AGRION

NEWSLETTER OF THE WORLDWIDE DRAGONFLY ASSOCIATION

PATRON: Professor Edward O. Wilson FRS, FRSE

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NEWSLETTER OF THE WORLDWIDE DRAGONFLY ASSOCIATION

AGRION is the Worldwide Dragonfly Association's (WDA's) newsletter, published twice a year, in January and July. The WDA aims to advance public education and awareness by the promotion of the study and conservation of dragonflies (Odonata) and their natural habitats in all parts of the world. *AGRION* covers all aspects of WDA's activities; it communicates facts and knowledge related to the study and conservation of dragonflies and is a forum for news and information exchange for members. *AGRION* is freely available for downloading from the WDA website at [https://worlddragonfly.org/publications/]. WDA is a Registered Charity (Not-for-Profit Organization), Charity No. 1066039/0. A 'pdf' of the WDA's Constitution and byelaws can be found at its website link at [https://worlddragonfly.org/wda/]

Editor's notes

Keith Wilson [kdpwilson@gmail.com]

WDA Membership

There are several kinds of WDA membership available either with or without the WDA's journal (*The International Journal of Odonatology*). You can sign up for a membership using the WDA's website [http://worlddragonfly.org/join/] or by contacting the WDA secretary directly [wda.secretary@gmail.com]. Sponsored memberships are also available for those who cannot afford the cost due to currency restrictions or other reasons.

Conference & Meeting News

2019 DSA Annual Meeting

The Dragonfly Society of the Americas (DSA) annual meeting will be held in Austin, Texas, immediately prior to the *International Congress of Odonatology*. The DSA meeting will be held from July 12th -14th with the talks and business meeting on Saturday at McKinney Roughs Nature Park. There will be a pre-meeting trip to east Texas from July 8th-11th. There will not be a post-meeting trip, but instead we encourage you to consider attending the *International Congress of Odonatology*.

You can view a checklist of the 117 species of odonates documented for Travis County, Texas at OdonataCentral [Link] as well as the seasonality of Texas species [Link]. Some of the dragonfly highlights that will be looked for during the field trip meeting include: rainpool spreadwing (*Lestes forficula*), Leonora's dancer (*Argia leonorae*), coral-fronted threadtail (*Neoneura aaroni*), orange-striped threadtail (*Protoneura cara*), turquoise-tipped darner (*Rhionaeschna psilus*), broad-striped forceptail (*Aphylla angustifolia*), narrow-striped forceptail (*Aphylla protracta*), five-striped leaftail (*Phyllogomphoides albrighti*), four-striped leaftail (*Phyllogomphoides stigmatus*), blue-faced ringtail (*Erpetogomphus eutainia*), bronzed river cruiser (*Macromia annulata*), Texas emerald (*Somatochlora margarita*), red-tailed pennant (*Brachymesia furcata*), gray-waisted skimmer (*Cannaphila insularis*), black setwing (*Dythemis nigrescens*), thornbush dasher (*Micrathyria hagenii*), carmine skimmer (*Orthemis discolor*), and Slough amberwing (*Perithemis domitia*).

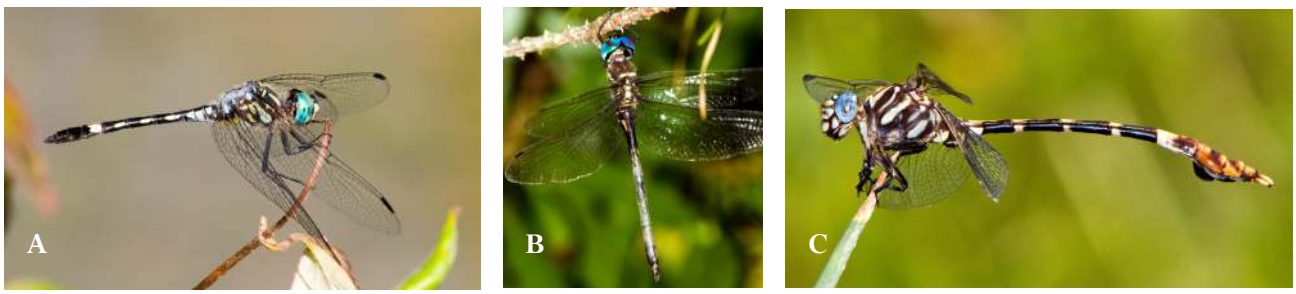

Figure 1. A selection of odonates documented for Travis County, Texas. (A) Thornbush dasher (*Micrathyria hagenii*). (B) Texas emerald (*Somatochlora margarita*). (C) Five-striped leaftail (*Phyllogomphoides albrighti*).

Cover: Male and female *Stylurus annulatus* (Djakonov 1926), South Korea. See article regarding its close allies and revised synonomy. Photo credit: Sungbin Cho.

Details and registration will be available on the new DSA website at the beginning of 2019. DSA members will receive an email when the new site is live. For additional details contact John Abbott [jabbott1@ua.edu].

ICO2019, 14-19th July 2019, Austin, Texas

For the first time since 1999, the *International Congress of Odonatology* will be held in the United States. This is a great opportunity to engage with researchers from around world studying Odonata. The 2019 ICO will be held in Austin, Texas in the southern US from July 14-19th. Austin is a great destination for dragonflies and damselflies with 116 species known from the Austin area and 245 species in Texas! The Sunday night icebreaker and all the meetings will take place in downtown Austin on Lady Bird Lake at the 2nd floor of the Palmer Event Center. On Wednesday night, our Congress Dinner will take place within walking distance from the Palmer Event Center, on boats touring Lady Bird Lake where we'll watch the famous Mexican free-tailed bats emerge from the Congress Street Bridge, the largest urban bat colony in the world.

To make costs more flexible, the mid-conference trip will now be an optional Friday local field trip. We will take you to some of the hotspots for dragonflies in the Austin area. The post-congress trip will travel to the Rio Grande Valley in south Texas to see some of the Neotropical fauna that just makes it into the United States.

Additional details are available on the congress website, https://worlddragonfly.org/meetings/ico2019/. Topics likely on the program will include: Odonata Without Borders, Los Odonatos de México, Natural History of Odonata, Odonate Conservation, Citizen Science as a Tool for Odonate research and Outreach, Identification of Nymphs and digitizing collections.

For more details contact John Abbott [jabbott1@ua.edu].

Student Research News & WDA Conservation and Research Reports

Hadeezah Bema, studying at Kwame Nkrumah University of Science and Technology, Ghana was awarded a WDA Research Grant in 2017. Her Research Report titled: 'Odonata diversity as indicators of freshwater habitat quality in the Owabi Wildlife Sanctuary, Ghana' is provided on page 25.

WDA's *International Journal of Odonatology* (*IJO*)

IJO 21(3-4) has now been published. Once again, because of the number of manuscripts, the Editor John Abbott had to combine issues. There are eight articles in the current issue [https://www.tandfonline.com/toc/tijo20/21/3-4?nav=tocList]. The printed version should be posted to you in the near future. John has made the article 'Emergence timing and fixation height in *Pachydiplax longipennis* (Odonata: Libellulidae) at varying substrate density and sunlight exposure' by Bried et al. [https://www.tandfonline.com/doi/full/10.1080/13887890.2018.1520652] open access for three months, so please pass this along to colleagues and via social media outlets. It should be listed as open access by mid-January 2019. There are currently eight articles in review, one awaiting revision and six in production.

Renewal of membership to WDA/*IJO*

Renewal notices for 2019 were sent out by email in December 2018. If you did not receive one, please get in touch with the WDA secretary at: [wda.secretary@gmail.com]. Your membership is vital in keeping the WDA/*IJO* active and we hope that you renew your membership for 2019. Even though many of you have access to *IJO* through your institution, your personal subscription is vital for the work of the WDA. It helps to support our grants progam that supports research, education and conservation initiatives (see the report for grant awarded in 2017 on page 25) and our Sponsored Memberships program that makes membership in the WDA and a subscription to *IJO* available to those who cannot otherwise afford it. Your personal subscription to WDA/*IJO* also supports the WDA's involvement in the International Congresses held every two years. Even a regular membership without a subscription to the journal helps to support the initiatives of the WDA including *Agrion*. WDA members are also eligible to apply for grants to support their research efforts.

Nominations to the WDA Board of Trustees 2019-2021

The new WDA Board of Trustees, except for the President Elect, will take up their positions for a 2-year term at the next Biennial General Meeting to be held during ICO2019 at Austin, Texas in July 2019. Our President Elect Adolfo Cordero Rivera, who would normally have taken over as President at ICO2019 has had to resign for health reasons. Jessica Ware, our current Secretary, has been nominated, seconded and agreed to take over as President for 2019-2021 provided there are no other nominations for President in accordance with our Constitution (see nomination form on page 36). Peter Brown, currently a Trustee, has kindly agreed to take on the roles of both Secretary and Treasurer for 2019-2021. Chistopher Beatty has agreed to serve as a Trustee for 2019-21. The remaining board members have agreed to serve for a further two years. If any WDA member wishes to nominate another WDA member for any position on the Board of Trustees (except for the Immediate Past President) please see "Nominations to the WDA Board of Trustees 2019-2021" on page 36 for more information and nomination procedures.

Next issue of *AGRION*

For the next issue of *AGRION,* to be published at the beginning of July 2019, please send your contributions to Keith Wilson [kdpwilson@gmail.com] or Graham Reels [gtreels@gmail.com]. All articles, information and news items related to dragonflies or of interest to WDA members are most welcome and will be considered for publication. Please send all text and figure captions in a Word file by email. Please do not include artwork with the text but provide a separate file or files, ideally in a compressed format (e.g. 'tiff', 'jpeg' or 'gif'). Do not make up plates of multiple photos but send original photo images as separate files.

If you have an odonate photo illustrating any rarely observed aspect of dragonfly biology, or an unusual species, or simply a stunning dragonfly shot, please submit it for consideration for publication on the front cover of *AGRION*.

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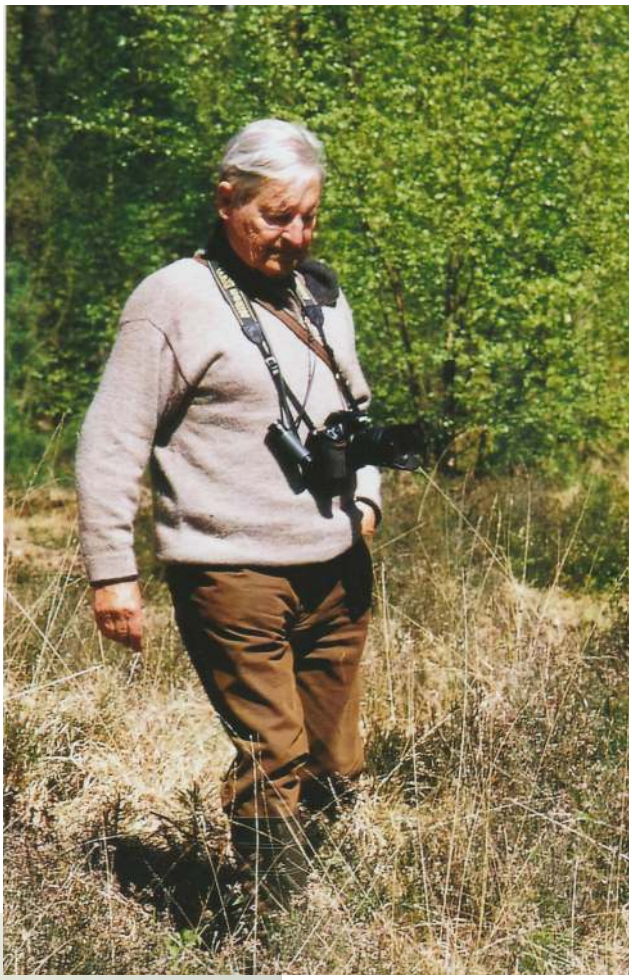
In memoriam of Prof. Dr. Eberhardt Schmidt
20 July 1935 to 9 July 2018

Klaus-Jürgen Conze [kjc@loekplan.de]
Executive board, *Gesellschaft deutschsprachiger Odonatologen*

In July 2018 Prof. Dr. Eberhardt Schmidt died after a severe illness but in the good custody of his family. Nearly all his life he was an odonatologist, from early beginnings as a pupil in Berlin to more than seventy years of experience in his later years. He published more than 250 scientific papers, around 180 of them about dragonflies! In 1971 he was involved in the foundation of the SIO (*Societas Internationalis Odonatologica*) and for several years he also worked on the board of this international scientific community of odonatologists from around the world. Together with Rainer Rudolph he founded the GdO (*Gesellschaft deutschsprachiger Odonatologen*) and for a long time he was the 'guiding spirit' of this society. Early on he gave advice on how to determine and document dragonflies by photographs; this knowledge is even today still very helpful and necessary. Also from the start of GdO he proclaimed long-term monitoring as an important task for odonatologists. We should certainly learn from him! But his huge body of work for the sake of the dragonflies is now a significant part of our baseline knowledge. Many of his papers produced ideas to be followed up and developed further e.g. using dragonflies as bioindicators for nature conservation of watercourses. No doubt, Ebi (as his friends called him) will always stay in our memory! The GdO is now preparing a dedicated supplement of *Libellula* to honour Eberhardt Schmidt.



Above: The late Prof. Dr. Eberhardt Schmidt accompanied and photographed by his wife Ute Schmidt.

Left: Young Eberhardt Schmidt shooting dragonflies with his camera. Photo credit: his wife Ute Schmidt.

Bounenkai (Year-end Party) of Tokyo Odonatological Society

Hide J. Natsume [romluna@y4.dion.ne.jp]

Eleven dragonfly enthusiasts got together at Kagaya, Izakaya (a traditional Japanese style bar) near East Japan Railway Company Uguisudani Station, Taitö, Tokyo, on December 22nd, Saturday 2018. Members of the so-called 'drinking team' get together monthly for various kinds of sake (alcoholic drinks; not only Japanese rice wine but also beer, wine, whiskey, cocktails etc.) and noisy conversation of new odonatological news. Bounenkai was held on a Saturday as some members were unable to attend meetings on Wednesday evenings because of jobs or remoteness from home.

The Master of Kagaya has been very generous as we have been using this bar for more than 20 years, and only for our Society are special terms afforded. We can order whatever cuisines and drinks we like unlimitedly until the bar is closed late night and special rate per person is just JY3,500 (US$30), consumption tax included.

I'd like to introduce the attendees for this occasion although some of our important members were not there due to unavoidable reasons. From far left end is Nao Nakayama san from Chiba and he is a very smart drinker always bringing local dragonfly news especially in Boso Peninsula where Chiba prefecture is included and always providing good support of drunken members by communicating with staff from the bar. He has been a member of TOS (Tokyo Odonatological Society) for more than 20 years and finally met Kato san after a long time at this occasion. Second from left, with arms folded is Sadayuki Ugai san, who is one of the legendary members of JSO (Japanese Society for Odonatology), founded in 1957; he has been involved in a lot of dragonfly works since he was a school boy. His interest in dragonflies has spread to the Americas since his work at a private company changed into global activity several years ago.

Third from left is Kaz Ikeda san, chairman of TOS since the late Wakana san retired in 21st century and he has become a semi-professional photographer of dragonflies and damselflies as he has been dragonfly crazy for more than 50 years and has experienced uncountable research and collection trips to various parts of the world. His success story in PR of China nearly 30 years ago and his survey tour to New Caledonia with much fun is repeatedly talked about and discussed especially when he is heavily inebriated.

Fourth from left with right arm up is me, secretary general of TOS. I'm trying to issue Shibuchan (official organ of TOS), which has not been published for more than one decade. I have been observing live Odonata for more than 50 years.

Fifth from left is Kenji Kato san who is also keen dragonfly hunter. He made a Taiwanese trip recently and found lots of fun with overseas fauna. His story of collecting at Okinawa islands was very interesting in old issues of Shibuchan. His father is the late Masayo Kato who was a famous cicada scholar and his collection is now kept

Figure 1. Members of the *Tokyo Odonatological Society* at their annual year end party (Bounenkai).

at University of Tokyo.

Sixth from right is T. Matsuzawa san who has joined this circle several years ago when he moved to Kanagawa pref. from Nagoya. His articles of dragonfly research in *Aeschna* (official organ of Odonatological Society of Osaka) are really interesting and from 2019 he will be the chair of editorial board of *Aeschna*. His experience from western and central parts of Japan's mainland gives us good species comparisons with Kanto region Odonata.

At front right with white cap and beard is Yamauchi san, painter at western Tokyo. He was also born to love dragonflies and nearly finished very beautiful booklet concerning the Odonata of Tokyo metropolis. Lots of local illustrated booklets are available in Japan but one for Tokyo has not yet been published.

Behind Yamauchi san, with grey sweater, is Tomomi Kojo san, one of the board members of JSO and serving for the Industrial University. He is living in the northern end of Saitama pref. and it is difficult for him to join the monthly meetings, but he finally attended this meeting after a three year absence as he had a lecture at his University in Tokyo.

Third from right is Nobuo Seki san who is one of the new members of JSO and his knowledge of dragonflies from Kanto region is indispensable to OST. He was born in downtown of Tokyo and has many records and collections from Mizumoto Park, western Tokyo.

Fourth from right is Koki Saito san, the youngest member of the drinking team. He became the age of 20 last year and attended officially with big excitement. This year he has collected female *Sympetrum fonscolombii* for the first time in Chiba pref (not published) and brought the specimen to this occasion.

Fifth from right is Toshiyuki Teramoto san, the experienced dragonfly master who every year visits overseas countries for collecting purposes. *Borneogomphus teramotoi* Karube & Sasamoto, 2014 and *Hemicordulia teramotoi* Yokoi, 2015 were collected by him.

Besides these regular members Kiyoshi Inoue san is also a member of OST as he lived in Tokyo before. And from time to time grasshopper enthusiasts, bee lovers, birdwatchers join our circle for fun. Our drinking team is always open to others so please join this drinking circle when you have a chance to stay on the second Wednesday of every month in Tokyo area. Of course non-alcoholic drinks are also widely available.

The genus *Stylurus* and resolution of *Stylurus annulatus* (Odonata: Gomphidae) and its close allies in Asia

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Abstract
The distribution of the Holarctic genus *Stylurus* Needham 1897 is reviewed and discussed. The Chinese *Stylurus flavicornis* (Needham, 1931), *Stylurus kreyenbergi* (Ris, 1928) and *Stylurus tongrensis* Liu, 1991 are shown to be junior synonyms of *Stylurus annulatus* (Djakonov, 1926), described from the Russian Far East, for which a revised synonymy is provided. Details are provided of the first record of *Stylurus clathratus* (Needham, 1930) from Hong Kong together with an updated synonymy. Details are also provided of a *Stylurus* sp., potentially a new species, from north Vietnam and a key to the Asian *Stylurus* is provided.

Key words: Odonata, Gomphidae, *Stylurus annulatus, Stylurus kreyenbergi, Stylurus flavicornis, Stylurus clathratus, Stylurus tongrensis,* synonym, nomenclature, taxonomy, Ussuri basin, Russian Far East, Russia, Hong Kong, Guangdong, Guizhou, China, South Korea, Vietnam, key.

Three species of *Stylurus* Needham 1897 were described from East Asia over a five-year period between 1926 and 1931. The first of these *Stylurus* was described as *Davidius* (?) *annulatus* by Djakonov in 1926 from a male collected from the Ussuri river basin, Far East Russia. Just two years later in 1928 Ris described *Gomphus kreyenbergi* from a single male collected in "Jentschoufu, Schantung", Shandong, China. The third member of the trio was described by Needham in 1931 as *Gomphus flavicornis* from a single female captured in Fujian. Needham stated in his original description that he thought his specimen might be the female of *G. kreyenbergi* described from Shandong, on account of its similar colouration, but he refrained from attributing it to *kreyenbergi* due to its larger size and described his female as a new species.

Asahina (1961) listed a male as *Gomphus* sp. (*annulatus* Djakonov ?) from "Lien-hwa-tung, Lushan" Jiangxi and stated that the Jiangxi specimen: '…will be identical with *Gomphus kreyengergi* Ris described from Shantung, and also with the Ussurian "*Davidius annulatus* Djakonov." Asahina clearly held the opinion that the *G. annulatus* and *G. kreyenbergi* were perhaps synonyms and stated in his 1961 paper that: 'A detailed taxonomic discussion will be made on a future occasion'. However, Asahina never made any further discussion regarding the synonymy of these two species. So, by 1961 there were clear indications from Needham and Asahina that both *G. flavicornis* and *G. kreyenbergi* were junior synonyms of *Stylurus annulatus* but no formal synonymy has been published until now.

Thirty years later Liu (1991) published a paper describing the new species *Stylurus tongrensis* from Guizhou based on a single female collected from Tongren. It is remarkably similar to the *S. flavicornis* female.

Stylurus is a Holarctic genus with representatives found in temperate and subtropical areas from North America, Asia and Europe. In the first edition of the *Dragonflies of North America* (Needham & Westfall, 1955) *Stylurus* was treated as a subgenus of *Gomphus* Leach 1815 but following many taxonomists' opinions, including Needham (1948), Asahina (1978), Carle (1986), Chao (1990) and Schmidt (1987), it is now universally accepted at generic level. The key characters used to determine the genus are small, simple post-like or narrow blade-like anterior hamules without hooks or teeth, simple and divaricate male cerci, short female subgenital plate (=<1/4 length of 9th sternite) deeply notched at tip, fourth segment of the penile organ very short, a short and wide post frons, absent or vestigial burrowing hooks on the larval mid and front tibia and elongate abdominal segment nine. Although the males of some species possess straight abdomens the majority have broadly clubbed abdomens with widely expanded abdominal segments 7-9. Chao (1991) commented that the genus *Stylurus* in China can easily be recognized by the shape of the posterior hamuli as well as by the colour marking on the frontal surface of the synthorax (dorsal stripes not confluent with collar stripe as observed in *Asiagomphus*). The posterior hamuli are long, narrow and always perpendicular or tangential to the longitudinal axis of the body.

Thirty species are currently recognised as belonging to the genus, including 12 from North America and 18 from Eurasia (Schorr & Paulson, 2018). The north Asian and European species *Stylurus flavipes* (Charpentier, 1825), treated as *Gomphus flavipes* in *The Field Guide to Britain & Europe* (Dijkkstra & Lewington, 2006) and in Schorr & Paulson (2018) should also be placed in *Stylurus* in accordance with Asahina (1973) & Schmidt (1987) making 19 species from Eurasia but reduced to 17 following the synonymy adopted here and the putative new species from Vietnam, mentioned later. According to Schmidt (1987), after he carefully evaluated the morphological characters of *S. flavipes,* he concluded: '…. there can be no doubt that *flavipes* is a true *Stylurus* and it confirms the generic status of *Stylurus.*' The placement of *flavipes* in *Stylurus* was also strongly supported by recent molecular genetic analysis conducted by Ware et al (2017).

In North America *Stylurus* species are found from latitudes ranging from ca. 20° in Mexico to ca. 53°

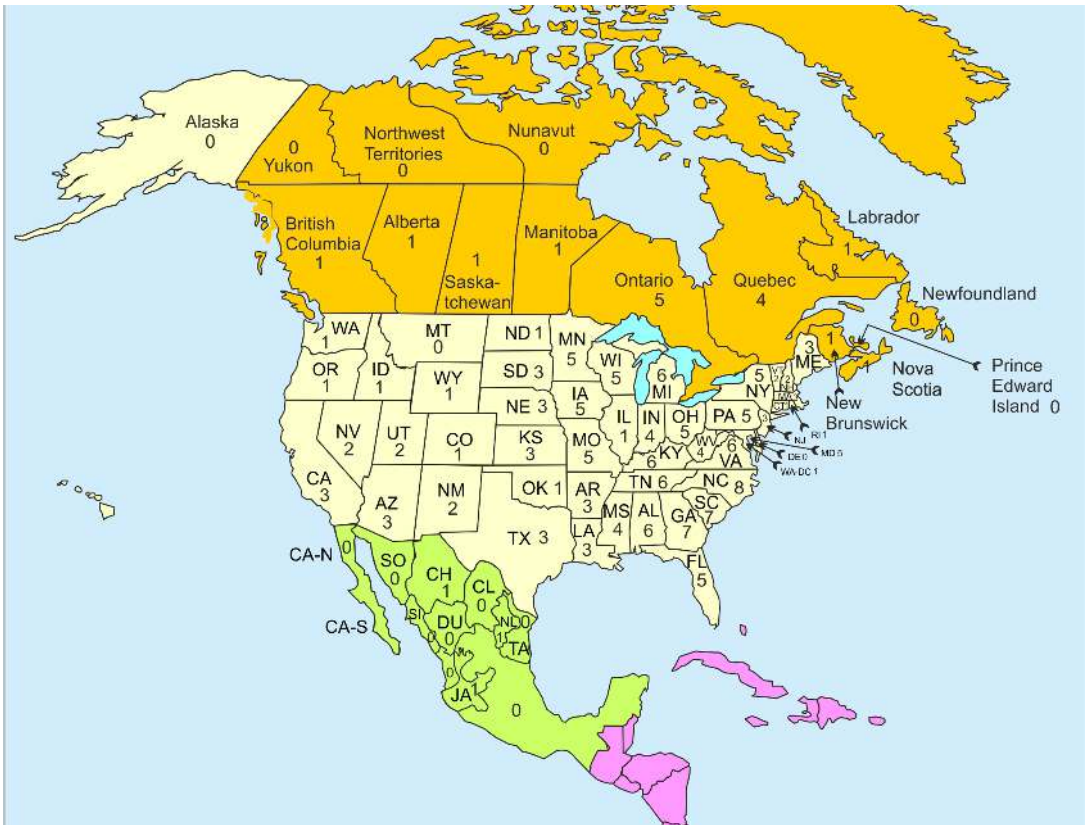

Figure 1. Map of North America showing number of species of *Stylurus* recorded in each state or province.

Figure 2. Map of China and east Asia showing number of species of *Stylurus* recorded for Vietnam, Japan, Russian Far East, Taiwan and Chinese provinces.

in Canada. The highest species richness is found unsurprisingly in the middle of this range at ca. 35° latitude in southeast USA. North Carolina has the highest number of recorded species where eight species are known. The next highest densities are found in South Carolina and Georgia where seven species are known from each state (see Figure 1). In China and East Asia a similarly wide latitudinal distribution pattern is found with *Stylurus* species recorded from ca. 18° to ca. 60° latitude. The highest numbers of species are recorded in south and southwest China at ca. 30° latitude with Sichuan recording eight species, Guangxi five species and Guangdong four species (see Figure 2). Individual species may also be distributed over large areas. In North America *Stylurus plagiatus* (Selys, 1954) is perhaps the most widespread with a distribution ranging some 2,600 km from Pelee Island, Lake Eyrie, Ontario across eastern, central and southwest USA to Nuevo León, Mexico (Dunkle, 1989). In Eurasia *Stylurus flavipes* ranges some 8,000 km from the French Atlantic coastline and southern Greece ca. 23° latitude across Europe to southern Finland at ca. 60° latitude (Boudot & Dyatova, 2015: 188-190) and across Asia to the Russian Far East at ca. 53 ° latitude (Malikova et al, 2007).

Stylurus annulatus and its allies

The larva and male of *Stylurus flavicornis* were described by Chao (1986). Over the past 35 years many specimens of *Stylurus annulatus* adults and larvae have been collected, described and photographed from both Korea and Japan and over the past ten years *Stylurus kreyenbergi* has been recorded from both Guangdong (Wilson & Xu, 2009) and Hong Kong (So, 2008). New Hong Kong records are also provided here. There are now sufficient specimens to resolve the relationships between *S. annulatus* and its closely related allies, namely *S. flavicornis*, *S. kreyenbergi* and *S. tongrensis*.

The ninth abdominal segment in *Stylurus* larvae is elongated and the length is variable in extent between species. The length of S9 in *Stylurus amicus* (Needham, 1930) larvae is more than two times the length of S8 but S9 is slightly less than 1.5 x S8 in both *S. annulatus* and *S. flavicornis*. The exuviae of *S. flavicornis* and larvae of *S. annulatus* are depicted in Figure 3 and are identical in form and abdominal segment proportion.

Hitherto the only putative female *S. kreyenbergi* was recorded by Schmidt (1931) from Ling Pin-Bezirk, Zhejiang, 18 May 1921, which was figured with no prominent horns above the lateral ocelli. Schmidt also figured the lateral body colour pattern (see Figure 4A), which resembles an onychogomphine colour pattern. It has a completely different colour pattern to the Asian female species of *Stylurus* (see Figure 4B), which have the same prominent yellow pattern as the males on segments 8-10 (see Figure 4C). Clearly the Zhejiang female, that has entirely black S8-9, does not belong to *S. kreyenbergi*. A true *S. kreyenbergi* female was recorded from Hong Kong on 15 September 2014 at Ma On Shan possessing prominent horns above the lateral ocelli, see Figure 8E (Tam, T.W., Hong Kong Agriculture, Fisheries and Conservation Dept. [AFCD] pers. comm., 23 Nov 2018).

The type male *kreyenbergi*'s measurements were given as ab. 40 mm, hw 30 mm whereas the holotype female *flavicornis*' measurements are ab. 40 mm, hw 35 mm. Zhang (1999) reported the measurements of *S.*

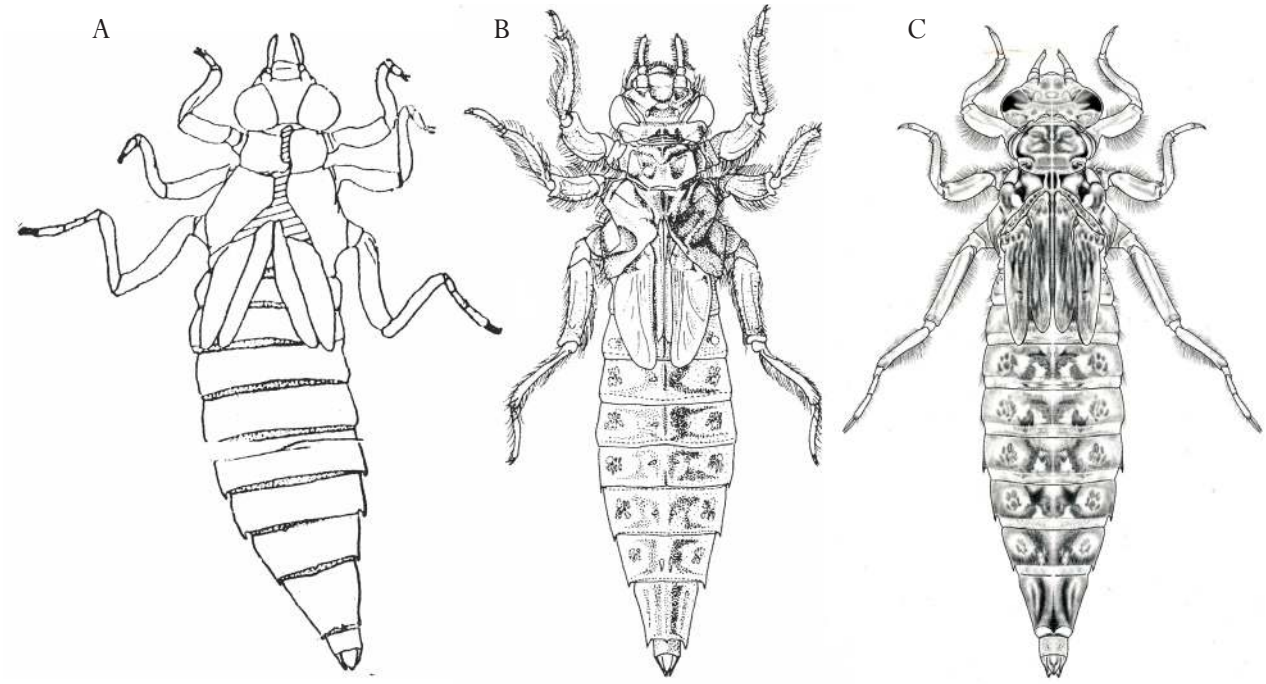

Figure 3. *Stylurus annulatus* larvae. (A) Exuviae identified as *Stylurus flavicornis* from Fujian (Chao, 1986, 1990). (B) Larvae of *Stylurus annulatus* from Japan (Ishida et al., 1988). (C) Larvae of *Stylurus annulatus* from S. Korea (Jung, 2011).

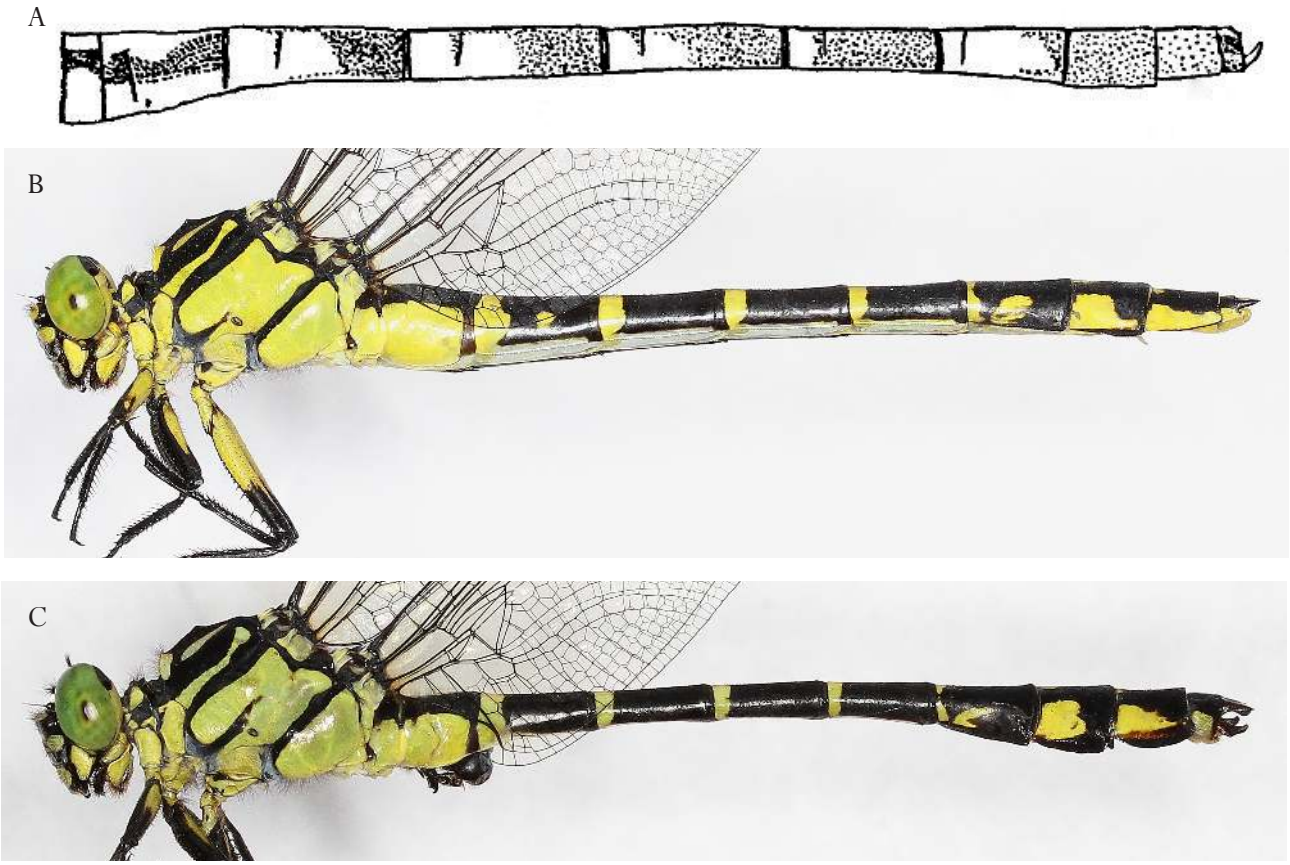

Figure 4. *Stylurus annulatus*. (A) Putative *Stylurus kreyenbergi* nec Ris 1928 female from Schmidt (1931). (B-C) *Stylurus annulatus* lateral, Korea. Photo credits: Sungbin Cho. (B) Female. (C) Male.

flavicornis as male ab. 42 mm, hw 35 mm, female ab. 45 mm, hw 37 mm. In Japan the male size range for *S. annulatus* is given by Sugimura et al (2001) as ab. 42-44 mm, hw 33-35 mm and female ab. 42-45 mm, hw 34-37 mm. The freshly emerged teneral male *S. kreyenbergi* collected from Panyu, Guangzhou in 2002 (Wilson & Xu, 2009) measured ab. 42 mm, hw 34 mm, which is within both the Japanese *S. annulatus* and the Fujianese *S. flavicornis* ranges. The type *S. kreyenbergi* appears to be relatively small but size is variable and this character alone is insufficient reason to designate a new species. Moreover it is likely that Ris overlooked *S. annulatus,* tentatively described under the genus *Davidius* two years earlier. The female holotype *S. tongrensis* measures ab. 46 mm, hw 36.5 mm, which is commensurate with Zhang's (1999) measurements for *S. flavicornis* female and measurements provided for Japanese *S. annulatus* Sugimura et al (2001).

The prominent horn-like projections above the female lateral ocelli have been figured by Sugimura et al (2001) and Bae & Lee (2012) for *S. annulatus*, by Needham (1931) and Chao (1990) for *S. flavicornis* (see Figure 5A-B, E) and Lui (1991) for *S. tongrensis* (see Figure 6A). These remarkable structures are identical in all drawings and can be clearly seen in the female *S. annulatus* specimen depicted in Figure 11A.

When Chao (1986) described the first male *flavicornis* and transferred it to the genus *Stylurus* for the first time he made no mention of *kreyenbergi*, which at the time he thought belonged in the genus *Burmagomphus* Williamson, 1907, and also no mention of *S. nanningensis* Liu, 1985, which had only just been described. In Chao's (1990) Chinese gomphid key he separated *S. flavicornis* from *S. kreyenbergi* based on the structures above the male lateral ocelli, describing *S. flavicornis*: 'with a pair of basally large triangular nodule-like tubercles' and *S. kreyenbergi*: 'with a pair of transverse apically rounded ridges'. The vertex area of the male *S. kreyenbergi* collected from Hong Kong (So, 2008) is depicted in Figure 5F & Figure 8B showing the transverse ridge above the central ocelli which is slightly deflected above each lateral ocelli. An identical structure can be seen in the Korean male *S. annulatus* depicted in Figure 11A and the Sichuan *S. kreyenbergi* reproduced from Chao (1990) in Figure 12A. The drawing provided by Chao (1986, 1990) for the male vertex area of *S. flavicornis,* showing structures above the lateral ocelli (see Figure 5D), described by Chao (1990) as: 'large triangular nodule-like tubercles' in fact shows tubercles identical to those of the male *S. nanningensis* (see Figure 16E-F).

When Liu (1991) described *S. tongrensis* he made comparisons of his single female with female *S. flavicornis* and *S. erectocornis* but made no mention of *S. annulatus* or *S. kreyenbergi*; probably dismissing the latter due to Schmidt's (1991) description of the misidentified female *S. kreyenbergi*. Liu separated female *S. tongrensis*

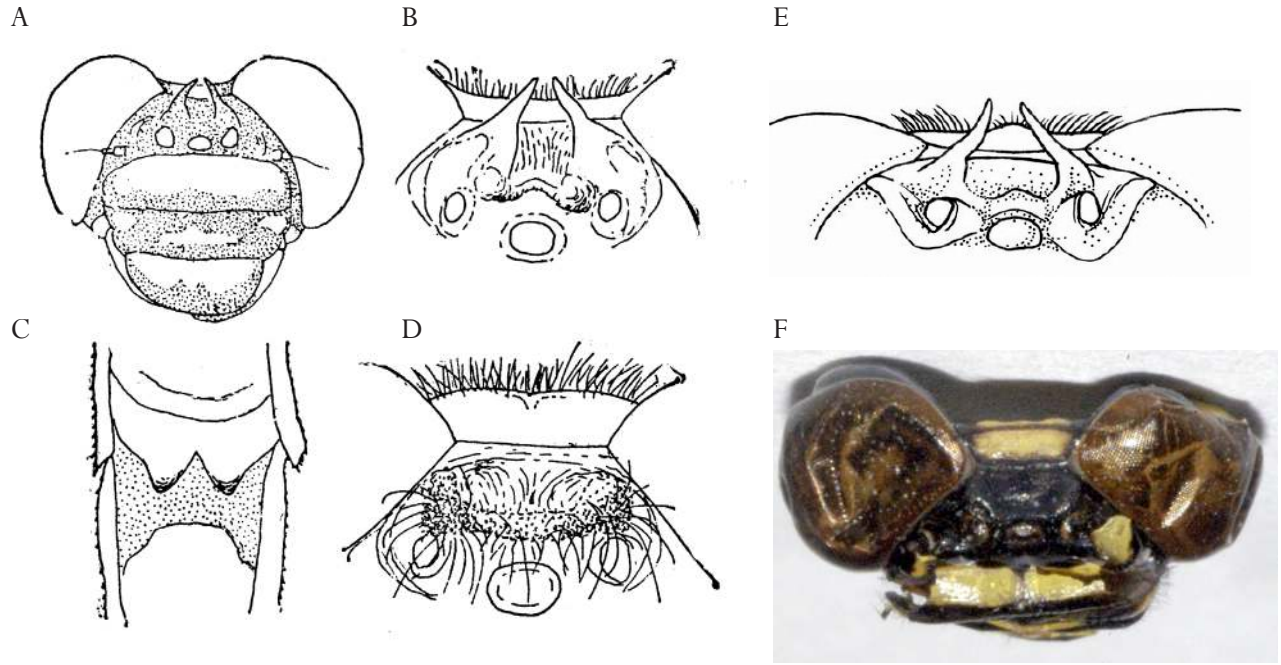

Figure 5. ***Stylurus annulatus.*** **(A-C) Drawings labelled as *Stylurus flavicornis,* Fujian from Chao (1986, 1990). (A-B) Female head, frontal. (C) Female subgenital plate. (D) Drawing identified as male vertex of *Stylurus flavicornis,* Fujian from Chao (1990), which looks like that of the male *Stylurus nanningensis* Liu 1985. (E) *Stylurus annulatus*, Korea., female vertex area, from Bae & Lee (2012). (F) Male identified as *Stylurus kreyenbergi*, 13 August 2008, Hong Kong, photo credit: Samson So.**

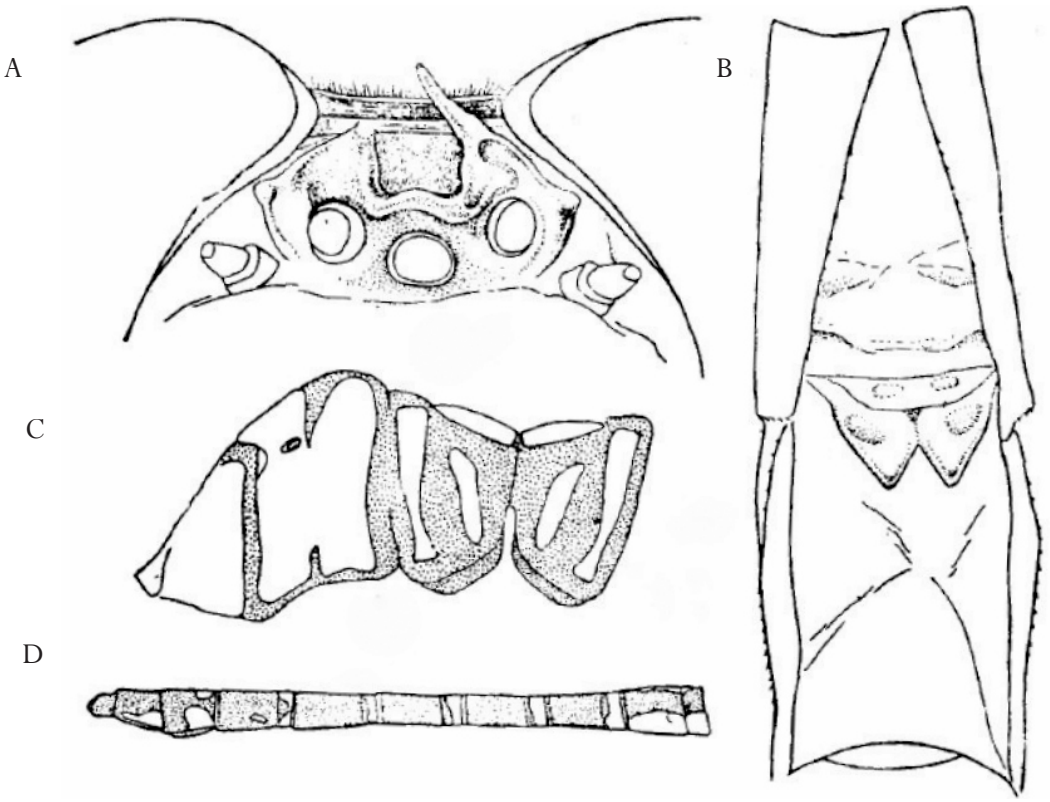

Figure 6. ***Stylurus annulatus,*** **female, Guizhou. (A-D) Drawings of the Guizhou holotype female *S. tongrensis* from Liu (1991). (A) Female vertex area. (B) Caudal abdomen and subgenital plate. (C) Synthorax. (D) Abdomen, lateral.**

from *S. flavicornis* based on a (i) black rather than yellow occiput, (ii) labrum yellow with broad black anterior margin, without a short black stripe on the centre and (iii) the subgenital plate with a pair of triangular lobes, the outer margins of the two lobes being straight, not curved. Occpital colour is not always consistent in gomphids and is often an unreliable character and certainly not in itself sufficient to name a new species. The occiput in Japanese *S. annulatus* males is typically black, whereas it is largely yellow in continental Asia. The second and third differences highlighted are not substantive and the differences mentioned so slight that they could be accounted for by phenotypic variation or, in the case of the subgenital plate, simply the perspective of the artist. In truth the subgenital plates figured for both holotypes in Figure 5C for *S. flavicornis* and Figure 6B for *S. tongrensis* look identical. The subgenital plate also looks identical to that drawn for Japanese *S. annulatus* (see Figure 9D). Korean females have slightly more developed yellow on the femora (Figure 4B) than the Guangdong female (Figure 8F). However, *S. flavicornis, S. kreyenbergi* and *S. tongrensis* females all share the same synthoracic markings, identical antehumeral stripes and body colour pattern and more importantly all possess the unique prominent horns above the lateral ocelli. It is likely that Lui would not have described *S. tongrensis* if, at the time, he had considered the possibility of his Guizhou female being the female of *S. kreyenbergi*.

The male caudal appendages and secondary genitalia of *S. kreyenbergi* from Guangdong (Figure 7A & Figure 8) and Sichuan (Figure 12) are identical to *S. flavicornis* from Fujian (Figure 7B-G) and *S. annulatus* from Japan and Korea (Figure 11C & Figure 9A-B). Moreover, the female subgenital plate, and horns on the vertex above the lateral ocelli, of both *S. flavicornis* (Figure 5A-C) and *S. tongrensis* from Guizhou (Figure 6A,E) are identical to *S. annulatus* from Korea (Figure 11E & Figure 5E). It is now quite obvious that *S. kreyenbergi*, *S. flavicornis* and *S. tongrensis* are synonyms. There are no significant structural differences between *S. kreyenbergi*, *S. flavicornis, S. tongrensis* and *S. annulatus*. *S. kreyenbergi*, *S. flavicornis* and *S. tongrensis* are all junior synonyms of *S. annulatus* (Figure 4B-C, Figure 11-Figure 12). Details of new records from Hong Kong and a revised synonymy are provided below.

New records of *S. annulatus* from Hong Kong (Tam, T.W., AFCD pers. comm., 23 Nov 2018)

1 ♀, 15 Sep 2014, Ma On Shan, Hong Kong (photo Figure 8E); 1 ♂, 27 Jun 2017, Ma On Shan, Hong Kong.

It is possible that these records from Ma On Shan indicate breeding in the 4,594 ha Plover Cove Reservoir, which was constructed in 1978. The reservoir is located just 2.5 km to the north of Ma On Shan across the Tolo Harbour Channel. The reservoir is supplied with water abstracted from a large slow flowing river, the Dong River, which is an eastern tributary of the Pearl River in neighbouring Guangdong province, southern China.

Stylurus annulatus (Djakonov 1926) Figs 3-12

Davidius* (?) *annulatus: Djakonov (1926: 232-234, holotype ♂, 27 Jul 1924, type-loc. "Ussuri-Gebiet", Ussuri river basin, Russian Far East).

Gomphus oculatus nec Asahina 1949: Cho (1958: Mt Soyo-san, Gyeonggi province, S. Korea).

Gomphus sp. (*annulatus* Djakonov ?): Asahina (1961: 3, figs 23–26, "Lien-hwa-tung", Lushan, Jiangxi).

Stylurus annulatus: Obana (1972: Mt. Geumjeongsan, Gyeonggi province, S. Korea); Ishida (1984: 77-79, pl. 18, larva, adult photos, Japan); Davies and Tobin (1985: 37, N.E. Asia-Japan); Asahina (1989: 9, Korean record); Ishida et al (1988: 88, pl. 21, figs 25, 88-96, larva, adult photos, Japan); Yoon & Kong (1988: 234-235, S. Korea); Kong (1988: 58, larvae description, S. Korea); Tsuda (1991: 113, China, Japan, N. Korea, S. Korea, Russia); Bridges (1994: VII.15, VIII.66); Yoon & Koon (1995: 49, larval key, S. Korea); Steinmann (1997: 148, Northeast Asia); Hua (2000: 12, China); Tsuda (2000: 113, China, Japan, N. Korea, S. Korea, Russia); Sugimura et al (2001: 128, 307, 334, 376, 515-516, adult photos, figs, Korea, NE China, Ussuri river basin, central Honshu, Japan); Lee (2001: 84, S. Korea [Gapyeong, Gyeonggi province; Yeongweol Gangwon province; Suncheon, Jeollanam]); Lee (2006: 26, Korean records); Jung (2007: 311-313, Korea); Jung (2011: 214-215, fig 39, larva, S. Korea); Bae & Lee (2012: 13, fig. 1F, 19, 66, pl 5, S. Korea [1 ♂ and 1 ♀, Yeoncheon-gun Baekhak-myeon, Gyeonggi province, 28 Jun 2009, 1 ♀, Gapyeonggun Daeseong-ri, Gyeonggi province 14 Jul 1982, 1 ♂, Yeongwol, Gangwon province, 16 May 1998]); Seehausen & Fiebig (2016: 207, 1 ♀, Taedongang River, [39.0415°N, 125.7722°E], N. Korea); Schorr & Paulson (2018).

***Gomphus kreyenbergi*:** Ris (1928: 273, holotype ♂, type-loc. "Jentschoufu, Schantung", Shandong); Needham (1930: 47, 54-55, 273, pl. 6, fig. 20, Shantung); Wu (1935: 260); Navás (1936: 38, "Kuling", Jiangxi). **Syn nov.**

Gomphus (*Gomphurus*) *kryenbergi*: Needham (1941: 160, Shandong).

Burmagomphus kreyenbergi: Chao (1954: 70, 80, 281-284, figs ♂, Jiangxi, Shandong & Zhejiang); Chao (1983: 100, Jiangxi, Shangdong & Zhejiang); Davies and Tobin (1985: 25, China); Steinmann (1997: 98, China).

Stylurus kreyenbergi: Chao (1990: 131–133, 10 figs, 2 ♂, 26 Jul 1935, Sichuan); Bridges (1994: VII.127, VIII.66); Tsuda (2000: 114, China); Hua (2000: 12, Jiangxi, Shandong, Sichuan, Zhejiang); Wilson & Xu (2009: 23-25, figs 11a-f, 1 ♂, Panyu, Guangzhou, Guangdong, 9 Aug 2002); So (2008: 1 ♂, Sai Kung

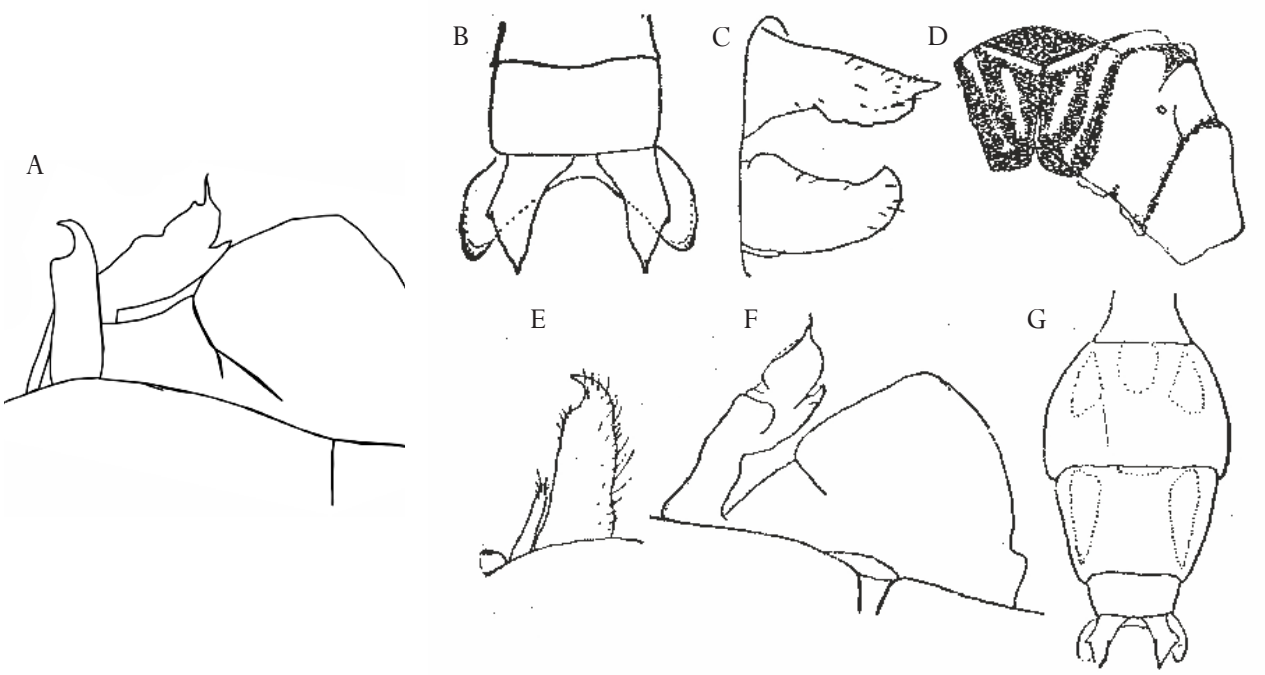

Figure 7. ***Stylurus annulatus*** **male. (A) Secondary genitalia, lateral, as *S. kreyenbergi*, Guangdong from Wilson & Xu (2009). (B-G) As *S. flavicornis,* Fujian from Chao (1990). (B-C) Caudal genitalia. (D) Thorax. (E-F) Secondary genitalia, lateral. (G) Caudal abdomen, dorsal.**

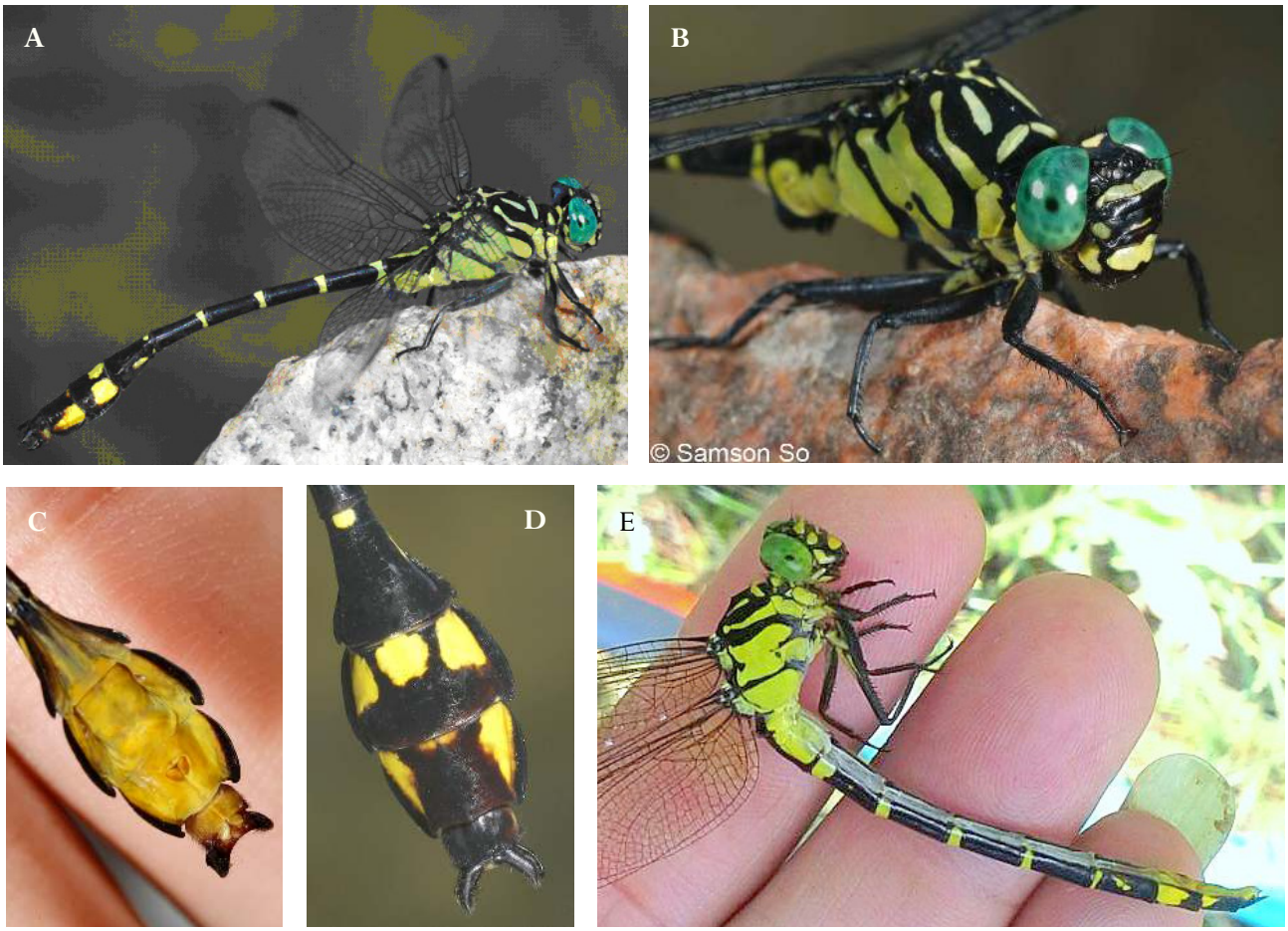

Figure 8. ***Stylurus annulatus.*** **(A-E) male, identified as *Stylurus kreyenbergi*, Sai Kung, Hong Kong, 13 August 2008 from So (2008), photo credits: Samson So. (A) Male and female frontal, left male, right female. (B) Male caudal abdomen, dorsal. (C) Male caudal abdomen, ventral. (D) Female caudal abdomen, dorsal. (E) Female initially identified as *S. kreyenbergi*, 15 Sep 2014, Ma On Shan, Hong Kong (Tam, T.W., AFCD pers. comm., 23 Nov 2018).**

[landed on vessel ca. 1 km from shore], Hong Kong, 13 Aug 2008); Leung & Tam, (2016: 16-17); Schorr & Paulson (2018).

***Gomphus flavicornis*:** Needham (1931: 3-4, fig 4, holotype ♀ type-loc. "Fukien"); Wu (1935: 259, Fujian); Needham (1941: 155, 157); Needham (1944: 155, 157); Chao (1953: 427, Fujian); Chao (1983: 101, Fujian); Davies and Tobin (1985: 29, China); Steinmann (1997: 116, northeast Asia). **Syn nov.**

Stylurus flavicornis: Chao (1986: 39-43, figs 22-31, first ♂ Fuzhou, Fujian, 26 June 1955, 1 ♀, 6 May 1986, reared from nymph, coll from small river, Shaowu City, Fujian); Chao (1990: 122-125, 12 figs, ♂, ♀, Fujian); Tsuda (1991: 113, China); Bridges (1994: VII.87, VIII.66); Zhang (1999: 262-263, fig. 24.94, Fujian); Hua (2000: 12, Fujian), Tsuda (2000: 113, China); Schorr & Paulson (2018).

Stylurus tongrensis: Liu (1991: 135-137, holotype ♀, Tongren, Guizhou); Schorr & Paulson (2018). **Syn nov.**

Ecological notes for *Stylurus annulatus*

Stylurus larvae are adapted to dwelling in slow-flowing or lentic conditions in soft substrates comprised of mud or sand and are found in large lowland rivers, reservoirs, lake shores and slow-flowing sections of streams (see

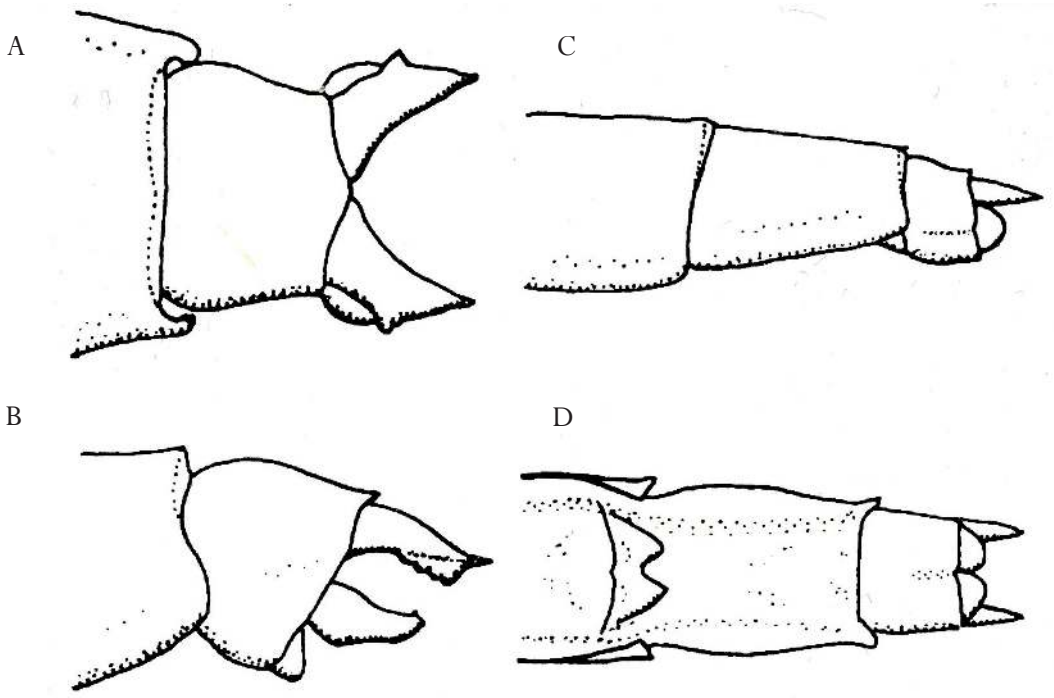

Figure 9. ***Stylurus annulatus*, Japan, from Sugimura et al (2001). (A-B) Male, caudal appendages (A) Dorsal view. (B) Lateral view. (C-D) Female, caudal abdomen. (C) Lateral view. (D) Ventral view showing subgenital plate.**

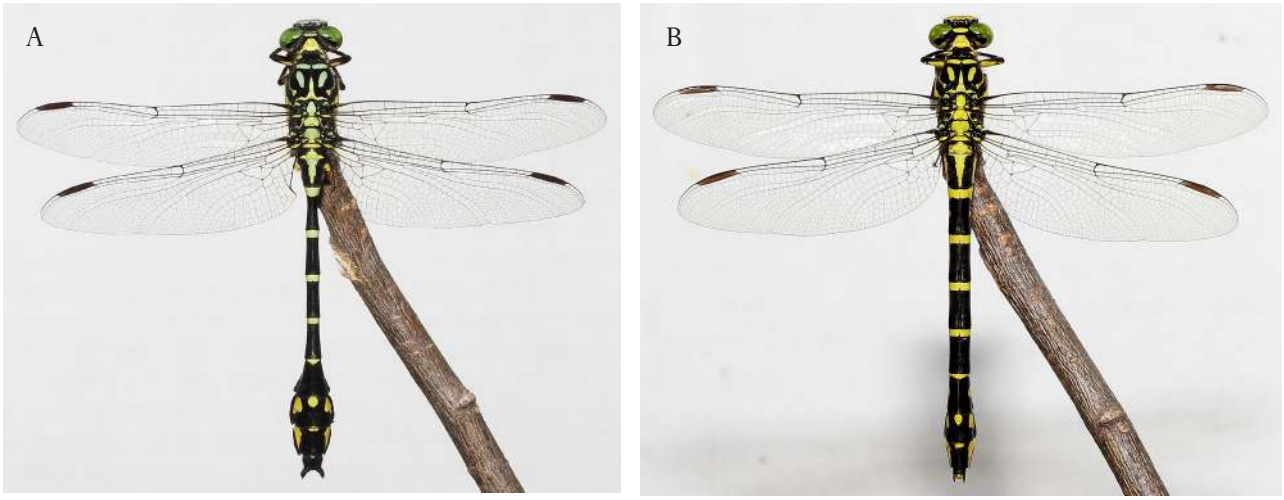

Figure 10. ***Stylurus annulatus*, South Korea. (A) Male. (B) Female. Photo credits: Sungbin Cho.**

Figure 11. ***Stylurus annulatus*****, South Korea. (A) Male and female frontal, left male, right female. (B) Male caudal abdomen, dorsal. (C) Male caudal abdomen, ventral. (D) Female caudal abdomen, dorsal. (E) Female caudal abdomen, ventral. Photo credits: Sungbin Cho.**

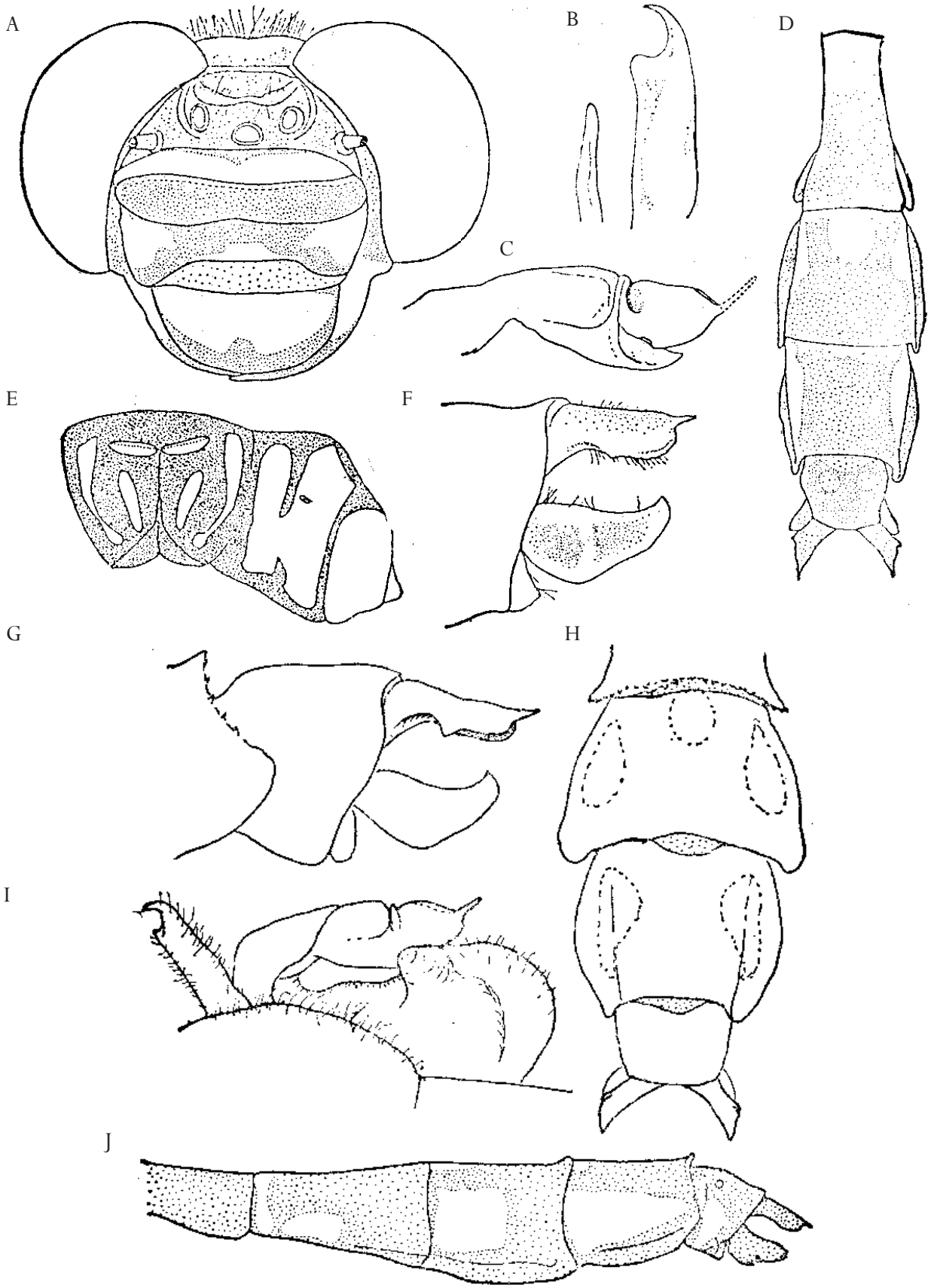

Figure 12. ***Stylurus annulatus*** **male, Emei Shan, Sichuan, China, from Chao (1990). A-J as *S. kreyenbergi,* Emei Shan, Sichuan. (A) Head, frontal. (B) Hamuli. (C) Penile organ. (D) Caudal abdomen, dorsal. (E) Synthorax. (F-G) Anal appendages, lateral. (H) Caudal abdomen, dorsal. (I) secondary genitalia. (J) Caudal abdomen, lateral.**

Figure 3). Several species are also found in small sandy streams. Emergence is generally protracted and peak flight activity is relatively late in the season.

In Korea *S. annulatus* inhabits large rivers and begins to emerge in June with the flight season extending through to September. The peak flight period in Korea is July and August (Sungbin Cho pers. comm., Oct 2018). The first Guangdong male was collected in early August (Wilson & Xu, 2009) and the second Guangdong male was captured in mid-August (So, 2008). The first male Guangdong specimen was captured in an industrial area of Panyu, Guangzhou and was one of several freshly emerged individuals observed at the riverside in the industrial setting of urban Guangzhou. The teneral dragonflies were found on the banks of a deep, broad, muddy leat of the Zhujiang (Pearl) river delta. Wilson & Xu (2009) commented that the larvae could clearly tolerate moderate to high levels of organic pollution in an industrial urban environment setting.

Hitherto the only Chinese record of *S. annulatus* was the original description of the holotype male from the Ussuri river basin where it was assumed to also occur in Heilongjiang, which forms the western part of the basin. There are now records of *S. annulatus* from Russia (Ussuri Basin), China (Fujian, Guangdong, Guizhou, Heilongjiang, Jiangxi, Shangdong & Sichuan), Japan (Honshu Island: Shiga, Kyoto, Osaka & Mie prefectures), N. Korea and S. Korea (Gyeonggi, Gangwon & Jeollanam). Note Schmidt's 1937 record of a female, as *G. kreyenbergi* from Zhejiang has been invalidated.

In Asia there are very few odonates that have a breeding range that extends from the Russian Far East through to southern China (Kosterin & Malikova, 2009). Within the family Gomphidae, apart from *S. annulatus,* only the lentic *Sinictinogomphus clavatus* (Fabricius, 1775) has such an extensive range. The ranges of the lentic macromiid *Epophthalmia elegans* (Brauer, 1865), the calopterygid *Atrocalopteryx atrata* (Selys, 1853) and the coenagrionid *Paracercion calamorum* (Ris, 1916) also extend from the Russian Far East to southern China as do several species of *Symptrum*; but *A. atrata* and *Sympetrum* spp. cannot be found resident below 23° latitude in southern China. As discussed earlier several lentic *Stylurus* in North America also have remarkably large distributions e.g. *S. intricatus* (Hagen in Selys, 1858) and *S. plagiatus,* both of which range from Canada through the USA to Mexico.

First record of *Stylurus clathratus* (Needham, 1930) from Hong Kong

A photo of a female *Stylurus* was taken by Ernest Chiu in June 2018, near Tai O, Lantau, which is located at the western extremity of Hong Kong territory in the Zhujiang (Pearl) River Estuary (see Figure 13). The *Stylurus* can be identified confidently as *S. clathratus* based on its well separated yellow, lateral thoracic stripes, its distinctive dorsal yellow abdominal pattern and the ratio of abdominal S8 to S9 and S10. I was able to compare the photo directly with two female *S. clathratus* specimens collected from Dinghu Shan, Guangdong in June 1994 (Wilson, 1999), see Figure 14. There can be no doubt that the photo is that of a female *S. clathratus.*

The photo represents the first record of *S. clathratus* recorded from Hong Kong territory. *S. clathratus* has now been recorded from China (Fujian, Guangdong, Guangxi, Hong Kong, Hubei & Sichuan) and Vietnam.

Synonymic notes are provided below.

Figure 13. *Stylurus clathratus*, female, June 2018, Tai O, Lantau, Hong Kong. Photo credit: Ernest Chiu.

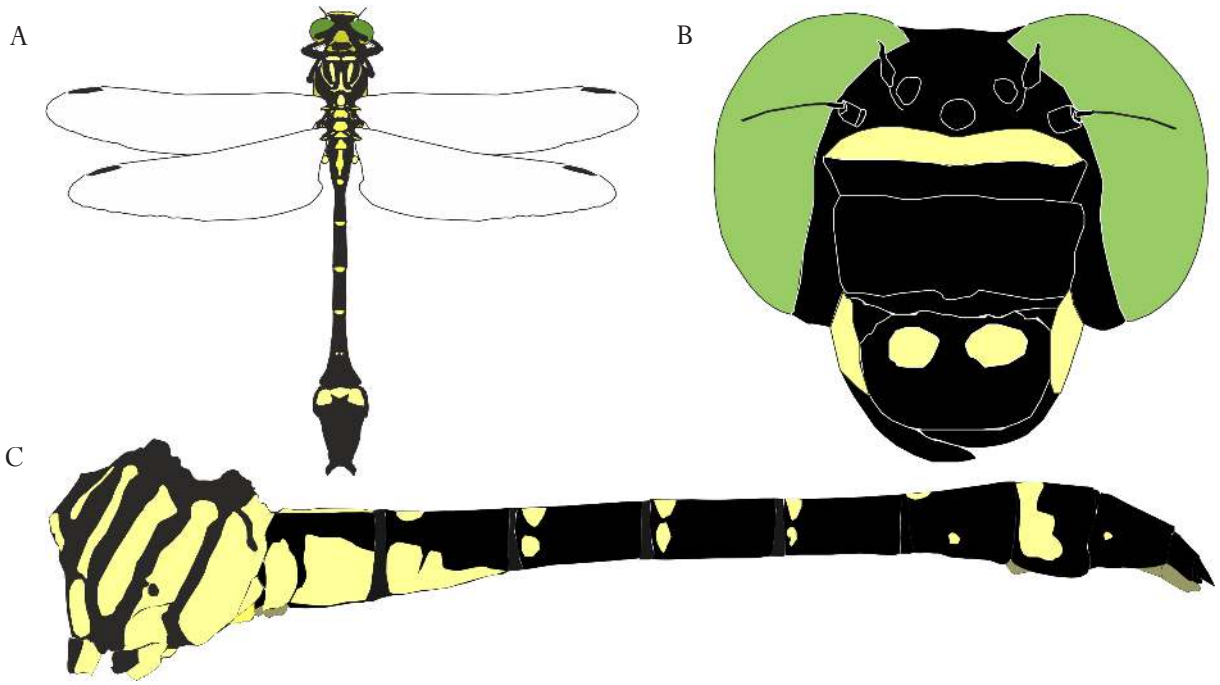

Figure 14. ***Stylurus clathratus*, 13-15 June 1994, Dinghu Shan, Guangdong, China. (A) Male. (B) Female head, frontal. (C) Female body, lateral.**

***Stylurus clathratus* (Needham, 1930) Figs 10-11**

Gomphus clathratus: Needham (1930: 64, pl. 6, fig. 4, 3 ♂, 2 ♀, type-loc. Fujian); Needham (1931: 1, Sichuan), Wu (1935: 259); Needham (1941: 150, 152): Needham (1944: 155, 157); Chao (1953: 422. figs 71-75); Chao (1983: 104, Fujian, Guangdong, Hubei, Sichuan); Davies & Tobin (1985: 29, China); Chao (1983: 104); Sui & Sun (1984: 41-43, pl. 32, figs A-E, Fujian, Guangdong, Sichuan); Steinmann (1997: 114, China).

Gomphus amicus nec Needham 1930: Needham (1930: 63-64, misidentified ♀).

Stylurus clathratus: Needham (1948: 336); Chao (1986); Chao (1990: 116-119, pl. 5-2.2, figs 1-14, Fujian, Taiwan, Sichuan); Tsuda (1991: 113, China); Wilson (1999: 39, 2 ♂, 2 ♀, 13-15 June 1994, Dinghu Shan, Guangdong); Zhang (1999: 261-262, figs 24.93 A-E, Fujian, Guangdong, Hubei, Sichuan); Tsuda (2000: 113, China); Hua (2000: 12, Fujian, Guangdong, Hubei, Sichuan); Kalkman (2005: 1 ♂, 14 July 2005, photo, Longshen, Guangxi); 1 ♂, 17 July 2005, photo, Dinghu Shan, Guangdong, identified as: 'maybe *S. clathratus*'); Karube (2014: 77, fig. 1, 1 ♂, [photo], 24 May 1993, Mt Tam Dao, Vietnam); Schorr & Paulson (2018).

Stylurus amicus nec Needham 1930: Asahina (1978: 5-6, figs 10-11, Foochow [Fujian], misidentification).

***Stylurus* sp., Vietnam**

A series of photos of a Vietnamese female *Stylurus* were posted on the *VietOdonata* web site [Link], June 2012 by Sébastien Delonglée. The photos were taken in the suburbs of Hanoi, north Vietnam at a polluted pond in a small wooded area, not far from the Red River, which is the likely breeding location (Sébastien Delonglée pers. comm., Oct 2018) - see Figure 15A-D. The female colour pattern includes an antehumeral stripe reduced to a small yellow spot and in this respect it is very similar to *Stylurus nanningensis*. The first female *S. nanningensis* was recorded from Dinghu Shan, Guangdong (Wilson, 1999) and is the only Asian *Stylurus* without a prominent antehumeral stripe, but the subgenital plate and the structures above the lateral ocelli are quite different (see Figure 16A-C). The subgenital plate (valvula vulvae) are deeply divided in the putative Guangdong *S. nanningensis* but undivided in the Vietnamese species (see Figure 15C). The male *S. nanningensis*, collected near the type locality in Guangxi (Wilson, 2005) is figured in Figure 16(E-J) and the female from Guangdong in Figure 16(A-D).

The female from Hanoi is either a new species or possibly the true female of *S. nanningensis* and the female described as the first female *S. nanningensis* (Wilson, 1999) actually represents a new species from Guangdong. *S. nanningensis* was described from Nanning, Guangxi. The Hanoi female was found ca. 325 km from Nanning and is 100 km closer to the *S. nanningensis* type-loc. than the Dinghu Shan, Guangdong female, which was found ca. 425 km from Nanning. In favour of the status quo is the fact that *S. nanningensis* type-loc and the Dinghu Shan female share the same river catchment; both are located close to the main Zhujiang (Pearl) River. Either way the Hanoi female represents the third species of *Stylurus* recorded from Vietnam along with *S. amicus* and *S. clathratus*.

A key is provided to the Asian *Stylurus* below.

Key to Asian *Stylurus* Needham 1897

1.	Markedly elongated abdominal S9 ca. =>4 x S10. Female with rear projection to central occipital margin.	*S. amicus* - Vietnam, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangsu, Sichuan
-	Not markedly elongate S9 less than 4 x S10. Female occiput with no rear projections.	2.
2.	Thoracic lateral 1st and 2nd yellow stripes well separated.	3.
-	Thoracic lateral 1st and 2nd yellow stripes fused (accept in *S. annulatus* from Japan)	8.
3.	Antehumeral stripe reduced to anterior spot.	4.
-	Antehumeral stripe present.	5.
4.	Male superior appendages bifid at tip with latero-ventrad projection at outer mid-point, tip of penile organ cup-shaped with characteristic plunging keel. Female with deeply divided subgenital plate.	*S. nanningensis* Liu, 1985 - Fujian, Guangdong, Guangxi
-	Male superior appendages unknown. Female with undivided and truncated subgenital plate.	*Stylurus* sp. Vietnam
5.	Male superior appendages bifid at tip. Female with truncated subgenital plate and with prominent short, pointed projections above and to the side of the lateral ocelli	*S. clathratus* (Needham, 1930) - Vietnam, Fujian, Guangdong, Guangxi, Hubei, Sichuan
-	Male superior appendages pointed at tip, not bifid. Female with divided, v-notched, subgenital plate and female not with prominent short, pointed projections above and to the side of the lateral ocelli	6.
6	Male superior appendages, stout and relatively short =< length S10. Female with prominent long, upright pointed projections located directly above lateral ocelli and with deeply divided subgenital plate. Yellow lateral spots on anterior clypeus (China).	*S. erectocornis* Liu & Chao in Chao, 1990 Guangxi, Hainan
-	Male superior appendages slender and long > length S10 (Korea & Japan). Female without prominent long, upright pointed projections.	7.
7.	Yellow triangular-shaped spots S3-6. Female occiput with large yellow spot & anteclypeus with lateral yellow spots. Female occiput & anteclypeus black.	*S. nagoyanus* Asahina, 1951 Japan
-	Male with yellow small round spots S3-6. Male & female with largely yellow labrum. Female occiput with large yellow spot & anteclypeus with lateral yellow spots.	*S. oculatus* (Selys, 1878) Korea & Japan
8.	Occiput black, antehumeral stripe incomplete.	9.
-	Occiput yellow, antehumeral stripe complete	11.
9.	Antehumeral stripe separated into superior spot and inferior stripe.	10.
	Antehumeral stripe very short connected to superior spot.	*S. takahii* (Asahina, 1966) - Taiwan
10.	Male with inferior appendages strongly reflexed vertically with blunt tips. Female subgenital plate with wide, shallow notch.	*S. endicotti* (Needham, 1930) - Guangxi, Sichuan
-	Male unknown; female subgenital plate with wide, shallow notch; short, pointed projections above and to the side of the lateral ocelli.	*S. placidus* Liu & Chao in Chao, 1990 - Sichuan (Possibly a syn. of *S. endicotti*)
-	Male with inferior appendages not strongly reflexed vertically with sharply pointed tip. Female subgenital plate deeply divided into two blunt equilateral trangles extending rearward about a fifth of S9; labrum black with pair of basal, transverse yellow spots.	*S. gideon* (Needham, 1941) - Hubei, Sichuan
-	Male unknown. Female subgenital plate as *S. gideon*; wide, u-shaped ridge above and between lateral ocelli; labrum mostly yellow.	*S. gaudens* (Chao, 1953) - Sichuan
11.	Entirely yellow anteclypeus	*S. nobilis* Liu & Chao in Chao, 1990 - Ningxia
-	Anteclypeus not entirely yellow	12.
12.	Apical segment of penis hook-shaped. Female subgenital plate shallow notch distally.	*S. occultus* (Selys, 1878) - Far East Russia, Gansu, Heilongjiang, Henan, Jiangxi, Taiwan
-	Apical segment of penile organ cup-shaped. Female subgenital plate deeply divided, v-notched	13.
13	Male and female dorsal abdomen S7-9 with central longitudinal, narrow yellow stripes.	*S. flavipes* (Charpentier, 1825) - Eurasia, Heilongjiang, Liaoning, Shaanxi, Sichuan
-	Male and female dorsal abdomen S7-9 with yellow basal spot or ring, no longitudinal stripes.	*S. annulatus* (Djakonov, 1926) - Far East Russia, Japan, Korea, Fujian, Guangdong, Guizhou, Heilongjiang, Sichuan, Jiangxi, Shangdong, Sichuan

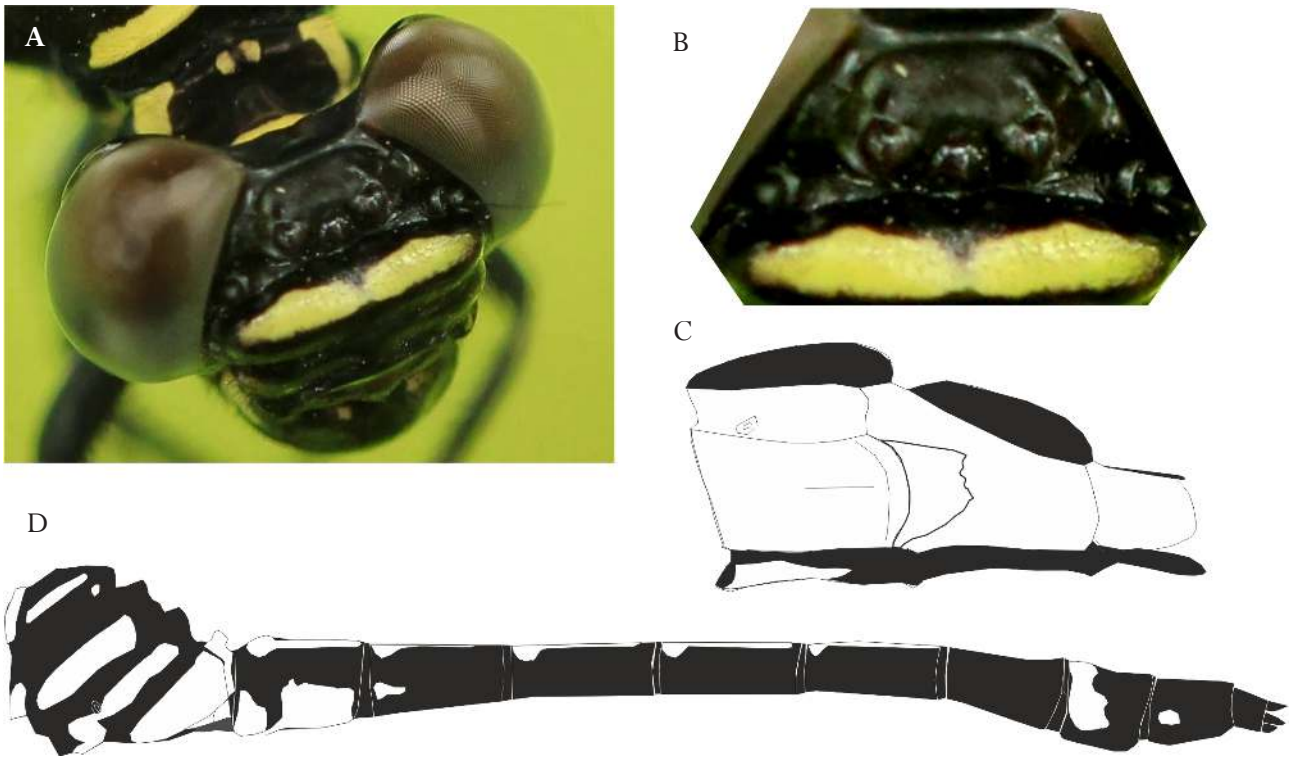

Figure 15. ***Stylurus*** **sp., female, late June 2012, suburbs of Hanoi, north Vietnam, from VietOdonata. Photo credits: Sébastien Delonglée. (A) Top of head. (B) Vertex area. (C) Caudal abdomen, ventral oblique, showing truncated undivided subgenital plate. (D) Body, lateral.**

Acknowledgements

I am very grateful to Kevin Chang Won Seo and Sungbin Cho for their helpful discussions regarding the synonymy of the *S. annulatus* and its allies and for providing high quality images of Korean *S. annulatus.* I am also extremely grateful to Kwang-Soo Jung for sending me a copy of his superb 2011 book on the Odonata larvae of Korea. Thanks also to Ernest Chiu for his permission to use his photo of the first ever recorded *Stylurus* from Hong Kong and to Sébastien Delonglée for her permission to use her photos of the Hanoi *Stylurus* sp. Lastly I'm also most thankful to Xin Yu for providing me with a copy of Liu (1991), to Oleg Kosterin for his helpful comments and input regarding *Stylurus* distribution in the Russian Far East and for his review, and to both Rory Dow and Graham Reels for their reviews and comments.

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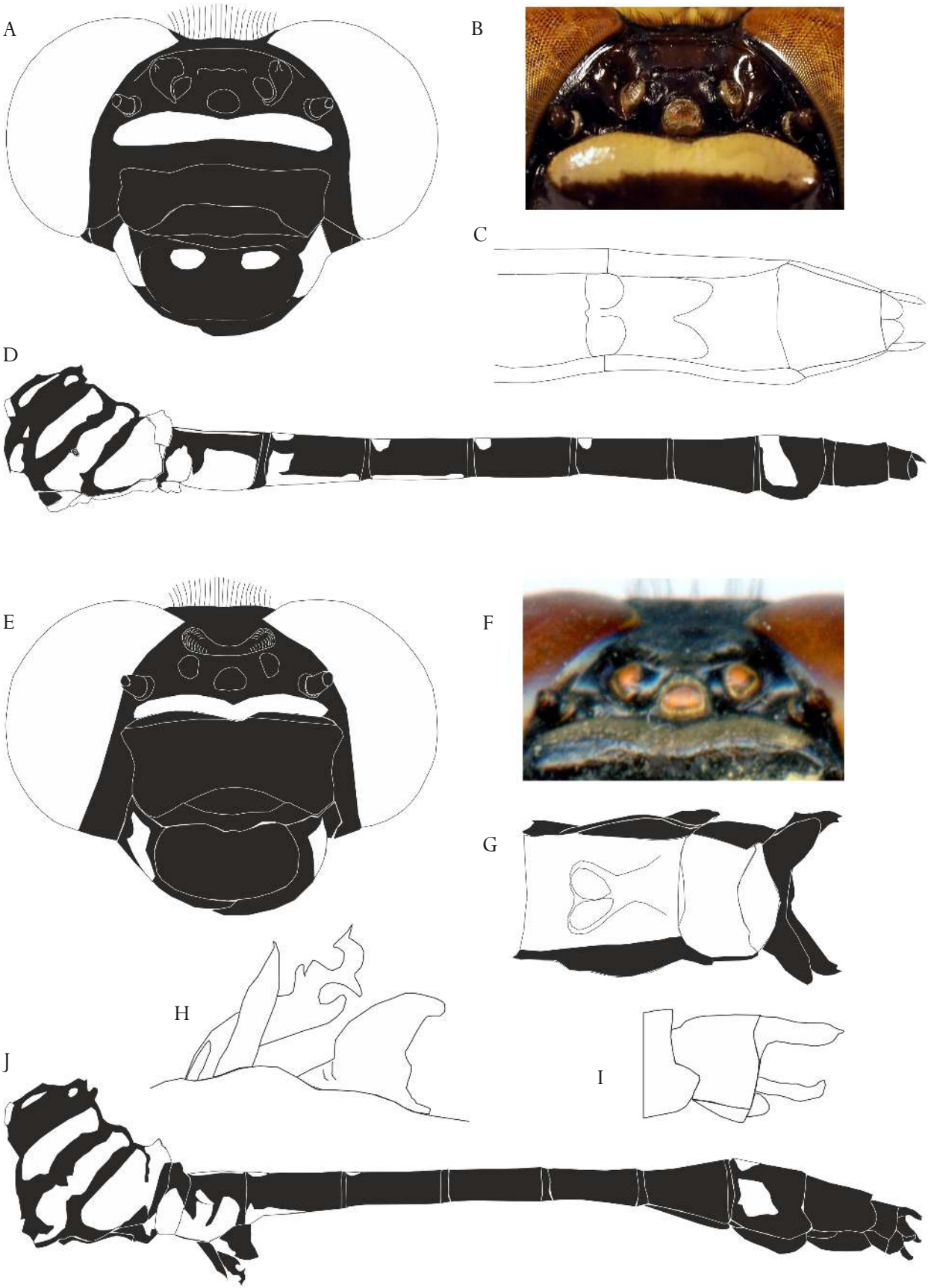

F igure 16. ***Stylurus nanningensis*****. A-D Female, Dinghu Shan, Guangdong, 10 June 1994. (A) Head, frontal. (B) Vertex area, photo. (C) Caudal abdomen, ventral, showing subgenital plate. (D) Body, lateral. E-J Male, Qinglongshan, Guangxi, 24 May 1998 (Wilson, 2005). (E) Head, frontal. (F) Vertex area, photo. (G) Caudal abdomen, ventral. (H) Secondary genitalia, lat. (I) Caudal appendages, lateral (J) Body, lateral.**

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Final Project Report

Odonata diversity as indicators of freshwater habitat quality in the Owabi Wildlife Sanctuary, Ghana

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Abstract

The Odonata fauna of the Owabi Wildlife Sanctuary, Kumasi, Ghana was characterized into different disturbance gradients to assess water quality in the reserve. A total of 207 individuals from 25 species were recorded in the study area. Of these, 105 individuals belonging to 12 species and 102 individuals in 13 species were recorded as damselflies and dragonflies respectively. The forest habitat exhibited the largest damselfly assemblages while the disturbed habitat exhibited the largest dragonfly assemblages.

Introduction

Odonata (dragonflies and damselflies) are present in all continents except Antarctica (Kalkman et al., 2008). Odonata are widely used as indicators of both freshwater and terrestrial habitat degradation impact owing to their amphibious nature and high diversity, well resolved taxonomy, and their conspicuousness (Clausnitzer, 2003). Their assemblages, especially relating to their abundance and diversity, can be used as an early warning signal for riverine and wetland degradation impacts (Clausnitzer, 2003). During reproduction, these insects oviposit in or near freshwater habitats and their high abundance, depending on particular species (generalist or specialist), is an indication of the quality of the habitat (Acquah-Lamptey et al., 2013).

The Owabi Wildlife Sanctuary is the only inland Ramsar site in Ghana, designated in 1988 (Ramsar, 2018). It harbours numerous streams, rivers and other wetland habitats that provide favorable habitat for odonates and other sympatric freshwater vertebrates and invertebrate species. The major rivers, including the Owabi, Sukobri, Akyeampomene, Pumpunase and Afu, have their headwaters in the Owabi Wildlife Sanctuary. These rivers are the main source of water for the fringing communities and provide more than 20% of the total potable water requirement in the Kumasi Metropolis (Akoto et al., 2008; Forestry Commission of Ghana, 2018). However, human-induced disturbances occurring in and around the sanctuary are major threat to the freshwater resources and its related biodiversity as well as the well-being of the local communities and the people of Kumasi.

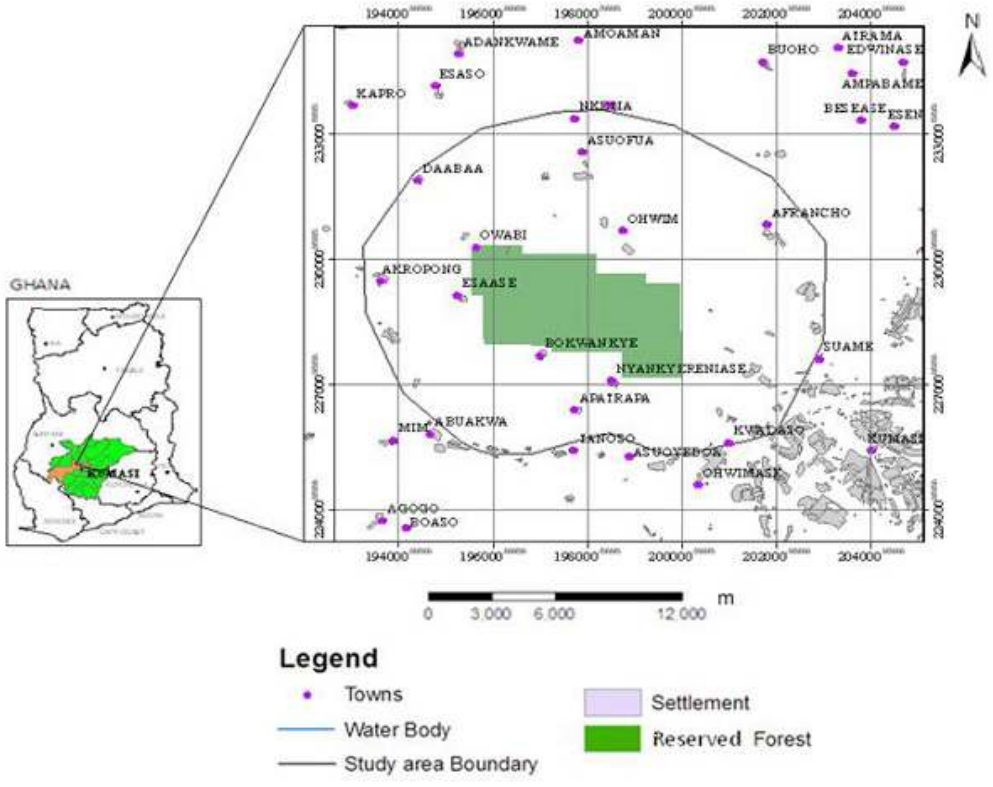

Figure 1. Map of the Owabi Wildlife Sanctuary, Kumasi, Ghana showing Study Area and forested reserve area.

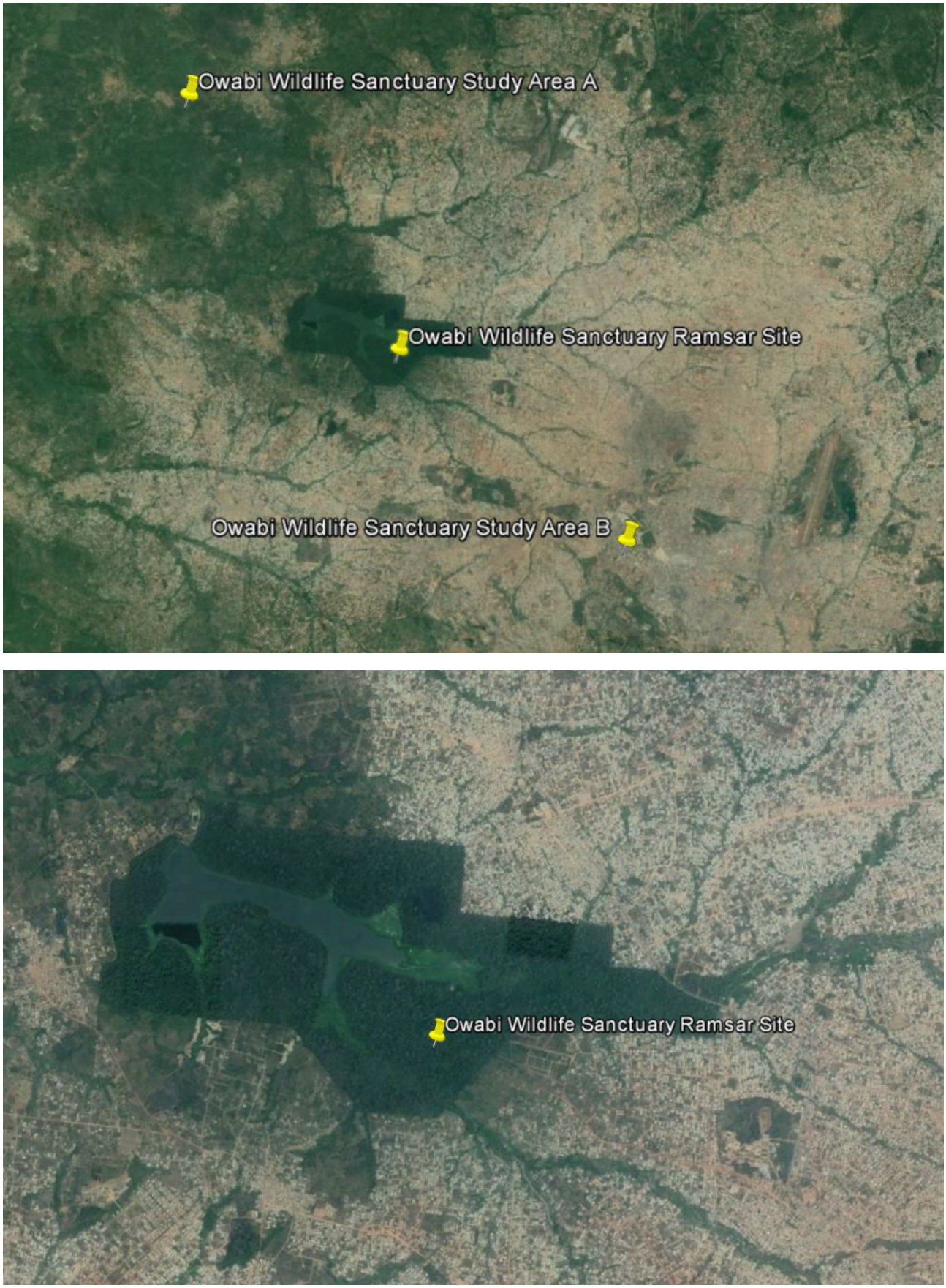

Figure 2. Google Earth maps of the Owabi Wildlife Sanctuary Ramsar site, Kumasi, Ghana. (A) Map showing the northwest to southeast extent of the Study Area. (B) Map showing the forested area within the Owabi Wildlife Sanctuary surrounding the Owabi Reservoir, which was formed from a damming the Owabi River in 1928.

Responsibility for protection of the sanctuary was turned over to the Department of Game and Wildlife in the early 1960s when the lands were designated a Wildlife Sanctuary. Although the forest is far from pristine, a large section remains mostly intact. The Owabi Wildlife Sanctuary is home to many endemic and threatened wildlife species including reptiles, mona monkey, water birds (herons, bitterns etc) (National Wetlands Conservation Strategy, 1999). It is a secondary forest surrounding a large water reservoir.

Studies on odonates have been virtually non-existent in the Owabi Wildlife Sanctuary. Hitherto there has not been any focal study to provide a comprehensive species checklist and/or assess the odonate diversity in the reserve. However, the reserve is under intense pressure from human-induced disturbances such as agricultural and human settlement encroachment, damming of the Owabi River, riparian logging, and small scale mining activities. These activities are degrading the freshwater resources in the reserve and impacting the Odonata and other sympatric freshwater invertebrates and vertebrate species. There is an urgent need to survey odonates in this protected area where such studies have not previously been conducted and assess the impact of these anthropogenic activities on the freshwater resources and its associated biodiversity. Odonata assemblages have been widely used as environmental and freshwater barometers (Clausnitzer, 2003; Dolný et al., 2012). Their presence can indicate the freshwater biodiversity status and the quality of that particular habitat (Clausnitzer, 2003).

This study seeks to survey Odonata fauna inside and outside the reserve and utilize the species assemblages as early warning signals of habitat degradation impacts. To achieve this aim, we compared the Odonata assemblages (diversity, species richness and evenness) between two land use matrices viz, disturbed (agriculture and dammed areas) and forest habitat in the Owabi Wildlife Sanctaury, Ghana.

Materials and methods

Study area

The Owabi Wildlife Sanctuary Study Area is located between latitudes 6°47'3.32"N to 6°41'52.31"N and longitudes 1°44'0.81"W to 1°37'53.04"W which is northwest Kumasi in the Ashanti region. It is one of the smallest wildlife sanctuaries in Ghana (see Figs 1-3) (Ministry of Lands & Forestry, Ghana, 1999).

Odonata survey and analysis

Odonates were sampled two times in each habitat (forest, agriculture and dammed areas) in the Owabi Wildlife Sanctuary using 100 m transects set parallel to the river bed. Four transects were laid in the forest habitats. Three and two transects were laid in the agricultural and dammed areas respectively along the Owabi River, which represented the disturbed habitats. The sampling was undertaken during the day between the hours of 10 am and 4 pm. Sampling of odonates was completed visually and when necessary using close-focus binoculars. A hand net was used to capture adult species either flying or perching which were then photographed with digital camera for subsequent identification using the key by Dijkstra and Clausnitzer (2014). Physicochemical variables such as conductivity, pH, dissolved oxygen, temperature and turbidity were recorded concurrently during the Odonata survey at the various demarcated habitats. Initial analysis of these variables showed no significant difference between the various habitats and also did not have any significant influence on the Odonata assemblages. Species diversity indices (Shannon- Weiner) as well as species richness Margalef and Pielou Evenness were computed using Past software and all were treated as surrogates for local biodiversity and habitat quality.

Results and discussion

A total of 207 individuals in 25 species were documented in the study area. Of these, 105 individuals belonging to 12 species and 102 individuals in 13 species were recorded as damselflies and dragonflies respectively. A total of 63 individuals in 10 damselfly species and 60 individuals in 11 dragonfly species were recorded in the forest habitats. Also, 42 individuals apiece for both damselflies and dragonflies were recorded in the disturbed habitats, representing 10 damselfly species and 11 dragonfly species (Table 1 and 2).

Damselflies and dragonflies diversity

The forest habitat exhibited the highest damselfly assemblages for Shannon-Weiner diversity (H), Margalef index and Pielou evenness (E) index when compared with the disturbed habitat (Table 3). Damselflies regulate their temperature exothermically through their choice of perching position. They therefore require high dense canopy cover to thermoregulate. Also, most damselflies require vegetation to carry out their life activities. They utilize the dense vegetation in the forest habitat as perching substrates, nocturnal roosting, oviposition and emergence substrate, hence their higher number in the forest habitat. The higher number of damselfly species recorded in the forest is an indication of the quality of the forest habitat. Most damselfly populations decline immediately the forest structure is slightly degraded. Dolný et al, (2012) stated that the composition of dragonflies and damselflies can be used as an indicator of the quality of forest habitat. They stated that damselflies are specialist in nature and therefore their proportion can be used as early warning of habitat degradation impacts.

Damselflies (Zygoptera)	Forest habitats	Disturbed habitats
Pseudagrion melanicterum	9	3
Pseudagrion hamoni	18	0
Pseudagrion isidromorai	3	0
Pseudagrion glaucum	1	3
Pseugagrion sjoestedti	5	1
Elattoneura bali	7	1
Ceriagrion glabrum	6	20
Africallagma vaginale	4	1
Allocnemis sp.	0	3
Ceriagrion ruberrocerinum	1	6
Phaon iridipennis	0	4
Agrocnemis maclachlani	9	0
Abundance	**63**	**42**
Species richness	**10**	**9**
Dragonflies (Anisoptera)	**Forest habitats**	**Disturbed habitats**
Brachythemis leucosticta	8	3
Palpopleura lucia	9	2
Palpopleura portia	5	2
Orthetrum chrysostigma	1	3
Orthetrum julia	7	6
Orthetrum microstigma	3	1
Orthetrum stemmale	1	0
Orthetrum monardi	3	3
Opogastra lugubris	4	0
Neodythemis klingi	1	12
Acisoma inflatum	18	4
Trithemis aconita	0	3
Hemistigma albipunctum	0	3
Abundance	**60**	**42**
Species richness	**11**	**11**

Table 1. Checklist and abundance of damselflies and dragonflies species recorded in the Owabi Wildlife Sanctuary.

Damselflies (Zygoptera)	Forest habitats	Disturbed habitats
Shannon index	2.16	1.82
Evenness	0.79	0.62
Margalef	2.35	2.36
Dragonflies (Anisoptera)	**Forest habitats**	**Disturbed habitats**
Shannon index	1.92	2.07
Evenness	0.68	0.79
Margalef	2.28	2.46

Table 2. Dragonflies assemblage indices between the Forest and Disturbed habitats.

On the other hand, the disturbed habitat was characterized by higher dragonfly (Anisoptera) diversity (H= 2.07), evenness (E= 0.78) and Margalef index of richness (2.46), compared to the forest habitats. Most anisopteran dragonflies are heliotherms that invariably require the sun to thermoregulate. Most of them favour sunny biotopes. This explains partly why the disturbed habitats in the Owabi Wildlife Sanctuary were characterized by higher dragonfly assemblages. The highest species assemblages exhibited by disturbed habitat are an indication of disturbance characterizing much of the reserve. Many of the dragonflies recorded, such as heliophilic and generalist species like *P. lucia, P. Portia* and *T. arteriosa,* serve as negative indicators, achieving dominance in disturbed habitat. Their dominance can therefore be used as a negative indication of habitat degradation.

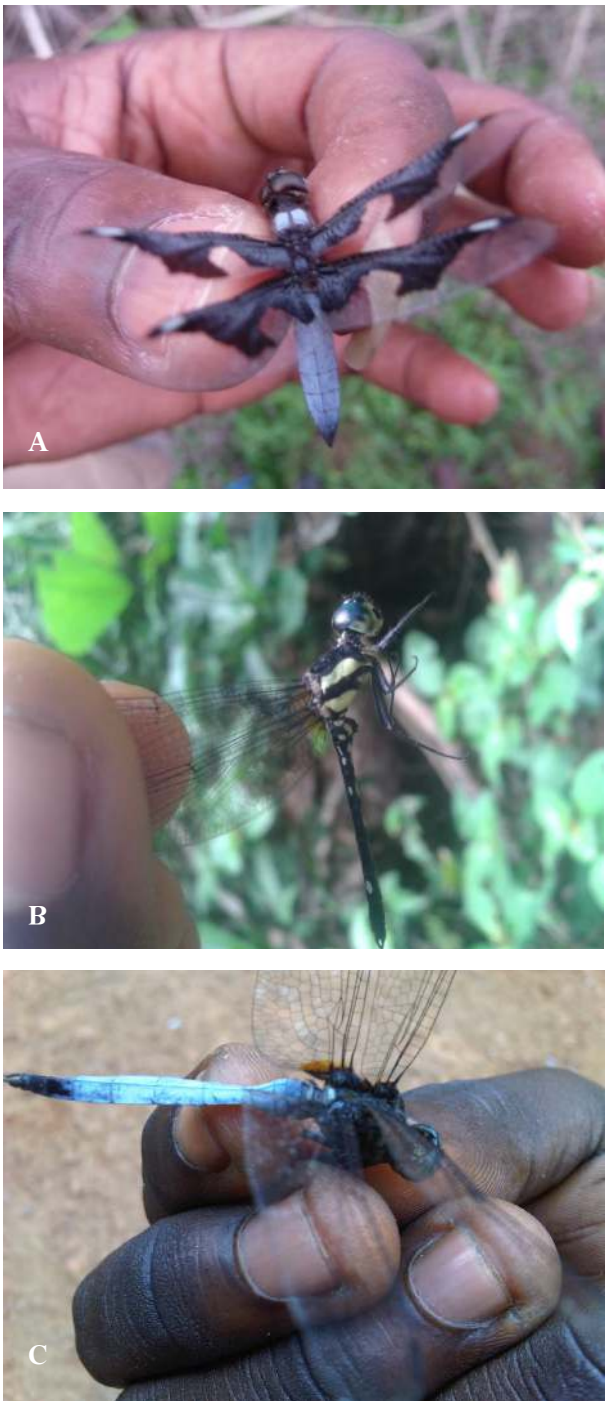

Figure 3. (A) *Palpopleura portia*. (B) *Neodythemis klingi*. (C) *Orthetrum julia*.

Acknowledgements

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Stories from the Stone Bowl
Nadarivatu, Viti Levu Island, Fiji

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& Bindiya Rashni [diyarash@gmail.com]

Before you continue reading further go back to the title because it is very likely you've misread it. Fijian people have specific rules around writing and pronouncing certain letters. If you are going to the international airport you'll buy a ticket where the destination is written as 'Nadi', however you'll be asking about your flight to 'Na**nd**i'. Fijians write 'd' and pronounce 'nd'. So, if you want to observe Fijian endemic Odonata in their ultimate glory and abundance of species and individuals you'll book your trip to Nadarivatu and will be heading towards 'Na**nd**arivatu'.

The story of the origin of the name goes back centuries to when the first settlers were walking on the ridge of the mountain hoping to find a place to claim home. Finally they had arrived at a big bow-like rock holding water. The travellers believed it was a divine gift and decided they wouldn't go any further.

Figure 1. View from Nadarivatu over the interior of Viti Levu Island

That this is a truly divine place everybody can easily see even driving through the villages. Good way to practice your reading skills in Fijian: Waikubukubu (read it Waiku**mb**uku**mb**u), up to Navai (no difference here), down to Monasavu and after a long winding road you get to a real gem tucked at the end of a seemingly endless road – Nasogo (or Naso**ng**o if you want to be correct). Milen found it a very good way to learn more Fijian (the best is of course drinking the traditional kava at night with friends). So, Naqelecibi (or Na**ng**ele**th**i**mb**i) appears to be 'rich soil' but the winner is Nabalesere (or Na**mb**alesere) – which would translate like 'little song before going to bed'. These are the places where you can understand what 'Fiji time' is.

We are not talking about the title of a newspaper. This is the magic which surrounds you making your way through the forest trying to catch up with your guide. You can feel it in the melodious bird songs encouraging you to continue further even when the heat and humidity gradually drain your strength. 'Fiji time' is definitely over there – behind the smiles of the locals when they greet you with the traditional 'Bula' or 'Yadra' in this particular region. 'Fiji time' asks you to surrender your mind to the life beats of the island, blend in to the environment and enjoy your intimacy with the forest. Don't think of work or something that you MUST accomplish. Thoughts like these will actually distance you from your goal. Let the 'Fiji time' to do its magic and you'll be rewarded.

For people like us the reward has always been more, more and more dragonflies. And just when we thought we couldn't have had a better day there was always something new to keep your senses up and sharp. This is how we felt for a two weeks field trip up there in the mountains within the catchments of three large rivers (Sigatoka, Wainibuka and Wainimala). The sampling was organised by the Institute of Applied Science of the University of South Pacific in Suva for investigating the diversity of biological forms within the existing nature reserves and eventually expand the existing borders of the reserve should we find diverse enough plants and animals.

Figure 2. ***Indolestes vitiensis***

We are still compiling the results and haven't seen other team members' reports but the Odonata

Figure 3. (A) ***Nesobasis angulicollis*****. (B)** ***Nesobasis comosa*****. (C)** ***Nesobasis erythrops*****. (D)** ***Nesobasis telegastrum*****.**

did fantastically well. The final approximate score from field examination only is for 42 taxa some identified to genus/family level. Just for comparison – in their Guide to the Dragonflies of Viti Levu, Marinov & Waqa-Sakiti (2013) report on exactly the same number of validated species inhabiting the island. Did we find any undescribed species or discover different colour variations of already existing ones – this is a task for the future. Frankly – this is not of a huge importance. Remember, we surrendered our life to Fiji time. Just enjoy what flies around.

This tactic really works – they were never in such a big numbers, species diversity and individual abundance. Was it the time of the year or the low human disturbance so high in the mountain – we couldn't answer. We actually didn't seek explanations but just drank in the beauty with large gulps. Local endemic species were encountered very quickly with *Indolestes vitiensis* (see Fig. 2) being one of the first to be recorded. The species from the endemic genus *Nesobasis* followed soon after and as usual were the centre of our attention. It is always a pleasure to see familiar faces of *N. angulicollis*, *N. comosa*, *N. erythrops* and *N. telegastrum* (see Fig. 3) but this time the reward came as *N. ingens* – probably the largest of the genus. This huge yellow damselfly has been reported only by types by Donnelly (1990) and consequently new information was never published. Our localities are further

north from the type locality, which is optimistic for the species because it is obviously distributed over a larger area than so far known and some of the localities were inside the existing nature reserve.

High mountain areas are a safe place for *Nesobasis leveri* (see Fig 4A). It was there in almost every stream up to about 800 m a.s.l. seeking its favourite mixed shadow perching site. Staying in streams and checking end branches of vegetation hanging down to the water is a good strategy to find *Nesobasis caerulecaudata* (see Fig 4B) especially at sites close to small waterfalls along the streams where the water forms small pools – deep or shallow. The latter were often favoured by *Procordulia irregularis* (see Fig 4C) which was very common all over the sites. In one locality we spotted an ovipositing female which was accompanied by a male. We could not tell if the male was the mating partner guarding the female although it appeared so by his movements. He hovered just in front of the female and changed his position with every movement of the ovipositing female. However, we appeared at the scene at the time when they were performing these flying movements and did not observe mating so cannot be sure if this was post-mating behaviour or accidental flight of the male close to the female. This observation was recorded with great attention because worldwide female Corduliidae are known to always oviposit alone.

A look inside the vegetation was almost always a successful encounter with *Melanesobasis corniculata*. The predominantly dark body is actually shiny with a slight lustre when you look from very close or use the flash of your camera. Dare to go deeper inside the bush along the tiny trickles and there you'll definitely see another dark congener, *M. mcleani*.

'Dare to climb up' is another type of challenge. Some of the streams within Nadarivatu area are sitting at the foothill of Fiji's highest peak – Mt. Tomaniivi. That was a golden opportunity to see how high can odonates actually go in the country. A climb up the Wainavai Stream reached to the highest point with flowing water and Odonata at around 1146 m a.s.l. Exactly at this point we got our other reward – the only record of *Nesobasis caerulescens*. Just like we expected – another female. This species is known by a small number of specimens all of which are females. This phenomenon of species being known by females only, is another of the peculiarities of Fiji and has been commented upon in various studies (Haynes 1984, Donnelly 2005, Rashni 2014). It has been suggested that perhaps certain species developed parthenogenesis but this hypothesis has never been tested experimentally.

Our experiment of adding another new species for the trip every day was going very well. Towards the end of the trip we were pretty sure the experiment would fail when above the village

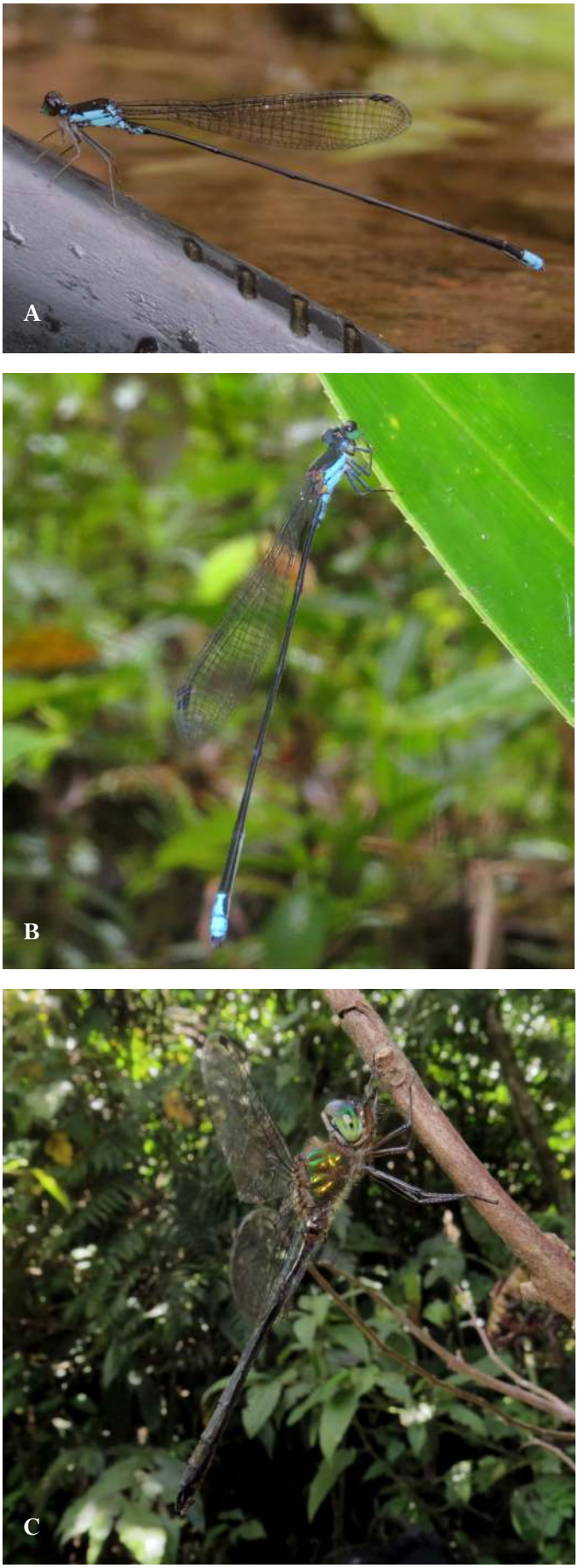

Figure 4. (A) ***Nesobasis leveri*****. (B)** ***Nesobasis caerulecaudata*****. (C)** ***Procordulia irregularis*****.**

of Nasogo we met tenerals of *Hypothemis hageni* – alongside *Nesobasis,* the second genus endemic to Fiji. Nasogo village showed us its true beauty even in a rainy day. They were there busy with their own business regardless of what we would normally consider poor atmospheric conditions. Another male *H. hageni*, this time fully mature, passed by with a swift flight and disappeared in the tree tops when we were going to one of the most remarkable waterfalls ever. We still can't decide what was it, that was streaming out of this waterfall. It looked like the ordinary – high rock and water falling down but as you came closer and peek behind the last big rock before the water force you could feel the whole strength upon you – water blasting its way down forming unstoppable waves of brisk watery wind. Fiji time – open your arm to embrace it.

Here we are – sitting at the door step of the house of the village headmen (Turaga ni Koro). We are there but already missing it because this is our last look before the end of the trip. A strong hand grabs ours in a farewell shake and the smile says 'You are coming again, right?' Feels like we've never left these hills although we see them for the first time!

References

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Haynes, A., 1984. *Guide to the Brackish and Fresh Water Gastropods in Fiji*. Institute of Natural Resources, University of the South Pacific, 39pp.

Marinov, M. & Waqa-Sakiti, H., 2013. *An illustrated guide to dragonflies of Viti Levu, Fiji.* University of South Pacific Press, 148pp.

Rashni, B., 2014. Effect of catchment forest cover on macroinvertebrate community structure in streams of Fiji. *Masters in Marine Science: School of Marine Studies.* University of the South Pacific, Suva, 171pp.

Figure 5. (A) On the way to Nabalesere village. (B) Wainavai stream above Navai Village. (C) Waterfall above Nasogo village. (D) Pool by Nasogo village.

Book Review

Dragonflies (Odonata) of the Murray-Darling Basin

Authors: Gunther Theischinger, Jan Miller, Cheryl Tang, Marion Huxley & Steve Jacobs.
406 pp. 2018
Available from: Amazon [Link] or Kindle [Link]

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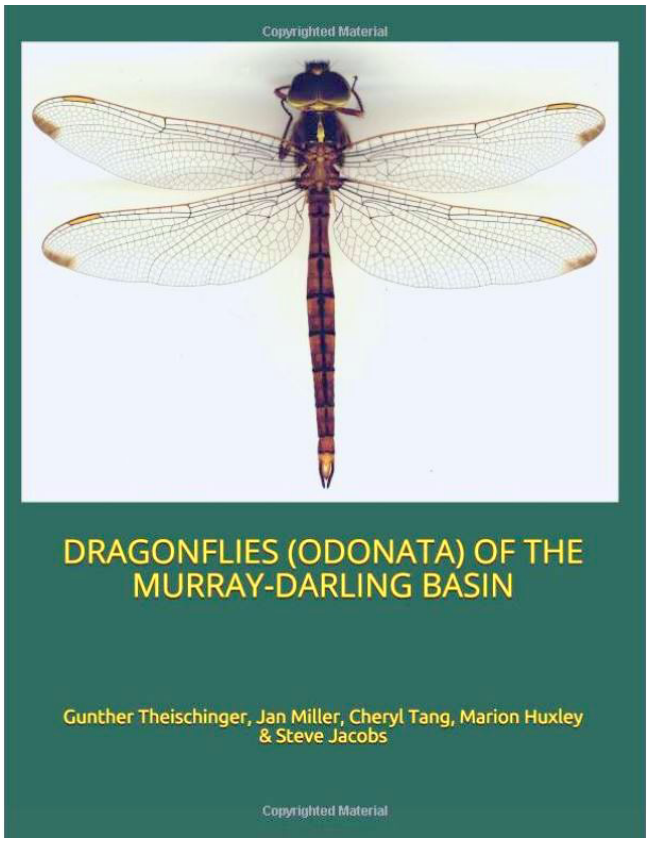

This book describes the Dragonfly component of the Murray Darling Basin Authority's Sustainable Rivers Audit, a federally funded survey which ran from 2004 to 2012. When nine erroneous species from the literature were removed, and 17 species added from new information, the Basin's total became 103, about one-third of Australia's total. Twenty-three pages are devoted to documenting these amendments and updating the checklist to the most recent taxonomic literature.

Illustrated keys are given for the identification of both adults and larvae. They are the keys from Theischinger & Endersby (2014) which have been modified by the removal of species which are not known from the Basin. The sampling was for aquatic larvae, not all of which can yet be identified to species. So, in the species accounts it has been necessary to lump indistinguishable taxa; the keys do not recognise this problem. A table shows the distribution of each species within the standard drainage divisions and also by State; then follows some discussion on distribution patterns.

The bulk of the book is titled 'Species Parade' and it consists of a standardised portrayal of each species, or species group if larvae cannot be separated. The order is that of the checklist for families, thereafter alphabetical, but there is a comprehensive table of contents which serves as an index. The accounts include an introduction mainly about distribution, a map (unaltered from that of Theischinger & Endersby (2014)) showing distribution throughout Australia, another map showing specimen records from the Murray-Darling Basin, a description and sometimes a photo of habitat, water quality range, a graph of altitude, and coloured photos of adult male and female and sometimes larvae, from live specimens wherever possible. Four species – *Hemiphlebia mirabilis*, *Caliagrion billinghursti*, *Austropetalia tonyana*, *Petalura gigantea* – have climate change scenarios, with maps showing the possible distribution in two differing futures: one with some mitigating strategies, the other with little curbing of emissions. The layout is a strange mixture of map and photo sizes apparently driven by the number of photos which had to be accommodated.

If you can handle Kindle buy a copy even if it's just for the excellent photographs of adults. If your interest in dragonflies, particular their distribution, is a little deeper, then you should consider getting a copy, too. This publication records the results of a nine year survey, augmented by an extensive literature review and much personal knowledge. It's not often you get that combination nowadays. A quick scan of the Acknowledgements shows how widely the net was cast.

Reference

Theischinger, G. & Endersby, I. (2014). *Identification Guide to the Australian Odonata.* Department of Environment, Climate Change and Water NSW: Sydney.

Book Review

Eponym Dictionary of Odonata

Author: Bo Beolens
Whittles Publishing Ltd.: Dunheath, Caithness, Scotland. 2018. xviii + 460 pp.
ISBN: 978-184995-365-8 NHBS Price: £44.99 $57/€51 approx (+ postage)

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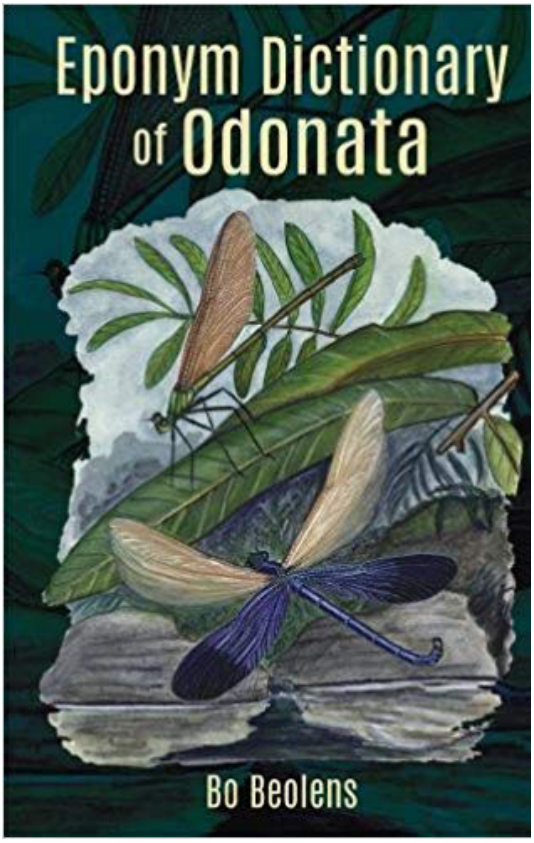

Moving on from eponym dictionaries of mammals, reptiles, amphibians, birds and sharks, Bo Beolens has now turned his attention to the Odonata. It started as a project of his son, Ashley, but the burgeoning demands of work, study and family meant that it was completed by Bo.

In his forward to this book, Matti Hämäläinen estimates that there are over 1,330 individuals who have been commemorated with an eponym. Beolen also includes characters from mythology or classical times, not considered true eponyms by some purists, and even toponyms (named for a place) when they look as though they might be an eponym.

Entries are given in alphabetical order of the person's name rather than the name of the species or genus. If a person is honoured with an eponym of their first name as well as their surname, the two entries are cross-referenced with the biography usually attached to the surname entry.

Each entry starts with the name of the recipient followed by a list of the eponymous genera and species names (three and 21 respectively for Selys) which are in the format: common name, taxon; author, date. Junior synonyms are noted as is the original name if a change to genus has occurred. Then follows a short biography of the recipient with the information standardised where possible into names and dates, university education and career with dates and institutions, expeditions, collecting trips, and major or relevant publications. Obviously some entries will be much fuller than others.

Sources are most easily recognised when the taxon author unequivocally states it. Next in the hierarchy is when the name is that of a well-known entomologist or family member. Next is the patient research of others and finally there is the need for an inspired guess. Beolens uses all of these media. Once the person is established then comes the construction of a biography where celebrations and obituaries, memories from relatives and the network of entomologists, and trawling the internet are all put to use. This has been a monumental task to assemble over 400 pages of such information.

The acknowledgement section is short but two names are predominant: Bert Orr and Matti Hämäläinen, who was introduced to the project by Bert. They gave unstintingly of their time and resources and made invaluable introductions to those who could help. In addition, Bert provided the artwork for the cover: courtship in *Neurobasis kaupi*, naturally an eponymous species. There is a large category "too many to name individually".

Because the book is alphabetical there is no need for an index and the bibliography is minimal, citing only Beolen's other eponym dictionaries and Hämäläinen's catalogue of eponyms in IDF Report 92 (2016).

This is a book to dip into, not read cover to cover, so I just dipped. The Princes of Serendip pointed out one phrase where a word was missing and a person listed as a professional entomologist whereas his real profession is far from that (although there is an etymological coincidence). Other dippings suggest that there are few errors in this handsomely produced volume.

Book reviews customarily end with accolades, when deserved, and a recommendation to purchase. Accolades I can give, based on the enormous amount of research that went into its compilation and the quality of its production. Should you buy it? I had my copy on order long before it was published but etymology and the history of odonatology is a particular interest of mine. If you have any inklings along that line then the answer is a definite "Yes". Modern currency is measured not in bitcoins but in cups of coffee. At less than 20 cups, go on and indulge yourself.

Nominations to the WDA Board of Trustees 2019-2021

In accordance with the WDA Constitution and By Laws, all members of the Board of Trustees, except for the President Elect, who automatically becomes President, resign at the Biennial General Meeting following that at which they took up their posts although all (apart from the President and the Immediate Past President) are eligible for re-election. For the new election period we are in the situation that **Adolfo Cordero**, who had agreed to accept the position of the President Elect, i.e. becoming new President 2019-2021, had to resign for health reasons. Therefore, we need to nominate persons to be elected as new President and new President Elect.

Nominated Board Members for the period 2019-2021 are as follows:
President: Jessica Ware (nominated by Frank Suhling, seconded by Ola Fincke)
President Elect: Yoshi Tsubaki (nominated by Ola Fincke, seconded by Mamuro Watanabe and Göran Sahlén)
Secretary and Treasurer: Peter Brown (nominated by Jessica Ware, seconded by Frank Suhling)
Managing Editor: John Abbott
Webmaster: Will Kuhn, with assistance as needed from Rhainer Guillermo
Symposium Coordinator: Javier Muzón
Chairman Conservation & Funding: Göran Sahlén
Editor Agrion Newsletter: Keith Wilson
Trustee: Mamoru Watanabe
Trustee: Christopher Beatty (nominated by Frank Suhling, seconded by Jessica Ware)

The following take the post by constitution and no vote is required:
Immediate Past President: Frank Suhling

Should you wish to nominate another member of the WDA for any position on the Board of Trustees (except Immediate Past President) please e-mail the Secretary or complete the following nomination form and return it to the Secretary so that it reaches her no later than 29th January 2019, after which no nominations can be registered. In the event of a vote being required for any position, email ballot slips will be emailed out and would need to be returned by January 31th, 2019. Please confirm that any nomination is supported by two WDA members and by the person nominated.

Nomination Form

I, ... (Write your name here and give your WDA membership number if known) wish to nominate the following WDA member for the office of:

.....

Name and WDA No. of Nominee: ..... (who has agreed to the nomination)

The nomination is seconded by:

.....

Please e-mail your nomination to the WDA Secretary, wda.secretary@gmail.com, by January 29, 2019 at the latest, after which no nominations can be registered.