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Haomiao Zhang

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Odonata fauna of Dai-Jingpo Autonomous Prefecture of Dehong in the western part of the Yunnan Province, China - a brief personal balance from seven years of surveys and workshop report on current studies

Hao-miao Zhang^{1,2}

¹State Key Laboratory of Genetic Resources and Evolution, Kunming Institute of Zoology, Chinese Academy of Sciences;

²Kunming Natural History Museum of Zoology, Kunming Institute of Zoology, Chinese Academy of Sciences.

Email: zhanghaomiao@mail.kiz.ac.cn

Summary

Between 2009 and 2016, a total of 174 Odonata species (Tab. 1) have been recorded in the Dehong Dai and Jingpo Autonomous Prefecture, China. 21 of these species are new records for China, and additional 26 taxa have to be described as new to science. Brief comments on selected species refer to morphological characters, distribution and seasonality.

Key words: China, Yunnan, checklist, wind-borne species, seasonality

Introduction

The southwestern provinces Yunnan, Guizhou and Sichuan form one of the major hotspots of biodiversity in Asia. An overview is given in "The Yunnan Biodiversity Hotspot Project – Program, Objectives, and Application" April 02 – 06 2016, Dresden, Germany (http://www.senckenberg.de/files/content/forschung/abteilung/mineralogiegeologie/palaeobotanik/yunnan_biodiversity_hotspot_project_symposium_volume_dresden.pdf).

To study the widely unknown Odonata fauna in the southwestern part of China, I conducted fieldwork in Yunnan province starting in 2009. The first visit, to the Dai Autonomous Prefecture of Xishuangbanna in the most southern part of the province (see Fig. 4), was funded by the International Dragonfly Fund (IDF) (Zhang, 2010). In the past seven years I collected at least 430 species in Yunnan and visited over 500 localities all over the province. During the years 2013-2016, I spent six to seven months each year in Yunnan. Many new species have been described from the material collected (Yang et al, 2014; Zhang et al., 2013; Zhang et al., 2014; Zhang et al., 2015a & b; Zhang et al., 2016).

However, my survey of this province is still inadequate. Zhaotong City (near Sichuan Province) has not been surveyed at all and the Wenshan Autonomous Prefecture (near Guangxi Province to the east and Vietnam to the south) (see fig. 4) has not yet

been adequately surveyed. I believe that at least 500 species could eventually be found in Yunnan, or perhaps even more, anything up to 600 species.

I have been having a very good time with so many beautiful insects in the wild. My first priority is to search for members of Chlorogomphidae, no doubt one of the most attractive dragonfly families worldwide. Especially the golden winged chlorogomphids (species belonging to the subgenus *Neorogomphus*) are my favorites. My first success with this group, the discovery of *Chlorogomphus (Neorogomphus) auratus* Martin, 1910 (Fig. 1), took place in eastern Yunnan. Later, *Chlorogomphus yokoii* Karube, 1995 was found in the southern part of the province. Until now four species of this subgenus have been found, including a new, still undescribed species.



Fig 1. *Chlorogomphus (Neorogomphus) auratus* Martin, 1910, female.

Writing this IDF report was challenging since thousands of nice photos are available and a lot of new species were discovered and new national records made for the fauna of China. So it was hard to decide where to begin. In my earlier IDF report (Zhang 2010) I just listed the species discovered in Xishuangbanna Dai Autonomous Prefecture during my first visits there in June and September 2009. After that, I visited the same place over 20 times and many more rare species were recorded. In May 2016, a wonderful male of *Camacinia harterti* Karsch, 1890 (Fig. 2) was encountered in the very dense forest of the Xishuangbanna National Nature Reserve, where I was working with Adolfo Cordero-Rivera. We also found a huge, marvellously orange *Anotogaster* species (Fig. 3). Adolfo could witness both the richness of dragonfly diversity and the variable human population inhabiting southern Yunnan. However, a lot of time is re-



Fig 2. *Camacinia harterti* Karsch, 1890, male from southern Yunnan.



Fig 3. *Anotogaster* sp., female from southern Yunnan.

quired to obtain a comprehensive knowledge of the odonate fauna of the Yunnan province, maybe at least ten years of continuous fieldwork.

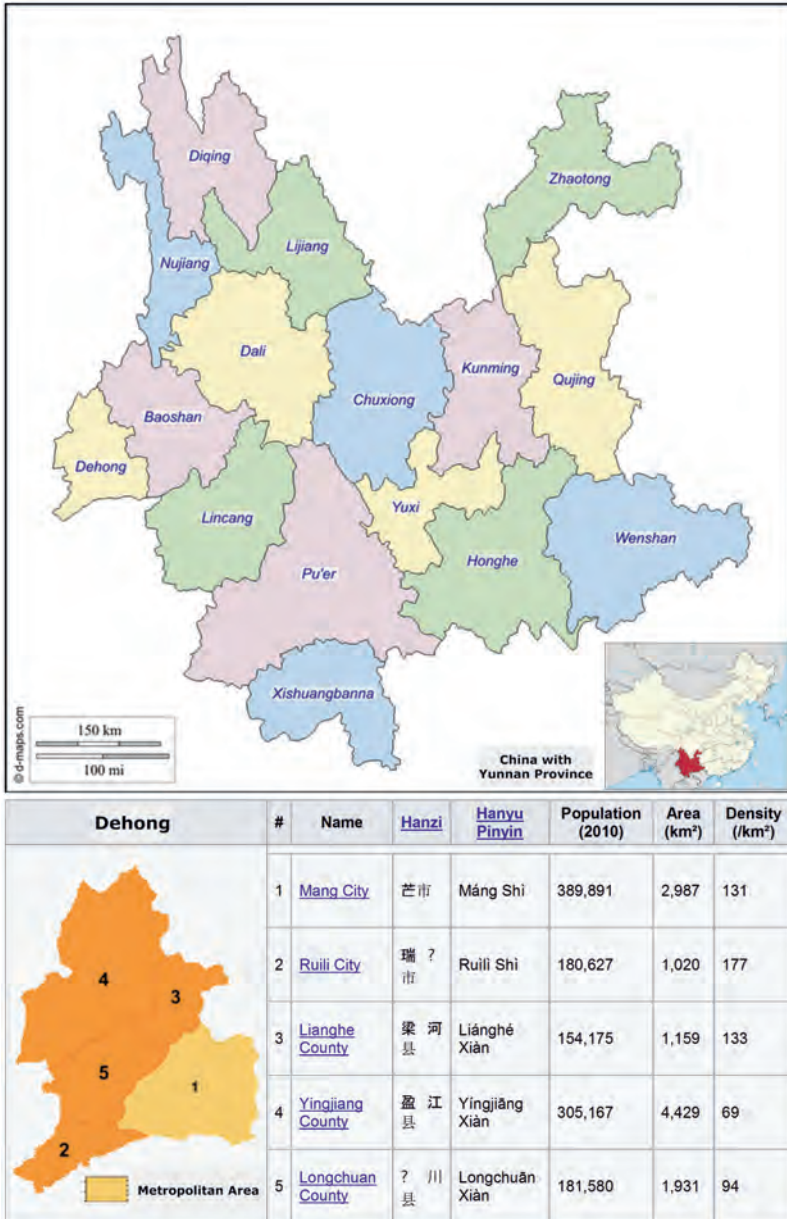


Fig. 4: Geographic situation of the study area. Map of Dai-Jingpo Autonomous Prefecture of Dehong, Yunnan Province, China (data from Wikipedia).

Starting odonate survey in Dai-Jingpo Autonomous Prefecture of Dehong

In this report, I add further information about the Yunnan Odonata fauna. In addition, I discuss the dragonfly fauna of a highly interesting area situated at the Chinese-Burmese border, the Dai-Jingpo Autonomous Prefecture of Dehong at the western border of Yunnan Province (Fig. 4).

Dehong is the smallest Autonomous Prefecture/City (Autonomous Prefecture and City are equal administrative divisions in the Province) in Yunnan. This westernmost part of Yunnan is quite different from the other areas of China due to its monsoon

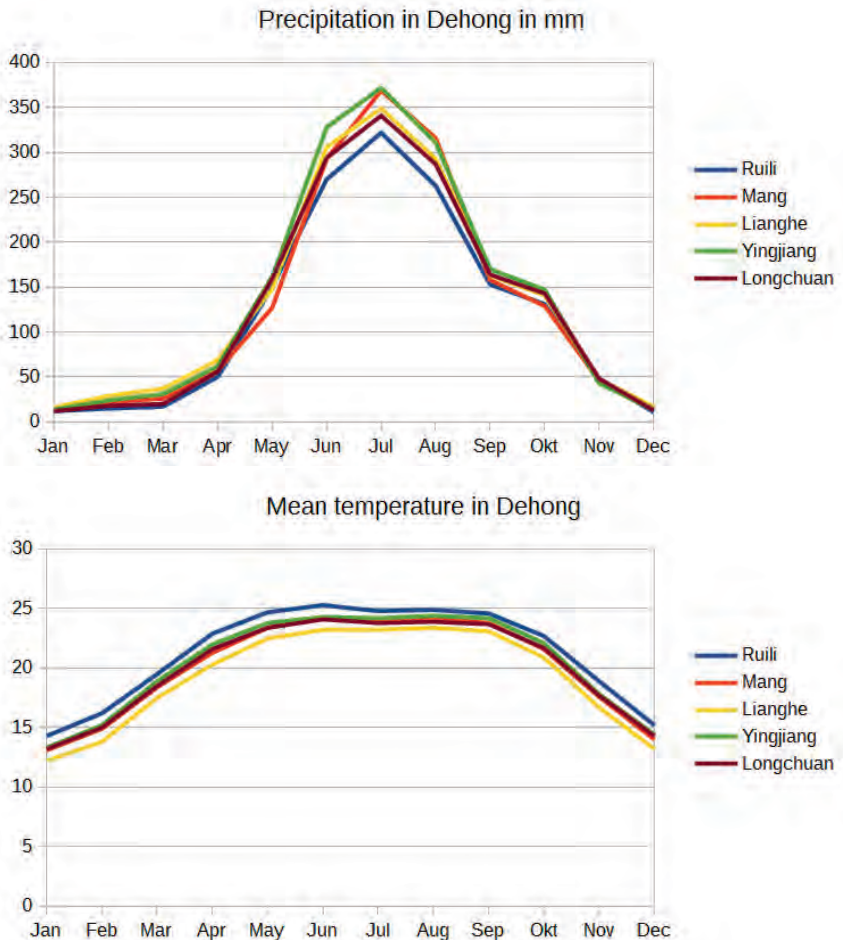


Fig. 5. Precipitation and temperatures in Dehong (Source: <https://en.climate-data.org>).

climate. Dehong is heavily influenced by the southwest monsoon bringing rain from the Indian Ocean. The rainy season begins in May and lasts till November. The other time of the year, especially the winter season, is always sunny and warm (Fig. 5).

This kind of climate enables dragonflies, such as libellulids, to be on the wing all year round. A lot of new records of species, previously known from India or Burma, were made in Dehong. I was pleased to witness the richness and beauty of Libellulidae, one of my favorite groups in this area. The Dehong odonate fauna is the biggest gift for me. Dehong must be one of the most important dragonfly areas in China and probably in the world as well (Figs. 6-14).



Fig 6. Overall view of Sino-Burmese border.



Fig 7. Rain forest in Tongbiguan National Nature Reserve.



Fig 8. Lowland wetlands in Nabang Town, Yingjiang County.



Fig 9. Lowland river in Nabang Town, Yingjiang County.

My field work in western Yunnan began in 2014. In the winter of 2013, I had visited my good friend Mrs. Guo-hui Yang, a teacher at Dali University with a good knowledge of dragonflies. I was very lucky to see her collection, a nice and comprehensive

selection of species from all over Yunnan, including a lot of species missing from my own Odonata collection. One species which attracted me especially was an *Atrocalopteryx* species with a deep brown band on the wings of the males. I



Fig 10. Lowland stream in Nabang Town, Yingjiang County.

remembered that Wen-bao Zhou, a famous odonatologist in China, had been in western Yunnan and had reported the first discovery of *A. laosica* in China (Zhou, 1987). I could not be absolutely sure of the identity of the specimens which I saw. So, a message with photos was immediately sent to Matti Hämäläinen. In his very fast reply he agreed with me that this was not the true *A. laosica*. After a careful examination it was finally confirmed to be a new species, which we termed *Atrocalopteryx fasciata* (Yang et al., 2014). Following the locality data in Yang's collection, I started to search for this strange species in Dehong in July 2014. Soon *A. fasciata* was found in several streams in the Tongbiguan National Nature Reserve (Fig. 15; for more information on the National Park see <http://indiwiki.xyz/c/?p=370545> or Yang & Du 2006). Another new species later publish-



Fig 11. Foggy forest in Tongbiguan National Nature Reserve.



Fig 12. Montane stream in Tongbiguan National Nature Reserve.



Fig 13. Waterfall in Tongbiguan National Nature Reserve.

ed as *Echo candens* (Zhang et al. 2015) was found in nearby seepages. *E. candens* came as a surprise to me, since I had been looking for another target species, *E. margarita* Selys, 1853. Luckily, half a year later, in November 2014, *E. margarita* was also found—at the same site where the holotype of *E. candens* had been collected. These damselflies hide in very dense tropical forests and are hard to find without diligent search. Meanwhile I have become very familiar with these two *Echo* species, and I pay these “old friends” a visit every year. Even my driver knows the “Echo site” well, and he can clearly remember the word “Echo” in English.

In this report, I will list all species found in Dehong, including a lot of species without confirmed species identity. IDF has funded my fieldwork in western Yunnan four times, including Dali, Baoshan, Dehong and Lincang. No doubt I will continue to study more of the local fauna. In 2016 I moved to a new working place, Kunming Institute of Zoology, Chinese Academy of Sciences, and am now working in Yunnan province, which more convenient for the surveys. In 2017 I intend to focus on eastern Yunnan. I am very grateful to my old friends Matti Hämäläinen and Oleg E. Kosterin. All three of us focus on the south and southeast Asian dragonfly

fauna, and we have the same preferences. Oleg believes that western Yunnan has a rather comprehensive or complete Burmese/Indian fauna; he must be correct. Many papers are planned: I will study the taxa in the superfamily Calopterygoidea with Matti; and I will continue to collaborate with Oleg for most of the Anisopterans. Most of the small damselflies, including the difficult species in the families Platystictidae, Platynemididae and Coenagrionidae, will be sent to Rory Dow for a careful check.

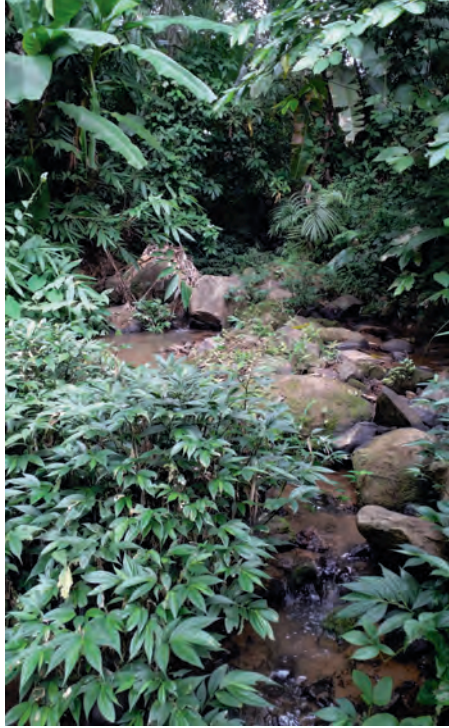


Fig 14. Stream in Tongbiguan National Nature Reserve.

Fig. 15. *Atrocalopteryx fasciata* Yang, Hämäläinen & Zhang, 2014, male.



Results - Brief comments on selected species

Zygoptera

Calopterygidae

Atracalopteryx fasciata Yang, Hämäläinen & Zhang, 2014 (Fig. 15)

This species has been found in its type locality, Yingjiang County in Dehong, as well as in Baoshan City and in the western part of Pu'er City. The populations in Dehong are quite large in July. In Pu'er the flight season is known to last until November.

Echo candens and *E. margarita* (Fig. 16)

Both are very shy species, which always perch in dark surroundings. In April, no individuals of *Echo* were found, but at the end of May *E. candens* becomes rather common in the deep forest seepages. The larval habitat is very muddy and not easy to visit.

E. margarita begins to emerge in the beginning of June and flies until November. Obviously, the flight season of *E. candens* ends in August; at the end of July the individuals are already aged.

Matrona nigripictus Selys, 1879? (Fig. 18 a)

M. nigripictus has a large range in Yunnan, but individuals from Dehong differ from those from other parts of the province. In males from Dehong the wings have



Fig. 16. Genus *Echo*: a) *E. candens*, male; b) *E. candens*, female; c) *E. margarita*, male; d) *E. margarita*, female.



Fig.17. Genus *Mnais*: a) *M. andersoni*, male with golden wings; b) *M. andersoni*, male with hyaline wings; c) *M. gregoryi*, male with black and white wings; d) *M. gregoryi*, male with hyaline wings.



Fig. 18. Calopterygidae a) *Matrona nigripectus*, male; b) *Noguchiphaea yoshikoeae*, male; c) *Vestalaria smaragdina*, mating pair; d) *Vestalis gracilis*, female.

a more waxy blue color on the upper side of both wings. Molecular study will be necessary to establish the status of the Dehong specimens.

Mnais andersoni McLachlan in Selys, 1873 (Fig. 17)

This species is very common in the western border localities. Recorded from April to July, but the flight season probably starts already in February.

Mnais gregoryi Fraser, 1924 (Fig. 17)

This is a highland species of which only a single male has been recorded in Dehong so far. *M. gregoryi* is very common and locally abundant in Dali.

Noguchiphaea yoshikoeae Asahina, 1976 (Fig. 18 b)

The species was found in Tongbiguan National Nature Reserve (Yingjiang County). Even at the end of October a lot of immatures can be seen, which suggest that they are on the wing throughout the winter season (November to January). *N. yoshikoeae* is common in several streams in eastern Yunnan but quite rare in the south and west of the province.

Vestalaria smaragdina (Selys, 1879) (Fig. 18 c)

This is a common and widespread late season species throughout Yunnan. In the south, they are on the wing from September to April. Individuals in the high elevation (above 1500 m) populations are much larger in size than those in lowland populations.

Vestalis gracilis (Rambur, 1842) Fig. 18 d)

In Yunnan, this is a widespread lowland species, which prefers dense rubber forest where there are lots of mosquitos. The populations are largest in late season (after September).

Chlorocyphidae (Fig. 19)

Aristocypha iridea (Selys, 1891)

This species has been discovered in Dehong and Lincang. It can be found in montane streams at elevations of 800-1400 m, but does not occur in the lowland. The flight season is quite long; populations are largest in late April, but small populations can be seen even in November.

Aristocypha quadrimaculata (Selys, 1853)

The discovery of this species in Yunnan was unexpected, and the first specimens were misidentified as *A. fenestrella*. *A. quadrimaculata* occurs at lower altitudes in Yingjiang County (200-650 m), but it seems to be confined to the Sino-Burmese border areas. *A. quadrimaculata* and *A. fenestrella* can be separated by several characters. In males of *A. quadrimaculata*, the dorsal triangle is narrower and the pterostigma is shorter and blue. *A. fenestrella* is always much larger in streams where the two species co-occur. Both species are on the wing year-round.

Heterocypha vitrinella (Fraser, 1935)?

A single chlorocyphid female collected at Yingjiang County in November 2016 is most likely the unknown female of *Heterocypha vitrinella* (Fraser, 1935). It was found perching near a ditch in the rubber forest. This species is currently known only from male specimens found in north-eastern India. Unfortunately, no male individuals were found. The only other chlorocyphid species in this location was *Heliocypha biforata*.

Rhinocypha arguta Hämäläinen & Divasiri, 1997

This is a late season species; the first teneral male was found in early September 2014. In October, it is common in semi-shady streams, but these damselflies appear only on very sunny days. Males disappear rapidly as soon as the sun is covered by clouds.



Fig. 19. Chlorocyphidae a) *Aristocypha iridea*, male; b) *Aristocypha quadrimaculata*, male; c) *A. quadrimaculata*, male, to show the dorsal triangle; d) *A. quadrimaculata*, females laying eggs; e) *Heterocypha vitrinella?*, female; f) *Rhinocypha arguta*, male.

Lestidae (Fig. 20)

Indolestes assamicus Fraser, 1930

This species is always found in cultivated habitats and it is common in paddy fields. They spend the dry season, from November to next April, when the paddy fields are without water, as adults. Emergence has been recorded in late autumn.

Indolestes peregrinus (Ris, 1916)

Common in highland wetlands, usually seen in shallow ponds with plenty of grass.

Lestes dorothea Fraser, 1924 and *Lestes praemorsus* Hagen in Selys, 1862

These two species are always seen together, but are easily confused. A good character for separating them is the colour of the apical part of the abdomen. *L. praemorsus* has whitish pruinescence on S9 and S10, but *L. dorothea* only on S10.



Fig. 20. Lestidae: a) *Indolestes assamicus*, male; b) *I. assamicus*, female; c) *I. peregrinus*, male; d) *Lestes dorothea*, male; e) *L. praemorsus*, male.

Incertae sedis group

Agriomorpha sp. (Fig. 21)

This species has a pale blue face and large whitish dorsal spots on S9. Currently *Agriomorpha fusca* is known from the eastern part of Yunnan, but this species is clearly different.

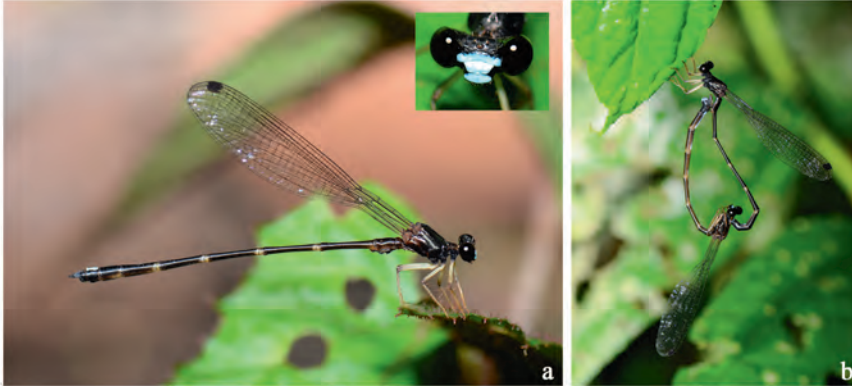


Fig. 21. *Agriomorpha* sp. a) male; b) mating pair.

Platycnemididae

Genus *Calicnemia* (Fig. 22)

Four species (Tab. 1) of this genus have been recorded in Dehong. They are common in small trickles and seepages descending from cliffs or large rocks.

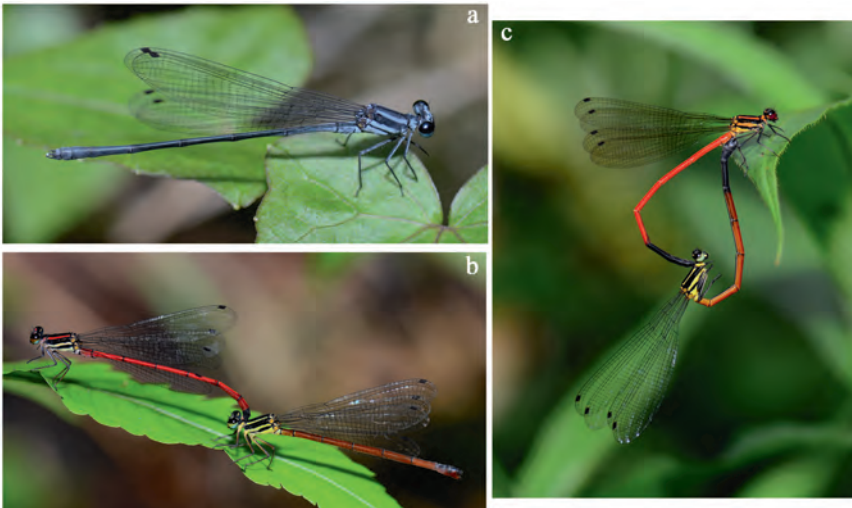


Fig. 22. Genus *Calicnemia*: a) *Calicnemia imitans*, male; b) *C. miles*, pair in tandem; c) *C. erythromelas*, mating pair.

Genus *Coeliccia* (Fig. 23)

Some of the seven recorded species from Dehong undoubtedly represent new species. The new discoveries increase the number of the *Coeliccia* species known from China greatly. One dominant species, *Coeliccia cyanomelas* Ris, 1912, is known to occur in a very large part of China, but most other *Coeliccia* species occur only in Yunnan and in western Guangxi. Yunnan is especially rich in the genus; I have collected at least 15 species from there.

Coeliccia didyma (Selys, 1863)

The true *C. didyma* occurs in Yingjiang County, western Yunnan. The formerly published records of this species from other part of China appear to be incorrect. Females of this species are polymorphic (blue morph and yellow morph). In contrast, the similar *C. cyanomelas* occurs only in the yellow morph.

Coeliccia sp. 1

I collected over 50 specimens of *C. didyma* and do not find much variation among them. So, the status of the male in Fig. 22c is problematic. Its dorsal thoracic stripes are reduced and only S9 and S10 have blue colour. No further specimens were found in spite of several later visits to the site, a montane stream in Tongbiguan National Nature Reserve, Yingjiang County.

Coeliccia sp. 2 & *Coeliccia* sp. 3

These two species were found together in small numbers in very shady and dark seepages in an intact tropical rain forest in Tongbiguan National Nature Reserve, Yingjiang County.

Coeliccia sp. 4

A lowland species. A large population was found in a stream flowing through a rubber forest in Nabang Town, less than 5 km to the Burma border, in October-November 2016.

Coeliccia sp. 5

This almost black species differs from its other known Chinese congeners by the absence of bright colors. It also has an unusually late flight season among *Coeliccia*. Emergence starts in September and the adults are on the wing until November. Currently it is only known from Tongbiguan National Nature Reserve, Yingjiang County.

Prodasineura sp. 1 (Fig. 22 h)

A species with orange-yellow thoracic stripes. A single male is from a large lowland pond in Nabang Town, Yingjiang County.

Platystictidae (Fig. 24)

Platystictidae is taxonomically a very difficult family. In Yunnan, species of this family can be found everywhere in suitable habitats from lowlands to high mountains. It is hard to place the recorded species into the currently recognized genera, so establishing



Fig. 22 a) *Coeliccia chromothorax*, male; b) *Coeliccia didyma*, male; c) *Coeliccia* sp.1, male; d) *Coeliccia* sp. 2, male; e) *Coeliccia* sp. 3, male; f) *Coeliccia* sp. 4, male; g) *Coeliccia* sp. 5, male; h) *Prodasineura* sp.1, male.

some new genera may be necessary. Since my knowledge of this family is quite limited, I have discussed this problem with Rory Dow and he has promised to work on my material. Six species have currently been collected from Dehong; some of them possess very expanded abdominal segments S8 and S9, and others are very tiny damselflies. The general habitus of many of these species is quite different from the other known species from elsewhere in China (eastern Yunnan, Guangdong, Guangxi and Hainan).



Fig. 24. Platystictidae: a) *Drepanosticta* sp. 1, male; b) *Drepanosticta* sp. 2, male; c) *Drepanosticta* sp. 3, male; d) *Drepanosticta* sp. 4, male; e) *Protosticta* sp.1, male; f) *Protosticta* sp.2, female.

Coenagrionidae

Aciagrion olympicum Laidlaw, 1919 (Fig. 25 a)

This species lives in paddy fields and in small marshes at elevations above 1000 m, becoming more common at elevations around 1500 m. Found in Lianghe County and Yingjiang County.

Aciagrion pallidum Selys, 1891 (Fig. 25 b)

Arare and local species with very slim body. So far only 2 male and 1 female specimens have been collected. The specimens were rather young and were found in a large forest in the winter season, suggesting that they overwinter as adults.

Agriocnemis clauseni Fraser, 1922 (Fig. 25 c)

Recorded only in a marsh habitat at the elevation of 2400 m in Longchuan County. It was abundant in the end of April, but was also seen in late season (October), indicating that it has a rather long flight period even in high mountains.



Fig. 25 Coenagrionidae: a) *Aciagrion olympicum*, male; b) *A. pallidum*, female; c) *A. clauseni*, male; d) *A. clauseni*, female; e) *A. splendissima?*, pair in tandem.

Agriocnemis splendissima Laidlaw, 1919 (Fig. 25 d)

This species has been found in lowland forests in Dehong and Lincang. The mature males have bluish white pruinescence on their thorax. Specimens from China and India differ in some aspects. Further studies of the identity of the Yunnan specimens are needed.

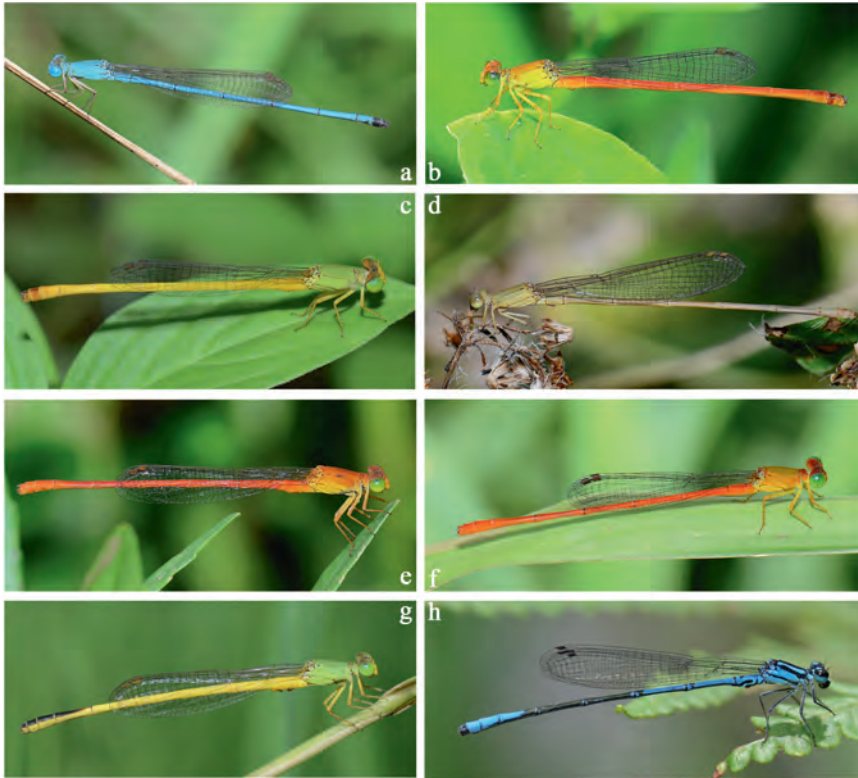


Fig. 26. Coenagrionidae: a) *Ceriagrion azureum*, male; b) *C. bellona*, male; c) *C. indochinense*, male; d) *C. olivaceum*, female; e) *Ceriagrion* sp.1, male; f) *Ceriagrion* sp.2, male; g) *Ceriagrion* sp.3, male; h) *Coenagrion fenchongensis*, male.

Genus *Ceriagrion* (Fig. 26)

The genus is speciose in this area; eight species have been found so far. Species occurring in lowlands fly throughout the year, whereas those from high mountains have shorter flight seasons (April to November). Two red species (*Ceriagrion* sp. 1 & sp. 2) inhabit lowland wetlands and are confined to the tropical zone. Another red

species, tentatively identified by me as *C. bellona* Laidlaw, 1915 is very widespread in Yunnan. The yellow *Ceriagrion* sp.3, which looks like a small *C. melanurum* Selys, 1876, may be a new species. It has been found only in a small pond in Tongbiguan National Nature Reserve.

Ceriagrion damselflies are widely distributed in China and probably many species have been misidentified in literature. A revision of the Chinese species is necessary.

Coenagrion tengchongensis Yu & Bu, 2007 (Fig. 26h)

The species is named after the type locality, Tengchong County in Baoshan City, which is adjoining Dehong. It is rather widespread and common in western Yunnan in wetlands at elevations of 1000-2500 m.



Fig. 27 *Anaciaeschna martini*, female laying eggs.

Anisoptera

Aeshnidae

Anaciaeschna martini (Selys, 1897) (Fig. 27)

A new record from Yunnan, but confined to high elevations (1700-2500 m). This species is widespread in China and in the east its range extends into Japan. Females are easy to see in the afternoon, when they often aggregate in small groups for laying eggs, but males are hard to see since they seldom approach water.



Fig. 27. Genus *Anax*: a) & b) *A. indicus*, male; c) & d) *A. panybeus*, male.

Anax indicus Lieftinck, 1942 (Fig. 28)

In Yunnan it was first found in Xishuangbanna Tropical Botanic Garden in 2012, but it is not sure if the specimens found were reproducing at the site or just migrants. Hitherto, the only confirmed breeding populations in China are in western Yunnan (Dehong and Lincang). This is a locally rare species which prefers grassy ponds.

Anax panybeus Hagen, 1867 (Fig. 28)

The discovery of this species is a valuable record since it is the first record made in mainland China. In Taiwan, the species is common. *A. panybeus* prefers ponds with rich marginal vegetation. The males usually hover in the center of the ponds but seldom approach the margin. Therefore, collecting is difficult.



Fig. 29. Genus *Gynacantha*: a) & b) *G. bayadera*, male; c) & d) *Gynacantha* sp., male.

Gynacantha bayadera Selys, 1891 (Fig. 29)

This species is very rare in Dehong. The single male was collected from a light in a restaurant in Nabang Town in the evening. Later, a foraging female was collected in the field at 18.30h.

Gynacantha sp. (Fig. 29)

A red-legged species. Recorded in Xishuangbanna, Dehong, Pu'er and Lincang prefectures. Females have been found laying eggs in a dried-up paddy field.

Gynacanthaeschna sikkima (Karsch, 1891) (Fig. 30)

A relatively small aeshnid, body dark brown with green maculation. *Gynacanth-*



Fig. 30. *Gynacanthaeschna sikkima*: a) & b) male; c) & d) female.

aeschna is closely related to *Cephalaeschna* but the female ovipositor is different. Anal triangle of *Gynacanthaeschna* is 3-celled, but in true *Cephalaeschna* there are 5 or even more cells. Female *Gynacanthaeschna* have an elongated prominence on S10, but this structure is absent in female *Cephalaeschna*. The taxonomy of the genus *Cephalaeschna* is still in chaos and I plan to introduce some new genera for the "false *Cephalaeschna*".

Periaeschna nocturnalis Fraser, 1927 (Fig. 31)

A widespread early season species in Yunnan. It flies in Dehong from April to June.

Periaeschna sp. (Fig. 31)

This species has been only found in western Yunnan, in Dehong and Pu'er prefectures. A medium sized species with dark brown body and green stripes. Species with



Fig. 31 Genus *Periaeschna*: a) *P. nocturnalis*, male; b) *P. nocturnalis*, female; c) & d) *Periaeschna* sp., male.

such general habitus known from China include *P. flinti* Asahina, 1978 and *P. zhangzhouensis* Xu, 2007. This species resembles more the latter species, but has more stripes on the thorax.



Fig. 32 Genus *Planaeschna*: a) & b) *P. owadai*, male; c) & d) *Planaeschna* sp.1, male; e) & f) *Planaeschna* sp.2, male.

Genus *Planaeschna* (Figs. 32-33)

It is amazing that these six species were found in the same stream (a montane stream in Tongbiguan National Nature Reserve, from 1300-1450m elevation) in September

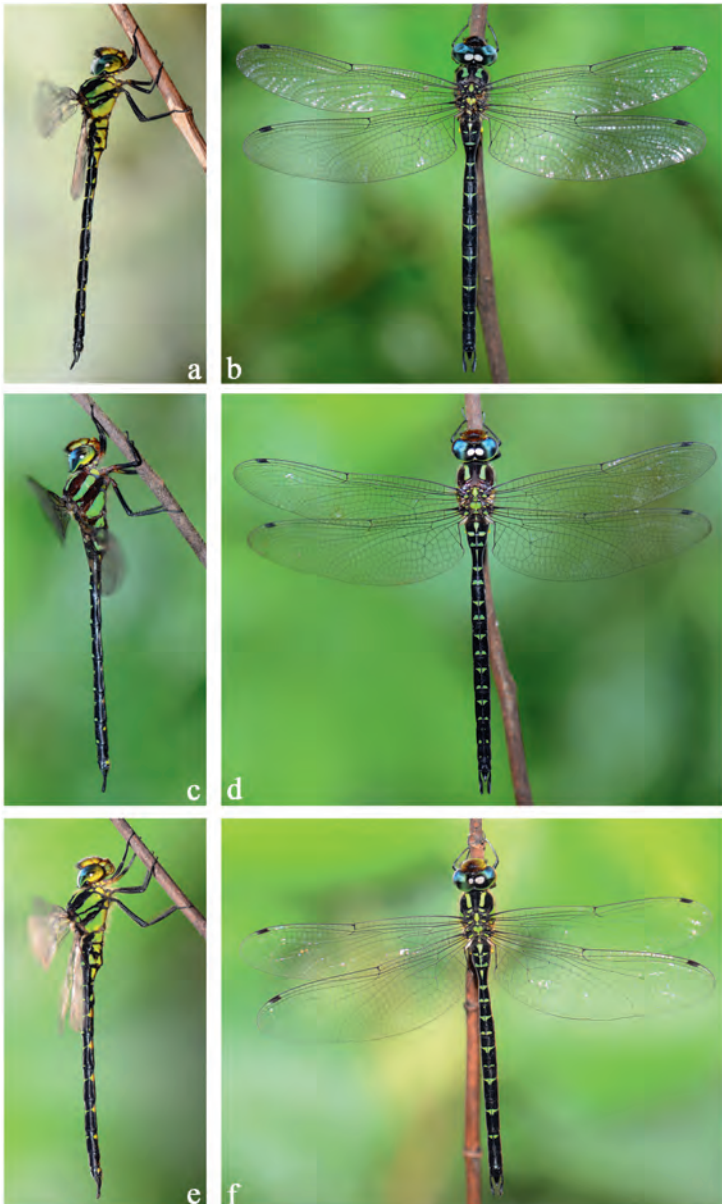


Fig. 33 Genus *Planaeschna*:
 a) & b) *Planaeschna* sp.3, male;
 c) & d) *Planaeschna* sp.4, male;
 e) & f) *Planaeschna* sp.5, male.

and October 2014. In one afternoon, a total of 7 specimens representing six different species was collected! Surveys conducted on this stream during three years have produced over a hundred aeshnid specimens of *Periaeschna*, *Gynacanthaeschna* and *Planaeschna*. Work on this material is continuing.

Polycanthagyna sp. (Fig. 34)

A short, brown species with bluish-yellow stripes. A late season species flying from September to December. This species is related to *P. ornithocephala* (McLachlan, 1896) known from central and southern China. In Dehong only a single female from Tongbiguan National Nature Reserve.



Fig. 34. *Polycanthagyna* sp., female.

Gomphidae (Fig. 35)

Genus *Amphigomphus*

No adults of this genus have been found so far in Dehong, but final stage larvae of at least two different species were collected. Elsewhere in Yunnan I found adults of two species: *A. nakamurai* Karube, 2001 from Honghe, eastern Yunnan and *A. somnuki* Hämäläinen, 1991 from Xishuangbanna prefecture, southern Yunnan.

Anisogomphus caudalis Fraser, 1926

This is a medium-sized species that was found on the steep slope of an open stream in Tongbiguan National Nature Reserve.

Davidius zhoui Chao, 1995

This species is widespread in Dehong and found from the elevation of 1300-2500 m in Yingjiang County and Mangshi City.



Fig. 35. Gomphidae: a) *Anisogomphus caudalis*, male; b) *Davidius zhoui*, male; c) *Davidius* sp. 1, male; d) *Davidius* sp. 2, male; e) *Lamelligomphus risi*, male; f) *Leptogomphus gestroi*, male; g) *Nepogomphus* sp. cf. *walli*, male; h) *Stylogomphus inglisi* sp. cf. *walli*, male.

Davidius sp. 1

A tiny and rare species. It co-occurs with *Davidius zhoui* in Tongbiguan Nature Reserve. Teneral were seen emerging from an open stream in the end of April. The fully mature males were never seen on this site, but were found perching in seepages upstream.

Davidius sp. 2

This is a large species, related to *Davidius bicornutus* Selys, 1878. Chao (1990) put *D. bicornutus* into the genus *Davidius* based on the venation only. Apparently, both *D. bicornutus* and this species should not be included in the genus *Davidius*.

Lamelligomphus risi (Fraser, 1922)

A lowland stream species. Its emergence time is not yet known, but the species has been seen in good numbers in several streams in October and November. Specimens from Dehong look almost identical to those from Darjeeling, northeastern India, as presented by Asahina (1995: figs 143-151).

Leptogomphus gestroi Selys, 1891

The species was first recorded from Yunnan by Yang & Davies (1993). I found it within a large range; it is especially common in western Yunnan, including Yingjiang, Dehong and Ximeng Counties in Pu'er City.

Nepogomphus sp. cf. *walli*

The genus *Nepogomphus* includes three known species of which two have been recorded in China: *N. modestus* (Selys, 1878) and *N. walli* (Fraser, 1924). *N. modestus* male possess a spine on the inner surface of the inferior appendage. Therefore, the male in Fig. 35g does not belong to it. Asahina (1995) illustrated also a female specimen of *N. walli* from Malaysia and the single female specimen collected in Dehong has identical thoracic stripes. But males show some differences from the Assamese males identified by Asahina as *N. walli*. It appears that in southern Yunnan there is a second small species without spine on the inferior appendages; the appendages being slightly different from *walli*.

Stylogomphus inglisi Fraser, 1922?

Only two male specimens are currently available of this rare, tiny species. More study is needed for its true identity; a female specimen would be useful.

Chlorogomphidae

The first species of this family collected by me in western Yunnan (in May 2015) is *Chlorogomphus* (*Neorogomphus*) *daviesi* Karube, 2001, from Lincang City. This beautiful insect was found in a rubber forest in lowland, the golden winged females were very remarkable when foraging high in the sky among hundreds of *Zygonyx*. In the same year, at the end of May and June, further species were found in the western Pu'er city. Many of them are undescribed species including the first record of a species belonging to subgenus *Petaliorogomphus* Karube, 2013. Till now no adult chlorogomphid was collected in Dehong prefecture, but larvae and exuviae were

found; the larva is quite small and belonging to the subgenus *Neorogomphus*, may be it represents a fifth member of *Neorogomphus* from Yunnan (I have four species records of this subgenus, not yet published, including one new species).

Cordulegastridae (Figs. 36-37)

Anotogaster chaoi Zhou, 1998

Dehong is the type locality of this species, but I have not found it there. In Dali it is locally abundant and I have seen over hundreds of individuals in one day. A dominant species for high elevation streams and ditches.

Total length 80-88 mm, abdomen 60-67 mm, hind wing 47-51 mm.

Anotogaster nipalensis (Selys, 1854)

A rare late season species in western Yunnan. Fully mature adult begins fly since October. The face is largely brown, differing from its other known Chinese congeners. Besides Yunnan this species is also known from Tibet.

The Yunnan specimens body length is 83-85 mm, abdomen 64-65 mm, hind wing 48-50 mm.

Anotogaster sp.

Currently the smallest species known for the genus (total length 73-80 mm, abdomen 56-62 mm, hind wing 42-47 mm), although the total length of the female reaches 80 mm. The face is almost black. A very rare species, females of which have been seen laying eggs in a very shadowy stream. Males patrolled over the seepages where *Echo* species were found.

Corduliidae (Fig. 38)

Hemicordulia edai Karube, 2012

This is one of the few members of this family currently known from Yunnan. *H. edai* is a dominant species in ponds in high mountains. It is widespread in Yunnan and it occurs even in the parks of Kunming city. In Dehong it is recorded from Yingjiang County.

Macromiidae

Presently much less species of this family are known from the western part of Yunnan than from the southern and eastern parts, but perhaps further surveys will reveal more *Macromia* species from Dehong. In the southern part of Yunnan the genus *Macromia* is speciose with over ten species recorded.

Ephthalma frontalis Selys, 1871

Except in Dehong this species was also recorded in Xishuangbanna prefecture, but it is more common in the fish ponds in the west. It is on the wing throughout the year.

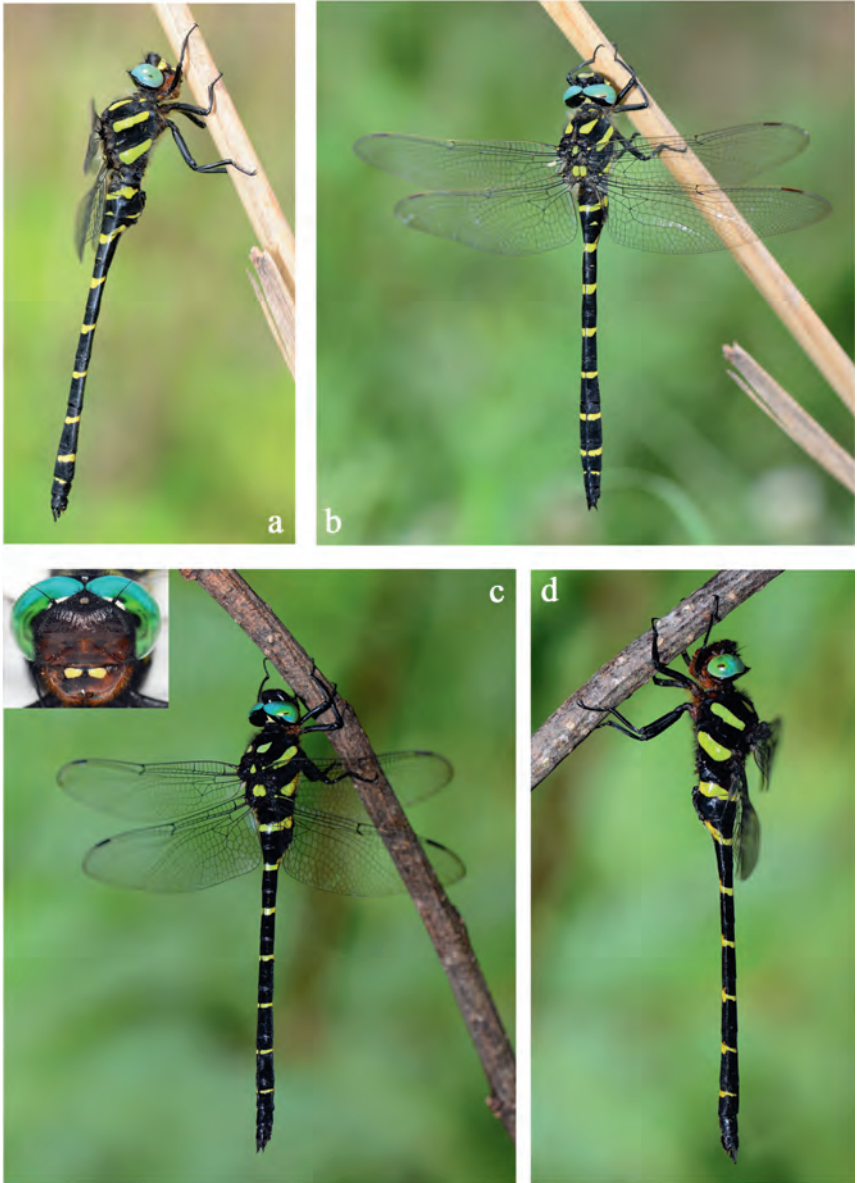


Fig. 36. Genus *Anotogaster*: a) & b) *A. chaoi*, male; c) & d) *A. nipalensis*, male.

Macromia m. moorei Selys, 1874

It is difficult to judge the subspecies of this very variable species. Populations from different altitude levels in Yunnan show much variation. The populations from other parts



Fig. 37. Genus *Anotogaster* sp.: a) & b) male; c) & d) female.

of China also differ in some aspect; specimens from Guizhou and Sichuan are much larger.

Macromia p. pinratani Asahina, 1983?

This species was only recorded in November 2016 at a large river in Nabang Town, Yingjiang County. The prominence on S10 is a good character to separate it from the very similar *M. moorei*. A similar species found in Xishuangbanna is on the wing from October to next April. The identity of these two taxa will be studied jointly with Oleg Kosterin.



Fig. 38 a) *Hemicordulia edai*, mating pair; b) *H. edai*, male in flight; c) *Epophthalmia frontalis*, male; d) *E. frontalis*, female; e) & f) *Macromia pinratani pinratani* ?, male.



Fig. 39. a) *Idionyx stevensi*: a) & b) male; c) & d) female.

Synthemistidae

Idionyx stevensi Fraser, 1924 (Fig. 39)

First recorded from China by Zhou (1989) and so far known from one single location in China—the Tongbiguan National Nature Reserve. An early species, on the wing from the end of April to early June.

Libellulidae

The large wetland areas in lowlands at the Sino-Burmese border support a rich libellulid fauna, which is still increased in the autumn season by migrating dragonflies from the west. These autumn migrations are caused by tropical hurricanes from the Bay of Bengal in the Indian Ocean. The survey in Dehong in autumn 2016 added

some more libellulid species to the list of Odonata from China. One example, *Indothemis limbata* (Selys, 1891) was found on 1st November, just after a hurricane from the Bay of Bengal. Three specimens were collected, but no more specimens were found the next day, when the hurricane had passed. This hurricane also brought a number of individuals of *Tramea basilaris burmeisteri* Kirby, 1889. The libellulids form

a considerable share of Dehong's odonate fauna and include many tropical species, not found elsewhere in China.

Genus *Aethriamanta* (Fig. 40)

Three species of the genus were found co-occurring in one pond in Nabang Town, Yingjiang County, with plenty of water hyacinth: *A. aethra*, *A. brevipennis* and *A. gracilis*. Their flight season is long, lasting from April to November; the species are most abundant from May to July. *A. brevipennis* and *A. gracilis* have been also found in the south, in Xishuangbanna Botanic Garden, Menglun Township, Mengla county in 2014. Earlier only *A. brevipennis* had been recorded in China – from Hong Kong, where it probably arrived as larvae with aquatic plants brought from Singapore. The Yunnan records refer to populations within the natural ranges of these species.

Amphithemis vacillans Selys, 1891 (Fig. 41 a)

A species with a very slim and long abdomen. A single male was collected on 4th November



Fig. 40. Libellulidae, genus *Aethriamanta*: a) *A. aethra*, male; b) *A. brevipennis*, male; c) *A. gracilis*, male.

2016. It was found in a small shady pond in the forest on a hot afternoon in Nabang Town, Yingjiang County.

Genus *Brachydiplax* (Fig. 41)

Three species have been found. They co-occur in the same ponds with plenty of water hyacinth or grass; males usually perch at leaf-tips guarding their territory.



Fig. 41. Libellulidae, a) *Amphithemis vacillans*, male; b) *B. chalybea*, male; c) *B. chalybea*, male; d) *B. sobrina*, male; e) *Bradinopyga geminata*, male; f) *Cratilla lineata*, female.

Bradinopyga geminata (Rambur, 1842) (Fig. 41 e)

So far only a single, immature male has been recorded in Nabang Town, Yingjiang County, in July 2014.

Cratilla lineata (Brauer, 1878) (Fig. 41 f)

This species is widely distributed in Yunnan. The specimens are larger in Dehong populations than elsewhere in Yunnan. Males have pruinose basal abdominal segments, and in females the wing tips are darkened. It is hard to conclude to which subspecies the Dehong populations belong.

Indothemis carnatica (Fabricius, 1798) (Fig. 42)

Several specimens were collected in Tongbiguan National Nature Reserve in September, 2014. In April 2015 it was found in lowland ponds in Nabang Town. A locally rare species.

Indothemis limbata (Selys, 1891) (Fig. 42)

Only three specimens have been collected, obviously migrants. Found on 1st November 2016 in Nabang Town, Yingjiang County, just after a hurricane from the Bay of Bengal.



Fig. 42. Libellulidae, a) *Indothemis carnatica*, male; b) *I. carnatica*, mating pair; c) *I. limbata*, male; d) *I. limbata*, female.

Neurothemis fluctuans (Fabricius, 1793) & *Neurothemis intermedia* (Rambur, 1842) (Fig. 43)

These species have recently been found in Dehong, These *Neurothemis* species usually spend the dry season as adults, similarly as the *Indolestes* species. In the winter season a lot of immatures can be seen. They do not become mature before the spring, when the red color in their body develops and they start to reproduce.

Neurothemis tullia subspecies (Fig. 43)

This might rather be a new species than a subspecies of *N. tullia*. It was found in low-land marshes in Nabang Town, Yingjiang County, and seen from April to November.



Fig. 43. Libellulidae, a) *Neurothemis fluctuans*, male; b) *N. fluctuans*, female; c) *N. intermedia*, male; d) *N. intermedia*, female; e) *N. tullia* subspecies?, male; f) *N. tullia* subspecies?, female.

Orthetrum sp. (Fig. 44)

This species is common in the high mountains (1500-2500 m) in Yunnan. In Dehong it is found in Lianghe, Yingjiang and Longchuan Counties. It is very similar to *O. internum* McLachlan, 1894, which occurs in eastern China, but the body colour is paler.

Phyllothemis eltoni Fraser, 1935 (Fig. 44)

Finding this species in Dehong represents the first record of this genus in China. The species was found in lowland ponds in dense forest. Since the individuals found in November 2016 were not aged, the species may have a long flight season or two annual generations. The life-history of this species will be studied in more detail in 2017.



Fig. 44. Libellulidae, a) *Orthetrum* sp., male; b) *Orthetrum* sp., female; c) & d) *Phyllothemis eltoni*, male.

Rhyothemis obsolescens Kirby, 1889 (Fig. 45)

Only a single male has been recorded so far in a pond hidden in the rubber forest in Nabang Town, Yingjiang County, July 2014. Several suitable pond habitats were discovered in November 2016, where this species might be found during the right season.

Rhyothemis triangularis Kirby, 1889 (Fig. 45)

Specimens in Dehong are smaller than those in Guangdong, also the reflection colour at the wing base is somewhat different. I have seen these small but strong fliers arrive at the ponds from high up in the sky and disappear again suddenly.



Fig. 45. Libellulidae, a) *Rhyothemis obsolescens*, male; b) *R. triangularis*, male; c) *Rhyothemis* sp., female; d) *Sympetrum hypomelas*, male; e) *S. speciosum haemato-neura*, male; f) *Tramea basilaris burmeisteri*, male; g) *T. transmarina euryale*, male; h) *Urothemis signata insignata*, male.

Rhyothemis sp. (Fig. 45)

The wings color pattern of this single female specimen found in Nabang Town, Yingjiang differs from the Nepalese and Indian specimens of *R. variegata variegata* (Linnaeus, 1763) by the less brownish black color on their wings. *R. v. variegata* has been found in Lincang, and also in the Sino-Burmese border area.

Sympetrum hypomelas (Selys, 1884) (Fig. 45)

This species, recorded from wetlands at elevations 1500-2500 m, is quite common and a dominant species in the late season.

Sympetrum speciosum haematoneura Fraser, 1924 (Fig. 45)

I regard this Himalayan form of *Sympetrum speciosum* Oguma, 1915 as a subspecies. The lack of amber brown spots at the wing base in *haematoneura* is a good separating character from the nominate subspecies.

Tamea basilaris burmeisteri Kirby, 1889 (Fig. 45)

Migrating individuals of this species have been found in several sites in Dehong, Honghe and Xishuangbanna. Most records are from October and November.

Tamea transmarina euryale (Selys, 1878) (Fig. 45)

This species has been confirmed to be the most common libellulid in the tropical part of Yunnan, including Xishuangbanna, Honghe, Lincang and Dehong prefectures. They fly year-round.

Urothemis signata insignata (Selys, 1872) (Fig. 45)

A good character of this subspecies is the reduced size of the red brown spots on its wing bases. The nominate subspecies, which is known to occur in Hainan, Guangdong and Guangxi provinces, has much more extensive red brown marks on its wings bases.

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Table 1. Species list of Odonata from Dehong, till November 2016 (A total of 174 species are recorded here).

Zygoptera-77 species

Family Calopterygidae-11 species

- Atricalopteryx fasciata* Yang, Hämäläinen & Zhang, 2014
- Caliphaea* sp.
- Echo candens* Zhang, Hämäläinen & Cai, 2015
- Echo margarita* Selys, 1853
- Matrona nigripectus* Selys, 1879?
- Mnais andersoni* McLachlan in Selys, 1873
- Mnais gregoryi* Fraser, 1924
- Neurobasis chinensis* (Linnaeus, 1758)
- Noguchiphaea yoshikoeae* Asahina, 1976*
- Vestalaria smaragdina* (Selys, 1879)
- Vestalis gracilis* (Rambur, 1842)

Family Chlorocyphidae-8 species

- Aristocypha fenestrella* (Rambur, 1842)
- Aristocypha iridea* (Selys, 1891) *
- Aristocypha quadrimaculata* (Selys, 1853) *
- Heliocypha biforata* (Selys, 1859)
- Heliocypha perforata* (Percheron, 1835)
- Heterocypha vitrinella* (Fraser, 1935)?
- Libellago lineata* (Burmeister, 1839)
- Rhinocypha arguta* Hämäläinen & Divasiri, 1997*

Family Euphaeidae-3 species

- Anisopleura yunnanensis* Zhu & Zhou, 1999
- Bayadera hyalina* Selys, 1879
- Euphaea ochracea* Selys, 1859

Family Lestidae-5 species

- Indolestes assamicus* Fraser, 1930
- Indolestes peregrinus* (Ris, 1916)
- Lestes dorothea* Fraser, 1924
- Lestes nodalis* Selys, 1891
- Lestes praemorsus* Hagen in Selys, 1862

Family Synlestidae-2 species

- Megalestes micans* Needham, 1930
- Megalestes kurahashii* Asahina, 1985*

Incertae sedis group-1 species

- Agriomorpha* sp.

Family Platycnemididae-17 species

Calicnemia erythromelas (Selys, 1891)
Calicnemia eximia (Selys, 1863)
Calicnemia imitans Lieftinck, 1948*
Calicnemia miles (Laidlaw, 1917)
Coeliccia chromothorax (Selys, 1891)
Coeliccia didyma (Selys, 1863)
Coeliccia sp. 1
Coeliccia sp. 2
Coeliccia sp. 3
Coeliccia sp. 4
Coeliccia sp. 5
Copera ciliata (Selys, 1863)
Copera marginipes (Rambur, 1842)
Copera vittata (Selys, 1863)
Indocnemis orang (Förster in Laidlaw, 1907)
Onychargia atrocyana Selys, 1865
Prodasineura sp.1

Family Platystictidae-6 species

Drepanosticta sp. 1
Drepanosticta sp. 2
Drepanosticta sp. 3
Drepanosticta sp. 4
Protosticta sp. 1
Protosticta sp. 2

Family Coenagrionidae-24 species

Aciagrion approximans Selys 1876
Aciagrion migratum (Selys, 1876)
Aciagrion olympicum Laidlaw, 1919
Aciagrion pallidum Selys, 1891
Agriocnemis clauseni Fraser, 1922
Agriocnemis femina (Brauer, 1868)
Agriocnemis pygmaea (Rambur, 1842)
Agriocnemis splendissima Laidlaw, 1919*
Agriocnemis rubescens Selys, 1877
Ceriagrion azureum (Selys, 1891)
Ceriagrion bellona Laidlaw, 1915*
Ceriagrion fallax Ris, 1914
Ceriagrion indochinense Asahina, 1967
Ceriagrion olivaceum Laidlaw, 1914
Ceriagrion sp. 1
Ceriagrion sp. 2
Ceriagrion sp. 3
Coenagrion tengchongensis Yu & Bu, 2007

Ischnura aurora (Brauer, 1865)
Ischnura rufostigma Selys, 1876
Ischnura senegalensis (Rambur, 1842)
Pseudagrion microcephalum (Rambur, 1842)
Pseudagrion pruinosum (Burmeister, 1839)
Pseudagrion rubriceps Selys, 1876

Anisoptera-97 species

Family Aeshnidae-20 species

Anaciaeschna jaspidea (Burmeister, 1839)
Anaciaeschna martini (Selys, 1897)
Anax guttatus (Burmeister, 1839)
Anax indicus Lieftinck, 1942
Anax nigrofasciatus Oguma, 1915
Anax panybeus Hagen, 1867
Anax parthenope julius Brauer, 1865
Gynacantha bayadera Selys, 1891
Gynacantha subinterrupta Rambur, 1842
Gynacantha sp.
Gynacanthaeschna sikkima (Karsch, 1891)
Periaeschna nocturnalis Fraser, 1927*
Periaeschna sp.
Planaeschna owadai Karube, 2002*
Planaeschna sp. 1
Planaeschna sp. 2
Planaeschna sp. 3
Planaeschna sp. 4
Planaeschna sp. 5
Polycanthagyna sp.

Family Gomphidae-13 species

Amphigomphus sp. 1
Amphigomphus sp. 2
Anisogomphus caudalis Fraser, 1926*
Burmagomphus divaricatus Lieftinck, 1964
Davidius zhoui Chao, 1995
Davidius sp. 1
Davidius sp. 2
Ictinogomphus decoratus (Selys, 1854)
Lamelligomphus risi (Fraser, 1922)*
Leptogomphus gestroi Selys, 1891
Nepogomphus sp. cf. *walli*
Scalmogomphus sp.
Stylogomphus inglisi Fraser, 1922?

Family Chlorogomphidae-2 species*Chlorogomphus* sp.1*Chlorogomphus* sp. 2**Family Cordulegastridae-3 species***Anotogaster chaoi* Zhou, 1998*Anotogaster nipalensis* (Selys, 1854)**Anotogaster* sp.**Family Corduliidae- 1 species***Hemicordulia edai* Karube, 2012***Family Macromiidae-4 species***Epophthalmia elegans* (Brauer, 1865)*Epophthalmia frontalis* Selys, 1871**Macromia moorei moorei* Selys, 1874*Macromia pinratani pinratani* Asahina, 1983?**Family Synthemistidae-1 species***Idionyx stevensi* Fraser, 1924**Family Libellulidae-53 species***Acisoma panorpoides* Rambur, 1842*Aethriamanta aethra* Ris, 1912**Aethriamanta brevipennis* (Rambur, 1842)*Aethriamanta gracilis* (Brauer, 1878)**Amphithemis vacillans* Selys, 1891**Brachydiplax chalybea* Brauer, 1868**Brachydiplax farinosa* Krüger, 1902*Brachydiplax sobrina* (Rambur, 1842)*Brachythemis contaminata* (Fabricius, 1793)*Bradinygyga geminata* (Rambur, 1842)**Cratilla lineata* (Brauer, 1878)*Crocothemis erythraea* (Brullé, 1832)*Diplacodes nebulosa* (Fabricius, 1793)*Diplacodes trivialis* (Rambur, 1842)*Hydrobasileus croceus* (Brauer, 1867)*Indothemis carnatica* (Fabricius, 1798)*Indothemis limbata* (Selys, 1891)**Lathrecista asiatica* (Fabricius, 1798)*Neurothemis fluctuans* (Fabricius, 1793)*Neurothemis fulvia* (Drury, 1773)*Neurothemis intermedia* (Rambur, 1842)*Neurothemis tullia* subspecies**Orthetrum chrysis* (Selys, 1891)*Orthetrum glaucum* (Brauer, 1865)

Orthetrum luzonicum (Brauer, 1868)
Orthetrum pruinosum neglectum (Rambur, 1842)
Orthetrum sabina (Drury, 1770)
Orthetrum triangulare (Selys, 1878)
Orthetrum sp.
Palpopleura sexmaculata (Fabricius, 1787)
Pantala flavescens (Fabricius, 1798)
Phyllothemis eltoni Fraser, 1935*
Potamarcha congener (Rambur, 1842)
Pseudothemis zonata (Burmeister, 1839)
Rhodothemis rufa (Rambur, 1842)
Rhyothemis obsolescens Kirby, 1889
Rhyothemis plutonia Selys, 1883
Rhyothemis triangularis Kirby, 1889
Rhyothemis sp.
Sympetrum hypomelas (Selys, 1884)
Sympetrum speciosum haematoneura Fraser, 1924
Tetrathemis irregularis Brauer, 1868
Tholymis tillarga (Fabricius, 1798)
Tramea basilaris burmeisteri Kirby, 1889
Tramea transmarina euryale (Selys, 1878)
Tramea virginia (Rambur, 1842)
Trithemis aurora (Burmeister, 1839)
Trithemis festiva (Rambur, 1842)
Trithemis pallidinervis (Kirby, 1889)
Urothemis signata insignata (Selys, 1872)*
Zygonyx iris insignis (Kirby, 1900)
Zygonyx takasago Asahina, 1966
Zyxomma petiolatum Rambur, 1842

*** * species or subspecies recorded from China for the first time; species not yet identified to the species level are not included**

INSTRUCTION TO AUTHORS

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