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Faunistic Studies in South-east Asian and Pacific Island Odonata

Rosser W. Garrison, Adolfo Cordero-Rivera & Haomiao Zhang

Odonata collected in Hainan and Guangdong Provinces, China in 2014

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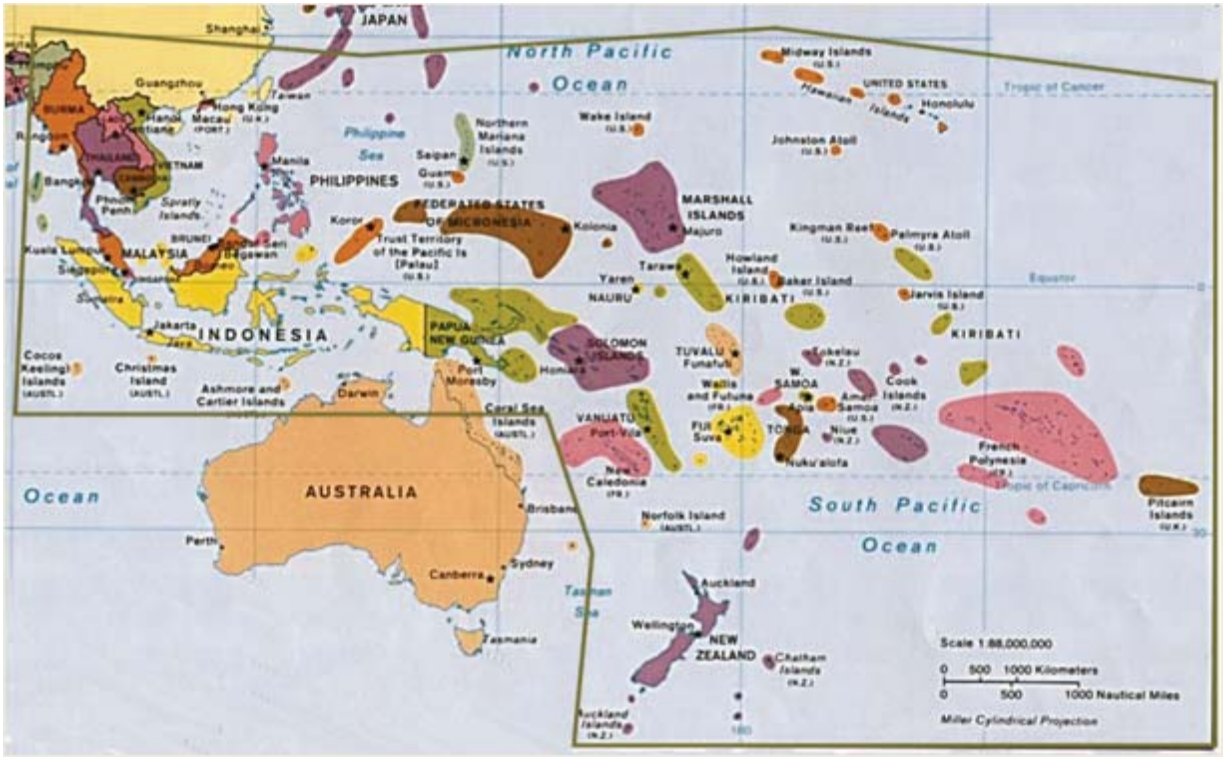

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Male of *Rhyothemis plutonia* Selys, Hainan, China (Zhang photo).

Odonata collected in Hainan and Guangdong Provinces, China in 2014

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Abstract

A three week trip to Hainan and Guangdong provinces was conducted between 26 May and 11 June 2014, sampling odonates within the vicinity of Diaoluoshan National Nature Reserve, Shuimanxing Village (both Hainan Province) and Nankunshan Nature Reserve (Guangdong Province). Additionally, Cordero and Zhang collected at Shuimanxing Village between 13 and 23 June. A total of 103 species in 78 genera were found for Hainan Province and 51 species in 42 genera in Guangdong Province. Lists of all species by locality, photographs of live specimens, are presented to facilitate identification to other collectors.

Key words: Odonata, China, Hainan, Guangdong

Introduction

At the invitation of the Chinese Academy of Sciences and H. Zhang, Rosser Garrison and Adolfo Cordero were invited to participate in a three week trip to survey the Odonata fauna at three localities in Hainan and at one in Guangdong, China from 26 May through 11 June, 2014 and one locality in Hainan (Shuimanxing Village between 13 and 23 June) for Cordero and Zhang. The Odonate fauna for China is a rich one and is becoming better known primarily through recent intensive collecting surveys especially in Yunnan Province by Zhang and it is estimated that well over 800 species occur in China —about twice that for the United States. Other researchers including Bu, Dumont, Hämäläinen, Kalkman, Kosterin, Reels, Wilson, Yu have also contributed to the knowledge of the Odonata of this large country. Furthermore, various areas of China remain largely unexplored and the total number of species for the country will undoubtedly increase. Hainan and especially Guangdong provinces have been sampled intensively and their Odonata fauna is relatively well known. Several surveys of the Odonata fauna of Nankunshan Nature Reserve in Guangdong by Zhang, and nature photographers Hongdao Wu and his wife have resulted in a wonderfully illustrated field guide: Huizhou Dragonflies (2012) and later by Dragonflies of Nankunshan, China (2014) by Cui Xiao Dong. The Odonata fauna of Hainan has recently reviewed by Wilson & Reels (2001), Zhang & Tong (2009), Hämäläinen et al. (2009), Reels (2010) and Guan & Dumont (2012). The goal of our trip was to 1: inventory the Odonata from these localities within different biomes and habitats and 2: study the reproductive biology of the endemic Hainan damselfly, *Pseudolestes mirabilis* Kirby.

Methodology

We met at the Guangzhou Baiyun International Airport on the afternoon of 26 May and took the overnight train to Haikou, Hainan arriving early the next morning, 27 May. The five of us, Rosser Garrison, Haomiao Zhang, Adolfo Cordero, Hongdao Wu and his wife Cuizhen Yan proceeded by rental car to the first locality, the Diaoluo-

shan National Nature Reserve. Our itinerary and lengths of stay are given below and are shown in Figure s 1 and 2.

Photographing and sampling of odonates with entomological aerial nets was carried out in various localities along trails, streams and rivers, and around swamps and ponds. Classification follows Dijkstra et al. 2013b. Numbers immediately following a species name (e. g.: – 1, 2, 3) refer to numbered localities listed below.

Locations

Hainan Province:

1- CHINA: Hainan Prov., Lingshui County, Benhao town, Diaoluoshan National Nature Reserve & vicinity, 18° 43' 29.9" N, 109° 52' 07" E, 937m, 27–31 May 2014 (Fig. 1). This locality consists of a series of hotels with individual rooms centered in a wonderful area of forest, a large lake (Fig. 3), and various streams and trails (Fig. 4) in the forest. Since the resort was off the beaten path and was away from any town. Localities also included roadside seeps on route to the Nature Reserve (Fig. 5).

2- CHINA: Hainan Prov., Wuzhishan City, Mt. Wuzhishan, Shuimanxing Village, 18° 53' 30.5" N, 109° 40' 18.1" E , 688m, 31 May – 1 June 2014 and 13 – 23 June (Cordero and Zhang) (Fig. 1). A small mountain stream partially shaded along varied parts as well as paths parallel to the creek (Figs. 6, 7).

3- CHINA: Hainan Prov., Xinglong County, Nan-Lin, Taiyanghe River, 18° 43' 32.6" N, 110° 08' 22.3" E , 44m, 2 – 3 June 2014 (Fig. 1). A large largely shallow exposed gravelly river (Fig. 8).

Guangdong Province:

4- CHINA: Guangdong Prov., Nankunshan Nature Reserve, Tian Tang Ding Forest Holiday Villa and vicinity, 23° 38' 25.0" N, 113° 51' 31.9" E, 501m, 5 – 10 June 2014 (Fig. 2). Varied streams shaded, to open, various trails, and an artificial pond and mud puddles around the holiday Villa. The week spent here was immediately after torrential rains had caused flooding in the area. Weather conditions were often cloudy and overcast but some days were hot and sunny. Most of the collecting was done along moderately wide gravely/rocky stream (Fig. 10) near the Tian Tang Ding Forest Holiday Villa at the Nankunshan Nature Reserve (Fig. 9).

5- CHINA: Guangdong Prov., Guangzhou, Campus pond, South China Agricultural University, 23° 09' 30.1" N, 113° 21' 23.6" E, 47m, 12 June 2014 (Fig. 2). A largely shaded pond within a park area on the University campus.

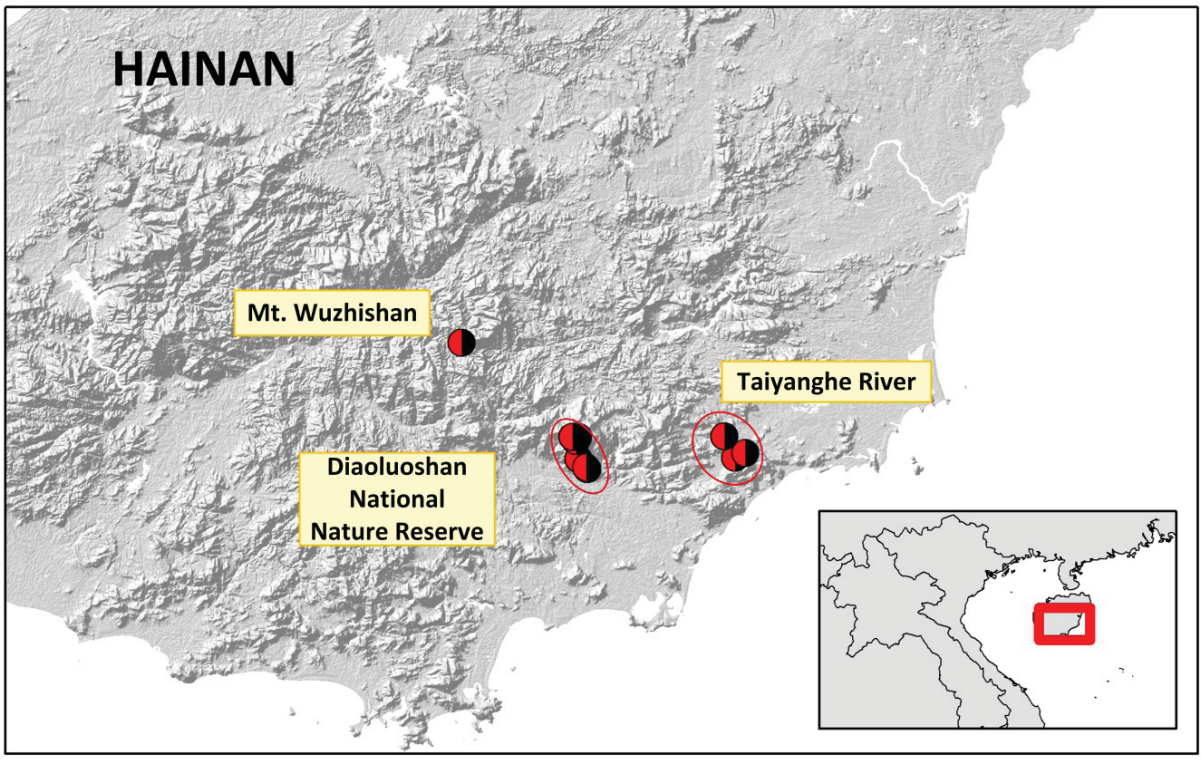

Figure 1. Map of southeastern Hainan Province showing localities visited.

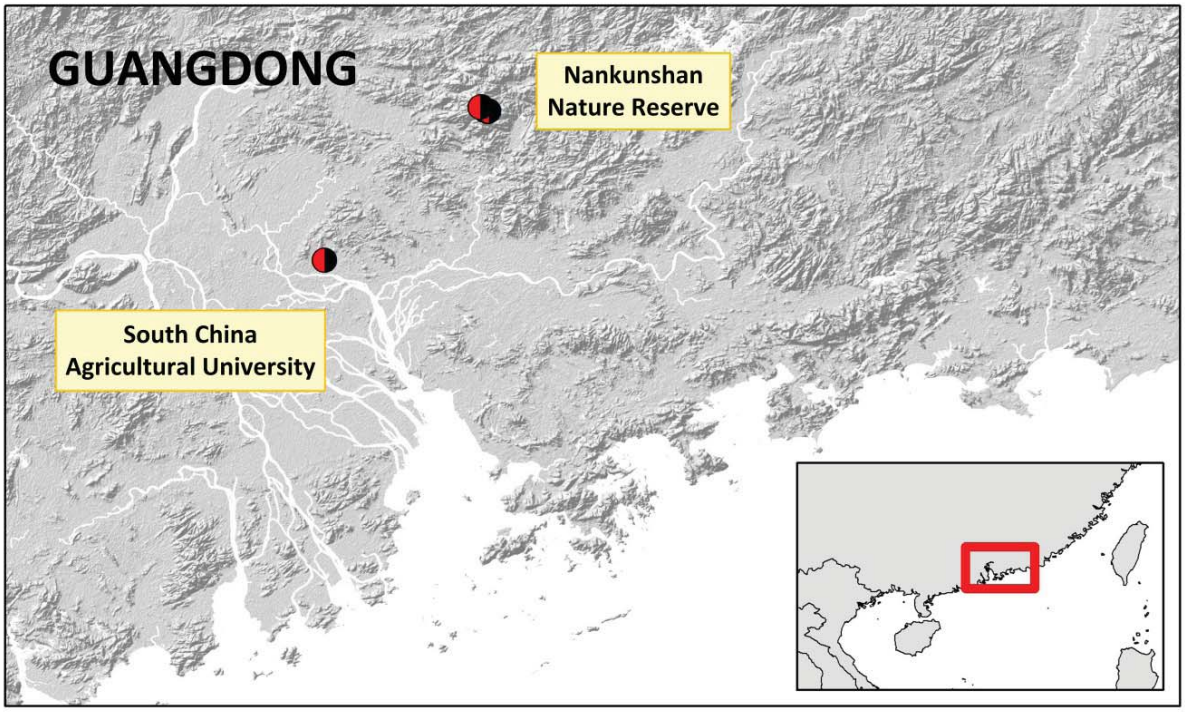

Figure 2. Map of southeastern Guangdong Province showing localities visited.

Figure 3. Pond at Diaoluoshan National Nature Reserve. *Copera ciliata, Acisoma panorpoides, Neurothemis fulvia, Palpopleura sexmaculata, Pantala flavescens, Pseudothemis zonata, Trithemis aurora* were found along the pond margins (Garrison photo).

Figure 4. Dirt path at Diaoluoshan Reserve. Along this path were found *Pseudolestes mirabilis*, species of *Orthetrum glaucum, O. pruinosum, O. triangulare* and occasionally *Philoganga vetusta* (Garrison, photo).

Fig. 5. Collecting along a roadside seep below Diaoluoshan Reserve. *Drepanosticta zhoui, Burmargiolestes xinglongensis* (both endemic to Hainan) and *Agriomorpha fusca* were collected by hand picking. Adolfo Cordero at left and Hongdao Wu and Cuizhen Yan on right (Garrison photo).

Fig. 6. Dirt road leading to creek above Shuimanxing Village (Garrison photo).

Figure7. Shaded portion of creek above Shuimanxing Village. *Drepanosticta elongata, D. zhoui, Agriomorpha fusca, Coeliccia cyanomelas, C. scutellum hainanense, Pseudolestes mirabilis, Mnais mneme, Periaeschna magdalena, Tetracanthagyna waterhousei, Leptogomphus celebratus, Chlorogomphus usadai, Idionyx victor, Macromidia rapida, Neurothemis fulvia* and several other species were found here (Garrison photo).

Fig. 8. Hainan Nan-Lin, Taiyanghe River. The few species were collected at this stream included *Libellago lineata, Dysphaea basitincta, Pseudagrion rubriceps, Pseudagrion pruinosum fraseri, Gomphidia kruegeri kruegeri* and *Ictinogomphus pertinax* although other species are known to occur here.

Fig. 9. Tian Tang Ding Forest Holiday Villa, Nankunshan Nature Reserve (Garrison photo).

Fig. 10. Open rocky stream below Tinn Tang Diang Forest Holiday Villa, Nankunshan Nature Reserve. *Lamelligomphus camelus* and *Macromia malleifera* flew here. Several other species including *Philoganga vetusta, Agriomorpha fusca, Rhipidolestes truncatidens, Calicnemia sinensis Coeliccia cyanomelas, Archineura incarnata, Atrocalopteryx melli, Mnais mneme, M. tenuis, Aristocypha chaoi, Bayadera bidentata, B. melanopteryx, Euphaea decorata, Periaeschna magdalena, Asiagomphus hainanensis, Gomphidia kruegeri, Leptogomphus intermedius, Megalogomphus sommeri, Nihonogomphus semanticus, Chlorogomphus kitawakii* and *Lyriothemis tricolor* occurred further upstream. (Garrison photo).

Fig. 11. *Philoganga vetusta* male Diaoluoshan Forest Reserve (Cordero photo).

Fig. 12. Male of *Matrona mazu* Diaoluoshan Forest Reserve (Cordero photo).

Fig. 13. Male of *Mnais mneme* Diaoluoshan Forest Reserve (Garrison photo).

Fig. 14. Male of *Neurobasis chinensis* (Cordero photo).

Fig. 15. Male of *Aristocypha aino* Diaoluoshan Forest Reserve (Cordero photo).

Fig. 16. Male of *Libellago lineata* Taiyanhe river (Cordero photo).

Results

Hainan Province:
The time spent here was during a drought which resulted in hot dry weather and low water levels. We collected 103 odonate species, representing about 60% of the total fauna (172) known from Hainan province.

Zygoptera:

PHILOGANGIDAE:
Philoganga vetusta Ris, 1912 –1. One male collected on dirt trail (Fig. 11).

CALOPTERYGIDAE:
Matrona mazu Yu, Xue & Hämäläinen, 2015 –1. A few males (Fig. 12) were seen on partially shaded streams at the reserve. This species was recently described and differentiated from Matrona basilaris Selys (Yu, Xue & Hämäläinen, 2015).

Mnais mneme Ris, 1916 –1, 2. Seen almost everywhere along small forested streams or seepages. Both orange-winged (Fig. 13) and hyaline-winged forms were seen.

Neurobasis chinensis (Linnaeus, 1758) –2, 3. Found only on exposed (i.e., largely lacking shade) streams (Fig. 14).

Vestalaria miao (Wilson & Reels, 2001) –1, only one male was collected in shady area near large open rocky river on road to Diaoluoshan National Nature Reserve.

Figure 17. Juvenile male of *Libellago lineata* perched in partial shade at Nan-Lin (Garrison photo).

CHLOROCYPHIDAE:
Aristocypha aino Hämäläinen, Reels & Zhang 2008 –1. A few males (Fig. 15) collected along shaded portions of stream often in company with Pseudolestes mirabilis.

Libellago lineata (Burmeister, 1839) –3. A few males collected margin of Taiyanghe River (Fig. 16). Their small size and proclivity to perch horizontally on vegetation on water's surface made them inconspicuous. Juvenile males and females were collected as they perched on branches in shade (Fig. 17).

Heliocypha perforata (Percheron, 1835) –2. Found only on exposed streams in company with Neurobasis chinensis (Fig. 18).

Figure 18. Male of *Heliocypha perforata* Diaoluoshan Forest (Cordero photo).

EUPHAEIDAE:
Dysphaea basitincta Martin, 1904 –3, A couple of males seen at the Taiyanhe River, only one taken. This species is normally common at this locality.

Euphaea ornata (Campion, 1924) –1, 2, 3, Endemic to Hainan, seen on almost every stream habitat (Fig. 19).

MEGAPODAGRIONIDAE:
Agriomorpha fusca May, 1933 –1, 2. ound everywhere along shaded seepage areas or along sides of stream. An abundant species (Fig. 20).

Figure 19. Male of Euphaea ornata Diaoluoshan Forest Reserve (Cordero photo).

Figure 20. Male of *Agriomorpha fusca* at Nankunshan Forest Reserve (Garrison photo).

Burmargiolestes xinglongensis Wilson & Reels, 2001 –1. Uncommon. Found only at two roadside seepages on road to Diaoluoshan Forest Reserve. Collected by hand picking (Fig. 21).

Philosina alba Wilson, 1999 –1. Uncommon. Males observed flaying along stream and perching on bamboo stems or other vegetation. Pruinose white bodies of males quite noticeable in flight (Fig. 22). The genus was recently revised by Zhang et al. 2011.

Figure 21. Male of *Burmargiolestes xinglongensis* at seepage by road to Diaoluoshan National Nature Reserve (Cordero photo).

Figure 22. Male of *Philosina alba* at Diaoluoshan Forest Reserve (Garrison photo).

PSEUDOLESTIDAE:

Pseudolestes mirabilis Kirby, 1900 –1, 2. This interesting damselfly (Fig. 23) was common at higher elevations. Ever since its description by Kirby (1900), the species has been studied off and on over the following decades. Calvert (1902) believed it to be a lestid, a decision followed by Needham (1930). Needham (1931) provided excellent illustrations of the wings and accessory genitalia. More recently, Wilson & Reels (2001) commented on behavior, as did Reels (2010) who included photographs

Figure 23. Male of *Pseudolestes mirabilis* perching along shaded patch along creek at Diaoloushan Reserve (Garrison photo).

Figure 24. Male of *Pseudolestes mirabilis* and photographer *Homo sapiens* (Adolfo Cordero)—nose to nose (Cordero photo).

Figure 25. Male of *Pseudolestes mirabilis* in flight. (Cordero photo).

Figure 26. Two males of *Pseudolestes mirabilis* in threat display (Cordero photo).

Figure 27. A case of mistaken identity: male *Pseudolestes mirabilis* confronting a hovering vespid wasp (*Eustenogaster nigra* Saito & Nguyan, 2006. [Vespidae: Stenogastrinae]) (Cordero photo).

Figure 28. Male *Pseudolestes mirabilis* in threat display (Cordero photo).

Figure 29. *Pseudolestes mirabilis* pair in copula (Cordero photo).

Figure 30. Female *Pseudolestes mirabilis* ovipositing (Cordero photo).

of adults in the field. Zhu et al (2015), using niche modeling techniques, characterized this species as possessing a small climate space characterized by low temperature and high precipitation. We observed this species at several partially shaded streams and Cordero studied its behavior on marked individuals at site 2. The damselfly seems to use only its fore-wings in agonistic flight, the hind pair being lowered and stationary during these flights and as means of courtship and male antagonistic display (Figs. 26–28). Several of his photographs above (Figs. 24–30), all by Cordero, reveal interesting aspects of behavior.

Figure 31. Male *Drepanosticta elongata* Mt. Wuzhishan. (Garrison photo).

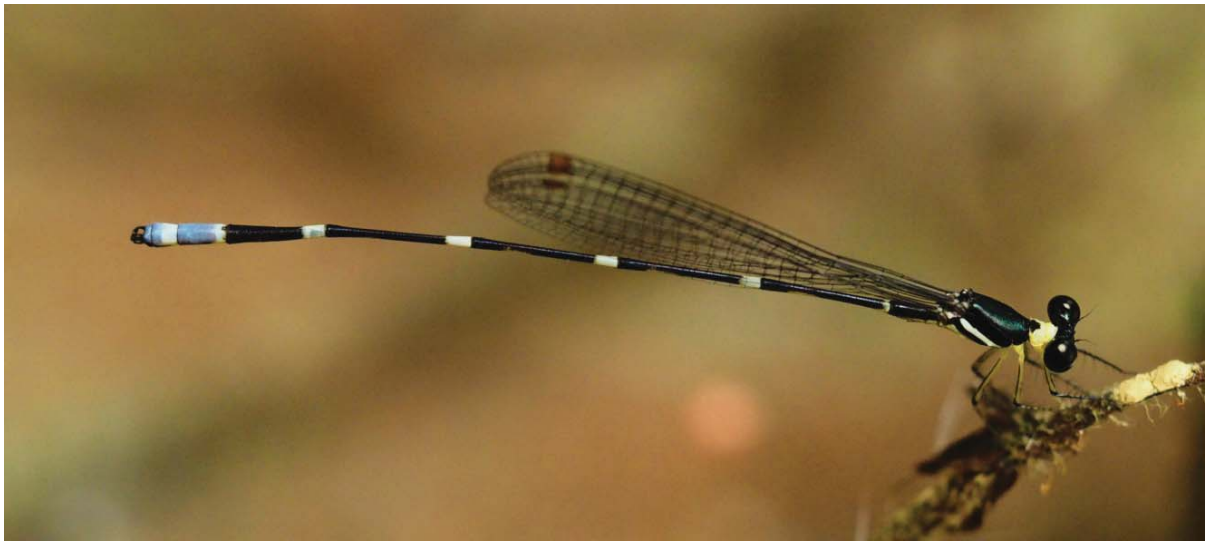

Figure 32. Male *Drepanosticta zhoui* Mt. Wuzhishan. (Garrison photo).

PLATYSTICTIDAE:

Drepanosticta elongata Wilson & Reels, 2001 –2. Males (Fig. 31) were occasionally seen in densely shaded areas within creek at the Mt. Wuzhishan locality.

Drepanosticta zhoui Wilson & Reels, 2001 –1, 2. The most common platystictid at Mt. Wuzhishan. Males (Fig. 32) commonly found along all areas of creek mostly, but not always, in densely shaded portions. Males with infuscated wingtips were reported by Wilson and Reels (2001) and some of these were seen at vertical seepages along roadside leading up to Diaoluoshan Reserve.

Sinosticta hainanse Wilson & Reels, 2001 –2. Rare at Mt. Wuzhishan. Apparently the flight season for this normally common species was almost over.

PLATYCNEMENIDAE (including Disparoneurinae):

Coelicia cyanomelas Ris, 1912 –1, 2. Perhaps the most abundant platycnemenid on the trip. Adults along seepages and vegetated creek shorelines. Adults perched on about vegetation (Fig. 33).

Coelicia scutellum hainanse Laidlaw, 1932 –2. Occasional along shaded areas of creek (Fig. 34), much rarer than C. cyanomelas.

Copera ciliata (Selys, 1863) –1. Occasional around the lake. Dijkstra et al. (2013a) have suggested placing this species in Fraser's genus *Pseudocopera* ("The genus *Platycnemis* should be limited to the Palaearctic species, and for its probable sister group of 'false' *Copera* species the name *Pseudocopera* is available…") based on molecular analysis but we use *Copera* here pending further study on this group of damselflies.

Figure 33. Male *Coelicia cyanomelas* Nankunshan. (Garrison photo).

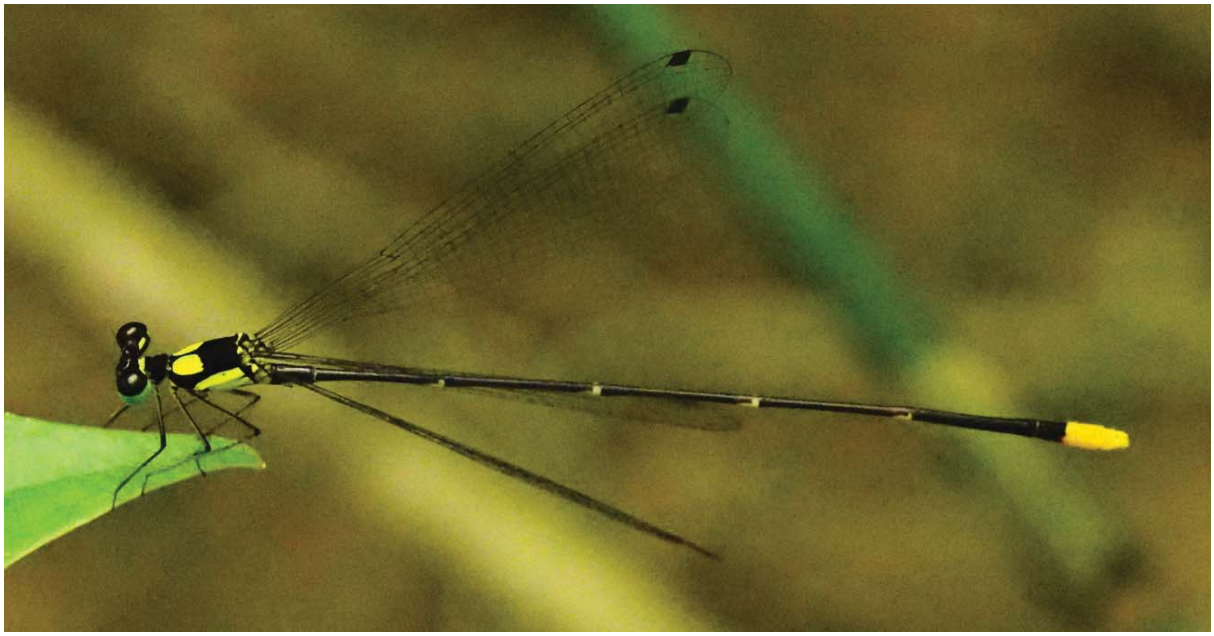

Figure 34. Male *Coelicia scutellum hainanse* Mt. Wuzhishan. (Garrison photo).

Copera vittata (Selys, 1863) –2. One male taken of this widespread and common species. New for Hainan.

Prodasineura autumnalis (Fraser, 1922) –3. A few adults seen at shaded muddy water holes. This is a common and widespread species. Garrison previously collected this black species in Hong Kong and Thailand. Kosterin (2014) has presented evidence for considering *P. autumnalis* a melanic subspecies of *P. humeralis* (Selys, 1860).

Prodasineura croconota (Ris, 1916) –1. A pair taken at one small site by stream's edge.

COENAGRIONIDAE:

Ceriagrion fallax Ris, 1914 –1. A pair taken by walkway over vegetated stream.

Figure 35. Female *Boyeria karubei* Nankunshan. (Cordero photo).

Figure 36. *Gynacantha ryukyuensis* Asahina male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

Figure 38. Periaeschna sp. 2. male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

Figure 39. *Sarasaeschna sabre* male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

AESCHNIDAE:

Boyeria karubei Yokoi, 2002 –1. A few of each sex were taken while resting on tree limbs at night. Adults perched hanging from tree branches, etc. These and "sleeping" *Pseudothemis zonata* were found by shining a strong beam of light into the branches bordering dirt trails (Fig. 35). No adults were seen during the day.

Gynacantha ryukyuensis Asahina, 1962 –2. This rare species is new for Hainan and it was recently found in Hong Kong (unpublished record from Zhang). The species flight period begins in May in the Wuzhishan Mountains (Fig. 36).

Periaeschna spp. –2. Specimens currently identified as *Periaeschna magdalena* Martin, 1909 from Hainan are in need of revision. They are either *Periaeschna* sp. 1 (Fig. 37) or *P.* sp. 2 (Fig. 38) as shown here and represent two new species for the genus. They will be described in a later paper by Zhang.

Sarasaeschna sabre (Wilson & Reels, 2001) –2. This species seems rare in Wuzhishan Mountains. An aged male was collected in the end of the trip (Fig. 39).

Figure 40. *Asiagomphus* sp. nov. male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

Figure 41. Male *Gomphidia kruegeri* Nankunshan. (Cordero photo).

Figure 42. *Labrogomphus torvus* male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

Figure 43. *Macrogomphus* sp. male, Xinglong, Hainan (Zhang photo).

Tetracanthagyna waterhousi McLachlan, 1898 –2. Two females were taken as each flew down to the shaded part of the small stream presumably to oviposit. No males were seen.

GOMPHIDAE:

Asiagomphus sp. nov. –2. This species will be described by H. Zhang in a later paper (Fig. 40).

Fukienogomphus prometheus Lieftinck, 1939 –1. One male on partially shaded stream.

Figure 44. *Orientogomphus armatus* male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

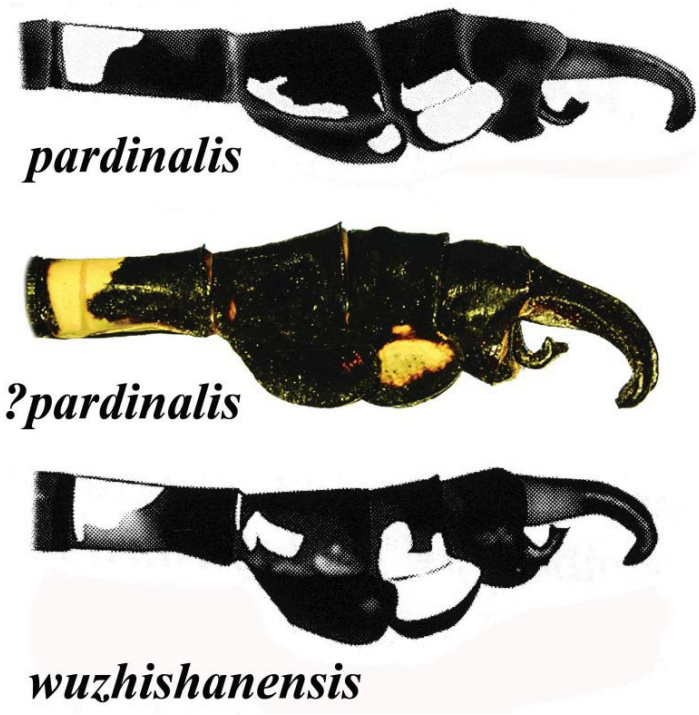

Figure 45. S7-10 of *Paragomphus*; non-color figures from Zhang & Tong (2009); colored (middle) figure of *P. ?pardinalis* collected at Mt. Wuzhishan.

Gomphidia kruegeri Martin, 1904 –1, 2. A few males found on shaded portions of stream. Males perched on snags by steam's edge (Fig. 41).

Gomphidia n. sp. –1. This species found on one portion of the stream where *G. kruegeri* did not occur. The new species will be described by H. Zhang.

Labrogomphus torvus Needham, 1931 –2. The male from Hainan (Fig. 42) has more yellow markings on S8 and S9 than males from other parts of the mainland.

Macrogomphus sp. –3. A single male was collected in Xinglong. The shape of posterior hamule is different from the similar species, *Macrogomphus matsukii* Asahina, 1986 and *M. guilinensis* Chao, 1982, neither of which are known from Hainan. The specimen will be studied by H. Zhang. (Fig. 43).

Merogomphus paviei Martin, 1904. –1. One male observed hovering over ripple of stream before perching on vegetation at stream's edge, a dead female was taken from a spider web high up in a tree along a dirt trail.

Figure 46. *Sieboldius alexanderi* female, Diaoluoshan, Hainan (Zhang photo).

Orientogomphus armatus Chao & Xu, 1987. –2. Males were collected over open streams near Shuimangxiang Village (Fig. 44).

Paragomphus ?pardalinus Needham, 1942. –2. One male taken at side of exposed fine sandy-bottomed creek just north of Shuimanxiang village, Mt. Wuzhishan; very hot, sunny. *Paragomphus wuzhishanensis* Liu, 1988, was described from a single adult

Figure 47. *Stylurus amicus* male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

female collected in 1957 from Mt. Wuzhishan; its male and larva was described by Zhang & Tong (2009b). These authors pointed out that "The [male foliaceous outgrowth on S8-9] in *P wuzhishanensi* males is much more extensive than in *P pardalinus* and *P capricornis*." Fig. 45 includes illustrations of *P. pardalinus* (top) and *P. wuzhishanensi* (bottom) taken from Zhang & Tong (2009b). The middle figure is S7-10 of the male from Mt. Wuzhishan. The foliate margins of the middle figure seem to more closely approach that for *P. wuzhishanensi* than for *P. pardalinus*. However, Garrison has other specimens approaching the middle figure from the same locality determined by Zhang as *P. pardalinus*. The two species seem to be closely related and we wonder if both might be synonyms.

Sieboldius alexanderi (Chao, 1955) –1, 2. Two pairs were collected at Diaoluoshan and Wuzhishan (Fig. 46)

Stylurus amicus (Needham, 1930) –2. A single male was collected along an open stream near Shuimangxiang Village (Fig. 47).

CHLOROGOMPHIDAE:

Chlorogomphus gracilis Wilson & Reels, 2001 – 1. Only a single female (Fig. 48) was found at the end of May on a semi-shady stream in Diaoluoshan National reserve, no males were seen on this trip but in mid April of 2009 some males were collected at the same site. The end of May may be past their prime flight season.

Chlorogomphus usadai Ishida, 1996 –2. males (Fig. 49) of this endemic species (Hainan) were found slowly coursing up and down a small mostly shady portion of the stream. Only one male was seen at a time but more were found when moving up and down the stream. One gynochrome female (Fig. 50) was collected when it suddenly appeared at the creek to oviposit. We observed but did not collect, an androchrome female flying high in late afternoon at Nankunshan. A photo of that form is shown in Fig. 51.

Figure 48. *Chlorogomphus gracilis* female, Diaoluoshan, Hainan (Zhang photo).

Figure 49. *Chlorogomphus usudai* male Mt. Wuzhishan (Zhang photo).

Figure 50. *Chlorogomphus usudai* gynochrome female Mt. Wuzhishan (Zhang photo).

Figure 51. *Chlorogomphus usudai* androchrome female Mt. Wuzhishan (Zhang photo).

Figure 52. *Macromia daimoji* male, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

Figure 53. *Macromia septima* female, Shuimanxiang, Wuzhishan, Hainan (Zhang photo).

CORDULEGASTRIDAE:

Anotogaster sp. –2. A larva was found in Wuzhishan Mountains. Hitherto only adult male have been collected from the Diaoluoshan Mountains. This is a large species and related to *A. sakaii* Zhou, 1988. A male was also collected and is currently being studied by Zhang.

MACROMIIDAE:

Macromia daimoji Okumura, 1949 –1. A single male (Fig. 52) was collected over an open stream near Shuimangxiang Village. New for Hainan.

Macromia moorei malayana Laidlaw, 1928 –1. One adult male found in water on shaded creek.

Macromia septima Martin, 1904, –2. Only female specimens collected (Fig. 53). They do not differ from specimens collected in Yunnan Province. This species is widespread and common in central to southern part of Yunnan and in Fujian and Guangdong Provinces.

Figure 54. *Macromidia rapida* male. Nan-Lin, small stream (Garrison photo).

Figure 55. *Acisoma panorpoides* male. Diaoluoshan Forest Reserve (Cordero photo)

Macromidia rapida Martin, 1907 –3. One male (Fig. 54) photographed in shade as it perched under a tree.

LIBELLULIDAE:

Acisoma panorpoides Rambur, 1842 –1. A few seen along margin of large pond at Diaoluoshan Forest Reserve (Fig. 55).

Diplacodes trivialis (Rambur, 1842) –3. Nan-Lin, small stream, afternoon; very hot, partly cloudy.

Lyriothemis tricolor Ris, 1919 –1. One female, Diaoluoshan National Nature Reserve on tip of branch.

Neurothemis fulvia (Drury, 1773) –1, 2. A few taken resting on tips of vegetation in partial shade (Fig. 56).

Onychothemis tonkinensis Martin, 1904 –1, 2- Occasionally seen flying over shaded rifle areas of clear stream. Adults perched on branches overhanging stream (Fig. 57).

Orthetrum chrysis (Selys, 1891) –1. A few seen on more stagnant parts of small stream in partial sun.

Orthetrum glaucum (Brauer, 1865) –1, 2. Adults frequent muddy puddles along dirt trails (Fig. 58) — often in company with *O. triangulare*.

Figure 56. *Neurothemis fulvia* male. Diaoluoshan Forest Reserve (Cordero photo).

Figure 57. *Onychothemis tonkinensis* female. Nan-Lin (Garrison photo).

Figure 58. *Orthetrum glaucum* male. Diaoluoshan National Nature Reserve (Garrison photo).

Figure 59. *Orthetrum pruinosum neglectum* male. Mt. Wuzhishan (Garrison photo).

Figure 60. *Palpopleura sexmaculata* male. Diaoluoshan National Nature Reserve (Garrison photo).

Figure 61. *Pseudothemis zonata* male. Diaoluoshan National Nature Reserve (Cordero photo).

Figure 62. *Trithemis aurora* male. Diaoluoshan National Nature Reserve (Garrison photo).

Figure 63. *Trithemis festiva* male. Diaoluoshan National Nature Reserve (Cordero photo).

Figure 64. *Zygonyx iris insignis* male. Diaoluoshan National Nature Reserve (Cordero photo)

Orthetrum pruinosum neglectum (Rambur, 1842) –1, 2. Adults landed on ground or rocks in partial sun along dirt trails (Fig. 59).

Orthetrum triangulare triangulare (Selys, 1878) –1. Adults occasional on muddy puddles along dirt trails — often in company with *O. glaucum* but not as common.

Palpopleura sexmaculata (Fabricius, 1787) –1. Adults were found on tips of dead snags at only one small area by lake's edge (Fig. 60).

Pantala flavescens (Fabricius, 1798) –1. Adults swarmed over open sunny areas within the hotel and lake area.

Pseudothemis zonata (Burmeister, 1839) –1. Swarms of 30-40 males encountered at a damned spillway at the border of a lake. They never landed or perched and were subsequently difficult to collect. A few adults were found at night perched in trees along dirt trails (Fig. 61).

Rhyothemis plutonia Selys, 1883 –3. A male at man-made fish pond near Taiyanhe River (Frontpiece).

Trithemis aurora (Burmeister, 1839) –1. A common species, adults perched on stems and snags bordering lake. (Fig. 62).

Trithemis festiva (Rambur, 1842) –1. A common species, adults on rocks and ground in stream or at stream's bank. (Fig. 63).

Figure 65. *Archineura incarnata* male, caught in the act of opening its wings. Nankunshan Nature Reserve (Cordero photo).

Zygonyx iris insignis Kirby, 1900 –1, 2. Adults patrolled partially shaded creeks and streams at Diaoluoshan National Nature Reserve and exposed creek just north of Shuimanxiang village (Fig. 64).

Zygonyx takasago Asahina, 1996 – 2. One male taken in company with the more numerous *Z. iris* while patrolling over exposed creek just north of Shuimanxiang village.

Guangdong Province:

The time spent here was during a week just after torrential rains had caused flooding in the area leading up to the reserve. Weather conditions were often cloudy and overcast but some days were hot and sunny. Most of the collecting was done along a moderately wide gravely/rocky stream (Fig. 10) near the Tian Tang Ding Forest Holiday Villa at the Nankunshan Nature Reserve (Fig. 9). Other collecting sites included the artificial man-made runnels bordering the hotel complex, a small artificial pond behind one of the hotel buildings, and along shaded paths bordering the stream. We collected 51 of the 155 odonate species recorded, representing about 33% of the total fauna known from Nankunshan province. These are listed below with notes concerning each species where appropriate. As noted above, numbers following a species name (e. g. – 4, 5), refer to numbered localities listed above. NOTE: All species known from this area are depicted in a recently published book, Dong (2014).

Figure 66. *Archineura incarnata* female. Nankunshan Nature Reserve (Cordero photo).

Zygoptera:

PHILOGANGIDAE:
Philoganga vetusta Ris, 1912–4. One male was seen at the village. Another dead male was found in one of the hotel buildings.

CALOPTERYGIDAE:
Archineura incarnata (Karsch, 1891) –4. This, the world's largest calopterygid, perched on boulders and rocks mostly in the middle of swiftly running streams (Fig. 65). Females (Fig. 66) were almost equally as common as males but rarely were two or

Figure 67. *Mnais tenuis* male. Nankunshan Nature Reserve (Cordero photo).

Figure 68. *Aristocypha chaoi* fully adult male. Nankunshan Nature Reserve (Cordero photo).

three individuals found at any one spot. Although they occupied various areas of the stream, none seemed to return to any one spot making capture difficult as one had to negotiate crossing the swiftly running stream. This is a weary species and was difficult to approach.

Atrocalopteryx melli (Ris, 1912) –4. A male and female, both juvenile, were found on a small trail off the road paralleling the stream. They were found at almost at identical spots along the trail near a crest but on different days. Garrison searched the surrounding area in hopes of finding more specimens but saw none.

Figure 69. *Aristocypha chaoi* juvenile male. Nankunshan Nature Reserve (Cordero photo).

Figure 70. *Heliocypha perforata* male. Nankunshan Nature Reserve (Cordero photo).

Mnais mneme Ris, 1916 – 4. Seen almost everywhere along small forested streams, seepages paralleling the stream. Both orange-winged (Fig. 13) and hyaline-winged forms were seen.

Mnais tenuis Oguma, 1913 – 4. Much rarer than *M. mneme* and found at same habitat (Fig. 67).

CHLOROCYPHIDAE:
Aristocypha chaoi (Wilson, 2004) – 4. A few males (Fig. 68) collected along partially shaded portions of stream. Apparently rare and endemic to the region. Fully adult males are bright blue; juveniles have a largely dark abdomen with blue coloration not yet fully developed (Fig. 69).

Heliocypha perforata (Percheron, 1835) – 4. Unlike *A. chaoi*, this widespread species was found along the sunny parts of the runnels bordering the hotel complex (Fig. 70).

Figure 71. *Euphaea decorata* male. Nankunshan Nature Reserve (Cordero photo).

EUPHAEIDAE:
Bayadera bidentata Needham, 1930 – 4. An uncommon species. Most individuals were taken perched on tips of branches above open parts of the stream. Several individuals were seen on bare snags of a tree several meters above the ground. They perched motionless for hours seemingly unaware of any movement below. Cordero fashioned a very long bamboo pole with his net attached to the tip (Fig. 95) and with this unwieldy apparatus, he was able to collect a few pairs.

Figure 72. *Agriomorpha fusca* pair in tandem. Nankunshan Nature Reserve (Garrison photo).

Bayadera melanopteryx Ris, 1912 – 4. Not common. The few males collected were juvenile and had sharply defined black wing tips.

Euphaea decorata Hagen in Selys, 1853 – 4. A common species seen at the runnels at the village and along the stream (Fig. 71).

MEGAPODAGRIONIDAE:
Agriomorpha fusca May, 1933 – 4. Found everywhere along shaded seepage areas on overhangs bordering shaded trail. A tandem pair (Fig. 72) was observed ovipositing in company with a tandem pair of *Coelicia cyanomelas* on low vegetative stems near the seepage.

Rhipidolestes truncatidens Schmidt, 1931 – 4. Only one old male found along shaded seepage area on trail. This species is normally common earlier in the season (Fig. 73).

Figure 73. *Rhipidolestes truncatidens* male. Nankunshan Nature Reserve (Garrison photo).

Figure 74. *Coelicia cyanomelas* – pair in tandem. Nankunshan Nature Reserve (Garrison photo).

PLATYSTICTIDAE:

Drepanosticta brownelli Tinkham, 1938 – 1. Only one male collected at side of road in brush at Sheng Dao; the day spent here (9 June) was overcast and drizzly.

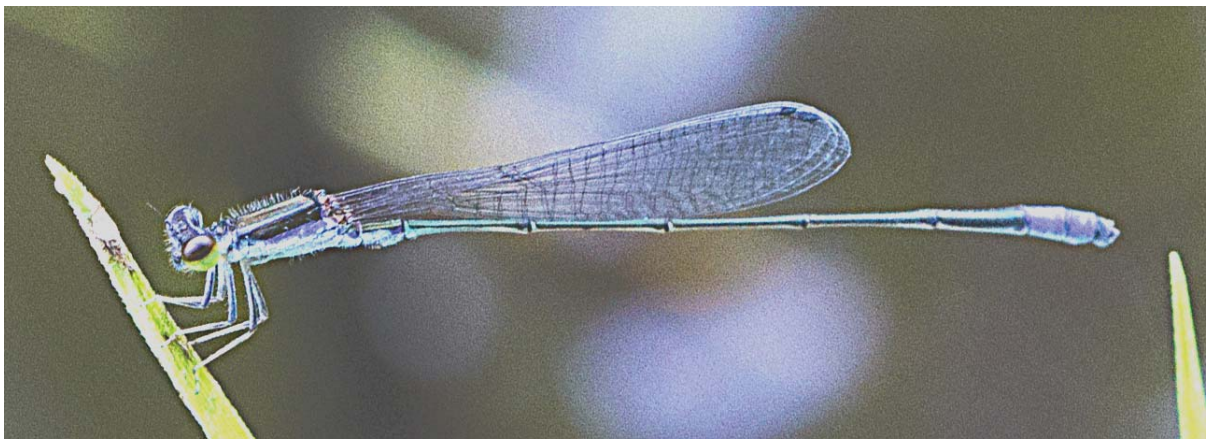

Figure 75. *Aciagrion tillyardi* male. Nankunshan Nature Reserve (Cordero photo).

Figure 76. *Ceriagrion auranticum ryukyuanum* male. Nankunshan Nature Reserve (Cordero photo).

PLATYCNEMENIDAE (including Disparoneurinae):

Calicnemia sinensis Lieftinck, 1984 – 4. A few specimens found along shaded seepage areas on overhangs bordering shaded trail. Their dull red coloration and small size rendered them difficult to see in the shade.

Coelicia cyanomelas Ris, 1912 – 4. Like *Agriomorpha fusca*, this species was found everywhere along shaded seepage areas on overhangs bordering shaded trail and, unlike *A. fusca*, along parts of the main stream. A tandem pair (Fig. 74) was observed ovipositing in company with a tandem pair of *A. fusca* on low vegetative stems near the seepage.

COENAGRIONIDAE:

Aciagrion tillyardi Laidlaw, 1919 – 4. A few taken on small emergent stems over open areas of the small artificial pond (Fig. 75).

Ceriagrion auranticum ryukyuanum Asahina, 1967 – 4. Frequent in grassy areas around the small artificial pond; the most common damselfly at the artificial pond (Fig. 76).

Ceriagrion fallax Ris, 1914 – 1. A male taken at the artificial pond.

I*schnura rufostigma* Selys, 1876 – 4. A couple taken in grassy area near the artificial pond.

Figure 77. *Asiagomphus hainanensis* male. Nankunshan Nature Reserve (Cordero photo).

Figure 78. *Lamelligomphus camelus* male. Nankunshan Nature Reserve (Cordero photo).

Figure 79. *Leptogomphus intermedius* male. Nankunshan Nature Reserve (Cordero photo).

Figure 80. *Megalogomphus sommeri* male. Nankunshan Nature Reserve (Cordero photo).

Figure 81. *Nihonogomphus semanticus* male. Nankunshan Nature Reserve (Cordero photo).

AESHNIDAE:

Anax nigrofasciatus Oguma, 1915 – 4. A few fond flying over the grounds of the village.

Gynacantha japonica Bartenev, 1909 – 4. One female flushed from bamboo thicket an small muddy rivulet near Tinn Tang Diang Forest Holiday Villa.

Periaeschna magdalena Martin, 1909 – 4. One male collected over shaded cement trail with thin sheet of water cascading down the trail. Adults were seen flying rapidly and erratically over the sheet of water.

GOMPHIDAE:

Asiagomphus hainanensis (Chao, 1953) – 4. Frequent along runnels at village and along margin of stream (Fig. 77).

Fukienogomphus prometheus (Lieftinck, 1939) – 4. Adults often perched on vegetation on partially shaded trail paralleling stream.

Gomphidia kruegeri (Martin, 1904) – 4. Occasional on margin of stream (Fig. 41).

Lamelligomphus camelus (Martin, 1904) – 4. Common on the large rocky stream. On 8 June, the sky was overcast but soon afterwards, the sun came out and about a dozen males of this species suddenly appeared over the gravel portion of the

stream, each hovering (Fig. 78) almost stationary over one spot. Males would occasionally chase one another from territory but then return.

Leptogomphus intermedius Chao, 1982 – 4. Like *Fukienogomphus prometheus*, adults of this species encountered perching on vegetation on partially shaded trail paralleling stream (Fig. 79).

Megalogomphus sommeri (Selys, 1854) – 4. This large species was infrequently found but adult males perched on snags next to sunny areas on the stream (Fig. 80)

Merogomphus paviei Martin, 1904 – 4. Occasional along stream margin.

Nihonogomphus semanticus Chao, 1954 – 4. Occasional along stream margin (Fig. 81).

Figure 82. *Chlorogomphus kitawakii* male. Nankunshan Nature Reserve (Cordero photo).

Figure 83. *Macromia daimoji* male. Nankunshan Nature Reserve (Zhang photo).

Figure 84. *Macromia malleifera* male. Nankunshan Nature Reserve (Cordero photo)

CHLOROGOMPHIDAE:

Chlorogomphus kitawakii Karube, 1995 – 4. A few were seen coursing up and down stretches of the open areas of the stream (Fig. 82).

MACROMIIDAE:

Epophthalmia elegans (Brauer, 1865) – 4. Solitary males were collected at margin of pond.

Macromia daimoji Okumura, 1949 – 4. Rare, a couple collected along margin of stream; apparently new record for the area (Fig. 83).

Macromia malleifera Lieftinck, 1955 – 4. Perhaps the most common large dragonfly at the site, adults everywhere on runnels and along stream border (Fig. 84).

CORDULIIDAE:

Idionyx carinata Fraser, 1926 – 4. One female collected at village house at Sheng Dao; the day spent here (9 June) was overcast and drizzly

LIBELLULIDAE:

Crocothemis servilia (Drury, 1770) – 4. One male taken at the Tian Tang Ding Forest Holiday Villa.

Lyriothemis tricolor Ris, 1919 – 4. One female collected at road upstream crossing stream.

Neurothemis fulvia (Drury, 1773) – 4. Adults at artificial pond and occasionally on forest trails (Fig. 56).

Orthetrum glaucum (Brauer, 1865) – 4. Common on trails and pathways (Fig. 58).

Orthetrum pruinosum neglectum (Rambur, 1842) – 4. Common on trails and pathways; preferred more open sunny areas than other congeners. This species also frequented rain puddles (Fig. 59).

Orthetrum triangulare (Selys, 1878) – 4. On trails and pathways, not as common as Orthetrum glaucum.

Palpopleura sexmaculata (Fabricius, 1787) – 4. Perched on snags at artificial pond (Fig. 60).

Pantala flavescens (Fabricius, 1798) – 4. Adults hovering over lawn areas during heat of day. Common.

Pseudothemis zonata (Burmeister, 1839) – 4. Occasional on pond at rushing water inlet.

Tramea virginia (Rambur, 1842) – 4. As with *Pantala flavescens*, some adults seen hawking over village roads.

Trithemis aurora (Burmeister, 1839) – 4. Along border of pond (Fig. 62).

Trithemis festiva (Rambur, 1842) – 4. At stream where adults perched on rocks. Common (Fig. 63).

Guangdong Province:
One day, 12 June, was spent collecting Odonata at the Guangzhou, Campus pond, South China Agricultural University.

PLATYCNEMENIDAE:

Copera ciliata (Selys, 1863) – 5. A couple taken border of pond. See nomenclatorial note above under this species (Hainan) concerning our reason for not adopting *Pseudocopora*.

COENAGRIONIDAE:

Ceriagrion auranticum ryukyuanum Asahina, 1967 – 5. Common everywhere (Fig. 76).

Figure 85. *Rhyothemis variegata aria* male. Hainan (Zhang photo).

Some other inhabitants of Hainan and Guangdong

Figure 86. *Pomponia ?linearis* (Walker) (Cicadidae: Cicadinae) Shuiman, Hainan China (Cordero photo)

Figure 87. *Satarupa gopala gopala* Moore (Hesperiidae), Hainan (Cordero photo).

Figure 88. *Ethope henrici* (Holland) (Nymphalidae: Satyrinae), endemic to Hainan (Garrison photo)

Figure 89. *Stichopthalma howquia* (Nymphalidae: Amathusiinae) on rotting fruit Wuzhishan, Hainan (Garrison photo).

Figure 90. *Nyctalemon zampa* Butler (Uraniidae) Mt. Wuzhishan, Hainan.

Figure 91. *Eustenogaster nigra* Saito & Nguyan, 2006. (Vespidae: Stenogastrinae) Mt. Wuzhishan, Hainan.

Figure 92. From left to right: Rosser Garrison, Adolfo Cordero, Haomiao Zhang in front of hotel residence at Tinn Tang Diang Forest Holiday Villa, Nankunshan Nature Reserve.

Figure 93. Adolfo, Rosser & Haomiao eating dinner at Shuimanxing Village, Hainan.

Figure 94. Haomiao in action Xing Long, Guangdong, China.

Figure 95. Adolfo with rigged net at Nankunshan. This apparatus allowed Adolfo to collect *Bayadera bidentata* amongst the very high branches in trees by the stream's edge.

LIBELLULIDAE:

Lyriothemis elegatissima Selys, 1883 – 5. A distinctly shade-loving species. A few adults taken as they perched on snags in shade.

Nannophyopsis clara (Needham, 1930) – 5. Common at the pond. Adults stayed close to water surface.

Pseudothemis zonata (Burmeister, 1839) – 5. Several seen coursing the pond (Fig. 61).

Rhyothemis variegata aria Drury, 1773 – 5. Perched in butterfly-like fashion on tips of emergent vegetation at pond's edge (Fig. 85).

Tramea virginia (Rambur, 1842) – 5. A few adults flew incessantly over pond mostly well out of reach of net.

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