The Potential of Arthropode Diversity for Ecotourism Development in Wonorejo Mangrove Ecosystem, Surabaya

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Abstract— Mangrove ecosystems all along coastal area has a lot of benefits, such as home for coastal animals (fishes and insects) and acting as coastal line protector. One of the biggest mangrove ecosystem in Surabaya is Wonorejo, which now not only act as mangrove preservation but also becoming one of eco-tourism destination in East Java. Tourists are usually come to take photos, fishing, enjoying the birds chirping and the ambience of mangrove forest. Beside that, Wonorejo also becoming one of research object for mangrove ecosystem in East Java. Several research has been done, such as research to examine mangorve diversity, birds, fishes and crabs. One of the research that hasn't been done is about Arthropods, especially in the class of Insects and Arachnids. In this paper, the potentiality of Arthropods diversity all along Wonorejo Ecotourism Area will be examined and researched. The results will be used as alternative in order to develop educational function in this area. Tourists will not only be enjoying the ambience and take photos, but also they will have educational experience when visiting Wonorejo. Arthropode samples from several Ordos, such as Diptera, Hymenoptera, Lepidoptera, Odonata, Coleoptera, Hemiptera, Orthoptera and Araneae have taken on June 2016 in Wonorejo Ecotourism Area using sweepnet and hands collecting methods. All of those sample then have examined in Zoology and Animal Engineering Laboratory at Institut Teknologi Sepuluh November, Surabaya. Then, the data will be used as the background to develop Wonorejo tourism potentials, especially in educational form.

Keywords— *arachnida*, eco-tourism, insects, arthropodes diversity, mangrove

INTRODUCTION

Mangrove ecosystems all along coastal area has a lot of benefits, such as home for coastal animals (fishes and insects) and acting as coastal line protector. One of the biggest mangrove ecosystem in Surabaya is Wonorejo, which now not only act as mangrove preservation but also becoming one of eco-tourism destination in East Java. Tourists are usually come to take photos, fishing, enjoying the birds chirping and the ambience of mangrove forest. Beside that, Wonorejo also becoming one of research object for mangrove ecosystem in East Java. Several research has been done, such as research to examine mangrove diversity, birds, fishes and crabs. One of the research that hasn't been done is about Arthropods, especially in the class of Insects and Arachnids. Previous exploration in Wonorejo has reported 22 mangrove species ini Wonorejo. Mangrove ecosystem is habitat a large of animal species. Arthropoda is one of animal group which use mangrove ecosystem as the habitat. There are abundance arthropode species lives in mangrove.

In this paper, the potentiality of Arthropods diversity all along Wonorejo Ecotourism Area will be examined and researched. The results will be used as alternative in order to develop educational function in this area. Tourists will not only be enjoying the ambience and take photos, but also they will have educational experience when visiting Wonorejo.

METHODS

a. Study Site

Location of the study is in mangrove ecosystem, east coast of Surabaya. The location in Wonorejo, Rungkut, Surabaya, East Java. Sebagaian manggrove area have been declire as Mangrove ecotourism since 9 Agusutus 2009 by dean of Surabaya. Ecotourism concept in Wonorejo mangrove forest is to protect and return mangrove ecological function, for education, workshop and manage mangrove forest contnuously and also as to be the place for find out the mangrove forest information. The temperature in the location was 29°C with fine weather.

b. Methods

Arthropods were sampled by sweep-netting with a round sweep net of 30 cm diameter. Sampling was conducted on a transect along jogging track area (station 1) and riverside near from Truno Djoyo post (station 2) by performing 3 double-sweeps (one double-sweep is defined as moving the net from the left to the right and back perpendicular to the walking direction) through the vegetation. All caught animals were transferred into 70% alkohol and stored therein until they were sorted in the laboratory. The sampling were focused on arthropods which detectable on daylight period, therefore sampling was conducted at 7-11 am on June-September 2016. The arthropod samples were sorted into taxonomic groups using key determination [4] of insect in Zoology and Animal Engineering Laboratory, Biology Department, ITS. Arthropods data biodiversity also obtained by exploring and taking picture in the habitat directly to describe the location where they commonly detectable. Literture study also used to discussing the potential of several Arthropods species for ecotourism development.

RESULTS AND DISCUSSION

There were 34 Arthropoda species have been colleting in Jogging track Wonorejo Angrove ecotourism area. Two species were identified as 4 spesies Orthoptera 5 spesies Coleoptera, 2 spesies Hemiptera, 5 spesies Diptera, 11 spesies Hymenoptera, 3 spesies Lepidoptera, 3 spesies Odonata dan 1 species Oxyopidae (Table I.).

Arthropods indirectly affect and enrich recreational activities such as ecotourism [2] and other outdoor activities; and they inspire a variety of arts, including design and the movie industry [7].

Orthoptera

Orthoptera as herbivor and prey for entomophagus Arthropods in mangrove ecosystem. Although Ortopthera are not an exotic insect that is attractive for tourists, but the insect predators that feed on it, generally an exotic insects such as dragonflies and spiders (Araneida). Therefore, the sustainability of Orthoptera also need to be maintained. Local communities living near ecotourism can cultivate grasshopper which can then be presented into a dish, as in the country of Thailand. Nevertheless, it should also be made a rule that people are not catching wild grasshoppers contained in ecotourism.

Fig 1. Phlaeoba fumosa

Coleoptera

A lot of Coleoptera species have attractive forewings appearance with bright colour. There were 5 species have identified in the study. Coleoptera derived from the words *Koleos* means "sheath" and *pteron* means "wing",

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thus Coleoptera have "sheathed wing" which called "elytra". Coleoptera as predator in mangrove ecosystem which eat other invertebrates among others Aphids. Coleoptera were found on associate mangrove vegetation (grass, pluchea leaves, chili's leaves).

A b c

Fig.1 Diversity of Family Coccinellidae in Wonorejo Mangrove Ecosystem: a. Micraspis discolor, b. Menochilus sexmaculatus, c. Coccinella septempunctata

Table 1. Arthropodes species diversity in Wonorejo Mangrove Ecosystem

No	Ordo	Family	Species
1	Orthoptera	Acrididae	*Phlaeoba fumosa*
2	Orthoptera	Acrididae	*Oxya chinensis*
3	Orthoptera	Acrididae	*Valanga nigricornis*
4	Orthoptera	Pyrgomorphidae	*Tagasta marginella*
5	Coleoptera	Coccinellidae	*Micraspis discolor*
6	Coleoptera	Coccinellidae	*Menochilus sexmaculatus*
7	Coleoptera	Coccinellidae	*Coccinella septempunctata*
8	Coleoptera	Crysomelidae	*Monolepta spp.*
9	Coleoptera	Carabidae	*Callidiola chinensis*
10	Hemiptera	Pentatomidae	*Banasa dimidiata*
11	Hemiptera	Scutelleridae	*Calliphara nobilis*
12	Diptera	Calliphoridae	*Calliphora vicina*
13	Diptera	Calliphoridae	*Chrysomia megacephala*
14	Diptera	Muscidae	*Musca domestica*
15	Diptera	Dolichopodidae	*Chrysosoma leucopogon*
16	Diptera	Bombyliidae	*Anthrax albofasciatus*
17	Hymenoptera	Formicidae	*Oecophylla longinoda*
18	Hymenoptera	Formicidae	*Componotus sericeiventris*
19	Hymenoptera	Formicidae	*Cremogastes sp.*
20	Hymenoptera	Formicidae	*Topinoma sessile*
21	Hymenoptera	Formicidae	*Polyrhachis sp.*
22	Hymenoptera	Chalcididae	*Brachymeria sp.*
23	Hymenoptera	Vespidae	*Xylocopa latipes*
24	Hymenoptera	Vespidae	*Delta campaniforme*
25	Hymenoptera	Vespidae	*Polistes sp.*
26	Hymenoptera	Vespidae	*Allorynchium sp.*
27	Hymenoptera	Vespidae	*Rhyncium haemorrhoidale*
28	Lepidoptera	Crambidae	*Sameodes cancellalis*
29	Lepidoptera	Nymphalidae	*Hypolimnas bolina*
30	Lepidoptera	Nymphalidae	*Danaus genutia*
31	Odonata	Coenagrionidae	*Pseudagrion microcephalum*
32	Odonata	Libellulidae	*Orthetrum sabrina*
33	Odonata	Libellulidae	*Diplacodes trivialis*
34	Araneida	Oxyopidae	*Oxyopes javanus*

Hemiptera

Two species which found in mengrove ecoutourism were Banasa dimidiata and Calliphara nobilis. Banasa dimidiata has tibiae not conspicuously spined, spines thin and length usually more than 7 mm. The species classified into stink bug (pentatomidae) [6]. Calliphara nobilis was a Heminoptera species which have attractive appearance, green metalic colour with six blackspot on the dorsal [8]. Larvae are found only on Excoecaria agallocha, feeding on developing seeds. Adults are 10–15 millimetres (0.4–0.6 in) long. Adults can be abundant in gregarious swarms beneath any large leaves (e.g.,Rhizophora spp.) and disperse with a loud buzzing when disturbed. The both spesies has exotic appearance with green color.

a b

Fig. 2. a) Banasa dimidiata; b) Calliphara nobilis

Diptera

There were 5 Diptera species have identified in this study. They often encounter in jogging track area from Station 2. Diptera were found a lot in jogging track, near the riverside, on *Rhizophora* sp. leaves. It is astonishing that a diverse group of animals as attractive as the bee flies — fuzzy, colorful and conspicuous [3] — should have been entirely neglected by the community or tourists in mangrove ecosystem.

a b c

Fig. 3. Diversity of Ordo Diptera; a) Chrysomia megacephala; b) Anthrax albofasciatus; c) Musca domestica

Hymenoptera

Hymenoptera species found in the study site was from Vespidae family. The family Vespidae includes some of the most common and conspicuous of all wasps so that the word "wasp" is often used to refer to common yellowjackets or paper wasps – the social species within the Vespidae – rather than members of other, much more diverse families of Hymenoptera [1].

Fig. 4. Hymenoptera

Lepidoptera

Lepidoptera (butteflies and moths) are popular targets for conservation efforts and as flagship species can help to publicize the need for habitat and resource protection and the ecological value of invertebrates.

Fig 4. Hypolimnas bolina

Orthoptera

Phlaeoba fumosa was one of Arthropods species which commonly found on grass. In some Asian countries such as China and in Japan, Odonata (dragonflies, damselflies) have a long history of being involved in recreation and leisure activities. Numerous symposia, festivals, and sanctuaries provide Japanese dragonfly enthusiasts with the opportunity to practice and perfect their skills (Primack et al., 2000). Recreation activities : the viewing of dragonflies, are the availability of books and field guides (Corbet, 1999; DuBois, 2005; Dunkle, 2000; Mead, 2003; Nikula et al., 2002), associations (e.g., Dragonfly Society of the Americas,

Fig. 5. Diplacodes trivialis

In some Asian countries such as China and in Japan, Odonota (dragonflies, damselflies) have a long history of being involved in recreation and leisure activities. In contemporary Japan, dragonflies enthusiasts, much like birders elsewhere, pride themselves on recognizing many different types of Odonata. fact, numerous symposia, festivals, and sanctuaries provide Japanese enthusiasts with the opportunity to practice and perfect their skills [9]. Dragonfly gatherings (e.g., counts, educational outings) in North America and Europe are also increasing in popularity. Facilitating the growth of these recreation activities, but more specifically the viewing of dragonflies, are

the availability of books and field guides [10][5], associations (e.g., Dragonfly Society of the Americas, Worldwide Dragonfly Association), and websites (e.g., Digital Dragonflies).

Araneae

Arthropods indirectly affect and enrich recreational activities such as ecotourism [Huntly et al., 2005] and other outdoor activities; and they inspire a variety of arts, including design and the movie industry [Prather et al., 2013]. Botswana use ecotourism as tools for biodiversity conservation Have goverment policy for ecotourism.

a b

Fig. 6 a) Argiope sp.; b)Oxyopes javanus

Fig. 7. The scheme of increasing insect value for developing ecoutourism

Increasing value of Arthropods should be done for evolving and applying Arthropods potency as ecotourism object and education at ecotourims area. Transfering information to wide community about kinds of activity which could be done in ecotourism site were one of effort which would increase interest of people to visit. The other means were giving information to community about the role of Arthropods for human life, exotist appearance of the species and their interesting behaviour of each species which can be observed. The tourist would be attract to visit the site and try to find out and prove the information about Arthropods before. On the other side, information and interesting activity could give the willingnes to the tourist candidate to spend their money in order to enjoy the beauty of the natural atmosphere provided in the ecotourism site.

Aside from being a tourist attraction, the diversity of arthropods may also educating visitors about the important values held by each species. The school-age visitors can learn directly in the native habitat of animals Arthropods. Likewise, students and researchers will try to examine more deeply every species of Arthropods found in the location associated with biological, or ecological role in the impact of human activity on the existence of each species. Choi et al [11] reveal that unique education/learning programs will help preserve insect biodiversity in the area and visitors better understand life forms such as insects found in the areas.

CONCLUSSION

Identified Arthropods in the study include Diptera, Hymenoptera, Lepidoptera, Odonata, Coleoptera, Hemiptera, Orthoptera dan Araneae. Lepidoptera, odonata, Coleoptera, Hemiptera and Araneae were several Arthropods which have potency for ecotourism development in Wonorejo Mangrove Ecosystem by means of increasing activity, interest, and visitor willingness and also extencify information about Arthropods roles in ecosystem and commonly location to find out the Arthropods.

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