of changes in the quality of the water and environmental health (Klym, 2003).

A research conducted by Suriana *et al.* (2014) showed a decrease in the diversity index of dragonflies in polluted habitats. Changes in the chemical and physical factors of the water have affected the presence of macroinvertebrates in the water. Dragonflies are among the biota, that experienced the effects of physio-chemical change.

According to Rohman survey (2018), there were 11 species of dragonflies found in the Asem Binatur River, in which the members of Libellulidae family are the most abundant. Therefore, the purpose of this study was to determine the diversity as well as the diversity index value of the dragonflies in Asem Binatur Pekalongan River.

This study was conducted at Asem Binatur River, Pekalongan, Indonesia from November 2018 until April 2019 (Figure 1). The length of the river is approximately 8.5 km and the width is about 2 - 3 m. The river water condition of the river is brownish, smelly and muddy structure. Data was collected at early dry season with slow or moderate flow conditions.

Collection of dragonflies was conducted in the morning from 07.00 until 10.00 hours. The observation time was 30 minutes at each station using a long high hand net, wrapping paper or papilot and camera at eight stations. A point count method was used with the distance in between observation points of about 50 m. Each sampling station consisted of three observation points. The species of dragonflies were identified and counted *in-situ* and counted. The main



**Figure 1.** Location of the Asem Binatur River, Pekalongan, Indonesia (Source: Google Map)

parameters were the type and the amount of dragonflies in each observation station. The identification of the dragonfly was based on the dragonfly identification manual (Watson *et al.*, 1991; Theischinger, 2009). The Shannon-Wiener diversity index was adopted in the study (Odum, 1993).

A total of seven species representing 59 individuals were recorded in the eight sampling stations (Table 1). These included *Orthetrum sabina*, *Diplacodes trivalis*, *Neurothemis ramburii*, *Crocothemis servilia*, *Pantala flavescens*, *Neurothemis stigmatizans* and *Orthetrum chrysis*.

At station A (Table 2), there were *O. sabina*, *C.*

*servilia*, and *N. stigmatizans* were recorded, whereas at Station B, the species found were *O. sabina*, *C. servilia* and *N. stigmatizans*, *O. chrysis*. At station C, there were five species recorded namely *O. sabina*, *D. trivalis*, *N. ramburii*, *C. servilia* and *P. flavescens*, while at station D, the species recorded were *O. sabina*, *C. servilia*, *P. flavescens* and *N. stigmatizans*. At station E, *O. sabina*, *D. trivalis*, *P. flavescens* and *N. stigmatizans* were found, while in Station F, there were *O. sabina*, *P. flavescens* and *N. stigmatizans* were found. At station G has seven species were recorded including *O. sabina*, *D. trivalis*, *N. ramburii*, *C. servilia*, *P. flavescens*, *N. stigmatizans* and *O. chrysis*. There was no dragonfly found at station H.

**Table 1.** List of dragonflies found in the Asem Binatur river

Family	Genus	Species
Libellulidae	<i>Orthetrum</i>	<i>Orthetrum sabina</i>
	<i>Diplacodes</i>	<i>Diplacodes trivalis</i>
	<i>Diplacodes</i>	<i>Diplacodes ramburii</i>
	<i>Crocothemis</i>	<i>Crocothemis servilia</i>
	<i>Pantala</i>	<i>Pantala flavescens</i>
	<i>Neurothemis</i>	<i>Neurothemis stigmatizans</i>
	<i>Orthetrum</i>	<i>Orthetrum chrysis</i>

**Table 2.** Species and number of dragonflies at the Asem Binatur river observation station

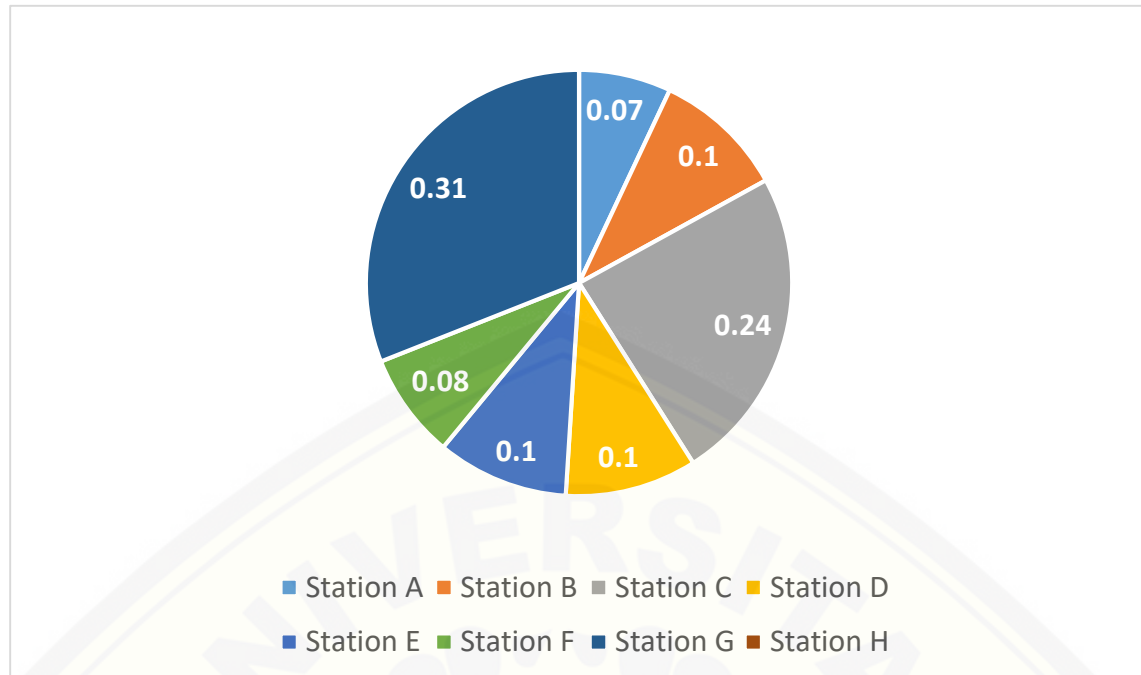
No	Dragonfly Species	Station								Total
		A	B	C	D	E	F	G	H	
1	<i>Orthetrum sabina</i>	1	1	3	2	2	2	3	-	14
2	<i>Diplacodes trivalis</i>	-	-	2	-	1	-	5	-	8
3	<i>Neurothemis ramburii</i>	-	-	1	-	-	-	2	-	3
4	<i>Crocothemis servilia</i>	2	2	4	2	-	-	2	-	12
5	<i>Pantala flavescens</i>	-	-	4	1	1	2	3	-	11
6	<i>Neurothemis stigmatizans</i>	1	2	-	1	2	-	2	-	8
7	<i>Orthetrum chrysis</i>	-	1	-	-	-	1	1	-	3
	Total	4	6	14	6	6	5	18	0	59

The calculation of Shannon-Wiener diversity index analysis at the stations ranged from 0 to 0.31, indicating low diversity (Figure 2). The abiotic parameters at eight sampling points in Asem Binatur river showed an average temperature of 30 °C, humidity of 67.17%, light intensity of 46,310 lux and the soil pH of 7.11.

There are seven dragonfly species belonging to family Libellulidae in Asem Binatur river,

Pekalongan. The family Libellulidae dominated in all the stations indicating family Libellulidae can adapt to the surrounding environment. According to Kandibane *et al.* (2005), Libellulidae family is a predator, which is usually aggressive, cannibal and prey on almost all types of insects, aquatic organisms such as *Anopheles* mosquito larvae and food crop pests and plantations (Folsom & Collins, 1984; Blois, 1985).





**Figure 2.** Shannon-Wiener Species Diversity Index in Asem Binatur River, Pekalongan

According to Odum (1993), at the value of  $H' < 1$ , the environment is resulted from the pressure of an unstable ecosystem and polluted environment. Jacob *et al.* (2017) reported that good water quality is indicated by a higher number of Odonata species in thirty Meenachil taluk ponds in the Kottayam district. In study by Amrullah (2018), the quality of the river in Babul National Park area was classified as an outstanding category. The condition of the community structure was still very stable. Rismayani (2018) reported that both Seppa and Sindalapai rivers were in a good condition with high diversity index.

Based on literature reports from 2015 to 2018, Asem Binatur river was considered as a polluted river (Ristekin, 2005; Badan Lingkungan Hidup Kota Pekalongan, 2016; 2017; Dinas Lingkungan hidup, 2018). In 2015, Technology and Innovation Research (Ristekin) of Pekalongan City used the Environmental Quality Index (IKLH) method to determine the waters quality of Asem Binatur River in Medono and Pasirsari areas had heavy metals concentration, which was above the acceptable standard. The monitoring results of the Pekalongan City Environment Agency in 2016 (Badan Lingkungan Hidup Kota Pekalongan, 2016) showed that of Asem Binatur River, Pekalongan was polluted. In 2017, the Quality

Index showed that Asem Binatur River was classified under class III, which indicates slight and moderate pollution. In 2018, Environmental Department data showed the river was contaminated.

According to Peirce *et al.* (1998), one of the criteria for good water quality is high oxygen level in the water. Water temperature is negatively correlated to oxygen level. An increase in the temperature of the water reduces the level of oxygen solubility thus, affecting the aquatic organisms that utilize the dissolved oxygen in the water (Chay, 2010).

Some adult dragonflies such as the Suborder Anisoptera (including the family Libellulidae) are flying insects that can migrate long distance, so it is widely spread. Abiotic factors affect the adult dragonflies flying. For instance, light intensity affects the interaction and propagation of dragonflies (Michael, 1994; Corbet, 1999). The soil pH of 7.11 is a limiting factor for organisms because the ideal pH value of organisms generally ranges from 7-8.5. pH significantly affects biochemical processes, such as nitrification. Changes in pH significantly affect the abundance, diversity, growth, and biological activity of biota (Gorham & Vodopich, 1992; Rychla *et al.*, 2011).

In conclusion, there are seven species of dragonflies in the Asem Binatur River, Pekalongan namely *O. sabina*, *D. trivalis*, *N. ramburii*, *C. servilia*, *P. flavescens*, *N. stigmatizans* and *O. chrysis*. The Shannon-Wiener diversity index values ranging from 0 to 0.31 indicate low diversity. The Libellulidae family were found to be dominant at all observation stations in Asem Binatur River showing that it can adapt to the surrounding environment.

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