Journal of **BIOLOGICAL RESEARCHES**

ISSN: 08526834 | E-ISSN:2337-389X

Volume 23| No. 1| December | 2017

Original Article

The distribution and composition of Odonata (Dragonfly and Damselfly) in Sriwijaya University, Inderalaya Campus South Sumatera

Yulia Pujiastuti[1]*, Yuanita Windusari[2], Muhammad Agus[3]

[1]Department of Plant Protection, Faculty of Agriculture, Sriwijaya University

[2]Department of Biology, Faculty of Mathematics and Natural Sciences, Sriwijaya University

[3]Department of Environmental Management, Graduate School of Sriwijaya University

Abstract

The information about distribution and composition of Odonata in Sriwijaya University campus area is still not much. The decrease areas supporting the growth of Odonata influence distribution and composition of these species. The objective of research was to analyze the distribution and composition of Odonata in Sriwijaya University, Inderalaya Campus. This research had been conducted from December 2016 until February 2017 and continued in April 2017 by using visual observation, direct capture, and sticky traps. The sampling locations were determined by five points of observation station by using purposive sampling method. The result revealed Odonata living in Sriwijaya University, Inderalaya Campus ~~is~~ was aggregated and consisted of 22 species belonged to five families. The highest composition of species was found in Libellulidae (77.65%) followed by Coenagrionidae (17.86%).

Keywords: composition, distribution, Odonata, Sriwijaya University.

Received: 16 June 2017 Revised: 21 August 2017 Accepted: 02 September 2017

Introduction

Sriwijaya University campus area consists of buildings, swamp areas, arboretum, agriculture land, oil palm plantation, green spaces and retention ponds. This campus area has high diversity of flora and fauna due to the variety of land conditions. Odonata is one of important components of this ecosystem. The environmental quality affects existence of Odonata (Suhonen *et al*., 2010).

Odonata is one of insects which play a role as environmental contamination indicator. Fresh environment can be seen from the presence of a living Odonata species in the area because larvae phase of Odonata species live only in undisturbed water conditions (Berquier *et al*., 2016). The loss of Odonata indicates the environmental disturbance, especially the waters of the area.

Odonata is one of the insects with high mobility. Its ability to fly and move from one place to another place in short time bring through a suitable place that has appropriate environmental conditions. The superiority of the dragonfly lies on the vision and ability of flying. Odonata is able to see in 360-degree angles and they are very sensitive to movement, leading theses insects as a reliable predator (Sigit *et al*., 2013).

Diversity of Odonata will be high in areas where water sources and habitat conditions are still in the natural or uncontaminated category (Siregar and Bakti, 2016; Suhonen *et al*., 2010; Khan, 2015). The existence of pool, flooded area, and heterogeneous vegetated location will support high diversity and the abundance of Odonata. Good environmental conditions are indicated by the pattern of Odonata distribution. Data about odonata in Sriwijaya University Inderalaya Campus is very rare, therefore observation of distribution of these insects is important to be conducted.

* Corresponding Author:
Yulia Pujiastuti
Department of Plant Protection, Faculty of Agriculture,
Sriwijaya University
Phone: 0711-580663 Fax: 0711-580276
e-mail: ypujiastuti@unsri.ac.id

Method

This study was conducted from December 2016 until February 2017 and continued in April 2017. Data collection was performed at Sriwijaya University Inderalaya Campus area, Ogan Ilir District, South Sumatera Province. The sampling location was determined by five points of observation station. Observation of Odonata was done by purposive sampling method (Figure 1).

Visual observations were performed at each location with a frequency of once a week. There was 5 locations of observation considered as replications. Observation was performed purposely to find perch Odonata. They were well documented using camera photo. These photographs were useful to identify Odonata. The observation time was done at 7-10 AM and 2-6 PM since they were active during these time.

The capture of the odonata was directly carried out by using an insect net, a cone-shaped net with a height of 60 cm, a diameter of 30 cm and a net length of 1 meter. The sticky trap to capture Odonata was made of bamboo with a length of 1.5 m and each bamboo was smeared with glue. Installation of sticky trap was conducted once a week and placed one tap at each location (Figure 2).

Odonata captured was identified by Theischinger and Hawking (2006); Paulson, (2009); Sigit *et al.* (2013), and Setiyono *et al.* (2015). Distribution pattern was analyzed by Morisita index (Id) (Krebs, 1999) (Equations 1)

$$Id = \frac{n \sum Xi\,(Xi-1)}{N\,(N-1)} \qquad (1)$$

http://dx.doi.org/10.23869/bphjbr.23.1.20171

The magnitude of the distribution Morisita index as follows:
value Id < 1 indicate distribution of species on area is uniform,
value Id = 1 indicate distribution of species on area is random and
value Id > 1 indicate distribution of species on area is aggregated (Krebs, 1999).

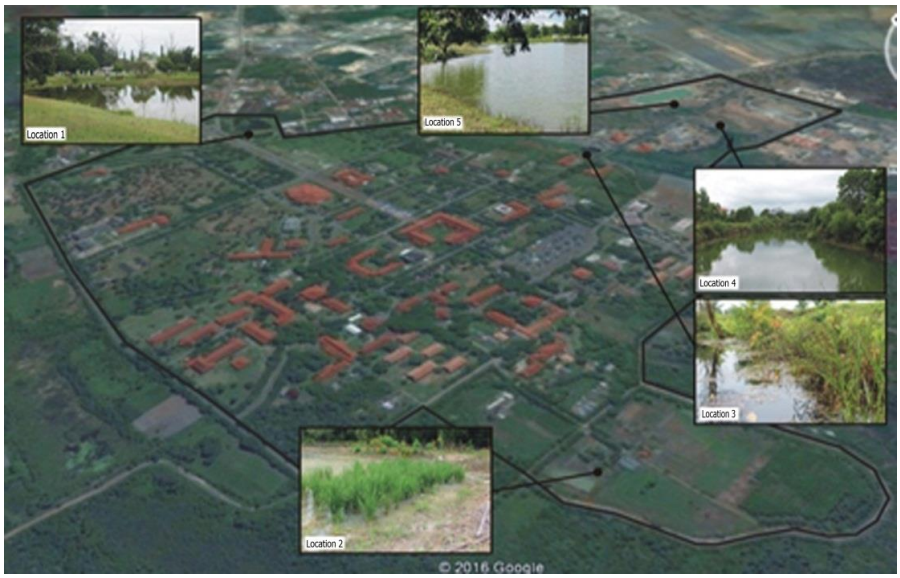

Figure 1. Map of research location on Sriwijaya University Campus, Indralaya

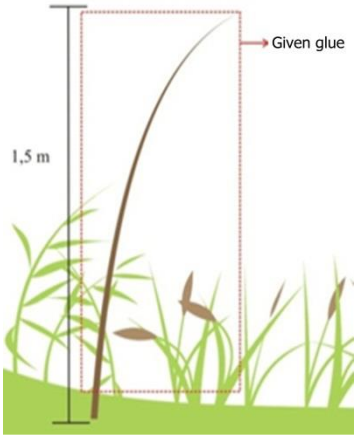

Figure 2. Sticky Trap to capture Odonata

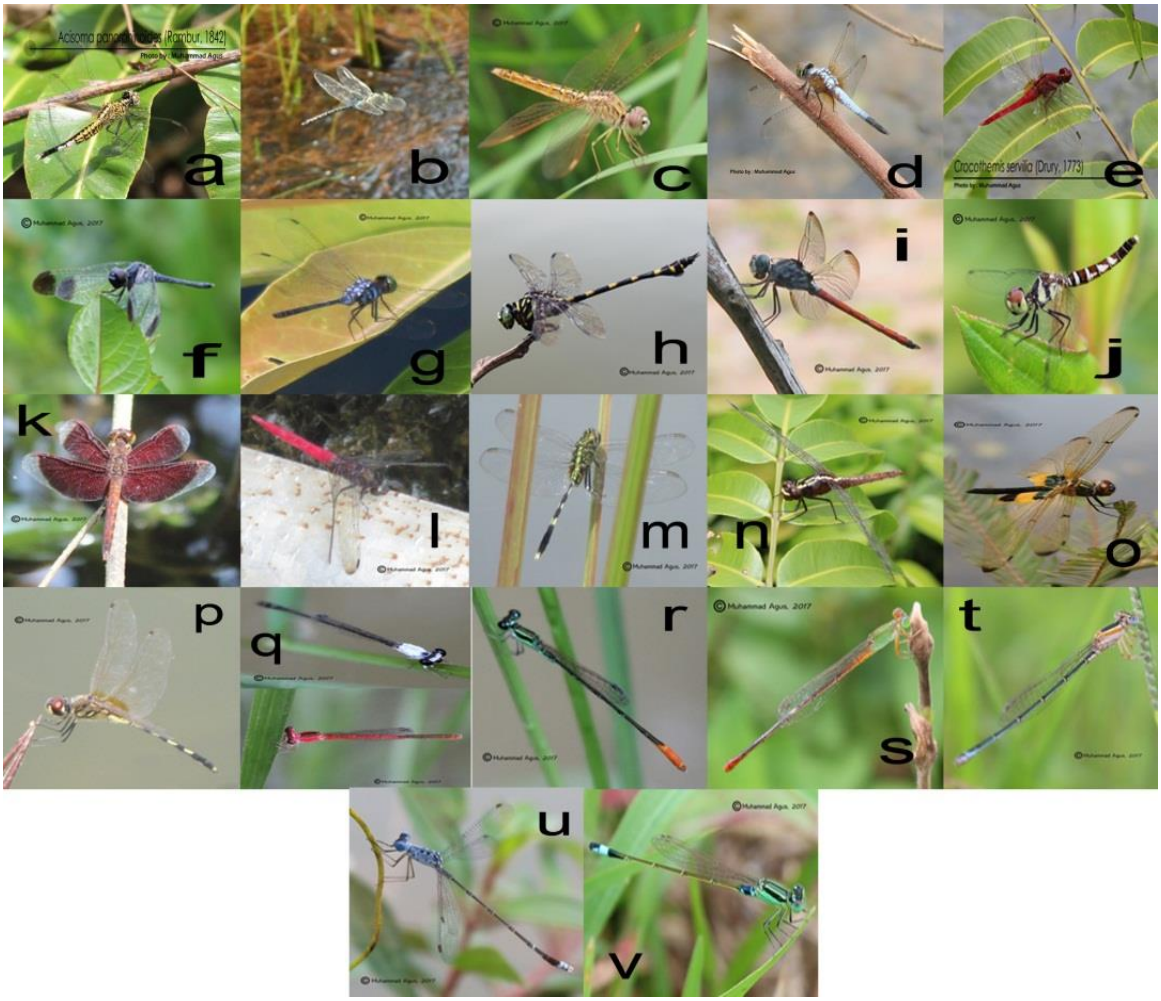

Figure 3. Member of Odonata order at Sriwijaya University campus area (a) *Acisoma panorphoides* (b) *Anax guttatus* (c) *Brachythemis contaminata* (d) *Brachydiplax chalybea* (e) *Crocothemis servilia* (f) *Diplacodes nebulosa* (g) *Diplacodes trivalis* (h) *Ictinogomphus decatus* (i) *Lathrecista asiatica* (j) *Nannophya pygmaena* (k) *Neurothemis ramburii* (l) *Orthetrum pruinosum* (m) *Orthetrum sabina* (n) *Rhodothemis rufa* (o) *Rhyothemis phyllis* (p) *Trithemis pallidinervis* (q) *Agriocnemis femina* (r) *Agriocnemis pygmaena* (s) *Ceriagrion auranticum* (t) *Ischnura senegalensis* (u) *Lestes praemorsus* (v) *Pseudagrium microcepha*

Results

Based on observation on Odonata by using visual observation method, direct capture and sticky trap from December 2016 until February 2017 and continued at April 2017 was found 22 species (Table 1 & Figure 3). These species were belonged to three families of Sub-Order Anisoptera namely Aeshidae, Gomphidae, and Libellulidae, and two families of Sub-Order Zygoptera namely such as Coenagrionidae and Lestidae.

Table 1. Distribution index of Odonata at Sriwijaya University campus area.

No	Species	December '16			January 2017			February 2017			April 2017		
		Xi	Id	D	Xi	Id	D	Xi	Id	D	Xi	Id	D
Anisoptera													
	Aeshnidae												
1	*Anax guttatus*	-	-	-	2	0	-	-	-	-	-	-	-
	Gomphidae												
2	*Ictinogomphus decatus*	-	-	-	24	1.54	A	13	2.95	A	8	1.96	A
	Liberlluidae												
3	*Acisoma panorphoides*	3	5.00	A	18	4.44	A	4	5.00	A	9	3.06	A
4	*Brachythemis contaminata*	104	2.11	A	175	1.75	A	231	1.79	A	160	4.07	A
5	*Brachydiplax chalybea*	-	-	-	-	-	-	-	-	-	2	0	-
6	*Diplacodes nebulosa*	-	-	-	-	-	-	-	-	-	1	0	-
7	*Diplacodes trivalis*	5	1.00	R	8	5.00	A	10	2.12	A	6	5.00	A
8	*Lathrecista asiatica*	-	-	-	2	5.00	-	-	-	-	-	-	-
9	*Neurothemis ramburii*	46	1.00	R	94	1.78	A	47	1.44	A	21	0.95	U
10	*Nannophya pygmaena*	-	-	-	-	-	-	-	-	-	2	5.00	A
11	*Trithemis pallidinervis*	14	5.00	A	21	5.00	A	8	5.00	A	-	-	-
12	*Orthetrum pruinosum*	-	-	-	11	2.82	A	-	-	-	2	5.00	A
13	*Orthetrum sabina*	70	1.92	A	81	1.43	A	72	1.45	A	36	2.02	A
14	*Rhyothemis phyllis*	50	3.72	A	60	3.52	A	85	3.49	A	21	3.10	A
15	*Crocothemis servilia*	15	1.90	A	23	2.51	A	23	2.31	A	9	1.39	A
16	*Rhodothemis rufa*	-	-	-	1	0	-	-	-	-	-	-	-
Zygoptera													
	Coenagrionidae												
17	*Agriocnemis femina*	8	2.32	A	12	2.05	A	3	1.67	A	-	-	-
18	*Agriocnemis pygmaena*	7	3.57	A	36	1.88	A	5	1.00	A	6	0.67	U
19	*Ceriagrion auranticum*	-	-	-	1	0	-	1	-	-	3	5.00	A
20	*Ischnura senegalensis*	12	1.59	A	36	1.40	A	24	1.85	A	8	3.75	A
21	*Pseudagrium microcephalum*	25	2.45	A	65	1.57	A	58	1.37	A	13	2.50	A
	Lestidae												
22	*Lestes praemorsus*	-	-	-	15	3.76	A	18	5.00	A	10	5.00	A

Species found in sub-Order of Anisoptera were *Acisoma panorphoides, Anax guttatus, Brachythemis contaminata, Brachydiplax chalybea, Crocothemis servilia, Diplacodes nebulosa, D. trivalis, Ictinogomphus decorates, Lathrecista asiatica, Nanophya pygmaea, Neurothemis ramburii, Orthetrum pruinosum, O. Sabina, Rhodothemis rufa, Rhyothemis Phyllis, Trithemis pallidinervis.* Species that were found in sub-Order of Zygoptera were *Agriocnemis femina, A. pygmaena, Ceriagrion latericum, Ischnura senegalensis, Lestes*

praemorsus, Pseudagrium microcephalum (Table 1 & Figure 3)

The distribution patterns of the three most commonly encountered species with the largest number of individuals from December 2016 to April 2017 were shown in Figure 4. Based on Figure 4, it was shown that the distribution patterns was aggregated. Species of *B. contaminata* was always found in every location and time of observations, except in April 2017. *B.contaminata* was highly aggregated in the fifth location and not visible in the second and third locations. It was predicted that the fifth location was lack of food sources.

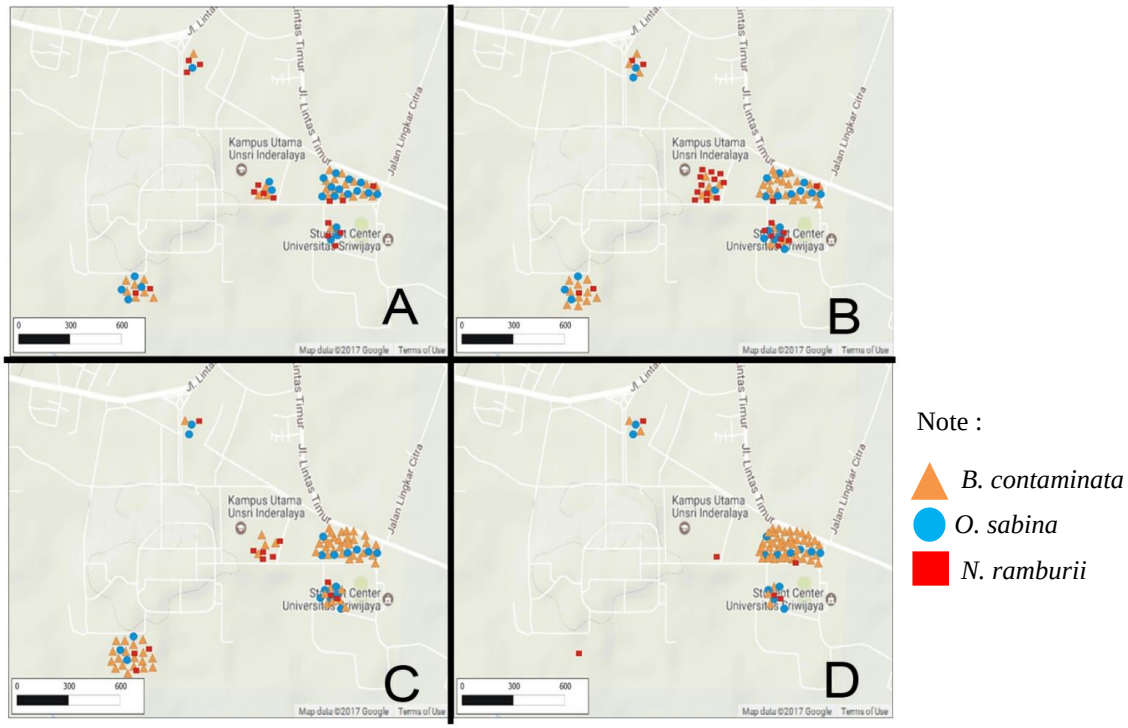

Figure 4. Distribution of *B. contaminata*, *O. sabina* dan *N. ramburii* pada bulan (a) December 2016 (b) January 2017 (c) February 2017 dan (d) April 2017

Discussions

The population of a species, when it reached the high level of density, and limitation of environmental carrying capacity, will experience spreading. Behavior to spread and form a particular pattern could be caused by the drive for food, avoidance of predators, climatic influences, marriage habits and other physical factors (Odum,1998). The dispersion pattern of a species will follow good environmental conditions (Suhonen *et al*., 2010 and Khan, 2015). Species spread to search typical food sources and conditions for appropriate activities (Alikodra, 2010; Indrawan *et al*., 2007)

Based on measurement of abiotic conditions, campus area of Sriwijaya University was categorized as having clean water condition. It might be related to the condition of the existence of living things, especially Odonata order in the region. The areas with unclean waters would remove species from Odonata (Suhonen *et al*., 2010). The olfactory sensory organs present in the antenna of Odonata will detect the condition of a watery area capable of supporting the life of the eggs to be placed. Therefore, Odonata will move from a dirty habitat to a clean habitat (Setiyono *et al*., 2015).

Species of *B. contaminata* was aggregated at the fifth location in April 2017. It was predicted that the fifth location was a place for *B. contaminata* to find partners. Animal aggregation was behavior in searching of spouses and other social behaviors (Campbell *et al*. 2003). Furthermore, Harrington and Stork (1995) explained that distribution of an animal can be caused by many factors such as changes in temperature, humidity, food sources, or the presence of interference.

Species of *B. contaminata*, *O. sabina* and *N. ramburii* which were part of sub-order Anisoptera found in Sriwijaya University campus area possessed a larger number of species when compared with sub-order Zygoptera. This might be happened due to the limited ability to spread of this sub-order (Harisah, 2016). Zygoptera was very sensitive to environmental conditions (Pamungkas and Ridwan, 2015) and preferred vegetated and shaded areas (Khan, 2015).

The fourth location was predicted as the most stable condition. It was showed number of *B. contaminata*, *O. sabina* and *N. ramburii* which were approximately similar and no dominating species (Figure 4). A stable condition of an ecosystem can create harmony condition among predators, preys and the environment. The preservation of population numbers would be able to maintain the diversity and evenness of species in an area. Balanced ecosystem conditions will reflect good environmental conditions.

The highest population growth in April 2017 was *B. contaminata*. Species of *B. contaminata* was feared to be uncontrollable and will lead to overpopulation. This condition will caused a negative effect, due to the increasingly tight competition. Excessive population can cause weak species will move to another place and the worse impact was extinction of species.

The existence of the Odonata could be influenced by natural enemy factors (Kalkman *et al*., 2010). The natural enemies of the Odonata Order were birds, frogs, lizards, larger carnivorous insects, even fellow Odonata (Paulson, 2009). The amount of *O. sabina* and *N. ramburii* was not as much as *B. contaminata*, but its presence can be found at each study site. The ability to fly of *O. sabina* and *N. ramburii* will lead to their survival. Species of *O. sabina* and *N. ramburii* were common species. They can be found every year, with high tolerance, and wide distribution (Kosterin, 2012; Pamungkas and Ridwan, 2015)

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