

New records of Odonata from Cambodia, based mostly on photographs

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មូលនិយសង្ខេប

កន្លឹកប្រាក់ប្រភេទក្នុងលំដាប់ Odonata – *Euphaea ochracea*, *Lestes nodalis*, *Gynacantha phaeomeria*, *Gynacantha demeter*, *Microgomphus chelifera*, *Amphithemis curvistyla*, *Orthetrum triangulare*, *Rhyothemis plutonia* និង *Tetrathemis platyptera* ត្រូវបានកត់ត្រាប្រភេទទៀតទៅលើប្រភេទកន្លឹកប្រាក់ (Dragonfly និង Damselfly) ដែលកើនរហូតដល់១៣៥ ប្រភេទសម្រាប់ប្រទេសកម្ពុជា។ កំណត់ត្រាប្រភេទថ្មីទាំងនោះ គឺផ្អែកទៅលើការថតរូបនៅក្នុងធម្មជាតិ លើកលែងតែប្រភេទ *E. ochracea* ដែលត្រូវបានវិភាគតាមសំណាកកន្លឹកប្រាក់។ អាស្រ័យលើការថតរូបនេះផងដែរ កំណត់ត្រាបាយថ្មី (new distributional records) សម្រាប់កន្លឹកប្រាក់៩៣ប្រភេទត្រូវបានផ្តល់សំរាប់តំបន់ផ្សេងៗនៃភ្នំក្រវាញ រួមមានតំបន់ជុំវិញភូមិតាតៃក្នុងខេត្តកោះកុង តំបន់ជុំវិញភូមិអូរសោមនិងប្រមោយ និងតំបន់មួយចំនួនទៀតនៅក្នុងដែនជម្រកសត្វព្រៃភ្នំសំកុស ខេត្តពោធិសាត់។ ក្នុងការសិក្សានេះផងដែរ ប្រភេទសត្វល្អិតបរាសិតក្រៅ (Ectoparasitic midges) ក្នុងពួក *Forcipomyia* (*Pterobosca*) ត្រូវបានប្រទះឃើញនិងកត់ត្រានៅលើកន្លឹកប្រាក់មួយប្រភេទក្នុងអំបូរ Coenagrionidae និង១១ប្រភេទផ្សេងទៀតក្នុងអំបូរ Libellulidae។

Abstract

Nine species of Odonata – *Euphaea ochracea*, *Lestes nodalis*, *Gynacantha phaeomeria*, *Gynacantha demeter*, *Microgomphus chelifera*, *Amphithemis curvistyla*, *Orthetrum triangulare*, *Rhyothemis plutonia* and *Tetrathemis platyptera* – are reported for the first time for Cambodia, raising the number of named Odonata species recorded in this country to 135. All of the new records are based on photographs taken in nature apart from *E. ochracea*, which is supported by a voucher specimen. Also based on photographs, new distributional records for 93 Odonata species are provided for a number of localities in the Cardamom Mountains: the environs of Tatai Village in Koh Kong Province, and the environs of Ou Saom and Pramoui villages, including parts of Phnom Samkos Wildlife Sanctuary, in Pursat Province. Ectoparasitic midges in the genus *Forcipomyia* (*Pterobosca*) were recorded on one species in the family Coenagrionidae and 11 species in the family Libellulidae.

Keywords

dragonflies, damselflies, ectoparasites, insects, *Forcipomyia*, new records, *Pterobosca*.

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Introduction

Until recently, very little was known about the dragonflies and damselflies (Odonata) of Cambodia. A number of species records and distributional data have been published since 2010, reporting a total of 125 named species of Odonata in Cambodia (Kosterin, 2010, 2011, 2012a,b; Roland & Roland, 2010; Day, 2011; Kosterin & Holden, 2011; Roland *et al.*, 2011; Kosterin *et al.*, 2012). However, this seems to be only about a half the number of species expected for this country, based on the better known faunas of the neighbouring Thailand and Vietnam, so any additional data are important.

Odonata are considered to be good indicators of the state of ecosystems (Clausnitzer & Jödicke, 2004). When tropical forests are transformed or replaced by secondary ecosystems, many species that have relatively small ranges and inhabit undisturbed areas tend to be replaced by commoner species with large ranges. The Cardamom Mountains in Southwest Cambodia and the southern Annamite Mountains in the East, are among the largest areas of primary, broadleaved, tropical evergreen forests in the Indo-Burma Ecoregion (Reels *et al.*, 2012). Knowledge of their Odonata fauna are of both theoretical interest with respect to understanding biodiversity patterns, and of practical interest with respect to nature conservation. So far, the territory of Cambodia appears as almost a blank spot on the maps of species richness, endemic species, globally threatened species and even Data Deficient species within the Indo-Burma Ecoregion (Reels *et al.*, 2012). That is, no doubt, the result of gaps in our knowledge, because the aforementioned mountains are expected to be hotspots of biodiversity.

Photographs of wild dragonflies and damselflies are a considerable source of such data. They have the advantage of ease of accumulation using digital photography and are non-invasive, but have the strong disadvantage of being insufficient for confident identification of some species – at least for specimens of certain sexes or ages – including some of the most interesting and complicated ones (Day *et al.*, 2012). Also, photographs cannot be used to describe species new to science unless they are accompanied with voucher specimens, although they may contribute to a description of their colours in life.

Two of the authors have taken photographs of Odonata in the Cardamom Mountains (Fig. 1). Some of these records were made by Jeremy Holden during survey work under the auspices of Fauna & Flora International and have been published (Kosterin & Holden, 2011), but many new photographs were taken in 2012, mostly in the Phnom Samkos Wildlife Sanctuary and around the communes of Ou Saom (O'Som) and Pramouï

(Pramaoy) in Veal Veang District, Pursat Province. Gerard Chartier has been photographing Odonata in the southern foothills of the Cardamom Mountains in the vicinity of Tatai Village since 2010. Most of the species he has photographed will be soon available at <http://www.rainbowlodgecambodia.com/wildlife.php?group=2>. In addition, François Mey recorded two additional species of Odonata while travelling in Cambodia for a botanical survey in 2007.

Most of the species were provisionally identified by their respective photographers; the rest by Oleg Kosterin who checked and revised all identifications. This bulk of data refers to 93 species, of which nine had not previously been recorded in Cambodia and are herein reported and illustrated. In view of the paucity of distributional data for dragonflies in Cambodia, we also provide locality lists of all species recorded using photographs (where there is no doubt as to their identification). However, one should keep in mind the aforementioned limitations of photographic records for Odonata and it would be desirable to further support all of these records with voucher specimens.

Methods

Gerard Chartier photographed Odonata using a Canon EOS 500D camera with 18–55 mm and 55–250 mm lenses. Since August 2010, he has made regular excursions in Tatai Commune, Koh Kong District, Koh Kong Province. The survey area is a rough triangle formed by the following three points: Rainbow Lodge on the Kep River (“Left Tatai River”), 1.6 km North of Phum Doung Bridge in Tatai Village (11.580°N, 103.127°E), the widening of the Sala Munthun River (“Right Tatai River”) locally called the “lake area”, 3.9 km North-Northwest of Phum Doung Bridge (11.599–11.601°N, 103.120–121°E) and the Tatai Waterfall at the same river, 4 km Northwest of Phum Doung Bridge (11.586°N, 103.097°E). The same area was examined by Day (2011). This area is a low ridge between the aforementioned rivers, covered partly with seemingly primary broad-leaved evergreen forest and partly a dense bamboo jungle (most probably secondary), with some swamped clearings and small brooks. The Sala Munthun River banks are mostly rocky, those of the Kep River at Rainbow Lodge are rather swampy and outlined by a stripe of the *Nyssa* palm and other mangrove species.

Kosterin (2010, 2011, 2012a,b) examined nearby localities, involving taking some voucher specimens, on three short visits in 2010 and 2011. His data were taken into account when assessing Gerard Chartier's photos.

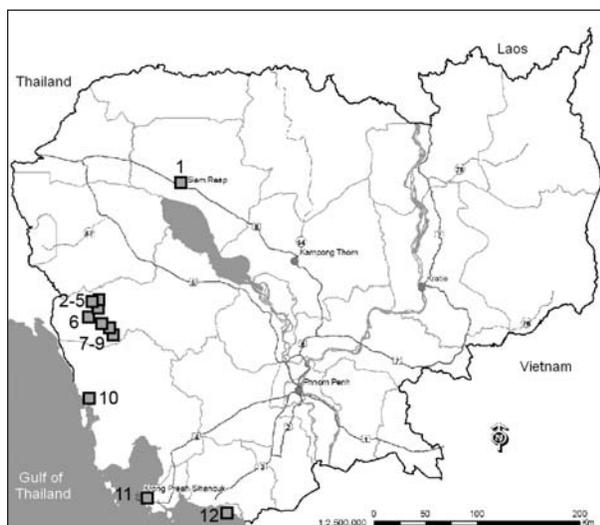


Fig. 1 A schematic map of the localities examined in Cambodia: 1: Angkor Wat; 2–5 (from North to South): Phnom Dalai, Tumpor Village, Pramoui Village, Anglong Reap Village; 6: Phnom Khmaoch, 7–9 (from North to South): Tuok Vei Village, Atay River, Ou Saom Commune; 10: Tatai Village; 11: Kbal Chhay Cascades; 12: Kep.

Jeremy Holden took photographs using a Nikon D3 camera with a 105 mm macro lens at a number of localities on his several trips to the Cardamom Mountains within Pursat Province, mostly around Ou Saom Commune in the Central Cardamoms Protected Forest and in the Phnom Samkos Wildlife Sanctuary in April, May, August and September 2012. Locality details are given below in the Results section.

François Mey took photographs using a simple compact Canon camera and collected one voucher specimen of *Euphaea ochracea*. His observations were made opportunistically during a botanical survey of Kampong Saom, Kep and Siem Reap provinces in July 2007.

Females of *Heliocypha biforata* and *H. perforata*, which are very similar in appearance, were distinguished according to the characters suggested by Kosterin (2011).

Results

New country records

Euphaeidae

Euphaea ochracea Selys, 1859

About six individuals, both males and females, were observed by F. Mey in July 2007 resting on emerging

rocks or flying over the rapids of Kbal Chhay Cascades, 12 km Northeast of Sihanoukville (10.675°N, 103.608°E). A voucher male specimen (Fig. 2) was collected on 16 July 2007.

When F. Mey returned to the same spot in August 2011, he did not find this species again.

Lestidae

Lestes nodalis Selys, 1891

A photo of a male, keeping low to the ground, was taken by J. Holden in low forest away from any water at Phnom Dalai, 12.4345°N, 103.0863°E, Phnom Samkos Wildlife Sanctuary, at 900 m a.s.l. on 8 April 2012 (Fig. 3).

This is sufficient for identification, based on such specific wing characters as spots at nodes, bicoloured pterostigmata and bluntly rounded wings, as well as the bluish abdomen with dark stripes (Lieftink, 1960; Asahina, 1985a).

Aeschnidae

Gynacantha demeter Ris, 1911

Nine males were photographed by G. Chartier in the forest on the hill behind Rainbow Lodge, *circa* 2 km North of Phum Doung Bridge in Tatai Village, Tatai Commune, Koh Kong Province (11.580°N, 103.127°E) on 22 September 2012 (Fig. 4a,b), 22 October 2012, 5 November 2012 (2 males), 12 November 2012 (2 males, Fig. 4c), 13 November 2012 (Fig. 4d–e), 16 November 2012 and 19 November 2012. The photographs clearly show the basal swelling of the cerci (a diagnostic character for a group of related species), their externally directed apices and the relative length, which fit this particular species (Asahina, 1986). Note also the very light-coloured epiproct with dark base and tip. Asahina (1986) noted: "... top of antefrons only darkened transversally without making any T-mark". Our photos show the top of the frons to be dark brown which obscures the darker marking (represented at least by a darker transversal bar), so no obvious T-mark is seen. On 24 October 2012, in the same locality, a copula was photographed that was most probably this species: the colouration of the male was identical and the epiproct seen on the photo has the same short length and light colour (Fig. 4f).

Gynacantha phaemeria Lieftinck, 1960

Four identifiable males were photographed by G. Chartier at Rainbow Lodge, Kep River, 1.6 km North of Phum Doung Bridge in Tatai Village on 5 May 2011 (Fig. 5c), 16 April 2012 (Fig. 5a) and 3 and 8 May 2012 (Fig. 5b). The photographs show the diagnostic appendages,

including black, broadly inflated and externally pointed cerci and a very long and conspicuously light-ochraceous coloured epiproct (Lieftinck, 1960).

Gomphidae

Microgomphus chelifer Selys, 1858

Two teneral males were photographed by G. Chartier on 4 August 2011 and 22 September 2012 (Fig. 6) at the widening of the Sala Munthun River (“lake area”) 3.9 km North-Northwest of Phum Doung Bridge in Tatai Village (11.599–11.601°N, 103.120–103.121°E). The thoracic pattern and appendage structure are clearly visible



Fig. 2 Male *Euphaea ochracea* collected in July 2007 at Kbal Chhay Cascades, 12 km NE of Sihanoukville. (© F.S. Mey).



Fig. 3 Male *Lestes nodalis*, understorey forest, Phnom Dalai, Phnom Samkos Wildlife Sanctuary, 900 m a.s.l., April 2012 (© J. Holden).

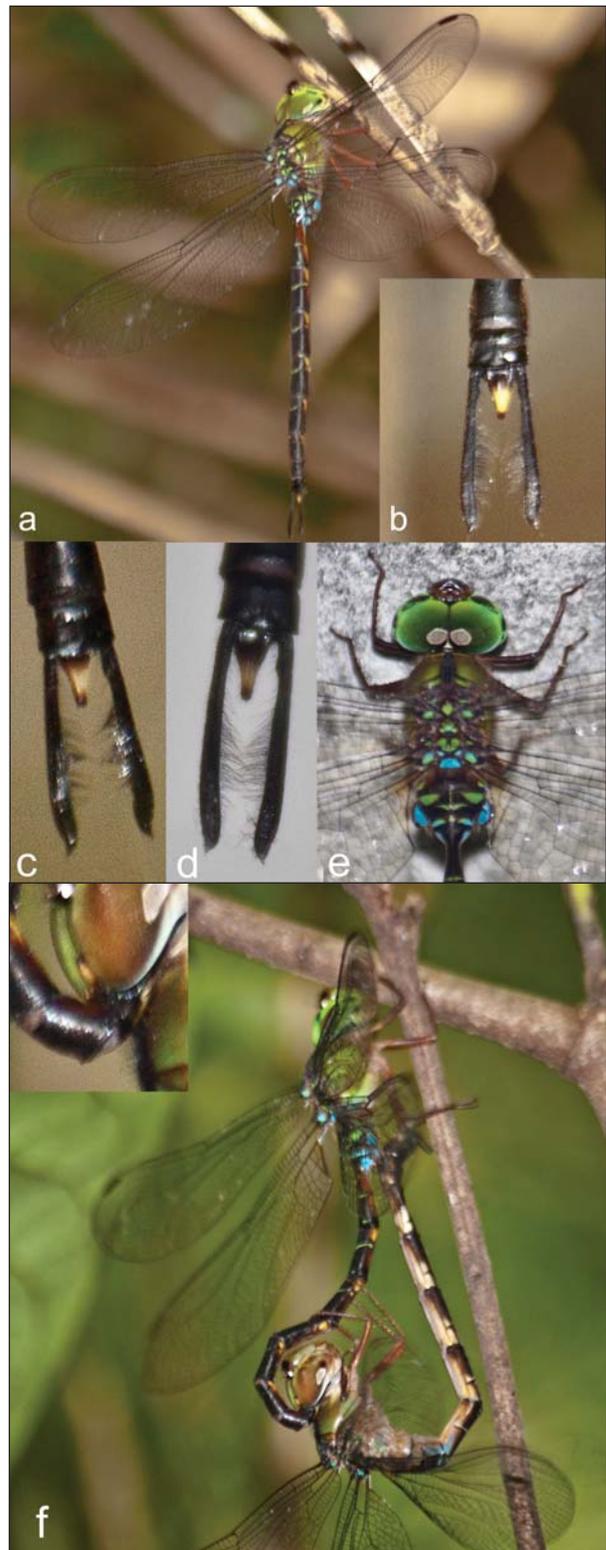


Fig. 4 *Gynacantha demeter* on the Kep River, 1.6 km North of Phum Doung Bridge, Tatai Village: **a**: general habitus (male); **b–d**: appendages; **e**: head and thorax; **f**: copula (© G. Chartier).



Fig. 5 *Gynacantha phaeomeria* males at Rainbow Lodge, Kep River, 1.6 km North of Phum Doung Bridge in Tatai Village: **a**: appendages, April 2012; **b**: appendages, May 2012; **c**: general habitus, May 2011. (© G. Chartier).



Fig. 8 Male *Orthetrum triangulare* at a forest pool at 1,100 m a.s.l. on Phnom Khmaoch, Phnom Samkos Wildlife Sanctuary, December 2010 (© J. Holden).



Fig. 6 Teneral male *Microgomphus chelifera* at the widening of the Sala Münthün River ("lake area"), 3.9 km North-Northwest of Phum Doung Bridge, Tatai Village: **a**: dorsal view; **b**: lateral view (© G. Chartier).



Fig. 9 Male *Rhyothemis plutonia* at a small pond near the tourist office within Kep, December 2010 (© F.S. Mey).



Fig. 7 Female *Amphithemis curvistyla* at Rainbow Lodge, the Kep River, 1.6 km North of Phum Doung Bridge in Tatai Village, September 2012. (© G. Chartier).



Fig. 10 Male *Tetrathemis platyptera* at a small permanent forest pond on the Phnom Dalai Mountain, Phnom Samkos Wildlife Sanctuary, 1,000 m a.s.l., April 2012 (© J. Holden).

and are diagnostic for this species (Asahina, 1990), but subspecific attribution is hardly possible.

Libellulidae

Amphithemis curvostyla Selys, 1891

A female with characteristic venation and body pattern (Fig. 7) was photographed by G. Chartier at Rainbow Lodge, Kep River, 1.6 km North of Phum Doung Bridge in Tatai Village, on 28 September 2012.

Orthetrum triangulare (Selys, 1878)

A male was photographed (Fig. 8) by J. Holden on 13 December 2010 at a forest pool at 1,100 m a.s.l. on Phnom Khmaoch, Phnom Samkos Wildlife Sanctuary (circa 12.150°N, 103.0832°E). The broad abdomen with a distinct, non-pruinose, black tip occupying segments 7-10, black basal spots on the hind wing and a dark thorax are unmistakable for this species. It was observed by J. Holden to be common at forested pools, all slightly above 1,000 m a.s.l., on three mountains in the wildlife sanctuary: Phnom Dalai, Phnom Khmaoch and Phnom Tumpor.

Rhyothemis plutonia Selys, 1883

A male was photographed (Fig. 9) by F. Mey on 17 July 2007 in a small artificial pond near the tourism office in Kep, Kep Province (10.486°N, 104.292°E). Three or four specimens were observed in total at this pond. When F. Mey and O. Kosterin returned to that site on August 2012, the pond was nearly dry and no *R. plutonia* were seen.

A seemingly well established population of *R. plutonia* (circa 20 specimens seen) was also observed by F. Mey in July 2007 in one of the outlying archeological sites of the Angkor temple complex, Siem Reap Province. The XIIth century site, Neak Pean, includes an artificial square pond, in the middle of which lies a small island made of various sculptures.

This pond was first visited by F. Mey in 1999 when it was full of water, but in July 2007 he found it was dry and the water replaced by grass. In spite of this, many specimens of *R. plutonia* and other Odonata, including *Camacinia gigantea* (Brauer, 1867), were observed hovering around that site.

Tetrathemis platyptera Selys, 1878

A male was photographed (Fig. 10) by J. Holden at a small permanent artificial pond in primary forest on Phnom Dalai, Phnom Samkos Wildlife Sanctuary, at 1,000 m a.s.l. on 7 April 2012. The amber of the basal half of the hind wing is very faint, as in specimens from Thailand (Asahina, 1988). It was not recorded at a further visit to this small pool in September 2012.

Site records

In this section, reliably identified photographic, and in some easiest cases, visual records of species or genera are listed. Uncertain identifications are marked with "?". ♂♂ signifies that more than one male was recorded, and ♀♀ signifies that more than one female was recorded.

Tatai Commune, Koh Kong District and Province, (records by Gerard Chartier)

In the list below, dates of photographs, and the sexes of individuals photographed between August 2010 and November 2012 are provided in parentheses for rare species. Only the total number and seasonality of records and/or short notes on abundance are given for locally common species.

Calopterygidae: *Neurobasis chinensis* (♂♂, ♀♀: 11 & 14 May 2010; 14 August 2011; 22 October 2011; 24 June 2012; 24 August 2012; 21 & 22 September 2012; 5, 14, 19 & 30 November 2012); *Vestalis gracilis* (many records throughout the year, but localised to some forest patches).

Chlorocyphidae: *Heliocypha biforata* (♂: 24 August 2012); *Heliocypha perforata limbata* (♂♂, ♀♀: 11 records in March–November, 2011–2012); *Libellago hyalina* (or what we presently understand to be *L. hyalina*) (♂♂: 9 January 2012; 23 April 2012).

Euphaeidae: *Dysphaea gloriosa* (♂♂: 25 April 2011 and 4 May 2012; teneral ♀: 11 May 2011); *Euphaea masoni* (♂♂: 25 April 2011; 26 September 2011; 24 & 26 June 2012; 24 August 2012; 22 September 2012).

Lestidae: *Lestes praemorsus decipiens* (♂♂: 19 & 23 June 2012; 9 July 2012; tandem: 18 August 2012); *Orolestes octomaculata* (♂: 25 March 2011).

Megapodagrionidae: *Rhinagrion viridatum* (♂: 31 March 2011).

Coenagrionidae: *Aciagrion borneense* (♀: 3 May 2012; ♂: 8 November 2012); *A. hisopa* (♂♂, ♀♀: 34 records June–October, 2011–2012); *Agriocnemis minima* (♂♂, ♀♀: 16 records June–November 2012), *A. nana* (♂♂, ♀♀: 35 records throughout the year), *A. rubescens rubeola* (♂♂: 15 records, mostly in November 2010–2012, but also 25 October 2011; 10 January 2012; 19–21 June 2012; 9 July 2012), *Ceriagrion calamineum* (♂♂: 25 June 2011; 8 August 2011; 15, 16 & 22 June 2012; 15 October 2012); *C. cerinorubellum* (♂♂, ♀♀: 15 records throughout the year), *Ischnura senegalensis* (♂: 18 February 2012; ♂♂, ♀♀, tandem: 15 October 2012); *Pseudagrion australasiae* (♂♂: 4 February 2012; 4 March 2012); *P. microcephalum* (♂♂: 6 January 2012; 27 January 2012; 7 October 2012; 6 November 2012); *P. rubriceps* (♂: 25 March 2011), *P. williamsoni* (♂: 7 October 2012).

Platycnemididae: *Coeliccia kazukoae* (♂♂, ♀♀: 12 records 20 April 2011; 5 November 2012; tandem 28 November 2012); *Copera vittata* (♂♂, ♀♀: 25 records throughout the year, plus many of immature individuals inferred to be this species).

Disparoneuridae: *Prodasineura autumnalis* (♂♂, ♀♀: 15 records throughout the year); *P. verticalis* sensu Asahina, 1983 nec Selys, 1860 (♂♂, ♀♀: 2 June 2011; 22 October 2011).

Aeshidae: *Anax guttatus* (♂♂: 21, 25 & 31 May 2012, 19 August 2012); *Gynacantha basiguttata* (♂: 11 February 2012); *G. demeter* (♂♂: 22 September 2012 [Fig. 4a,b]; 22 October 2012; 5 November 2012; 12 November 2012 [Fig. 4c]; 13 November 2012 [Fig. 4d–e]; 16 & 19 November 2012; tandem of this species? 24 October 2012 [Fig. 4f]); *G. phaeomeria* (♂♂: 5 May 2011 [Fig. 5c], 16 April 2012 [Fig. 5a], 3 May 2012, 8 May 2012 [Fig. 5b]); *Gynacantha subinterrupta* (♂: 4 February 2012); *Heliaeschna crassa* (♂: 24 October 2012); *H. uninervulata* (♀: 14 August 2011).

Gomphidae: *Burmogomphus asahinai* Kosterin, Makbun & Dawwrueng, 2012; *Microgomphus chelifera* (teneral ♂♂: 4 August 2011, 22 September 2012 [Fig. 6]); *Nepogomphus walli* (teneral ♂, 26 June 2012).

Macromiidae sensu lato: *Macromia* sp. (Fig. 11) (♂♂: 11 October 2011; 19 September 2012).

Libellulidae: *Amphithemis curvistyla* (♀: 28 September 2012, Fig. 8); *Brachydiplax c. chalybea* (♂♂, ♀♀: 20 records June–November 2012); *Cratilla lineata calverti* (♂♂, ♀♀: 12 records July–August 2011; April–September 2012); *Crocothemis servilia* (♂: 24 December 2010; ♀♀: 17 November 2010; 3 May 2012); *Diplacodes nebulosa* ♂: 24 November 2010; ♀: 28 June 2012); *Diplacodes trivialis* (♂♂, ♀♀: 36 records throughout the year); *Hydrobasileus croceus* (♂♂: 13, 17 & 21 September 2012); *Indothemis carnatica* (♀: 18 September 2012); *Indothemis limbata* (♂♂: 26 September 2011, 5 & 6 October 2012; ♀: 5 October 2012); *Lathrecista asiatica* (♂♂, ♀♀: 8 records April 2011, March–May 2012); *Neurothemis fluctuans* (♂♂, ♀♀: very common year-round); *Neurothemis fulvia* (♂♂, ♀♀: 21 records April–November 2010–2012); *Neurothemis intermedia atalanta* (♂♂: 20 November 2010; 3 July 2011; 24 August 2011; 23 January 2012; 19 February 2012; 19 & 20 May 2012; ♀: 19 November 2012); *Neurothemis t. tullia* (♂♂, ♀♀: 18 records throughout the year); *Orchithemis pulcherrima* (♂♂: 31 March 2011; 12 April 2012); *Orthetrum chrysis* (♂♂, ♀♀: common throughout the year); *Orthetrum glaucum* (♂♂, ♀♀: 16 records throughout the year); *Orthetrum prunosum neglectum* (♂♂: 9 July 2012; 30 November 2012); *Orthetrum sabina* (common year-round); *Pantala flavescens* (♂♂, ♀♀: 10 records throughout the year); *Potamarcha*

congener (♂♂: 20 January 2012; 27 November 2012; ♀♀: 1, 3 & 15 September 2011; 27 January 2012; 7, 14 & 15 September 2012); *Pseudothemis jorina* (♀: 14 January 2012; ♂♂: 30 November 2012); *Rhodothemis rufa* (♂♂: 10 records 15 April 2012, 22 April 2012 and 28 September 2012 – 18 October 2012; ♀♀: 25 August 2011; 14 September 2012); *Rhyothemis obsolescens* (♂♂, ♀: 8 records 23 April 2012 – 5 October 2012); *Rhyothemis phyllis* (many records, June–November 2012); *Rhyothemis triangularis* (♂: 3 October 2012; ♀: 8 September 2012); *Rhyothemis variegata* (♂♂: 15 July 2011; 20 November 2012; gynochromic ♀♀: 19 September 2010; 10 April 2012, 14 August 2012; 2 October 2012); *Tholymis tillarga* (♂♂, ♀♀: 15 records throughout the year); *Tramea transmarina euryale* (♂♂: 23 June 2012; 7 September 2012; 19 November 2012; ♀: 27 September 2012); *Trithemis aurora* (♂♂, ♀♀: 17 records throughout the year); *Trithemis festiva* (♂: 10 November 2012; ♀: 14 January 2011); *Trithemis pallidineris* (♀: 5 November 2012); *Urothemis signata* (♂: 23 June 2012); *Zygonyx iris malayana* (♂♂: 14 May 2011; 14 October 2011; 5 March 2012; 3 May 2012; 24 August 2012; 29 October 2012); *Zygomma petiolatum* (♂♂: 18 April 2012; 21 June 2012; 9 September 2012, 2 October 2012).

Central Cardamoms Protected Forest and Phnom Samkos Wildlife Sanctuary, Pursat Province (records by Jeremy Holden)

In this section, the number of individuals is from visual observations and confirmed by photographs of one or two individuals. For rare species, their habitats are also mentioned.

Phnom Dalai, Phnom Samkos Wildlife Sanctuary (12.4345°N, 103.0863°E): *Lestes nodalis* (♂: 8 April 2012, 900 m a.s.l., understory forest, Fig. 3); *Orolestes octomaculatus* (♂: 8 April 2012, 300 m a.s.l., puddle along open forest track); *Aciagrion pallidum* (1♂: 11 September 2011); *Copera vittata* (1♂, 2 ♀♀: 25 September 2011); *Orthetrum triangulare* (♂♂: September 2012); *Tetrathemis platyptera* (♂: 7 April 2012, 1,000 m a.s.l., in small temporary forest pond [Fig. 10]).

Tumpor Village environs, a medium-sized fast-flowing river with an adjacent forest and arable land, (12.3811°N, 103.1001°E), 300 m a.s.l.: *Neurobasis chinensis* (1♂, 1♀: 27 September 2012); *Heliocypha bifurcata* (1♂, 1♀: 22 September 2012); *Libellago lineata* (5♂♂, 1♀: 10 May 2012); *Euphaea masoni* (♀: 10 May 2012; ♀: 22 September 2012); *Prodasineura autumnalis* (a tandem, 22 September 2012, at Tumpor River); *Cratilla lineata* (several ♂♂, 1♀, 21 September 2012, along forest puddles).

Pramoui Village environs, Phnom Samkos Wildlife Sanctuary (12.3715°N, 103.1010°E): *Agriocnemis pygmaea*

(several individuals, 26 September 2012); *Brachythemis contaminata* (1♂, 1♀: September 2010); *Neurothemis fluctuans* (numerous); *N. intermedia atalanta* (several individuals: August 2012); *N. tullia* (1♂, 1♀: May 2010); *Orthetrum sabina* (♂: September 2010)

Anglong Reap Village (near Pramoui Village) environs, Phnom Samkos Wildlife Sanctuary, an open stream in secondary evergreen forest at 300 m a.s.l.: *Neurobasis chinensis* (several individuals: September 2010); *Helioocypha biforata* (several ♂♂: September 2010); *Agriocnemis pygmaea* (2♂♂, 1♀: September 2010), *Prodasineura autumnalis* (♂: December 2010, along Thom River); *Acisoma panorpoides* (♂: December 2010); *Neurothemis fluctuans* (numerous, September 2010).

Tuok Vei Village environs; two small artificial ponds at the Pramoui – Ou Saom road, Phnom Samkos Wildlife Sanctuary, surrounded by secondary regrowth (12.1716°N, 103.1155°E). 18–20 August 2012: *Lestes elatus* (♂: 18 August 2012); *Orolestes octomaculatus* (1♂, 1♀); *Ceriagrion* sp. (?indochinense) (2♂♂); *Copera vittata* (1♀ away from water); *Ictinogomphus decoratus* (1♂); *Brachydiplax farinosa*: (4♂♂); *Neurothemis fluctuans* (several individuals); *N. intermedia atalanta* (several individuals); *Trithemis aurora* (1♂); *Euphaea masoni* (6♂♂: October 2011).

Phnom Khmaoch, Phnom Samkos Wildlife Sanctuary (circa 12.150°N, 103.0832°E): *Aciagrion pallidum* (1♂: 18.12.2010); *Coelliccia yamasakii* (1♂, 1♀: 20.12.2010; photographed in primary evergreen forest between 800–1,100 m a.s.l.; usually seen in the vicinity of shallow forest streams and along forest paths); *Orthetrum triangulare* (♂: 12 December 2010, 1,000 m a.s.l. [Fig. 8]).

The inundation zone of the Atay River hydroelectric dam, Phnom Samkos Wildlife Sanctuary, composed of open grassy “veals” crossed by small streams and flooded in the wet season. These will eventually all be lost under the Atay River reservoir. A swampy grassland on roadside inundation area (12.1032°N, 103.1747°E), 19 August 2012: *Lestes praemorsus decipiens* (♀); *Agriocnemis lacteola* (few ♂♂); *Ceriagrion* sp. (?calamineum) (5♂♂); *Neurothemis intermedia atalanta* (2♂♂); *N. tullia* (1♂). The same locality, 8 January 2011: *Ischnura senegalensis* (♂).

Nearby, a similar, small slow-moving stream with some deep pools, in a deforested area at the end of the Stung Atay inundation zone, 9–10 May 2012: *Helioocypha biforata* (1♀: 10 May 2012); *Aciagrion borneense* (1♂: 9 May 2012); *Prodasineura verticalis* sensu Asahina, 1983 nec Selys, 1860 (2♂♂, 1♀: 9 May 2012, 1 tandem laying eggs in bank-side rootlets); *Nannophya pygmaea* (3♂♂: above stream pool); *Rhyothemis obsolenscens* (1♂).



Fig. 11 Male *Macromia* sp. at Rainbow Lodge, April 2012 (© G. Chartier).

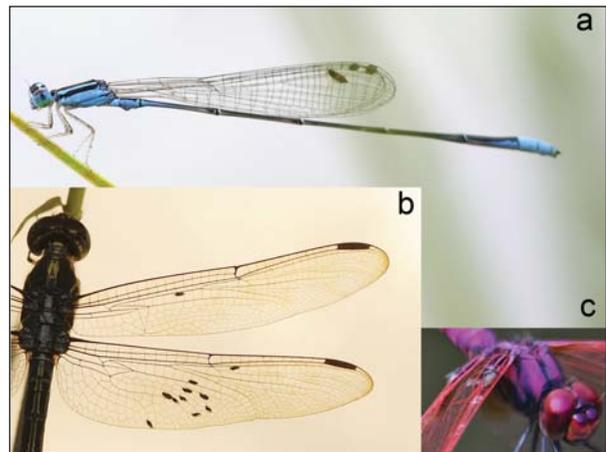


Fig. 12 *Forcipomya* (*Pterobosca*) sp. midges on Odonata wings: **a**: on male *Aciagrion hisopa*, Atay River Dam, August 2012; **b**: on male *Cratilla lineata*, Ou Saom Commune, April 2012 (© J. Holden); **c**: on male *Trithemis aurora*, Kep River, 1.6 km North of Phum Doung Bridge, June 2012 (© G. Chartier).

A swift-flowing stream at the end of the above mentioned inundation zone, with adjacent swampy grassland, shallow pools and reeds (12.1374°N, 103.1858°), 20 August 2012: *Lestes praemorsus decipiens* (1♀: in flooded grass); *Aciagrion hisopa* (3♂♂, 1♀: in swampy pool); *Agriocnemis lacteola* (3♂♂, 1♀: in short reeds in shallow swamp beside stream); *A. nana* (2♂♂, 1♀: among the former species); *Ceriagrion ?calamineum* (2♂♂, 1♀: in swampy pool); *Diplocades nebulosa* (♂); *Indothemis carnatica* (♂: on reeds above stream); *Nannophya pygmaea* (~20 ♂♂, 1♀: on short reeds along stream or close to stagnant pools beside stream); *Neurothemis fluctans* (2♂♂); *N. intermedia atalanta* (♂); *Onychothemis testacea* (♂ perched on reeds above swift flowing stream); *Orthetrum chrysis* (♂); *O. luzonicum*

(♂); *Rhyothemis triangulare* (2♂♂); *Trithemis aurora* (♂); *T. festiva* (♂).

Ou Saom Commune forest (Tasok River), Central Cardamoms Protected Forest, *circa* 500 m a.s.l., 25–26 May 2012: *Vestalis gracilis* (♂: 3 more individuals, 25 April 2012, evergreen forest); *Copera vittata* (♂: 25 April 2012, a deep puddle in evergreen forest); *Cratilla lineata calverti* (♂: 26 April 2012, a drier forest [Fig. 12b]; teneral ♀: 19 August 2012, forest tracks).

Parasitic midges on Odonata wings

The subgenus *Pterobosca* of the genus *Forcipomyia*, Cera-topogonidae, Diptera, mostly comprises specialised parasites of Odonata (Orr & Granston, 1997). Among the numerous photos referred to in this paper, these midges were seen on the wings of one species of Coenagrionidae and eleven species of Libellulidae. The Coenagrionidae were represented by a male *Aciagrion hisopa*, photographed at the Atay River Dam inundation zone on 20 August 2012 (1 individual, Fig. 12a). In the Libellulidae, these parasites were seen twice on *Cratilla lineata calverti*, on individuals photographed at Tatai and Ou Saom communes (Fig. 12b), on *Trithemis aurora* (Fig. 12c), and once each on *Hydrobasileus croceus*, *Lathrecista asiatica*, *Neurothemis fluctuans*, *Orthetrum chrysis*, *O. glaucum*, *O. sabina*, *Potamarcha congerer* and *Zygonyx iris malayana*, all in the Tatai area.

Discussion

Eight of the nine species hereby reported for the first time for Cambodia were found in the Cardamom Mountains. Six of them, namely *Euphaea ochracea*, *Lestes nodalis*, *Gynacantha demeter*, *G. phaomeria*, *Orthetrum triangulare* and *Tetrathemis platyptera*, were expected to occur in this area because they have previously been recorded in the same mountain chain in the neighbouring Thailand (i.e. in Chanthaburi Province: Hämäläinen & Pinratana, 1999). *Amphithemis curvistyla* is a rare species that has been recorded in Thailand only in four western and central provinces (Hämäläinen & Pinratana, 1999; Donnelly, 2000). *Microgomphus chelifera* was previously known in Thailand only from the southern areas along the Burmese border: on the Malayan Peninsula isthmus and in Ratchaburi Province (Hämäläinen & Pinratana, 1999; Ferro *et al.*, 2009; Day *et al.*, 2012). A voucher specimen from the Cardamom Mountains would be useful for examination of finer morphology to confirm the species identity, although the photo shows the known diagnostic characters. Note that another, perhaps undescribed species of *Microgomphus*, with both its thoracic pattern and cercus

structure differing from *M. chelifera*, was earlier collected on a river at Thma Bang Village, *circa* 40 km Northeast of Tatai Village (Kosterin, 2010).

Rhyothemis plutonia is also known from Chanthaburi Province in Thailand (Hämäläinen & Pinratana, 1999) but despite being a conspicuous dragonfly, it still has not been found in the Cambodian Cardamom Mountains. Here we report it for the more easterly Kep and Siem Reap provinces of Cambodia, hence corroborating a distant sighting of what was presumably this species in Kep Province by Kosterin (2010).

With nine males and a supposed copula photographed, *Gynacantha demeter* appeared a common species in the Tatai area, at least during autumn 2012. This is in contrast to its scarcity in neighbouring Thailand, from which only two specimens have been so far recorded in Chanthaburi Province (Hämäläinen & Pinratana, 1999). Three more species of this genus have also been registered in the Tatai area (but, somewhat surprisingly, still missing the expected *G. bayadera*). Generally, the still-forested low foothills of the Cardamom Mountains seem to be a paradise for *Gynacantha* species. They have been depleted in Thailand because “the habitats of *Gynacantha* larvae are generally lowland wetlands which are easily destroyed to make paddies, or are much polluted by human activity” (Asahina, 1986, p. 86).

Heliaeschna uninervulata, now found at Rainbow Lodge, Kep River, was previously reported for Cambodia by Lieftinck (1953), who mentioned a pair from “Cambodge” in the Museum National d’Histoire Naturelle in Paris, which were labelled “*uninervulata*” by the species’ author, René Martin. However, these specimens did not belong to the type series and Martin did not mention the species in his Indochinese review (Martin, 1904). This (very imprecise) record was overlooked in Cambodian listings by Tsuda (2000) and Kosterin (2010). Now at least one precise Cambodian locality is on record.

Taking into account the earlier missed *H. uninervulata*, the nine species new for Cambodia, the previous count in Kosterin (2012a), a recently described species (Kosterin *et al.*, 2012), and with some reconsideration of reliability of old records, the national list of Odonata has been increased to 135 named species (Appendix 1). Based on the better known faunas of the neighbouring Thailand and Vietnam, 135 species may be only about a half of the actual dragonfly and damselfly species in Cambodia. Note the absence of as many as five families known from both Thailand (Hämäläinen & Pinratana, 1999) and Vietnam (Tsuda, 2000): Amphipterygidae, Synlestidae, Platystictidae, Cordulegasteridae and Chlo-

rogomphidae. Of these, at least Platystictidae and Chlogomphidae must be present in Cambodia as well.

Our findings have also extended the known distribution ranges of several species in Cambodia. Important new distributional records included the first finding in the Cardamom Mountains of *Indothemis carnatica*, a species first reported from the Seima Protected Forest in Mondulkiri Province (Roland *et al.*, 2011); *Orthetrum pruinatum neglectum*, previously known from Bokor Plateau in the Damrei Mountains (Kosterin, 2011; 2012b); *Orthetrum luzonicum* and *O. testaceum*, previously known from Kep (Kosterin, 2012a) and *Lestes elatus*, known from both Bokor and Kep (Kosterin, 2011). *Indothemis carnatica* and *O. p. neglectum* seem to be rare in the Tatai area in the Cardamom Mountains foothills, having been recorded only once each during two years of continuous observations.

The unidentified *Macromia* sp., twice photographed at the Kep River (Fig. 11), is neither *M. septima* nor *M. cupricincta*, recorded from other localities in the Cardamom Mountains foothills within Koh Kong Province by Kosterin (2012a). Quite likely it could be an undescribed species. Voucher specimens are needed for reliable identification in this genus.

In contrast to most explorers who have investigated Odonata during trips, G. Chartier is a permanent resident of the foothills of the Cardamom Mountains and has been investigating Odonata all year round. As a result, his list of 72 identified species is quite rich and the records more or less reflect the relative abundance and seasonality of species, although a further 10–30 rare species are still expected in this area. Some of the species recorded by G. Chartier were previously reported for the exactly the same area by Day (2011), who also took pictures, and by Kosterin (2010, 2011, 2012a) who mostly examined the Sala Munthun River around the Tatai Waterfall and took voucher specimens. In addition to the species revealed by G. Chartier, Day (2011) reported *Copera marginipes* and *Brachygonia oculata* while Kosterin (2010, 2011, 2012a) reported *Aciagrion pallidum*, *Agriocnemis pygmaea*, *Archibasis viola* and *Pseudagrion pruinatum*, which were not recorded by G. Chartier. Some more species were found by Kosterin (2010, 2011, 2012a) at Phum Doung Bridge, at the junction of the Kep and Sala Munthun rivers: *Mortonagrion falcatum*, *Ictinogomphus decoratus melanops*, *Idionyx* sp. and *Macromidia rapida*.

Our hundreds of dragonfly and damselfly photos made in nature have provided a good opportunity to register unidentified *Forcipomyia* sp. (or spp.) midges on their wings (see Fig. 12 for examples). They were seen once on the wings of one Coenagrionidae species, nine

Libellulidae species and twice on *Trithemis aurora* and *Cratilla lineata*. The latter species seems to be especially prone to infestation by these parasites in Cambodia, for the midges were also seen also on a male photographed by Kosterin (2012a: Fig. 26) at the “Lake area” of the Sala Munthun River. Also, Kosterin (2012a: Fig. 20) registered a midge on the wings of *Archibasis viola* in Koh Kong Province. In the Oriental region, information on infected Odonata species has been published from Brunei, where two species of Chlorocyphidae and Coenagrionidae were found to have been infected by midges attached to the thorax (Orr & Granston, 1997), while in Europe *Forcipomyia paludis* has been found on the wings of representatives of nine families of dragonflies and damselflies (Martens *et al.*, 2007).

At present, the gentle, coastal foothills of the Cardamom Mountains in the Koh Kong Province have been rather well assessed as to the Odonata fauna (Kosterin, 2010, 2011, 2012a; Day, 2011; this paper), although up to 30 additional species may be still found here, mostly from the families Gomphidae and Corduliidae *sensu lato*. However, only occasional data exist for the central areas of this mountain range, in Pursat Province (Kosterin & Holden, 2011; this paper). This elevated area, with more diverse habitats, should support a far richer fauna of Odonata.

Our next goal in assessing the dragonfly and damselfly fauna of Cambodia will be a special, thorough survey of the Central Cardamoms Protected Forest and Phnom Samkos Wildlife Sanctuary. Our second target for an Odonata survey is the extreme East of the country, in the provinces of Ratanakiri and Mondulkiri, which occupy the western slopes of the Annamite Mountains and which are expected to have a somewhat different, “more Vietnamese” fauna. We should expedite our surveys before potentially significant areas for biodiversity are lost. Logging of primary forests, inundation of valleys by hydropower dam reservoirs and mining are going on very actively, in spite of more than 20% of the Cambodian territory being protected areas of various types.

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Appendix 1

Updated Checklist of Species Reported for Cambodia

In the following list, only the reliably identified, named species are numbered. Subspecies are not included. A reference to the first report for Cambodia is provided for each species. (Tsuda, 2000, attempted to summarise data known at the time of his publication, but his listing of *Copera ciliata*, *Pantala flavescens* and *Trithemis festiva* for Cambodia were based either on earlier published records, which we failed to find, or on unpublished data; these common species being repeatedly reported later).

- | | | |
|--|--|--|
| <p style="text-align: center;">Calopterygidae</p> <p>1. <i>Vestalis gracilis</i> (Rambur, 1842)
Martin (1904).</p> <p>2. <i>Neurobasis chinensis</i> (Linnaeus, 1758)
Kosterin (2010).</p> <p style="text-align: center;">Chlorocyphidae</p> <p>3. <i>Aristocypha fenestrella</i> (Rambur, 1842)
Kosterin (2011).</p> <p>4. <i>Aristocypha fulgipennis</i> (Guerin, 1871)
Martin (1904).</p> <p>5. <i>Heliocypha biforata</i> (Selys, 1859)
Kosterin & Vikhrev (2006).</p> <p>6. <i>Heliocypha perforata</i> (Percheron, 1835)
Martin (1904).</p> <p>7. <i>Libellago hyalina</i> (Selys, 1859)
Martin (1904).</p> <p>8. <i>Libellago lineata</i> (Selys, 1859)
Roland <i>et al.</i> (2011).</p> <p style="text-align: center;">Euphaeidae</p> <p>9. <i>Euphaea guerini</i> Rambur, 1842
Asahina (1985b).</p> <p>10. <i>Euphaea masoni</i> Selys, 1879
Kosterin (2010).</p> <p>11. <i>Euphaea ochracea</i> Selys, 1859
This paper.</p> <p>12. <i>Dysphaea gloriosa</i> Fraser, 1938
Kosterin (2010).</p> | <p style="text-align: center;">Lestidae</p> <p>13. <i>Lestes concinnus</i> Hagen in Selys, 1862
Kosterin & Vikhrev (2006).</p> <p>14. <i>Lestes elatus</i> Hagen in Selys, 1862
Kosterin (2011).</p> <p>15. <i>Lestes nodalis</i> Selys, 1891
This paper.</p> <p>16. <i>Lestes platystylus</i> Rambur, 1842
Kosterin (2011).</p> <p>17. <i>Lestes praemorsus</i> (Selys, 1862)
Roland <i>et al.</i> (2011).</p> <p>18. <i>Orolestes octomaculata</i> Martin, 1902
Martin (1904).</p> <p style="text-align: center;">Megapodagrionidae</p> <p>19. <i>Rhinagrion viridatum</i> Fraser, 1938
Kosterin (2011).</p> <p style="text-align: center;">Coenagrionidae</p> <p>20. <i>Aciagrion borneense</i> Ris, 1911
Kosterin & Vikhrev (2006).</p> <p>21. <i>Aciagrion pallidum</i> Selys, 1891
Asahina (1967a).</p> <p>22. <i>Aciagrion tillyardi</i> Laidlaw, 1919
Kosterin (2011).</p> <p>23. <i>Aciagrion hisopa</i> (Selys, 1876)
Kosterin (2012a).</p> <p>--- <i>Aciagrion</i> sp.
Roland <i>et al.</i> (2011).</p> <p>24. <i>Agriocnemis femina</i> (Brauer, 1868)
Kosterin (2011).</p> | <p>25. <i>Agriocnemis lacteola</i> Selys, 1877
Kosterin & Holden (2011).</p> <p>26. <i>Agriocnemis minima</i> Selys, 1877
Kosterin & Vikhrev (2006);
Benstead (2006).</p> <p>27. <i>Agriocnemis nana</i> (Laidlaw, 1914)
Kosterin & Vikhrev (2006).</p> <p>28. <i>Agriocnemis pygmaea</i> (Rambur, 1842)#
Asahina (1967a).</p> <p>29. <i>Archibasis oscillans</i> (Selys, 1877)
Martin (1904).</p> <p>30. <i>Archibasis viola</i> Lieftinck, 1948
Kosterin (2011).</p> <p>31. <i>Argiocnemis rubescens</i> Selys, 1877
Roland <i>et al.</i> (2011).</p> <p>32. <i>Ceriagrion auranticum</i> Fraser, 1922
Benstead (2006).</p> <p>33. <i>Ceriagrion calamineum</i> Lieftinck, 1951
Kosterin (2011).</p> <p>34. <i>Ceriagrion cerinorubellum</i> (Brauer, 1865)
Asahina (1967a).</p> <p>-- ? <i>Ceriagrion indochinense</i> Asahina, 1967
Roland <i>et al.</i> (2011); Kosterin (2011):
insufficiently convincing photographic
records.</p> <p>35. <i>Ceriagrion malaisei</i> Schmidt, 1964
Asahina (1967b).</p> <p>36. <i>Ceriagrion olivaceum</i> Laidlaw, 1914
Asahina (1967a).</p> |
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37. *Ceriagrion praetermissum* Lieftinck, 1929 --- *Prodasineura verticalis* sensu Asahina nec --- *Hemicordulia* sp.
Kosterin & Vikhrev (2006). Selys, 1860 Kosterin (2011).
38. *Ischnura aurora* (Brauer, 1865) Asahina (1967a). 74. *Idionyx thailandica* Hämäläinen, 1985
Roland et al. (2011). Kosterin (2012a).
39. *Ischnura senegalensis* (Rambur, 1842) 56. *Anax guttatus* (Burmeister, 1839) 75. *Macromia cupricincta* Fraser, 1924
Asahina (1967a). Martin (1904). Kosterin (2012a).
40. *Mortinagrion aborensis* (Laidlaw, 1914) 57. *Anax immaculifrons* Rambur, 1842 76. *Macromia septima* Martin, 1904
Kosterin (2011). Kosterin (2012a).
41. *Mortonagrion falcatum* Lieftinck, 1934 58. *Gynacantha basiguttata* Selys, 1882 --- *Macromia* sp.;
Kosterin (2011). Martin (1904). This paper.
42. *Onychargia atrocyana* (Selys, 1865) 59. *Gynacantha demeter* Ris, 1911 77. *Macromidia rapida* Martin, 1907
Kosterin (2010). This paper. Kosterin (2012a).
43. *Paracercion calamorum* (Ris, 1916) 60. *Gynacantha subinterrupta* Rambur, 1842 **Libellulidae**
Benstead (2006). Asahina (1967a).
44. *Pseudagrion australasiae* Selys, 1876 61. *Gynacantha phaeomeria* Lieftinck, 1960 78. *Acisoma panorpoides* Rambur, 1842
Asahina (1967a). This paper. Benstead (2006).
45. *Pseudagrion microcephalum* (Rambur, 1842) 62. *Heliaeschna crassa* Krüger, 1899 79. *Aethriamanta aethra* Ris, 1912
Kosterin (2011). Day (2011). Roland & Roland (2010).
46. *Pseudagrion pruinosum* (Burmeister, 1839) 63. *Heliaeschna uninervulata* Martin, 1909 80. *Aethriamanta brevipennis* (Brauer, 1842)
Roland et al. (2011). Lieftinck (1953). Roland & Roland (2010).
47. *Pseudagrion rubriceps* Selys, 1876 **Gomphidae** 81. *Aethriamanta gracilis* (Brauer, 1878)
Benstead (2006). 64. *Burmagomphus divaricatus* Lieftinck, 1964 82. *Agrionoptera insignis* (Rambur, 1842)
Kosterin (2012a).
48. *Pseudagrion williamsoni* Fraser, 1922 65. *Burmagomphus asahinai* Kosterin, 83. *Amphithemis curvostyla* Selys, 1891
Asahina (1967a). Makbun et Dawwrueng, 2012 Kosterin (2012a).
- Platynemididae** 66. *Gomphidictinus perakensis* (Laidlaw, 1902) 84. *Brachydiplax chalybea* Brauer, 1868
Asahina (1967a).
49. *Coeliccia kazukoae* Asahina, 1984 67. *Ictinogomphus decoratus* (Selys, 1854) 85. *Brachydiplax farinosa* Krüger, 1902
Asahina, 1967 (unnamed); Asahina, 1984 (named). Martin (1904). Kosterin (2012a).
50. *Coeliccia ocotgesima* (Selys, 1863) 68. *Ictinogomphus rapax* (Rambur, 1842) 86. *Brachydiplax sobrina* (Rambur, 1842)
Martin (1904). Martin (1904); biogeographically 69. *Merogomphus parvus* Krüger, 1899 87. *Brachygonia oculata* (Brauer, 1878)
suspicious, may be another species. Kosterin (2012a). Martin (1904).
51. *Coeliccia yamasakii* Asahina, 1984 70. *Microgomphus chelifer* Selys, 1859 88. *Brachythemis contaminata* (Fabricius, 1793)
Kosterin & Holden (2011). This paper. Asahina (1967a).
- *Coeliccia* sp. 1. 71. *Nepogomphus walli* (Fraser, 1924) 89. *Camacinia gigantea* (Brauer, 1878)
Roland et al. (2011). Kosterin (2010). Martin (1904).
- *Coeliccia* sp. 2. 72. *Paragomphus capricornis* (Förster, 1914) 90. *Cratilla lineata* (Brauer, 1878)
Roland et al. (2011). This paper. Kosterin (2010). Martin (1904).
52. *Copera ciliata* (Selys, 1863) 73. *Epophthalmia frontalis* Selys, 1871 91. *Cratilla metallica* (Brauer, 1878)
? Tsuda (2000). Roland et al. (2011). Kosterin (2011). Martin (1904).
53. *Copera marginipes* (Rambur, 1842) 74. *Epophthalmia frontalis* Selys, 1871 92. *Crocothemis servilia* (Drury 1770)
Kosterin (2010). Roland et al. (2011). Asahina (1967a).
54. *Copera vittata* (Selys, 1863) 75. *Epophthalmia frontalis* Selys, 1871 93. *Diplacodes nebulosa* (Fabricius, 1793)
Kosterin (2010). Roland et al. (2011). Asahina (1967a).
- Disparoneuridae** **Corduliidae sensu lato** 94. *Diplacodes trivialis* (Rambur, 1842)
Asahina (1967a).
55. *Prodasineura autumnalis* (Fraser, 1922) 76. *Epophthalmia frontalis* Selys, 1871 95. *Diplacodes trivialis* (Rambur, 1842)
Kosterin (2010). Roland et al. (2011). Asahina (1967a).

95. *Hydrobasileus croceus* (Brauer, 1867) Benstead (2006).
96. *Indothemis carnatica* (Fabricius, 1798) Roland *et al.* (2011).
97. *Indothemis limbata* (Selys, 1891) Roland *et al.* (2011).
98. *Lathrecista asiatica* (Fabricius, 1798) Kosterin (2010).
99. *Lyriothemis cleis* Brauer, 1868 Martin (1904).
100. *Lyriothemis elegantissima* Selys, 1883 Kosterin (2012a).
101. *Macrodiplax cora* (Brauer, 1867) Kosterin (2011).
102. *Nannophya pygmaea* Rambur, 1842 Kosterin (2011).
103. *Neurothemis fluctuans* (Fabricius, 1793) Asahina (1967a).
104. *Neurothemis fulvia* (Drury, 1773) Asahina (1967a).
105. *Neurothemis intermedia* (Rambur, 1842) Martin (1904).
106. *Neurothemis tullia* (Drury, 1773) Martin (1904).
107. *Onychothemis testacea* Laidlaw, 1902 Kosterin (2012a).
108. *Orchithemis pulcherrima* Brauer, 1878 Day (2011).
109. *Orthetrum chrysis* (Selys, 1891) Kosterin (2010).
110. *Orthetrum glaucum* (Brauer, 1865) Roland *et al.* (2011).
111. *Orthetrum luzonicum* (Brauer, 1868) Kosterin (2012a).
112. *Orthetrum pruinatum* (Burmeister, 1839) Martin (1904).
113. *Orthetrum sabina* (Drury, 1770) Asahina (1967a).
114. *Orthetrum testaceum* (Burmeister, 1839) Kosterin (2012a).
115. *Orthetrum triangulare* (Selys, 1878) This paper.
116. *Pantala flavescens* (Fabricius, 1798) Donnelly (2000).
117. *Potamarcha congener* (Rambur, 1842) Asahina (1967a).
118. *Pseudothemis jorina* Förster, 1904 Benstead (2006).
119. *Rhodothemis rufa* (Rambur, 1842) Martin (1904).
120. *Rhyothemis obsolescens* Kirby, 1889 Kosterin (2010).
121. *Rhyothemis phyllis* (Sulzer, 1776) Martin (1904).
122. *Rhyothemis plutonia* Selys, 1883 This paper.
123. *Rhyothemis triangularis* Kirby, 1889 Roland & Roland (2010).
124. *Rhyothemis variegata* (Linnaeus, 1763) Martin (1904).
125. *Tetrathemis platyptera* Selys, 1878; This paper.
126. *Tholymis tillarga* (Fabricius, 1798) Asahina (1967a).
127. *Tremea transmarina* Brauer, 1867 Kosterin (2010).
128. *Tremea virginia* (Rambur, 1842) Martin (1904).
129. *Trithemis aurora* (Burmeister, 1839) Asahina (1967a).
130. *Trithemis festiva* (Rambur, 1842) ? Tsuda (2000).
131. *Trithemis pallidinervis* (Kirby, 1889) Martin (1904).
132. *Urothemis signata* (Rambur, 1842) Martin (1904).
133. *Zygonyx iris* Selys, 1869 Kosterin (2010).
134. *Zyxomma petiolatum* Rambur, 1842 Kosterin (2010).
135. *Zyxommoides breviventre* Martin, 1921 Asahina (1967a).

Excluded records:

- *Aciagrion occidentale* Laidlaw, 1919: Reported by Asahina (1967a), but most probably it was *A. borneense*, which was not well known at that time.
- *Neurothemis ramburii* (Kaup in Brauer, 1866): Reported by Roland & Roland (2010), but biogeographically unexpected. Most probably aberrant *N. fluctuans*.
- *Rhyothemis fuliginosa* Selys, 1883. Reported by Martin (1904), but biogeographically hardly possible. Most probably *R. plutonia*.
- *Rhyothemis regia* (Brauer, 1867): Reported by Donnelly (2000), but too uncertain a sighting. Could also be *R. plutonia*.