BONOROWO WETLANDS
Volume 9, Number 1, June 2019
Pages: 27-31

P-ISSN: 2088-110X
E-ISSN: 2088-2475
DOI: 10.13057/bonorowo/w090103

Short Communication: Diversity of dragonflies (Ordo: Odonata) on the natural reserve areas of Mt. Sigogor and Mt. Picis, Ponorogo District, Indonesia

MALINDA DUTA PERTIWI PRANOTO[1,♥], DHENY MARDIONO[2], TETRI WIDIYANI[1], RIZQI ADANTI PUTRI PERTIWI[1], FATIMAH AZ ZHARA[1], NAILA IZZATI[1]

[1]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret. Ir. Sutami 36 A, Surakarta 57126, Central Java, Indonesia. Tel./fax.: +62-271-663375. ♥email: malindaduta98@gmail.com

[2]Conservation and Natural Resources Region 1, Madiun. Jl. Dungus Km. 7, Madiun 63181, East Java, Indonesia

Manuscript received: 11 April 2019. Revision accepted: 5 June 2019.

Abstract. *Pranoto MDP, Mardiono D, Widiyani T, Pertiwi RAP, Az Zhara F, Izzati N. 2019. Short Communication: Diversity of dragonflies (Ordo: Odonata) on the natural reserve areas of Mts. Sigogor and Picis, Ponorogo District, Indonesia. Bonorowo Wetlands 9: 27-31.* The Mount Sigogor and Picis Natural Reserves are the conservation areas in Ponorogo, East Java. Mount Sigogor and Picis nature reserves have an ecosystem of tropical rain forests that are naturally protected, providing the reserve with a high potential for biodiversity. The preserved ecosystem conditions are a good habitat for the dragonfly since some dragonfly species require a clean habitat and are sensitive to pollutants. The study was conducted from January to February 2019. The research site was carried out at 7 points, covering 5 points in the reserve and 2 points around Mount Sigogor Nature Reserve. Data retrieval was done using the explorative method. Qualitative and quantitative descriptions were used to analyze the results of dragonflies' biodiversity. The results have found 18 species of dragonflies with details of 6 species as damselflies (Zygoptera) and 12 species of common dragonflies (Anisoptera). There are 5 species of endemic dragonflies from Java Island, i.e., *Drepanosticta sundana*, *Euphaea variegata*, *Heliogomphus drescheri*, *Heliocypha fenestrat*, and *Vestalis luctuosa*. From the Shannon-Wiener discounting index, the value of index diversity on the entire research site is 1.466. The highest diversity value lies in the river's location leading to Toyo Marto's waterfall with a 2.02 diversity-index value. Obtained results that the *Euphaea variegata* has the most abundant with a 40.23% value.

Keywords: Dragonflies, explorative method, Mount Picis Nature Reserve, Mount Sigogor Nature Reserve

INTRODUCTION

The dragonfly (Order: Odonata) is an easily recognizable flying insect in its distinctive form, having an attractive variety of body colors and wings. The Odonata order itself refers to the mandibular character of a dragonfly with toothlike projections (spina) (Greek, *Odontos* = teeth) (Baskoro et al., 2018). The dragonfly experiences three phases of life cycles: egg, larva (naiad), and adult phase (imago). In both egg and naiad phases, the dragonfly lives in the aquatic ecosystem, while in the adult phase, the dragonfly lives as an aerial insect (Gillot 2015). The dragonfly generally has two large groups: the Anisoptera (the great dragonfly) and the Zygoptera (the needle dragonfly/damselfly). The differences in his body structure are obvious. Anisoptera tends to be larger than Zygoptera, compound eyes coalesced, larger front wings than the rear, and when it alights, an Anisoptera spreads its wings. Whereas the Zygoptera group is small and slender, there are compound eyes of one pair, with the same large front and rear wings, and the way to land is by folding wings over the body (Samways 2008).

Mountain forests with a natural and clean river are the most diverse habitats of the dragonfly, besides vast underwater waters (swamps and lake). Some dragonflies have an exceptional habitat, but some species have adapted to urban areas and utilize manmade aquatic ecosystems (Setiyono et al., 2017). Some dragonfly species cannot live in polluted waters; they can thus become ideal insects to judge the health of the freshwater ecosystem (Cai et al., 2018). The dragonfly also has the role of insect predator. The dragonfly is one of the components of biological diversity that plays a vital role in food nets. The dragonfly larvae occupy the predator position on food nets in the aquatic ecosystem, while the adult dragonfly acts as a predator for plant pests in the breeding area (Siregar and Bakti 2016).

The natural reserve areas are conservations areas because of the natural affinity of plants, animals, and specific systems of animals or ecosystems that need to be protected and progress naturally. Wildlife conservation management is used only to preserve existing plants, animals, and ecosystems. The natural resources conservation hall closely guards it under the Directorate General for Forest Protection and The Conservation of The Ministry of Forestry of The Republic Indonesia. The natural reserve areas are maintained by maintaining natural conditions and minimizing natural damage. However, within reserve areas, it still makes it possible for research, education, science, and other activities that promote the conservation of animals and plants (Undang-Undang No. 5 Tahun 1990).

The Mount Sigogor Natural Reserve is an established reserve in East Java Province, Indonesia, located in Pupus Village, Ngebel Sub-district, Ponorogo. While, The Mount Picis Natural Reserve lies in the village of Gondowido, Ngebel Sub-district, Ponorogo (BBKSDA Jatim, 2012). The reserve area's still heavily protected condition makes it a suitable habitat for the dragonfly. However, no data have been found of species of dragonflies and biodiversity on Mount Sigogor and Mount Picis Natural Reserves. Therefore, the expected use of this study would result in a database of dragonfly diversity in the natural reserve areas of Mount Sigogor and Mount Picis. It is hoped that this research could generate a database on the diversity of dragonflies on the Mount Sigogor and Mount Picis Natural Reserves and could be the first step in safeguarding the natural habitat of dragonflies.

MATERIALS AND METHODS

Data retrieval in the field occurs from January to February 2019, when the rainy season. An instrument used in the study is the insect net, which is about 150 cm long, cameras, pencil, GPS, and maps application of Avenza Maps. In this study, researchers used the Avenza Maps application to facilitate the logging point of reference to locating dragonflies in Sigogor and Picis Mountain Reserves, Ngebel Sub-district, Ponorogo District, East Java, Indonesia (Figure 1). The object considered in this study is dragonflies found at the research site. The research sites contained mountains of Sigogor and Picis. Data reteaching was done through exploration, which involved tracing the established paths. Mature dragonflies can live in different habitats, such as rivers, forests, lakes, reservoirs, and swamps, with an altitude of 100 meters until 3000 meters. Then, the two natural reserve areas have an altitude of about 1.200-1.600 meters with a type of tropical rain forest ecosystem (BBKSDA Jatim, 2012; Kulkarni & Subramanian 2013; Rugayah and Pratiwi 2014).

The Mount Sigogor and Mount Picis Natural Reserves have very close distances and are situated within the same landscape but have different ecosystem conditions. The Mount Sigogor Natural Reserve was dominated by forests with dense vegetation, valleys, hills, and flowing rivers. On the other hand, the Mount Picis Natural Reserve is a lightly wooded hill with a reed field, and there are also no rivers. Even though the Mount Picis and Sigogor Natural Reserves have a close range, Mount Sigogor and Mount Picis have a distinct landscape form and considerable diversity and quantity of dragonflies. The Mount Sigogor and Mount Picis Natural Reserves have an average air temperature of between 24-36^{o}C, the lowest temperature being measured at 09.30 am and the highest temperature being measured at 12.00 pm. According to Corbet (1999), dragonflies are found in open places with warm temperatures (about 25-33 ^{o}C).

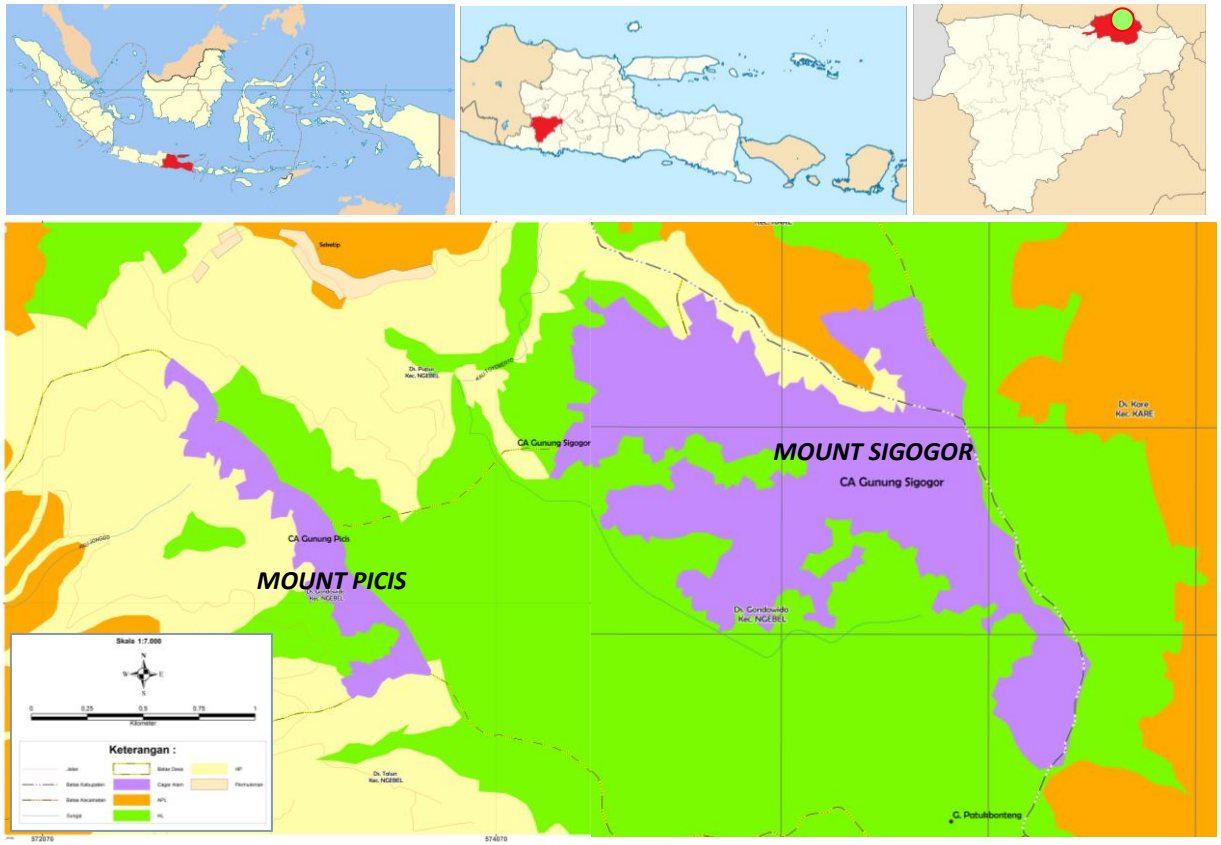

Figure 1. Map of research location in the Natural Reverse Area of Mount Picis and Mount Sigogor (○) in Ngebel Sub-district, Ponorogo District, East Java, Indonesia

Since the dragonfly is a mobile animal, it also enhances the diversity of the dragonfly not only in the natural reserve area but also in the areas around the reserve. Hence, areas explored are the river and surrounding areas. The observation was made from 09.30 am-01.00 pm. The dragonfly is found in the name of species and the number of individuals on the tally sheet, and it is then documented. Identification is made by reference to the books *Odonata of Semarang Raya* (2018) and *Dragonflies of Yogyakarta* (2017); data retrieved includes species of dragonflies, altitude of places, time found, and numbers of individuals of dragonflies.

The data analysis used involves qualitative and quantitative analysis. A qualitative analysis of the type and habitat of the host species. A quantitative analysis is done using a comparative index of diversity and abundance index with a formula:

Shannon-Wiener Biodiversity Index:

$$H' = -\sum_{i=1}^{n} pi \ln pi$$

Where:
H: Shannon-Wiener biodiversity index
pi: Abundance of proportionality

Relative Abundance Index

$$KR \quad \frac{ni}{N} \; x \; 100\%$$

Where:
KR: Relative abundance
Ni: The number of individual dragonflies
N: The number of individuals all kinds of dragonflies

RESULTS AND DISCUSSION

In the Mount Sigogor Natural Reserve and nearby areas, data collection is carried out in areas leading to Japan's Cave, Wates (those dominated by the plant of Puspa (*Schima wallichii*), Ngasep (an area surrounded by coffee gardens (*Coffea* sp.), Watu Blandar (there are swift streams with considerable light intensity), and then Perhutani River and river to Toyo Marto waterfalls. On the Mount Picis Natural Reserve, data retrieval occurs at Dawuk, which is the top of the natural reserve area. Data retrieval points were based on the possible discovery of dragonflies and dexterous terrain.

Eighteen dragonflies were discovered in the Mount Sigogor and Picis Natural Reserves, 6 species of dragonflies go into Zygoptera, and 12 other species include suborder Anisoptera. The most common of the Libellulidae, which comprised 9 species and 9 different species belonging to the Calopterygidae (1 species), Chlorocyphidae (2 species), Euphaeidae (1 species), Platycnemididae (1 species), Platystictidae (1 species), Corduliidae (1 species), and Gomphidae (1 species).

Based on calculations of the relative abundance value (Table. 2), it may be known that the *Euphaea variegata* has the highest relative abundance (40.23%). *Euphaea variegata* can be found in practically all research locations except Dawuk. Then, the comparative value of abundance after *Euphaea variegata* was possessed by *Pantala flavescens* (15.28%) and *Vestalis luctuosa* (13.43%). According to Lieftinck (1954), *Euphaea variegata* often fly together with a *Vestalis luctuosa* and *Heliocypha fenestrata*. The abundance of *Vestalis luctuosa* can be a bioindicator that water quality in a body of water is still sufficiently protected since it is a type of dragonfly prone to environmental change. Dragonflies, especially Anisoptera, oviposit their eggs in water, in both streams or slow-moving water, by the naiad's ability to cope with the water speed. This means the presence of dragonflies cannot be separated from water availability (Nugrahani et al., 2014).

Pantala flavescens is a cosmopolitan wanderer found in almost any habitat with even contaminated conditions. Very common dragonfly and often present in a swarm, sometimes of hundreds of individuals. They perch infrequently and are easily found in open areas (Setiyono et al., 2017). The dragonfly is most commonly found in Dawuk, a vegetative reserve on Mount Picis and dominated by the grass (*Imperata cylindrica*). The relatively lowest abundance value of 0.17% belongs to 3 species of dragonfly, known as *Drepanosticta sundana*, *Diplacodes trivialis*, and *Orthetrum testaceum*. The species of dragonflies are found only in 1 location in the river area leading to Toyo Marto's Waterfall. *Drepanosticta sundana* is a rare dragonfly, while *Diplacodes trivialis* and *Orthetrum testaceum* have an easy encounter. But as a limited data intake area approaches a wildlife preserve with a property trait consistent with a *Diplacodes trivialis* and *Orthetrum testaceum*, both species are identified only in a small number of individuals.

On the Mount Sigogor Natural Reserve, 5 species of endemic dragonfly from Javanese island were founded: *Vestalis luctuosa*, *Heliocypha fenestrata Euphaea variegata*, *Drepanosticta sundana*, and *Heliogomphus drescheri*. *Drepanosticta sundana* is the biggest Javan Platystictid, has a striped black and white with black-green eyes. This species can be found in forest streams with low light intensity and humid air. The dragonfly with the genus *Drepanosticta* is unique in that all species of this genus are endemic dragonflies. *Heliocypha fenestrata* has a black abdomen with the blue-spotted on segment 1 until segment 5. Wings are black with pink reflections when exposed to the sunlight (Setiyono et al., 2017). According to (Nugrahani et al. 2014), in addition to *Vestalis luctuosa*, *Zygonix ida* and *Drepanosticta sundana* are dragonflies sensitive to pollution. Therefore, discovering the dragonfly from *Vestalis luctuosa*, *Zygonix ida,* and *Drepanosticta sundana* species suggests that the Mount Sigogor and Picis Natural Reserves have well-preserved water conditions. Some species of an endemic dragonfly, such as *Depanosticta sundana* and *Heliogomphus drescheri* are rare frequencies and have a smaller population than other species; thus, maintaining river conditions can preserve the presence of an endemic dragonfly.

Table 1. Environmental conditions at the location where the dragonfly diversity is observed in The Natural Reverse Area of Mount Sigogor and Mount Picis, Ponorogo, Indonesia

Location	Coordinate	Altitude	Vegetation types
Japan's Cave	7°47'15.3" S; 111°40'47.8" E	1202 m	Foreshadowed
Wates	7° 47'12.4" S; 111°14'32.2" E	1130 m	Foreshadowed
Ngesep	7°47'37.0" S; 7°40'31.4" E	1207 m	Foreshadowed
Dawuk	7°47'32.8" S; 111°39'46.7" E	1402 m	Open area
Watu Blandar	7°47'37.2" S; 111°40'31.7" E	1189 m	Open area
Perhutani River	7°46'59.1" S; 111°40'27.4" E	1020 m	Open area
Direction to the Waterfall	7°47'10.9" S 111°40'05.7" E	944 m	Open area

Table 2. Relative abundance value (KR) of dragonflies in the Mount Sigogor and Mount Picis Natural Reserves, Ponorogo, Indonesia

Family	Species	Relative abundance value KR (%)							Average
		AG	WT	NG	DW	WB	SP	AA	
Calopterygidae	*Vestalis luctuosa*			40		25	15.3	13.7	13.43
Chlorocyphidae	*Heliocypha fenestrata*							7.5	1.07
	Rhinocypha anisoptera					25	7	3.7	5.10
Euphaeidae	*Euphaea variegata*	100	100	20		35	14.1	12.5	40.23
Platycnemididae	*Coeliccia membranipes*			33.3			8.2		5.93
Platystictidae	*Drepanosticta sundana*							1.2	0.17
Corduliidae	*Idionyx montana*						3.5		0.50
Gomphidae	*Heliogomphus drescheri*			6.7			2.4		1.30
	Onychogomphus fruhstorferi						1.2	2.5	0.53
Libelullidae	*Diplacodes trivialis*						1.2		0.17
	Orthetrum glaucum						4.7	6.2	1.56
	Orthetrum pruinosum						5.8	7.5	1.90
	Orthetrum sabina				31.4		11.8	20	9.03
	Orthetrum testaceum						1.2		0.17
	Pantala flavescens				65.7		18.8	22.5	15.28
Libelullidae	*Potamarcha congener*				2.8				0.40
	Rhodothemis rufa						3.5		0.50
	Zygonyx ida					15	1.2	2.5	2.67

Note: AG: Arah Goa Jepang (Japan's Cave), WT: Wates, NG: Ngesep, DW: Dawuk, WB: Watu Blandar, SP: Sungai Perhutani (Perhutani River), AA: Arah Air Terjun (Direction to the Waterfall)

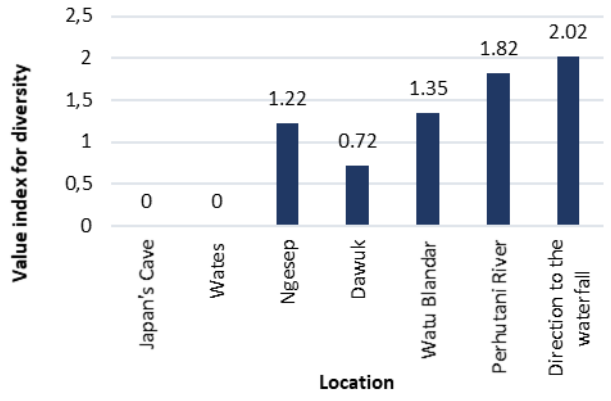

Figure 3. Value of dragonfly diversity index (H') in the Mount Sigogor and Picis Natural Reserves

In addition to the relative abundance index, the study also calculated the diversity index value using the Shannon-Wiener diversity index. The highest biodiversity value belongs to the rivers that lead to the waterfall (2.02). This is because the river is a reasonably swift stream with a rocky torso and high sunlight intensity. This condition is the preferred habitat of dragonflies (Susanti 1998). The second place with a great diversity of dragonflies is the Perhutani river. The Perhutani (Figure 3) river's condition is almost similar to the rover leading to the Toyo Marto's Waterfall. Still, the vegetation in the Perhutani river is denser and shady because around the river are planted with coffee plants. In the Mount Picis Natural Reserve, observation was made in Dawuk; this area is a hill with a low peak, a high intensity of sunlight, and wind. In the Natural Reserve of Mount Picis, rivers have not been found in the park, so the dragonfly species was found less than at the Mount Sigogor Natural Reserve. Therefore, Dawuk has low numbers of dragonfly biodiversity. The lowest value index of biodiversity is located in The Wates Region, leading to Japan's Cave, where no dragonflies have been found. Wates and the terrain leading to Japan's Cave provide an area of trees with a large canopy, making it difficult for sunlight to reach the ground, and there's no river.

In all, Mount Sigogor and Mount Picis Natural Reserves in seven surveillance locations have a 1.466 diet-level value index that is moderate value. However, insufficient time, reasonably dangerous terrain conditions, and a limited amount of observational time in a day do not preclude the possibility that there are still unknown species of dragonflies in the study.

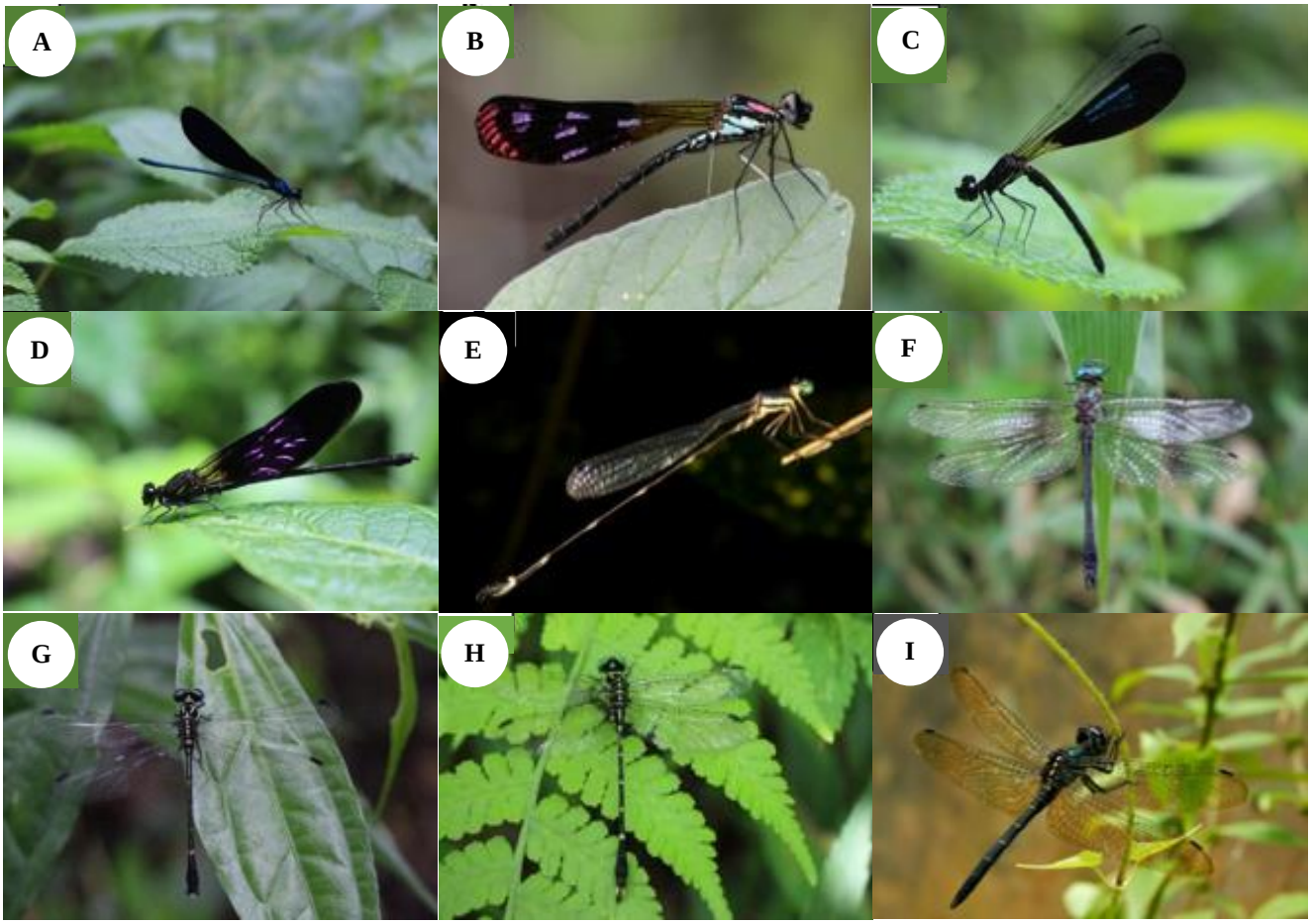

Figure 4. Some species of dragonfly have been found in and around Natural Reserves of Mount Sigogor and Mount Picis, Ponorogo District, Indonesia: A. *Vestalis luctuosa*, B. *Heliocyphafenestrata*, C. *Rhinocypha anisoptera*, D. *Euphaea variegata*, E. *Drepanosticta sundana*, F. *Idionyx montana*, G. *Heliogomphus drescheri*, H. *Onychogomphus Fruhstorfer*, I. *Zygonix ida*

In conclusion, this research could provide preliminary data on the dragonfly biodiversity database in the Mount Sigogor and Mount Picis Natural Reserves and the surrounding areas. Some species of dragonflies found are endemic dragonflies with a lack of information. Like *Heliogomphus drescheri*, this species is not listed in IUCN Redlist website data. However, because of the time limit in data retrieval, researchers have not been able to list dragonfly species in all areas of Mount Sigogor and Mount Picis Natural Reserves. Therefore, other species of dragonflies can be discovered using the same method. The exploration method can also be used to list organisms besides dragonflies, like a butterfly (Lepidoptera), orchids, etc.

REFERENCES

Balai Besar Konservasi Sumber Daya Alam jawa Timur. 2012. Cagar Alam Gunung Picis dan Cagar Alam Gunung Sigogor. http://bbksdajatim.org/cagar-alam-gunung-picis-2. [Indonesian]

Baskoro K, Irawan F, Kamaludin N. 2018. Odonata Semarang Raya. Universitas Diponegoro. Semarang, Indonesia. [Indonesian]

Cai Y, Ng CY, Ngiam RJW. 2018. Dragonflies' diversity, distribution, and habitat characteristics in Nee Soon Freshwater Swamp Forest, Singapore. Gard Bull Singap 70 (1): 123-153. DOI: 10.26492/gbs70(suppl.1).2018-07.

Corbet PS. 1999. Dragonflies: Behavior and Ecology of Odonata. Cornell University Press, New York.

Gillot C. 2005. Entomology, 3rd ed. Springer, Netherland.

Kulkarni AS, Subramanian KA. 2013. Habitat and Seasonal Distribution of Odonata (Insecta) of Mula and Mutha River Basins, Maharastra, India. J Threatened Taxa 5 (7): 4084-4095. DOI: 10.11609/JoTT.o3253.4084-95.

Lieftinck MA. 1954. Handlist of Malaysian Odonata: A Catalogue of The Dragonflies of The Malay Peninsula, Sumatra, Java, and Borneo Including The Adjacent Small Island. Treubia, Bogor.

Nugrahani MP, Nazar L, Makitan T, Setiyono J. 2014. Peluit Tanda Bahaya, Capung Indikator Lingkungan. Indonesia Dragonfly Society, Yogyakarta, Indonesia. [Indonesian]

Rugayah W, Pratiwi. 2004. Pedoman Data Keanekaragaman Flora. Pusat Penelitian Biologi LIPI, Bogor, Indonesia. [Indonesian]

Samways MJ. 2008. Dragonflies dan Damselflies of South Africa. Pensoft Publisher, Sofia.

Setiyono J, Diniarsih S, Oscilata ENR, Budi NS. 2017. Dragonflies of Yogyakarta. Indonesia Dragonfly Society, Yogyakarta, Indonesia. [Indonesian]

Siregar AZ, Bakti D. 2016. Diversity and distribution of odonata in University Sumatera Utara, Medan, Indonesia. Intl J Sci Technol Res 5 (5): 229-234.

Susanti S. 1998. Seri Panduan Lapangan Mengenal Capung. Puslitbang Biologi-LIPI, Bogor, Indonesia. [Indonesian]

Undang-Undang Republik Indonesia Nomor 5 Tahun 1990. Konservasi Sumber Daya Alam dan Ekosistemnya. [Indonesian]