

Dragonflies (Odonata) of Coastal Bachok, Kelantan and Promoting Common Names.

Y. Norma-Rashid

Institute of Biological Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur.

ynorma@um.edu.my (Corresponding author)

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ABSTRACT A brief study of odonates in the coastal area of Bachok, Kelantan found 16 species, belonging to two families Coenagrionidae (made up 25 % of the population) and Libellulidae (75 %). The common names used here are accepted internationally for cosmopolitan species, while others are coined to reflect local descriptions. The Eastern Scarlet, *Crocothemis servilia* (Drury, 1770) was most predominant followed by the Pinhead midget, *Agriocnemis femina* (Brauer, 1868) while the rest of the species occurred in moderate numbers. Population numbers were biased towards males rather than females which were reflective of male tendency to exploit water as a reproductive strategy in acquiring mates.

ABSTRAK Kajian dijalankan keatas Odonata di Bachok menghasilkan jumlah 16 diversiti spesies yang merupakan jenis hidupan persisiran pantai. Nama-nama am spesies disenaraikan mengikut yang diterimapakai di antarabangsa bagi spesies yang cosmopolitan, namun yang selainnya diterbitkan mengikut penerimaan istilah kegunaan tempatan. Kesemua spesies tersebut adalah ahli Famili Coenagrionidae (25%) dan Libellulidae (75%). Spesies yang paling ketara dari segi bilangan adalah, Eastern Scarlet, *Crocothemis servilia* (Drury, 1770) dan diikuti dengan Pinhead midget, *Agriocnemis femina* (Brauer, 1868), manakala yang selainnya dalam bilangan sederhana. Bilangan populasi adalah cenderung terhadap jantan daripada betina, ini mungkin disebabkan oleh strategi pembiakan jantan yang cenderung mengeksploitasi badan air untuk menangkap pasangan bagi tujuan membiak.

(Keywords: Odonata, coastal species, Peninsular Malaysia, common names.)

INTRODUCTION

Dragonflies are known to be generally sun-loving creatures which are able to withstand high temperatures of the midday sun. This explains why they are able to thrive in coastal areas of scotching sunlight. Some have peculiar perching habits, pointing their abdomens right-up into the air [1, 2, 3]. This behaviour is said to assist in thermoregulation of body temperatures [1]. These creatures are agile fliers equipped with amazing abilities such as fast manoeuvres and displaying swarming behaviour, thus the ability to capture prey in flight [4]. More astonishing is their capacity to migrate over vast distances in huge numbers often witnessed in coastal areas. This behaviour has attracted a lot of devoted long-term research to investigate their phenomenal ability of long distance flights [5, 6, 7, 8]. The Oregon Dragonfly Migration Group is one such example with their work dating back to 1998. The monitoring of migratory dragonflies and damselflies has received public involvement worldwide under the theme "Dragonfly Science Needs Your Help". Such effort and dedication should be applauded. Public reporting can be found in the odonate mailing list e.g.

ODONATA-L, sponsored by the University of Puget Sound, Washington. It has attracted discussions on wide ranging topics pertaining to dragonfly biology from both professionals and amateurs.

One interesting report by Sharon Brown from South Carolina (September 2006) describes below the phenomena of a swarm of migrating dragonflies at the seafront of the Edisto Beach:

"The procession stretched in both directions (flying along the beach) as far as my eyes could see, went from near the water's edge at least 100 feet back to the line of houses, and my estimate on density was 1 ode per 2' x 2' x 2' of aerial space all the way up to Wandering Glider flight height. The procession was fully in progress when I arrived at about 6:30 and continued after biting flies made me leave at 7:15..."

The migrating species comprised of two predominant species, the wandering gliders (*Pantala*) and the common green darner (*Anax*). Scientific reports on the involvement of the darners (Family: Aeshnidae) and skimmers (Family: Libellulidae) in migratory

behavior were supported by Moskowitz *et al.* [9]. They reported migratory swarms of mixed species comprising of monarch butterflies and three species of dragonflies which flew across the Atlantic Ocean (40°25'53.88"N, 74°23'44.24"W) in September 1999. During a 80-minute count, a total of 584 individuals were recorded comprising 283 monarchs and 301 dragonflies consisting of three species (197 *Tramea lacerata*, 103 *Anax junius*, and 1 *Pantala* sp.).

In the local scene, I have not observed such a migratory behaviour during many of our sampling trips in the coastal areas facing the South China Sea or in the Straits of Malacca facing the seafront of Carey Island [10] or on the islands of Pulau Jarak, Pulau Perak and Pulau Sembilan [11, 12] and Pulau Aur in the Straits of Johore [12, 13]. Representatives of the species collected from such coastal areas support the presence of migratory species. The current work focused in coastal regions provides additional data on coastal species and their migratory patterns. Common names of species used here can promote dragonfly awareness among the local communities [14, 15].

STUDY SITES AND METHODS

Sampling sites

Bachok is a coastal area facing the South China Sea that has been exploited for development of resorts, chalets, aquaculture, fishing and recreation activities. The setting up of the University Malaysia Kelantan (UMK) in Tok Bali will further impact the area. The work reported here is part of an expedition first conducted in June 2008 and followed by a second trip in April 2009. The expedition was organised by the Institute of Oceanography and Earth Sciences (IOES), University of Malaya to survey and inventorize the biodiversity of the coastal environment of Kelantan.

Coastal localities that were inhabited by odonates were visited (Table 1). Descriptions of the study sites would be useful to gauge the typical habitats of the species found:

- Pantai Melawi – abbreviated as P. Melawi; sandbanks and stretches of sandy coast interspaced with water pools and puddles, mixture of trapped seawater and freshwater. An open area with few fringing *Rhizophora* and *Nypa*, and coconut trees lining the river banks.
- Kg. Telong – a cultivated area with crops and herbal plots, water ditches rather polluted and typically silty. An open area with no canopy cover.
- Beach front – given the acronym beach; sandy coastline interspaced with the pine trees; water bodies could be quite some distance away.
- Lily pond – abbreviated as lily P; a fresh water pond covered with *Nymphaea*, highly vegetated banks with weedy plants and shrubs. More inland and close to residential area. Predominant catch from this locality.
- Kuala Tok Bali – abbreviated as Tok Bali; an estuarine mangrove area with *Nypa* vegetation and puddles of salt and freshwater.
- Sg. Petai – peat-soil area with fringing *Avicennia* and *Nypa*. Close to aquaculture ponds, water shallow and polluted.

Sampling methodology

The collection trips resulted in not less than 60 hours of sampling when it was typically hot in the morning and mid-afternoon followed by late evening downpours on some days. The samplings were done in areas where odonates were known to be present. Standard methods were used for catching adults by aerial nets for flyers and aquatic nets for larvae in water with manual search for exuviae (caste skins of emerged adults from larvae). Abundance was estimated by visual counts of flying adults.

Table 1. Site localities with GPS readings for Odonata sampling in Bachok, Kelantan.

HABITAT	GPS READING
Pantai Melawi	N 06°01'275" / E 102°25'175"
MARDI Station – Kg. Telong	N 05°58'483" / E 102°25'547"
Beach front	N 05°58'152" / E 102°26'537"
Inland Village (lily pond)	N 05°58'949" / E 102°25'359"
Kuala Tok Bali	N 05°57'926" / E 102°30'503"
Semerak – Sg. Petai	N 05°48'711" / E: 102°27'177"

RESULTS AND DISCUSSIONS

In non-destructive sampling, species of high densities were not sampled exhaustively but proportionately collected to reflect their high numbers within the sympatric population. A total of 113 individuals were collected. These were represented by two families: Coenagrionidae (represented 25% of the total collection) and Libellulidae (75%) comprising a total of 16 species. The annotated list is reported below. No apparent migratory habits were observed. This study confirms the occurrence of species in coastal areas. The predominant occurrence of the Skimmers (Libellulidae) as in previous studies [10, 11, 12, 13, 14] was the Eastern Scarlet, *Crocothemis servilia*. This species topped the chart followed closely by the Pinhead midget, *Agriocnemis femin*. The rest were recorded in moderate numbers while three species had the lowest abundance (Figure 1). As summarized in Table 2, the species found in the coastal areas of Bachok are widely distributed in South East Region [15]. At least three other neighbouring countries have similar species. Ten of the species (63%) are

cosmopolitan in the Asian region. No endemic species were found in Bachok. With the exception of two species, Cloudy velvetwing (*Neurothemis tullia tullia*) and Spine-legged redbolt (*Rhodothemis rufa*), the rest are typical coastline species sampled elsewhere in Peninsular Malaysia or islands in Malaysian waters (10,11,13,14 and 15) (Table 2). Some species displayed tolerance for brackish water (Table 2). Reports by Hobson [16] supported the low diversity count of coastal odonates in which he listed 11 species for the popular beach resort known as Grandview Beach in Hampton, Virginia, comprising one new record for the county; commonly known as the Marl Pennant (*Macrodiplax balteata*). The others were *Anax junius*, *Brachymesia gravida*, *Erythemis simplicicollis*, *Erythrodiplax berenice*, *Ischnura ramburii*, *Libellula needhami*, *Pachydiplax longipennis*, *Pantala flavescens*, *Tramea carolina*, and *Tramea lacerata*. Four of the genera were similar to Malaysian coastal species as reported here in Bachok, while others have been described in Peninsular Malaysia in earlier reports [10, 11, 12, 13, 14].

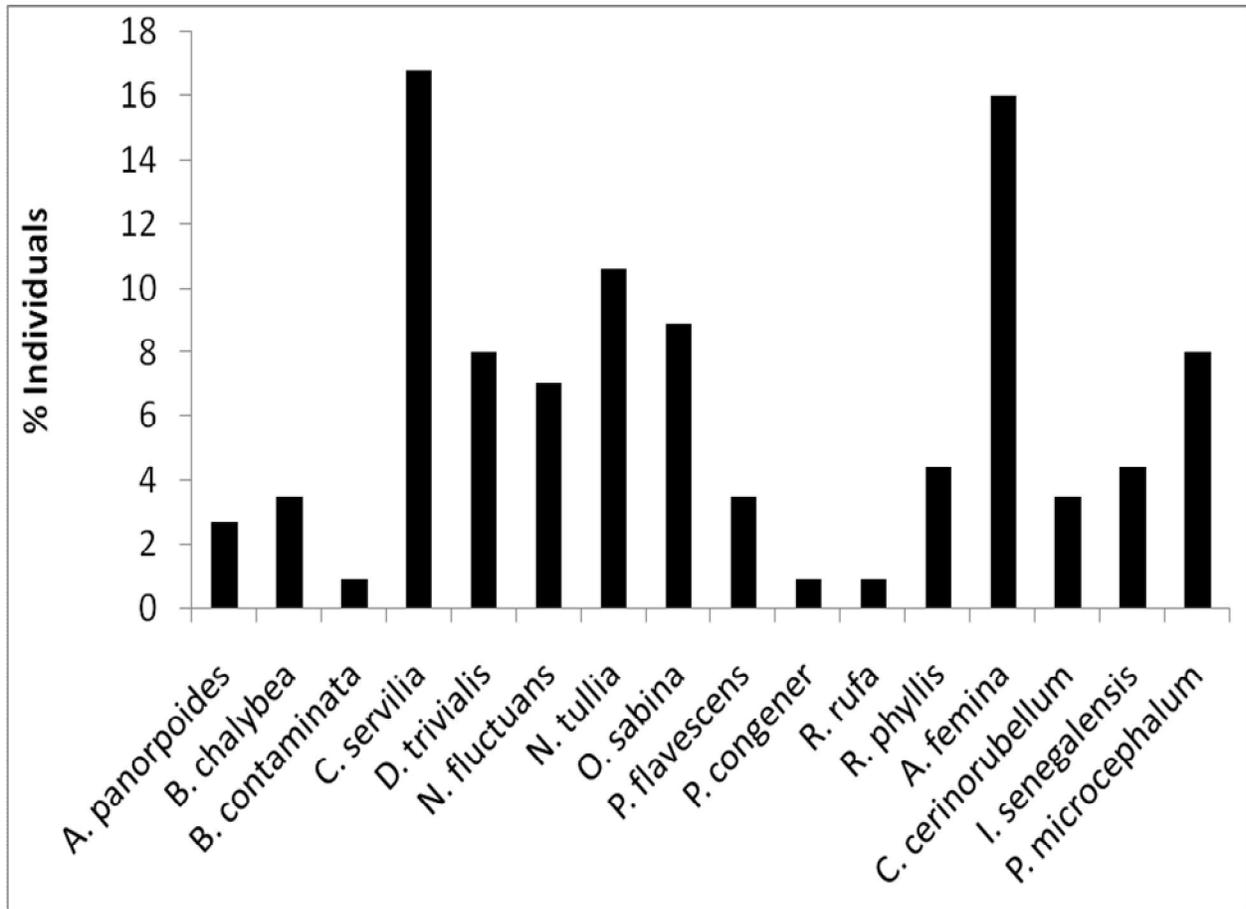


Figure 1. Percentage number of individuals for all species sampled.

Table 2. Descriptions of habits, habitats and distribution in neighbouring regions of the species listed, based on published records (as legend below) A to E.

FAMILY: Species List	Descriptive Habits and Habitat	Anecdotal Records of Distribution	
		Coastal Areas of Peninsular Malaysia	South East Asian Region
FAMILY: LIBELLULIDAE			
<i>Acisoma panorpoides</i>	Common in weedy ponds	A =3 of 7 sites	TH, IN, BN, SG
<i>Brachydiplax chalybea</i>	Very common; tolerate brackish water	A=abundant	VN, TH, IN, BN, SG
<i>Brachythemis contaminata</i>	Very common; natural to man-made ponds; aquaculture ponds	A=4 of 6 sites; ponded	VN, TH, IN, BN, SG
<i>Crocothemis servilia servilia</i>	Very common; stagnant to flowing waters	A=abundant	IN, TH, BN, SG*
<i>Diplocodes trivialis</i>	Also found away from water; migratory	A=4 of 7 sites; B, C= abundant	VN, TH, IN, SG
<i>Neurothemis fluctuans</i>	Very common; ponds; cultivated area and drain	A=all 7 sites; B	TH, IN, BN, SG
<i>Neurothemis tullia tullia</i>	Cultivated areas; paddy fields		TH, IN, BN
<i>Orthetrum sabina sabina</i>	Very widespread and common; brackish	A=all 7 sites	IN, TH, VN, BN, SG
<i>Pantala flavescens</i>	Globally widespread; migratory	A, B & C=swarming and abundant, D=big swarm & roosting	IN, TH, VN, BN, SG
<i>Potomarcha congener</i>	Ponds and even in tanks	A=1 of 7 sites	VN, TH, IN, BN, SG
<i>Rhodothemis rufa</i>	Ponds and vegetated ditches	-	VN, TH, IN, BN, SG
<i>Rhyothemis phyllis phyllis</i>	Records of swarming behavior; brackish	A=4 of 7 sites; B; C=close to village	BN, VN, TH, SG
FAMILY: COENAGRIONIDAE			
<i>Agriocnemis femina</i>	Very common; polymorphic; pruinosity	A=3 of 7 sites; B	IN, VN, TH, BN, SG
<i>Ceriagrion cerinorubellum</i>	Ponds; ditches and marches	A=only ponded area	VN, TH, IN, BN, SG
<i>Ischnura senegalensis</i>	Very common; tolerate brackish water	A=4 of 7 sites; B	IN, VN, TH, BN, SG

	Widespread species; prefers lowland streams and ponds	A=4 of 7 sites	VN, TH, IN, BN, SG
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Pseudagrion microcephalum

Abbreviations used are: BN=Borneo, IN=Indonesia, SG=Singapore, TH=Thailand, VN=Vietnam.

- A. Norma-Rashid, Y. 2006. Promoting biodiversity conservation in Carey Islands: Focus on dragonflies. *Proc. Biodiversity Conservation through Sustainable Plantation Practices on Carey Island*. pg 39-46.
- B. Norma-Rashid, Y. Sofian-Azirun, M, Rosli Ramli & Rosli Hashim. 2008. Dragonflies on the islands in the Stratits of Malacca. *Malaysian Journal of Science*. **27(3)**: 105-111.
- C. Norma-Rashid, Y. & M. S. Azirun. 2008. Insect fauna of Pulau Aur focusing on dragonflies (Order: Odonata) and butterflies (Order: Lepidoptera). In: *Ocean, coastal biodiversity and bioproductivity - Marine and Terrestrial survey of Pulau Aur and surrounding islands*. 7pp. Pulau Aur Expedition Report.
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- E. Asia Dragonfly Database. <http://www.asia-dragonfly.net/>.



Plate 1. Female Cloudy velvetwing, *Nerothemis tullia tullia* (Drury, 1773) showing cloudy patched wings with black adjacent lines and patches of black wing tips.



Plate 2. Male Cloudy velvetwing, *Nerothemis tullia tullia* (Drury, 1773), clearly dimorphic wing patterns with added spread of black wing areas and clear wing tips, although with similar body colours.



Plate 3. Male Coppertone velvetwing, *Neurothemis fluctuans* (Fabricius, 1793) has clear coppery coloured patched wings with clear wing tips.



Plate 4. Female Coppertone velvetwing, *Neurothemis fluctuans* (Fabricius, 1793) clear hyaline wings displaying sexual dimorphism.

Morphological dimorphism is an interesting phenomenon among dragonflies as in other insects and animals. *Neurothemis* (velvetwings) with two congeneric species are distinctive in their colour forms [17, 18]. The females of *Neurothemis tullia tullia* (Cloudy velvetwing) have cloudy patched wings (Plate 1) and males have in addition to the cloudy markings, heavily tinted black wings (Plate 2). The males of *Neurothemis fluctuans* (Coppertone velvetwings) have equally deep tinted wings with deep copper colour (Plate 3). The female wings are void of colour or markings (Plate 4).

Targeted samplings near water bodies had thus resulted in an overall population biased towards male captures (62%) as often reported in other studies [8] (t-test: $U_{d.f. (1,19)} = 2.05$; $p < 0.05$). This is least surprising as females only made intermittent visits to water for egg laying while at other times they are away from water [2, 3]. The females collected in this study were close to water bodies except for *Pantala* species. All the five specimens were females and captured while in flight. *Pantala* species are known for long distance migration in spite of their small bodies with little fat reserves. They compensate by wing drift flying [19]. Rowe [20] made an interesting finding from his collection records of *Pantala*, where all collected samples comprised of females. He attributed this phenomenon of sexual bias to differences in dispersal abilities. Although the samples caught by us and Rowe were low in numbers, such casual observation proves interesting and warrants further investigation.

ANNOTATED LIST

FAMILY: COENAGRIONIDAE (Pond damsels / Bluets)

***Agriocnemis femina* (Brauer, 1868) (Pinhead midget)**

4 teneral males + 2 matured males + 1 female in Lily P; 2 males at beach; 5 males + 4 females in Tok Bali. Small in size, aggregating at grassy banks.

***Ceriagrion cerinorubellum* (Brauer, 1865) (Bi-colored damsel)**

3 males + 1 female in Lily P. Perching posts included tip of lily flower petals/buds and on broad leaf blades.

***Ischnura senegalensis* (Rambur, 1842) (Common bluetail)**

1 female in Kg. Telong; one copulating pair + 2 males in Sg. Petai.

***Pseudagrion microcephalum* (Rambur, 1842) (Small-headed sprite)**

2 males + 5 females in Tok Bali; one copulating pair in Sg. Petai.

FAMILY: LIBELLULIDAE (Skimmers)

***Acisoma panorpoides* Rambur, 1842 (Asian pintail)**

1 male + 2 females in Lily P. Very elusive, perching at very low level on fringing weedy vegetation.

***Brachydiplax chalybea* Brauer, 1868 (Yellow patched lieutenant)**

2 males in Lily P; 1 male in Tok Bali; 1 male in Sg. Petai. Fast flier, dispersing quickly.

***Brachythemis contaminata* (Fabricius, 1793) (Asian amberwing)**

1 female at beach. Tolerant of polluted water.

***Crocothemis servilia* (Drury, 1770) (Eastern scarlet darter)**

3 males in Melawi; 2 males + 1 female in Melawi; 4 males + 1 female at beach; 4 males + 1 female in Tok Bali; 2 immature males; 3 males + 3 females in Sg. Petai. A widespread species.

***Diplocodes trivialis* (Rambur, 1842) (Little blue darter)**

1 female in Melawi; 1 female Tok Bali; 3 males + 1 female in Sg. Petai. Perching post of high visibility in open areas.

***Neurothemis fluctuans* (Fabricius, 1793) (Coppertone velvetwing)**

All males, 2 juveniles + 4 adults in Lily P; 2 males in Sg. Petai. Normally found in very high numbers but here living sympatrically with congener.

***Nerothemis tullia tullia* (Drury, 1773) (Cloudy velvetwing)**

4 males in Kg. Telong; 4 males + 2 females in Lily P; 2 females in Sg. Petai. Sympatric occurrence with congener, thriving in agricultural settings.

***Orthetrum sabina* (Drury, 1770) (Sober skimmer)**

A single male in Kg. Telong and Beach; 5 males in Sg. Petai. Hardy species and able to live in impacted habitats. Also typical species in mangrove habitats.

***Pantala flavescens* (Fabricius, 1798) (Globe skimmer)**

2 females in Melawi; 2 females in Sg. Petai. Known for its migratory and swarming habits, but not seen in large swarms in Bachok.

***Potomarcha congener* (Rambur, 1842) (Blue chaser)**

1 male & a female in Melawi. Found in seclusion and away from other species, perching on high branches of tree.

***Rhodothemis rufa* (Rambur, 1842) (Spine-legged redbolt)**

A single female at the Beach area taking shelter under the shade of pine trees. May have dispersed from nearby ponds.

***Rhyothemis phyllis* (Sulzer, 1776) (Batik glider)**

A single female in Kg. Telong and Beach front; 1 male and 3 females in Lily P; 1 female in Sg. Petai. Typical local species, seemingly a feeble flier but with high dispersal capacity.

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