Karst Forest Odonata from Southern Guizhou, China

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Abstract

The paper compiles records from four excursions to study the Odonata fauna of southern Guizhou, China. Between 2007 and 2010 in Xiaoqikong Park and Maolan National Nature Reserve, 104 taxa have been recorded. Some interesting species are discussed, compared with sibling taxa, and information on habitats and habits is given.

Introduction

The Odonata fauna of Guizhou Province is poorly known and this area has not been surveyed or reported prior this study and private surveys from 2007-2010. The very rich Odonata fauna is triggered in the north by habitats in mainly upland and preserved primary forest, and in the south by relative lowland and the karst topography with its splendid diversity of water biotopes. It is estimated that the province will hold over 200 Odonata species.

Many regional forest parks within the Province as well as some nature reserves are open to the public. Two of them, included within the Libo County borders, the southernmost area of Guizhou Province, were surveyed with particular focus on their Odonata fauna. These were: Xiaoqikong Forest Park – one of the most famous tourist sites, including the Zhangjiang River landscape spot and Maolan National Nature Reserve – famous among the Chinese national stage reserves for its Karst forest, waterfalls and carven (Figure 1).

Figure 1. Map of Libo County, S Guizhou Province, China

Xiaoqikong Forest Park (25.24-27 N 107.68-74 E, Figures 2-10): This is a free accessible park 28 km from Libo County and 56 km away from Guangxi. Within the boundaries of the park there are some lakes and a main stream about 12 km long. The elevation changes from the north 900 m to the south 400 m. The Zhangjiang River is in the south of the park near the eastern gate. This river is very abundant in many beautiful damselflies, some of them are very uncommon in the south of China.

Maolan National Nature Reserve (25.31-35 N 107.87-94 E, Figures 11-12): The reserve is situated 35 km from the central Libo County and covers a total area of 213 km^2, the southern entrance is only 70 km away from Guangxi Province border. This is a strictly protected area and anyone who wants to collect in this area should get permission from the management office in Libo County before entering.

Both the Xiaoqikong Forest Park and Maolan National Nature Reserve have been included in the world natural heritage list since 2007.

Figures 2-6. Xiaoqikong Forest Park, Photo by SLM

Figures 7-12: 7-10. Xiaoqikong Forest Park; 11-12. Maolan National Nature Reserve, Photo by SLM

Method

The Odonata fauna of both nature territories was studied in four occasions (table 1).

Table 1. Surveys in Libo County, 2007-2010

Locality	Date	Participants
Xiaoqikong Park	04-08 May 2007	Haomiao Zhang, Chunwei Bai
Maolan National Nature Reserve	25-28 July 2008	Haomiao Zhang, Ye Liu
Xiaoqikong Park	07-10 June 2010	Haomiao Zhang, Samson So
Xiaoqikong Park	07-10 July 2010	Haomiao Zhang, Shanlian Mo

Odonata were recorded (whenever possible: photographed) and voucher specimens were collected. The weather was relatively fine during the survey with occasional cloud cover and light rain.

It is known from a long lasting experience that voucher specimens of Odonata in most cases will lose their colours post mortem (e.g. Williamson 1916). I therefore decided to involve experienced photographers in my research, to take pictures on live insect prior collecting and keep as many as possible voucher specimens to have information on their colours in the life-stage.

I here use the opportunity briefly to introduce them: Since 2006 two photographers have been involved in most of the Odonata surveys in South China. Samson So (SS) (Figure 13) got his Bachelor of Science and Master of Philosophy in ecology from the Department of Ecology and Biodiversity, the University of Hong Kong, and Master of Journalism from the Journalism and Media Studies Centre, the University of Hong Kong. He had been working for the World Wide Fund For Nature, Hong Kong on different projects for 12 years. In the past 18 years Samson had undertaken extensive research, training activities as well as environmental education in Hong Kong, mainland China and South East Asia. His research interests are birds, wetlands, mangroves, dragonflies and butterflies. Mr. Shanlian Mo (SLM) (Figure 14) has focused on the photography of Odonata after he retired and he accompanied me in most of the fieldworks.

Some of the photos published in this report were taken my myself (Haomiao Zhang (HMZ).

Figures 13-14: 13. Haomiao Zhang (right) and Samson So (left) in Xiaoqikong; 14. Shanlian Mo in the field.

Use of Money from the IDF

The money granted by IDF was used for the transportation to the Xiaoqikong Park in June and July in 2010.

Results

A total of 104 species of Odonata was recorded from both areas between 2007 and 2010 (table 2). The taxonomic status of the taxa with * is currently under discussion and still has to be confirmed. All figures can be seen in the appendix to this paper.

Table 2 Species list from Libo County, southern Guizhou Province, China (XQK = Xiaoqikong Forest Park; ML = Maolan National Nature Reserve).

Taxon	Material	Status
Zygoptera		
Philoganga robusta Navás, 1936 (Figure 15)	2♂♂,2♀♀, XQK, 2007-05-06; 2♂♂,2♀♀, XQK, 2010-06-09; 1♂,1♀, XQK, 2010-07-10.	Common
Archineura incarnata (Karsch, 1891)	1♂, XQK, 2007-05-06	Uncommon
Atrocalopteryx atrocyana (Fraser, 1935)	2♂♂,2♀♀, ML, 2008-07-25	Uncommon
Matrona basilaris Selys, 1853	1♂, XQK, 2010-07-10.	Uncommon
Neurobasis chinensis (Linnaeus, 1758)	4♂♂, XQK, 2007-05-04.	Uncommon
Aristocypha chaoi (Wilson, 2004) (Figure 16)	1♂, 1♀, ML, 2008-07-25	Uncommon
Aristocypha fenestrella Rambur, 1842	2♀♀, XQK, 2010-07-10; 10♂♂,3♀♀, XQK, 2007-05-06	Common
Heliocypha perforata perforata 7 (Percheron, 1835)	4♂♂, XQK, 2007-05-04; 1♂, XQK, 2010-06-08.	Common
Indocypha catopta Zhang, Hämäläinen & Tong, 2010	3♂♂, 1♀, ML, 2008-07-25; 1♂, ML, 2008-07-28.	Uncommon
Indocypha katharina (Needham, 1930) (Figures 17-18)	16♂♂, 2♀♀, XQK, 2010-06-08; 1♀, XQK, 2007-05-06	Common
Rhinocypha drusilla Needham, 1930	1♂, ML, 2008-07-28	Uncommon

Taxon	Material	Status
Dysphaea basitincta Martin, 1904 (Figures 19-20)	4♂♂,2♀♀, XQK, 2010-06-09; 4♂♂, 2♀♀, XQK, 2010-07-09	Common
Euphaea decorate Hagen in Selys, 1853	2♂♂, 2♀, ML, 2008-07-25	Common
Euphaea superba Kimmins, 1936 (Figures 21-22)	12♂♂, 4♀♀, XQK, 2010-07-09 4♂♂, ML, 2008-07-28	Common
Philosina buchi Ris, 1917 (Figures 23-24)	22♂♂, 8♀♀, XQK, 2010-07-09; 2♂♂, 1♀, XQK, 2010-06-08; 2♂♂, XQK, 2007-05-07; 1♂, ML, 2008-07-27	Common
Rhinagrion hainanense Wilson & Reels, 2001	4♂♂,2♀♀, ML, 2008-07-25; 1♂, XQK, 2010-07-08	Uncommon
Agriocnemis femina oryzae Lieftinck, 1962	1♂, XQK, 2010-07-08;	Common
Agriocnemis pygmaea (Rambur, 1842)	1♂, XQK, 2010-07-08	Common
Ceriagrion auranticum ryukyuanum Asahina, 1967	1♂, XQK, 2010-07-08	Common
Ceriagrion chaoi Schmidt, 1964 *	1♂, ML, 2008-07-25	Uncommon
Ischnura rufostigma Selys, 1876	2♂♂, XQK, 2010-06-08	Common
Pseudagrion microcephalum (Rambur, 1842)	2♂♂, XQK, 2010-07-08	Common
Pseudagrion pruinosum fraseri Schmidt, 1934	2♂♂, XQK, 2010-07-08	Common
Pseudagrion rubriceps rubriceps Selys, 1876	1♂, XQK, 2010-07-08	Common
Pseudagrion spencei Fraser, 1922	3♂♂, ML, 2008-07-26	Common
Calicnemia eximia (Selys, 1863)	1♂♂, 3♀, XQK, 2010-07-08	Uncommon
Coeliccia cyanomelas Ris, 1912	5♂♂, XQK, 2007-05-07	Common
Copera marginipes (Rambur, 1842)	2♂♂, XQK, 2010-07-08	Common
Copera ciliata (Selys, 1863)	1♂, XQK, 2007-05-05	Uncommon

Taxon	Material	Status
Indocnemis orang Förster in Laidlaw, 1907	3♂♂, 3♀♀, ML, 2008-07-26	Uncommon
Prodasineura autumnalis (Fraser, 1922)	1♂, ML, 2008-07-26	Uncommon
Prodasineura verticalis (Selys, 1860)	12♂♂, 5♀♀, XQK, 2010-07-08	Common
Anisoptera		
Anax guttatus (Burmerister, 1839)	1♂, XQK, 2010-06-08	Uncommon
Anax nigrofasciatus Oguma, 1915	1♂, XQK, 2007-05-08	Uncommon
Anax parthenope julis Brauer, 1865	1♂, ML, 2008-07-25	Uncommon
Boyeria karubei Yokoi, 2002; (Figure 25)	1♂, XQK, 2007-05-07; 1♂, XQK, 2010-06-07; 1♀, ML, 2008-07-28	Uncommon
Gynacantha japonica Bartenef, 1909	1♀, ML, 2008-07-28	Uncommon
Periaeschna zhangzhouensis Xu, 2007 (Figure 26)	2♂, ML, 2008-07-28	Uncommon
Periaeschna flinti Asahina, 1978; (Figure 27)	4♂♂,ML, 2008-07-28; 1♂, XQL, 2010-07-08	Uncommon
Planaeschna gressitti Karube, 2002 *	1♀, ML, 2008-07-28	Uncommon
Polycanthagyna erythromelas (McLachlan, 1896); (Figures 28-29)	2♂♂, 2♀♀, XQK, 2007-05-07; 2♂♂, 1♀, XQK, 2010-06-07; 1♂, 1♀, XQK, 2010-07-08	Common
Polycanthagyna ornithocephala (McLachlan, 1896); (Figure 30)	1♂, ML, 2008-07-28	Uncommon
Anisogomphus anderi Lieftinck, 1948 (Figure 40)	2♂♂, 1♀, XQK, 2010-06-07	Common
Anisogomphus koxingai Chao, 1954	2♂, 1♀, XQK, 2010-07-08	Uncommon
Asiagomphus giza Wilson, 2005 (Figures 31-39)	1♀, XQK, 2010-07-08; 2♂♂, XQK, 2010-06-07; 3♂♂, XQK, 2007-05-07	Common
Asiagomphus pacificus (Chao, 1953)	7♂♂, 1♀, XQK, 2010-07-08;	Common

Taxon	Material	Status
(Figure 41)	6♂♂, 1♀, XQK, 2010-06-07; 1♂♂, 1♀, XQK, 2007-05-07	
Burmagomphus sp.; (Figure 44)	7♂♂, 3♀♀, XQK, 2010-07-08; 3♂♂, 3♀♀, XQK, 2010-06-07	Common
Burmagomphus gratiosus Chao, 1954 (Figure 42)	6♂, 5♀♀, XQK, 2010-07-08; 7♂, 4♀♀, XQK, 2010-06-07	Common
Burmagomphus sowerbyi Needham, 1930; (Figure 43)	2♂♂, 2♀♀, XQK, 2010-07-08; 1♂, 2♀♀, XQK, 2010-06-07	Common
Gomphidia kruegeri fukienensis Chao, 1955	1♂, XQK, 2010-07-08	Uncommon
Gomphidia kruegeri kruegeri (Martin, 1904)	1♂, XQK, 2010-07-08; 1♂, ML, 2008-07-26	Uncommon
Ictinogomphus pertinax (Hagen in Selys, 1854)	1♂, ML, 2008-07-26	Common
Labrogomphus torvus Needham, 1931; (Figure 45)	2♂♂, 2♀♀, ML, 2008-07-26; 1♀, XQK, 2010-07-08	Uncommon
Lamelligomphus camelus (Martin, 1904)	4♂♂, 2♀♀, ML, 2008-07-26	Common
Lamelligomphus formosanus (Matsumura in Oguma, 1926)	4♂♂, 1♀, ML, 2008-07-26	Common
Merogomphus paviei Martin, 1904 (Figure 46)	2♂♂, ML, 2008-07-26; 1♂, XQK, 2010-07-08	Common
Merogomphus sp.	1♂, ML, 2008-07-26	Uncommon
Nihonogomphus thomassoni (Kirby, 1900)	2♂♂, 1♀, XQK, 2010-06-07; 1♂, 1♀, XQK, 2007-05-07	Uncommon
Nihonogomphus sp.	1♂, 1♀, XQK, 2007-05-07	Uncommon
Sinictinogomphus clavatus (Fabricius, 1775)	1♂, ML, 2008-07-26	Uncommon
Stylurus amicus (Needham, 1930); (Figure 47)	1♂, 2♀♀, XQK, 2010-06-07	Uncommon
Chlorogomphus papilio Ris, 1927	1♀,ML, 2008-07-26	Migration

Taxon	Material	Status
Epitheca marginata (Selys, 1883)	2♂♂, XQK, 2007-05-07	Uncommon
Epophthalmia elegans (Brauer, 1865)	1♂, ML, 2008-07-26	Common
Idionyx carinata Fraser, 1926	1♂, ML, 2008-07-28; 4♀♀, ML, 2008-07-27	Uncommon
Macromia calliope Ris, 1916	1♂, ML, 2008-07-27; 1♂, XQK, 2010-07-08	Uncommon
Macromia chui Asahina, 1968; (Figure 48)	1♂, XQK, 2007-05-07; 1♂, XQK, 2010-06-07	Uncommon
Macromia clio Ris, 1916	1♂, XQK, 2007-05-06; 1♂, XQK, 2010-06-09	Uncommon
Macromia manchurica Asahina, 1964 (Figures 50-51)	4♂♂, ML, 2008-07-27; 1♀, XQK, 2010-06-07	Uncommon
Macromia moorei malayana Laidlaw, 1928	12♂♂, XQK, 2007-05-06; 1♂, 1♀, 1 XQK, 2010-06-07; 3♂♂, ML, 2008-07-26	Common
Macromia unca Wilson, 2004; (Figure 49)	1♀, XQK, 2007-05-06; 1♂, XQK, 2010-06-07	Uncommon
Macromia urania Ris, 1916	1♂, ML, 2008-07-27	Uncommon
Macromia sp.	1♂, XQK, 2010-07-08	Uncommon
Macromidia sp1	2♀♀, XQK, 2010-07-08	Uncommon
Macromidia sp2	1♂, ML, 2008-07-25	Uncommon
Atratothemis reelsi Wilson, 2005 (Figure 54)	1♂, XQK, 2007-05-06	Uncommon
Acisoma panorpoides panorpoides Rambur, 1842	1♂, XQK, 2007-05-06	Uncommon
Brachythemis contaminata (Fabricius, 1793)	1♂, ML, 2008-07-25	Common
Crocothemis servilia servilia (Drury, 1770)	1♂, XQK, 2010-06-07	Common

Taxon	Material	Status
Lyriothemis bivittata (Rambur, 1842)	1♂, XQK, 2007-05-06; 1♀, ML, 2008-07-25	Uncommon
Lyriothemis pachygastra (Selys, 1878)	4♂, ML, 2008-07-27	Uncommon
Lyriothemis tricolour Ris, 1919	1♀, ML, 2008-07-25	Uncommon
Neurothemis fulvia (Drury, 1773)	Observed in XQK and ML	Uncommon
Orthetrum albistylum Selys, 1848	1♂, ML, 2008-07-25	Uncommon
Orthetrum glaucum (Brauer, 1865)	Observed in XQK and ML	Common
Orthetrum japonicum internum McLachlan, 1894	1♂, XQK, 2007-05-06	Uncommon
Orthetrum luzonicum (Brauer, 1868)	2♂♂, ML, 2008-07-27	Common
Orthetrum pruinosum neglectum (Rambur, 1842)	Observed in XQK and ML	Common
Orthetrum sabina sabina (Drury, 1770)	Observed in XQK and ML	Common
Orthetrum triangulare triangulare (Selys, 1878)	Observed in XQK and ML	Common
Palpopleura sexmaculata (Fabricius, 1787)	Observed in XQK and ML	Common
Pantala flavescens (Fabricius, 1798)	Observed in XQK and ML	Common
Pseudothemis zonata (Burmeister, 1839)	Observed in ML	Common
Sympetrum darwinianum Selys, 1883	2♂♂, ML, 2008-07-27	Uncommon
Sympetrum eroticum ardens (McLachlan, 1854)	3♂♂, ML, 2008-07-27	Common
Sympetrum risi risi Bartenev, 1914	1♂, ML, 2008-07-27	Uncommon
Sympetrum parvulum (Bartenev, 1912)	1♂, ML, 2008-07-26	Uncommon
Sympetrum xiao Han & Zhu, 1997 *	1♂, ML, 2008-07-26	Uncommon
Tetrathemis platyptera Selys, 1878	1♂, XQK, 2010-06-07	Uncommon
Tramea virginia Rambur, 1842	Observed in XQK	Uncommon

Taxon	Material	Status
Trithemis aurora (Burmeister, 1839)	Observedin XQK and ML	Common
Trithemis festiva (Rambur, 1842)	Observedin XQK and ML	Common
Zygonyx iris insignis (Kirby, 1900)	4♂♂, 2♀♀,ML, 2008-07-26; 1♂, XQK, 2010-07-08	Common
Zygonyx takasago Asahina, 1966	2♂♂, XQK, 2010-06-07 10♂♂, 5♀♀, XQK, 2007-05-06	Common

Comments on selected species

From a personal view I selected some interesting species to comment on their taxonomic status and/or to give information on their habitats or habits. In general, the knowledge on the regional fauna is still poor. New species to science could well be found if the research be intensified in the future. The knowledge on the habitats, e.g. reproduction biotopes, is very basic. The notes on the habits of some species, provided here, will help odonatologists to trace more efficiently species within this region and other understudied areas in China.

Philogangidae

Philoganga robusta Navás, 1936

This very robust species is one of the largest damselflies in China. Its body is predominantly black and possesses an uninterrupted antehumeral stripe in both sexes.

The emergence started from late April in this area, and most of the individuals were not fully mature in early May. They were observed to hang on the branches of the naked trees in very sunny afternoon while all other species disappear. These immature individuals can tolerate long time exposure to the sun in early May, even when daytime temperatures reach more than 30°C. This species was common in Xiaoqikong Park and was easy to be found along the river and stream sides.

Calopterygidae

***Archineura incarnata* (Karsch, 1891) and *Neurobasis chinensis* (Linnaeus, 1758)**

A. incarnata is a very attractive large sized calopterygid. It was recorded from a large range in southern and southwestern China. It is very strange that only one male was found in early May 2007 in Xiaoqikong Park, and not a single specimen was collected in the surveys conducted later. The main stream in this park is rocky and similar to

those habitats in Guangdong where the species is abundant. This may be related to some floods attacking the park which even destroyed the stony road for tourists. A second calopterygid, *N. chinensis*, also disappeared during the floods and only was collected in early May in 2007. At that time it was rather common along the river.

I visited the same place many times again. Nothing changed in the habitat and some species like *Philosina buchi and Euphaea superba* were still flourishing.

Atrocalopteryx atrocyana (Fraser, 1935)

Its broad bluish violet wings separate it easily from other members of the family. Several very old individuals were found in a shady forest in Maolan Reserve in late July. The stream passing through the forest was rocky and fast flowing. Two female specimens were collected in north Guangdong in a lowland paddy field when they were resting in a ditch along the footpath.

Chlorocyphidae

Aristocypha chaoi (Wilson, 2004)

It was described from Guangdong and recently known from Guizhou, Chongqing, Hunan and Vietnam (own unpublished records and information made available by colleagues). I have discussed the Guizhou specimens with Matti Hämäläinen and compared with specimens from Guangdong. We confirmed that this is a widespread species with a variable body maculation. It is an obligatorily forest dwelling species with an altitudinal distribution ranging from 450m to 1100m a.s.l. The sampling site in Maolan Reserves was around 840m. More research on the distribution is needed especially for the Chongqing specimens.

Indocypha catopta Zhang, Hämäläinen & Tong, 2010

This orange and large chlorocyphid was recently described from Maolan Reserve and is only known from the type specimens (for details see Zhang et al. 2010).

Indocypha katharina (Needham, 1930)

This is a medium size *Indocypha* with reddish brown abdomen. The thorax is mainly black with some fine yellow stripes. The maculation of basal abdominal segments is very variable. An extraordinary male with predominantly white abdomen was described from Sichuan (Needham 1930) and also recorded from the neighboring provinces Guangxi and Guangdong (Wilson & Reels 2003; Wilson & Xu 2007).

The males hold the territory in the vegetated riverside. They usually perch on top of

the overhanging branches or the tree leaves near the river bank. Three or four males can be found perching within a distance of 3 metres. Females are very difficult to find. They only appear in sunny days. A young female was collected in early May and many males were collected in July.

***Dysphaea basitincta* Martin, 1904**

All male specimens of this species in Zhangjiang River belong to the entirely 'blackened wing form' as illustrated and discussed by Wilson and Reels (2003). No typical form (see: http://www.flickr.com/photos/grahamreels/5059839196/) occurred in this area, but all male specimens from Taiyanghe river, Hainan Province belong to the normal form. More taxonomy research is needed for this blackened form.

It is a dominant species in the river. Males hold their territory by perching on the rocks or branches hanging down the water surface. Females are easily to be found in the riverside resting on the top of the branches. Both sexes are susceptible for disturbance and suddenly fly far away. After mating tandem pairs can travel a long time along the riverside to find a good oviposition site. Females oviposit underwater. It can be seen even in rainy days and becomes fully mature in early May.

***Euphaea superba* Kimmins, 1936**

This is a reddish brown species and a dominant species along the river. The reddish brown stripes on thorax of the males do not change with the age. The males behave similar as *Dysphaea basitincta*, sometimes males of the two species compete for the territory. Immature males and young females can be encountered in very shady bamboo grove.

***Philosina buchi* Ris, 1917**

This is very robust, white coloured damselfly with the male's distal abdomen brightly red. Fully maturated males will get highly pruinose with than a light red abdomen. This is a very strong flyer which performs the flight similar to an aeshnid. It is very abundant in this area. Both sexes are active all the daytime, even after sunset. Females were observed to oviposit into the mud with high gradient of the riverside.

***Rhinagrion hainanense* Wilson & Reels, 2001**

The species was described from Hainan and here is the first record of the genus from mainland China. A small group of males were collected in the bamboo grove close to the stagnant sections of the stream in Maolan Reserve, and two females were found close to the male sites. A male was collected also in the bamboo grove in Zhangjiang River in July.

Aeshnidae

Boyeria karubei Yokoi, 2002

A teneral male was collected in early May and an immature male was collected in early June in Zhangjiang River. A female was observed to emerge in the afternoon in early May, which is extraordinary as most aeshnid larvae tend to emerge at night or early morning. Many females were observed to oviposit into the mud in forest streams in Guangdong (personal record from Chebaling National Reserve and Nankunshan Reserve). Mature males are difficult to find. The species is very active at dusk. In a night survey in Nankunshan (21:00-22:00, July 2009) some individuals were found roosting near the stream, perching rather low on the trees and easy to reach.

Periaeschna zhangzhouensis Xu, 2007

It was found in a narrow stream near the biggest of the Latan Waterfalls in Maolan Reserve. The individuals were active rather late in the afternoon together with males of *P. flinti.* The species is also locally common in central Guizhou and some protected area in Guangdong. All *Periaeschna* species are very active at dusk, males hold their small territories along the stream with hovering flight.

Planaeschna gressitti Karube, 2002 *

The species is known by a single female only collected in a sunny morning near the Lantan Waterfall in Maolan Reserve. The colour pattern is identical to the holotype male of *P. gressitti* from Guangdong. The species is very similar to *P. suichangensis* and *P. tamdaoensis* in both the colour pattern and the structure of genitalia.

Gomphidae

The recorded 19 gomphids were mainly found in the Zhangjiang river, some of them, such as *Asiagomphus*, *Burmagomphus* and *Lamelligomphus* species were very abundant in this area. In the June survey, hundreds of *Burmagomphus* larvae were observed emerging during the daytime, the emergence peak was around 9:00-11:00. Only *Asiagomphus pacificus* is the resident of the mountain streams, and more species are expected to be found in such habitats. Several species from the genera of *Burmagomphus*, *Merogomphus* and *Nihonogomphus* are probably un-described taxa.

Asiagomphus giza Wilson, 2005

This is a poorly known species and described from a single female from Guangxi. The male from Xiaoqilong is identical to the female in maculation (Figures 31, 33). The holotype female has three stout horns on the occipital ridge (Figure 32), which is

similar to *A. perlaetus*. A single female collected from Xiaoqikong has more developed yellow stripes than the holotype (Figure 34). The structure of the male appendages (Figures 36, 38) and penis (Figure 35) is similar to *A. perlaetus*, but the anterior hamule (Figure 37) exhibits three serrations, a structural character which is different from *A. perlaetus*. Chao (1990) pointed the distal margin of anterior hamule of *A. perlaetus* without any serration. Valvulae vulvae of female *A. giza* is well developed to form a pair of triangular-shaped flaps (Figure 39) which is different from *A. perlaetus* .

***Burmagomphus gratiosus* Chao, 1954**

This species is very closely related to *B. vermicularis* and can be distinguished following the diagnosis in Chao (1990): 1) the labrum entirely black; 2) postclypeus without yellow spots; 3) dorsal stripes disconnect with lower antehumeral stripe; 4) superior spot absent; 5) S8 entirely black; 6) distal S10 with very fine yellow stripes.

It is common in the Zhangjiang River. Emergence starts from early June and takes place during daytime. Immature individuals stay in the open area of the river bank during maturation, forage and perch on the hillside. Fully mature individuals were common in July.

***Burmagomphus* sp.**

This is a relatively large member of the genus. The thorax in both sexes possesses completed second and third lateral stripes. Two Chinese *Burmagomphus* species - *B. arvalis* and *B. intinctus* - have such similar stripes, and they are very closely related to the doubtful taxon discovered during the current research, but can be separated by the structure of superior appendage. This interesting species from Guizhou is very easy to distinguish from *B. arvalis* and *B. intinctus* by the presence of a spinous tooth on the inner margin of superior appendage. More research is needed to clarify the taxonomic status of the species.

***Merogomphus* sp.**

One unidentified species is reported here. It is similar to *M. paviei*, but can be distinguished by its larger size, abdominal maculation and the relatively short appendages. The two species co-occur in Maolan Reserve. More research is needed to settle the taxonomy of the species.

Cordulegastridae

***Chlorogomphus papilio* Ris, 1927**

In my note book I wrote “The single female was found flying very high near the biggest Latan Waterfall in Maolan Reserve in the sunny afternoon, it was foraging

together with many *Zygonyx iris insignis* but very extractive by the colourful wings. ” The specimen is thought to be a migrant since there is no suitable habitat for Chlorogomphinae in the surveyed area. Most of the rivers and streams are too deep for the members of this taxonomic group.

Corduliidae

Like Gomphidae, most species of the family were collected and observed in the river habitat and several upriver branches in Maolan Reserve.

***Epitheca marginata* (Selys, 1883)**

It was originally known from Japan, South Korea and central China. (Selys-Longchamps 1883, Asahina 1989, Needham 1930). This record in Guizhou extends its range to southern China. I also collected some specimens in a reservoir in Guiyang City, central Guizhou province in late April, believing now it is widespread in this province. The second Chinese species, *E. bimaculata* (Charpentier, 1825), is widespread in northern China.

***Macromia calliope* Ris, 1916**

This small *Macromia* species was found at many sites within the area. It was collected in the tributary to the main river in Maolan Reserve and then in some narrow streams in the Xiaoqikong Park. The males patrolled in a very small area along the riverside and streams with stable flight. It co-occurs with *M. urania* and an additional *Macromia* species also belonging to the *calliope*-group.

***Macromia chui* Asahina, 1968**

This species, originally described from Taiwan, and now known from the Chinese mainland, seems to be widely distributed in southern China. I have found it in many lowland rivers and streams in Guangdong province. Fully mature specimens were collected in early May. It is an early season species in Guangdong, and flight period is from April to late July.

***Macromia manchurica* Asahina, 1964**

This is a medium size species within the genus. The male possesses a pyramidal process on S 10 but does not develop a long spine. There is a pair of triangular shaped spots on the labrum in both sexes. A similar species *M. hamata*, described from Guizhou also possesses a similar pyramidal process on S 10 and two yellow spots on labrum, the body maculation is also very similar. *M. manchurica* can be distinguished from *M. hamata* by the absence of the triangular shaped hammer at the tip of posterior hamulus.

M. manchurica was also found in many lowland streams and rivers in Guangdong, also recorded from the northeast of China (Zhu & Ou 1998).

Additional material of the two species from other provinces of China is also harbored in the collection of the author and is ready for further examination of the two species:

- *Macromia manchurica:* 6♂♂, 3♀♀, 13 Aug 2005, Mudanjiang River, Mudanjiang City, Heilongjiang Province, N. China; 2♂♂, same locality, 27 July 2001; 1♂, 15 July 2007, Yinshitan Park, Dalian City, Liaoning Province; 1♀, 01 Aug. 2007, foot of Mt. Yunmengshan, N. Beijing; 2♂♂, 17 Aug 2008, Yadongxi, Conghua City, Guangdong Province, China; 4♂♂, 1♀, 22 Sep.2010, Chebaling National Nature Park, Shaoguan City, Guangdong;
- *Macromia hamata:*1♂, 1♀, 13 Aug 2010, near Wannian Temple, Mt. Emeishan, Sichuan Province.

***Macromia moorei malayana* Laidlaw, 1928**

The species is very abundant in this area and appears very early in the season. Adults only inhabit the upland streams and never appear in the lowland river. Males patrol all the day time when the weather is fine, and sometimes they can be seen wandering over the road. The exuviae can be found clipped at the big rocks in the streams.

***Macromia unca* Wilson, 2004**

This rather small and robust species prefers gloomy weather. Individuals are active in dawn and usually aggregate for foraging in a small group. It is very difficult to encounter them in day time. I collected a very young female in early May in Zhang-jiang River. When disturbed it perched in the bamboo grove in the southern side of the river. It made a short flight and returned to the same branch again. Several old males were collected in the cloudy afternoon in July. It is an early season species with emergence time starting from middle of April in Guangdong.

***Macromia* sp**

Several interesting specimens of the *calliope*-group from Guizhou and Yunnan Provinces are still not properly identified. Comparative material from Asia is needed.

***Macromidia* sp1**

Only two females were collected from this small sized species. It is active in twilight, both sexes were observed to fly across the riverside in rapid flight. A male specimen is expected to reveal its true identity.

***Macromidia* sp2**

A singe male specimen was collected with the distal abdominal segments missing. It is related to *M. kelloggi* from Guangdong, Fujiang and Zhejiang but lager than *M. kelloggi* specimens from Guangdong and Zhejiang.

It was found in a narrow stream with dense submerged aquatic vegetation in Mao-lan Reserve. More specimens are needed for taxonomic research.

Libellulidae

***Atratothemis reelsi* Wilson, 2005**

A single male of this beautiful and rare libellulid was collected in Xiaoqikong Park in early May. Four individuals were observed at the small shady pool deeply hidden in the Guibeishan Mount in a sunny morning. They all were flying quickly across the forest and remained in this pool with less than one minute circling flight. It seems that this pool was not their typical habitat but accidental visitors (for more details see Wilson 2005).

***Lyriothemis bivittata* (Rambur, 1842)**

This large and orange red species is rare in the studied area. The first male was collected in early May and an old female was collected in late July. An old female of *Lyriothemis tricolour* was also collected in late July. Both species were found perching near a waterfall. *L. pachygastra* can be found in some farmland biotopes of Maolan Reserve and is more likely to be encountered.

***Orthetrum japonicum internum* McLachlan, 1894**

This is an early season species and was collected in a paddy field in Xiaoqikong Park. It was also found in many other paddy field sites of the province including Mt. Fanjingshan and Doupengshanv (personal records). This taxon should be widespread in Guizhou. It is now known as widely distributed in southern China, and I had encountered it in paddy fields located in southern Zhejiang and Hunan.

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Appendix

Figures 15-16: 15. *Philoganga robusta* male, Photo by SLM; 16. *Aristocypha chaoi* male, Photo by SLM

Figures 17-18. ***Indocypha katharina*** **males, Photo by SLM**

Figures 19-20. *Dysphaea basitincta* 19. Pair in wheel; 20 female, Photo by SLM

Figures 21-22. *Euphaea superba*: 21.tandem pair; 22. male, Photo by SLM

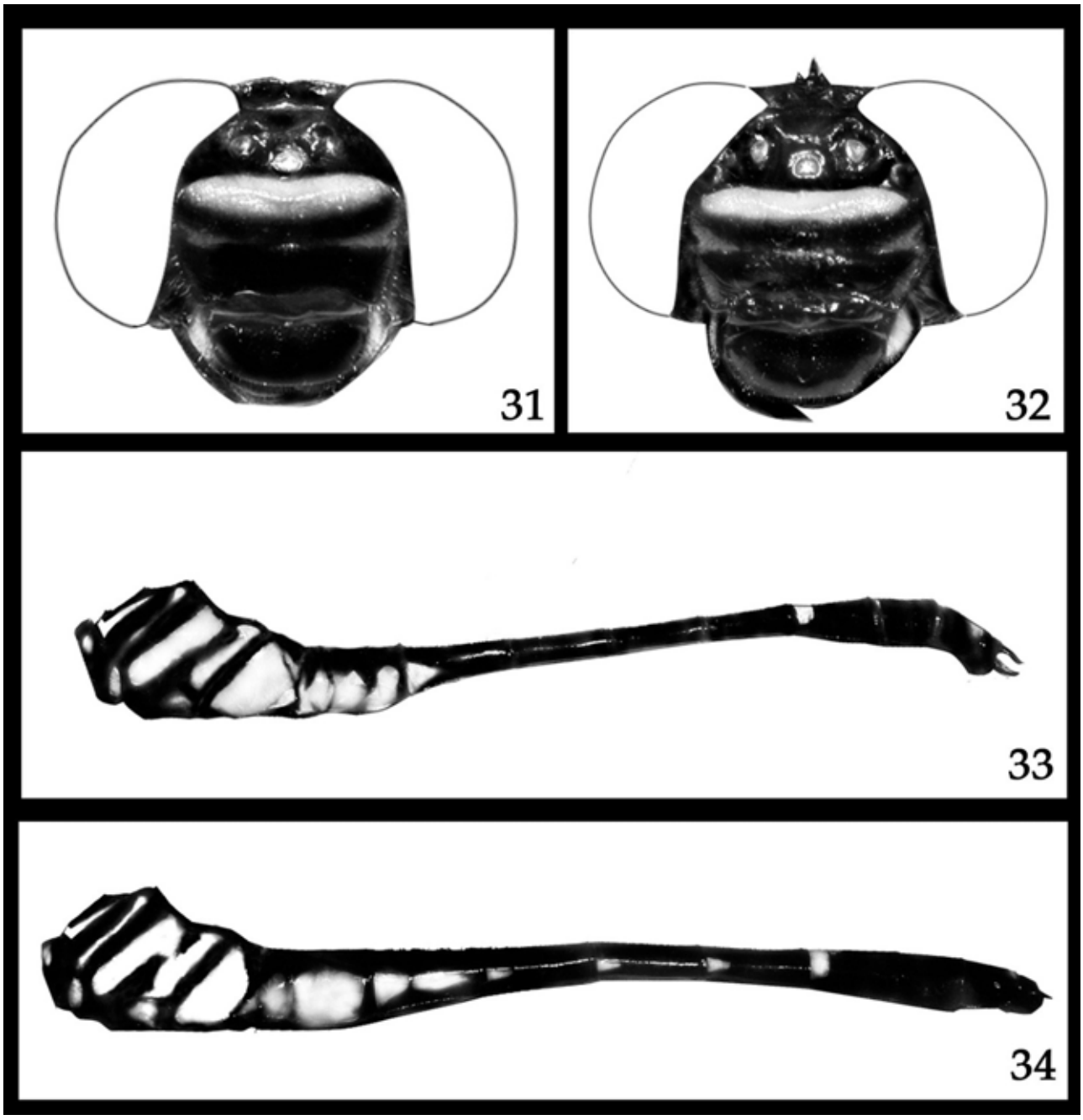
Figures 23-24. *Philosina buchi:* 23. male; 24. female, Photo by SLM

Figure 25. ***Boyeria karubei male,*** **Photo by SLM**

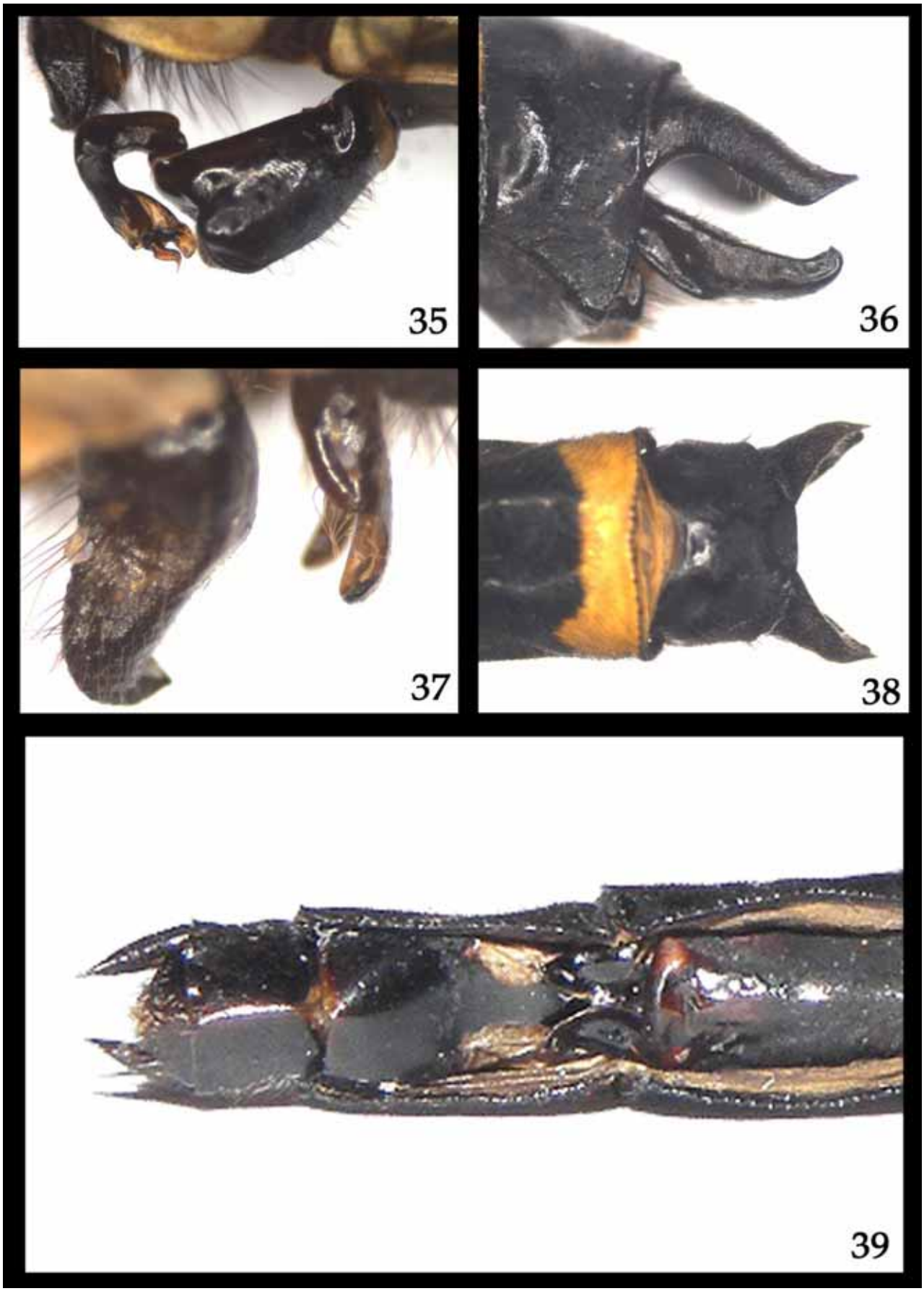
Figure 26. ***Periaeschna zhangzhouensis*** **male, Photo by HMZ**

Figures 27-28: 27. *Periaeschna flinti* male, Photo by SLM; 28. *Polycanthagyna erythromelas* male, Photo by SS

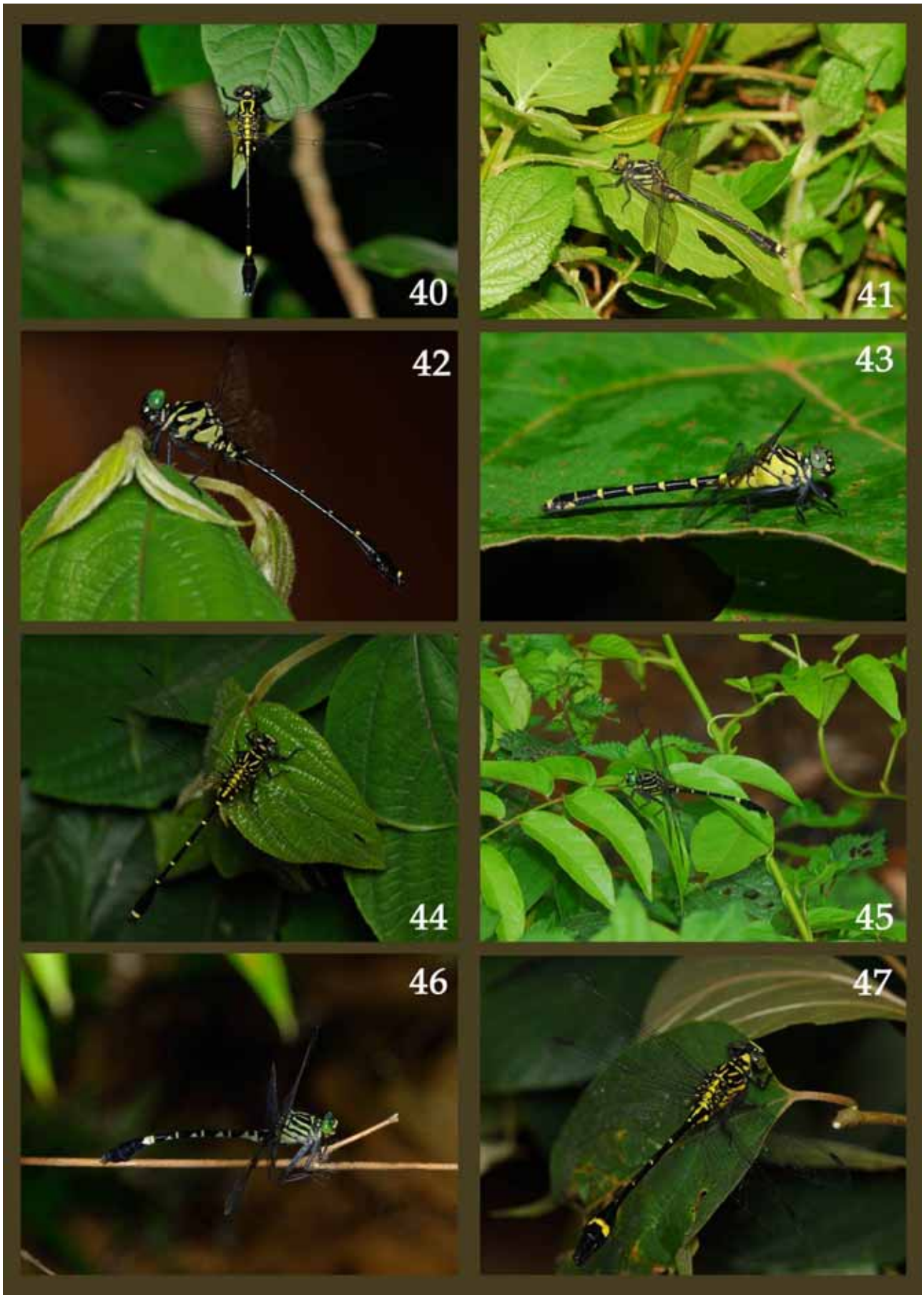
Figures 29-30: 29. *Polycanthagyna erythromelas* male, Photo by SLM; 30. *Polycanthagyna ornithocephala* male, Photo by SLM



Figures 31-34. *Aisagomphus giza*: 31. male head, frontal view; 32. female head, frontal view; 33. male thorax and abdomen, lateral view; 34. female thorax and abdomen, lateral view. Photo by HMZ.



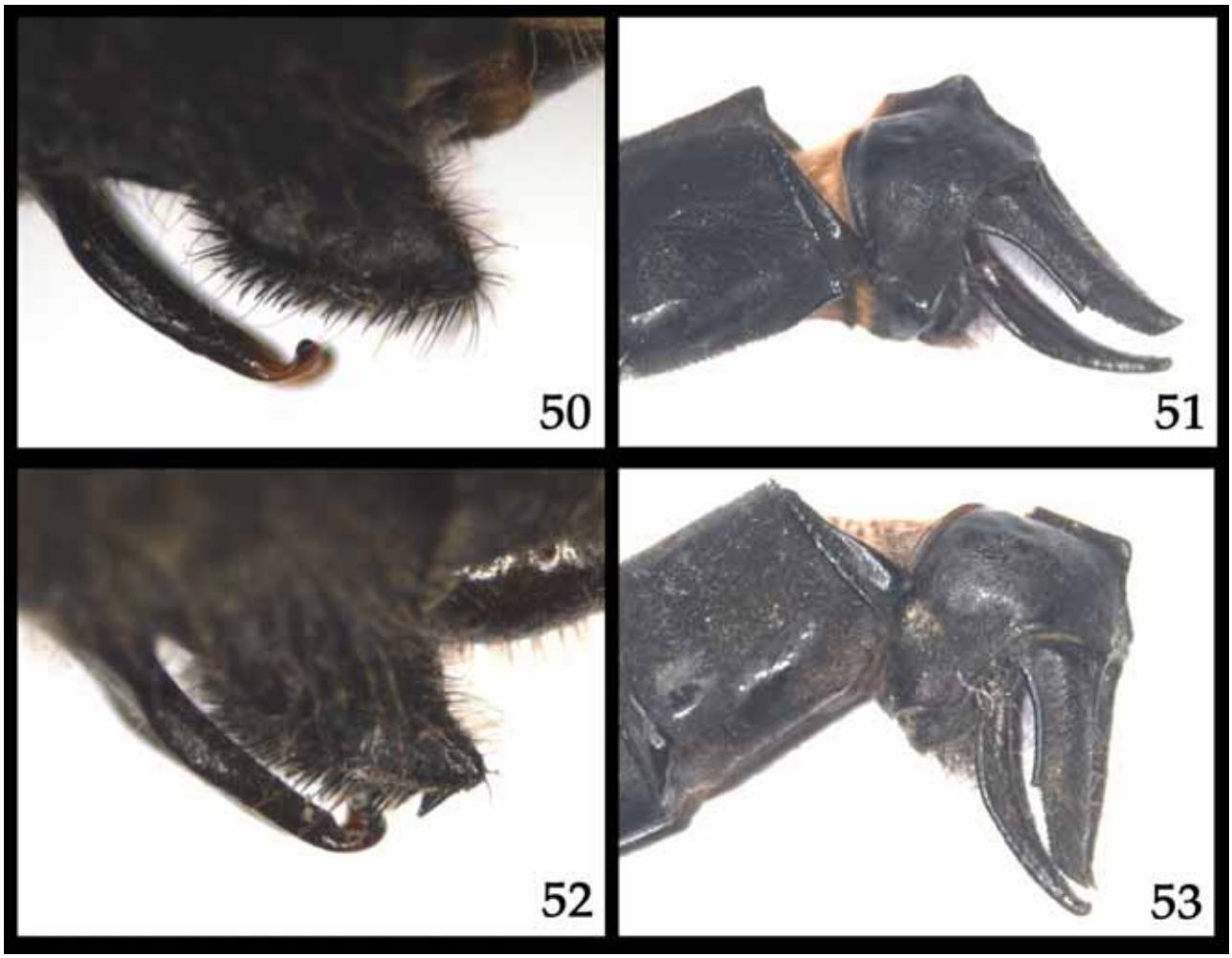
Figures 35-39. *Aisagomphus giza*: 35. penis, lateral view; 36. male caudal appendages, lateral view; 37.hamules, lateral view; 38. male appendages, dorsal view; 39. female valvula vulvae, ventral view, Photo by HMZ.



Figures 40-47: 40. *Anisogomphus anderi* male, Photo by SS; 41. *Asiagomphus pacificus* male, Photo by SLM; 42. *Burmagomphus gratiosus* male, Photo by SS; 43. *Burmagomphus sowerbyi*

female, Photo by SLM; 44. *Burmagomphus* sp. male, Photo by SS; 45. *Labrogomphus torvus* male, Photo by SLM; 46. *Merogomphus paviei* male, Photo by SLM; 47. *Stylurus amicus* male Photo by SS

Figures 48-49: 48. *Macromia chui* male, Photo by HMZ; 49. *Macromia unca* male, Photo by HMZ



Figures 50-53: 50-51. *Macromia manchurica*: 50. hamules, lateral view; 51. male caudal appendages, lateral view; 52-53. *Macromia hamata*: hamules, lateral view; 53. male caudal appendages, lateral view, Photo by HMZ

Figure 54. *Atratothemis reelsi* male, Photo by HMZ