



Odonata of Sungai Bebar, Pahang, Malaysia, with four species recorded for the first time from mainland Asia

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Abstract: Records are presented of Odonata collected in September 2009 from the Sungai Bebar and the surrounding area, in Pekan Forest Reserve, southeastern Pahang, Peninsular Malaysia. A total of 50 species from nine families were collected. Two of the species listed, *Amphicnemis bebar* and *A. hoisen*, were first discovered during this survey. Another four previously known species were recorded in mainland Asia for the first time: *Elatoneura coomansi*, *Elatoneura longispina*, *Brachygonia ophelia* and *Tyriobapta laidlawi*.

Keywords: Damselflies, dragonflies, Malaysia, new records, Odonata, Pahang, peat swamp forest, Pekan Forest Reserve, Sungai Bebar.

Bahasa Melayu Abstract: Rekod persampelan Odonata dari Sungai Bebar dan kawasan berhampiran Hutan Simpan Pekan, selatan Pahang, Semenanjung Malaysia dalam September 2009 dilaporkan. Sejumlah 50 spesies pepatung daripada sembilan famili telah disampel. Dua spesies baru telah diperihal daripada persampelan ini: *Amphicnemis bebar* dan *A. hoisen*. Empat spesies yang direkod adalah rekod baru kepada tanah besar Asia: *Elatoneura coomansi*, *Elatoneura longispina*, *Brachygonia ophelia* dan *Tyriobapta laidlawi*.

INTRODUCTION

In September 2009 Professor Yong Hoi Sen and the authors made a short Odonata sampling trip to Sungai Bebar in Pekan Forest Reserve. Sungai Bebar is situated in southeastern Pahang, Peninsular Malaysia (Fig. 1). Sungai Bebar flows southeastern through Pekan, Kedondong and Nenasi forest reserves before entering the South China Sea at Nenasi. Dow et al. (2010) incorrectly stated that the forest reserve where sampling took place was Nenasi FR. Much of Sungai Bebar is surrounded by disturbed peat swamp forest. Malaysia originally had an estimated 1.54 million hectares of peat swamp forest, but less than 20% was in Peninsular Malaysia (UNDP 2006). We do not have figures for how much peat swamp forest remains today, but it has been reduced to scattered, fragmentary remnants, mostly in Selangor, Pahang and Johor states; the largest such area is located in southeastern Pahang and consists of Pekan, Kedondong, Nenasi and Resak forest reserves.

Swamp forest in general, and peat swamp forest in particular, has been little surveyed for Odonata in Peninsular Malaysia. Norma-Rashid et al. (2001) reported on odonate surveys at Tasek Bera, a lake in Pahang with a large area of swamp forest around it, including peat swamp forest; however, most of the collecting reported in that publication appears to have been made on the lake and surrounding river channels; little sampling appears to have taken place inside the swamp forest. Hämmäläinen (2000)

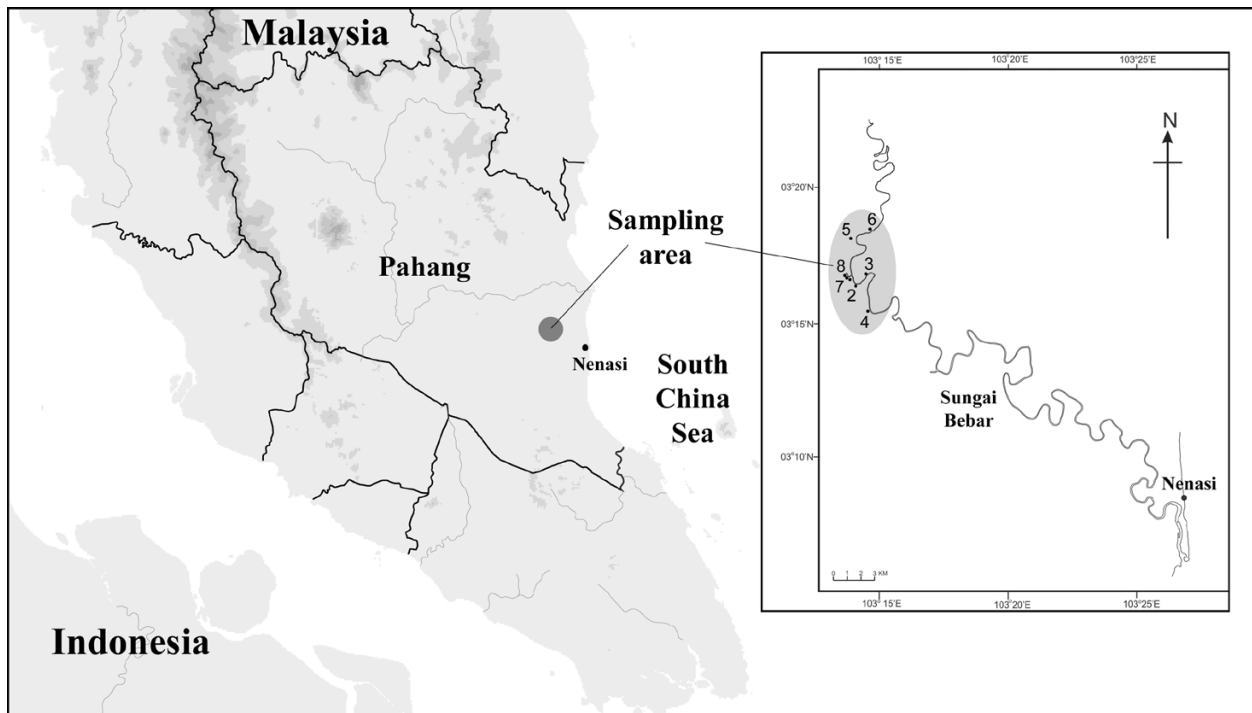


Figure 1. Sampling area in Peninsular Malaysia.

includes a number of records made in swamp forests of various types. In 2006, CYC collected odonates from swamp forests in Panty Forest Reserve, Johor (Choong 2009). Other records from swamp forest in Peninsular Malaysia are scattered amongst the odonatological literature of the last century.

In the present survey, six species not previously reported from Peninsular Malaysia were found. Two were of the coenagrionoid genus *Amphicnemis* and new to science; these species (*A. bebar* and *A. hoisen*) were described by Dow et al. (2010). The other four species, two members of the Protoneuridae (*Elattonaura coomansi* Lieftinck and *E. longispina* Lieftinck) and two from the Libellulidae (*Brachygonia ophelia* Ris and *Tyriobapta laidlawi* Ris), had not previously been recorded from mainland Asia but were known either from Borneo, or Borneo and the Indonesian Islands of Belitung and Bangka. Here we list all the species collected in the Sungai Bebar area, with details of specimens collected and notes on species of particular interest.

MATERIALS AND METHODS

Study sites

Sampling was carried out at the locations listed below (Fig. 1), from 20–24 September 2009:

- (1) On the Sungai Bebar (Image 1) between locations 4 and 6.
- (2) Margin of the Sungai Bebar with emergent vegetation, chiefly *Pandanus*, at the water margin and in disturbed scrub inland, 3°16.845'N & 103°13.894'E and 3°16.604'N & 103°14.446'E.
- (3) Tributary of the Sungai Bebar (Image 2) and surrounding highly disturbed swamp forest, 3°17.134'N & 103°14.878'E.
- (4) Highly disturbed swamp forest at 3°15.650'N & 103°14.687'E.
- (5) Less disturbed swamp forest (Image 3) with stream, 3°18.696'N & 103°14.120'E.
- (6) Highly disturbed swamp forest (Image 4) at 3°19.372'N & 103°15.136'E.
- (7) Black water drains and a stream in a mosaic of highly disturbed forest and open meadow and road, 3°17.078'N & 103°13.559'E.
- (8) A pond at the edge of degraded forest at 3°17.173'N & 103°13.368'E.
- (9) Water filled wheel ruts near location 2.



Image 1. The Sungai Bebar.



Image 4. Swamp forest in Pekan Forest Reserve (location 6).

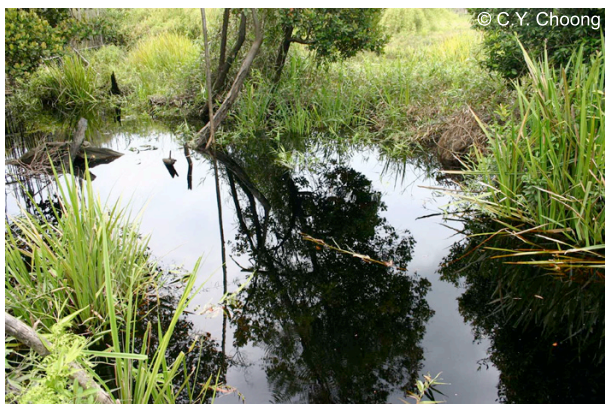


Image 2. Tributary to the Sungai Bebar (location 3).



Image 3. Swamp forest in Pekan Forest Reserve (location 4).

Sampling and identification

Adult specimens were collected using handheld nets. Sampling on the Sungai Bebar was conducted from a boat. Specimens were preserved either by treatment with acetone, drying or immersion in ethanol. The family level taxonomy used below follows that in Orr (2005).

The material collected is held in either the Centre for Insect Systematics at Universiti Kebangsaan Malaysia (UKM), the Netherlands Centre for Biodiversity Naturalis (RMNH), collection CYC or collection RAD. Material was identified to species using a stereomicroscope, with reference to relevant literature, and direct comparison with material, including type material, held in The Natural History Museum, London (BMNH) and RMNH.

RESULTS

A total of 218 individual Odonata specimens were collected, comprising 50 species in nine families. Species, locations and number of specimens collected at each location on a given date are listed below, together with notes on species of particular interest. For species of *Amphicnemis*, details of specimens collected at Sungai Bebar are given in Dow et al. (2010) and are not repeated here. The species recorded at each location sampled are summarised in Table 1.

Zygoptera

Chlorocyphidae

(i) *Libellago hyalina* Selys, 1859 — 2, 3:4 males, 2 females, RAD, 20.ix; 2 males, 1 female, CYC, 20.ix; 4:1 male, 1 female, RAD, 21.ix.

Megapodagrionidae

(i) *Podolestes buwaldai* Lieftinck, 1940 — There are few published records of this species, originally described from Sumatra (Lieftinck 1940). Hämäläinen (2000) made the first report for Peninsular Malaysia;

Table 1. Species recorded at each sampling site.

Species	Sampling Site								
	1	2	3	4	5	6	7	8	9
<i>Agriocnemis femina</i>						y			
<i>Agriocnemis minima</i>									y
<i>Agriocnemis nana</i>						y			
<i>Amphicnemis bebar</i>					y	y			
<i>Amphicnemis gracilis</i>			y			y			
<i>Amphicnemis hoisen</i>					y				
<i>Archibasis incisura</i>		y							
<i>Archibasis melanocyana</i>					y				
<i>Brachydiplax chalybea</i>							y	y	
<i>Brachygonia oculata</i>				y	y	y	y		
<i>Brachygonia ophelia</i>					y				
<i>Ceriagrion cerinorubellum</i>							y		
<i>Ceriagrion species</i>					y				
<i>Chalybeothemis fluviatilis</i>	y	y	y					y	
<i>Copera ciliata</i>							y		
<i>Copera vittata</i>						y			
<i>Elatoneura aurantiaca</i>		y		y	y	y			
<i>Elatoneura coomansi</i>		y			y	y			
<i>Elatoneura longispina</i>					y				
<i>Epopthemia vittigera</i>	y								
<i>Gomphidia abbotti</i>	y								
<i>Ictinogomphus acutus</i>	y								
<i>Ictinogomphus decoratus</i>	y								
<i>Ischnura senegalensis</i>							y		
<i>Libellago hyalina</i>		y	y	y					
<i>Macrogomphus decemlineatus</i>	y								
<i>Macromia cincta</i>	y						y		
<i>Nannophya pygmaea</i>							y		
<i>Nesoxenia lineata</i>				y					
<i>Neurothemis fluctuans</i>							y		
<i>Oligoaeschna species</i>				y					
<i>Onychothemis testacea</i>	y								
<i>Orchithemis pruinans</i>				y	y				
<i>Orchithemis pulcherrima</i>			y						
<i>Orthetrum chrysis</i>		y					y		
<i>Pantala flavescens</i>		y							
<i>Podolestes buwaldai</i>					y	y			
<i>Pornothemis serrata</i>				y	y				
<i>Potamarcha congener</i>									y
<i>Prodasineura humeralis</i>					y				
<i>Pseudagrion rubriceps</i>	y								
<i>Pseudagrion williamsoni</i>	y	y						y	
<i>Rhyothemis aterrima</i>		y							
<i>Rhyothemis obsolescens</i>		y		y					
<i>Rhyothemis phyllis</i>		y							
<i>Rhyothemis pygmaea</i>					y				
<i>Risioptlebia dohmi</i>			y						
<i>Tyriobapta laidlawi</i>					y				
<i>Urothemis signata insignata</i>							y		
<i>Zyxomma petiolatum</i>				y					
Total number of species	10	11	5	9	15	9	10	3	2

Kalkman (2004) and Choong et al. (2008) also recorded it from Malaysia. At Sungai Bebar it was moderately common in the least disturbed swamp forest area sampled. 5:3 male, 2 female, RAD, 22.ix; 3 male, 2 female, RAD, 23.ix; 2 males, 2 females, CYC, 23.ix; 6:1 male, 1 female, RAD, 24.ix; 1 female, CYC, 24.ix.

Protoneuridae

(i) *Elattonaura aurantiaca* (Selys, 1886) — 2:5 male, 1 female, RAD, 20.ix; 1 male, 1 female (in tandem), CYC, 20.ix; 4:1 male, RAD, 21.ix; 5:3 male, RAD, 22.ix; 2 males, 1 female, RAD, 23.ix; 6:2 males, RAD, 23.ix.

(ii) *Elattonaura coomansi* Lieftinck, 1937 — This is the first record of this species from Peninsular Malaysia; it is otherwise known from Kalimantan and Bangka and Belitung islands (Lieftinck 1954). Most of the specimens collected were taken amongst *Pandanus* at the edge of Sungai Bebar 2:4 male, RAD, 20.ix; 5:1 male, RAD, 23.ix; 6:1 female, RAD, 24.ix.

(iii) *Elattonaura longispina* Lieftinck, 1937 — This species has not been recorded from mainland Asia before; it was described from west Kalimantan and is also known from Sarawak (Dow & Unggang 2010) and Belitung (Lieftinck 1954). One male was collected at Sungai Bebar. However, in 2006 CYC collected two tandem pairs of this species from Pondok Tanjung Forest Reserve, northern Perak, a small peat swamp forest; these specimens were misidentified as *Elattonaura analis* (Selys 1860) and the mistake was only discovered in early 2010. This species is expected to have wider distribution in Peninsular Malaysia and might also occur in southern Thailand. 5:1 male, CYC, 22.ix.

(iv) *Prodasineura humeralis* (Selys, 1860) — 5:1 male, CYC, 23.ix.

Coenagrionidae

(i) *Agriocnemis femina* (Brauer, 1868) — 6:1 female, RAD, 24.ix.

(ii) *Agriocnemis minima* (Selys, 1877) — 9:1 male, 2 females (1 pair in tandem), RAD, 21.ix; 1 male, CYC, 21.ix.

(iii) *Agriocnemis nana* (Laidlaw, 1914) — 7:1 male, 2 females, CYC, 20.ix.

(iv) *Amphicnemis bebar* Dow et al., 2010 — See Dow et al. (2010) for a discussion of this and the next

two species. Locations 5 and 6 (Image 5).

(v) *Amphicnemis gracilis* Krüger, 1898 — Locations 3 and 6.

(vi) *Amphicnemis hoisen* Dow et al., 2010 — Location 5 (Image 6).

(vii) *Archibasis incisura* Lieftinck, 1949 — This is a rather local species, and its preferred habitat is probably streams and rivers in low pH swamp forest, for instance see Dow & Unggang (2010). 2:2 male, RAD, 20.ix; 1 male, CYC, 23.ix.

(viii) *Archibasis melanocyana* (Selys, 1877) — 5:1 male, CYC, 23.ix; 1 male, CYC, 24.ix.

(ix) *Ceriagrion cerinorubellum* (Brauer, 1865) — 7:1 male, RAD, 20.ix; 1 male, CYC, 20.ix.

(x) *Ceriagrion* species — A single female, identical in general appearance to *C. cerinorubellum*, collected in peat swamp forest. It differs from *C. cerinorubellum*, and all other species of *Ceriagrion*, in having the central part of the pronotal posterior lobe deeply and squarely excised; this does not appear to be the result of damage to the specimen, but the possibility that it is simply an abnormal individual of *C. cerinorubellum* cannot be ruled out unless further examples are collected. 5:1 female, RAD, 23.ix.

(xi) *Ischnura senegalensis* (Rambur, 1842) — 7:1 male, CYC, 20.ix.

(xii) *Pseudagrion rubriceps* Selys, 1876 — 1:1 male, RAD, 20.ix.

(xiii) *Pseudagrion williamsoni* Fraser, 1922 — 1:1 male, RAD, 20.ix; 2:2 males, CYC, 20.ix; 8:1 male, RAD, 21.ix.

Platycnemididae

(i) *Copera ciliata* (Selys, 1863) — 7:1 female, CYC, 20.ix.

(ii) *Copera vittata* (Selys, 1863) — 6:1 male, RAD, 24.ix.

Anisoptera

Gomphidae

(i) *Gomphidia abboti* Williamson, 1907 — 1:1 male, RAD, 22.ix.

(ii) *Ictinogomphus acutus* (Laidlaw, 1914) — 1:1 male, RAD, 21.ix; 1 male, RAD, 22.ix; 2 males, CYC, 22.ix.

(iii) *Ictinogomphus decoratus melaenops* (Selys, 1858) — 1:1 male, RAD, 22.ix.

(iv) *Macrogomphus decemlineatus* (Selys, 1878)



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Image 5. *Amphicnemis bebar* male.



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Image 6. *Amphicnemis hoisen* male.



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Image 7. *Brachygonia ophelia* male.



Image 8. *Chalybeothemis fluviatilis* male.



Image 9. *Tyriobapta laidlawi* male.

— 1:1 male, RAD, 21.ix; 1 male, CYC, 24.ix.

7:1 male, RAD, 20.ix.

Aeshnidae

(i) *Oligoaeschna* species — It has not proved possible to identify the single female collected reliably to species. 4:1 female, RAD, 21.ix.

Corduliidae

(i) *Epopthalmia vittigera* (Rambur, 1842) — 1:1 male, CYC, 21.ix.

(ii) *Macromia cincta* Rambur, 1842 — 1:1 male, RAD, 22.ix; 1 male, CYC, 21.ix; 1 male, CYC, 22.ix;

Libellulidae

(i) *Brachydiplax chalybea* Brauer, 1868 — 7:1 male, CYC, 20.ix; 1 male, CYC, 22.ix; 8:1 male, RAD, 21.ix.

(ii) *Brachygonia oculata* (Brauer, 1878) — 4:1 male, RAD, 21.ix; 5:1 female, CYC, 23.ix; 6:1 male, RAD, 24.ix; 7:1 male (in forest), RAD, 21.ix; 2 males (in forest), CYC, 21.ix.

(iii) *Brachygonia ophelia* Ris, 1910 — This very local swamp forest species has not been recorded

from Peninsular Malaysia until now; it is otherwise only known from scattered locations in Borneo (e.g. Lieftinck 1954, Orr 2001 & 2003). Image 7. 5:2 males, RAD, 22.ix; 1 male, 1 female, RAD, 23.ix; 2 males, CYC, 23.ix.

(iv) *Chalybeothemis fluviatilis* Lieftinck, 1933 — This species is known from scattered locations across Borneo, Sumatra, Belitung, Singapore and Peninsular Malaysia and southern Thailand (Dow et al. 2007). It often appears to prefer low pH habitats, but occurs on MacRitchie Reservoir in Singapore (Tang et al. 2010). It was common on parts of Sungai Bebar during the sampling period. Image 8. 1:1 male, RAD, 21.ix; 1 male, RAD, 22.ix; 2:1 male, RAD, 20.ix; 3:2 males (on the tributary); RAD, 20.ix; 2 males (on the tributary), CYC, 20.ix; 8:1 male, RAD, 21.ix.

(v) *Nannophya pygmaea* Rambur, 1842 — 7:1 male, RAD, 20.ix; 1 male, CYC, 21.ix.

(vi) *Nesoxenia lineata* (Selys, 1879) — 4:2 males, CYC, 21.ix.

(vii) *Neurothemis fluctuans* (Fabricius, 1793) — 7:1 male, RAD, 20.ix; 1 male, CYC, 20.ix.

(viii) *Onychothemis testacea* Laidlaw, 1902 — 1:1 male, CYC, 21.ix.

(ix) *Orchithemis pruinans* (Selys, 1878) — 4:5 males, RAD, 21.ix; 5:1 female, RAD, 22.ix; 1 male, RAD, 23.ix; 2 males, CYC, 21.ix.

(x) *Orchithemis pulcherrima* Brauer, 1878 — 3:1 male, CYC, 20.ix.

(xi) *Orthetrum chrysis* (Selys, 1891) — 2:1 male, RAD, 20.ix; 7:1 male, CYC, 20.ix.

(xii) *Pantala flavescens* (Fabricius, 1798) — 2:1 female, RAD, 21.ix; 1 male, CYC, 20.ix; 1 male, CYC, 21.ix.

(xiii) *Pornothemis serrata* Krüger, 1902 — 4:2 males, RAD, 21.ix; 2 males, 1 female, CYC, 21.ix; 5:1 male, RAD, 22.ix.

(xiv) *Potamarcha congener* (Rambur, 1842) — 9:1 male, RAD, 20.ix; 1 male, CYC, 20.ix.

(xv) *Rhyothemis aterrima* Selys, 1891 — 2:1 male, RAD, 20.ix; 1 male, CYC, 21.ix.

(xvi) *Rhyothemis obsolescens* Kirby, 1889 — 2:1 male, RAD, 20.ix; 1 male, CYC, 20.ix; 4: 1 male, RAD, 21.ix.

(xvii) *Rhyothemis phyllis* (Sulzer, 1776) — 2:1 female, RAD, 20.ix; 1 female, CYC, 20.ix.

(xviii) *Rhyothemis pygmaea* (Brauer, 1867) — 5:1 male, RAD, 22.ix; 1 male, CYC, 23.ix; 1 male, CYC,

24.ix.

(xix) *Risioptionia dohrni* (Krüger, 1902) — 3:1 male, RAD, 20.ix.

(xx) *Tyriobapta laidlawi* Ris, 1919 — This species, otherwise known from Borneo, has not been recorded from Peninsular Malaysia before. It appears to be most common in low pH swamp forest. A convincing photographic record was also made in Ayer Hitam Forest Reserve in Johor by M. Silvius of Wetlands International on 26.xi.2010. Image 9. 5:2 males, RAD, 22.ix; 1 male, RAD, 23.ix; 1 male, CYC, 23.ix.

(xxi) *Urothemis signata insignata* (Selys, 1872) — 7:1 male, RAD, 20.ix.

(xxii) *Zyxomma petiolatum* Rambur, 1842 — 4:1 female, RAD, 21.ix.

DISCUSSION

Although we had modest hopes of making interesting finds at Sungai Bebar, we were not expecting to make six new records for Peninsular Malaysia and mainland Asia in just five days of fieldwork. These discoveries demonstrate how poorly surveyed Odonata have been in low pH swamp forest habitats in mainland Southeast Asia; more discoveries can be expected with further collecting effort.

Many parts of the peat swamp habitat around Sungai Bebar are only accessible by small boat. The riverbanks and shallow parts of the river have an extensive growth of *Pandanus*, which at some points completely clogs the waterway. The Jakun (indigenous people living around Sungai Bebar) normally burn the overgrown *Pandanus* during the dry season to clear a passage. The clear, low pH waters and vegetation structure of the river appear to provide an ideal habitat for a number of Odonata: *Ictinogomphus acutus*, *I. decoratus*, *Macromia cincta*, *Chalybeothemis fluviatilis*, *Elatoneura aurantica* and *Pseudagrion williamsoni* were abundant along the entire section of the river sampled.

Despite the new records made at Sungai Bebar, there were also some surprising absences from our sample. In Borneo, species of the coenagrionoid genera—*Mortonagrion* and *Teinobasis*—are almost invariably found in such habitats. Members of these genera, especially the small *Mortonagrion*, are typically inconspicuous, but the authors have considerable

experience of collecting Odonata, and were looking out for these genera. However, the three species currently placed in *Mortonagrion* and known from Peninsular Malaysia—*M. aborensis* (Laidlaw 1914), *M. arthuri* Fraser, 1942 and *M. falcatum* Lieftinck, 1934—are not necessarily swamp forest species (see Dow 2011 for a discussion of *M. arthuri*). Four species of *Teinobasis* are known from Peninsular Malaysia (Dow 2010): *T. cryptica* Dow, 2010, *T. kirbyi* Laidlaw, 1902, *T. rajah* Laidlaw, 1912, *T. ruficollis* (Selys, 1877); of these all except *T. kirbyi* would be expected in the habitats at Sungai Bebar, and are likely to be found there with further collecting.

In other respects the odonate fauna of Sungai Bebar is similar to that of low pH swamp forest in Borneo: rich in coenagrionids, especially *Amphicnemis*, and libellulids, poorer in numbers of species from other families, but including a number of specialist species from some of these families. The protoneurid genus *Elattoneura* is well represented at Sungai Bebar, with three species. All the *Amphicnemis* and *Elattoneura* (except *E. analis*) species of Peninsular Malaysia are inhabitants of alluvial swamp or peat swamp forest. All of the *Amphicnemis* (except *A. ecornuta* Selys, 1889) and *Elattoneura* (again except *E. analis*) species that have so far been recorded for Peninsular Malaysia were found at Sungai Bebar. This suggests that the Sungai Bebar area still has enough high quality habitat to sustain a high diversity of specialist peat swamp forest species. Several gomphids were collected on the Sungai Bebar, and more can be expected there, and on smaller streams in the swamp forest. Of the Gomphidae so far recorded at Sungai Bebar, *Ictinogomphus acutus* appears to be a specialist of low pH habitats (see Dow & Unggang 2010). Additional members of the Corduliidae, for instance *Hemicordulia tenera* Lieftinck, 1930, are to be expected. Swamp forest in SE Asia is sometimes rich in members of the Aeshnidae, in particular species of *Gynacantha* and *Heliaeschna*. However, the Aeshnidae are typically difficult to collect so that their diversity in an area is normally only revealed over longer sampling periods; more than the single species recorded to-date must occur in the Sungai Bebar area.

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Author Contribution: RAD identification of, and information on, the Odonata collected, collection of specimens. YFN information on the area sampled, and on peat swamp forest in Peninsular Malaysia; organization of the sampling trip. CYC identification of, and information on, the Odonata collected, collection of specimens, photography.