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, which is normally published twice a year in January and July. Occasionally a special issue may be produced, as was the case in May 2020 when a special issue was published in response to the ongoing Covid-19 pandemic. 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/about/agrion/]. 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/about/].

Editor's notes

Keith Wilson [kdpwilson@gmail.com]

WDA Membership

Membership signing up and renewal process is handled by WDA directly from the WDA website. There are three kinds of WDA membership available, either **Regular** or single (£50/year), which is the standard category, **Family** (£25/year) or **Reduced** (£25/year). The latter is a reduced membership category for students (grade school, undergraduate, graduate, etc.) and anyone (student or not) residing in a developing nation. Prior to 2021, membership options were with or without the WDA's journal (*The International Journal of Odonatology*)—in electronic form or hard copy, but as from January 2021 the IJO will only be available in electronic form and will be freely accessible through Open Access. For further information consult the WDA website at: [https://worlddragonfly.org/new-changes-in-2021/]. You can sign up for membership using the WDA's website [https://worlddragonfly.org/membership-account/membership-levels/] 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

The International Congress of Odonatology ICO2023

The next ICO will be held in Paphos, Cyprus at the Neapolis University. The Congress was originally scheduled to be held in 2021 but, due to Covid-19 related uncertainties, has now been rescheduled for 25th to 30th June 2023. For further information consult the WDA website [Link] or contact David Sparrow, Chair of the Organising Committee [davidrospfo@hotmail.com]. See also ICO2023 news article by David and Ros Sparrow on page 50.

Virtual WDA event & Biennial General Meeting - 15th July 2021

In view of the ICO2021 postponement to 2003 the WDA is organising a virtual online event for 15th July 2021. The meeting will take place on Zoom, and will commence at 10 AM GMT. There will be the screening of the winners of the short videos of field work contest, plenary talks about work being done on each continent, and "My Dragon River" movie screening, by Georg and Dagmar Rüppell. Further details can be found on the WDA's website [Link], Twitter [Link] and WDA's Facebook group [Link]. The WDA Biennial General Board Meeting will also be held virtually during this meeting, at which attendance by all members is welcome. To register for the zoom, please complete the online registration form at: [https://docs.google.com/forms/d/e/1FAIpQLSc20ieaxtDkMUNzgZ0GLA2a5McIck_kE1M8c4f3YI-FvpzxOQ/viewform?usp=sf_link].

Cover: *Rhinagrion tricolor* Krüger, 1898, Nusakambangan Island, south Java, Indonesia, 19 September 2020. *Rhinagrion tricolor* is a Javan endemic rediscovered on Nusambangan Island in 2017 after a long period of no records. Prior to 2017 it was last recorded in June 1958 from west Java. See article: 'An expedition to Nusambangan Island: survey of the Javan endemic damsefly *Rhinagrion tricolor*' on page 76. Photo credit: Muhammad Nu'manudin.

European Congress on Odonatology (ECOO) 2020 postponed to 2021 due to Covid-19
In view of the Coronavirus disease (Covid-19) outbreak, the Organisers and the Scientific Committee have carefully assessed the global situation and after due consideration regarding the health and safety of the participants have jointly agreed to postpone the 6th European Congress on Odonatology, which was scheduled from 29 June to 2 July 2020 in Kamnik, Slovenia. The Slovene Dragonfly Society have now rescheduled the 6th ECOO provisionally for 27-30 June 2022 at the same location. [https://ecoo2016.wordpress.com/].

Sociedad(e) de Odonatología Latinoamericana (SOL) 3rd annual meeting 2020 postponed to 2021
The Sociedad(e) de Odonatología Latinoamericana 3rd annual meeting was rescheduled to be held in Cusco, Peru from 11-13 November 2020. Due to the continuing current global Covid-19 health crisis the organisers have been forced to postpone the SOL Odonata Congress for the year 2021 and have rescheuled for November 2022. See the SOL site website [odonatasol.org/] for further updates.

WDA and social media
WDA has an active social media team coordinated by Manpreet Kohli [https://worlddragonfly.org/about/social-media-team/]. The team regularly posts information on Facebook and Twitter about Odonata related news and reserach. WDA's Facebook group can be found at [https://www.facebook.com/WorldwideDragonflyAssociation], and its Twitter presence at [https://twitter.com/worlddragonfly?lang=en].

Next issue of *AGRION*
For the next issue of *AGRION*, to be published at the beginning of January 2022, 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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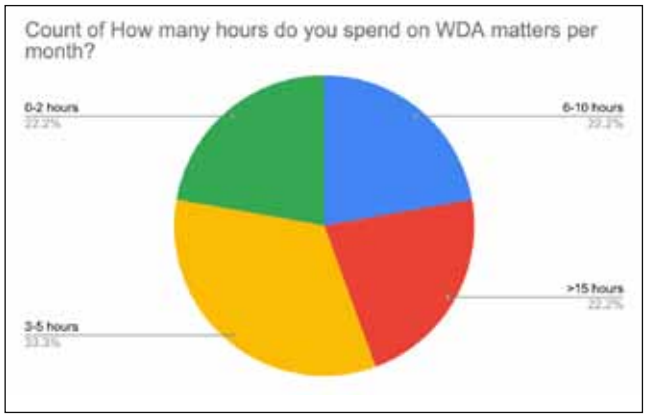
WDA Biennial Report 2019-2021

Report from the President

What a turbulent time it has been as your president! After the Austin ICO meeting in 2019, the board was eager to put into action the suggestions made by members: resuming handling of membership, working to provide more member resources, upgrading our website, and having more social media presence. By December, and then January everything began to change quickly---Taylor and Francis did not wish to renew our contract, and the search began for a new publisher! The website team had begun working on the website update, and the social media team was working to get posts out about member news and publications. And then….COVID-19 hit which caused shifts in schedules, supply chains, and work-life balance!

As we struggled to find a new publisher, revamp the website, and social media accounts, it was clear that some board members had far more work that would be considered "volunteering" (i.e., more than 15 hours a month) and others could have more specific descriptions of position requirements. We undertook a survey of the board members, to gather data about which board positions did which tasks, how long they took, and so on. We had a strategy planning meeting and have moved to having board members head ad hoc committees of volunteers which will allow the work to be more evenly distributed and efficient. We now have a social media committee and a website committee, led by the website and social coordinator board positions. We hope that this new committee-based format will make the volunteer positions more feasible for members to undertake. From our board survey, we learned that the average time spent on the WDA board is 5 years; while this is admirable service by members, it also suggests we could benefit from more input and new voices. We need more folks to consider running for positions on the board to work with WDA to advocate for odonates! Would you like to join us? Please contact anyone on the board if interested in volunteering!



Despite much of this presidency being during a lockdown, we managed to work toward a new publishing model with Wachholtz, which includes free open access for members. We put out a "special edition" of Agrion, in Spring 2020. We have a wonderful abundance of articles for IJO this year! We began regular posting of dragonfly content on social media, building public interest in Odonata and growing our membership. As Frank Suhling mentioned in his presidential report in 2019, membership had fallen over the years from a high of about 400 to well below 200. We are now with a positive slope on the graph of increasing membership! Thank you to everyone for supporting WDA, and to the WDA board members working to increase membership value!

Unfortunately, we were not able to safely hold the ICO meeting this summer, but have plans for an engaging virtual meeting on July 15. This meeting will include the regular general board meeting, and videos made by members of Odonata work in their global locations, as well as a special video presentation by the Rüppells. The Sparrows have worked tirelessly to organize and reorganize the ICO meeting and I know when we convene in Paphos it will be a truly wonderful meeting! Frank Suhling has been in conversations with congress planners and has a wonderful schedule for the next several future ICOs!

While this was an unusual two years to serve as your president, which began with declining membership, a strained relationship with our publisher and was further complicated by a global pandemic, we managed to steer the society toward a brighter future! I am thankful to Frank Suhling for his guidance over the last two years, and I wish Yoshi Tsubaki a terrific presidency!

With many thanks,
Jessica Ware, NYC, USA

Welcome to the 2021 Board:

President: Yoshi Tsubaki
President Elect: Kendra Abbott
Secretary and Treasurer: Peter Brown
Managing Editor: John Abbott.
Webmaster: Will Kuhn, with assistance as needed from Rhainer Guillermo.
Symposium Coordinator: Frank Suhling (nominated by Jessica Ware and Göran Sahlén)
Chairman Conservation & Funding: Göran Sahlén.
Editor Agrion Newsletter: Keith Wilson, with assistance from Graham Reels.
Trustee: Kehinde Kemabonta
Trustee: Christopher Beatty
Past President: Jessica Ware

Report from the President Elect

I took on the job of President-elect with some misgivings, as I am not preadapted for an administrative role, particularly in the English-speaking world, and didn't know enough about the WDA. But I was confident that I could expect kind support and cooperation from many of the Board members.

This two-years has been a period of learning for me the inside workings of this organization. Recently WDA is changing quickly. WDA's membership and pricing plan was simplified. IJO now has a new publisher and is open access. All information including publishing news, announcements and short field notes from the WDA community, is in the regularly renewing website. I've been impressed with the manner in which so many board members friendly offer their time for inside workings. I feel the WDA is in a very fine structure and is increasing its strength even further.

During the next two years, I look forward to working with the WDA board for ICO2023 (Paphos, Cyprus) which has been postponed from 2021 due to the SARS-CoV-2 pandemic. Another important issue we need to focus on is to maintain the high quality of the publications of IJO and Agrion. The IJO, as a web-journal, has just started recently and is still at a test-run stage, however, I am looking forward to seeing it under normal operation.

Yoshi Tsubaki, Japan

Report from the Secretary

In 2019 we decided that it may be prudent for the Secretary & Treasurers roles to be performed by the same person as there is quite an overlap in some areas and I agreed to take this on. However, it has proved to be rather too much work especially since we took over the membership administration and the publication of IJO from Taylor & Francis, which has increased the financial administration required. So, the Board would be interested in someone else taking on the important role of Secretary. If you feel you have good communication and admin skills and would like to take on the role to greatly assist the running of the WDA, then please get in touch with any Board member. We will, of course, provide all the support you need to actively take over the role.

The move of the IJO to an Open Access platform has not had a major effect of the number of membership renewals, as the odonate community still want to support the WDA and this is very encouraging, but we are even more reliant on membership fees to keep the association financially viable in the future, as the cost of self publication is considerably more expensive than the original Taylor & Francis solution.

We still need an active increase in both new members and membership renewals and of course thank you for your continued support.

Peter Brown, United Kingdom

Report of the Managing Editor

Since the last report, in 2019, part of Vol. 22 (issues 2-4, 127 pp.), Vol. 23 (422 pp.) and part of Vol. 24 (36 pages) of the International Journal of Odonatology were published. I am pleased to report that the impact factor for the journal continues to increase. Since the last biennial report it has grown from 0.846 (2018) to 1.029 (2019). The 5 Year Impact Factor is 0.773. The journal has also moved up in the rankings in the Entomology JCR category from 65/98 to 59/101. I am pleased with this trend in impact factor and believe it remains respectable given the size of the odonate community and the Worldwide Dragonfly Association.

With Richard Rowe's enthusiasm and help serving as Guest Editor, we successfully published a special issue on flight (volume 23, issue 1, 2020). This issue was envisioned following the special symposium on flight at the Cambridge ICO in 2017. The issue contains nine articles by 15 authors. Thanks to Richard for putting this special issue together!

There have been significant changes to the journal and its editorial board. The journal had been published by Taylor and Francis since 2011, but after 10 years, we received notification that they no longer wanted to publish the journal starting in 2021. As a result, much of 2020 was spent finding a new publisher. After entertaining several possibilities, the WDA Executive Board decided on Wachholtz Verlag, a small publishing house located in Germany. Along with this change in publishers, the board made other significant changes, including taking the journal to an open access format, with only the requirement of WDA membership for the corresponding author, and no longer having printed issues. These are significant changes, especially doing away with a printed journal, but the hope is that an affordable open access journal with a steadily increasing impact factor will not only be attractive to potential authors, but also increase WDA membership.

As part of this transition, all of the IJO issues up through 2020 are now hosted on the WDA website (https://worlddragonfly.org/) and are freely available. Thanks to webmaster extraordinaire Will Kuhn, for all the time he invested in making the website so user friendly and aesthetically pleasing to consumers of IJO.
There have also been a number of changes to the Editorial Board since the last report. We had five retirements, Stanislav Gorb, Albert Orr, Kenneth Tennessen, Florian Weinrauch, and Keith Wilson. All of these individuals have contributed a significant amount of time and expertise to the editorial board over the years. They have earned their "retirement," but will be missed. With the move to a new publisher, I also took the opportunity to significantly expand the editorial board from 22 members to 29 (https://worlddragonfly.org/ijo/editorial-board/). This expansion is designed to help spread the workload and to better handle the increasing variation in subject matter of manuscripts being submitted to IJO. We welcome the following new members to the editorial board: Chris Beatty, Jason Bried, Sebastian Büsse, Ryan Caesar, Viola Clausnitzer, Paulo de Marco, Jr., Ryo Futahashi, André Günther, Leandro Juen, Manpreet Kohli, Yoshi Tsubaki, and Wade Worthen.

I can't thank this tremendously capable group of individuals enough for their work and assistance for making IJO the successful journal that it is. It continues to be a pleasure to work with each and every one of them. They quite literally make my job possible!

John Abbott, Alabama, USA

Report from the WDA newsletter *AGRION* editors'

In addition to the normal January and July issues of Agrion, a Covid-19 special issue was also published in May 2020. The 117-page special issue received many contributions including articles from every continent, except Antarctica, reflecting the global reach of the ongoing Covid-19 pandemic. In total Agrion Volume 24 (2020) was a record 220 pages indicating that our formal society newsletter continues to play a well-supported role alongside social media platforms such as Facebook and Twitter.

Articles were extremely varied, including members' reflections, experiences, and activities—especially in relation to Covid-19 lockdowns—faunistic reports, stories from social and cultural odonatology, developmental threats to dragonfly populations, odonate morphology, taxonomic issues, information on new odonate books, book reviews, obituaries and reports from attendees at Odonata related conferences and regional meetings.

Keith Wilson and Graham Reels served as Agrion's newsletter editors for the period 2019-2021 and both are willing to serve for the coming two-year 2021-2023 period. However, both the editors are conscious of the fact that they have now served as Agrion's editors for a long period of 14 years. Much has changed over this period and both are willing to make way for a new editor or editorial team. If anyone would like to take over the editorial role of publishing Agrion please contact either the WDA Secretary [wda.sceretary@gmail.cm] or the editors directly: either Keith Wilson [kdpwilsdon@gmail.com] or Graham Reels [gtreels@gmail.com].

Keith Wilson and Graham Reels, United Kingdom

Report from the International Symposia Committee

Javier Muzon served as Congress Coordinator until he had to retire in 2020 due to other obligations. Javier made the job for future organisers easy because he pre-organised several congresses (see below). He also spent a lot of effort in organising the involvement of WDA into the congresses particularly by proposing clear guidelines about the financial involvement by WDA, as described by him in the 2019 report. These guidelines will be a great help for all future congress organisers. The board and whole WDA thanks Javier for his invaluable contributions!

After the retirement of Javier the position of the Congress Coordinator was vacant for a while so that Jessica Ware as WDA president had to care for difficulties caused by the Corona Pandemic. I volunteered to continue the task in March 2021.

The ICO2019 was held in Austin, Texas under the coordination of John and Kendra Abbott. The meeting was attended by over 70 students and researchers from 20 countries from all over the world. The meeting organizers put special emphasis on students for this Congress, working hard to get as many students as possible to attend and involving them throughout the meeting in new and creative ways. Financial support for student member attendance was generously provided by the Dragonfly Society of the Americas (DSA) and Gesellschaft deutschsprachiger Odonatologen (GdO) as well as WDA grants. There were five plenary talks and 49 oral presentations organised into nine sessions. Focused sessions included the Future of Odonatology, Natural History of Odonata, Morphology & Biomechanics of Odonatology, Odonata without Borders and Odonata Outreach. The ICO2019 was really an enjoyable event allowing also for many discussions with friends and colleagues.

ICO2021 was scheduled for June 2021 in Paphos, Cyprus; organisers are David and Rosalyn Sparrow. We all looked forward to meeting in Cyprus. Unfortunately, the conference had to be postponed due to the Corona Pandemic, first to later in 2021 and with ongoing problems in Europe it was decided to postpone it to 2023. This was due to two reasons, first to keep the normal schedule and second to avoid competition with the European conference of Odonatology to be held in Slovenia 2022. We thank David and Rosalyn for their flexibility and their willingness to postpone and reorganise several times. We all look forward to meeting in Cyprus in 2023.

Some more future venues for ICO have been proposed and in the meantime a schedule has been further developed.

2025 - Boyacá, Colombia. Organiser will be Melissa Sanchez Herrera.
2027 - Brasil. Proposed by Rhainer Guillermo Ferreira. The exact venue has still to be decided. As Rhainer pointed out, Brazil is a huge country and there are many opportunities.
2029 - New Zealand, proposed by Milen Marinov
Frank Suhling, Germany, Acting Congress Coordinator

Report from the Webmasters and Social Committee

Facebook: We have established a Facebook account (Worldwide Dragonfly Association), which, as of July 12, 2021, has 1613 followers (up 171 since January 2021). Additionally, we cross-post all content from our Twitter to Facebook. We also have an Instagram account that currently has 130 new followers (up 130 since January 2021).

Twitter: There are 487 Twitter followers to date (up 120 followers since January 2021). Each month, the social media committee decides on a theme and aims to post 3x each week on that theme.

Report from the Treasurer

Since we took over the membership administration and the publication of IJO from Taylor & Francis, over the last two years, and the number of bank accounts has increased due to our online payment methods, the financial administration has rapidly become more complex. The decision was taken to implement QuickBooks Online, an industry standard accounting system. The chart of accounts has been designed to allow us to accurately track the profit & loss of all sources of income & expenditure, including the funding of each ICO, membership & IJO publishing, so that we can make better informed financial decisions.

Historical financial transactions dating back to January 2015 and all current transactions have been entered and reconciled up until July 2021.

Once income exceeds £25,000 regardless of the related expenses, the UK Charity Commission requires audited accounts for the relevant period. As the WDA administers the ICO financial transactions, income exceeds the auditing threshold as the delegate fee income is healthy, but of course this is offset by the considerable expenses. To be on the safe side and as we now have all the relevant transactions in one place, the accounts have been audited by JDL Business Services, an independent accountant, for years ending 2017, 2018 & 2019 and the relevant audited accounts submitted to the Charity Commission. The 2020 accounts are due to be submitted by October 2021.

The ICO in Texas during 2019 was a great success both academically and financially with a total income of £28,179.20 and expenses of £22,048.08 allowing a net profit of £6,131.12 which has significantly boosted the WDA reserves.

As Taylor & Francis, the existing publisher of the IJO decided not to renew our contract, we were forced to seek an alternative solution. After considerable effort (particularly from our Managing Editor, John Abbott, to which we are indebted) we moved to the Wachholtz publishing house. The move to Wachholtz has been traumatic and very expensive compared to Taylor & Francis, and expenditure currently exceeds membership income, so this will deplete our financial reserves in the next few years unless we are able to reduce costs or increase our membership considerably.

The membership categories were simplified to take into account the Open Access availability of the IJO and to make the membership processing more efficient. A massive thank you to all the members who renewed this year and a very warm welcome to the new members who have subscribed - your support is greatly appreciated and will help us maintain the high standards of the well respected IJO plus help to keep the WDA financially viable.

We have the ICO in Cyprus to look forward to in 2023 and we are in a good financial position to fund the congress.

The number of bank accounts has risen in order to provide the online administration of both the membership and the ICO, so we now have accounts with Bank of America, Lloyds in the UK, PayPal, Square and Stripe.

One of the downsides of online payment systems is that they attract the criminal fraternity and we have not been immune to fraudulent transactions. For a 9 day period at the end of 2020 we were subjected to 704 fake membership attempts using stolen credit card account details, that are freely available to criminals via the dark web.

Of these attempts 35 were successful and we received £350 of funds into our Stripe account as criminals were testing credit card numbers to see which were active by purchasing the old £10 reduced memberships. I **stress** that **none** of our online data was compromised and we had other people's money transferred into our account. This may seem like a gift, but once we recognised the fraudulent transactions, Stripe started to refund the £10 back to the card holders, but charged us a £25 fee for each fraudulent transaction. Fortunately we were able to convince them that we were a completely innocent party and the fees were dropped.

Our balance sheet as of the 12th July 2021, shows a Net Current Asset figure of £68,480 with Liabilities of £12,401 giving us a Total Capital & Reserve figure of £57,079 but this does not take into account the IJO publishing costs falling due this year. Our Net Income over the period 12th July 2019 to 12th July 2021 was £5,243 but our IJO publishing costs are expected to exceed £8,500 per year, so we will be running at a loss until we can reduce costs or increase our membership as outlined above. Fortunately our reserves are sufficient to sustain us in the near future, so we have time to work on this.

Peter Brown, United Kingdom

Report from the chair of Conservation and Funding

During the past two years, the application processes for grants have been changed and are now fully online. WDA offers the Richard Rowe Grant for participation in International Congresses of Odonatology. As The ICO for 2021 is postponed until 2023, there has been no travel grants offered during this year. WDA also offers the Philip S. Corbet Grant to stimulate research and conservation of dragonflies, foremost supporting smaller projects. Here the new application system has been up for almost the entire period, but unfortunately there has been a long delay from application until evaluation. This has resulted in four projects not receiving any funding until now, but they are currently under evaluation and the applicants will hear from us shortly. We hope the new system with application deadlines in November and May each year will attract applications from foremost younger members, especially now that the technical problems have been resolved.

Göran Sahlén, Sweden

Motions Passed* during tenure of WDA President Jessica Ware

"We move to propose that we enter into a contract with Clarivate to utilize ScholarOne Manuscripts at the cost of $2,500/year with Clarivate's standard increase of 4.5%/yr for 3 years, after which financial review will be undertaken."

REVISED DATE

The International Congress of Odonatology 2023
23-25 June 2023, Paphos, Cyprus

David and Ros Sparrow [davidrospfo@hotmail.com]

An ICO meeting in Paphos was originally planned for 2021 but has now been rescheduled to 2023, when it will be held at Neapolis University in Paphos, Cyprus. This has the huge advantage of having affordable on-site accommodation. The Congress will start with a welcome cocktail reception on the evening of Sunday 25 June. Monday to Wednesday and Friday will be congress days and there will be a "mid-congress" field trip on Thursday. The event will end with the Congress Dinner on Friday 30 June. There will be an optional three-day post-congress field trip.

Cyprus has a modest 38 species of dragonflies, but with its position in the eastern Mediterranean at the crossroad of three continents, it has a unique mix of European, Asian and African species. These include three charismatic species: *Epallage fatime* (Odalisque), *Anax immaculifrons* (Magnificent Emperor), and *Caliaeschna microstigma* (Eastern Spectre). It is also the only place in Europe where the rare *Ischnura intermedia* (Persian Bluetail), which appears on the ICO 2023 logo, can be seen. For bird watchers, Cyprus has the highest level of endemic birds in Europe and it should be possible to see summer-breeding birds.

Paphos is a major tourist destination and apart from sun, sea and sand has a rich cultural heritage. Paphos Archaeological Park is a UNESCO World Heritage Site featuring Greco-Roman mosaics which are rated among the finest in the world, as well as monumental rock-cut tombs.

Congress fees are expected to remain at the modest level of €320 for full-paying delegates and €160 for students, inclusive except for the Congress dinner.

We hope to see you in Paphos for ICO 2023.

For further information contact David Sparrow, Chair of the Organising Committee [davidrospfo@hotmail.com] and see the WDA web site [Link].

Observation before, at and after oviposition of *Tetrathemis irregularis cladophila* (Anisoptera, Libellulidae)

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Abstract
Observations made in tropical Queensland before, at and immediately after the oviposition of *Tetrathemis irregularis cladophila* Tillyard, 1908 are described, illustrated and discussed.

Introduction

Tetrathemis irregularis cladophila Tillyard, 1908, was originally described from Cooktown on Cape York Peninsula. It is now known from north-eastern Queensland in Australia and from the Aru Islands in Indonesia (Watson et al. 1991). It is very distinctive by its small size, the black and yellow pattern of thorax and abdomen, and by the brilliant green eyes of the male in particular. The species/subspecies is rather rare and elusive, and live photos in field guides were not available before Theischinger et al. (2021). It therefore appears fortunate that the following observations by GW, before, during and after the oviposition of *Tetrathemis irregularis cladophila,* can not only be described, but also illustrated by photographs.

Observations

All observations and photos were made on December 3, 2020 by GW in north-eastern Queensland, Australia, on a tributary of Mary Creek which flows through Maryfarms and are as follows:

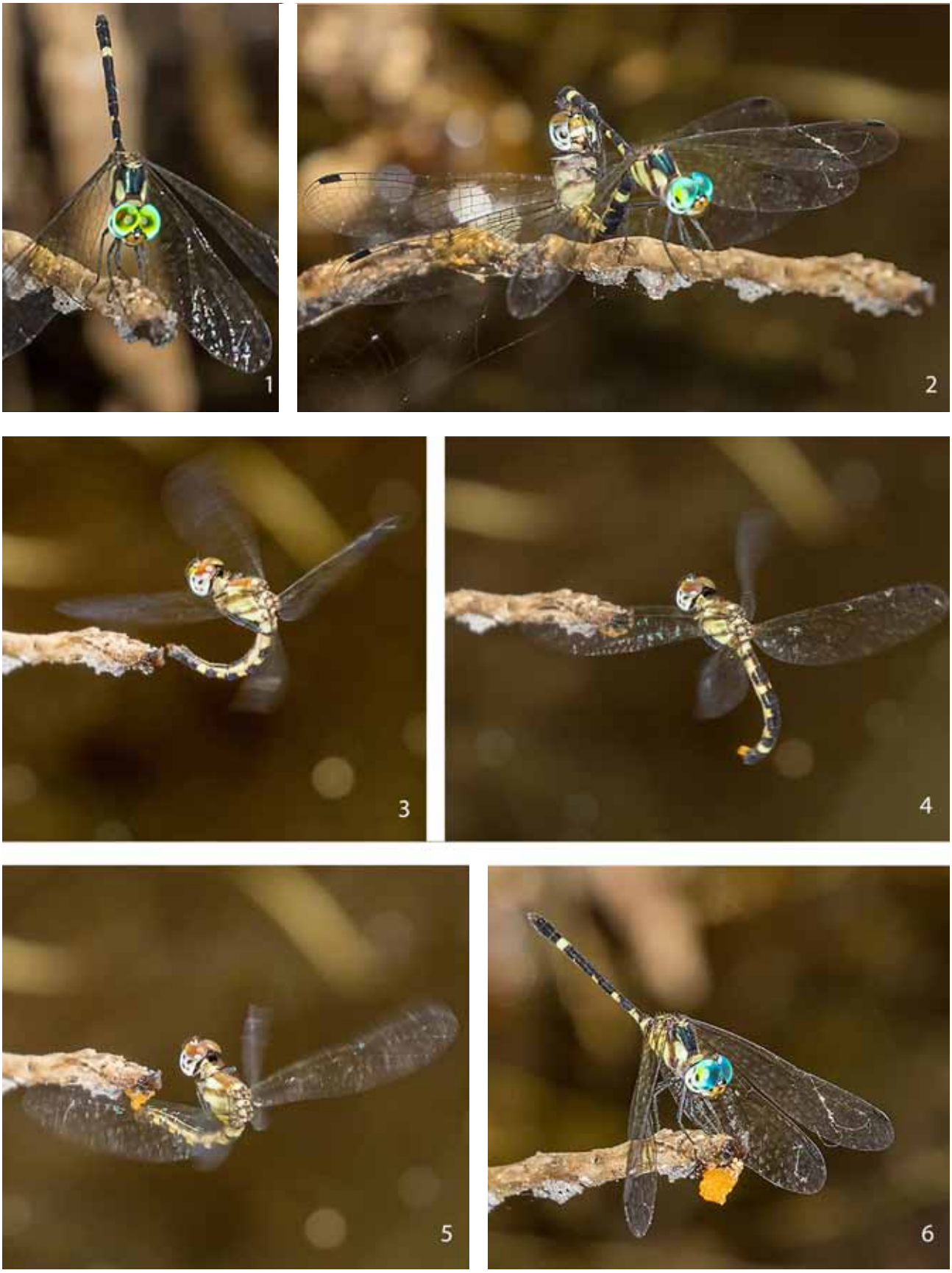
On a small, stagnant pool, in a heavily treed non-rainforest area, a male of *Neurothemis s. stigmatizans* was observed chasing a tiny dragonfly, that finally settled on a small, dry twig which curved up from the far edge of the pool. The top of the twig was horizontal, about 10 cm above the water, and the first photograph was taken at 10:32:21 am, where the dragonfly was identified as *Tetrathemis irregularis cladophila* (Fig. 1). Some more photos were taken over the next 30 seconds, with the male flying off and returning to the twig, and no other *Tetrathemis* being seen. At 10:32:40 the male flew off, and at 10:33:41 a pair in wheel position was photographed on the perch he had just left (Fig. 2). The pair separated, and just 20 seconds or less thereafter, at 10:34:07, the female began depositing eggs with the male apparently gone. During the oviposition, which lasted just over one minute, she did not support herself, but hovered at the end of the perch, periodically bending her abdomen towards the tip of it and producing a substantial mass of eggs, which adhered to the underside of the twig (Figs 3-5). She then flew away and was not seen again. The male, however, returned to the perch, where he stayed, and was photographed there between 10:36:09 and 10:44:12 (Fig. 6). After about an hour, when other sections of the stream had been explored, he was still found sitting at the same spot.

The pool was isolated and the water was dark with depth unknown. One side of the pool was a fairly steep, cut away bank with vegetation on it; the other side was gently sloped, with soft river soil/sand. Green algae was not noticed on the surface. After good rain, that pool would be flowing water, but not in the main current of the creek. The perch was obviously a popular one, as there were older eggs on the perch from previous encounters (Fig. 2). The male in Fig. 6 may give the impression of guarding the egg mass; however, from the old, apparently hatched eggs, it appears that the perch was obviously a popular ovipositing spot. It may have been an opportune perch, used over some time by the observed male and / or others, from which to spot, perhaps even attract, females for pairing.

Orr (2003) writes on *Tetrathemis irregularis*: Males guard tiny pools and remain perched on station for most of the day.

Discussion

According to the described observations *Tetrathemis irregularis cladophila* displayed, to express it using the terminology of Eda (1964) and Corbet (1999), an unguarded epiphytic flying-oviposition. A photograph of *Tetrathemis irregularis cladophila* on the Internet shows a male of *T. irregularis cladophila* perching on a twig similar



Figures 1-6. ***Tetrathemis irregularis cladophila*****. (1) Male perching. (2) Male and female, pairing. (3-5) Female, ovipositing. (6) Male, guarding/perching?**

in position and shape and also with masses of hatched eggs on its underside as can be seen in our photos [Link]. Thus it appears that this mode of oviposition may be more common, or perhaps the rule, in this species. His own Cover photo of *AGRION* 12(2) Wilson (2008) captions: "*Tetrathemis irregularis* (Libellulidae) ovipositing towards the tip of a stick projecting from a small, shaded, tropical forest pond (13 May 2006, 15:28 hrs, Endau-Rompin, Johor, Peninsular Malaysia) [Link]. The female is shown carefully depositing her eggs at a specific site. The orange mass represents hundreds of recently deposited eggs. Such egg-laying behaviour is unusual in libellulids, which typically deposit their eggs freely onto an oviposition site i.e. the water's surface or damp marshy vegetation." Whereas the female oviposited onto a horizontal branch/twig in the two previously mentioned observations the twig in Wilson's photo is upright.

Some information on oviposition is available for several African and Asian species of *Tetrathemis,* but little is known about whether oviposition behaviour shows much intra- and interspecific variation in this genus. The Asian *T. platyptera* Selys, 1878 for example was recorded to display an unguarded epiphytic flying-oviposition (Kiran & Kakkassery 2007), much like the Australian *T. irregularis cladophila*, whereas possibly guarded epiphytic sitting-oviposition was recorded by McCrae & Corbet (1982) for the African *T. polleni* (Selys, 1877).

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The marvellous polythorid damselfly *Euthore mirabilis* and other new Odonata species discovered by Clarence Buckley, with notes on the zoological legacy of this poorly known late 19th century collector in Ecuador and Bolivia

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Introduction

There are three valid, extant odonate species bearing the species epithet *mirabilis*, the Latin adverb meaning miraculous, marvellous, or wondrous. Two of these are well known species: the Australian *Hemiphlebia mirabilis* Selys, 1868 and the Hainanese *Pseudolestes mirabilis* Kirby, 1900, both being the sole representatives of their respective families, Hemiphlebiidae and Pseudolestidae. In these two species, the epithet *mirabilis* was given to denote peculiarities in the wings. In the tiny *Hemiphlebia mirabilis*, a relict taxon, the quadrilateral of the forewing is open at its base. In *Pseudolestes mirabilis*, the hind wings are broad and falcate, much shorter than the fore wings, and on the underside (in mature males) they bear long, flat wax fibres that collectively reflect silver, and due to the filtering of the amber tinted wing membrane, this appears as an extraordinary metallic, coppery-gold colour seen from above (Orr & al. 2017).

The third species, the polythorid *Euthore mirabilis* McLachlan, 1878, also received this epithet on account of its spectacular, beautifully coloured wings. It was found by Clarence Buckley in Intag (=Intaj, or Intac), Ecuador in July 1877 and has never been collected since; both the species and its collector have remained very poorly known among past and present odonatologists. Here I wish to provide new information on this species, as well as on other odonate species, discovered by the Englishman Clarence Buckley (born on 30 May 1832 in Baitool, British India; died in 1885 or 1886 in London). He was a prolific collector of zoological material, who made five expeditions to Ecuador and Bolivia in 1868-1879, and was dubbed by Henry Walter Bates as 'that prince of collectors'. For more details on Buckley's life, expeditions, collecting activities and his zoological legacy, see below on page 62 to page 65.

The mysterious *Euthore mirabilis* McLachlan, 1878

Euthore mirabilis was among the six new species that Robert McLachlan (1837-1904), the well-known English expert on Neuropterous insects (in the old, broad Linnaean sense) described in the paper titled "Calopterygina collected by Mr. Buckley in Ecuador and Bolivia", which was read at the meeting of the Entomological Society of London on 6 February 1878 (McLachlan (1878). The new species included five polythorids and one calopterygid (Table 1).

Euthore mirabilis was described from six male and six female specimens (all mature) collected in "Intaj, Ecuador". McLachlan (1878, pp. 87-88) characterized the male wings as follows: "Wings dilated in the middle; the base up to somewhat beyond the end of the quadrilateral, and the costal margin up to the nodus, smoky-hyaline; the apical border from beneath the pterostigma smoky-brown; *all the rest of the wing dark opaque orange-red (or vermilion)*, the outer edge of this portion extremely oblique."The female wings were described as follows: "Wings hyaline, tinged with smoky-brownish; in the anterior wings there is a *large* (nearly equilateral) *triangular opaque orange -red spot* placed so that the nodus is above the middle of its base (the costal margin remaining hyaline), externally with a narrow smoky line not touching its edge in very mature individuals; in the posterior wings there is a similar spot, but the colour is changed to reddish-brown, margined externally by smoky-brown." He further wrote: "Although there are other Odonata that, through the presence of metallic colours, may rival this in beauty, there exist, so far as I know, none with the same deep opaque orange-red coloration. The reticulation of the wings is more dense than in the other species of *Euthore*". McLachlan did not illustrate *E. mirabilis*, nor any other species in his paper, but three years later beautiful, coloured illustrations of both sexes of *E. mirabilis* became available.

In the late 1870s, Charles Owen Waterhouse (1843-1917), an entomologist at the Zoology Department of the British Museum and godson of Charles Darwin, conceived the notion of publishing a series of hand-coloured lithographs of insects representing different orders from all over the world. These aimed to provide help in identifying species that had been described without illustrations. In 1880 he started to publish these illustrations in sets of 7-8 plates each, under the title "*Aid to the identification of insects*". The original plan was to publish a set of 8 or 9 plates at intervals of one month or six weeks. In 1882, the first 13 parts, including a total of 100 plates, were bound as a separate bound volume (Waterhouse 1880-1882) and 17 later parts, including a total of 89 plates, appeared as a separate bound volume in 1890 (Waterhouse 1882-1890).

Robert McLachlan provided specimens of five conspicuous 'neuropteroid' species to be illustrated in Waterhouse's series. Four of them had been described by McLachlan; among them were male and female of *Euthore mirabilis*. The lithographs (Fig. 1), executed by Edwin Wilson (1855-1915), appeared in 1881 as plates 65 and 66 (apparently in Part 9).

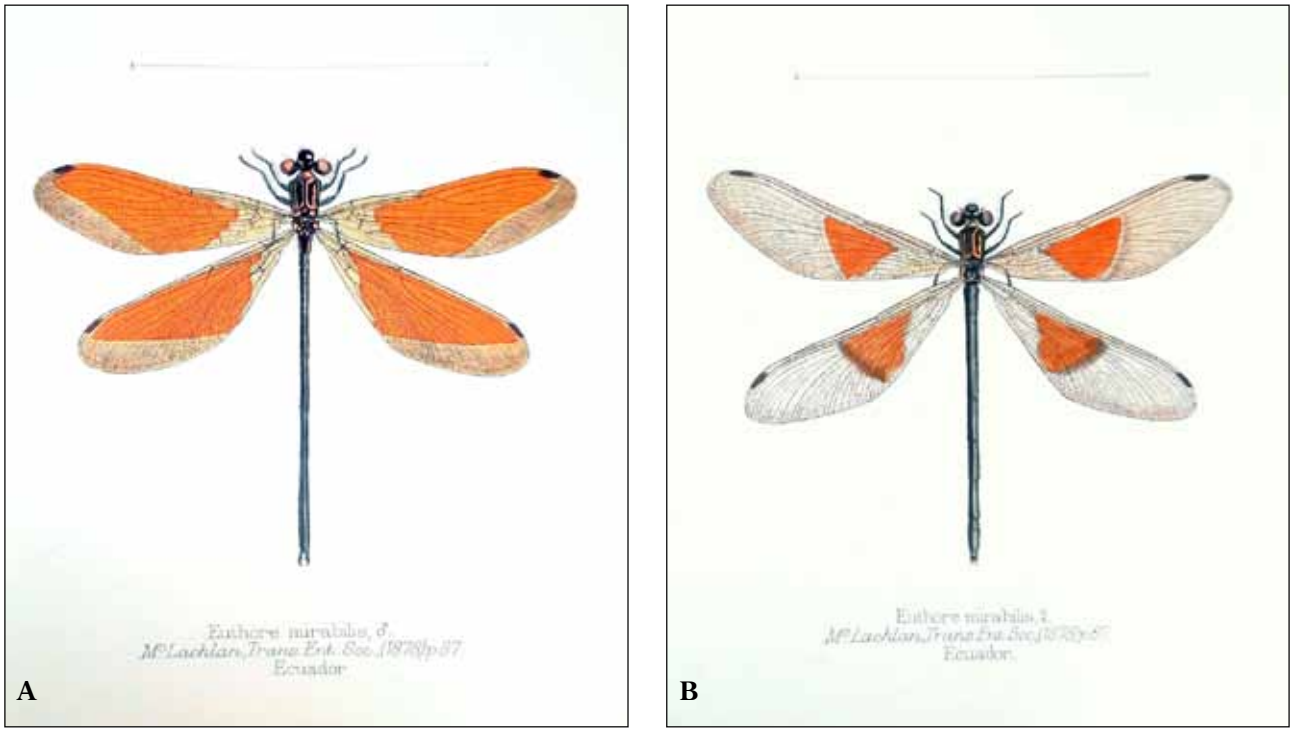

Figure 1. (A-B) Illustrations of *Euthore mirabilis* copied from the plates 65 and 66 in Waterhouse (1880-1882). Artwork by Edwin Wilson. (A) Male. (B) Female. Image credits: Naturalis Biodiversity Center, Leiden.

Surprisingly, no subsequent author publishing on Polythoridae has ever referred to these beautiful and informative illustrations. Obviously, Edmond de Selys Longchamps knew of them, since he did not illustrate (or hire Guillaume Séverin to illustrate) *Euthore mirabilis* in his portfolio of Odonata illustrations (Verspui & Wasscher 2016; 2017), although his collection included two male and two female specimens of the type series of this species. René Martin's unpublished manuscript 'Famille des Calopterygidae' [submitted in 1912 to the series 'Collections Zoologiques du Baron Edm. de Selys Longchamps – Catalogue Systématique et Descriptif ' [see Hämäläinen (2015) and Vespui & Wasscher (2017, Appendix 3)] includes Séverin's ink drawing of the male appendages of *Euthore mirabilis* (Fig. 2), but does not refer to the illustrations in Waterhouse (1880-1882).

When and where was *Euthore mirabilis* collected?

For the collection locality of *Euthore mirabilis*, McLachlan (1878) gave only "Intaj, Ecuador" with no date. The labels attached to the specimens (Figs. 4 E; 5 C), handwritten by McLachlan, have the same information.

According to Thomas (1880), Clarence Buckley collected in 'Intaj' (Intac or – hereafter - Intag) in July 1877. The collecting dates '1 October 1839', 'October 1839' or '1839', given by Mauffray & Tennessen (2018; 2019 and Tennessen & Mauffray (2018) are incorrect. Buckley's visit to this area took place during his third expedition to Ecuador in 1876-1879.

Intag is a montane area in the Cotacachi Canton of the Imbabura Province in the northern part of the Andes geographical region of Ecuador. It is possible that Buckley's residence during his visit was at the same place, which Chapman (1926, p. 710) described as follows: 'Intac, Prov. Imbabura (B-4 [*reference to a folded map*]. Alt. 3,900 ft.). – A pueblo in the western Subtropical Zone…' In the folded map (Plate xxx) attached in Chapman (1926) 'Intac' was placed on the shore of the Rio Llurimagua (presently also known as the Rio Intag), between two river junctions (Fig. 3). Seen from Google Earth, there is a small village at 0.243255°, -78.595764°, the altitude of which (ca 1200 m) matches

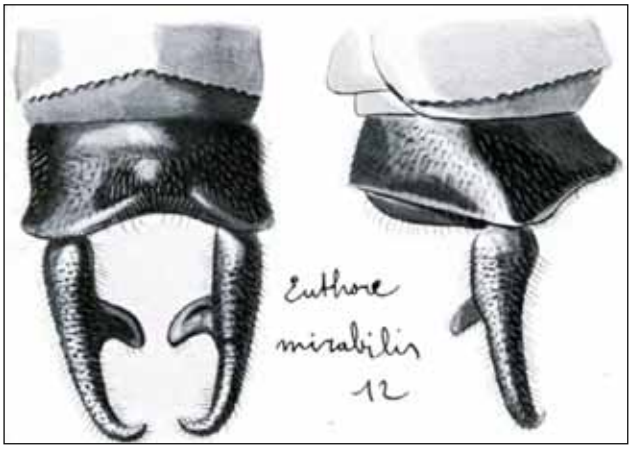

Figure 2. Drawings of male anal appendages of *Euthore mirabilis* copied from René Martin's unpublished manuscript on the calopterygoid damselflies of the World (submitted in 1912). Drawings by Guillaume Séverin.

Figure 3. An extract copied from the folded map on Ecuador (Plate xxx) in Chapman (1926).

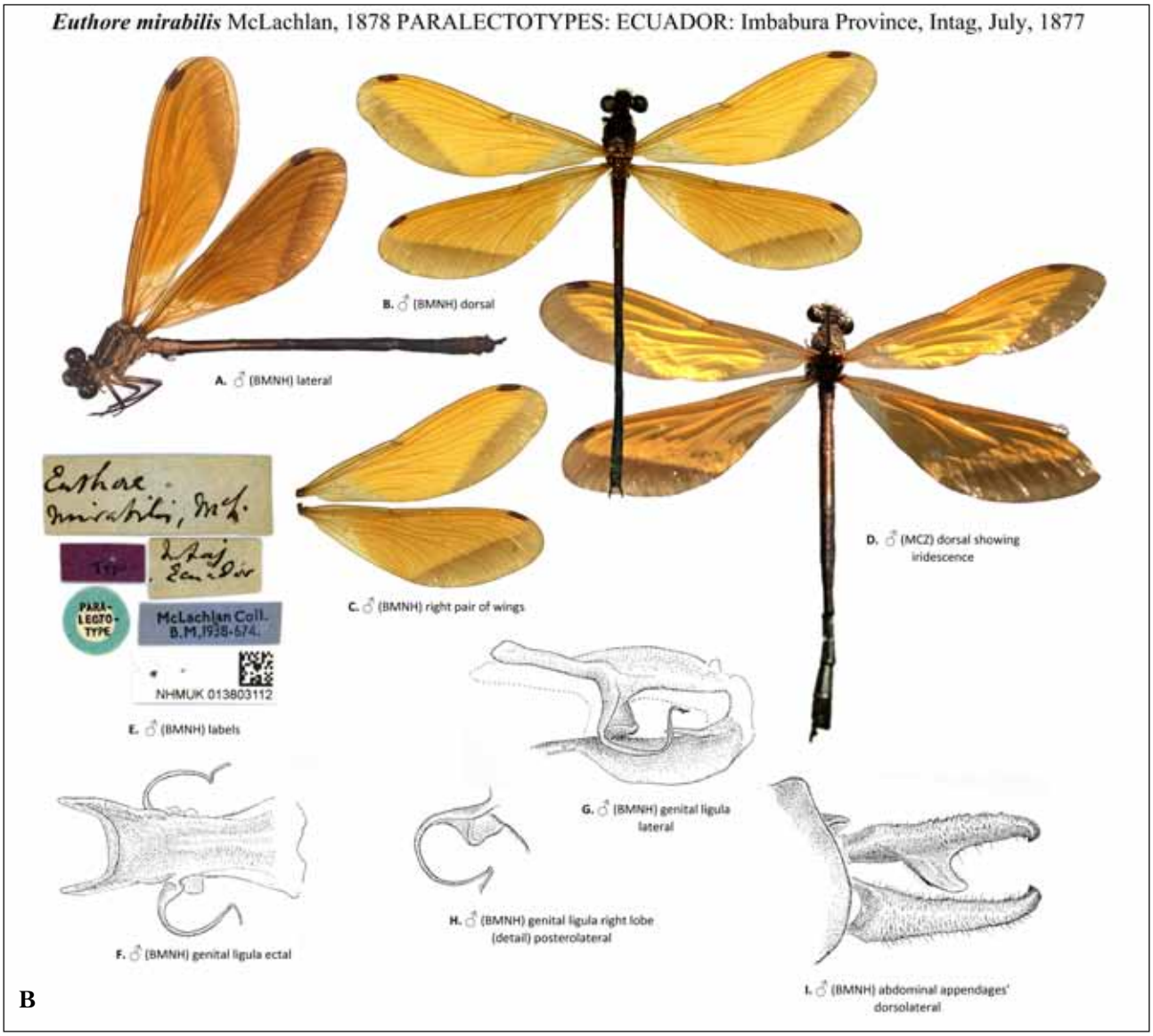

Figure 4. Photos and drawings of two paralectotype males of *Euthore mirabilis*. (A) Habitus, lateral view. (B) Habitus, dorsal view. (C) Right pair of wings. (D) Habitus (dorsal view), showing yellow iridescence. (E) Attached labels. (F) Genital ligula, ectal view. (G) Genital ligula, lateral view. (H) Right lobe of genital ligula, posterolateral view. (I) Anal appendages, dorsolateral view. [Fig. 4 D taken from a specimen at MCZ, the others from a specimen at BMNH.] Photos and drawing credits: Rosser W. Garrison.

with the altitude (3 900 ft) given by Chapman. This village is ca 17 km south of Apuela. It might be the place referred to by Chapman. Based on the references given by Chapman, it is known that at least three ornithologists have stayed in 'Intac' village and collected birds. Walter Goodfellow and his associate Claud Hamilton visited there in 1898 or 1899 as did Paul Rivet at the beginning of the 20th century.

Buckley must have travelled to his destination from Otavalo (0.2353°, -78.2611°, alt. 2530 m), using the montane route (at the time just a trail) passing Cuicocha (alt. 3200 m), Plaza Gutierrez (alt. 1930 m) and Apuela (alt. 1600 m). It is impossible to know whether Buckley collected his dragonfly specimens (at least ca 40 specimens of 10 species, see Tables 1 and 2) around his headquarters at Intag, or somewhere along the route from Otavalo and back. However, the strongly hirsute body of *Euthore mirabilis*, as well as that of the coenagrionid *Oreiallagma prothoracium* (Kimmins, 1945) (see below) suggests that these two species were found at a high elevation.

Mauffray & Tennessen (2019) gave a supposed, approximate, type locality of *Euthore mirabilis* as follows: 'IM, Cotachchi; "Intag" Apuela, NE on Apuela-Cuicocha Road, along Rio Intag and tributaries between 1800–2800m, 0.3588°, -78.4509° at junction of Rio Intag and a tributary.' The same 'type locality' (with the incorrect 1839 as the year of collecting) was suggested for all seven new species described from Buckley's Intag material. However, the given coordinate is not accurate. It does not show the river junction of Rio Intag and a tributary, but a mountain site along the road to Otavala. Anyway, it cannot be ruled out that some of the species may have been collected in the area SW of Apuela, Buckley's possible residence during his stay.

No specimens of *Euthore mirabilis* have ever been found since Buckley's original collections. However, it seems no further collections of dragonflies in the Intag area were made until Kenneth Tennessen and William Mauffray visited the locality for eight days in late August 2018. Their main target was to find *Euthore mirabilis* and *Cora dualis* McLachlan, 1878, another polythorid species discovered by Buckley in Intag, and never found again (see below). Unfortunately, they found neither of these lost species. Mauffray & Tennessen (2019, p. 16) wrote: "We surveyed along part of the original route that Buckley took, a trail at that time but now a road between Plaza Gutierrez and Apuela (from 0.3495°, -78.4917°, elev. 1940 m westward to 0.3555°, -78.5125°, elev. 1575 m); it is likely that Buckley's specimens were taken at small streams along or near this route. All streams along this road and in most other parts of Intag are now deforested; small patches of primary forest still exist, although most forest we saw is secondary growth and small to medium-sized farms now dominate the landscape.' Earlier, Tennessen & Mauffray (2018) wrote: 'The area contains two of the world's biodiversity "hot spots", the Tropical Andes biological hotspot and the Tumbes-Chocó-Magdalena hotspot. Deforestation and agriculture (50% of the land area of Intag has been converted to small and medium-sized farms) have greatly impacted streams in the region. Copper and gold deposits have been found and extraction has been ongoing."They summed up: "In short, after eight days of searching in mostly sunny weather, we were unable to find these two target species. We feel that our negative findings increase the likelihood that these two species are extinct."

Although *Euthore mirabilis* and *Cora dualis* are undoubtedly threatened species, I think that much more extensive studies in the mountains of the Intag region and elsewhere in northern Ecuador, in different seasons, are needed, before these two species can be declared extinct.

Notes on the type specimens of *Euthore mirabilis*

Rosser Garrison was able to borrow a paralectotypic pair of *Euthore mirabilis* from the BMNH. He has kindly included a description of the pair supported by detailed illustrations. **Male**: Head (Figs. 4 A, B), postclypeus shiny black; epicranium entirely matte black except for the following orange areas: a pair of obscure midlateral spots on labium, genae, and base of mandibles, a spot medial to each lateral ocellus, a triangular spot at each end of occipital bar. Prothorax black dorsally, middle lobe orange laterally, a small medial orange geminate spot on posterior lobe; synthorax primarily orange, middorsal carina and antealar crest black, a pair of disjunct matte black mesepisternal stripes, the posterior one narrower; a matte black stripe occupying most of mesepimeron; a thin black line on upper half of interpleural suture, its upper end connecting with black antealar carina; a pair of obscure matte black stripes on metepisternum and metepimeron, the latter one narrower as shown in Fig. 4 A. Coxae, trochanters and basal half of femora orange, the remainder of legs including armature black. Wings (Figs. 4 A-D) with two thickened antenodal veins, the first between wing base and arculus, the second opposite the arculus; basal fifth and first and second series of antenodals up to and beyond nodus pale smoky brown, a large opaque band of orange extending distally to just beyond pterostigma, thence forming a straight diagonal line terminating at third sector beyond CuA in fore wing, at CuA in hind wing, this opaque area strongly iridescent when exposed to certain angle of light (as in Fig. 4 D); reminder of wing smoky brown. Abdomen primarily black with S1-2 broadly orange laterally, S3 with a narrow orange lateral stripe, S4 similar to S3 but stripe narrower and disappearing at distal fifth, and interrupted by a narrow transverse black stripe at basal sixth; S5-6 with a small orange lateral basal spot; S7-10 entirely black [evidence of orange mold on S7-10 as shown in Fig. 4 A]. Genital ligula typical of the genus but base of lateral lobe slightly broadened forming an angulate lobe as shown in Figs. 4 F-G). Cercus typical of the genus, extending beyond S10, forked at midlength, the lower fork shorter and more

Figure 5. Photos of a paralectotype female of *Euthore mirabilis* at BMNH. (A) Habitus, lateral view. (B) Right pair of wings. (C) Attached labels. Photo credits: Rosser W. Garrison.

robust than upper as shown in Fig. 4 I.

Female (Fig. 5 A) as in male, abdomen stocky, orange lateral stripe extending to end of S5. Wings with opaque orange band reduced as shown in Figs. 5 A, B; Hind wing opaque band darker than fore wing band, its distal margin becoming brown; remainder of wings smoky.

Remarks. All six specimens of *Euthore mirabilis* were collected in the same area (Intag) as *Oreiallagma prothoracicum*, another species which has not been collected since. All known species of the latter genus, along with *Protallagma*, are known from relatively high elevation areas (800 to 2300m) along the Andean cordillera (von Ellenrieder & Garrison 2008; Bota-Sierra & Sandoval-H 2007). The bodies of some of these species are adorned with long setae—a characteristic of species from colder areas. De Marmels (1985) noted that *Acanthagrion tepuiense* De Marmels, 1985 is setose in specimens from the Venezuelan tepuis but less so in specimens from the Gran Sabana lowland. The specimens of *E. mirabilis* are somewhat setose as is typical for other members of this genus. For example, specimens of *E. fassli* Ris, 1914 from Colombia were collected at an elevation of 2376-2400m; *E. fasciata fasciata* (Hagen *in* Selys, 1853) from Venezuela at 680-3300m; *E. fasciata inlactea* Calvert, 1909 from Colombia at 2070m and *E. fasciata plagiata* (Selys, 1873) from Venezuela at 300-1760m (all specimens in collection of Rosser Garrison). All of them are relatively setose indicative of high elevation habitats.

Notes on other Odonata species collected by Clarence Buckley in Ecuador and Bolivia

Three authors, Robert McLachlan, Edmond de Selys Longchamps and Douglas Eric Kimmins described a total of 23 new odonate species and one subspecies from Clarence Buckley's material (Table 1). Twenty-two of these taxa are valid species. In addition, records of at least 12 other Odonata species from Buckley's material have been published (Table 2).

It is noteworthy that nearly all of these 34 species are damselflies (Zygoptera). Only two anisopteran species are present. Among the damselflies, the colourful calopterygoid and the large and conspicuous 'pseudostigmatid' species (now placed in Coenagrionidae) form the majority.

During his first two expeditions in Ecuador (1868-1869 and 1870-1871), Buckley collected only a few specimens of Odonata, most of them from the Amazon geographical region of Ecuador. These specimens ended up in McLachlan's collection. In turn McLachlan gave the calopterygid and polythorid specimens to Selys for study and description (Selys Longchamps 1873; 1879; 1880), but described (McLachlan 1877) two new 'pseudostigmatid' species himself. These two, as well as one of Selys' new species, were first believed to originate from eastern Peru, but were later reported to have been collected (by Buckley) at 'Rio Napo' in Ecuador. However, Rio Napo can hardly be the correct collection site of these specimens; see below on page 60.

During his two Bolivian expeditions in 1873-1874 and 1875, Buckley evidently collected only three odonate specimens, these representing two new polythorid species, *Polythore boliviana* and *Cora terminalis*, described by McLachlan (1878). In Bolivia, as in his first two expeditions to Ecuador, netting a few colourful calopterygoids and large and striking 'pseudostigmatids', was merely a casual digression from his butterfly collecting activity.

As discussed below (page 63), Buckley's first expedition to Ecuador focussed only on collecting butterflies for William Chapman Hewitson, who financed his travel expenses. On his later expeditions Buckley was his own man, and besides collecting butterflies for Hewitson, he also amassed specimens of other animal groups (such as birds, mammals, reptiles, frogs, molluscs, beetles and moths), guided by the requests of various zoologists.

It is obvious that for his third, four year long, expedition to Ecuador in 1876-1879, Buckley had received an order from Robert McLachlan to collect damselflies, especially the calopterygoids and 'pseudostigmatids', the odonate groups in which McLachlan was most interested at that time. The other insect groups that Buckley collected during this expedition were butterflies, moths and various beetle families. I have not found any publications that would show him also collecting specimens from other insect orders. Thus, Buckley must have been very selective and concentrated on collecting only what had been requested. The paucity of Anisoptera specimens in Buckley's material also suggests selective collecting.

McLachlan published three papers on the results of this third expedition to Ecuador. The first of the papers (McLachlan 1878) includes descriptions of a new calopterygid and three new polythorid species found at Intag. In the second paper (McLachlan 1881a) he described four new polythorid and one new 'pseudostigmatid' species (*Mecistogaster buckleyi*), collected at Rio Bobonaza in the Amazonas geographical region. In the third paper (McLachlan 1881b) he described a new anisopteran species, *Gomphomacromia fallax*, from Intag. Selys also studied part of Buckley's material from Intag and Rio Bobonaza, and he described (Selys Longchamps 1886) two new *Heteragrion* (the other from an unspecified locality, probably from Buckley's earlier expeditions) and two new *Teinopodagrion* species. Selys had also identified and labelled an additional new coenagrionid species from Intag as '*Telagrion prothoracicum*'. Kimmins (1945) described it as a new species using Selys' manuscript name. Presently it is known as *Oreiallagma prothoracicum*.

Buckley's collections of Polythoridae species from Ecuador are especially impressive. Altogether they included 13 species of which 9 were new species. His material represents over half of the 24 polythorid species presently known from the country. Besides *Euthore mirabilis*, at Intag Buckley collected specimens (3 ♂, 2 ♀) of another rare polythorid species *Cora dualis*, which has also not been rediscovered since. The watercolour portfolio of Selys includes Guillaume Sevérin's illustrations of both sexes of this species (Fig. 6).

The photos taken in nature (Figs. 7-8) show a selection of species, originally described from Clarence Buckley's specimens.

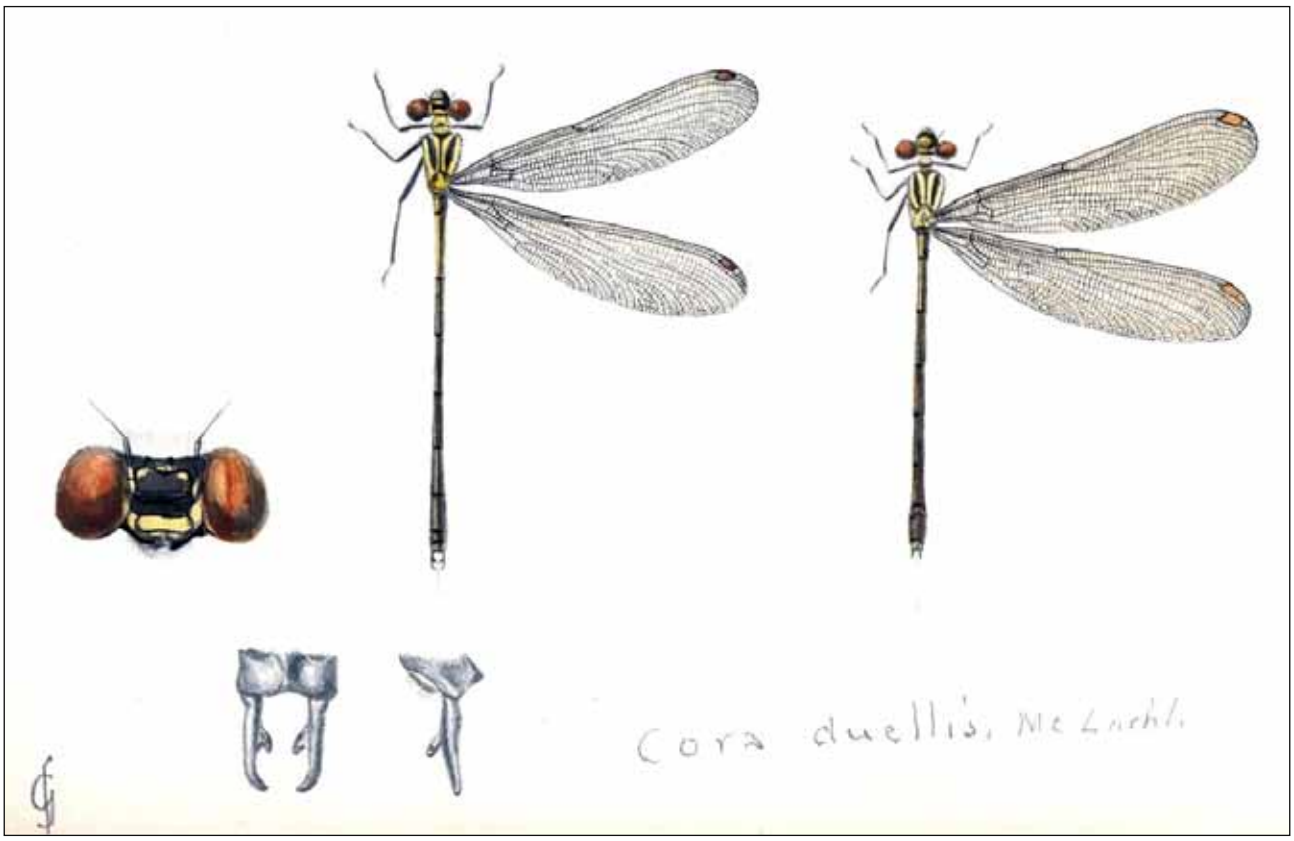

Figure 6. Illustrations of *Cora dualis* (executed by Guillaume Sevérin) in the watercolour portfolio of Edmond de Selys Longchamps. By courtesy of the Royal Belgian Institute of Natural Sciences, Brussels.

Figure 7. Photos of polythorid species described from specimens collected by Clarence Buckley. (A) *Cora inca* male. Credit: Kenneth Tennessen. (B) *Cora munda* male. Credit: Jim Johnson. (C) *Polythore mutata* male. Credit: Jim Johnson. (D) *Polythore mutata* female. Credit: Rosser Garrison. (E) *Polythore derivata* male. Credit: Kenneth Tennessen. (F) *Polythore concinna* male. Credit: Jim Johnson.

Notes on the locations of Clarence Buckley's collecting sites of Odonata

Ecuador. Specimens reported (or later discovered) to have been collected by Clarence Buckley in Ecuador, come from three specific localities: 'Rio Napo', 'Intaj' and 'Rio Bobonaza' or from an unspecified locality in Ecuador.

- Locality 'Rio Napo'. Buckley's specimens of *Mnesarete devillei*, *Mnesarete fulgida*, *Polythore aurora*, *Anomisma abnorme* and the synonymous *Microstigma terminatum*, originally reported (or report later amended) as having come from 'Rio Napo', were collected during his first expedition in 1868-1869. In that expedition Buckley collected butterflies for Hewitson. In the preface of the first part of his '*Equatorial Lepidoptera collected by Mr. Buckley*', (published on December 2, 1869), Hewitson (1869-1877) reported in some detail the itinerary of this expedition. He wrote: "The furthest point reached by Mr. Buckley was St. Rosas, on the Napo river. He left Guayaquil on the 5th of July, 1868, and, after staying ten days at Riobamba and Baños, and nearly two months at St. Ines (a solitary hut), he reached Canelos on the 17th of October. From Canelos he went to Sarayaco, leaving it on the 30th of November for St. Rosas, staying on his way for a month at Curaray. He remained a very short time at St. Rosas, returning again to Curaray and Sarayaco, from whence he made an excursion down the Rio

Figure 8. Photos of males of various damselfly and dragonfly species described from specimens collected by Clarence Buckley. (A) ***Ormenophlebia imperatrix*****. Credit: Kenneth Tennessen. (B)** ***Mnesarete devillei*****. Credit: Kenneth Tennessen). (C)** *Teinopodagrion curtum.* **Credit: Kenneth Tennessen. (D)** ***Teinopodagrion setigerum.*** **Credit: Jim Johnson. (E)** ***Heteragrion angustipenne.*** **Credit: Jim Johnson. (F)** ***Gomphomacromia fallax*****. Credit: Kenneth Tennessen.**

Bobanaza to the mouth of the Rio Ratuno, spending several days upon the banks of that river. He was again, on his return journey, at Canelos, at St. Ines another month, stayed at Jorge twenty days, and reached Guayaquil on the 26th of June."

Although, Buckley had visited Rio Napo and reached 'St. Rosas', i.e. Santa Rosa de Otas (- 0.978°, -77.457°), the dragonfly specimens from 'Rio Napo' could scarcely have been collected at Rio Napo. In the 'Index of species and their localities' in the fourth part of his publication (dated March 10, 1870), Hewitson does

not list a single butterfly species from 'Rio Napo', nor any from 'St. Rosas', 'Tena' or 'Puerto Napo'. It is probable that the dragonfly specimens were collected at 'Curaray', where Buckley spent in total two months on his way from Sarayacu to Santa Ines de Otas and back. The whereabouts of the settlement 'Curaray' is uncertain. Brown (1941) wrote: "VILLANO, Rio, Napo-Pastaza; ca. 1° 30' S, 77° 30' W; ca. 400 m. This name is applied to the first of the three rivers that form the headwaters of the Curarai when traveling northeast from Canelos; it is about six hours walk. The jungle is dense and very wet. It is probably the same as Feyer's Curaray. (Buckley)." The place suggested by Brown (1941) is on the bank of Rio Villano, a tributary of Rio Curaray, at -1.500°, -77.500°. This location would agree with Buckley's travel route as given by Hewitson.

- Locality 'Intaj' (Intac, Intag) in Imbabura Province, in Andes Region. See above on page 55.

- Locality 'Rio Bobonaza'. This locality refers to the river Rio Bobonaza, a tributary of Rio Pastaza, in Pastaza province in the Amazonas geographical region of Ecuador. Most likely the specimens reported from 'Rio Bobonaza' were collected in the vicinity of the village of Sarayacu [-1.7323°, -77.4868°, alt. 373 m] on the bank of the Rio Bobonaza, which was Buckley's headquarters during most of his 1876-1879 expedition (Schlater & Salvin, 1880). He had already stayed in this place during his first expedition to Ecuador in 1868-1869. According to Brown (1941) most of Buckley's collections there were made within two days walk of the settlement.

- Locality 'Ecuador'. No detailed locality was given for *Cora inca*, '*Thore picta aequatorialis*' [= *Polythore vittata*] or *Heteragrion angustipenne*. The first two were described in 1873; therefore, they were collected during Buckley's first (likely) or second expedition. Probably also the third species (described in 1886) originated from the same series as the other two, since the specimens from Buckley's third expedition to Ecuador were labelled with more detailed locality data.

Bolivia. In Bolivia, Buckley's published Odonata specimens come from two locations, both in montane valleys eastwards of La Paz.

- Locality 'Chairo', the type locality of *Polythore boliviana*. There is a small village named Chairo on the river Rio Chairo at -16.2033°, -67.836° at the altitude of 1280 m. The single male of *P. boliviana* may have been collected there or elsewhere along the same river.

- Locality 'Unduavi', the type locality of *Cora terminalis*. Unduavi (- 16.3136°, -67.9080°) is a small village on the river Rio Unduavi at the altitude at ca 3150 m. However, it is likely that the pair of *C. terminalis* was collected at much lower elevation along the stream. At Puenta Villa (- 16.4043°, -67.6445°) the altitude of the river is already as low as 1200 m.

Clarence Buckley – 'that prince of collectors' and his zoological legacy

Clarence Buckley (Fig. 9) was an intrepid and skilled collector of zoological specimens in South America in the latter half of the 19th century. Although his name is well known among zoologists familiar with the history of discovery of the South American fauna, particularly birds and butterflies, Clarence Buckley the man has remained something of a mystery. Also, little is known of the itineraries of his South American expeditions.

Background and family

In an article 'A portrait of Clarence Buckley, zoologist', Vane-Wright (1991) stated: "Despite the significance of his contributions to Victorian lepidopterology and mammalogy, we know nothing of his date and place of birth, his upbringing, education, or where and when he died. From Hewitson's comments we may presume that Clarence Buckley was an Englishman, but even that is not certain. Perhaps Buckley died in the Andes, soon after Hewitson's own death. Clearly he was still actively collecting in September 1878, over ten years after he first set foot in South America, and apparently he was still alive in 1880." In more recent times, brief personal accounts on Buckley have appeared in various 'eponym' dictionaries and other publications; the biographic information in these sources is inconsistent and often inaccurate, sometimes confusing him with other individuals with the same surname, and on two occasions, with a certain 'William Buckley (1814-1888)', presumably referring to the English artist and entomologist William Buckler (1814-1884)!

Fortunately, in July 2018, an Australian relative of Clarence Buckley appeared in a discussion chain on Clarence Buckley at 'BirdForum' on the internet: [Link] and provided the long-forgotten details of his birth and family connections in India and London.

According to the information on the website given by this contributor ('Jan18', Buckley's 1st cousin five times removed), Clarence Buckley was born in Baitool [Baitul] in British India on the 30th of May 1832, as the second of three sons of Colonel Frederick Buckley and his wife Jane Cox [daughter of Captain W.B. Cox], who

had married in Calcutta on the 18th of January 1823. Colonel Buckley was a career soldier with the Bengal Army. He is known to have collected butterflies in India; his collection was given to the East India Company. He died in India in 1853. After that his widow and sons repatriated to London, presumably to be near Frederick Buckley's brother and sisters who resided there. Clarence Buckley married Emma Southcombe in 1860, and they lived first in Bloomsbury and later in Regent's Park. Clarence's mother Jane died in 1878. Buckley's wider family was quite wealthy, which apparently helped him to finance his extensive expeditions to South America. Clarence Buckley was still recorded as living in Regent's Park in 1885.

The exact date of his death has evidently not yet been confirmed from official records, but he died either in late 1885 or in 1886; in a paper submitted on 7 February 1887, Boulenger (1887) refers to him as 'the late Mr. Clarence Buckley'. His wife Emma was registered in the 1891 census as a widow.

It could be added here that, besides butterflies, Colonel Frederick Buckley also collected beetles and he is immortalized in the name of the north Indian and Nepalese cerambycid *Spinimegopis buckleyi* (Gahan, 1894).

Figure 9. Clarence Buckley, pictured in Ecuador in c. 1870. Unsigned portrait, oil in board, 10.75" x 8.75". Originally owned by W.C. Hewitson. In some sources the portrait has erroneously been claimed to show 'William Buckley (1814-1888)', an evident confusion with William Buckler (1814-1884), an English artist and entomologist. Photo credit: Mallett, London.

Buckley's expeditions to South America

With the exception of his first expedition to Ecuador in 1868-1869, there are no published dated itineraries available for Buckley's five South American expeditions. It is known that his first expedition to Ecuador was initiated, and apparently fully financed, by William Chapman Hewitson (1806-1878), a wealthy English naturalist and famous describer and illustrator of butterflies worldwide. According to Hewitson (1869-1877, Part 1, p. i-ii; 15 December 1869), Buckley's actual field work in Ecuador lasted nearly twelve months (from 5 July 1868 to 26 June 1869; for more details of his itinerary, see above on page 60. On his later expeditions to Ecuador and Bolivia, Buckley was his own man, covering his expenses by selling the collections, obviously 'pre-ordered' by various zoologists, with the help of his agent Edward Gerrard, Jr. Already, in his first expedition Buckley had hired a young and capable attendant, Manuel Villagomez, to help with collecting. Later, Villagomez also carried out independent collecting in Ecuador for Buckley, finding many new species of birds and butterflies; for butterflies, see Hewitson (1870).

Based on a note by John Gould (1870), we know that Buckley's second expedition to Ecuador in 1870-1871 began in the autumn of 1870, but it is unclear when he returned to England the following year. Nor is there any information on the duration of Buckley's two expeditions in Bolivia in 1873-1874 and 1875. In Bolivia his headquarters were at La Paz, from where excursions were made into the valleys and ranges to the north and east of that city (Sclater & Salvin (1879). In his first Bolivian expedition Buckley collected mainly butterflies for Hewitson, (Hewitson 1874) and on his second expedition he was mostly occupied collecting birds for Osbert Salvin and Frederick DuCane Godman (see below).

Referring to Buckley's last and longest expedition to Ecuador, Sclater & Salvin (1880, submitted on 2 March 1880) wrote "Mr. Clarence Buckley has just returned from Ecuador, after four years absence." This suggests that the expedition had started in early1876 and ended before the end of 1879 or the beginning of 1880. Among his first collecting locations during his stay was Gima (Jima), a pueblo on the headwaters of Rio Pamar, in Loja province in southern Ecuador, where he collected butterflies for Hewitson (Hewitson 1869-1877, p. 81; dated 11 April 1877 and Brown 1941). During most of this expedition he was headquartered at

the village of Sarayacu on the Rio Bobonasa, a tributary of the Rio Pastaza, from where he made visits to several sites in the surrounding areas. However, he also collected at other places, such as Intag (for details, see above page 55). During his stay he made large collections of birds for Salvin and Godman (see below). He also collected other vertebrates. His insect collecting focused on butterflies, moths, beetles and dragonflies.

Discoverer of over 700 new species. In zoological circles, Clarence Buckley had already gained a reputation as an outstanding collector following his two first expeditions. In 1872, the great Amazon explorer Henry Walter Bates dubbed Buckley "that prince of collectors" (Bates, 1872, p. 237). Earlier, William Chapman Hewitson had written: "I do not, of course, compare the collection of Mr. Buckley with the perennial collections of Bates and Wallace, which increased by one-third the known butterflies; but I do not hesitate in saying, that during the twenty-five years in which I have been a student of these things, no such single collection (either for its perfection or extent) has been brought to Europe." (Hewitson 1869-1877, Part 1, p. i-ii; dated 15 December 1869).

In a presentation at the meeting of the Zoological Society of London on 6 December 1870, the eminent ornithologist John Gould eulogized the zeal and perseverance displayed by Mr. Buckley in having collected so many species [130 specimens of 30 hummingbird species] during the very short time he had been in the country [in Ecuador in the autumn 1870] (Gould 1870). In June 1880, a few months before his death, Gould named *Pinarolaema buckleyi* (Fig. 11), a new hummingbird species from Bolivia after Buckley, a signal honour given Gould's passion for the group. Unfortunately, this, which would be the last new species Gould described, later turned out to be synonym of one of his earlier species: *Colibri c. coruscans* (Gould, 1846) (Sparkling Violetear).

Two other leading ornithologists, Philip Lutley Sclater and Osbert Salvin praised the consignment of 10, 000 bird skins of 800 species, which Buckley, with help of his local collectors, had gathered during his last four year sojourn in Ecuador, as "one of the finest series of birds-skins which we have ever had the pleasure of looking through." (Sclater & Salvin 1880). [It should be noted here that Chapman (1926, p. 728) criticized the errors in labelling attached to the skins in this collection. The labels had been added by the agent Gerrard in London.] In Bolivia, Buckley had collected ca 700 bird skins belonging to 500 species (Sclater & Salvin 1879).

I have attempted to locate from literature (presently available online) those species described as new from material collected by Buckley. There appear to be at least over 700 new species (including a few taxa named as subspecies) described from Buckley's material; most likely there are many more. With the exception of the birds, other vertebrates, dragonflies, and the eponymous '*buckleyi*' names, no attempt was made to determine how many of these species are presently ranked as valid.

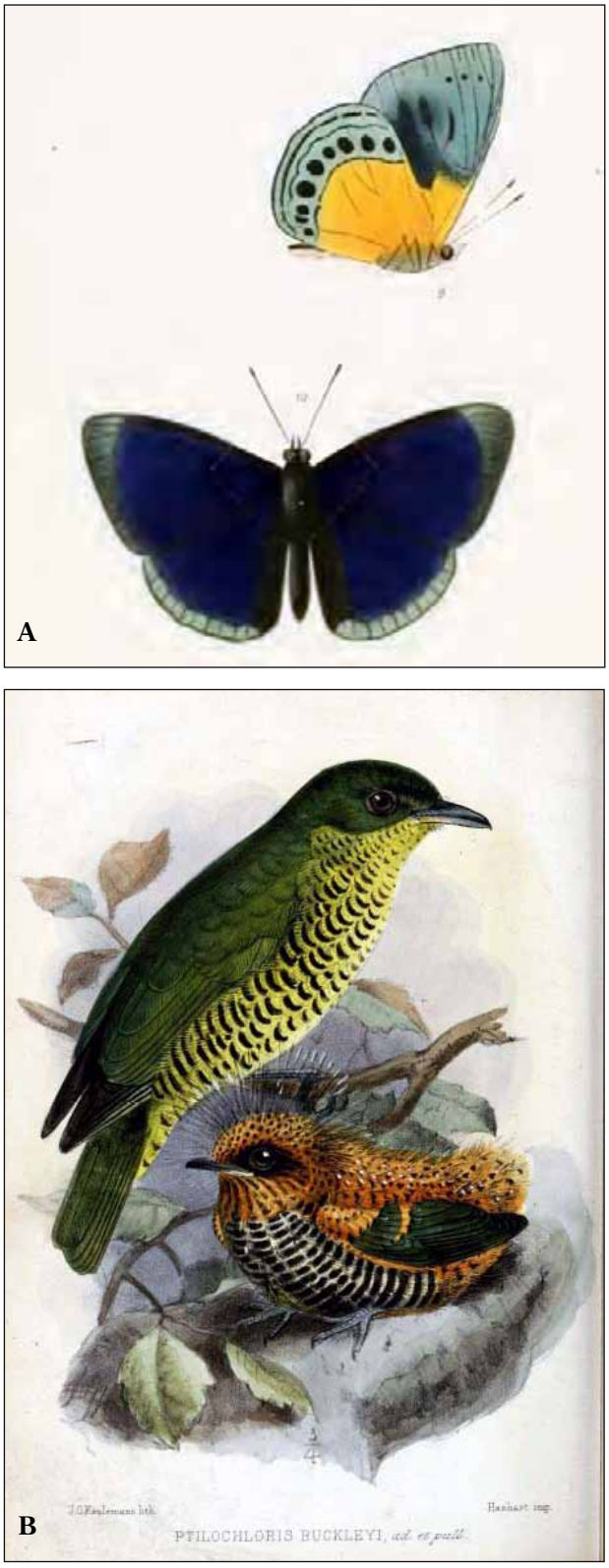

Figure 10. Examples of species dedicated to Clarence Buckley. (A) *Callithea buckleyi* Hewitson, 1869 [present name *Asterope buckleyi*]; Artwork by W.C. Hewitson, dated Dec. 1869. Credit: Internet Archive. (B) *Ptilochloris buckleyi* Sclater & Salvin, 1880 [Present name *Laniisoma buckleyi*]; Artwork by J.G. Keulemans, copied from Sclater & Salvin (1880). Credit: British Heritage Library.

Birds. Based mainly on information garnered from the lists of type-specimens of the birds in the British Museum (Natural History) by Warren (1966) and Warren & Hamilton (1971), at least 95 species-group taxa of birds have been named from Buckley's material. Cross-checking these taxa with various recent online checklists and databases of the birds of the world, 38 of these taxa are presently ranked as valid species (see Table 3) and 32 as valid subspecies. The remaining 25 are synonyms.

Other vertebrates. At least two new mammals have been described from Buckley's material. These are the olingo *Bassaricion alleni* Thomas, 1880 (Eastern Lowland Olingo) and a monkey *Callicebus paenulatus* Elliot, 1909, which is a synonym of *Plecturocebus discolor* (I. Geoffroy Saint-Hilaire & Deville, 1848) (White-tiled titi). At least 11 new species of reptiles, 16 species of frogs and 18 species of fish have also been named from Buckley's material.

Insects. According to Vane Wright (1991) ca 200 new butterfly species have been described from Buckley's material. In addition, three more new butterfly taxa were described as recently as 1998 and 2006 (see Table 5). There are at least 190 moth species and at least 150 beetles from various families described from Buckley's material but these figures may be underestimates. Moreover, there are 22 valid species of damselflies and dragonflies (Table 1). Interestingly, the search for the new species did not give any hits in any other insect orders. This suggests Buckley's collecting was very selective.

Molluscs. At least six species of land shells have been named from Buckley's material.

Figure 11. Examples of species dedicated to Clarence Buckley. *Pinarolaema buckleyi* Gould, 1880 [Synonym of *Colibri c. coruscans* (Gould, 1846). Artwork by William Hart. Credit: Internet Archive**.**

Species dedicated to Clarence Buckley

Various authors have named nearly 90 new species (including a few taxa named as subspecies) in honour of Clarence Buckley (Tables 4 and 5; Figs 10-11). Twenty of these dedications are vertebrate names (Table 4). Among birds there are no fewer than eight dedications, of which only six are listed by Beolens & al. (2014). It is interesting, despite the numerous new species provided by Buckley, Hewitson named only one butterfly species after him (Fig. 10 A), whereas Herbert Druce (1846-1913) honoured him with no fewer than 14 moth species. Curiously enough, three of the five butterfly dedications to Buckley are quite recent. This suggests that Buckley's memory as 'that prince of collectors' is undergoing a revival.

Acknowledgements

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Table 1. New Odonata species described from specimens collected by Clarence Buckley in Ecuador and Bolivia. The present binomials are used, with the exception of synonymous taxa. Species in which the type series includes also specimens by other collector(s) are marked with an asterisk *

Type material		
Calopterygidae		
Ormenophlebia imperatrix (McLachlan, 1878)	Intag, Ecuador	4 ♀; Lectotype ♀
**Mnesarete devillei* (Selys, 1880)	Rio Napo, Ecuador	1 ♂,1 ♀; Lectotype ♂
Mnesarete fulgida (Selys, 1879)	Rio Napo, Ecuador	1 ♂,1 ♀; Lectotype ♂
Polythoridae		
Cora dualis McLachlan 1878	Intag, Ecuador	3 ♂, 2 ♀; Lectotype ♂
**Cora inca* Selys, 1873	Ecuador	1 ♀; Syntype
Cora jocosa McLachlan, 1881	Rio Bobonaza, Ecuador	1 ♂; Holotype ♂
Cora munda McLachlan 1878	Intag, Ecuador	3 ♀; Lectotype ♀
Cora terminalis McLachlan, 1878	Unduavi, Bolivia	1 ♂, 1 ♀; Lectotype ♂
Euthore mirabilis McLachlan 1878	Intag, Ecuador	6 ♂, 6 ♀; Lectotype ♂
Polythore aurora (Selys, 1879)	Rio Napo, Ecuador	2 ♂, 2 ♀; Lectotype ♂
Polythore boliviana (McLachlan, 1878)	Chairo, Bolivia	1 ♂; Holotype ♂
Polythore concinna (McLachlan, 1881)	Rio Bobonaza, Ecuador	15 ♂, 4 ♀; Lectotype ♂
Polythore derivata (McLachlan, 1881)	Rio Bobonaza, Ecuador	6 ♂, 2 ♀; Lectotype ♂
Polythore mutata (McLachlan, 1881)	Rio Bobonaza, Ecuador	8 ♂, 1 ♀; Lectotype ♂
Thore picta aequatorialis Selys, 1873 [**Syn.** of *Polythore vittata* (Selys, 1869)]	Ecuador	1 ♀; Holotype ♀
Heteragrionidae		
**Heteragrion aequatoriale* Selys, 1886	Rio Bobonaza, Ecuador	1 ♂ Syntype [1]
Heteragrion angustipenne Selys, 1886	Ecuador	1 ♂, 1 ♀; Lectotype ♂
Teinopodagrion curtum (Selys, 1886)	Rio Bobonaza, Ecuador	1 ♂; Holotype ♂
Teinopodagrion setigerum (Selys, 1886)	Intag, Ecuador	1 ♂; Holotype ♂
Coenagrionidae		
Anomisma abnorme McLachlan, 1877	Rio Napo, Ecuador	1 ♂; Holotype ♂
Mecistogaster buckleyi McLachlan, 1881	Rio Bobonaza, Ecuador	2 ♂; Lectotype ♂
Oreiallagma prothoracium (Kimmins, 1945)	Intag, Ecuador	4 ♂; Holotype ♂
Microstigma terminatum McLachlan, 1877 [**Syn.** of *Anomisma abnorme* McLachlan, 1877]	Rio Napo, Ecuador	1 ♀, Holotype ♀
Synthemistidae		
Gomphomacromia fallax McLachlan, 1881	Intag, Ecuador	3 ♂, 2 ♀; Lectotype ♂
Additional later specimens of the above species		
Mnesarete devillei	Rio Bobonaza, Ecuador	4 ♂, [? 3 ♀]
Polythore vittata [as *Thore aequatorialis*]	Intag, Ecuador and Rio Bobonaza, Ecuador	3 ♀ and 2 ♀, respectively
Anomisma abnorme	Rio Bobonaza, Ecuador	15 spec. (♂, ♀)

Footnote

1 Daigle & Garrison (in prep.) provide evidence that the selection of one of the three males of *Heteragrion* housed in the BMNH as lectotype by Kimmins was not one of the specimens used in the original description. They represent the species subsequently described as *Heteragrion mitratum* Williamson, 1919. These specimens were most likely identified subsequently (erroneously) as *H. aequatoriale* some time after 1886. Daigle & Garrison suggest that Kimmins designation was in error and that the true syntypes of *H. aequatoriale* reside in the RBINS.

Table 2. Other Odonata species collected by Buckley in Ecuador.

Published records		
Calopterygidae		
Hetaerina caja (Drury, 1773)	Rio Bobonaza, Ecuador	3 ♂
Mnesarete metallica (Selys, 1869)	Rio Bobonaza, Ecuador	4 ♂, 1 ♀
Polythoridae		
Euthore fasciata (Hagen *in* Selys, 1853)	Intag?, Ecuador	2 ♂
Polythore gigantea (Selys, 1853)	Intag?, Ecuador	3 ♂
*Polythore procera (*Selys, 1869)	Ecuador	Numerous (♂, ♀)
Polythore neopicta Bick & Bick, 1990 [as *Thore picta* (Rambur, 1842)]	Ecuador	2 ♂
Coenagrionidae		
Mecistogaster jocaste Hagen, 1869	Rio Bobonaza, Ecuador and Rio Napo, Ecuador	1 ♀ and 1 ♀, respectively
Mecistogaster linearis (Fabricius, 1776)	Rio Bobonaza, Ecuador	Many (♂, ♀)
Mecistogaster lucretia (Drury, 1773) [as *Mecistogaster marchali* Rambur, 1842]	Rio Bobonaza, Ecuador	Several
Microstigma rotundatum Selys, 1860	Rio Bobonaza, Ecuador	Numerous (♂, ♀)
Heteragrionidae		
Heteragrion sp. (likely *H. mitratum* Williamson, 1919)	Rio Bobonaza, Ecuador	1 ♀
Corduliidae		
Neocordulia batesi Selys, 1871	Rio Bobonaza, Ecuador	5 ♂, 1 ♀

Unpublished records	
Collections of BMNH (London) contain a large number of unidentified damselfly specimens from the New World. So far, Rosser W. Garrison has recognized the following species collected by Clarence Buckley. These are:	
Coenagrionidae	
Argia adamsi Calvert, 1902	Rio Bobonaza, Ecuador
Argia medullaris Hagen *in* Selys, 1865	Rio Bobonaza, Ecuador and Intag, Ecuador

Table 3. Bird species described from the type specimens collected by Clarence Buckley or by his local assistants

Anabazenops dorsalis (Sclater & Salvin, 1880)	Bamboo foliage-gleaner
Anairetes flavirostris Sclater & Salvin, 1876	Yellow-billed tit-tyrant
Aramides calopterus Sclater & Salvin, 1878	Red-winged wood rail
Asthenes griseomurina (Sclater, 1882)	Mouse-colored thistletail
Atlapetes leucopis (Sclater & Salvin, 1878)	White-rimmed brush-finch
Capito squamatus Salvin, 1876	Orange-fronted barbet
Celeus spectabilis Sclater & Salvin, 1880	Rufous-headed woodpecker
Chaetocercus bombus Gould, 1871	Little woodstar
Columbina buckleyi (Sclater & Salvin, 1877)	Ecuadorian ground dove
Contopus nigrescens (Sclater & Salvin, 1880)	Blackish pewee
Creurgops dentatus (Sclater & Salvin, 1876)	Slaty tanager
Diglossa glauca Sclater & Salvin, 1876	Deep-blue flowerpiercer
Epinecrophylla spodionota (Sclater & Salvin, 1880)	Foothill stipplethroat
Euchrepomis humeralis (Sclater & Salvin, 1880)	Chestnut-shouldered antwren
Geranoaetus poecilochrous (Gurney, 1879)	Puna hawk
Grallaria dignissima Sclater & Salvin, 1880	Ochre-striped antpitta
Grallaria erythrotis Sclater & Salvin, 1876	Rufous-faced antpitta
Hapalopsittaca pyrrhops (Salvin, 1876)	Red-faced parrot
Haplophaedia assimilis (Elliot, 1876)	Buff-thighed puffleg
Heliangelus micraster Gould, 1872	Flame-throated sunangel
Heterocercus aurantiivertex Sclater & Salvin, 1880	Orange-crested manakin
Kleinothraupis calophrys (Sclater & Salvin, 1876)	Orange-browed hemispingus
Laniisoma buckleyi (Sclater & Salvin, 1880)	Andean laniisoma
Leptotila megalura Sclater & Salvin, 1879	Yungas dove
Lipaugus uropygialis (Sclater & Salvin, 1876)	Scimitar-winged piha
Megascops ingens (Salvin, 1897)	Rufescent screech owl
Micrastur buckleyi Swann, 1919	Buckley's forest falcon
Myiotheretes fuscorufus (Sclater & Salvin, 1876)	Rufous-bellied bush-tyrant
Neomorphus radiolosus Sclater & Salvin, 1878	Banded ground cuckoo
Nonnula brunnea Sclater, 1881	Brown nunlet
Pseudastur occidentalis (Salvin, 1876)	Grey-backed hawk
Rallus aequatorialis Sharpe, 1894	Ecuadorian rail
Rhegmatorhina melanosticta (Sclater & Salvin, 1880)	Hairy-crested antbird
Silvicultrix pulchella (Sclater & Salvin, 1876)	Golden-browed chat-tyrant
Sipia nigricauda (Salvin & Godman, 1892)	Esmeraldas antbird
Snowornis cryptolophus (Sclater & Salvin, 1877)	Olivaceous piha
Stilpnia argyrofenges (Sclater & Salvin, 1876)	Straw-backed tanager
Thalurania hypochlora Gould, 1871	Emerald-bellied woodnymph

Table 4. List of scientific names of vertebrate taxa named after Clarence Buckley.

	Original binomial	Group
Birds		
Columbina buckleyi (Sclater & Salvin, 1877) Ecuadorian ground dove	*Chamaepelia buckleyi*	Columbiformes: Columbidae
Laniisoma buckleyi (Sclater & Salvin, 1880) Andean laniisoma	*Ptilochloris buckleyi*	Passeriformes: Cotingidae
Micrastur buckleyi Swann, 1919 Buckley's forest falcon		Falconiformes: Falconidae
Odontophorus gujanensis buckleyi Chubb, 1919 Marbled wood quail		Galliformes: Odontophoridae
Tityra inquisitor buckleyi Salvin & Godman, 1890 Black-crowned tityra	*Tityra buckleyi*	Passeriformes: Cotingidae
Chrysuronia buckleyi Boucard, 1893. Synonym of *Chrysuronia oenone* (Lesson,1832), Golden-tailed sapphire		Apodiformes: Trochilidae
Diphlogæna iris buckleyi Berlepsch, 1887. Synonym of *Coeligena i. iris* (Gould,1854) Rainbow starfrontlet		Apodiformes: Trochilidae
Pinarolaema buckleyi Gould, 1880. Synonym of *Colibri c. coruscans* (Gould,1846) Sparkling violetear		Apodiformes: Trochilidae
Reptiles		
Alopoglossus buckleyi (O'Shaughnessy, 1881)	*Leposoma buckleyi*	Squamata: Gymnophthalmidae
Anolis buckleyi O'Shaughnessy, 1885. Synonym of *Anolis transversalis* Duméril, 1851		Squamata: Dactyloidea
Goniodactylus buckleyi O'Shaughnessy, 1881. Synonym of *Gonatodes concinnatus* (O'Shaughnessy, 1881)		Squamata: Sphaerodactylidae
Elaps buckleyi Boulenger, 1896. Synonym of *Micrurus ornatissimus* (Jan, 1858)		Squamata: Elapidae
Amphibians		
Agalychnis buckleyi (Boulenger, 1882)	*Phyllomedusa buckleyi*	Anura: Phyllomedusidae
Centrolene buckleyi (Boulenger, 1882)	*Hylella buckleyi*	Anura: Centrolenidae
Osteocephalus buckleyi (Boulenger, 1882)	*Hyla buckleyi*	Anura: Hylidae
Pristimantis buckleyi (Boulenger, 1882)	*Hylodes buckleyi*	Anura: Graugastoridae
Caecilia buckleyi Boulenger, 1884. Synonym of *Caecilia pachynema* Günther, 1859		Gymnophiona: Caeciliidae
Edalorhina buckleyi Boulenger, 1882. Synonym of *Edalorhina perezi* Jiménez de la Espada, 1870		Anura: Leiuperidae
Fish		
Paradon buckleyi Boulenger, 1887		Characiformes: Parodontidae
Pimelodella buckleyi (Boulenger, 1887)	*Pimelodus buckleyi*	Siluriformes: Heptapteridae

Table 5. List of scientific names of invertebrate taxa named after Clarence Buckley.

	Original name	Family
Lepidoptera - butterflies		
Asterope buckleyi (Hewitson, 1869)	*Callithea buckleyi*	Nymphalidae
Hyalenna buckleyi Willmott & Lamas, 2006		Nymphalidae
Ithomiola buckleyi Hall & Willmott, 1998		Riodinidae
Pedaliodes praxia buckleyi Pyrcz & Viloria, 2006		Nymphalidae
Setabis buckleyi (Grose-Smith, 1898)	*Aricoris buckleyi*	Riodinidae
Lepidoptera – other groups		
Asthenia buckleyi (Druce, 1890)	*Asthenidia buckleyi*	Saturniidae
Cyanopepla buckleyi (Druce, 1883)	*Charidea buckleyi*	Erebidae
Dasysphinx buckleyi (Druce, 1883)	*Homoeocera buckleyi*	Erebidae
Dysschema buckleyi (Druce, 1910)	*Pericopis buckleyi*	Erebidae
Gorgonidia buckleyi (Druce, 1883)	*Zatrephes buckleyi*	Erebidae
Hagnagora buckleyi Druce, 1885		Geometridae
Iscadia buckleyi Druce, 1890		Nolidae
Langsdorfia buckleyi Druce, 1901		Cossidae
Notophyson buckleyi (Druce, 1895)	*Anthomyza buckleyi*	Erebidae
Pero buckleyi (Butler, 1881)	*Azelina buckleyi*	Geometridae
Phostria buckleyi (Druce, 1902)	*Phryganodes buckleyi*	Crambidae
Polygrammodes buckleyi (Druce, 1895)	*Pachynoa (?) buckleyi*	Crambidae
Pseudatteria buckleyi (Druce, 1901)	*Atteria buckleyi*	Tortricidae
Trocherateina buckleyi (Druce, 1892)	*Eratina buckleyi*	Geometridae
Castnia buckleyi Druce, 1883. Synonym of *Duboisvalia ecuadoria* (Westwood, 1877)		Castniidae
Coleoptera		
Ancistrosoma buckleyi Sallé, 1887		Melolonthidae
Bolax buckleyi Ohaus, 1931		Rutelidae
Brachacantha buckleyi Crotch, 1874		Coccinellidae
Calleida buckleyi Liebke, 1939		Carabidae
Calophaena buckleyi Liebke, 1930		Carabidae
Cantharolethrus buckleyi Parry, 1872		Lucanidae
Chalcophana buckleyi Jacoby, 1880		Chrysomelidae
Cholus buckleyi Pascoe, 1872		Curculionidae
Coelomera buckleyi Jacoby, 1880		Chrysomelidae
Colaspis buckleyi Jacoby, 1880		Chrysomelidae
Cnemidochroma buckleyi (Bates, 1879)	*Callichroma buckleyi*	Cerambycidae
Delognatha buckleyi Bates (F.), 1874		Tenebrionidae
Dercylus buckleyi Chaudoir, 1883		Carabidae
Desmogramma buckleyi Bowditch, 1911		Chrysomelidae
Diabrotica buckleyi Baly, 1879		Chrysomelidae
Discopus buckleyi Bates, 1880		Cerambycidae
Doryphora buckleyi Baly, 1877		Chrysomelidae
Dyscolus buckleyi (Chaudoir, 1879)	*Colpodes buckleyi*	Carabidae
Epilachna buckleyi Crotch, 1874		Coccinellidae
Erotylus buckleyi Crotch, 1876		Erotylidae
Euplectalecia buckleyi (Waterhouse, 1905)	*Halecia buckleyi*	Bubrestidae

	Original name	Family
Goniochenia buckleyi (Baly, 1872)	*Mesomphalia buckleyi*	Chrysomelidae
Gymnetis hieroglyphica buckleyi Janson, 1879	*Gymnetis buckleyi*	Cetoniidae
Homocopris buckleyi (Waterhouse, 1891)	*Pinotus buckleyi*	Scarabaeidae
Imatidium buckleyi (Spaeth, 1929)	*Himatidium buckleyi*	Chrysomelidae
Lamprosphaerus buckleyi (Jacoby, 1881)	*Phaedra buckleyi*	Chrysomelidae
Lema buckleyi Baly, 1876		Chrysomelidae
Longitarsus buckleyi Baly, 1877		Chrysomelidae
Lycomedes buckleyi Waterhouse, 1880		Dynastidae
Mastostethus buckleyi Baly, 1876		Megalopodidae
Megalopus buckleyi Jacoby, 1889		Megalopodidae
Megatharsis buckleyi Waterhouse, 1891		Scarabaeidae
Mesomphalia buckleyi Baly, 1872		Chrysomelidae
Metadorcinus buckleyi (Waterhouse, 1886)	*Sclerostomus buckleyi*	Lucanidae
Mimolaia buckleyi (Bates, 1885)	*Callia* (*Mimolaia*) *buckleyi*	Cerambycidae
Oligocorynus buckleyi (Crotch, 1876)	*Zonarius buckleyi*	Erotylidae
Oxygonia buckleyi Bates, 1872		Carabidae
Plagiometriona buckleyi Spaeth, 1937		Chrysomelidae
Semiotus buckleyi Candèze, 1874		Elateridae
Sympagus buckleyi (Bates, 1885)	*Nyssodrys buckleyi*	Cerambycidae
Taeniotes buckleyi Bates, 1872		Cerambycidae
Thonius buckleyi Crotch, 1876		Erotylidae
Chalcolepidius buckleyi Janson, 1882. Synonym of *Alaus haroldi* (Candèze, 1878)		Elateridae
Mallaspis buckleyi Waterhouse,1880. Synonym of *Mallaspis scutellaris* (Olivier, 1795)		Cerambycidae
Prionacalus buckleyi Waterhouse, 1872. Synonym of *Prionacalus iphis* White, 1850		Cerambycidae
Odonata		
Mecistogaster buckleyi McLachlan, 1881		Coenagrionidae
Gastropoda		
Buckleyia Higgins, 1872 (subgenusof genus *Aperostoma* Troschel, 1847). Synonym of *Daronia* Adams, 1861		Neocyclotidae
Neniaptyx buckleyi (Higgins, 1872)	*Clausilia (Nenia) buckleyi*	Clausiliidae
Drymaeus buckleyi (Sowerby, 1895)	*Bulimus (Drymaeus) buckleyi*	Bulimulidae
Thaumastus buckleyi (Higgins, 1872)	*Orthalicus* (*Porphyrobaphe*) *buckleyi*	Megaspiridae

Rediscovery of *Ceriagrion annulosum* (Lieftinck, 1934) from Java, Indonesia

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Introduction

Ceriagrion annulosum Lieftinck, 1934 (Zygoptera: Coenagrionidae) is a species that has not been evaluated for the International Union for Conservation of Nature's (IUCN) Red List. The main reason for this is that distribution records are poorly known. *C. annulosum* Lieftinck (1934a) was described from a single male collected from somewhere in Java by Fruhstorfer Lieftinck (1934b). A second male, collected by Toxopeus, 27 September 1933, was reported from: 'Lampong, Geisting 500m', south Sumatra island by Lieftinck, (1934b). Lieftinck (1935) later provider further locality details where the same male was described from: 'S. Lampoeng Res.: Mt. Tanggamoes, Gisting, 500 m'. The location is close to Mount Tanggamus, Lampung Province at the southern tip of Sumatra. Asahina (1967) recorded four males and three females from 'Sempoertjondong, Tjdaeon, south Java', collected 8 November 1935. This locality is Cidaun in the southern part of West Java Province. These three locality records, two from Java and one from Sumatra—all based on specimens collected between 1933 and 1935, are hitherto the only known records of *C. annulosum*. Here, after a gap 85 years, we report the rediscovery of *C. annulosum* at a new locality at the southern part of East Java Province.

Observation

On 12 November 2020, at 10.00-13.00 AM, we found *C. annulosum* at coordinates 8°23'42.84" S 112°32'19.32" E while conducting a butterfly survey. It was located at Sumber Bening Village, Bantur District, Malang, East Java, Indonesia. The type of ecosystem was tropical lowland forest, 24 m a.s.l., which was impacted by road construction (Figure 1B-C). The patch of habitat where the species was found is around a puddle of water for

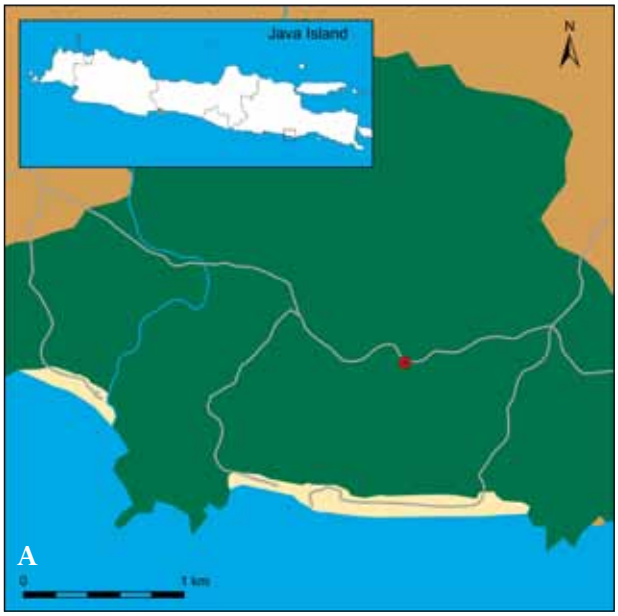

Figure 1. (A) Map of a survey site and patch habitat where *C. annulosum* was found in 2020 at coastal Forest, Sumber Bening Village, Bantur District, East Java, Indonesia. A red point marker shows the observation site of *C. annulosum*. (B-C) Patch habitat. (B) Bush vegetation. (C) Puddle of water near road construction, 12 November 2020. Photo Credits: (A) Abdul Mutholib Syahroni, (B). Agus Nurrofik.

drainage, 13 m from the road works with surrounding bushes. We found eight individuals: five males (Figure 2) and three females, flying and perching around bush vegetation (Figure 1B). Moreover, there were three other pairs found in tandem position on *Mimosa pudica* vegetation during observations (Figure 2B). The individual was confirmed as *C. annulosum* by the bluish-green morphological color, curious dark apical rings of the abdomen, and its anal appendages [compared with description provided by Asahina (1967)]. These findings were also confirmed by the Indonesia Dragonfly Society (IDS).

Figure 2. *Ceriagrion annulosum*, 12 November 2020. (A) Male *C. annulosum*. (B)Tandem pair. Photo credits: Abdul Mutholib Syahroni.

Brief description

Male: Dominant colour head bright greenish-blue from frons to labium. Ocellus is black and compound eyes are turquoise. Bluish-green prothorax. Thoracic colour patches bluish-green with a brownish-green median line and a black humeral line. Pale yellowish-green legs, spiked black and tarsus more blackish. Both wings are transparent. Pterostigma black. The abdomen's colour is blue with black patches. The bluish colour becomes whiter ventrally. Black ring patches are found at each end of segments 3-7. Segment 8-10 base colour is black with a blue ring on the dorsal side. Anal cerci are black.

Female: The head is yellowish-green. Compound eyes green. The green thorax is more yellowish ventrally with a black humeral line. The legs are pale yellow and there are posterior black stripes along the femur to the tarsus. Spines black. Transparent wings with yellow pterostigma. The abdomen is almost the same as the male in that there is a ring in each apical segment, pale brown base colour from segment 2 to segment 10.

Recommendation

The rediscovery of *C. annulosum* in an area disturbed by anthropogenic activity brings some urgency to the continued assessment of this species. Further research of habitat patches used, morphological data for re-description, analysis of population trends, taxonomy, adaptation, and metamorphosis are recommended to provide a possibility of determining the conservation status of *C. annulosum* by the IUCN. Thus, the record of this species is an important indication to encourage the exploration and monitoring of dragonflies in the remaining forest areas, especially at patches of water puddles, on Java Island.

Acknowledgements

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An expedition to Nusambangan Island: survey of the Javan endemic damselfly *Rhinagrion tricolor*

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2020 was a difficult year for everyone, with a pandemic that has hit the whole world. This situation has caused new challenges to be faced, including in the world of conservation. The Indonesian Dragonfly Society has a mission to preserve dragonflies and their habitats. One of the ways of achieving this is through research. We were very grateful to receive a grant from The Rufford Foundation to research the Javan endemic damselfly *Rhinagrion tricolor* Krüger, 1898, currently recorded only from Nusakambangan Island. *Rhinagrion tricolor* is a damselfly that belongs to the Family Philosinidae (Dijkstra et al., 2014). Lieftinck (1954) reported that these damselflies only live in deeply recessed streams in dense primeval forest, 100 - 300 m above sea level. Specimen data shows that *Rhinagrion tricolor* is generally found in the coastal forests of southern West Java. These are: Kalipucang, Sindangbarang, Cidamar (Citoe), Cipandak (Citoe), (all West Java) and Ujung Kulon, Banten. There is a single record from Mount Tengger, East Java (Kalkman & Villanueva, 2011; Natural History Museum, 2017).

Figure 1. Specimen of *Rhinagrion tricolor* stored in National History Museum. It was collected from south Java by Bartels in 1935. Credit: Natural History Museum (2017).

Java is the most populous island in the world, so the rate of deforestation is quite high. From 2009 to 2013, the deforestation of Java Island was around 326,953 hectares (32.64%) (Purba et al., 2014). There has been extensive loss of lowland forest in Java; this is a serious cause for concern with regards to this species (Dow, 2009).

After a long period of no records, a *Rhinagrion tricolor* population was finally rediscovered by the Biolaska Team in 2017, while studying *Dipterocarpus littoralis*. The *Rhinagrion tricolor* population was found on western Nusakambangan Island, Central Java (Zaman et al., 2018). The island is separate from Java Island and is highly secured because most of its territory is used as a prison. The direct result of the presence of this high-security area is that forest conditions are still pristine. Therefore, *Rhinagrion tricolor* can still be found on the Nusakambangan Island. In addition to its highly secure status, Nusakambangan Island has high humidity and great rainfall even in the

Figure 2. Habitat of *Rhinagrion tricolor* in Kali Jati River, West Nusakambangan Nature Reserve. Males prefer perching on vegetation that touches the water or fallen branch at the edge of the river. Photo credit: Muhammad Nu'manudin.

driest period of the east monsoon. This condition enables many aquatic insects to produce a continuous succession of broods, so that rare species of dragonflies such as *Lyriothemis magnificata* can be found throughout the year (Lieftinck, 1934).

With this background, we decided to make an expedition to Nusakambangan Island. We divided the research locations into the eastern, central, and western parts of the island. This *Rhinagrion tricolor* expedition was carried out from August 2020 to February 2021. We surveyed a total of 17 locations. From the results of the expedition, 48 *Rhinagrion tricolor* individuals were found, of which 44 were males and four were females. The *Rhinagrion tricolor* population was distributed in six rivers: Kali Kencana, Kali Jati, Banjar (near SBI mining area), West Nusakambangan River Nature Reserve (Solok Bokong Track), Nirbaya and a river near Lapas Batu. This result is certainly very encouraging considering that *Rhinagrion tricolor* is categorized as very rare and its distribution is very limited. During the expedition, we collaborated with the Central Java Nature Conservation Agency (BKSDA) represented by RKW Cilacap, Lapas Nusakambangan, IUCN Dragonfly Specialist Group, and local society. We also took part in reforestation around *Rhinagrion tricolor* habitat at Kali Jati River with RHL NKB 2021 team.

The data generated in this study are the most up-to-date information on the *Rhinagrion tricolor* population in Nusakambangan Island, and provide the basis for determining the conservation status and direction of policies to conserve the *Rhinagrion tricolor* population. We hope to carry out further research in other areas considering that we have not explored all of the potential habitats. Apart from Nusakambangan, there are other locations, such as Ujung Kulon, which was previously recorded as a site for *Rhinagrion tricolor*.

We are very grateful to The Rufford Foundation for entrusting us to carry out this research. We hope to continue to contribute to the sustainability of the *Rhinagrion tricolor* population. We also thank RKW Cilacap, the Lapas Nusakambangan, and Nusa Segara Indonesia Foundation for helping to continue this research.

Figure 3. *Rhinagrion tricolor,* Nusakambangan Island, south Java. (A-B) The beautifully-coloured male *Rhinagrion tricolor,* 19 September 2020. Photo credits: (A) Nanang Kamaludin, (B) Muhammad Nu'manudin. (C) Female perching, 17 September 2020. Photo credit: Hening Triandika Rachman.

Figure 4. Research team on the beach in front of the West Nusakambangan Nature Reserve. Photo credit: Muhammad Nu'manudin.

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Some observations on the natural history of *Archibasis lieftincki* (Zygoptera: Coenagrionidae)

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Introduction

The Odonata fauna of Sri Lanka currently consists of 130 species with 58 endemics (Kalkman et al. 2020). The genus *Archibasis* was recorded in the country relatively recently with the discovery of two species in 2013 (Conniff and Bedjanič 2013). The endemic species *Archibasis lieftincki* (Figure 1) was described from material collected from the southwestern wet zone of the country and it has been reported from multiple localities throughout the low country wet zone (Bedjanič et al. 2014; Sumanapala et al. 2016).

Archibasis lieftincki is known to inhabit slow-flowing streams with a sandy substrate and rich riparian vegetation, in association with lowland rainforests. Adults have been observed throughout the year (Sumanapala 2017). The species has been proposed to be categorized as Endangered under IUCN red listing categories and criteria 3.1 (Bedjanič et al. 2014). Here we report observations on the natural history of the species collected during a preliminary field survey.

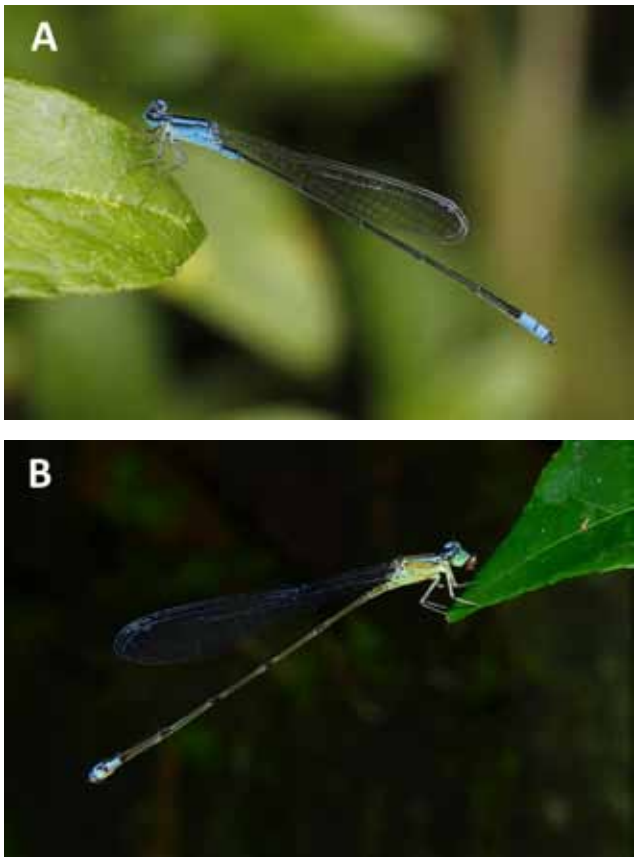

Figure 1: *Archibasis lieftincki* (A) Male. (B) Female.

Methods

Field observations were made as part of an ongoing survey on Odonata in Madugeta Village (6.3848 N, 80.4058 E), Neluwa, Sri Lanka (Figure 2). The study area is located close to the southern border of the Sinharaja World Heritage Forest Reserve. The Thambalagama Dhola (=rivulet), a tributary to the river Gin, and a complex network of streams are present in the study area. The primary study site is about 20 km west-northwest from the type locality of *Archibasis lieftincki*. Observations were made by naked eye or with the aid of Yashica YBC 1248 (10x42) binoculars.

Observations

Archibasis lieftincki was most commonly observed in medium-size streams with an average width of three to five meters in the study area (Figure 3). The stream substrate mainly consisted of sand, pebbles and cobbles with very little silt. Abundance was highest in places with emerging aquatic plants and bank vegetation such as *Legenandra* (Araceae) and *Eriocaulon* (Eriocaulaceae), and dense riparian vegetation with plants like *Ochlandra stridula* (Poaceae) and *Cerbrera odollam* (Apocynaceae). Adult *Archibasis lieftincki* were never observed in irrigation canals in association with paddy fields with higher silt content in the substrate.

Adult *Archibasis lieftincki* have been observed throughout the year in the study area. However, abundance was significantly higher from June to August, when both sexes were regularly observed along or in the immediate vicinity of the streams. Males were often observed perching on emerging aquatic vegetation while females were usually observed among the surrounding riparian vegetation.

The reproductive behaviour of the species (Figure 4) was observed on 21 June 2020, at around 1010 h in a stream with emerging aquatic vegetation. The female was flying about a meter above the water when the male grasped her, initiating the tandem. The pair in tandem flew around for about a minute and landed on an emerging

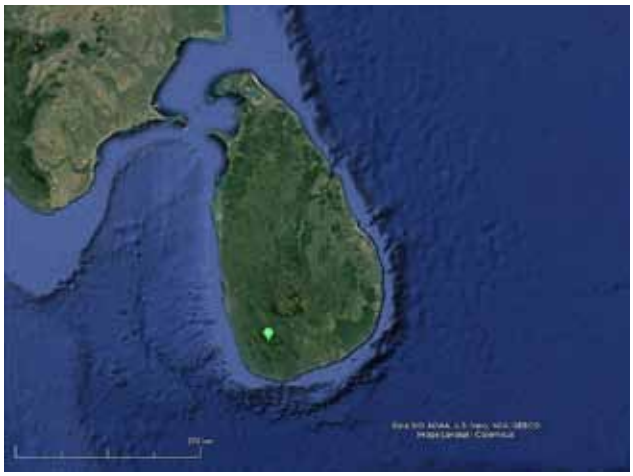

Figure 2: Location of Madugeta Village. Credit: Google Earth.

Figure 3. Typical habitat of *Archibasis lieftincki* in the study site.

aquatic plant and assumed the wheel position. Several minutes later they started flying around presumably looking for a suitable ovipositing site and settled on a partially submerged *Legenandra* leaf. The female crawled into the water along the leaf, while the male remained in tandem, and started ovipositing into the submerged portion of the leaf. At certain times both the female and the male were observed to be fully submerged. About five minutes into the oviposition, the male detached itself from the female and flew away, while the female continued to oviposit underwater. After ovipositing for about five more minutes, the female ended the process, crawled out of the water along the leaf and flew away from the ovipositing site.

Discussion

Based on the observations made during the present work and previously known information on the species, it is clearly evident that *Archibasis lieftincki* prefers slow-flowing, medium to large streams with emerging aquatic

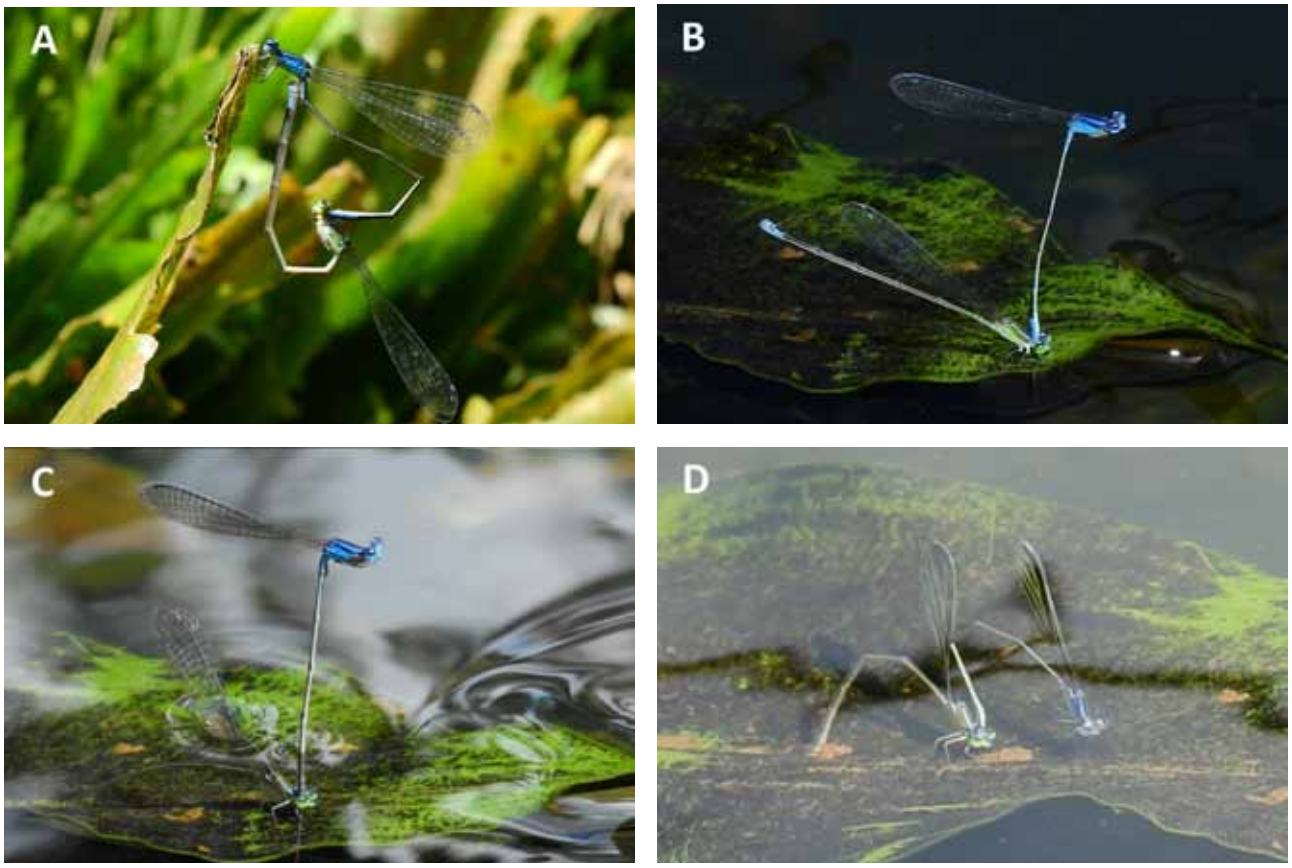

Figure 4. Reproductive behaviour of *Archibasis lieftincki*. (A) Mating wheel. (B) Tandem at ovipositing site. (C) Ovipositing. (D) Submerged ovipositing.

vegetation, dense riparian vegetation and a substrate with sand, pebbles and cobbles. The emerging aquatic plants in the suitable stream habitat are crucial for the survival of the species as they utilize these as perching and ovipositing sites. Any conservation activities targeting the species should focus on maintaining the native emerging and riparian aquatic vegetation along their habitats to support a healthy population. Further research is required to widen the understanding of the ecological requirements of the species and how it responds to the changing environmental conditions.

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