Malaysian Journal of Science 27 (3): 105 - 111 (2008)

Dragonflies on the Islands in the Straits of Malacca

***Norma-Rashid Y, Sofian-Azirun M, Rosli Ramli and Rosli Hashim**

Institute of Biological Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur
* ynorma@um.edu.my (Corresponding author)

ABSTRACT The odonate fauna of Pulau Perak, Pulau Jarak and some islands of the Sembilan group of islands were surveyed. Although no endemics were found, fifteen species, all first records for the islands were documented. Various biological aspects of the dragonfly such as population, distribution and relative abundance were discussed. Morphometric aspects were also studied and possible explanations for the attributed differences between the island populations of Pulau Perak and Pulau Lalang are proposed.

ABSTRAK Fauna Odonata telah dikaji di kepulauan Selat Melaka, iaitu Pulau Perak, Pulau Jarak dan sebahagian dari Pulau Sembilan. Walaupun tiada spesies endemik telah dijumpai, kesemua lima belas spesies yang didokumentasikan merupakan rekod baru untuk pulau-pulau tersebut. Pelbagai aspek biologi pepatung seperti populasi pepatung, taburan dan kepadatan relatif dibincangkan. Aspek morfometrik juga turut diselidiki dan beberapa huraian telah diturakan untuk menjelaskan perbezaan ketara populasi pepatung di Pulau Jarak dan Pulau Lalang.

(Odonata, diversity, new records, islands, Peninsular Malaysia, morphometrics)

INTRODUCTION

Several islands in the Straits of Malacca such as Pulau (= island) Langkawi and Pulau Pangkor are well known touristic attraction. The Sembilan group of islands is a cluster of nine small islands, namely, Pulau Agas, Pulau Payong, Pulau Nipis, Pulau Saga, Pulau Buluh, Black Rock, White Rock, Pulau Rumbia and Pulau Lalang which are uninhabited but are visited by fishermen and the few who seek camping, snockling and diving activities. The scenic marine spots are located in the channels between Rumbia and Lalang islands. Not far away from the Sembilan islands is the remote island of Jarak which has also enticed those who like fishing and diving. More remote is Pulau Perak thought to be a barren igneous rock formation when last visited by C.A. Gibson-Hill and T.W. Burdon in 1949. This however has changed evidently from the recent SESMA expeditions which have uncovered various living organisms that successfully thrive on the island.

Dragonflies and damselflies of the order Odonata are now receiving worldwide attention from as objects of research. Such work, besides those that involve the appreciation of their aesthetic value [1], have wide application in the area of conservation [2], bioindication and biomonitoring [3,4], biocontrol [5] and more recently, in the design of surveillance tools fondly named 'Dragon Spies' which mimic the form and habit of the dragonfly.

The migratory behaviour of odonates such as observed in two prominent species, *Anax guttatus* and *Pantala flavescens*, has been well studied [7]. If distance travelled is any measure of their agility and endurance, then these species of dragonflies are the most likely to be found in distant islands far away from the mainland. The SESMA expeditions to remote islands in the Straits of Malacca thus provided an opportunity to test this.

The objective of this work is to document the odonate diversity of these remote islands and to assess their distribution, abundance and population characteristics (morphometrics).

MATERIALS AND METHODS

Sampling sites

The study locations are depicted in Figure 1. The

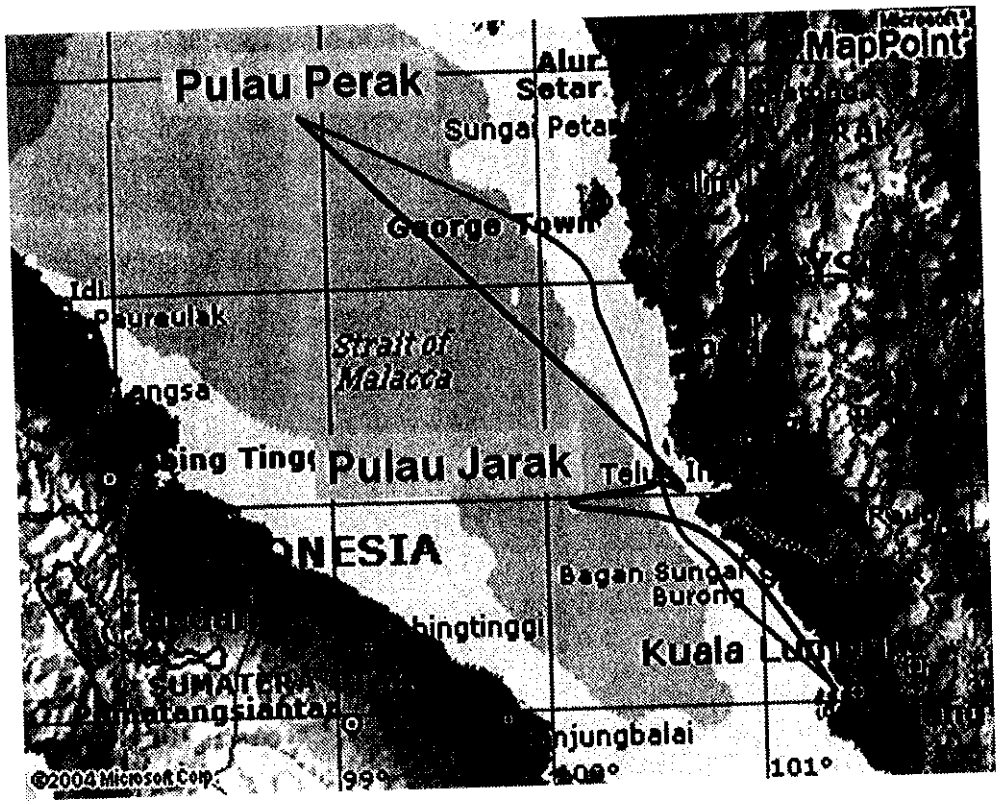

Figure 1: Map to show the island locations.

islands were Pulau Perak, Pulau Jarak and Pulau Lalang and Pulau Rumbia of the Sembilan islands. Pulau Perak is considered an oceanic island [8], although vegetated and has no freshwater bodies. Dragonflies were either caught while roosting on tree tops or attracted to light traps. Pulau Jarak is a tiny island about 8 hectares in size and 50m above sea level, well vegetated but with no beach. Although the presence of four small streams was mentioned by Wyatt-Smith [9], he warned that water frequently disappeared beneath large boulders. This could be the reason why we found only one stream. Pulau Lalang is considered to be the best in the group of Sembilan Islands; it has a fresh water stream which is ideal for dragonfly sampling.

Sampling methodology

The voyage to the islands began on 4 June 2004 and ended on 9 June 2004. Subsequent trips were made on the 10-13 August 2004 and a final trip from 23-26 November 2007. No attempts were made to do a systematic sampling as periods of visits to the islands were not consistent. The manual search and capture of adults utilizing insect nets were random and covered areas of the islands that were accessible by foot. The search targeted stagnant water bodies, streams where available and visualization of roosting and swarming species with the aid of binoculars. When overnight trips permitted the use of light traps, the latter were set up to lure certain species of dragonflies. All captured specimens were placed in insect envelopes and treated before they were brought back to the laboratory for morphometric analysis.

RESULTS AND DISCUSSIONS

Species Diversity

The total number of odonates recorded from these islands comprised of 15 species belonging to the families Libellulidae and Coenagrionidae (Table 1). Libellulidae topped the list which is not unusual for this diverse family group [10]. Three among these 15 species eluded capture but were either photographed or visually identified. The common names [10, 11] are included for all species and the skimmers (five out of the total 15 species) predominated the species list. There were no endemics among the recorded

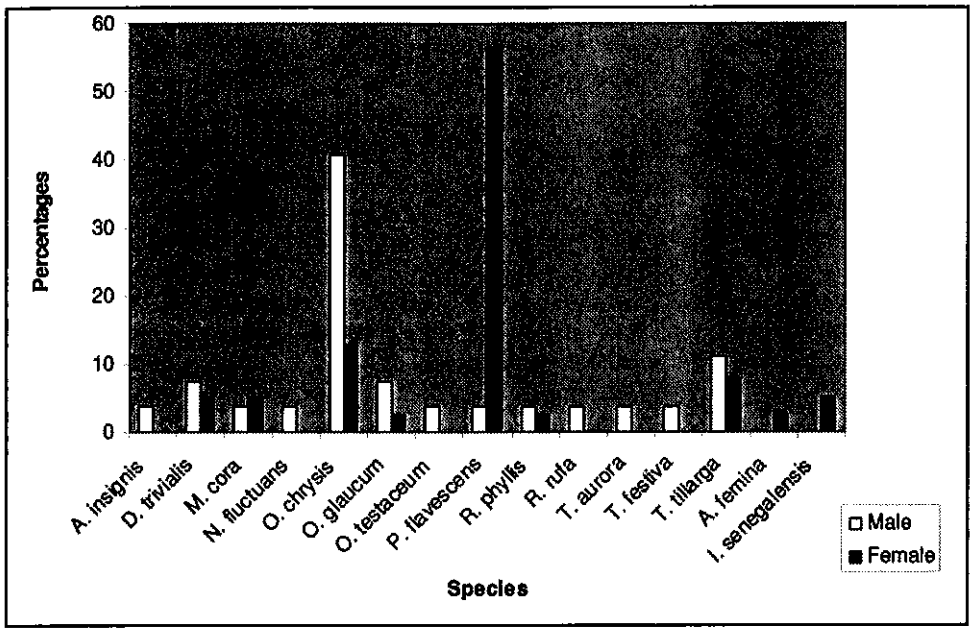

Figure 2: Percentages of male and female individuals for all the species found.

species which are cosmopolitan in the Asian region [12] and all documented species are also found on the mainland of Peninsular Malaysia. Diversity of the species is reflective of a disturbed habitat [13] and most of stagnant waters [10], in contrast to the pristine waters of Jarak as perceived by Audy et al. in the 1950s [14]. Although odonate species of common status were present here, they are all first records for the island as no previous work on dragonflies had been conducted for these islands. Audy et al. [14] noted the remarkable absence of the insects on Jarak Island except culicine mosquitoes, small wood-boring beetles, two species of termites, few butterflies and two species of ants.

Male and Female Populations

Capture of specimens enabled verification of sex where species were not sexually dimorphic in body coloration [5]. Male densities commonly exceeded female numbers when samplings were conducted at water bodies [9]. This phenomenon is supported by the high presence of male *Orthetrum chrysis* (Figure 2) sampled in the stream of Pulau Lalang. However, from Figure 2, it is evident that there was a relatively balanced sex distribution (t-test: $U_{(1,14)}$ = 5.86, $p > 0.05$). A slight skewness of higher female proportion is due to the aggregating females of *Pantala flavescence.*

Distribution and Abundance

Table 1 also shows the distribution and proportional abundances of species sampled on the island. These data should be treated with caution as the sampling allocation for each of the islands was disproportionate. Although Pulau Rumbia was visited, there was no dragonfly species present. Pulau Lalang had an equal number of species as Pulau Perak, both with eight species, and Pulau Jarak had the least with only two species. The globe skimmer (*Pantala flavescens*) was the most abundant in Pulau Perak where they were found swarming by the jetty as well as roosting on trees by the cliffs at the peak of the island. In Pulau Lalang, the spine-tuffed skimmer (*Orthetrum chrysis*) were predominant in numbers and behaviour where the males aggressively chased other dragonflies [15].

Morphometrics

Morphometrical features measured were the fore-wing (FW), hind-wing (HW) and abdominal (AL) lengths as standard protocol for odonate population studies [16,17]. Representative populations (to reflect consistency) from the Pulau Perak and Pulau Lalang are presented in Figure 3 and Figure 4 respectively. The overall measurements showed a significant difference (Friedman ANOVA test: $\chi^2_{(N=14,\ d.f=5)}$ = 53.37, $p < 0.01$). The Box and Whisker

Table 1. List of species found in the islands of Perak, Jarak and Lalang reported as relative proportions where, the symbols indicated: x = <10%; xx = 20-25%; xxx = 30-35%.

SPECIES LIST	P. PERAK	P. JARAK	P. LALANG	COMMON NAMES	COMMENTS
SUB-ORDER ANISOPTERA					
FAMILY LIBELLULIDAE				Chasers	
Agrionoptera insignis (Rambur, 1842)			x	Slim metallica	caught in P. Lalang
Diplacodes trivialis (Rambur, 1842)	x		x	Little blue darter	one male very pruinosed
Macrodiplax cora (Kaup, 1867)			x	Crimson basker	also known as coastal pennant
Neurothemis fluctuans (Fabricius, 1793)	x			Coppertone velvetwing	photographic record
Orthetrum chrysis (Selys, 1891)			xx	Spine-tufted Skimmer	also known as red faced skimmer
Orthetrum glaucum (Brauer, 1865)			x	Asian Skimmer	also known as common blue skimmer
Orthetrum testaceum (Burmeister, 1839)			x	Orange skimmer	photographic record
Pantala flavescens (Fabricius, 1798)	xxx			Globe skimmer	also known as wandering glider
Rhyothemis phyllis phyllis (Sulzer, 1776)	x			Batik flutterer	also known as batik glider
Rhodothemis rufa (Rambur, 1842)	x			Spine-legged Redbolt	caught in P. Perak
Trithemis aurora (Burmeister, 1839)			x	Down dropwing	also known as crimson dropwing
Trithemis festiva (Rambur, 1842)			x	Indigo dropwing	visual record
Tholymis tillarga (Fabricius, 1798)	x	x		Evening skimmer	also known as foggy-winged twister
SUB-ORDER ZYGOPTERA					
FAMILY COENAGRIONIDAE				Bluets/Pond damsels	
Agriocnemis femina femina (Brauer, 1868)	x			Pinhead midget	white-backed wisp
Ischnura senegalensis (Rambur, 1842)	x	x		Common bluetail	only females caught
Total number of species	**8**	**2**	**8**		

Legend

x = <10%; xx = 20-25%; xx = 30-35%

Plot (Figure 5) revealed a contrast between the odonate populations of Pulau Perak and Pulau Lalang. There was a significantly correlation between the wing and abdominal measurements of each island populations. These were supported by Spearman Correlation Test for Pulau Perak (AL versus FW: $R = 0.58$, $t(N-2) = 2.45$, $p < 0.03$; AL versus HW: $R = 0.69$, $t(N-2) = 3.31$, $p < 0.01$), Pulau Lalang (AL versus FW: $R = 0.79$, $t(N-2) = 4.56$, $p < 0.01$; AL versus HW: $R = 0.77$, $t(N-2) = 4.19$, $p < 0.01$). Such correlations are consistent with other populations of other species of dragonflies previously studied [16]. More interestingly are the contrasts between the island populations which are consistently significant using the Wilcoxon Matched Paired Test (fore-wing contrast: $N = 14$, $T = 13$, $Z = 2.48$, $p < 0.01$; hind-wing contrast: $N = 14$, $T = 9$, $Z = 2.73$, $p < 0.06$; abdominal length: $N = 14$, $T = 16$, $Z = 2.29$, $p < 0.02$). The preceding results revealed that the odonate population of Pulau Perak had far larger body parts than in Pulau Lalang. The possible explanations for this observable fact could be due to:

- Pulau Perak is far isolated from the mainland and thus the odonate populations thrive and fluorish on the rich food resources within the island without much competition from similar feeding guilds.
- Pulau Lalang, on the other hand, is closer to the mainland and to other islands of the Sembilan group. This would encourage migration between islands and land mass in search of better resources when faced with extreme conditions on the island. Such frequent migrations would result in loss of body fat reserves and thus contributing to limited growth. Migratory behaviour and dispersal patterns in dragonflies have been documented by many scientists [18].
- The short distance between Pulau Lalang and Peninsular mainland could increase diversity of other species due to dispersal, migration and emigration [19]. This would create higher competition amongst the island dragonflies for the limited resources. Behavioural strategies such as predator avoidance would impose heavy demand on internal reserves to the detriment of body size and thus populations in Pulau Lalang would have smaller body sizes.

Thus it would be of interest to further investigate the morphometric characteristics of dragonflies of other islands in the region in order that further comparisons could be made.

ACKNOWLEDGEMENTS

We would like to thank the University of Malaya for a grant that make this study possible, particular individuals who spearhead the voyage of discovery: Tan Sri Halim, Dato' Hashim, Phang S.M. and Azhar Husin, and to UM team members for their company in joyous and suffering occasions. Last but not least, my gratitude to Mohaiyidin my dragonfly hunting partner.

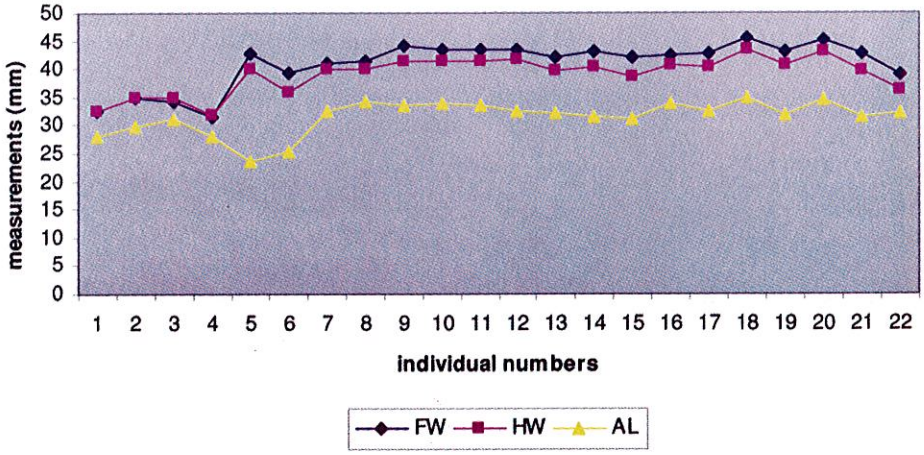

Figure 3: Line graphs for all three morphometric measurements of abdominal lengths(AL), hind- (HW) and fore wings (FW) made on the representative individuals from Pulau Perak.

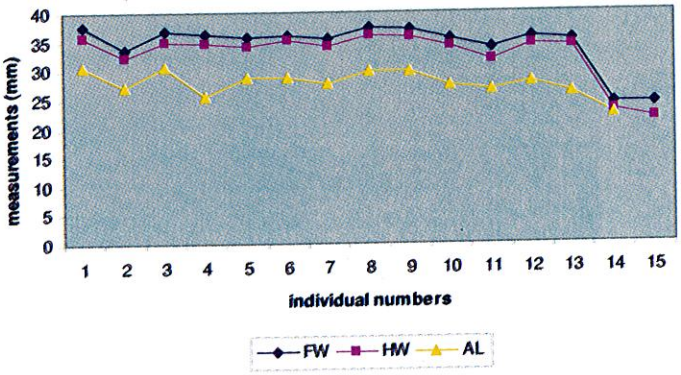

Figure 4: Line graphs for all three morphometric measurements of abdominal lengths (AL), hind- (HW) and fore wings (FW) made on the representative individuals from Pulau Lalang

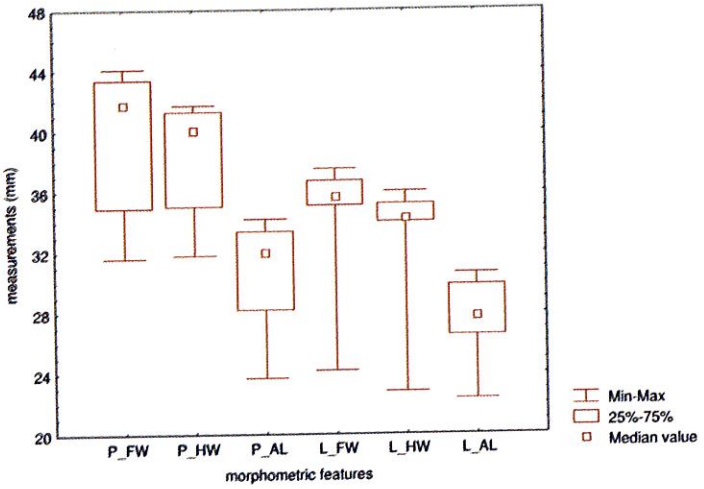

Figure 5: The Box and Whisker plot for the morphometric measurements made. The abbreviations for specimens: P_FW = Pulau Perak fore-wing measurements, P_HW = Pulau Perak hind-wing measurements; P_AL = Pulau Perak abdominal length measurements; L-FW = Pulau Lalang fore-wing measurements; L_HW = Pulau Lalang hind-wing measurements; L_AL = Pulau Lalang abdominal length measurements.

REFERENCES

1. Norma-Rashid,Y. (2000). The garden visitor – the dragonflies. *Garden Asia.* **2**:18-21
2. Samways, M.J. (1992). Dragonfly conservation in South Africa: a biogeographical perspectives. *Odonatologica.* **21(2)**: 165-180
3. Schmidt E. (1985). Habitat inventarization, characterization and bioindication by a representative spectrum of odonata species (RSO). *Odonatologica.* **14(2)**: 127-133.
4. Wayne Steffens and William Smith. (1999). Manitoba Dragonfly Survey Status Survey for Special Concern and Endangered Dragonflies of Minnesota: Population Status, Inventory and Monitoring Recommendations. http://www.naturenorth.com/dragonfly/index.html.
5. Corbet, P.S. (1999). *Dragonflies - Behaviour and Ecology of Odonata.* Harley Books, Essex. pp. 829
6. Rick Weiss. (2007). Dragonfly or insect spy? Scientists at work on robobugs. Washington Post. October 9: page A03.
7. Srygley, R.B. (2003). Wind drift compensation in migrating dragonflies Pantala (Odonata: Libellulidae). *Journal of Insect Behavoir.* **16(2)**: 217-232.
8. Tweedie, M.W.F. (1950). A note on Pulau Jarak considered as an oceanic island. *Raffles Bulletin.* **23**: 262 – 263.

9. Wyatt-Smith, J. (1970). The vegetation of Jarak Island, Straits of Malacca. *Journal of Ecology.* **41(2)**: 207-225.
10. Norma-Rashid, Y. and M. Sofian-Azirun. (2007). Common dragonflies and damselflies (Insecta: Odonata) at Hulu Selai, Endau-Rompin, Johor, Malaysia. In: The Forests and Biodiversity of Selai, Endau-Rompin (eds. H. Mohamed and M. Zakaria Ismail). ISBN 978-083-42197-0-3.
11. Norma-Rashid, Y. (2007). Dragonflies – museum repositories and common names. *Jurnal Sains.* **15(1)**: 36 - 40.
12. Lieftinck M. (1954). Handlist of Malaysian Odonata. *Treubia.* **22**: 2002pp
13. Orr, A.G. (2005). Dragonflies of Peninsular Malaysia and Singapore. Natural History Publications. Kota Kinabalu. 125pp. ISBN 983-812-103-7.
14. Audy, J.R., Harrison, J.L. and Wyatt-Smith, J. (1950). A survey of Jarak Island, Straits of Malacca. *Raffles Bulletin.* **23**: 230-261
15. Norma-Rashid Y. (1995). A dynamic encounter with the odonates in Sungai Selieh, Kelantan, Peninsular Malaysia. *Wallaceana.* **76**: 17-22.
16. Norma-Rashid, Y. (1999). Behavioural Ecology of Tyriobapta torrida Kirby (Anisoptera: Libellulidae) at the breeding and resting site. *Odonatology.* **28(2)**: 139-150.
17. Norma-Rashid, Y. (1999). Ecomorphology in dragonfly, Neurothemis fluctuans (Fabricius, 1973). *Malaysian Journal Science.* **18**: 79-82.
18. Nijhoutt, H.F. and Emlen, D.J. (1998). Competition among body parts in the development and evolution on insect morphology. *Proceedings National Academy Sciences U S A.* **95(7)**: 3685–3689.
19. Srygley, R.B., Oliveira, E.G. and Dudley, R. (1996). Wind drift compensation, flyways, and conservation of diurnal, migrant Neotropical Lepidoptera. *Proceedings of the Royal Society of London.* **263**: 1351–1357.