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PRELIMINARY STUDY ON ODONATE OF THE SUNGAI CHONGKAK RECREATION FOREST, SELANGOR AND THE PASOH FOREST RESERVE, NEGERI SEMBILAN

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ABSTRACT

A preliminary study on diversity of Odonata (dragonfly) in Pasoh Forest Reserve (HSP), Negeri Sembilan and Sungai Chongkak Recreational Forest (HLSC) was conducted from 4th Mac until 12th August 2006. Forty one species of dragonflies representing 12 families and 31 genera were collected and *Vestalis amoena* was found to be the most common species, represented by 37 individuals. Of these, 28 and 29 species were collected from the HLSC and HSP respectively. Libellulidae with 21 species and 113 individuals represented the most diverse as well as abundant dragonfly family in both areas. The total number of species and the abundance of individual per family were found not significantly different ($P > 0.05$) between the two sites. The Shannon-Weiner Diversity Indexes (H') of the HLSC (2.95) and HSP (2.84) was not significantly different ($P > 0.05$). The Simpson Indexes (D) value indicates that the distribution patterns of the dominance species were generally consistent in HSP than in HLSC. The intermediate percentage (36.5%) of the species

overlapping between the HLSC and HSP indicates species uniformity between the two sites. Asimptot value shows that more frequent and intensive sampling approaches are needed to get a broad overview of the species diversity in any particular habitat.

ABSTRAK

Kajian awal bagi penentuan kepelbagaian Odonata (pepatung) telah dijalankan di Hutan Simpan Pasoh (HSP), Negeri Sembilan dan Hutan Lipur Sungai Chongkak (HLSC), Selangor bermula dari 4 Mac hingga 12 Ogos 2006. Empat puluh satu spesies pepatung mewakili 12 famili dan 31 genera telah dikumpul dengan *Vestalis amoena* direkodkan sebagai spesies paling umum dengan perwakilan 37 individu. Daripada jumlah ini 28 dan 29 spesies adalah di kumpul masing-masingnya daripada HLSC dan HSP. Libellulidae yang diwakili oleh 21 spesies dan 113 individu, mendominasi dengan kepelbagaian spesies dan kelimpahan individu tertinggi pada kedua-dua kawasan. Didapati bilangan spesies dan kelimpahan individu per famili yang dikumpulkan dari kedua-dua kawasan kajian adalah tidak signifikan berbeza ($P > 0.05$). Nilai indeks kepelbagaian Shannon–Weiner (H') bagi HLSC (2.95) dan HSP (2.84) adalah tidak berbeza secara signifikan ($P > 0.05$). Nilai Indeks Simpson (D) menunjukkan corak taburan spesies dominan adalah lebih konsisten di HSP berbanding HLSC. Peratus pertindihan spesies (36.5%) yang sederhana diantara HLSC dan HSP menunjukkan keseragaman spesies diantara kedua-dua kawasan kajian. Nilai asimptot menunjukkan persampelan yang lebih kerap dan intensif boleh mendapatkan gambaran kepelbagaian spesies di habitat tertentu.

INTRODUCTION

The Sungai Chongkak Recreation Forest is reputed for its clear-gleaming water and beautiful river drains the hills and lowlands in the northern and eastern parts of Hulu Langat Forest Reserve. HLSC is situated 3°15'10"- 3°11'45" N, 101°50'13" - 101°51'30" E, about 35 km east of Kuala lumpur. It is apart of the Hulu Langat Forest Reserve with a total area of about 2,068 ha, of which 30

ha was designated as the recreation park and the remaining forest is virgin jungle covered by lowland dipterocarp forest. Lowland dipterocarp forest occurs below 300 m and dominant species include *Meranti, Balau* and *Kapur.* Implementation of development on this recreational forest started in 1978 but it is open for public only in 1982. Topography of HLSC ranges from lower to upper hill, with the lowest point noted at 150 meters above sea level up to the Bukit Chenuang, the highest point which is about 850 meters above sea level (JPSM 2003). The fauna of Sungai Chongkak Recreation Forest has been little studied so information on the biodiversity of this area is very scarce.

The Pasoh Forest Reserve (HSP) that is situated at 2° 59' - 2° 58' N, 102° 17' - 102° 20' E, is one of the Forest Reserve managed by the Forest Research Institute of Malaysia (FRIM) since 1977. It is located about 8 km from the town of Simpang Pertang in the state of Negeri Sembilan, approximately 70 km southeast of Kuala lumpur (140 km by road). With an area of 2,450 ha, the Pasoh Forests Reserve is surrounded by oil palm plantations and joined to virgin hill dipterocarp forest on its northeastern boundary. The main part of the reserve consists of lowland dipterocarp forest of the Keruing-Meranti type, with the core area of about 600 ha of undisturbed forest surrounded by a buffer zone of regenerating lowland forest. The International Biological Programme used this forest for an ecological and dynamic study of a tropical rain forest between 1970 and 1974.

The knowledge on the distribution, habitat requirements and phenology of the different species of Malaysian Odonata are still rather inadequately known. However, studies on the dragonflies (Anisoptera) and damselflies (Zygoptera) started about 150 years ago. Much attention has been paid to it ever since. Only one attempt was made to prepare a comprehensive list of the Malaysian odonate fauna (Lieftinck 1954), which has been an important reference for systematists and biologists interested in this attractive and beautiful insects of the region. The handlist includes 189 species of which Zygoptera and Anisoptera are represented by 77 and 112 species respectively. Recently, studies by Norma (1995, 1996, 2001) and Orr (2005) carried out in a number of localities in Peninsular Malaysia and Singapore

revealed an addition records to at least 230 dragonfly species, known to occur at present. However, to date, no attempt was made for odonata studies in HLSC and HSP. In view of this fact, a preliminary study of the dragonfly fauna in both studied sites was initiated and the results are presented here.

MATERIALS AND METHODS

Samplings of odonata was carried out for a total of nine occasions between 4th Mac to 12th August 2006 at HLSC and HSP, generally for 2-3 days per trip between 0900 - 1730, under favorable conditions for odonates flight. At HLSC, samplings were done along the jungle trails and stretch of streams as well as standing water habitats such as small ponds, concreted drains and temporary puddles within a 2 km² area. Whereas in HSP, samplings were conducted in two suboccasions; the open area consists of buildings and ranger houses toward the edge of 50 ha plot of forested portion and along the jungle trail toward the main entrance of the forest.

Odonate samplings using sweep nets was employed in this study. Specimens caught were placed in triangular envelopes and left overnight to empty their stomach contents. Each envelopes was labelled and brought back to the laboratory. These were later dried in the oven, sorted and identified. The specimens were sexed and morphological measurements taken. The species identification was made based on Silsby (2001) and Orr (2005). However, classification and naming of the odonata species in this study is in accordance to that of Orr (2005).

Specimen numbers of each species obtained were recorded and subjected to statistical analysis. Shannon's species diversity (H') values, as well as Simpson index value (D') were computed and compared using a Biodap programme (Thomas 1997). Shannon's species evenness or equitability (E') index values and richness (R') were also computed using the same programme. The assessment of the odonata fauna is based on the statistical comparison of the H' values, relative comparison of the E'and R' values and of obvious features from the species checklist and cumulative table (Table 1).

The odonata specimens are currently deposited at the Center for Insect Systematics, School of Environmental and Natural Resources, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Malaysia (UKM).

RESULTS AND DISCUSSION

Composition and Distribution of Odonata

A total of 228 individuals odonates representing 12 families, 31 genera and 41 species were recorded for the whole study area (Table 1). Of these, 121 and 107 individual odonates were collected from the HLSC and HSP respectively. There were relatively more species collected in HSP (29) than in HLSC (28), and this represents 12.6% and 12.2% of odonata species recorded in Peninsular Malaysia and Singapore (Orr 2005). Interestingly, eventhough HSP was the driest forest station in Peninsular Malaysia (Manokaran & LaFrankie 1990), it still favored high diversity of Odonata species, probably due to its surrounded by taller and diverse vegetation, which provides food and protection, supports more odonata species than does the HLSC area. Many species require the root masses of particular plants, such as *Pandanus* or bamboo stumps and fringing vegetation, for oviposition (Orr 2003). In contrast, majority of odonates in HLSC are closedly associated with streams. The greatest number of species is usually found on the larger streams which provide a variety of microhabitats, which often form along the river banks (Orr 2003). This tends to agree with our result which encountered high number of individuals odonata in HLSC.

An interesting feature of the results of this survey is that all of these 41 species are new records for both areas, simply because, there has been no study and publication on dragonfly species from the study sites.

Majority of the collections comprised of Libellulidae (49.6%) with 21 species and 113 individuals, represented the most diverse as well as abundant odonata family from both areas. The zygopterans were dominated by the Calopterygidae (19.7%), followed by Chlorocyphidae and Platycnemididae (7.9%), as

shown in Figure 1. Euphaeidae were moderately represented (6.6%), followed by Amphipterygidae (2.6%) and Gomphidae (2.2%). The minority family groups with less than 1% representation were Aeshnidae, Cordulidae, Lestidae, Coenagrionidae and Protoneuridae.

Among the libellulids, *Neurothemis fluctuans* (Fabricius) (Table 1) appeared to be the most abundant species in the whole area. This was followed by *Tyriobapta torrida* Kirby, *Cratilla metallica* (Brauer), *Orthetrum chrysis* (Selys), *Orthetrum luzonicum* (Brauer), *Cratilla lineata lineata* (Brauer), *Orthetrum testaceum testaceum* (Burmeister), *Trithemis festiva* (Rambur) and *Zygonix iris malayana* (Laidlaw), which were represented by 14, 12, eight, six, five, five, five and five individuals, respectively. The minority libellulids species with less than five individuals recorded were *Agrionoptera insignis insignis* (Rambur), *Lathrecista asiatica asiatica* (Fabricius) and *Lyriothemis biappendiculata* (Selys) (4); *Brachythemis contaminata* (Fabricus) and *Orthetrum sabina sabina* (Drury) (3); *Onychothemis culminicola* Forster and *Orthetrum glaucum* (Brauer) (2); *Agrionoptera sexlineata* Selys, *Nesoxenia lineata* (Selys), *Onychothemis testacea testacea* Laidlaw, *Tetrathemis irregularis hyalina* Kirby and *Trithemis aurora* (Burmeister) (1). The high occurence and widespreads distribution of Libellulidae in both study areas may be contributed by their territorial characteristic and occupancy of most habitat types especially in tropics region (Corbet 1999). Similar results were found by Norma *et al.* (2001) since certain species of libellulid are of cosmopolitan distribution and able to live in wide ranging habitats.

The other families, Chlorocyphidae, Platycnemididae, Gomphidae and Calopterygidae were represented by four, four, three and two species respectively. Among the chlorocyphids, *Aristocypha fenestrella* was the commonest species encountered. Preference for the open area is probably the reason for higher numbers (13 individuals) of chlorocyphids collected in HLSC than does HSP (5 individuals). This is probably due to higher light intensity in HLSC, attracted more individual chlorocyphids (light tolerant species) than in forest area (HSP). This tends to support Norma *et al.* (1996) which noted that the chlorocyphids were

frequently observed within the forest and agricultural lands with a high degree of sunlight penetrated.

Among the other platycnemidids, *Indocnemis orang* was frequently observed in HLSC particularly along the concreted drain which remains bare of vegetation for long periods. None of *I. orang* was encountered in HSP.

Gomphidae, being well represented in the Oriental region with over 300 species, however was not well presented in our sampling. This was probably due to most species being canopy flier and approach the water only briefly to mate and oviposit (Orr 2003). Of these, many species are therefore not encountered in the course of survey conducted on the ground. The common gomphid collected from both area was *Gomphidictinus perakensis* Laidlaw. Although Libellulidae is the predominant family group in both study site, the calopterigid *Vestalis amoena* gained the highest individuals in the areas.

Calopterygidae is a widespread family and the adults are usually found in abundance along forest paths searching for small insects on the leaves of low shrubs (Che Salmah *et al.* 2005). Other families were Euphaeidae, Amphipterygidae, Corduliidae, Aeshnidae, Lestidae, Coenagrionidae and Protoneuridae, each represented by one species. However, none of Platystictidae and Chlorogomphidae was encountered in this study. This is probably due to most species were confined to a submontane and montane areas, of which some of it were rare and endemic species (Orr 2005).

Table 1 Odonata family specimens obtained at the Sungai Chongkak Recreation Forest and the Pasoh Forest Reserve

	Taxa	No. of specimens HLSC	HSP	Total
LIBELLULIDAE				
1	*Agrionoptera insignis insignis* (Rambur)	2	2	4
2	*Agrionoptera sexlineata* Selys	1	0	1
3	*Brachythemis contaminata* (Fabricus)	3	0	3
4	*Cratilla lineata lineata* (Brauer)	0	5	5
5	*Cratilla metallica* (Brauer)	0	12	12
6	*Lathrecista asiatica asiatica* (Fabricius)	4	0	4
7	*Lyriothemis biappendiculata* (Selys)	3	1	4
8	*Nesoxenia lineata* (Selys)	0	1	1
9	*Neurothemis fluctuans* (Fabricius)	19	7	26
10	*Onychothemis culminicola* Forster	2	0	2
11	*Onychothemis testacea testacea* (Laidlaw)	1	0	1
12	*Orthetrum chrysis* (Selys)	3	5	8
13	*Orthetrum glaucum* (Brauer)	1	1	2
14	*Orthetrum luzonicum* (Brauer)	0	6	6
15	*Orthetrum sabina sabina* (Drury)	1	2	3
16	*Orthetrum testaceum testaceum* (Burmeister)	2	3	5
17	*Tetrathemis irregularis hyalina* (Kirby)	0	1	1
18	*Trithemis aurora* (Burmeister)	0	1	1
19	*Trithemis festiva* (Rambur)	3	2	5
20	*Tyriobapta torrida* Kirby	5	9	14
21	*Zygonix iris* malayana (Laidlaw)	5	0	5

..... table 1 continue

CHLOROCYPHIDAE				
22	*Aristocypha fenestrella* (Rambur)	8	1	9
23	*Heliocypha biforata* (Selys)	2	3	5
24	*Heliocypha perforata limbata* (Selys)	3	0	3
25	*Libellago hyalina* (Selys)	0	1	1
PLATYCNEMIDIDAE				
26	*Coellicia albicauda* (Forster)	6	0	6
27	*Copera vittata* (Selys)	0	2	2
28	*Copera ciliata* (Selys)	0	1	1
29	*Indocnemis orang* (Forster)	9	0	9
GOMPHIDAE				
30	*Gomphidictinus perakensis* (Laidlaw)	1	2	3
31	*Ictinogomphus decoratus melaenops* (Selys)	1	0	1
32	*Paraghompus capricornis* (Forster)	1	0	1
CALOPTERYGIDAE				
33	*Neurobasiss chinensis chinensis* (Linnaeus)	7	1	8
34	*Vestalis amoena* (Selys)	12	25	37
EUPHAEIDAE				
35	*Euphae ochracea ochracea* (Selys)	12	3	15
AMPHIPTERYGIDAE				
36	*Devadatta argyoides argyoides* (Selys)	5	1	6

..... table 1 continue

CORDULIIDAE			
37 *Idionyx yolanda* (Selys)	2	0	2
AESHNIDAE			
38 *Gynacantha subinterrupta* (Rambur)	0	2	2
LESTIDAE			
39 *Orelestes wallacei* (Kirby)	0	2	2
COENAGRIONIDAE			
40 *Archibasis incisuri* (Lieftinck)	0	1	1
PROTONEURIDAE			
41 *Prodasineura laidlawii* (Forster)	1	0	1
Total no. of specimens	**121**	**107**	**228**
Total no.of species	**28**	**29**	**41**

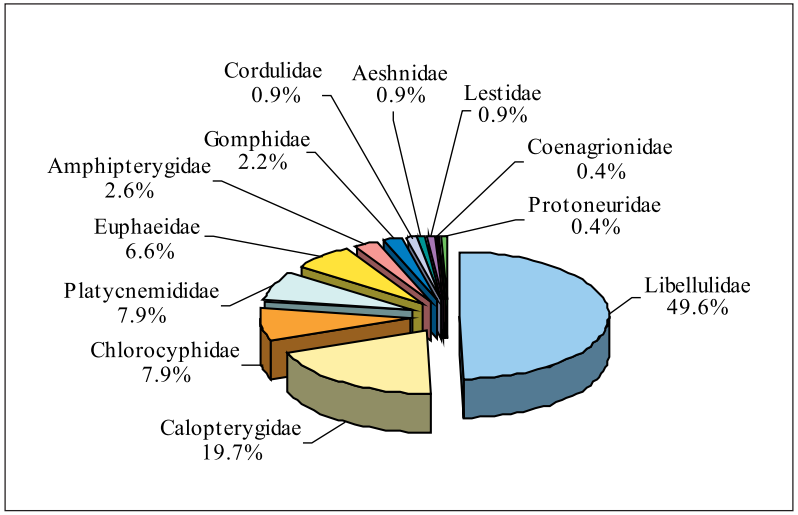

Fig. 1 The percentage of total individual catch of all family groups caught from Sungai Chongkak Recreational Forest and Pasoh Forest Reserve.

Common and Abundant Species

This survey indicates that four species (*Vestalis amoena* Selys, *Tyriobapta torrida* Kirby, *Neurothemis fluctuans* (Fabricius) and *Euphaea ochracea* Selys) are relatively common in both study areas. The calopterygid *V. amoena* was found relatively more abundance than the *N. fluctuans, E. ochracea*, *T. torrida, C. metallica, A. fenestrella, I. orang, O. chrysis, N. chinensis, O.luzonicum, C. albicauda, D. agryiodes, C. lineata, O. testaceum, T. festiva, Z. iris, H. biforata, A. insignis, L. asiatica, L. biappendiculata, B. contaminata, O. sabina, H. perforata, G. perakensis, O. culminicola, O. glaucum, C. vittata, I. yolanda, G. subinterrupta* and *O. wallacei*. Only one specimens of each *Archibasis incisuri* and *Prodasineura laidlawii* were caught during this study.

Species Diversity and Evenness

The Shannon–Weiner's diversity index, H' is widely used to illustrate the diversity of organism in their natural habitat and niche (Sparks 2000). Specimens collected from the two areas showed HLSC with the highest index of 2.95, followed by HSP with 2.84 but with no significant different ($P > 0.05$) between it (Table 2). This showed that both study sites support higher diversity of dragonflies fauna. This could also be attributed to the fact that tropical evergreen rainforest of Peninsular Malaysia have a great deals of flora and fauna diversity, as well as higher in productivity, which support in food availability and formation of multihabitat for odonates and other insects.

Equitability (E') or evenness of the scattering dragonfly individuals among the species is illustrated by this index. A greater number of species increased species diversity, and a more even or equitable distribution among species will also increased species diversity measured by the Shannon-Weiner function (Magurran 1998; Pielou 1975). According to the computed value of E' in both study sites, HLSC had the highest species equitability of odonates with 0.88. This suggests that the abundance of species is more even in HLSC than in HSP.

Simpson's index (D) of diversity is an approach to determine the diversity and dominance of an organism in their natural habitat (Magurran 1998). This index emphasized more on the probability of picking two organisms at random that are different species. However, Simpson's index gives relatively little weight to the rare species and more weight to the common species (Simpson 1949). The D value is found highest in HSP (0.085) than HLSC (00.62) (Table 2). This clearly supports the probability theory of picking two species of odonates that could be different species, since the former had the smallest number of individual and species diversity caught. This is because Simpson's index gives increasing values of D with increasing dominance of one or a few species and decreasing values of D with increasing diversity (Simpson 1949).

Table 2 Summary of Odonata species diversity analysis

Index	HLSC	HSP
Number of individual	121	107
Number of species	28	29
Shannon – Weiner Diversity Indexes, H'	2.95[a]	2.84[a]
Equitability Indexes, E'	0.88	0.84
Margalef Richness Indexes, R'	5.63	5.99
Variances of H, var H'	0.0053	0.0095
Simpson Indexes, D	0.062	0.085
Simpson Reciprocal Indexes, 1/D	16.026	11.815

H' values represented by the same alphabetical order were not significantly different (Paired t-test, $P > 0.05$).

CONCLUSION

Results of this preliminary study serves as base-line information on documenting the odonata fauna of Sungai Chongkak Recreation Forest and Pasoh Forest Reserve. Studies on Odonata as well as other aquatic insects are necessary to assess the role of these insects within natural communities of forest ecosystem. Further studies of the dragonfly fauna in both forest should be conducted so that at least a nearly complete checklist could be made.

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