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THE 2015 INTERNATIONAL CONGRESS OF ODONATOLOGY will be convened in La Plata (Argentina). Organizing team: Dr J. Muzon [jmuzon@gmail.com] & Dr F. Lozano [federicolozano82@gmail.com]. Mailing address: ILPLA-CONICET, cc 712, AR-1900 La Plata, Argentina.

THE 2017 INTERNATIONAL CONGRESS OF ODONATOLOGY will be convened in Algeria. Organizing Secretary: Dr B. Samraoui [bsamraoui@yahoo.fr].

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EDITORIAL
AT THE CONCLUSION OF FOUR DECADES OF EDITORSHIP
(1971-2013)

In October 1971, I was entrusted by the participants of the First European Symposium of Odonatology (Ghent, Belgium) with the organisation and editorship of ODONATOLOGICA. This was to appear quarterly and include, in addition to research papers, the abstracts of contemporary odonatological literature published elsewhere. With the present issue, the 42nd volume is completed: the 168 issues contain about 1400 research papers and over 19,800 abstracts of works published throughout the world since 1971.

The editing and the intensive daily contacts with the odonatological community became my life style, bringing much pleasure and many personal friendships. It was not easy, and with much sorrow and regret, that I had to decide to resign from the office upon the completion of the current volume: the advancing age is being increasingly felt and my health condition is not optimal any more.

I trust the world odonatological community will share my feelings of thanks to Dr Florian WEIHRAUCH (Jägerstrasse 21/A, D-85283 Wolnzach, Germany; – odonatologica@osmylus.com) for his acceptance of the responsibilities for the journal, its administration, production, editorship and circulation as from the 43rd volume onwards. With his profound experience in worldwide scientific communication and odonatological editorship, he is perfectly qualified to navigate the journal on the waves of contemporary scientific requirements and standards and to guide it to an increasingly high scientific level.

Since the birth of ODONATOLOGICA, two people have been crucial for its development: without the support and much more than the manifold help from the late Professor Dr Janny M. van BRINK (Utrecht/Bilthoven, The Netherlands) and my wife, MARIANNE, it would have been unthinkable to continue in the office for so long. For some decades, Marianne has been the backbone of the SIO and ODONATOLOGICA, taking care of all the technical matters and much more.

Likewise, since the very first issue until today, the editorial help rendered by Dr Peter J. MILL (Leeds, UK) has been indispensable. There is hardly an issue in the production of which he has not been involved, either as a peer reviewer, style model-

ler or a language corrector.

Kiyoshi INOUE's (Osaka, Japan) and Professor Dr Minter J. WESTFALL's

(Gainesville FL, USA) manifold help and continuous encouragement during the four decades were among the cornerstones of much of my work.

In recent years, my son, Adjunct Professor Dr George KIAUTA-THUCYDIDES (Vancouver, Canada) opened new horizon by managing the website and the electronic edition of the journal. For this I thank him very sincerely.

At its very onset, ODONATOLOGICA enjoyed the active support and assistance of well over a hundred odonatologists from all parts of the world. From among those deceased, at least a few peer reviewers, collaborators of the Odonatological Abstracts section and/or helpers in other editorial matters should be recalled here, viz. [academic titles omitted]: N.N. AKRAMOWSKI (Armenia), S. ASAHINA (Japan), B.I. BALINSKY (Sth Africa), J. BELLE (Netherlands), B.F. BELYSHEV (Russia), G.H. BICK (USA), F. CAPRA (Italy), H.-f. CHAO (China), P.S. CORBET (UK), D.A.L. DAVIES (UK), R.M. GAMBLES (UK), D.C. GEIJSKES (Netherlands), L.K. GLOYD (USA), A. Yu HARITONOV (Russia), H. KAISER (Germany), M.A. LIEFTINCK (Netherlands), C. LONGFIELD (Eire), T.T. MACAN (UK), S. MIELEWCZYK (Poland), P.L. MILLER (UK), T.R. MITRA (India), E.B. MONTGOMERY (USA), P. MÜNCHBERG (Germany), C. NIELSEN (Italy),



Figs 1-3. Charter Meeting of the Societas internationalis odonatologica (SIO), held during the First European Symposium of Odonatology, Ghent, Belgium, 22-23 October 1971, Dr B. Kiauta in Chair: (1) the birth of SIO (first row, from left to right: C. Fischer, Dipl.-Ing. H. Schumann, Dr. J.M. van Brink and Dr G. Jurzitza); – (2) Dr F. Schaller, proposing the name 'Odonatologica' for the Society's journal; – (3) discussion on the set-up of the first Editorial Board. – [Photographs by D. Smit, Utrecht]

E.C.G. PINHEY (Rhodesia/UK), A. PORTMANN (Switzerland), G. PRITCHARD (Canada), Z. SPURIS (Latvia), V. TEYROVSKÝ (Czech Republic), J.A.L. WATSON (Australia) and M.J. WESTFALL (USA).

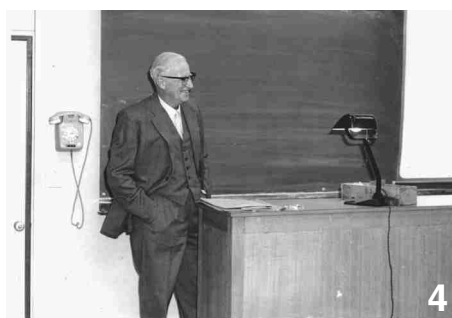
My warm thanks go to the dozens of external peer reviewers and to the past and present members of the Editorial Board, as listed on p. 2 of the cover of each issue. Some of these are currently the sole (or almost so) living experts in certain narrow fields of odonatology; hence their help remains indispensable.

A journal is made by the contributing authors and it is to them I owe profound thanks for the high standard and the impact ODONATOLOGICA enjoys, the latter despite its narrow restriction to a very small group of organisms. It is also due to them that the journal has been in a position to adhere strictly to the publication dates, as set-up in 1971.

*The 3rd issue of Volume 2 appeared in time solely due to M.J. PARR's (UK) submission of his two excellent *Ischnura elegans* manuscripts*

but otherwise the flow of manuscripts has been invariably reasonable, occasionally overwhelming. We never had any problem meeting publication dates; throughout the loyalty and cooperativeness of the odonatological community has been invariably splendid, sincere, trustful and dependable. Very many thanks to all.

Some of the great workers of our time published their first or earliest research papers in ODONATOLOGICA. The members of the Editorial Board were always eager to encourage and help young dragonfly students in the presentation of their work. In this field, the merits of the late George BICK (USA), Philip CORBET (UK), Dirk GEIJSKES (Netherlands), Maus LIEFTINCK (Netherlands), Peter MILLER (UK), Gordon PRITCHARD (Canada) and Minter WESTFALL (USA) cannot be exaggerated and are to be particularly acknowledged. Whenever there was any uncertainty as to the identity of the species, M.A. LIEFTINCK



Figs 4-5. Charter Meeting of SIO: (4) Dr M.A. Lieftinck, one of the four SIO Members of Honour, elected at the Charter Meeting; the others were Dr S. Asahina (Japan), Dr B.F. Belyshev (USSR) and Dr E.C.G. Pinhey (Rhodesia); – (5) Some participants: 1: Dr J. Olesen, – 2: Dr F. Schaller, – 3: Dr A.M. Moens-Bullens, – 4: Dr J. Moens, – 5: Dr M. Mouze, – 6: J.C. Andries, – 7/8: Mrs & Mr H. Itzerott, – 9: Dr J. Legrand, – 10: L.E.M. de Boer. – [Photographs by D. Smit, Utrecht]

(mostly) checked systematically the identifications of voucher specimens, if provided by the authors upon request.

The Odonatological Abstracts section has been a standard feature of the journal. During the earlier years the personal computer was unknown, the facilities for copying scarce, not very good, elaborate and expensive. I had to depend almost entirely on the exceptionally well-stocked Library of the Netherlands Entomological Society (Amsterdam) where, during 40 years, I checked monthly the newly arrived issues of hundreds of entomological periodicals. The reprints sent more or less regularly by numerous workers were, of course, very useful. Some colleagues volunteered at various times and over various lengths of time, to collect for me systematically the odonatological works published in their country or a larger region. Most important were the contributions covering Australia and New Zealand (by J.A.L. WATSON), China (H.-f. CHAO), Germany (R. RUDOLPH), India (T.R. MITRA), Italy (C. UTZERI), Japan (in succession: S. ASAHINA, S. EDA, K. INOUE), The Netherlands (M.Th. WASSCHER), New Zealand (W.J. WINSTANLEY), Poland and eastern Europe (P. BUCZYŃSKI), Russia (N.N. AKRAMOWSKI, S.N. GORB, A. Yu. HARITONOV), Slovenia (M. BEDJANIČ), Switzerland (H. WILDERMUTH) and Thailand (A. PINRATANA). During recent years, until mid 2012, the overwhelming help by W. PIPER (Germany), covering the entire world and including considerably more than three thousand publications, made the preparation of the abstracts easier than ever before. Since that date M. SCHORR (Germany) has been helping similarly.

This account would not be complete without mentioning Dick SMIT (Utrecht), the artist at the former Institute of Genetics of the University of Utrecht, The Netherlands, who designed the SIO and ODONATOLOGICA logo and handled all the illustrations published in the first 12 volumes.

In the field of administration and local distribution of ODONATOLOGICA much help was/is continuously rendered by some of the SIO National



Figs 6-8. Charter Meeting of SIO: (6) Dr J.M. van Brink, the "Mother" of SIO, its Treasurer and Joint Editor of *Odonatologica* from its inception to her death in March 1993, at the Symposium/Charter Meeting Banquet; – (7) Dr J. Legrand (left) and Dr S. Carfi (right) at the Banquet; – (8) Dr P.J. Mill (left) and Dr J.M. van Brink (right) in conversation during a break. – [Photographs by D. Smit, Utrecht]

Offices in Germany (in succession R. RUDOLPH, R. JÖDICKE), in Italy (C. UTZERI), Japan (K. INOUE), Slovenia (A. PIRNAT), Thailand (A. PINRATANANA), United Kingdom (first P.J. MILL, then J. SILSBY, currently G. VICK) and in the United States (M.J. WESTFALL, at present B. MAUFFRAY).

Last but not least, my heartfelt thanks go to our page-maker and go-between with the printers, Mrs Joke M. SCHIPPERS-KOK of "De Zetspiegel" (Hardinxveld-Giessendam, The Netherlands), for her reliability and her invariably high-quality work; also for her very dependable cooperation of every kind and for her strict adherence to publication dates, even when these were occasionally not easy to meet.

For the sake of record it should be mentioned that over the years the guestbook at the Editorial Office was signed by more than hundred visiting odonatologists, by some on several occasions. Among the legible signatures are those of: Adamović, Ž.R.; – Anselin, A.; – Asahina, S.; – Askew, R.R.; – Bechly, G.; – Bedjanič, M.; – Belle, J.; – Bick, G.; – Bick, J.; – Biedermann, J.; – Bischof, A.; – Boon von Ochssée, T.; – Butler, S.; – Cannings, R.; – Cannings, S.; – Cempirek, J.; – Corbet, P.S.; – Davies, D.A.L.; – De Jong, T.H.; – De Marmels, J.; – Deacon, K.; – Devai, G.; – Dijkstra, K.-D.B.; – Donnelly, T.W.; – Dumont, H.; – Dyatlova, E.S.; – Erbids, N.; – Falchetti, E.; – Geijskes, D.C.; – Geister, I.; – Grossniklaus, H.-P.; – Hämäläinen, M.; – Haritonov, A.Yu.; – Hartung, M.; – Higler, L.W.G.; – Hilton, D.F.J.; – Holmquist, J.; – Hostetler, K.; – Inoue, K.; – Jensen, A.; – Jödicke, R.; – Jurzitza, G.; – Kalkman, V.; – Kemp, R.G.; – Komnik, H.; – Kotarac, M.; – Krüner, U.; – Legrand, J.; – Lencioni, F.; – Lieftinck, M.A.; – Lohmann, H.; – Machado, A.B.M.; – Marinov, M.; – Martens, A.; – Meier, C.; – Michiels, N.; – Mielewczyk, S.; – Mill, P.; – Miyakawa, K.; – Mol, A.; – Montgomery, B.E.; – Moore, N.W.; – Müller, R.; – Nielsen, P.; – Nimz, C.; – Norma-Rashid, Y.; – Parr, M.J.; – Peterson, J.; – Pilon, J.-G.; – Pinhey, E.C.G.; – Pinratana, A.; – Piper, W.; – Pirnat, A.; – Poboljšaj, K.; – Popova, O.; – Pritchard, G.; – Rehfeldt, G.; – Robertson, H.; – Rudolph, R.; – Šalamun, A.; – Sandhall, Å.; – Schaller, F.; – Schiess, H.; – Schmidt, Eb.; – Schorr, M.; – Schröter, A.; – Sherk, T.; – Siegenthaler, I.; – Sovinc, A.; – Strub, O.; – Suzuki, K.; – Tembhare, D.B.; – Treagust, A.; – Tyagi, B.K.; – Ubukata, H.; – Utzeri, C.; – Van Tol, J.; – Velthuis, H.; – Verdonk, M.; – Vermeir, J.; – Wasscher, M.Th.; – Watson, J.A.L.; – Weihrauch, F.; – Westfall, M.J.; – White, T.R.; – Wildermuth, H.; – Williams, E.C.; – Winstanley, B.; – Wolf, M.; – Wysoki, M.

The recollections of the 43 years of editorship and of almost 20 years of my odonatological life preceding that period would make a book. I embarked on the study of dragonflies in 1952 and my class-mate, colleague and very close friend during the past 70 years (!), Professor Dr Matija GOGALA (Ljubljana, Slovenia), was involved in this decision. My first dragonfly teachers were Ž.R. ADAMOVIĆ (Serbia) and D.E. KIMMINS (UK), and I had the privilege of having been in the position to conduct some correspondence with our classic odonatologists of the past, such as P.P. CAL-

VERT (USA), F.C. FRASER (UK), F.F. LAIDLAW (UK), Erich SCHMIDT (Germany), D.ST. QUENTIN (Austria), K.J. VALLE (Finland), E.M. WALKER (Canada) and F.E. ZEUNER (UK). Laidlaw's brief correspondence exercised much influence and gave me much encouragement, while the frequent and long letters from Erich Schmidt were to sow in me the first seed that later gave birth to *ODONATOLOGICA*, though in our correspondence of the 1960s we were referring to the journal as *Notulae odonatologicae*. The name, *ODONATOLOGICA*, was proposed at the First European Symposium of Odonatology (Ghent, Belgium) by Professor Dr François SCHALLER of the University of Strasbourg, France.

My correspondence archive (1952-2013) and odonological library comprise close to 10 and 150 shelf-metres, respectively. Among the earlier correspondents (and aside of some persons mentioned in the foregoing paragraphs above) were, e.g.: K. ANDER (Sweden), P. AGUESSE (France), G.H. & A.F. BEATTY (USA), A. BILEK (Germany), D.J. BORROR (USA), C. BUCHHOLTZ (Germany), K. BUCHHOLTZ (Germany), F. BULIMAR (Romania), F. CASSAGNE MEJEAN (France), F. CIRDEI (Romania), A. COMPTE SART (Spain), C. CONCI (Italy), N. DIAS DOS SANTOS (Brazil), T.W. DONNELLY (USA), H.J. DUMONT (Belgium), M. ETCHEVERRY (Chile), A.E. GARDNER (UK), M. HÄMÄLÄINEN



Figs 9-13. The First European Symposium of Odonatology: (9) during a lunch, from left to right: Dr D.C. Geijskes, Dr M.A. Liefertinck and Dr B. Kiauta; – Figs 10-13: Paper presentations: (10) Dr H.J. Dumont; – (11) Dr P.J. Mill; – (12) Dr G. Jurzitza chairing a Paper Session; – (13) Dr Eb. Schmidt. – [Photographs by D. Smit, Utrecht]

(Finland), G. JURZITZA (Germany), J. LEGRAND (France), N. MacNEILL (Eire), A.B.M. MACHADO (Brazil), N.W. MOORE (UK), T. OKSALA (Finland), T. OMURA (Japan), F. PÓR (Romania), J. RÁCENIS (Venezuela), P.-A. ROBERT (Switzerland), H. SCHIEMENZ (Germany), Eb. SCHMIDT (Germany), A. STANIONYTE (Lithuania), H. STEINMANN (Hungary), A. TJØNNELAND (Norway), J. URBAŃSKI (Poland), O.-P. WENGER (Switzerland) and very many others. Some of these rendered various kind of help to *ODONATOLOGICA* as well.

Heartfelt thanks go to all who were/are supporting *ODONATOLOGICA*, either by submitting or mediating the submission of manuscripts, offering suggestions and/or constructive criticism, helping in editorial details, promoting circulation of the journal and/or assisting in any other way, not the least by their encouragement, expressed in correspondence or otherwise. An exhaustive list of the persons involved would be too long here. However, foremost among these stands Dr Brij Kishore TYAGI (Madurai, India) to whom I am extending very special thanks – not merely for all he did for *ODONATOLOGICA* during the years he served as the Head of the SIO National/Regional Office in India and SE Asia – but most particularly also for his initiative and editorial preparation of the monumental Festschrift “*Odonata: biology of dragonflies*” (2007, Scient. Publishers, Jodhpur). The book took me completely by surprise on my 70th birthday and continues rendering manifold encouragement ever since. Warm thanks go also to the 38 authors, from 17 countries, that had contributed papers published in that volume.

Profound and very special thanks also to the 18 workers from Australia, Brazil, China, Finland, France, Hungary, the United Kingdom, the United States and Venezuela for dedicating to me the names of 14 odonate taxa (1986-2013).

Finally, the initiative of Drs M.Th. WASSCHER (Utrecht) and Prof. Dr M. GOGALA (Ljubljana) that resulted in a “national acknowledgement” of my work in, respectively, The Netherlands (2002) and Slovenia (2007) are warmly recalled.

Last but not least, and although this does not concern directly the *ODONATOLOGICA* work, I would like to acknowledge here also the assistance, hospitality and/or various kinds of other help I have enjoyed during my numerous odonatological missions and field work from e.g.: G. ALBERTI (Italy), S. ASAHINA (Japan), P. BOVEY (Switzerland), J.W. BOYES (Canada), H. BURLA (Switzerland), L.J.M. BUTOT (Netherlands), R. & S. CANNINGS (Canada), H. FRANZ (Austria/Nepal), E. GHIRARDELLI (Italy), A. Yu. HARITONOV (Russia), U. HELLMICH (Germany/Nepal), L.W.G. HIGLER (Netherlands), K. INOUE (Japan), G.B. KALIKOTE (Nepal), M. KOTARAC (Slovenia), M.A. LIEFTINCK (Netherlands/France), J.C. LIEN (Taiwan), M.F. MÖRZER BRUYNIS (Netherlands), R.A. MÜLLER (Switzerland), A. PISKERNIK (Slovenia), R. SCHLOETH (Switzerland), I. & O.R. SIEGENTHALER STRUB (Switzerland), M. TITAYAVAN (Thailand), B.K. TYAGI (India), M.J. WESTFALL (USA), E.C. WILLIAMS (USA) and from some dozens more persons in various parts of

the world. My wife, MARIANNE, actively participated in almost all my field work. Aside of her technical and other assistance, her skilful management of the logistics was indispensable particularly in the Himalayan, SE Asian and the Philippine missions, where her familiarity with some of the local languages and scripts was often a valuable asset also.

From 2014 onwards I shall continue my work on the SIO Board of Trustees and on various odonate research projects. I am appealing herewith to the world dragonfly community in the hope that they will continue to help me with their support and also with copies of their current publications, etc. In this way I hope to remain informed on the developments in odonatology and stay in vivid contact with the odonatologists throughout the globe. Thank you in anticipation.

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THE NEXT ISSUE OF *ODONATOLOGICA* (Vol. 43, No. 1)
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**GOMPHUS PULCHELLUS SELYS RECORDED ON THE
EASTERN EDGE
OF ITS DISTRIBUTION AREA IN MONTENEGRO
(ANISOPTERA: GOMPHIDAE)**

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A larva from the Zeta river (Danilovgrad, 12-X-2010) is brought on record, figured and its habitat is described. This is the first record of *G. pulchellus* larva from the Balkans. The eastern records of the sp. are reviewed and mapped, and the eastern range of *G. pulchellus* is discussed.

INTRODUCTION

Gomphus pulchellus Sel. is a West European endemic species with a clumped distribution area ranging from the Iberian Peninsula to Germany. It has also been recorded from sites farther to the east. However, most of this data is questionable or definitely incorrect (DIJKSTRA, 2006). Therefore, every accurate record of the occurrence of this species at the edge of its clumped distribution range, as well as beyond, is valuable. This is particularly important since *G. pulchellus* belongs to the species that have been noted for their geographic expansion associated with climate warming (OTT, 2010).

In this paper we analyse the first record of *G. pulchellus* in Montenegro, i.e. on the outskirts of the species' clumped distribution area.

MATERIAL AND METHODS

The material was collected in October 2010 during studies on the zoobenthos of the river valleys of central and southern Montenegro. Semi-quantitative samples were taken with the use of a hydrobiological kick net sampler and material was also picked out by hand from objects submerged in the water. Adult odonates were sporadically caught with an entomological net. In total, from 16 sites, 117 larvae and 12 adults were obtained.

The data presented in this paper was collected in the lower course of the Zeta (catchment area 1597 m², course length 85 km), the biggest tributary of the Morača river, flowing into the latter from the Northwest. The lower course of the Zeta is characterized by a slow and constant flow throughout the year, at the level of Danilovgrad its average value is 78.5 m³·s⁻¹. The slope of the entire river averages 1.1% (BOŠKOVIĆ & BAJKOVIĆ, 2006). Due to the presence of karst the river is rich in calcium carbonate. It is relatively deep (usually 4-5 m), with a small number of rapids and pools.

In 2010, biological indices classified the Zeta in the 1st-2nd class of water quality, microbiological indices in the 2nd-3rd class and the concentrations of nitrogen compounds in the 3rd class. The concentrations of phosphates were the most limiting factor (>3rd class) (AZZ, 2011).

RESULTS

One larva of *Gomphus pulchellus*, together with a *Calopteryx virgo* (L.) larva, were caught on 12th October 2010 in the Zeta river below the town of Danilovgrad (42°32' N, 19°07' E, UTM: CN41, ca 40 m a.s.l.) (Fig. 1). The total length of the *G. pulchellus* specimen was 10 mm. Its habitus and some of its morphological features are shown in Figure 2.

The larval *G. pulchellus* was caught in one of the shallow pools by the river bank. The width of the river channel at this point is about 20 m. The bottom of the pool is of sand and gravel mixed with silt, together with stones overgrown by *Fontinalis antipyretica*. In the cracks between stones and gravel particles, fine detritus had accumulated.



Fig. 1. *Gomphus pulchellus* habitat near Danilovgrad, Montenegro. – [Photograph by Edyta Stępień]

The water can be described as transparent, with a high content of CaCO₃.

The narrow belt of sharply indented river banks, with a height of 4-5 m, is overgrown by broadleaved, deciduous woodland – alluvial forests consisting of *Salix alba*, *Populus alba*, *Fraxinus excelsior*, *Alnus glutinosa* and riparian mixed forests with *Quercus robur*, *Ulmus laevis* and

U. minor, *Fraxinus excelsior* or *F. angustifolia*. At some places this narrow belt of forest had abundant understory shrubs. The area surrounding the forest belt is formed by fertile valleys covered with vast complexes of meadows, pastures and crops. The river's silt has created favourable conditions for communities of summer therophytes of the *Bidentetea tripartitae* class. Also, patches of partly developed communities of rushes of the *Phragmitetea* class have been noted.

DISCUSSION

Despite the fact that the *G. pulchellus* larva caught in Montenegro was relatively young, it represents well most of the diagnostic features of this species (ASKEW, 2004; GERKEN & STERNBERG, 1999; HEIDEMANN & SEIDENBUSCH, 2002; KOHL, 2003; SUHLING & MÜLLER, 1996). The lack of lateral spines on the 6th abdominal segment distinguishes it from the larvae of most other representatives of the genus, including *G. flavipes* (Charp.) and *G. vulgatissimus* (L.). A mistake for *G. flavipes* is impossible due to the well-developed apical burrowing spurs on the fore and middle tibiae as well as the shape of abdomen. The dorsal spine on the 9th abdominal segment is very typical of *G. pulchellus*; although it can be present in *G. flavipes* it is far less developed in the latter species.

G. pulchellus is a West Mediterranean species. It inhabits Europe from the Iberian Peninsula to the Benelux countries, central Germany, western Austria, Swit-

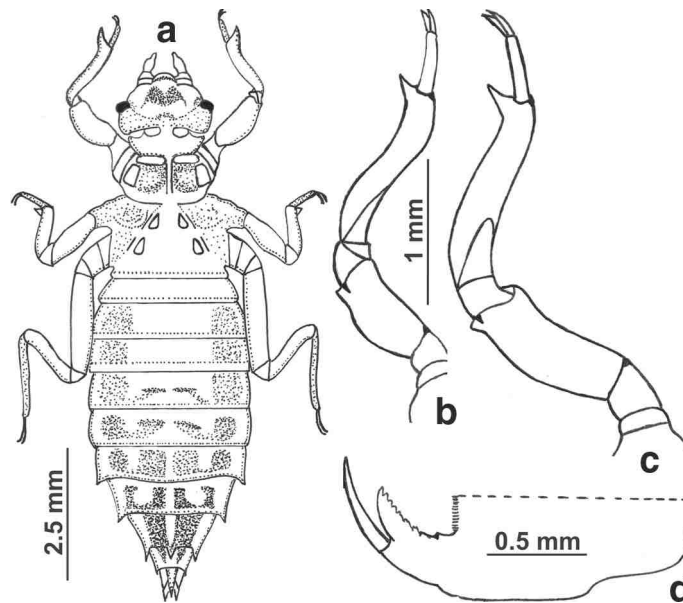


Fig. 2. *Gomphus pulchellus* larva, collected in the Zeta river, Montenegro: (a) general view; – (b) fore leg; – (c) middle leg; – (d) mask. – [Drawn by Edyta Buczyńska]

zerland and south-eastern France (Fig. 3). The focal point of its range is situated in the Southwest of this area where *G. pulchellus* is very common and widespread (BOUDOT et al., 2009; DIJKSTRA, 2006; SUHLING & MÜLLER, 1996). *G. pulchellus* has been reported from at least 10 separate sites in eight countries in southern, central and eastern Europe (Fig. 3):

- (1) Italy, Piedmont (no details) (PIROTTA, 1879).
- (2) Italy, Vicentino ad Vinzenza (no details) (PIROTTA, 1879).
- (3) Croatia, Rabac in the Istrian peninsula, backed up stream, 1 ♂, 10-VII-1982, H.-J. Eickmeyer leg., W. Schneider det. et coll. (SCHNEIDER, 1984).
- (4) Czech Republic, Cep ad Třeboň, Cepské rybníky ponds, 10-VIII-1967, 1 ♂, J. Flíček leg. et det., V. Teyrovský et J. Pudil rev. Documentary specimen does not exist – it was later destroyed by store pests (DOLNÝ et al., 2007; FLÍČEK, 2000).
- (5) Poland, Chodecz ad Włocławek, lake Chodeckie and its vicinity, larvae, data from 1911-1912 (WOLSKI & SŁONIMSKI, 1914). The history of the documentary materials is unknown.
- (6) Slovakia, Žar nad Hronom, the river Hron, larvae, material probably from the years 1922-1944 (DUDICH, 1958). The documentary material has been lost.
- (7) Hungary, the vicinity of Szeged, lower courses of the Tisza and Marosz riv-

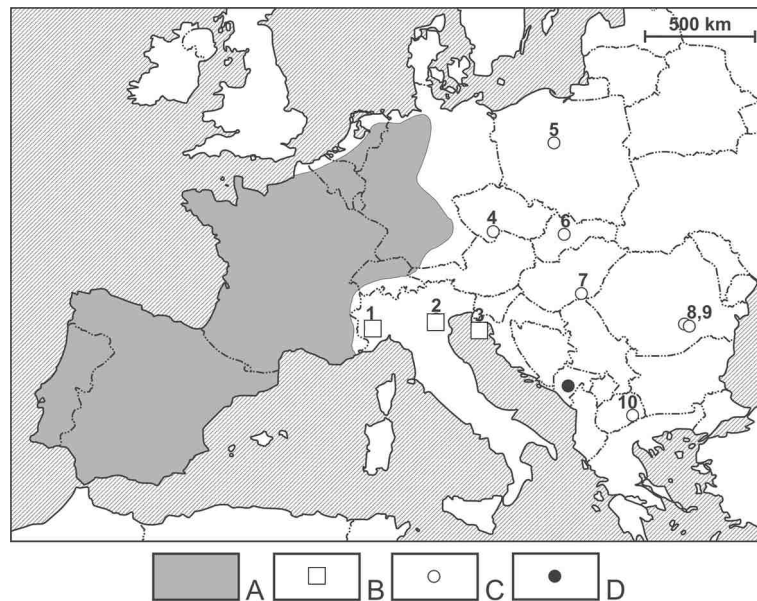


Fig. 3. *Gomphus pulchellus* geographical distribution: (A) main area; – (B) confirmed sites; – (C) doubtful or incorrect sites; – (D) new site in Montenegro. – For the locality names, see “Discussion”. – [From DIJKSTRA (2006), modified by Paweł Buczyński].

ers, larvae, general data from the years 1963-1964 (FERENCZ, 1974). No documentary material.

- (8) Romania, Snagov ad București, imago? (no details) (CÎRDEI & BULIMAR, 1965). The documentary material has been lost.
- (9) Romania, lake Căldărușani, imago?, 1986 (VINTILA, 1989).
- (10) Macedonia, Bogdantsi ad Gevgeli, imago? (no details), data from the years 1915-1919, July (PETKOV, 1921).

On the website about the dragonflies of Slovakia (ŠACHA, 2012) another site was incorrectly given: Žitný ostrov (an island in the Danube near the town of Šamorín) (TRPIŠ, 1957). However, *G. pulchellus* is not mentioned in this paper at all. Nevertheless, in “Fauna Europaea” (VAN TOL et al., 2013) the information about the occurrence of *G. pulchellus* in Bulgaria is given. This probably results from the misinterpretation of the data of PETKOV (1921): Bogdantsi ad Gevgeli once belonged to Bulgaria but is now in Macedonia (V.L. Beschovski, pers. comm.); moreover, in northeastern Bulgaria there is a village with the same name: Bogdantsi ad Tutrakan, a well-known tourist destination.

Most of the data discussed above is considered unreliable and is omitted in the literature on the fauna of the respective countries (BERNARD et al., 2009; JEZIORSKI & HOLUŠA, 2011; MANCI, 2012; MIELEWCZYK, 1990; ŠACHA, 2012; TIBOR & DÉVAI, 2008), as well as in monographs at the European level (ASKEW, 2004; BOUDOT et al., 2009; DIJKSTRA, 2006; SUHLING & MÜLLER, 1996) (Fig. 3). Usually, the reason for the rejection is the lack of documentary materials, together with the possibility of misidentification, which is probably due to the large distances from the range boundary of *G. pulchellus* in central and western Europe (in the case of the East Balkans 1300-1500 km). Many mistakes in a source paper and/or in other papers of various authors were also indicated, which makes the data uncertain (DAVID & JANSKÝ, 2012; G. Dévai, pers. comm.).

However, three sites were considered reliable (BOUDOT, 2012; BOUDOT et al., 2009) (Fig. 3). These are well-documented and include relatively new data from Croatia (SCHNEIDER, 1984), as well as very old data from Italy, validated by recent finding of a specimen from Piedmont (SCHNEIDER & UTZERI, 1994). In the light of the data mentioned above, the site of *G. pulchellus* in Montenegro is very interesting. It is situated about 1000 km from the range boundary as well as 700-900 km from the sites in Italy and 500 km from the site in Croatia, being the easternmost and the most isolated site of the occurrence of the species (Fig. 3). Furthermore, although the presence of a single larva does not allow an assessment of the durability of the occurrence of *G. pulchellus* in Montenegro, the fact of catching a larva indicates the possibility of reproductive success.

The environment in which *Gomphus pulchellus* was found in the Zeta river is typical. It prefers rivers and canals, although it also inhabits a wide spectrum of standing waters (both natural and anthropogenic). Its larvae live in the mineral,

often gravel, bottoms rich in detritus (STERNBERG et al., 2000; SUHLING & MÜLLER, 1996). Only in the northeastern part of its distribution area are standing waters in the valleys of rivers, especially oxbows and gravel excavations, crucial (BOS, 2002; GRAND & BOUDOT, 2006; HEIDEMANN & SEIDENBUSCH, 2002; RAAB et al., 2007; STERNBERG et al., 2000). The expansion of the species towards the North and the East is associated with the increase in the number of gravel excavations, which date back to the end of the 19th century (EGGERS & MARTENS, 2009; RUDOLPH, 1980). Expansion in this direction is also currently in progress, probably enhanced by climate warming (CONZE et al., 2010; DE KNIJF et al., 2001; GROS, 2006; OTT, 2010; STERNBERG et al., 2000; TERMAAT et al., 2010). Oxbows and especially gravel excavations probably provide suitable thermal conditions and many of them have microhabitats favourable for larvae. This is also confirmed by the one-year life cycle in an artificial small water body in the valley of the Rhine near Karlsruhe (SCHRI-MACHER et al., 2007), whereas the usual cycle takes 2-3 years (SUHLING & MÜLLER, 1996). However, in south-eastern Europe it is not very important: running waters should be warm enough for *G. pulchellus*. Should the species actually be present in this area, it is most likely to be expected in running waters.

The Montenegrin site of *Gomphus pulchellus* forms an interesting sequence with the data from Italy and Croatia (PIROTTA, 1879; SCHNEIDER, 1984) and Macedonia (PETKOV, 1921) (Fig. 3, sites Nos 1-3 and 10). It shows the hypothetical route of migration of this species. However, it has to be said that, without further data, it is most difficult to interpret unambiguously its occurrence in Montenegro. It could be the result of a single, random migration. If that was the case, this migration demonstrates the possibility of occasional occurrence of the species very far from its range boundaries. This leads us to the conclusion that caution is needed when negating older data of a similar nature, in particular the data collected from areas close to Germany and Austria. Some of them may indeed be correct and the lack of specimens is quite common in many European countries, a fact resulting from the two world wars of the 20th century (e.g. BIELEWICZ, 1973).

However, the expansion of *G. pulchellus* that has been noted in central Europe may have already taken place, or is currently beginning to take place, also in the south of the continent. If so, one can expect that the species will colonize northern Italy and further extend its occurrence to the western part of the Balkans. In order to ascertain whether range expansion is occurring, further investigation is urgently required.

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**PHYLOGENY OF THE GENUS *ISCHNURA*,
WITH EMPHASIS ON THE OLD WORLD TAXA
(ZYGOPTERA: COENAGRIONIDAE)**

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COI and ITS DNA fragments were used to gain insight into the phylogenetic relationships within *Ischnura*. The genus is recovered as monophyletic, and the 24 species-level taxa considered (about one third of the total) suggest the existence of 2 main clades, here called the *I. elegans* and *I. pumilio* groups. Each group has a core number of about 4-5 spp. while the placement of most others is not well resolved and will require further study. However, for a number of taxa, their relationship within the species group is clarified. This is true of formerly enigmatic spp. like *I. aralensis*, but also of *I. fountaineae*, *I. evansi*, and others. *I. aurora* is found to be only distantly related to *I. rubilio* and both certainly deserve full species status and occupy disjunct geographic ranges. *Ischnura nursei* is confirmed as a true *Ischnura*. *I. graellsii* and *I. saharensis*, although closely related to *I. elegans*, appear to be good species.

INTRODUCTION

WESTFALL & MAY (1996) characterize *Ischnura* as “probably the most cosmopolitan genus of Zygoptera, occurring almost everywhere Odonata are found”. Worldwide, they list 69 species, of which 15 occur in North America, 14 in temperate and continental Eurasia, and another five or six in India and South China. The total number of species is somewhat uncertain because of controversies over the status of a number of species and even genera (the North African *Ischnura saharensis*, and the Mediterranean insular *I. genei*, for example, are often considered as subspecies of *I. elegans*) (see below). Among the species found in Europe and North Africa, at least four (*I. elegans*, *I. pumilio*, *I. aurora* and *I. senegalensis*)

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sis) cover extensive ranges, including two or three different continents. *I. pumilio*, for example, extends from North Africa to northern China. In North America, *I. ramburii* likewise is found across a wide geographic range, and the Oriental *I. aurora* extends from Polynesia to Thailand. Other species are narrowly endemic, often of small islands. Insular species occur in the Mediterranean basin (*I. genei*), in the Indian Ocean islands of Mauritius and Madagascar, and on several islands of the South Pacific (LIEFTINCK, 1966). Other endemics are, curiously,

Table I
Taxon sampling

Species	Location	Country	Date	Collector
<i>Ischnura abyssinica</i>	Ambo	Ethiopia	May 2004	V. Clausnitzer, K.D. Dijkstra
<i>Ischnura aralensis</i>	South Ural	Russia	Jul 2004	H.J. Dumont
<i>Ischnura asiatica</i>	Beijing	China		H.J. Dumont
<i>Ischnura aurora</i>	Near Adelaide	S. Australia		J. Hawking
<i>Ischnura aurora</i>	Baliem valley	New Guinea	Nov 2005	V. Kalkman
<i>Ischnura aurora</i>	Perth	AUS	2009	K. Martens
<i>Ischnura aurora</i>	Wallis-Futuna	Polynesia	2004	N. Mary-Sasal
<i>Ischnura aurora</i>	Nakhon Sawan	Thailand	Nov 2008	Noppadon Makhbun
<i>Ischnura aurora</i>	See GENBANK	Japan		H. Karube et al., 2012
<i>Ischnura cervula</i>	Mayor pond, Utah	USA	Aug 2004	E. Pilgrim
<i>Ischnura denticollis</i>	Mayor pond, Utah	USA	Aug 2004	E. Pilgrim
<i>Ischnura elegans</i>	Affligem	Belgium	May 1999	H.J. Dumont
<i>Ischnura elegans</i>	Batumi, Georgia	USA	Oct 1997	H.J. Dumont
<i>Ischnura evansi</i>	Sarbaz Gorge	Iran	Oct 1997	H.J. Dumont
<i>Ischnura ezoin</i>	See GENBANK	Japan		H. Karube et al., 2012
<i>Ischnura fluviatilis</i>	Rio Doce lakes, MG.	Brazil	Mar 2010	H.J. Dumont
<i>Ischnura forcipata</i>	Solphur spring, Dehra Dun	India	Mar 1999	H.J. Dumont
<i>Ischnura fountaineae</i>	Samarkand	Uzbekistan	Jul 2004	H.J. Dumont
<i>Ischnura graellsii</i>	Ifrane	Morocco	Jun 1996	H.J. Dumont
<i>Ischnura heterosticta</i>	See GENBANK	FIJI		H. Karube et al., 2012
<i>Ischnura nursei</i>	Near Bandar Abbas	Iran	Nov 2010	S. Sadeghi
<i>Ischnura nursei</i>	Sarbaz River	Iran	Oct 1997	H.J. Dumont
<i>Ischnura nursei</i>	100km S of Jaipur	India	Mar 1999	H.J. Dumont
<i>Ischnura perparva</i>	Mayor pond, Utah	USA	Aug 2004	E. Pilgrim
<i>Ischnura pumilio</i>	Damvallei	Belgium	Jun 1998	H.J. Dumont
<i>Ischnura ramburii</i>	Maryland, Talbot County	USA	Jul 2003	R. Hovmöller
<i>Ischnura rubilio</i>	Kerala	India	Mar 1999	F. Kakkassery
<i>Ischnura rubilio</i>	Paro	Bhutan	May 2005	H.J. Dumont
<i>Ischnura rufostigma</i>	Shangri La, Yunnan	China	Jul 2011	H.J. Dumont
<i>Ischnura saharensis</i>	Aghrmakoum	Mauretania	Jul 2006	E. Durand, J. Renault
<i>Ischnura senegalensis</i>	Hadibu	Socotra	Feb 1999	K. Van Damme
<i>Ischnura senegalensis</i>	Nairobi, swamp	Kenya	Apr 2003	V. Clausnitzer, K.D. Dijkstra
<i>Ischnura senegalensis</i>	Matam	Madras	Jan 1998	H.J. Dumont
<i>Ischnura senegalensis</i>	Palangka Raya	Borneo (IND)	May 2006	H.J. Dumont
<i>Ischnura senegalensis</i>	Ngozi Crater Lake	Tanzania	Sep 2001	V. Clausnitzer, K.D. Dijkstra
OUTGROUP				
<i>Coenagrion puella</i>	Kalmthout	Belgium	May 1998	H.J. Dumont
<i>Coenagrion pulchellum</i>	Laon	France	May 1998	J. Vermeir
<i>Agriocnemis femina</i>	Loksado	Borneo	May 2006	H.J. Dumont

restricted to mountain ranges, with a species flock in New Guinea most prominent (LIEFTINCK, 1959). Virtually no species frequent wet equatorial rainforests. Thus, not a single species is endemic to the African equatorial lowlands. Few species, finally, live in South America and Australia.

Part of the *Ischnura* group has been analysed by molecular methods: CHIP-PINDALE et al. (1999) studied fourteen out of the fifteen North and Central American species (including two subspecies of *I. posita*), using sections of three mitochondrial genes. Their study revealed the existence of a large (7 taxa) cluster of closely related species, hereafter called the *I. denticollis*-group. All other clades were small and contained two (*I. hastata* plus *I. prognata*) or a single species (the *I. ramburii*, *barberi* and *capreola*-clades). The *denticollis*-group does not, at first sight, look particularly homogeneous from a morphological point of view, yet most of its relatives share a lamina mesostigmalis with a posterior upright flange in one or both sexes, and a black dorsum of the synthorax in males, with the antehumeral stripes largely or completely obliterated. Other noteworthy studies include those by KARUBE et al. (2005, 2012) on the Japanese taxa of *Ischnura* and related genera, but the rest of Asia as well as Europe have remained undocumented.

Here, we use molecular methods to arrive at an understanding of the relationships between the Old World species of *Ischnura* and a few allied genera. We included few representatives of some North American species and a single South American species for comparison.

MATERIAL EXAMINED

A list of 24 taxa sampled and their origin is given in Table I. Of the wide-ranging species *Ischnura senegalensis*, *elegans* and *aurora* (s. str.) several geographically distant populations were included, to test for possible cryptic speciation. The outgroup consisted of three non-ischnurid Coenagrionidae species.

METHODS

We studied two fragments of DNA, the mitochondrial COI (the so-called barcoding segment of the gene) and the nuclear ribosomal ITS1-5.8S-ITS2 section of the ribosomal operon. Both are well-known, hypervariable segments of DNA. Here, we used both to serve as a check on one another. In few cases, we failed to amplify the DNA of one of the gene fragments in a particular species. The reason for this is unknown, and explains why the taxa in both trees are not identical.

For a description of the methods of DNA extraction and purification, PCR amplification procedures, nucleotide sequencing (including primers used), and phylogeny estimation methods, the reader is referred to the papers by DUMONT et al. (2007 and 2010). For aligning the gene fragments, we used MAFFT-G; ambiguously aligned positions were eliminated using GBLOCKS v0.91b (CASTRESANA, 2000), but since genetic distances were generally not above 15% (Kimura 2 Parameter pairwise genetic distances), there appeared to be no problem of saturation.

The model of DNA evolution that fitted best the data, calculated after NYLANDER (2004) was the general time-reversible substitution model. Several types of analysis were performed, but only

Bayesian analysis is shown here. The total number of trees was set at 10 million generations; trees were sampled every 1000 generations, burn-in was set at 50 %. Majority-rule consensus trees were recovered after discarding the burn-in.

RESULTS

Figures 1 and 2 show the phylogenetic estimates obtained for the two gene fragments. Both agree in the way they recover species-level clades, but not in the

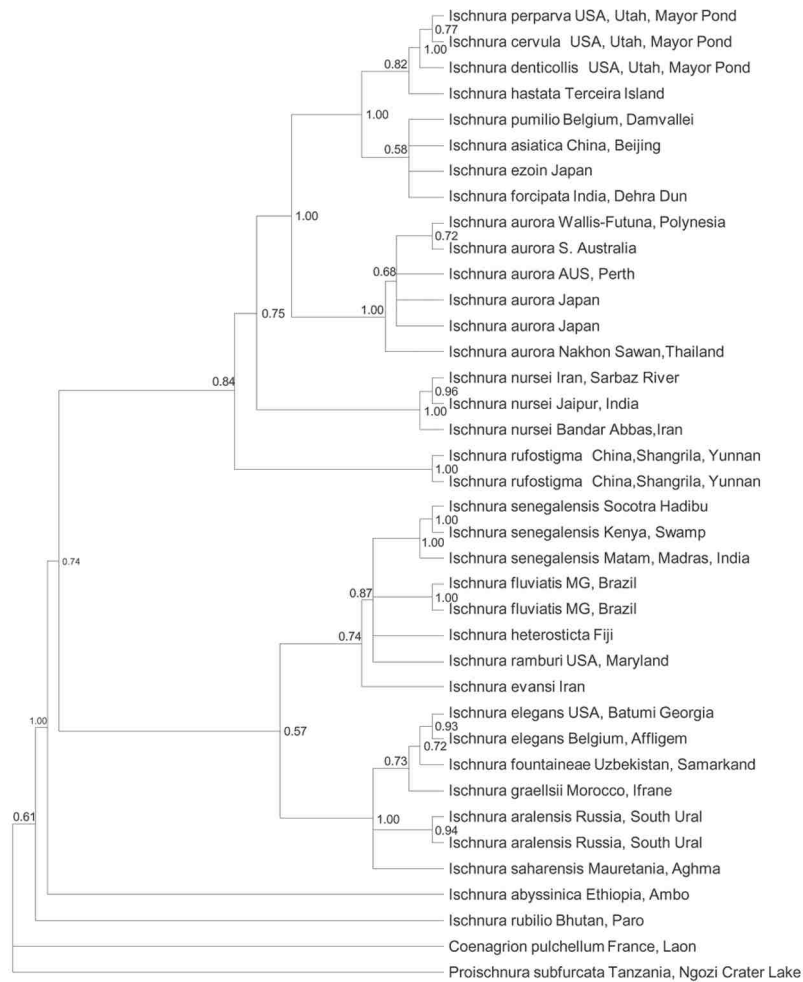


Fig. 1. Estimate of phylogenetic relationships within *Ischnura* by the Bayesian method of inference based on the nucleotide sequence of the nuclear ITS1 and ITS2.

way they organize them into deeper clades. The COI tree (Fig. 1) basically consists of three clades: *Ischnura hastata*, a rather small *I. pumilio* clade (including *I. pumilio*, *forcipata*, *asiatica* and *rubilio*), and a large and complex clade, here termed the *I. elegans*-group. In the ITS-derived tree (Fig. 2), *I. rubilio* is sister to all other *Ischnura*, and *I. abyssinica* to all *Ischnura* minus *rubilio*. Next, there are two main clades, one of which is an *I. elegans* clade, comprised of *I. senegalensis*, *fluviatilis*, *heterosticta*, *ramburi*, *evansi*, and a core group of *elegans*-like species. The latter are identical to those of Figure 1, but in addition are comprised of *I. fontaineae* and *I. aralensis*. The second main clade is the *I. pumilio* clade, that includes the same core species as in the COI tree, in addition to four North American taxa, all *I. aurora* samples, and *I. nursei*. However, the nodes responsible for this unequal division are rather weak in both genes, being recovered with a posterior probability of 0.74 and 0.76 respectively.

DISCUSSION

Ischnura is probably a genus of rather recent age: specimens in Dominican amber studied by BECHLY (2000) were of Oligocene origin, 25-45 m years old. Consequently, it should not be too surprising to find it to be made up of closely related groups. By and large, the material studied consists of two main clades, the *elegans* s.l. and the *pumilio* s. l. clades, with some smaller clades (*aurora*, *nursei*, and *rufostigma*) difficult to place.

Also noteworthy, but understandable in light of the comparatively young age of the genus is the fact that there is little differentiation between specimens of *I. elegans* s.s. from Belgium (supposedly the nominal subspecies) and from the foot of the Caucasus (supposedly ssp. *pontica* or *ebneri*) (SCHMIDT, 1938). The same is true of *I. senegalensis* (almost no difference between East Africa and SE Asia), and to a lesser degree to the different populations of *I. aurora* sampled. All of these taxa may be of early Pleistocene age. *I. fluviatilis* from South America may be the ecological equivalent, as well as a rather close relative (perhaps even sharing a common ancestor with it) of the Old World *I. senegalensis*. More work will be needed to decide on this matter, however. Another matter of interest concerns two species, one Iberian (*I. graellsii*), one North African (*I. saharensis*). Both are recovered as indeed closely related to *I. elegans*, but appear to deserve full species treatment.

While the placement of the major clades within *Ischnura* remains unsettled, we did succeed in clarifying the position of many individual species. *I. aralensis*, for example, was described comparatively recently (HARITONOV, 1979, 1988) from the Syr Darja valley, Central Asia. It extends as far west as the South Ural in Russia, and therefore could be typified as a west Asian endemic. It shares two conspicuous characters with the North American *denticollis*-group: an erect posterior flange on the laminae mesostigmas in both sexes, and males having the

synthorax often largely to completely black, with only a trace of an antehumeral stripe. If relationships were derived from morphology only, a credible scenario could have been that *aralensis* is an offshoot of a late-cenozoic trans-Beringia connection with North America. In fact, however, it is a member of the *I. elegans* group. *I. fountaineae*, which frequently co-occurs with *I. evansi* in arid and semi-arid areas from Central Asia to Northern Africa (DUMONT, 1991), is also recovered as a member of the *I. elegans* group, but belong to a different subgroup,

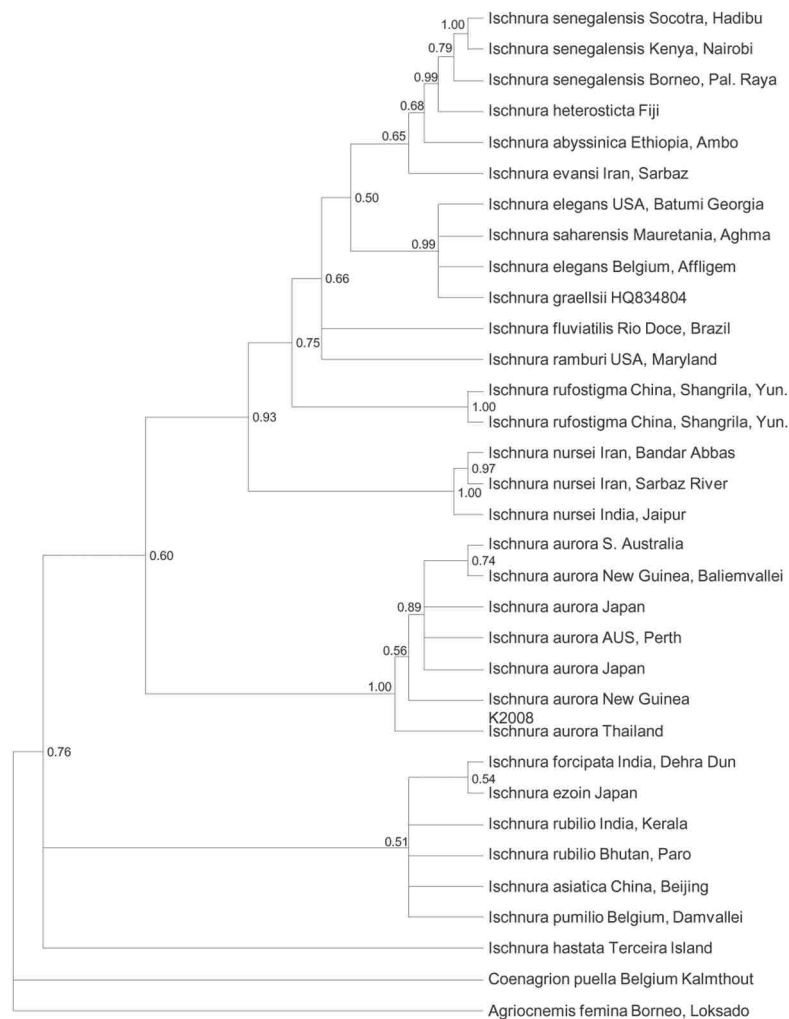


Fig. 2. Estimate of phylogenetic relationships within *Ischnura* by the Bayesian method of inference based on the nucleotide sequence of the barcoding segment of the COI gene.

such that their similar habitus (not their structural characters) must be considered homoplastic.

Three North American taxa form an *I. denticollis* group, conforming exactly to the grouping found by CHIPPINDALE et al. (1999). This trio is recovered as sister to *I. hastata*, a widespread North and Central American species that has colonized the Azores Islands (CORDERO-RIVERA et al., 2005), and the whole is part of the *I. pumilio* group s.l. Clearly, moreover, the genus name *Anomalagrion*, coined specially for *I. hastata*, is superfluous, and the same is true for *Boninagrion* (KARUBE et al., 2012) and *Rhodischmura* (DUMONT et al., 2011), in spite of the exotic appearance of the latter species.

A remark needs to be made regarding *Ischnura aurora*. This species, with type locality in Tahiti, is still widely believed to be a passive disperser, found from Polynesia and Australia-New Zealand to as far west as India and Pakistan. This assessment is incorrect, however: *I. aurora* is rare or totally absent West of the Wallace Line, while specimens on the Indian subcontinent and Iran have been found to belong to a different taxon, *I. rubilio* (PAPAZIAN et al, 2007). We denote this as a full species, because at the molecular level, it was here found to be totally unrelated to true *I. aurora*. It is either basal to the genus *Ischnura*, or, more probably (on account of its structural morphology), an isolated offshoot of the *I. pumilio* group.

The conspicuous yellow and orange colours displayed by three of the *Ischnura* taxa included in the present study, finally, turn out to be no sign of relatedness, but arose independently.

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**TEMPORAL VARIATION IN ODONATA
LARVAL ASSEMBLAGE DIVERSITY IN A LOWLAND STREAM
IN WESTERN MEXICO**

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There is limited information on the structure and seasonality of Mexican Odon., in particular for lowland regions. Here, the structure and seasonal changes in the diversity of larval Odon. at El Ticuiz stream (10m asl) are described by conducting seven surveys over the yr. The study reach was impacted by dredging that resulted in the occurrence of lotic and lentic-like environments that promoted the abundant growth of aquatic macrophytes. Overall, Odon. diversity was high and a total of 13 spp. of Zygoptera and 23 of Anisoptera were recorded. The dominant spp. were *Argia pulla* and *Telebasis salva*, both dominating assemblages during the entire period of study. Two peaks in species richness, spring and autumn, were found suggesting that most spp. have at least 2 generations per yr. Potential causes for the high diversity found include the low elevation, low flow, the effects of dredging in habitat availability, and the presence of water hyacinths and *Potamogeton* sp. Changes in species richness and composition appear to be mostly related to seasonality.

INTRODUCTION

Dragonflies and damselflies (Odonata) are among the best-studied insects, recognized for their aesthetic and scientific value, but are also in need of assessment to understand their diversity and conservation status (SUHLING et al., 2010). Odonates have been used as indicators of anthropogenic impacts to aquatic ecosystems (HORNUNG & RICE, 2003; FOOTE & HORNUNG, 2005; REECE & MCINTYRE, 2009; SILVA et al., 2010; SHARMA & CHOWDHARY, 2011; BALZAN, 2012) and also of aquatic diversity (SAHLEN & EKESTUBBE, 2001; BRIERS & BIGGS, 2003). Adults and larvae are differentially sensitive to changes

in the environment, such as alterations to the riparian (SILVA-MONTEIRO et al., 2013; DE CARVALHO, 2013) and aquatic vegetation (REMSBURG & TURNER, 2009; CANNINGS et al., 2000; NACHTRIEB et al., 2011), as well as chemical changes in the water (WORTHEN et al., 2001; TREVOR et al., 2010; CHE SALMAH et al., 2012). Larval distribution is affected by habitat characteristics (GÓMEZ-ANAYA & NOVELO-GUTIÉRREZ, 2010), availability of preferred substrates (HAWKING & NEW, 1999; GIBBS et al., 2004), and the presence of top predators (PIERCE, 1988; JOHANSSON & BRODIN, 2003; JOHANNES & JOHANSSON, 2004). In addition, assemblage richness and composition often changes in response to factors such as seasonality (WISSINGER, 1988) and elevation (SHARMA, 2009), which often also affect on voltinism (number of generations per year, CORBET et al., 2005).

Advancing our knowledge on factors controlling assemblage structure and composition is critical to facilitate the use of odonates as bioindicators of human impacts on aquatic ecosystems and also to use them in monitoring and managing protected areas. Mexican Odonata are well-known taxonomically, particularly the adults (GONZÁLEZ-SORIANO & NOVELO-GUTIÉRREZ, 2007). However, there is still limited information on factors controlling assemblage structure and how those factors result in temporal variability in richness and composition. Available information indicates that habitat availability (GÓMEZ-ANAYA & NOVELO-GUTIÉRREZ, 2010) and elevation (NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA, 2009) play an important role structuring adult and larval assemblages. However, studies are still limited to a few geographic locations within Mexico.

In order to advance our understanding of factors affecting Odonata assemblage structure and composition in Mexico, we studied temporal and spatial changes in larval odonates in a lowland stream within the Coalcomán Mountain Range, Michoacán. The Coalcomán Mountain Range is a priority area for the study of biodiversity (region RTP 115; CONABIO, 2013), which has an ample altitudinal gradient ranging from sea level to 2000 m in elevation. Although this mountain range contains high biological richness and is an area of high endemism, available information on many taxonomic groups is limited (VILLASEÑOR-GÓMEZ et al., 2005). Our goal for the present study is to describe larval odonate assemblage structure and composition at El Ticuiz stream, in the lower part of the range, and assess environmental factors potentially controlling temporal changes in larval assemblages.

STUDY AREA

El Ticuiz (TZ) stream is located near the seashore at 18°40.403'N; 103°40.601'W, 10 m asl, in the municipality of Coahuayana, Michoacán state, Mexico (Fig. 1a). The region has a tropical climate with the rainy season during summer; annual average precipitation is 968.9 mm, and the annual average air temperature ranges from 22.2° to 34°C (mean 28.1°C) (average data from National Meteorology

logical Service (SMN), period 1971-2000, at San Juan Lima station but corrected by the tropospheric vertical gradient at TZ). Most of the original riparian vegetation has been replaced by banana plantations, and some segments of the water course are frequently altered by dredging. In the surveyed segment no riffles were observed, only small, shallow runs (Fig. 1b). The substrate was predominantly composed of fine gravel and mud, and the aquatic vegetation was dominated by *Eichhornia crassipes* (Mart.), *Potamogeton* sp., *Lemna gibba* L., *Pistia stratiotes* (L.), and *Typha latifolia* L. (Figs 1b,c) (NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA, 2009).

MATERIAL AND METHODS

DATA COLLECTION. – Larval sampling was conducted during 2005, as follows: March 29 and June 1 (spring1 and spring2), July 7 and August 17 (summer1 and summer2), September 28 and November 9 (autumn1 autumn2), and January 20 (2006, winter), along a 500m reach using a D-frame aquatic net (0.2mm mesh). A total of 12 samples were taken on each occasion. A stratified random sampling design on shoreline and mid-channel covering a variety of substrates such as sand, grav-

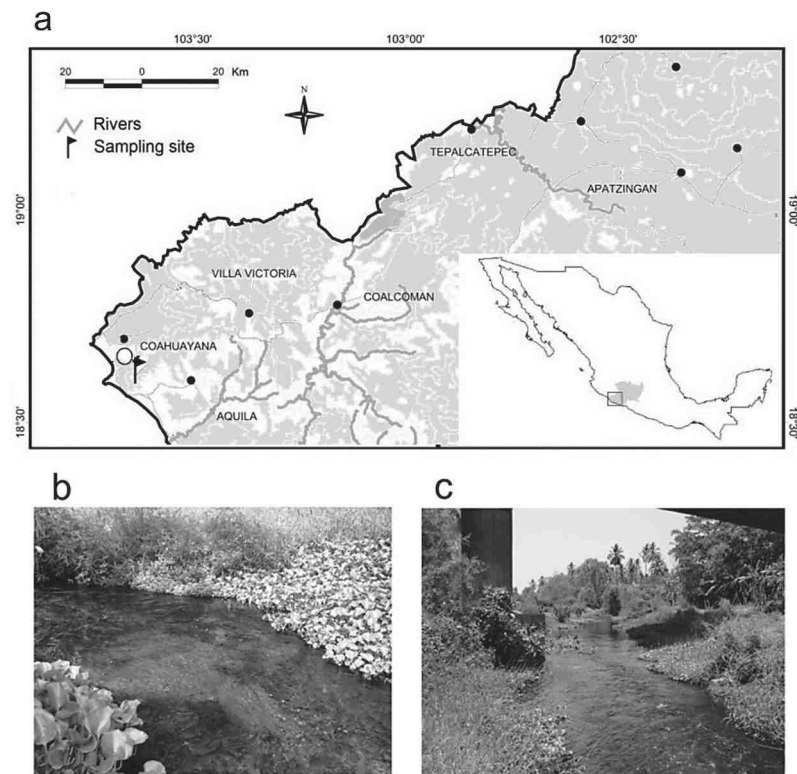


Fig. 1. Features of the study area: (a) map of the sampling site (open circle), municipality of Coahuayana, Michoacán, Mexico; – (b) sampling stretch, with *Potamogeton* sp. at the center and *Eichhornia crassipes* (water lily) along the shores; – (c) large rocks were absent in the channel along the entire sampling stretch.

el, debris, mud, roots, algae, macrophytes (*Potamogeton* sp.) was applied. Each sample consisted of “seeping out” substrates for about 2 minutes. All samples were preserved in 96% ethanol with a replacement within the first 24h. In the laboratory, Odonata larvae were separated from the other fauna and stream debris using a stereomicroscope, counted and identified to species. For correct identification of the larvae was necessary to observe adults in the field or capture and cultivate some larvae on each sampling date. All specimens were deposited in the Entomological Collection at the Instituto de Ecología, A.C. (IEXA).

In addition to larval sampling, during each sampling event, the physicochemical variables pH, dissolved oxygen (mg/L), water temperature (°C), and conductivity ($\mu\text{S cm}^{-1}$) were measured (except for spring1) using a digital water analyzer (ICM Model 51500, Industrial Chemical Measurement, Hillsboro, Oregon, USA). Stream discharge was estimated only for April and July (dry and rainy seasons in 2006) by measuring channel depth, width, and flow in 9 cross-sections. In each cross-section, channel width was measured once and average water depth and velocity were obtained after measuring 2 to 4 times. Discharge was calculated as the product of area (width \times average depth) and average velocity.

DIVERSITY MEASURES AND DATA ANALYSIS. – We obtained the mean values and standard errors of physicochemical variables of the seven surveys and for width, depth, velocity and discharge during dry and rainy seasons. All data was analyzed using Statistica 6.0 (STATSOFT, 2006). Renyi diversity profiles (TÓTHMÉRÉSZ, 1995), which provide information on richness and evenness of study sites, were used to compare the diversity of odonates between the seven surveys. The major advantage of Renyi diversity profiles is that sites can easily be ordered from high to low diversity. We calculated Simpson's index as a measure of dominance, Shannon's index as a relative measure of diversity and the effective number of species as exp^H according to JOST (2006). Expressing assemblage diversity as the effective number of species allows for the comparison of the magnitude of the difference among two or more assemblages. This comparison is done by the following relationship: if diversity of community A (D_A) is greater than the diversity of community B (D_B), then community B will have only a fraction ($D_B \times 100/D_A$) of the diversity of community A (MORENO et al., 2011). Additionally, we used rank abundance species plots (Whittaker plots, WHITTAKER, 1965) which display logarithmic species abundances against species rank order. These plots are expected to be effective in analyzing types of abundance distributions in communities. Rank abundance curves

Table I
Mean values (\pm s.e.) of physicochemical variables of each survey and of dry and rainy seasons –
[* = measured in 2006]

Survey	Temperature °C	s.e.	pH	s.e.	Conductivity $\mu\text{S cm}^{-1}$	s.e.	Oxygen mg/L	s.e.	N
Spring2	30.30 \pm	0.10	7.46 \pm	0.02	663.00 \pm	8.87	3.80 \pm	0.23	6
Summer1	30.07 \pm	0.09	7.66 \pm	0.01	647.83 \pm	8.10	2.78 \pm	0.21	6
Summer2	29.62 \pm	0.09	7.69 \pm	0.01	688.67 \pm	8.10	1.33 \pm	0.21	6
Autumn1	29.70 \pm	0.09	7.03 \pm	0.01	548.67 \pm	8.10	4.57 \pm	0.21	6
Autumn2	31.08 \pm	0.09	7.50 \pm	0.01	606.17 \pm	8.10	10.85 \pm	0.21	6
Winter*	25.40 \pm	0.09	7.50 \pm	0.01	689.83 \pm	8.10	2.60 \pm	0.21	6
Season*	Width m	s.e.	Depth m	s.e.	Flow m/s	s.e.	Discharge m ³ /s	s.e.	N
Dry	3.59	0.95	0.21	0.02	0.87	2.57	0.50	3.40	9
Rainy	5.29	1.08	0.22	0.03	34.74	2.91	37.11	3.85	9

are plotted from most abundant to least on the horizontal axis versus log of proportional abundance. The last data point corresponds to the number of species observed; the first point shows the degree to which the community is dominated by the most abundant species. The slope of the declining line indicates evenness, with more even communities producing flatter lines. We compared the seven curves, one against each other, using a Kolmogorov-Smirnov-two-sample-test (see MAGURRAN, 2004; SOKAL & ROHLF, 2012). Rank abundance plots were generated in Excel Spreadsheet.

RESULTS

Mean values and standard errors of the physicochemical variables recorded during the seven surveys are shown in Table I. Temperature remained almost constant from spring2 to autumn2 and then descended in winter; conductivity varied from 548.67 $\mu\text{S}/\text{cm}$ (autumn1) to 689.83 $\mu\text{S}/\text{cm}$ (winter1); pH varied little through the surveys, and oxygen showed high variation ranging from 1.33 mg/L (summer2) to 10.85 mg/L (autumn2). Width, flow and therefore discharge averages were significantly greater in rainy season (Tab. I).

LARVAL RICHNESS AND COMPOSITION

A total of 2,107 larvae were collected in the seven surveys (Tab. II). The total number of species was 36 (13 Zygoptera and 23 Anisoptera), belonging to 21 genera and 6 families. Two species were numerically dominant: *Argia pulla* (55.6%) and *Telebasis salva* (24.6%), which together comprised 80.2% of the total abundance. 77.8% of the species were present in abundances lower than 1%. In general, the number of Zygoptera species was lower along the seven surveys, varying between 4 species (28.6% in autumn1) and 9 species (44.4% in spring1).

The number of species peaked in the spring1 and autumn2 surveys and was lowest in winter (Tab. II). Abundance was also higher in spring1 and autumn2, but the next highest abundance occurred in winter. Shannon diversity had also two peaks in autumn1 and autumn2. In spring1 the number of species and abundance were the highest, however, the value of diversity was moderate because dominance was moderately high. In autumn1 both the number of species (13) and abundance (194 larvae) were intermediate, but dominance was lower showing a tendency to increase diversity to autumn2. Effective number of species was higher in both autumn1 and autumn2 surveys, showing that diversity is generally higher in this season of the year. According to the effective number of species diversity in autumn1 is 70.6% of that of autumn2. However, the smallest difference in effective number of species (true diversity) was located between summer2 and winter surveys, being the winter diversity 97.20% of that of summer2.

The largest difference in diversity (summer1 vs autumn2) was due to differences in the number of species and abundance, but mostly the result of dominance by *Argia pulla* during summer1. Similar cases occurred between spring2 and autumn2, and between autumn2 and summer2, when there were also large

Table II
 Richness, composition and abundance of the seven Odonata larval assemblages surveyed from El Ticuiz stream.
 Effective number of species was calculated as exp^H

		Spring1	Spring2	Summer1	Summer2	Autumn1	Autumn2	Winter1	Total
Number of individuals		669	136	196	108	196	499	303	2107
Number of species		21	9	8	8	14	20	7	36
Simpson index		0.47	0.76	0.83	0.70	0.25	0.20	0.58	
Shannon index		1.13	0.61	0.44	0.73	1.68	2.03	0.76	
Effective number of species		3.1	1.84	1.55	2.08	5.37	7.61	2.14	
ZYGOPTERA									
Calopterygidae									
<i>Hetaerina americana</i>	<i>Hetame</i>	1	-	-	-	1	-	-	2
<i>H. occisa</i>	<i>Hetocc</i>	1	-	-	-	-	-	-	1
<i>H. titia</i>	<i>Hettit</i>	6	-	-	-	-	-	-	6
Coenagrionidae									
<i>Argia carlcooki</i>	<i>Argcar</i>	-	-	-	-	-	1	-	1
<i>A. oenea</i>	<i>Argoen</i>	2	-	-	-	-	-	-	2
<i>A. pulla</i>	<i>Argpul</i>	423	117	178	90	70	88	220	1186
<i>A. tezpi</i>	<i>Argtez</i>	1	-	-	-	-	-	-	1
<i>Enallagma</i>									
<i>novaehispaniae</i>	<i>Enanov</i>	21	-	1	-	38	11	-	71
<i>E. semicirculare</i>	<i>Enasem</i>	-	-	-	-	-	15	-	15
<i>Telebasis salva</i>	<i>Telsal</i>	171	8	10	2	52	187	70	500
<i>T. levis</i>	<i>Tellev</i>	-	2	-	-	-	48	-	50
Protoneuridae									
<i>Neoneura amelia</i>	<i>Neaame</i>	-	1	-	-	-	-	1	2
<i>Protoneura cara</i>	<i>Procar</i>	1	-	-	1	-	-	-	2
ANISOPTERA									
Gomphidae									
<i>Aphylla protracta</i>	<i>Aphpro</i>	-	1	-	1	11	2	-	15
<i>Erpetogomphus elaps</i>	<i>Erpela</i>	1	-	-	-	-	-	-	1
<i>Phyllogomphoides</i>									
<i>pacificus</i>	<i>Phypac</i>	-	1	1	-	1	-	-	3
<i>Progomphus clendoni</i>	<i>Procle</i>	10	-	-	-	-	-	-	10
Aeshnidae									
<i>Coryphaesha adhexa</i>	<i>Coradh</i>	-	-	-	1	8	3	1	13
<i>C. apeora</i>	<i>Corape</i>	-	-	-	-	2	-	-	2
<i>C. viriditas</i>	<i>Corvir</i>	-	-	-	-	-	1	-	1
<i>Remartinia luteipennis</i>	<i>Remlut</i>	1	-	-	2	-	11	-	14
Libellulidae									
<i>Dythemis nigrescens</i>	<i>Dytnig</i>	1	-	-	-	1	8	-	10
<i>D. sterilis</i>	<i>Dytste</i>	1	-	-	-	4	2	-	7
<i>Erythemis plebeja</i>	<i>Eryple</i>	2	-	-	-	-	55	-	57
<i>E. simplicicollis</i>	<i>Erysim</i>	1	-	-	-	-	-	-	1
<i>Erythemis</i> sp.	<i>Erythem</i> sp	3	-	1	-	2	2	-	8
<i>Erythrodiplax fervida</i>	<i>Eryfer</i>	-	-	-	-	1	-	-	1
<i>Erythrodiplax</i> sp.	<i>Erythrod</i> sp	-	-	-	4	-	-	-	4
<i>Miathyria marcella</i>	<i>Miamar</i>	1	3	1	-	-	1	-	6
<i>Micrathyria aequalis</i>	<i>Micaeq</i>	19	2	1	-	1	5	6	34
<i>M. didyma</i>	<i>Micdid</i>	1	-	-	-	-	-	-	1
<i>Orthemis ferruginea</i>	<i>Ortfer</i>	1	-	-	-	-	19	1	21
<i>Pachydiplax longipennis</i>	<i>Paclon</i>	-	1	-	-	-	-	-	1
<i>Perithemis domitia</i>	<i>Perdom</i>	-	-	3	7	4	34	4	52
<i>Pseudoleon superbus</i>	<i>Psesup</i>	-	-	-	-	-	5	-	5
<i>Tauriphila australis</i>	<i>Tauaus</i>	-	-	-	-	-	1	-	1

differences in species numbers and abundance, yet the dominance of *A. pulla* was slightly lower than in summer 1. Major peaks in richness and abundance in spring 1 and summer 2 could be related to the fact that most of the species of lowland areas have at least two generations per year (bivoltine). The first peak of highest richness (spring 1) had 669 larvae of 21 species, however, the diversity was moderate (1.13) because the dominance also was (0.47), while in the second peak of increased diversity (autumn 2) 499 larvae of 20 species were collected, obtaining the highest diversity (2.03) because the dominance was the lowest (0.20).

RENYI'S DIVERSITY

Renyi's diversity profiles for both autumn surveys (Fig. 2, black full and dotted lines) are located above the rest of the assemblages, indicating highest diversity in this period. Diversity was slightly lower in the first autumn survey (autumn 1) and increased rapidly to the second survey of this season. The diversity of spring 1 (black dashed line) only was higher than autumn diversity when alpha took the value of 0, that is, when comparing only the number of species. Note that the diversity of winter (grey full line) was not the lowest, as with the number of species (alpha = 0).

SPECIES ABUNDANCE STRUCTURE

Rank abundance plots showed a clear dominance by *Argia pulla* and *Telebasis salva* almost through all surveys (Fig. 3). In Figure 3, the assemblages were ordered sequentially in time to assess changes in the temporal dominance of species. During spring (spring 1 + spring 2), 805 larvae belonging to 25 species (11

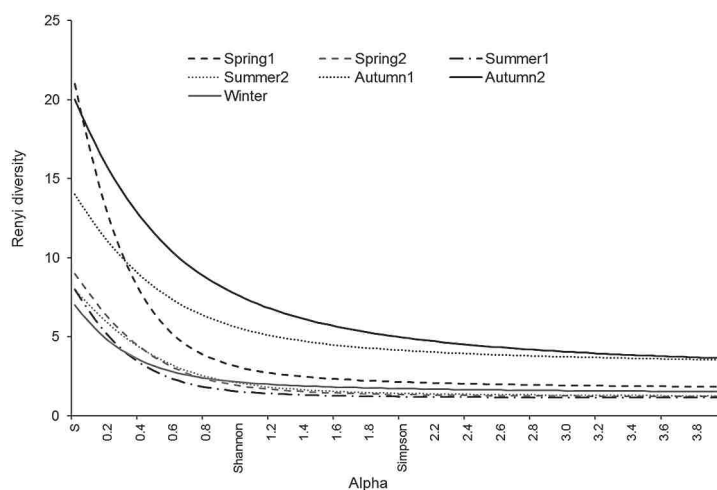


Fig. 2. Renyi's diversity profiles for the seven surveys of the Odonata larval assemblages in El Ticuiz.

Zygoptera and 14 Anisoptera) were collected, being numerically dominant *A. pulla* (65.2%) and *T. salva* (24.4%), which together accounted for 89% of spring abundance. In both summer surveys 305 larvae belonging to 14 species (4 Zygoptera and 10 Anisoptera) were collected, being dominant *A. pulla* (88.4%). In the autumn (autumn1+autumn2), 695 larvae belonging to 24 species (7 Zygoptera and 17 Anisoptera) were collected, being dominant *T. salva* (34.2%) and *A. pulla* (23.2%), which constituted 57% of the total abundance of this season. Finally, in the winter survey a total of 303 larvae of 7 species (3 Zygoptera and 4 Anisoptera) were collected being again dominant *A. pulla* (73%) and *T. salva* (23%), which represented 96% of the total abundance of this season.

DISCUSSION

RICHNESS AND COMPOSITION

The Odonata larval assemblage of TZ is outstanding because the number of species in only one stream is similar to those reported from other localities in Mexico, which considered several water bodies. However, most previous studies were focused on presence-absence surveys from temperate climates or higher elevations than sea level. For example, NOVELO-GUTIÉRREZ & GONZÁLEZ-SORIANO (1991) reported 31 species (23 as larvae) from lentic and lotic environments at La Michilia (Durango) in an elevational range from 1734 to 2950m

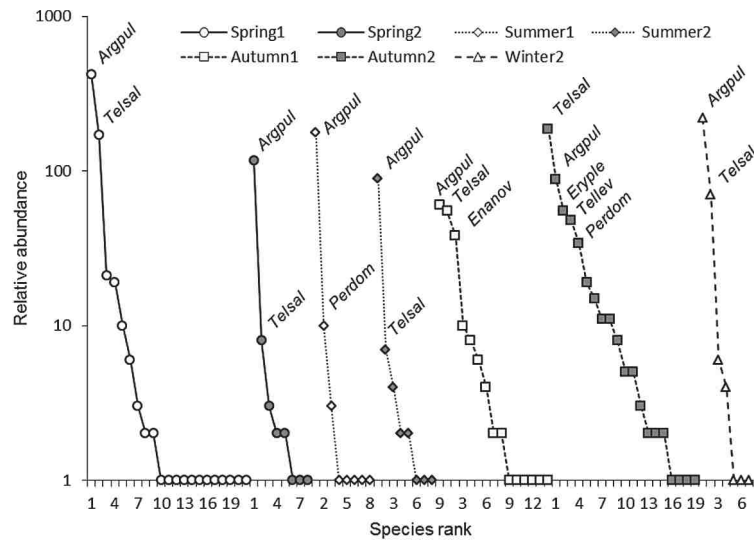


Fig. 3. Rank abundance models for the seven surveys of the Odonata larval assemblages, with only the dominant species labelled in each assemblage. — [For full species names, see Tab. II].

asl; GÓMEZ-ANAYA et al., (2000) reported 41 species (range 18-32) from four tributaries of the Hydroelectric facility Zimapán (Hidalgo) in an elevational range from 1590 to 1650m asl. Therefore, our assessment of TZ represents the first lowest elevation (10m asl) study of Odonata larval assemblage structure in Mexican lotic environments.

The near sea level location of TZ, with warm and wet climatic conditions, is potentially the reason for the occurrence of Neotropical genera such as *Coryphaeschna*, *Remartinia*, *Aphylla*, *Erpetogomphus*, *Phyllogomphoides*, *Progomphus*, *Dythemis*, *Erythemis*, *Erythrodiplax*, *Micrathyria*, *Orthemis*, *Perithemis*, *Pseudoleon* and *Tauriphila*. These genera are widely distributed in Mexico and through South America (excepting *Erpetogomphus* and *Pseudoleon*) (GARRISON et al., 2006; GONZÁLEZ-SORIANO & NOVELO-GUTIÉRREZ, 2007). In addition to elevation, the high number of species (36 species) could be the result of the availability of slow and fast flowing water habitats. Besides standing water, slow flowing areas also had floating water hyacinth *Eichhornia crassipes* (Mart. Solms). Furthermore, the presence of submerged macrophyte (*Potamogeton* sp.) in very shallow and moderately fast flowing areas added complexity to the system. The TZ channel is frequently dredged to extract gravel which contributes to generate medium-sized lentic-like habitats. These habitats allow for the establishment and spread of aquatic macrophytes, such as *E. crassipes* and *P. stratiotes*, which are good substrates to be occupied by opportunistic libellulids of the genera *Erythrodiplax*, *Erythemis*, *Miathyria*, *Micrathyria*, *Orthemis*, and *Perithemis*. Therefore, the high diversity of Odonata at TZ is potentially related to the large habitat availability created by aquatic macrophytes.

The overall assemblage at TZ was numerically dominated by two small-body zygopteran, *Argia pulla* and *Telebasis salva*, regardless of the presence of a diverse subassemblage of anisopteran, which almost double the number of zygopteran species. The outstanding dominance of *A. pulla* and *T. salva* could also be related to frequent disturbances at TZ. Dredging and removal of original riparian vegetation appear to have increased appropriate habitat conditions for the establishment of some species. These changes can be evidenced in dominance structure and usually one or two species tend to dominate the community (SOUSA, 1984; HAGVAR, 1994). Dominance of *A. pulla* and *T. salva* occurred over all the surveys (seasons) and sampled habitats, indicating that both species were able to find suitable conditions (perhaps oviposition sites on the abundant shore and floating vegetation) through time and space in TZ. Although channel alteration by dredging can be seen as a disturbance, its impacts on Odonata assemblages appear to be opposite from those caused by organic and inorganic pollution (chemical changes), which often reduce the number of species (diversity) (HARVEY & LISLE, 1998; PEARSON & JONES, 2003). Dredging could have also benefited larval odonates by negatively impacting predatory fishes and other predatory insects. Dredging can also change riverine function at both physical and biological

levels. Physically, it can disrupt water flow and deposition of sediment through the creation of reservoirs (UNESCO, 2011). Reservoirs change stream sections from lotic to lentic systems. Consequently, they act as collection points for sediment (sand, gravel, cobble, debris). Dredging can also simplify channel structure and result in water quality degradation. Changes in flow can cause impacts in temperature and dissolved oxygen. These changes can negatively affect the native fish populations potentially predators of odonates (HARVEY & LISLE, 1998). However, it is known that sites subject to dredging can also have more species of fish (SCHLOESSEN et al., 2008). Perhaps this same principle could be applied to odonate assemblages. Of the two dominating species, it is noteworthy that *Argia pulla* has been recorded, as adult and larvae, in other stressed aquatic environments (CUEVAS-YAÑEZ, 2007). Therefore, it could be considered as a potential bioindicator of human impact in both lentic and lotic habitats (GARZÓN-SANABRIA & REALPE, 2009).

The high abundance of zygopterans, mainly related to *Argia pulla* and *Telebasis salva*, could be associated to the abundant riparian herbaceous vegetation and floating and submerged macrophytes. REMSBURG & TURNER (2009) suggested that the physical structure of vegetation influences the diversity of odonates that uses it during both the larval and adult stages. In TZ, adults of *A. pulla* and *T. salva* can find high substrate availability for oviposition (endophytic in both species) along both sides of the channel as well as in submerged and floating macrophytes. We did not observe the other endophytic species, *T. levis* (50 individuals) and *E. semicircularis* (15 individuals), in shoreline samples, indicating that both species must use submerged or floating macrophytes for oviposition. *E. semicircularis* is typically found in pools of slow streams in either woodland or open habitats, but also occurs on rain pools (ABBOTT, 2011) and *Telebasis* presumably is also associated with macrophytes (CARVALHO & NESSIMIAN, 1998; FULAN & HENRY, 2006).

An uncommon feature of the larval Odonata assemblage from TZ was the poverty of the genus *Argia*, which had just four species: *A. pulla*, *A. oenea*, *A. tezpi* and *A. carlcooki*. The last species with just one specimen collected in autumn, and two specimens of *A. oenea* and one of *A. tezpi* from spring. It is worth mentioning that *A. tarascana* has also been reported as imago from TZ (NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA, 2009), but it was not found as larvae.

ABUNDANCE

In the Coalcoman Range, *A. pulla* abundance decreases as altitude increases (GÓMEZ-ANAYA et al., 2011). The same authors also reported that *A. pulla* abundance was significantly associated with stream water temperature and that the highest abundance occurred at TZ elevation. Furthermore, the dominant zygopterans *A. pulla* and *T. salva* were recorded as both larvae and imagoes all

through the sampling gradient (NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA, 2009; GÓMEZ-ANAYA et al., 2011). A quick view of all the samples collected of *A. pulla* and *T. salva* larvae showed a great heterogeneity of larval sizes (including last instar), which could be a result of a multivoltine life history. Similar observations have been reported for the species *Paltothermis lineatipes*, *Pseudoleon superbus* and *Argia anceps* from Zimapán (Hidalgo, Mexico) by NOVELO-GUTIÉRREZ et al. (2002), and may be characteristic of many tropical lowland species. Voltinism (number of generations completed in a year) in tropical Odonata has been poorly studied, although its knowledge is required to understand how life cycles have become adapted to local environments in different regions and how seasonal regulation is achieved (CORBET, 1999). The annual number of generations in tropical-centered odonates can range from three or more per year to one every two years, and various species in the same area can be variously voltine (CORBET, 1999). This variation in both immigration and life cycle completion rates can introduce complications into interpreting species assemblages at a study site. It is clear that the number of generations in a year is greater towards the lowlands although this fact also depends on other factors such as the nature of the water body (lotic, lentic, temporal) and historic origin of each genus. Furthermore, because the two dominant species were recorded in all the samples and in most of substrates, they are undoubtedly eurytopic species.

The potential to find additional species at TZ is large. A parallel study of imagoes in the same area reported seven more species (*H. titia*, *Enallagma* spp., *O. ferruginea*, *D. steriis*, *M. marcella* and *P. domitia*) with a frequency of 100% in the sampling area, and another seven species (*Neoneura amelia*, *Protoneura cara*, *T. griffini*, *C. adnexa*, *E. plebeja*, *O. discolor* and *T. australis*) with frequency of 86% (R. Novelo-Gutiérrez, unpubl. data). Including this 14 additional species, the list for TZ increases to 50. The fact that we did not find these species as larvae could be due to the fact that: (1) some species do reproduce far from the boundaries of the studied reach; (2) some species breed within the sampling site but without success; and (3) some species were not recorded as larvae due to sampling deficiency.

SEASONALITY

Most changes in Odonata richness seems to be related to seasonality. A similar pattern of richness distribution was reported by GÓMEZ-ANAYA & NOVELO-GUTIÉRREZ (2010) from Río Pinolapa (616 m asl) in the same Range from spring to autumn. A decrease in the number of species was recorded at both locations during the intermediate season (summer), but winter contained the richest assemblage at Pinolapa. Differences could be related to only 50% of sampling effort was applied at TZ in winter or maybe due to both low temperature and oxygen in water (Tab. I), as it was recorded at Río Pinolapa. Seasonally, the Odo-

nata diversity at TZ was higher in both autumn surveys (autumn1 and autumn2). Both autumn diversity profiles were located above all others and the spring1 profile was the next below despite having one more species and almost equal abundance as autumn's surveys together. The least diverse profile was summer (only crossed to winter one). Although the sampling was done only once in winter, the Renyi's function allows us to appreciate that the diversity of this season was not the lowest, except when comparing the number of species ($\alpha = 0$). This can be underlined as a property of this function. High autumn diversity could be, in part, the result of the lower water level and slower flow during this season, which facilitate larval sampling.

Overall, relative to previous studies in Mexico, we found a species-rich Odonata assemblage at TZ that is dominated by a few species. Assemblages change over time, showing some degree of seasonality even when physicochemical variables did not fluctuate greatly. Our findings provide important information on the dynamics of Odonata assemblages in lowland regions and how they fluctuate over time.

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**THE TRUE STATUS OF
SOMATOCHLORA TAIWANA INOUE & YOKOTA:
A GENUINE SPECIES OR A SYNONYM
OF *S. DIDO* NEEDHAM?
(ANISOPTERA: CORDULIIDAE)**

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The taxonomic status of *S. taiwana*, described from Taiwan, is controversial. It may be a genuine sp. or a synonym under *S. dido*, a sp. that occurs in mainland China. Based on morphological and DNA analyses, it is proposed here that *S. taiwana* should be treated as a genuine sp.

INTRODUCTION

Somatochlora taiwana was described from Taiwan by INOUE & YOKOTA (2001). The discovery of a corduliid species in Taiwan was surprising, because these insects had not been recorded in numerous entomological studies during the 20th century. This species is limited to the high altitude region of Taiwan, and only a few individuals have been recorded until now.

In the original description it is emphasized *S. taiwana* is closely allied to *S. dido* Needham, 1930, a rare continental species that has been recorded occasionally from P. R. China, viz. Sichuan (type locality) (NEEDHAM, 1930), Guangxi (WILSON, 2005), Yunnan (ASAHINA, 1997), Henan (WANG, 2007), Heilongjiang (HUA, 2000), and Jilin provinces (QIAN et al., 2012), Hong Kong (LAI, 1971), and northern Vietnam (ASAHINA, 1996), although some records

are doubtful or incorrect (see Discussion). INOUE & YOKOTA (2001) claimed that *taiwana* can be distinguished from *dido* in the following ways: (1) in the morphology of the superior caudal appendages, specifically the ratio of the distance between the base and the basal spine to the total length; (2) the position of the broadest part of the superiors in lateral view; (3) the morphology of the superiors in dorsal view; (4) the range of orange yellow tint of the hindwing; (5) the size of the yellow stripes on the pterothorax. Subsequently, WILSON (2005) synonymized *taiwana* under *dido* on the grounds that the characteristics of his newly obtained material of *dido* from Guangxi province were intermediate between those of *taiwana* and of the original description of *dido* (NEEDHAM, 1930), and that the Guangxi record represents a geographical bridge between Sichuan and Taiwan. However, both INOUE & YOKOTA (2001) and WILSON (2005) did not directly examine *dido* and *taiwana* at the same time. Recently we obtained three additional specimens of *taiwana* from the type locality, and two *dido*, one of which was the same specimen recorded by WILSON (2005), and the other was newly collected from Hubei province in China by Dr Haomiao Zhang. Here we report our results of a detailed morphological comparison and molecular phylogenetic analyses of nuclear and mitochondrial DNA, and propose the taxonomic status of *dido*.

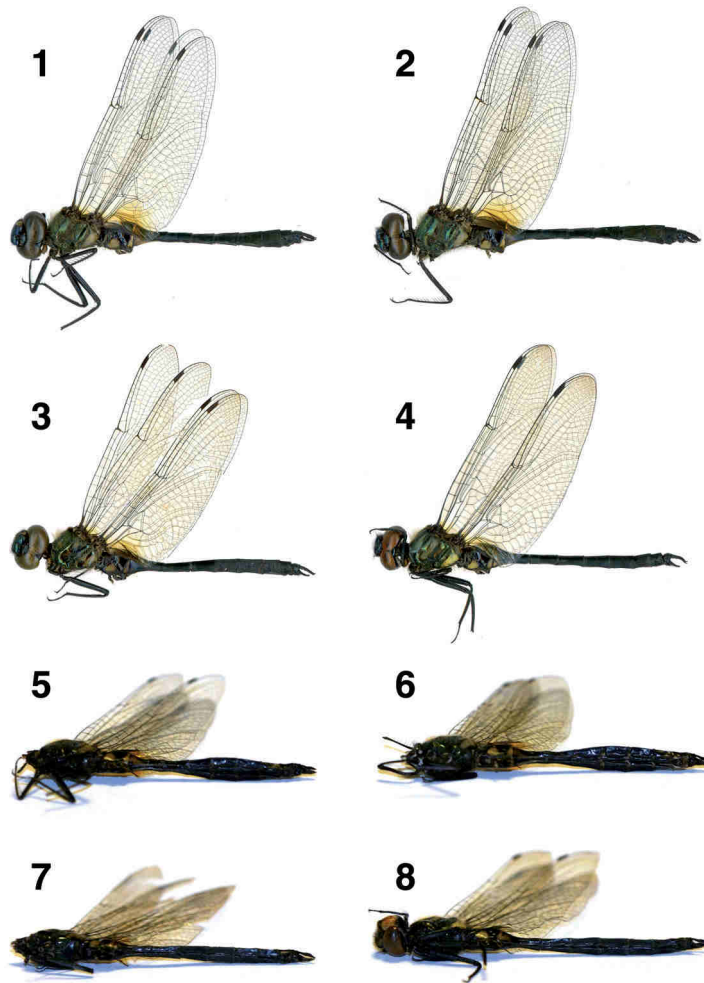
MATERIAL AND METHODS

M a t e r i a l. – *S. "taiwana"*: 1♂: near Yuan Yang Lake, alt. 1670 m, Chiensih, Hsinchu Hsien, Taiwan, Republic of China, 21-VII-2011, Hiroshi Yokota leg.; 2♂: same locality, 24-VII-2011, same collector. – *S. dido*: 1♂: Maoershan, altitude 700-2142 m, Xingan County, NE Guangxi, People's Republic of China, 22-VIII-1998, Graham Reels leg. (the same specimen reported in WILSON, 2005); 1♂: Dajiu Lake, Shennomejia, Hubei, P. R. China, 9-VIII-2012, Haomiao Zhang leg. In addition, we examined the photographs of each part of the holotype of *S. dido* deposited in the U.S. National Museum taken by Dr T. Cashatt.

M e t h o d s. – For morphological comparisons all the material studied was preserved as dried specimens. The morphology was observed under a stereoscopic microscope and small parts of the specimens were measured with an ocular micrometer.

One leg of each dried specimen was homogenized and DNA extracted using a QIAamp DNA mini Kit (Qiagen, Tokyo, Japan). We used other *Somatochlora* and corduliid species for comparison. DNA fragments of ITS1, ITS2, mt16SrRNA, and mtCOI were amplified by the polymerase chain reaction (PCR) with the following primers: 5'-GGC CAA ACT TGA TCA TTT AG-3' and 5'-GCC GGC CCT CAG CCA G-3' for ITS1 (FUTAHASHI & SASAMOTO, 2012), 5'-CGG TGG ATC ACT CGG CTC GT-3' and 5'- TTT CAC TCG CCG TTA CTA AGG GAA TC-3' for ITS2 (FUTAHASHI & SASAMOTO, 2012), 5'- CCG GTC TGA ACT CAG ATC ACG T-3' and 5'- CGC CTG TTT ATC AAA AAC AT-3' for mt16SrRNA (PALUMBI et al., 1991), and 5'- ATA ATT GGR GGR TTY GGR AAY TG-3' and 5'- CCA AAR AAT CAA AAT AAR TGT TG-3' for mtCOI (HAYASHI et al., 2005). PCR amplifications and sequencing of the amplified products were performed as previously described (FUTAHASHI & SASAMOTO, 2012). The sequence data of *S. taiwana* and *S. dido* are available in DDBJ/EMBL/GenBank databases (accession numbers are AB848385-AB848399). The sequences of the other species were already reported (KARUBE et al., 2012). Sequences were aligned using Clustal_X (THOMPSON et al., 1997). Molecular phylogenetic analyses were conducted by three methods, neighbor-joining with MEGA5 (TAMURA et al., 2011),

maximum likelihood with MEGA5 (TAMURA et al., 2011), and Bayesian with MrBayes v3.1.2 (RON-QUIST & HUELSENBECK, 2003). The Maximum Composite Likelihood and Tamura Nei models were used for neighbor-joining and maximum likelihood analysis, respectively (TAMURA & NEI, 1993). Bootstrap values for neighbor-joining and maximum likelihood phylogenies were obtained by 1,000 bootstrap replications. For Bayesian analysis, Markov chain Monte Carlo (MCMC) analysis was performed under the General Time Reversible + Invariable sites (GTR + I) model. In total 3,750 trees were generated for each Bayesian analysis (ngen = 500,000, samplefreq = 100, burn in = 1,250).



Figs 1-8. Habitus in lateral view: (1, 2) *Somatochlora taiwana* (Taiwan); – (3) *S. dido* (Guangxi); – (4) *S. dido* (Hubei). Note the differences of the yellow marking on the pterothorax and the orange yellow patches of the basal hindwing. – Figs 5-8: Abdomen in ventral view: (5, 6) *Somatochlora taiwana* (Taiwan); – (7) *S. dido* (Guangxi); – (8) *S. dido* (Hubei). Note that the abdomen of *S. taiwana* is much constricted in the proximal segments, then well dilated in the distal segments, compared with *S. dido*.

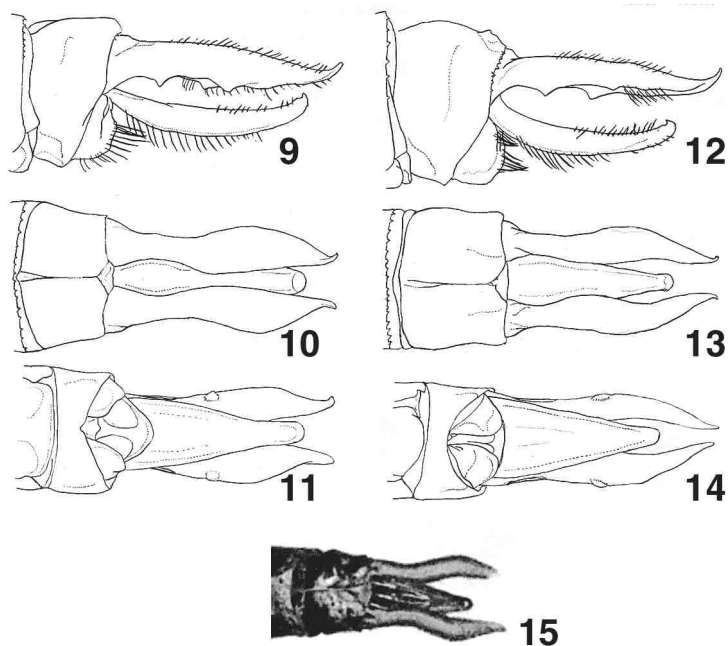
RESULTS

MORPHOLOGICAL COMPARISON

There are no differences in facial coloration. On the pterothorax, as already pointed out by INOUE & YOKOTA (2001), the yellow marking on the mesepisternum of *taiwana* (Figs 1-2) is narrower and fainter than that on *dido* from Guangxi (Fig. 3), and broader on the specimen from Hubei (Fig. 4) and the holotype, which is an immature stage (T. Cashatt, pers. comm.).

The orange yellow patches on the base of the hindwing are larger in *taiwana* than in *dido*, as reported by INOUE & YOKOTA (2001). The patches extend beyond the midrib of the anal loop, and nearly reach the base of the triangle cell in *taiwana*, while in *dido* they hardly cover the membrane on the distal cell row of the anal loop. However, this characteristic may be variable in the maturing stage and among individuals (Figs 1-2).

A distinctive characteristic of the abdomen is the width of the segments when seen in ventral view. In *taiwana*, the 3rd abdominal segment is greatly constricted after which the segments gradually increase in width to a maximum at the 6th



Figs 9-15. Caudal appendages: (9-11) *Somatochlora taiwana*; – (12-14) *S. dido* (Guangxi); – (15) *S. dido* (holotype) (Sichuan), photo by T. Cashatt. The apex of the right superior is broken. (9, 12) lateral view; – (10, 13, 15) dorsal view; – (11, 14) ventral view.

segment, which is twice as wide as the 2nd segment. Posterior to the 6th segment, the abdomen tapers (Figs 5-6). By contrast, in *dido*, the width of the abdominal segments is relatively uniform (Figs 7-8).

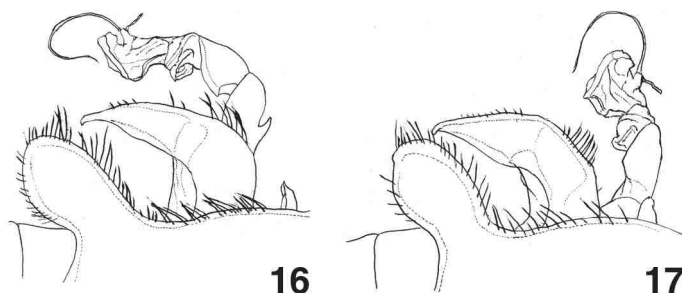
On the superiors of the caudal appendages, the basal ventral spine is relatively acute in *taiwana* (Fig. 9), whereas it is gentle in *dido* (Fig. 12); the ratio of the distance between the base and the basal spine to the total length of the superiors is 0.21~0.23 in *taiwana*, and 0.18~0.19 in *dido* collected from Guangxi and Hubei provinces. The broadest part of the superiors in lateral view is on the second latero-ventral spine in *taiwana*, which is the half of the total length. By contrast, the corresponding part in *dido* is around the medio-ventral spine but unclear laterally due to undulation, as mentioned by WILSON (2005). The superiors when seen in dorsal view are clearly different. In *taiwana*, the distal two-thirds is thicker and their inner margin is not hollowed (Fig. 10). In *dido*, this feature is relatively slender and almost the same undulating inward (Fig. 13 in Guangxi; Fig. 15 in the holotype specimen). The inferior appendage of *taiwana* in ventral view is bottle-shaped (Fig. 11), whereas that of *dido* is in the form of an elongated triangle (Fig. 14).

The posterior hamulus of the accessory genitalia in *taiwana* is slender in apical fifth (Fig. 16), whereas that of *dido* gradually tapers apically (Fig. 17).

In summary, *S. taiwana* can be distinguished from *dido*, especially in the following three characteristics: (1) a rather constricted and dilated abdomen in ventral view (Figs 5-8); (2) the morphology of the caudal appendages (Figs 9-15); (3) the slender distal part of the posterior hamulus (Figs 16-17)

GENETIC ANALYSES

The molecular phylogenies based on nuclear DNA (ITS1, 5.8S rRNA, and ITS2) and mitochondrial DNA (mt16S rRNA and mtCOI) sequences are shown in Figures 18 and 19. Statistical support values higher than 50% are indicated at the nodes in the order of neighbor-joining (NJ)/maximum-likelihood (ML)/Bayesian (BA) values.



Figs 16-17. Accessory genitalia and penile organ: (16) *Somatochlora taiwana*; – (17) *S. dido* (Guangxi).

S. taiwana was differentiated from *S. dido* based on both nuclear and mitochondrial molecular phylogenies, although the differences were small. The *dido-taiwana* clade was well differentiated from the other Asian members of the

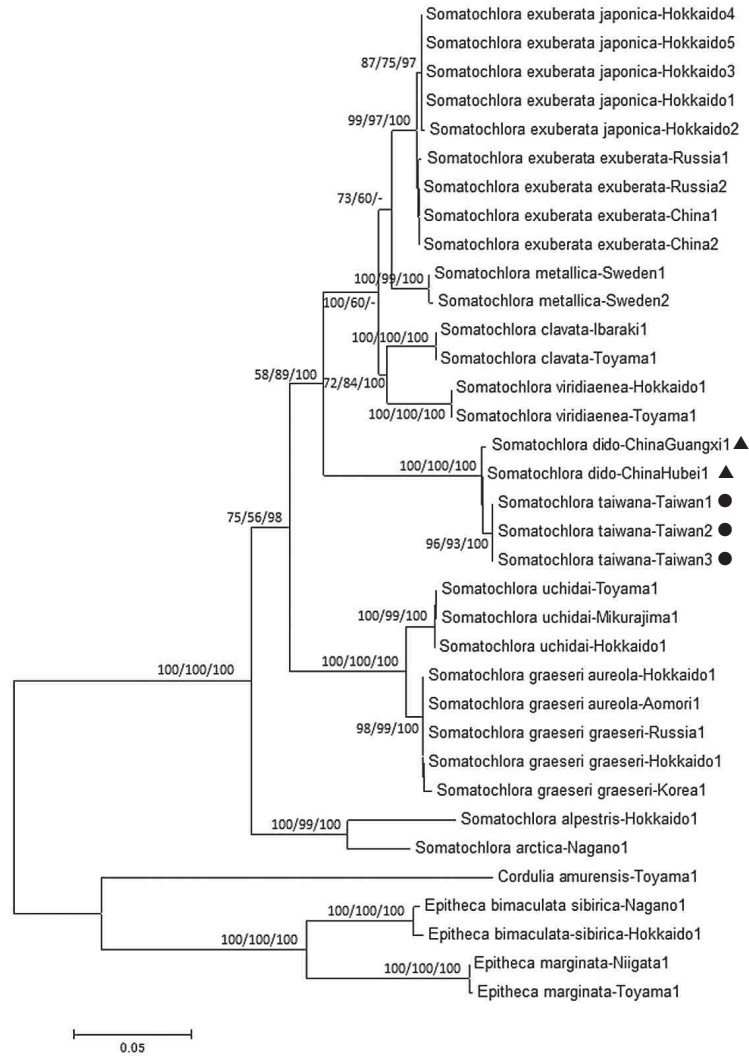


Fig 18. Molecular phylogenetic analysis of *Somatochlora taiwana* (●) and *S. dido* (▲) with related taxa based on nuclear genes (ITS1-5.8S-ITS2, 754 bp). A neighbor-joining phylogeny is shown, while maximum likelihood and Bayesian phylogenies exhibited substantially similar topologies. On each node, statistical support values are indicated in the order of [bootstrap value of neighbor-joining]/[bootstrap value of maximum likelihood]/[posterior probability (percentages) of Bayesian]. Hyphens indicate support values lower than 50%. *Cordulia* and *Epitheca* were used as outgroups.

same genus, but relatively near to the *S. metallica* group (including *exuberata*) and *S. viridiaenea* and *clavata*, rather than the other species (*S. uchidai*, *graeseri*, *arctica* and *alpestris*).

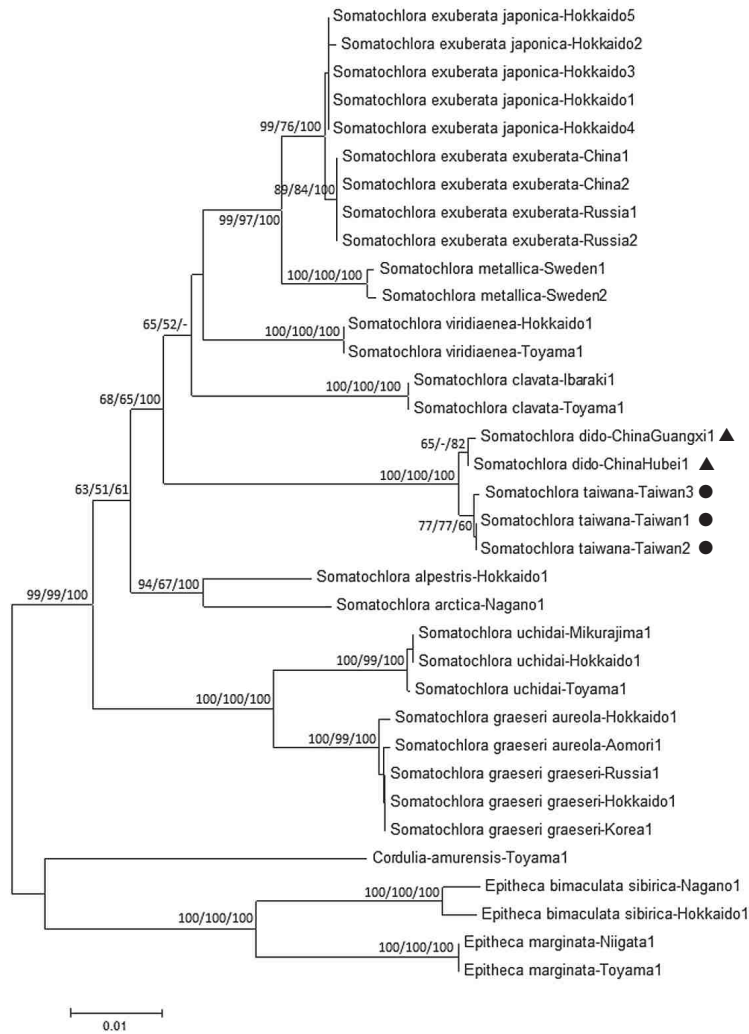
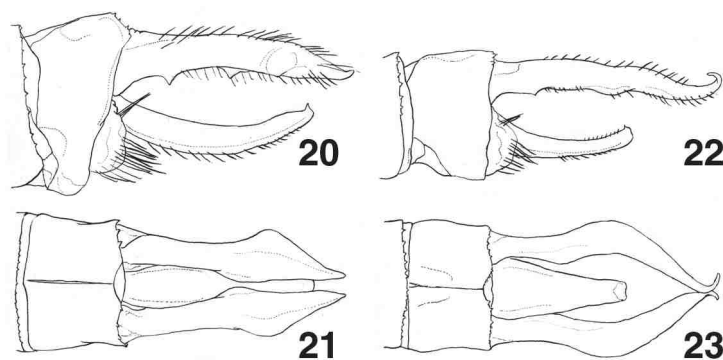


Fig 19. Molecular phylogenetic analysis of *Somatochlora taiwana* (●) and *S. dido* (▲) with related taxa based on mitochondrial genes (16S rRNA and COI, 961 bp). A neighbor-joining phylogeny is shown, while maximum likelihood and Bayesian phylogenies exhibited substantially similar topologies. On each node, statistical support values are indicated in the order of [bootstrap value of neighbor-joining]/[bootstrap value of maximum likelihood]/[posterior probability (percentages) of Bayesian]. Hyphens indicate support values lower than 50%. *Cordulia* and *Epithea* were used as outgroups.

DISCUSSION

We confirmed that *S. taiwana* can be morphologically distinguished from *S. dido* in several characteristics. The proportion of the abdomen and the morphology of the caudal appendages clearly suggest that they are different species, and we believe that the differences are not a spectrum of intraspecific variation as suggested by WILSON (2005). Furthermore, DNA analyses indicated that they are genetically different. Here we propose that *S. taiwana* is to be recognized as a genuine species.

We also point out the problem of the distribution of *S. dido* on the Asian continent. *Somatochlora dido* has been reported from the provinces of Sichuan (= Szechuan, type locality; NEEDHAM, 1930), Guangxi (WILSON, 2005), Hubei (this paper), Yunnan (ASAHINA, 1997), Henan (WANG, 2007), Heilongjiang (HUA, 2000), Jilin (QIAN et al., 2012), and Hong Kong (LAI, 1971) in the P. R. China, and Lao Cai province in northern Vietnam (ASAHINA, 1996). However, all, except the first three records, must be verified. The climate in Heilongjiang and Jilin is much cooler than that of Sichuan and Guangxi, and it is unlikely that this species can adapt to such conditions. HUA (2000) did not show detailed data or photographs of the specimen. QIAN et al. (2011) illustrated lateral and dorsal views of caudal appendages, which were largely different from those of *dido*. WANG (2007) showed the habitus and caudal appendages of specimens from Henan, which were also different from those of *S. dido*. The photo of the habitus of the specimen from Hong Kong (LEI, 1971) indicates that it was misidentified (T.-w. Tam, pers. comm.). Despite the extensive research of Wilson and Tam, no *Somatochlora* species have been found in Hong Kong (WILSON, 1995; TAM, 2011). The specimens from Yunnan (Baihualing, Boshn city) and northern Vietnam (Deo Tram Ton, Lao Cai prov.) identified as *dido* by ASAHINA



Figs 20-23. Caudal appendages of two unidentified *Somatochlora* species, formerly identified as *S. dido* by ASAHINA (1996; 1997): (20, 21) from Deo Tram Ton, Lao Cai prov. (N. Vietnam); – (22, 23) from Boshn, Yunnan prov. (P. R. China). (20, 22) lateral view; – (21, 23) dorsal view.

(1996; 1997), which are now deposited at National Museum of Nature and Science (Tokyo), are also problematic. We examined these individuals (specimen number: NSMT-I-Od-10016~19) and found that each has the following caudal appendage morphology: Yunnanese specimens have distinctly and suddenly outward-swollen superior appendages in dorsal view (Figs 20-21), and Vietnamese specimens have slender and longer superiors with a sharply twisted apex and with a relatively shorter inferior appendage (Figs 22-23; ASAHINA, 1996, fig. 19). These characteristics are different from those of *S. dido* and *taiwana*, and probably belong to two undescribed species.

At present, *S. dido* and *taiwana* are considered to belong to the same group together with *S. daviesi* (India; Meghalaya) (LIEFTINCK, 1977) and *S. nepalensis* (central and western Nepal) (ASAHINA, 1982), with some undescribed species like the above-mentioned. These species-groups have a relatively smaller body size (e.g., abdominal length not beyond 35 mm), two yellow markings on the mesepimeron and metepimeron even in the mature male, and superior appendages with a basal third directed inwards, then more or less outwards when seen in dorsal view. These species are distributed in the southernmost parts of the distributional range of this genus, unlike the majority of this genus that are distributed in cooler regions. We hypothesize that the ancestor extended southwards in a cooler era, but was then left as isolated groups in the high altitude regions of warmer zones, each group evolving independently as a relict species.

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We are grateful to Mr HIROSHI YOKOTA, Dr KEITH D. P. WILSON, Dr HAOMIAO ZHANG for the supply of the specimens, to Dr TAKUYA KIYOSHI (National Museum of Nature and Science, Tokyo) for permitting the examination of the specimens deposited in the museum, to Drs TIMOTHY E. VOGT and TIM CASHATT for the vulnerable information on the type specimen of *S. dido*, and to Dr TAM TZE-WAI for the kind advice on the record of *dido* from Hong Kong.

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**TWO NEW SPECIES OF *PERICNEMIS* FROM BORNEO,
WITH COMPARATIVE NOTES ON RELATED SPECIES
(ZYGOPTERA: COENAGRIONIDAE)**

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Pericnemis triangularis Laidlaw was described on the basis of a single ♀ from Betotan in NE Borneo. Specimens from Brunei and neighbouring Sarawak previously referred to this sp. are reappraised with reference to the type and described as *Pericnemis dowi* sp. n. *P. kiautarum* sp. n. from Sabah, N. Borneo is described and figured based on a single ♂ specimen. The new spp. are also compared and discussed in relation to *P. stictica*, the other Sundaland sp. of the genus. Both are distinguished by their ♂ caudal appendages and by the form of a well developed horn on the hindlobe of the pronotum. The form of the appendages suggests a closer relationship between *P. dowi* and *P. kiautarum* than *P. stictica*. Both *P. dowi* and *P. stictica* breed in phytotelmata and it is conjectured that *P. kiautarum* probably does likewise. The potential hazards of describing spp. from the ♀ sex only are discussed.

INTRODUCTION

The genus *Pericnemis* Hagen in Selys, 1863 (in most publications incorrectly credited to 'Selys, 1863') currently includes seven described species occurring in Sundaland and the Philippines with many Philippine forms still awaiting description. At present two species of the genus are known from Borneo: *P. stictica* Hagen in Selys, 1863 (the type species of the genus), and *P. triangularis* Laidlaw, 1931.

The genus has had a somewhat chequered history with respect to what species should be included. Originally five new *Pericnemis* species from the Philippines were described by NEEDHAM & GYGER (1939) who also transferred *Amphicnemis glauca* Brauer, 1868 and *A. lestoides* Brauer, 1868 to *Pericnemis*. LIEF-

TINCK (1940, 1957) disagreed and considered all Philippine *Pericnemis* taxa to belong to the genus *Amphicnemis* Selys, 1863. Recently VILLANUEVA (2012) re-defined all Philippine *Amphicnemis* (sensu Lieftinck) and *Pericnemis* (sensu Needham & Gyger) taxa, placing them into four distinct genera: *Luzonobasis* (nov.), *Pandanobasis* (nov.), *Sangabasis* (nov.) and *Pericnemis*; no species were retained in *Amphicnemis* which was considered endemic to Sundaland. VILLANUEVA et al. (2013) described *Pericnemis melansoni* from Mindanao and several new Philippine *Pericnemis* species are expected to be described by VILLANUEVA & DOW (in preparation). None of the Philippine species are known to breed in phytotelmata.

P. stictica, originally described from Java, is widespread in Sundaland. Its range extends from southern Thailand (Trang) to Peninsular Malaysia, Sumatra and Borneo. *P. triangularis* is so far known only from a single female specimen described by LAIDLAW (1931) from Bettotan on the north-east coast of the island. In a series of ecological studies of phytotelmata in Brunei (ORR, 1994, 1997, 2006; KITCHING & ORR, 1996) described the life history and discussed the role in the foodweb of a *Pericnemis* species which was referred to as *P. triangularis* based on a determination made at the then RMNH, Leiden. The male was described as *P. triangularis* by ORR (2001) based on bred specimens and a single mature wild male. Since that time we have examined photographs of the type of *P. triangularis*, held in the Natural History Museum, London and it has become clear that the Brunei specimens are not conspecific. It is therefore described here as *P. dowi* sp. n.

In 2002 the second author (MH) received from Haruki Karube a selection of Bornean Zygoptera for identification. This material included an interesting *Pericnemis* specimen from Poring (Sabah), which was forwarded to the first author (AGO) for further study. The existence of an undescribed Bornean *Pericnemis* species was briefly mentioned in ORR (2003, p. 87). It is described here as *P. kiautatum* sp. n. The prothoracic structures of *P. stictica* and details of the pterostigmata of *P. stictica* and *P. triangularis* are figured here for the first time, while the male appendages of *P. stictica*, and *P. dowi*, figured respectively by VILLANUEVA (2012) and ORR (2001) are refigured for ease of comparison.

PERICNEMIS DOWI SP. NOV.

Figures 1a,c, 2a, 3a,b, 4a,b

Pericnemis triangularis [nec. Laidlaw, 1931]: ORR, 2001: 184-185.

Pericnemis triangularis [nec. Laidlaw, 1931]: ORR, 2003: 19, 87, 115, 138-139 (pl. 1, fig. f), 142-143 (pl. 3, fig. f).

Material. – **Holotype** ♂: BORNEO, Brunei, Kuala Belalong Field Studies Centre (KBFSC), near Pondok Tikus, 12-VIII-1994, A.G Orr leg., deposited in Queensland Museum, Brisbane, Australia. QM registration number T189609. – **Paratypes**: 1 ♂ BORNEO, Sarawak, Miri division, Gunung Mulu, Gunung Mulu National Park, Trailside on summit trail between camp 1 and camp 2 in

mixed dipterocarp forest, 12-I-2008, R.A. Dow leg., coll. R.A. Dow; 1 ♀, same data as holotype; 1 ♀ BORNEO, Brunei, KBFSC, east ridge path, August 1994, A.G. Orr leg.; 1 ♀ BORNEO, Brunei, KBFSC, east ridge path, May 1991, A.G. Orr leg., all in coll. A.G. Orr.

E t y m o l o g y. – The specific epithet *dowi*: a noun in the genitive case, named in honour of Dr R o r y D o w who first recognised the species as being distinct from *P. triangularis* and who has made numerous and important recent contributions to the systematics and faunistics of Bornean Odonata.

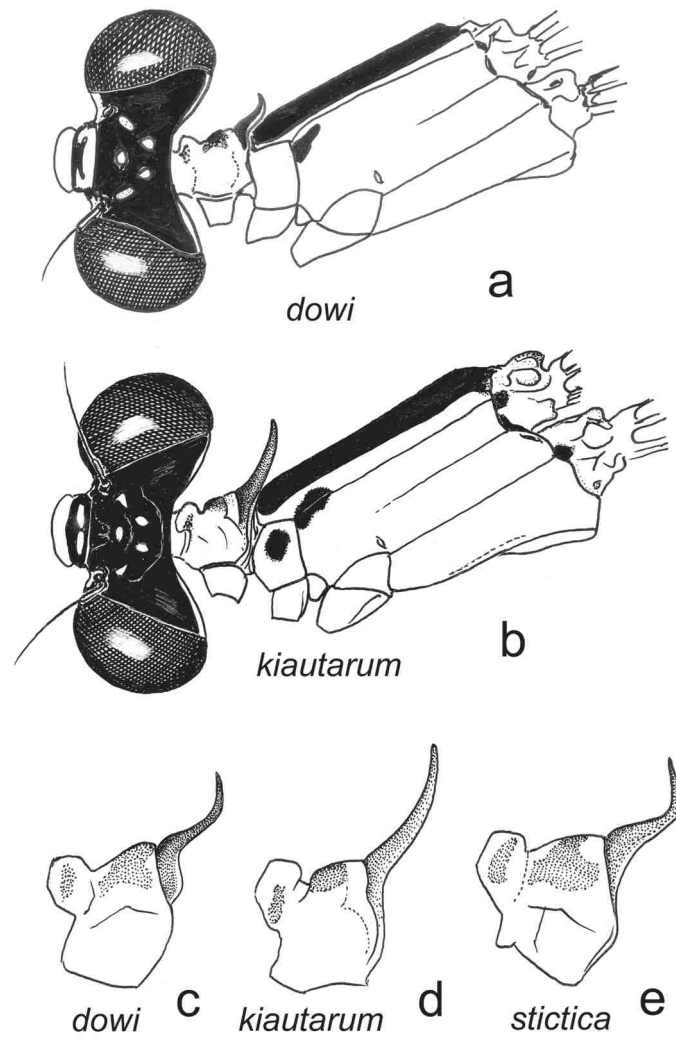


Fig. 1. Males of *Perinemis* spp.: (a-b) head and thorax of (a) holotype of *P. dowi* sp. n., (b) holotype of *P. kiautarum* sp. n.; – (c-e) lateral view of prothorax of (c) *P. dowi* sp. n., (d) *P. kiautarum* sp. n., (e) *P. stictica* [a specimen from Sarawak, Teng Bukap, 4-V-1987, K. Maruyama leg. In Coll. Haruki Karube].

DIAGNOSIS – A moderately large coenagrionid with bifid superior appendages and very short inferiors. It may be distinguished from its closest relatives *P. stictica* and *P. kiautarum* sp. n. by the form of the anal appendages, with the upper branch strongly recurved and the lower branch similar in length. The spine on the hindlobe of the prothorax has a distinct shoulder at its base and bent sharply upwards.

MALE (**holotype**). – H e a d (Fig. 1a). – Labium golden ochre, slightly darker towards extremities; labrum light ochre with slight marginal infuscation; frons strongly angulated; entire front of head up to level of frontal angle pale ochre, except for postclypeus which is black anteriorly and laterally with broad ochre ‘horned’ shape basally (Fig. 1a). Upper surface of the head black with slight metallic green cast, with small elongate-oval ochre flecks between the ocelli and the antennal base. Antennal S1, S2 light brown; S3 ochreous with light brown line along anterior surface and brownish apex; remaining segments light brown.

T h o r a x (Figs 1a,c). – Prothorax (Fig. 1a) mainly pale ochre with brown-black markings on dorsum of anterior and median lobe, most of posterior lobe dark with pale margins. Anterior lobe swollen cephalad but contracted caudad to form a narrow saddle between anterior and domed median lobe. Posterior lobe (Fig. 1c) produced into a spine with distinct basal shoulders, turned up abruptly at about its midpoint. Ratio of length of spine (from base to apex) to dorsum of median+anterior lobes = 0.96. Synthorax (Fig. 1a) pale ochre with metallic black markings as follows: mesepisternum with broad bands reaching from the well de-

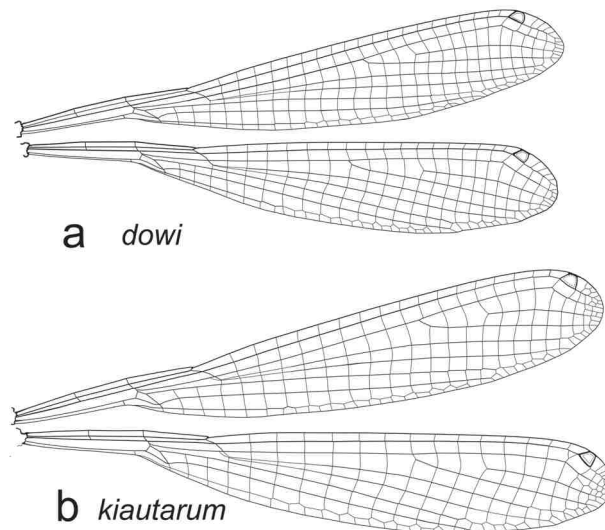


Fig. 2. Wings of: (a) holotype male of *Pericnemis dowi* sp. n. and – (b) holotype male of *P. kiautarum* sp. n.

finned median carina almost to well short of the humeral suture; small patch on shoulder of mesepimeron. Legs uniformly ochre with short, light brown spines.

Wings (Fig. 2a). – Long and narrow; Px 20: 17/20: 17; M3 and Rs arising at subnodus and in forewing fused for two thirds of a cell breadth. Pt ochre with brownish centre; broad rounded trapezoidal shape in both wings, strongly convex apically, with anterior margin about two thirds length of posterior margin; only one row of cells beyond Pt in all wings (Fig. 3a).

Abdomen. – Long and gracile; S1 ochreous with dorso-apical brown smudge; S2-7 with upper half brown, lower ochreous except at apex, faint, ochreous subapical, dorsal transverse bar; S8, S9 mainly brown with ventral margin broadly ochreous; S10 brown, laterally ochreous.

Anal appendages (Figs 4a,b). – Superior appendages bifid; in lateral view upper branch dark brown, finger-like and smoothly but strongly recurved apically; tips with inner-posterior subapical swelling associated with a slight internal concavity; overall substantially longer than S10. Lower branch pale ochreous, fine and gently up-curved apically ending in a small darkened pointed tip; almost reaching upper branch apex. In dorsal view upper branches broad basally with robust inner tooth ca 4/5th of distance from base; lower branch barely visible in dorsal view. Inferior appendages very short and broad in lateral view; barely visible in dorsal view.

Measurements (mm). – Hw 31.5; abdomen + appendages 48.

VARIATION. – The male paratype is significantly larger than the holotype. Hw 35 mm, abd + apps 58.5 mm. Its facial markings are darker and slightly more extensive.

FEMALE. – Head. – Almost identical to male with some variation in dark coloration of postclypeus, this being entirely dark in one specimen.

Thorax. – Prothorax with posterior lobe rounded with a very slightly elevated rim. Coloration of entire thorax similar to that of male. Wings similar to male but in all cases M3 arising at subnodus; Rs arising just proximal to subnodus. Pt of variable form but always moderately broadly trapezoidal, even in one wing where oblique axillary vein meets posterior margin; Px of three female paratypes 19:15/16:20, 17:15/18:16 and 19:16/16:19.

Abdomen. – S1 pale basally with broad dark dorsal saddle apically; remaining segments dark above with venter ochre, becoming progressively darker posteriorly. Ovipositor reaching to end of S10. Anal appendages about 2/3rd length of S10, pale.

Measurements (mm). – Hw 32-36; abd+apps 46-54.

REMARKS. – The present species was originally discovered during surveys of phytotelmata in Brunei and its early stages and ecology have been well documented (ORR, 1994). In addition to the type series a number of bred specimens and wild caught females are in the collections of Naturalis Biodiversity Centre, Leiden but cannot at present be located. All were collected and examined by AGO and it can

be stated with confidence that the form of the male appendages are like those of the holotype, and the range in variation in the pterostigma did not exceed that found in the paratype series. No known specimens from this population exhibit the narrow sub-triangular pterostigma of *P. triangularis*, which gives it its name, nor the supplementary vein meeting the outer margin of the pterostigma as in *P. triangularis* and *P. stictica*. One large female (hw 36 mm) has an oblique supplementary vein in the right left forewing, but the pterostigma remains set further back from the wing tip. The holotype female of *P. triangularis* is a small specimen (hw 31mm) and hence its complex post-pterostigma venation is unlikely to result from allometric development. The venation is generally denser in *P. dowi* specimens. The upper branch of the superior appendage differs markedly from that of *P. stictica* in dorsal view, being much thicker basally with a post-median inner tooth, as opposed to a small subapical tooth. A specimen from Kubah National Park, Sarawak, in the collection of R.A. Dow has very similar, but not identical, appendages and differs in the markings of the thorax and the shape of the posterior horn on the prothorax (DOW & REELS, 2010). Similar variation in the shape of this structure occurs in *P. stictica* (R.A. Dow, pers. comm.) and thus it is possible this specimen also belongs to *P. dowi*, but until more comparative material becomes available we treat this specimen as *incertae sedis*. The same policy is adopted for a similar specimen recorded from Semenggoh Nature Reserve, Sarawak (see DOW & REELS, 2013).

PERICNEMIS KIAUTARUM SP. NOV.

Figures 1b,d, 2b, 3c, 4c,d

Material. – **Holotype** ♂: BORNEO, Sabah, Poring [Hot Springs], 4-VI-1992, S. Nakamura leg. Deposited at Kanagawa Prefectural Museum of Natural History, Odawara, Japan.

Etymology. – The specific epithet *kiautarum*, a plural noun in the genitive case, named jointly in honour of Professor Dr Bastiaan Kiauta and Mrs Marianne Kiauta, who, working as a well oiled team, edited, published and circulated *Odonatologica* for 42 years; year in year out this quarterly journal has always appeared punctually and in good order – surely an unparalleled achievement in the history of entomological publication.

DIAGNOSIS. – A large, moderately dark coenagrionid with bifid superior appendages and very short inferiors. It may be distinguished from its closest relatives *P. stictica* and *P. dowi* sp. n. by the form of the anal appendages, with the lower branch of the superior relatively short, and the exceptionally well developed erect spine on the posterior lobe of the prothorax, longer than the dorsum of the median and anterior lobes combined.

MALE (holotype). – **Head.** (Fig. 1b). – Labium pale ochre, slightly darker towards extremities; labrum light ochre with small, dark, mid-basal mark and infuscation laterally; frons strongly angulated; entire front of head up to level of frontal angle pale ochre, except for postclypeus which is black with small, paired, sub-

basal transversely elongate ochre spots and small black intrusions from the antennal bases. Upper surface of the head black with slight metallic green cast, with small triangular ochre flecks between the ocelli and the antennal base. Antennal S1, S2 light brown; S3 ochreous with light brown line along anterior surface and brownish apex; remaining segments light brown.

T h o r a x (Figs 1b, d). – Prothorax (Fig. 1b) mainly pale ochre with brown-black markings on dorsum of median lobe and small brown streaks on either side of anterior lobe; most of posterior lobe dark, fading apically. Anterior lobe swollen cephalad but contracted caudad to form a narrow saddle between anterior and domed median lobe. Posterior lobe produced into a long semi-erect spine curving gently upwards from its base (Fig. 1d). Ratio of length of spine (along dorsal margin) to dorsum of median+anterior lobes = 1.52. Synthorax (Fig. 1b) pale ochre with metallic greenish black markings as follows: mesepisternum with broad bands reaching from the well defined median carina almost to the humeral suture; well developed patch on mesinfraepisternum and another at base of mesepimeron. Legs uniformly ochre with short, light brown spines.

Wings (Fig. 2b). – Long and narrow; Px 16: 14/16: 14; M3 arising at subnodus; Rs arising just proximal to subnodus. Pt bright ochre; broad slightly rounded trapezoidal shape in both wings, with anterior margin about half length of posterior margin; more than one row of cells beyond Pt in left wings and in right forewing (Fig. 3c).

A b d o m e n. – Long and gracile; S1 ochreous with dorso-apical brown smudge; S2 upper half brown, lower ochreous except at apex; faint, ochreous, subapical, dorsal transverse bar; S3-7 similar but with basal ochreous ring and successive segments progressively darker and with subapical ochreous mark fainter; S8, S9 mainly brown with ventral margin broadly ochreous; S10 ochre with brown marking on dorsum and laterally along apical margin.

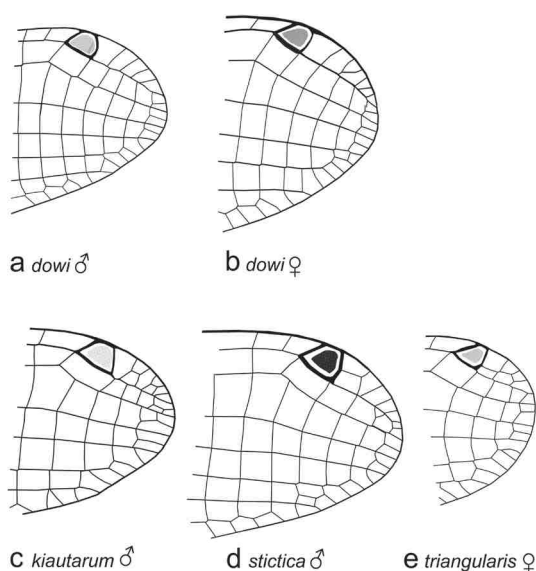


Fig. 3. Detail of pterostigma and surrounding veins of *Pericnemis* spp.: (a) holotype male of *P. dowi* sp. n.; – (b) paratype female of *P. dowi* sp. n.; – (c) holotype male of *P. kiautarum* sp. n.; – (d) male of *P. stictica* [cf. Fig. 1e]; – (e) holotype female of *P. triangularis*.

Anal appendages (Figs 4c, d). – Superior appendages bifid; in lateral view upper branch dark brown, broad finger-like, down-curved at about 45° at 4/5th of distance from base; tips slightly expanded and spatulate; substantially longer than S10. Lower branch pale ochreous, fine and gently up-curved apically ending in a small darkened pointed tip; approximately one half total length of upper branch with tip well short of upper branch apex. In dorsal view upper branches strongly swollen basally with robust inner tooth ca 2/5th of distance from base; lower branch barely visible in dorsal view. Inferior appendages very short and broad in lateral view, markedly hirsute; barely visible in dorsal view.

M e a s u r e m e n t s (mm). – Hw 35.5; abdomen + appendages 58.5.

FEMALE unknown.

REMARKS. – Although very similar in size, stature and venation to *P. stictica* this species is clearly distinct from it. The structure of the upper branch of the superior anal appendages seen in dorsal view suggests a closer affinity with *P. dowi* (Fig 4b) than *P. stictica* (Fig. 4f). The spine arising from the posterior lobe of

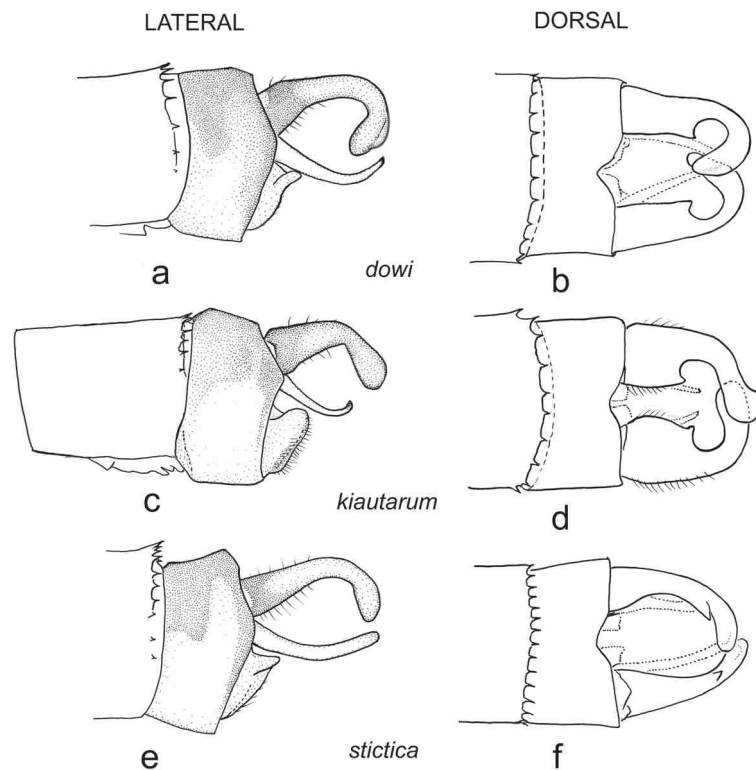


Fig. 4. Male anal appendages of *Pericnemis* spp., lateral and dorsal views: (a-b) holotype of *P. dowi* sp. n.; – (c-d) holotype of *P. kiautarum* sp. n.; – (e-f) *P. stictica* [cf. Fig. 1e].

the prothorax (Fig. 1b) is considerably longer, straighter and more erect than in either *P. stictica* (Fig. 1c) or *P. dowi* (Fig. 1a). The shape of both wings resembles that of *P. stictica* but the venation is less dense, with the latter having 2-3 more Px in both wings, and although in three wings of *P. kiautarum* supplementary veins are present beyond the pterostigma, none connect to the pterostigma, as is usually the case in *P. stictica* (Fig. 3d) and in the unique *P. triangularis* female (Fig. 3e). Presumably for this reason the pterostigma is pentagonal in *P. stictica* and *P. triangularis* but rounded or rounded-trapezoidal in *P. kiautarum* (Fig. 3c), and also in *P. dowi* (Fig. 3a, b). There is in the collection of R.A. Dow a female from Poring Hot Springs which may belong to this species, but as there is no certain evidence to associate the two it is not included in the type series. In this case however the pterostigma, as in the male *P. kiautarum*, is relatively broad on the costal margin and no supplementary veins connect to it. An additional male specimen in collection R.A. Dow from Kalimantan Tengah exhibits anal appendages and pterostigmata very like those of *P. kiautarum*. The anteriorly broad pterostigma of *P. kiautarum* and differences in venation suggest it is unlikely to be the male of *P. triangularis*.

DISCUSSION

The genera *Amphicnemis* and *Pericnemis* were separated by SELYS LONG-CHAMPS (1863) on the basis of venational characters and the pentagonal pterostigma of the latter, found in *P. stictica*, at that time the only known species of *Pericnemis*. The validity of these venational characters has since been challenged (VILLANUEVA, 2012), and at present the only character separating the two genera would seem to be the presence or absence of a tubercle or ridge present in the distal portion of the base of the penis. We have not confirmed this character for either *P. dowi* or *P. kiautarum* as the material available is too limited to risk destructive examination, and therefore we include the new species in *Pericnemis* because of their obvious affinity with *P. stictica*, and *P. triangularis*. Otherwise the three taxa are separated from *Amphicnemis* by characteristics such as general facies, colouration and stature. The longer lower branch of the superior appendage is also noted as characteristic of *Pericnemis* (VILLANUEVA, 2012), but *P. kiautarum*, which must be placed in the same genus as *P. dowi*, and *P. stictica* does not conform in this respect.

In describing these two new species we are aware that there is a remote chance one may in fact be a synonym of *P. triangularis*. However this may be impossible to prove. The type locality of *P. triangularis* is now heavily deforested and planted with oil palm, and even were specimens found, the range of variation in venation and shape of the pterostigma may make it impossible to associate them with *P. triangularis*. The form of the pterostigma in the holotype is narrowly pentangular and this is the case on all four wings. The pterostigma is placed very near the

apex. There is a small supplementary vein meeting the outer margin of the pterostigma in all wings. As it is a rather small specimen (Hw 31 mm) this is unlikely to be an allometric effect associated with larger size (a similar, but more oblique vein is present in one wing of a large specimen of *P. dowi*). In these characters it also seems to fall well outside the range of variation found in *P. dowi*. The single male specimen of *P. kiautarum* differs even more in the shape of the pterostigma, which is strongly trapezoidal. The type localities of *P. triangularis* and *P. kiautarum* are relatively near to each other (ca 150 km apart) but they almost certainly originate from different forest types and as *P. kiautarum*, or a species very like it, known from a distant locality in Kalimantan Tengah it is likely that species is actually widespread, but elusive. The conundrum we have been faced with does however signal a cautionary note. New species should not be described from the female sex only unless the specimens exhibit outstanding distinguishing characters.

Both *P. dowi* and *P. stictica* are recorded as breeding only in phytotelmata such as buttress pans, rot holes in trees and broken bamboo stumps (LIEFTINCK, 1934, 1941; ORR, 1994, 1997, 2001; NGIAM & LEONG, 2012). It seems likely that *P. kiautarum* and *P. triangularis* breed in similar situations. The variation in size observed is likely to be associated with this habit with some evidence that, counter-intuitively, large containers produce several smaller individuals due to the effects of inter- and intra-specific competition, whereas small containers with adequate nutrients produce a single large individual (A.G. Orr, unpublished).

ACKNOWLEDGEMENTS

We would like to thank the following for their invaluable assistance: Dr RORY DOW for generously supplying photographs of comparative material, loan of a specimen and much helpful discussion, Mr DAVID GOODGER who facilitated access to the type material held in the Natural History Museum London and Mr HARUKI KARUBE who kindly loaned us the specimens of *P. kiautarum* and *P. stictica*.

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NOTES ON SOME *COELICCIA* SPECIES FROM VIETNAM (ZYGOPTERA: PLATYCNEMIDIDAE)

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The original descriptions of *C. acco* Asahina, 1997, *C. kazukoe* Asahina, 1984, *C. montana* Fraser, 1933 and *C. yamasakii* Asahina, 1984 are supplemented and enhanced, and new illustrations of these species are provided. A teneral form of *C. yamasakii* is described and figured. *C. kazukoe* is recorded for the first time from Vietnam.

INTRODUCTION

Among the Platycnemididae, *Coelliccia* Kirby, 1890 is the largest genus with over 60 currently known species (SCHORR & PAULSON, 2013). The genus occurs from India in the west to Japan in the east, and southwards to Java.

The genus *Coelliccia* is represented in Vietnam by 13 named species, namely *C. acco* Asahina, 1997, *C. chromothorax* (Selys, 1891), *C. cyanomelas* Ris, 1912, *C. hoanglienensis* Do, 2007, *C. mingxiensis* Xu, 2006 (recorded for the Vietnamese fauna in 2009 by DO (2011)), *C. montana* Fraser, 1933, *C. onoi* Asahina, 1997, *C. poungyi* Fraser, 1924, *C. pyriformis* Laidlaw, 1932, *C. satoi* Asahina, 1997, *C. scutellum* Laidlaw, 1932 (*C. tomokunii* Asahina, 1997 is considered here to be a junior synonym of *C. scutellum*), *C. uenoi* Asahina, 1997 and *C. yamasakii* Asahina, 1984.

The last complete revision of the genus was made by LAIDLAW (1932). Since then many new species have been described, and unfortunately some synonyms have been published, for instance *Coelliccia tomokunii* is very probably a synonym of *Coelliccia scutellum* (WILSON & REELS, 2001; DO, 2009), and *Coelliccia megumii* Asahina 1984 was recently placed to synonymy with *Coelliccia kazukoe* (KOSTERIN, 2011).

Additionally, many published descriptions and drawings of *Coeliccia* species are of a rather inadequate quality, which makes it even more difficult to identify the species of this genus. There is a need for improved descriptions and information on variability within species to help prevent the creation of further synonyms. DOW (2010) did a first revision of one group of *Coeliccia* from Borneo but the status of many species still remains unclear. It should be noted here, that the monophyletic status of the genus *Coeliccia* is in doubt (GASSMANN, 2004).

In this publication, we address these problems in the case of four species found in Vietnam, by enhancing the original descriptions as well as providing new illustrations. We include a new record for the Vietnamese fauna and the description of a previously undescribed teneral form.

The terminology used follows FRASER (1956) and GARRISON et al. (2010); terminology for wing venation follows RIEK & KUKALOVÁ-PECK (1984). Abbreviations in the text as follows: S1-10 for segments 1-10, Fw (forewing), Hw (hindwing), Px (postnodal cross vein), RMNH (Naturalis Biodiversity Centre, Leiden).

COELICCIA ACCO ASAHINA, 1997

Figures 1 a-i

Material. – Total 3 ♂: 1 ♂, Cuc Phuong National Park, Ninh Binh province, northern Vietnam, 30-IV-2009, Do Manh Cuong leg.; 1 ♂, Phong Nha-Ke Bang National Park, Quang Binh province, central Vietnam, 17-V-2011; 1 ♂, Ba Vi National Park, 18-VI-2012, Do Manh Cuong leg.

C. acco was described by ASAHINA (1997); the holotype originates from Cuc Phuong. Unfortunately, Asahina's account is not detailed, it lacks a descriptive text of the structure of the anal appendages, wings and the genital ligula. Furthermore, the drawings of these structures are rather rough and can easily lead to misidentifications and confusion.

In the following, the differences between Asahina's description and the characters examined by us are pointed out. In addition, a description of the anal appendages, genital ligula and wings is given. Figures of all important characters are added.

ASAHINA (1997: 29) described the pterothorax as black "... with ... distinct bluish stripe". In his drawing of the synthorax, these markings look quite straight or even slightly distally curved; in our specimens, we found them rather distinctly curved inwards and of a sky-blue color (Fig. 1 b). Furthermore Asahina described the sides of the abdomen with "... a pale yellowish or reddish spot present near the end of S3-6 ...". In our specimens these spots are whitish, the same as the color found on the sides of prothorax, coxae and trochanters. S7 also shows this characteristic white spot in our specimens.

Wings (Figs 1 h-i). – Hyaline with black pterostigma covering about 1 1/4-1 1/3 cells. Three postdiscoidal cells to level of subnodus in both Fw and Hw.

RP2 arising at 10th Px in Fw and at 8th Px in Hw. IR1 arising slightly distal to 10th-12th Px in Hw and from 12th-13th Px in Fw. RP3 arising slightly distal to subnodus in both wings. IR2 inserted at subnodal vein.

Right Fw with 21 Px, left Fw with 20 Px. Both Hw with 19 Px.

A n a l a p p e n d a g e s (Figs 1 c-e). – Terminal appendages golden yellow. Inferior appendages oriented dorsoapically, superior appendages nearly straight. Superior anal appendages about $1 \frac{1}{5}$ times length of S10, broad and blunt in

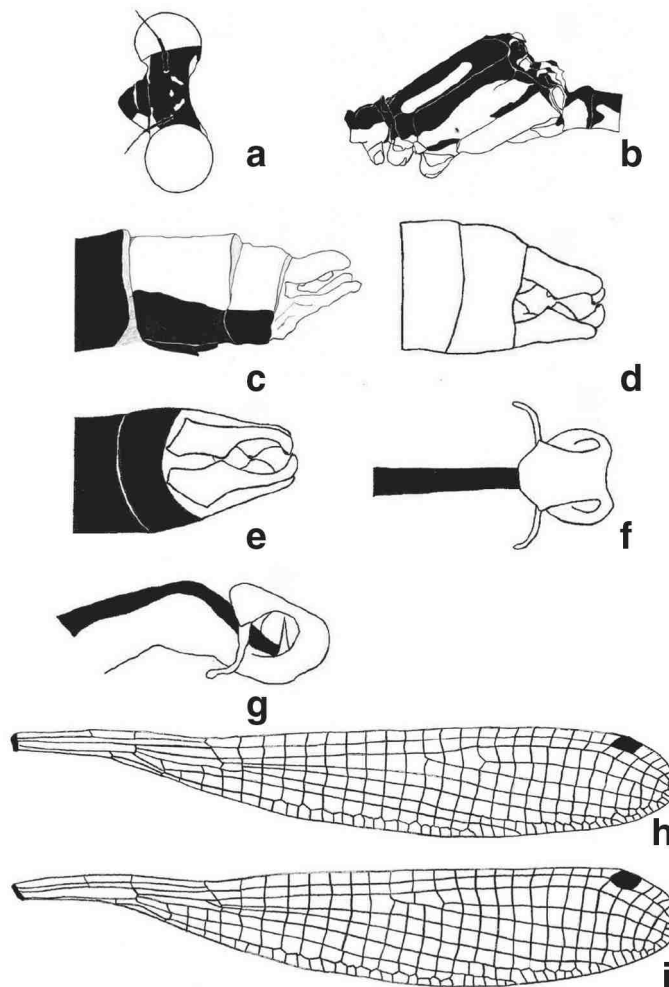


Fig. 1. *Coelliccia acco* ♂: (a) head, oblique lateral view; – (b) thorax, lateral view; – (c) anal appendages, lateral view; – (d) anal appendages, dorsal view; – (e) anal appendages, ventral view; – (f) penile organ, ventral view; – (g) penile organ, lateral view; – (h) forewing; – (i) hindwing. – [Drawings by Philip O.M. Steinhoff]

lateral view, widest part in the middle. In dorsal view thinner, with ventromedial black tooth at half of their length. Inferior anal appendages typically Coelliccia-shaped, slender and with black apical tooth, slightly overtopping superior anal appendages in length.

Genital ligula (Figs 1 f-g). – First segment simple, distally curved in lateral view; second segment with sharp, spine-like internal fold but without terminal fold; two laterally placed flagella, arising proximal from below the third (terminal) segment. Ends of the flagella thickened in lateral view.

COELICCIA KAZUKOAE ASAHINA, 1984

Figures 2 a-i

Material. – 1♂, Ka Nak, K' Bang, Gia Lai province, southern Vietnam, 27-IV-2010, Do Manh Cuong leg.

C. kazukoe is a new addition to the Vietnamese fauna. Earlier this species had been known only from Thailand and Cambodia (DOW, 2011). KOSTERIN (2011) suggested that *Coelliccia megumii* and *C. kazukoe*, both described by ASAHINA (1984) from Thailand, are synonymous. Kosterin selected the name *kazukoe* to take priority. ASAHINA's (1984) description of *C. kazukoe* and *C. megumii* is rather detailed, Kosterin later highlighted some variations of thoracic pattern and shape of the anal appendages of *C. kazukoe*. For this reason, we will refrain from giving a full description of the male *C. kazukoe* collected in Vietnam here, but compare our specimen with the characters described by Asahina and Kosterin. Additionally, we give figures of the wings, head, thorax, genital ligula and anal appendages.

COMPARISON WITH A SPECIMEN AND PUBLISHED DESCRIPTIONS. – To confirm the identity of our specimen, we compared it with a male specimen of *C. kazukoe* from Klong Sai, near Bo Rai, Amphoe Khao Saming, Trat province, Thailand, 13-I-1996, M. Hämäläinen leg. & det.; deposited at RMNH. The shape of the genital ligula and anal appendages agrees with that of the specimen from Vietnam, while the coloration of the terminal abdominal segments differs somewhat between the two specimen. The pattern of markings on the head resembles those of the photographs given by KOSTERIN (2011: 98, fig. 77 a, c), but differs from the drawings and description given by ASAHINA (1984) for both *C. kazukoe* and *C. megumii*. In the original drawings for *C. kazukoe*, Asahina shows large pale areas extending over the frons as well as over the dorsal part of the head. In his original description for *C. megumii*, Asahina points out that the "... standard postocular crescent spots are obliterated being amalgamated with the median pale area" (ASAHINA, 1984: 17). However, this pale median area does not exist in our specimen, nor in the specimen presented by KOSTERIN (2011). A useful character of *C. kazukoe* for easy identification in the field, is the prominent

posterior lobe that is “(...) well raised backwards” as Asahina puts it in his original description of *kazukoae* (ASAHINA, 1984: 17). The markings of the prothorax differ somewhat among the different specimens; the individual presented

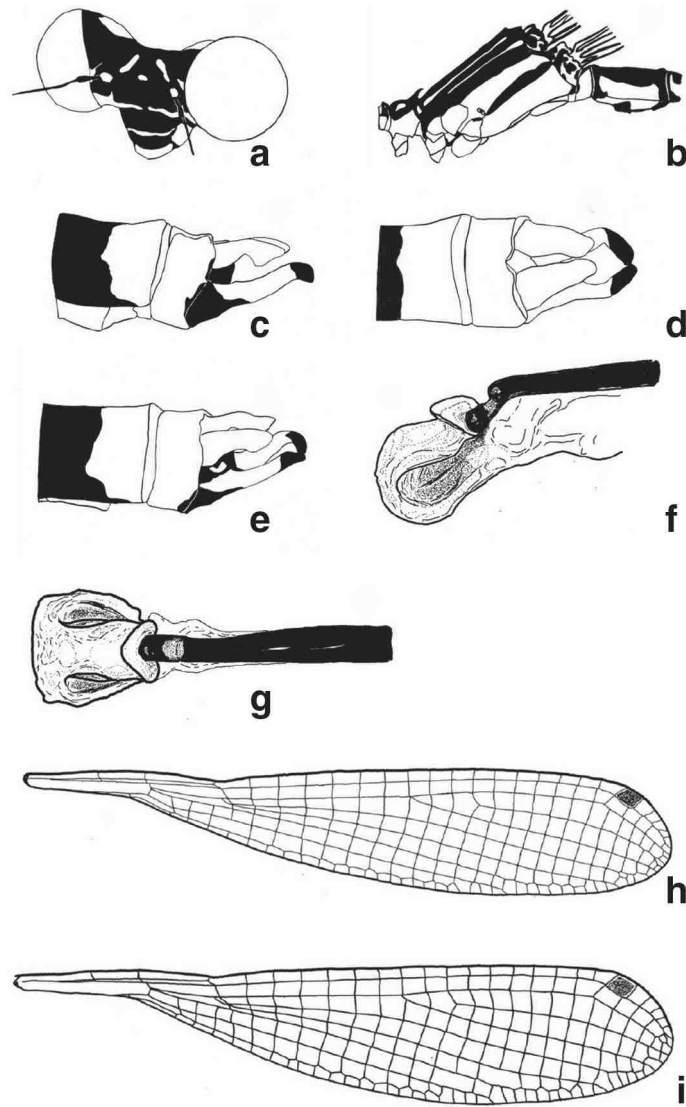


Fig. 2. *Coelliccia kazukoae* ♂: (a) head, oblique anterior view; – (b) thorax, lateral view; – (c) anal appendages, lateral view; – (d) anal appendages, dorsal view; – (e) anal appendages, oblique lateral view; – (f) penile organ, oblique lateral view; – (g) penile organ, ventral view; – (h) forewing; – (i) hindwing. – [Drawings a-e by Philip O.M. Steinhoff, drawings f-i by Do Manh Cuong]

here has a pale lateral spot that can be seen in Asahina's drawings of *C. megumii* and in figure 77 c of Kosterin's analysis. The color patterns of the thorax then are generally consistent in all of the discussed specimens. Only the holotype of *C. kazukoae* differs significantly from the others, not so much in the pattern of the markings but in the color of the pterothorax, which is not "azure blue" and "striped black" (for *megumii* in ASAHINA, 1984: 15) but "pale brownish" and "pale yellowish" (for *kazukoae* in ASAHINA, 1984: 17). The individual from Vietnam has a narrow blue stripe on the humeral suture, running parallel to the blue marking on the mesepisternum. Among the compared specimens, this character can only be found in the drawings of Asahina for *C. kazukoae*.

The wings have not been described in detail by Asahina in the original description, thus we give here a rather complete description of the wings of our specimen.

W i n g s (Fig. 2 h-i) hyaline with dark brown pterostigma covering about 1 1/4 cells. Three postdiscoidal cells to level of subnodus in both fore- and hindwings. Wings with 16 Px in both fore- and Hw. RP2 arising at 7th Px in both wings. IR1 arising proximal of the 9th Px in Hw and proximally of the 10th Px in Fw. RP3 arising slightly distal to subnodus in both wings. IR2 inserting at subnodal vein.

The superior anal appendages of the specimen presented here resemble figure 77 d in KOSTERIN (2011: 98) most closely. The structure of the genital ligula agrees with that originally illustrated for *C. megumii* by ASAHINA (1984: 15, fig. 56).

The differences pointed out here, are mostly in the coloration of the individuals. We believe, that this might show some general variation in the color pattern of *C. kazukoae* or, as Kosterin (2011: 97) already pointed out, that it is age related.

COELICCIA MONTANA FRASER, 1933

Figures 3 a-i

M a t e r i a l. – Total 2♂: 1♂, Hon Ba, Khanh Hoa province, southern Vietnam, 10-V-2010, Do Manh Cuong leg.; 1♂, same locality and collector, 30-IV-2009.

There are only two known earlier records of *C. montana* (DOW, 2009). The species was described from a single male specimen from Laos (FRASER, 1933). ASAHINA (1969) later described a male specimen from southern Vietnam and gave some rather rough sketches of the head, thorax and anal appendages. Although Fraser did not include any drawings, his description of *C. montana* is quite detailed and adequate for proper identification. Here we compare the characters of our specimens with the characters described by Fraser. Additionally, we give drawings of the head, thorax, wings and anal appendages. The genital ligula has not been described before, thus we give drawings and a full description.

DESCRIPTIVE NOTES. – Head as described by FRASER (1933), only antefrons

differently colored, marked by a pale (in life probably blue) band. Prothorax dorsally black; the three lobes of the pronotum black, the propleuron pale yellowish below, dark above (Fig. 3 b). This coloration is consistent with ASAHINA's (1969: 4, fig. 1) drawing and Fraser's original description in which he presumably

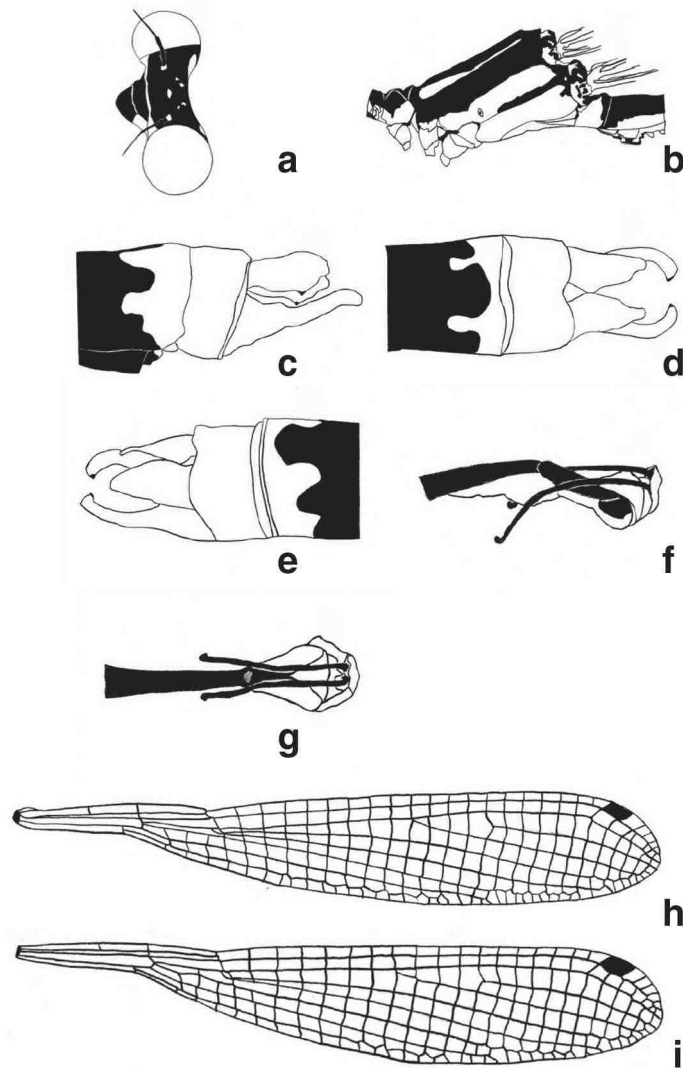


Fig. 3. *Coeliccia montana* ♂: (a) head, oblique lateral view; – (b) thorax, lateral view; – (c) anal appendages, lateral view; – (d) anal appendages, dorsal view; – (e) anal appendages, oblique lateral view; – (f) penile organ, oblique lateral view; – (g) penile organ, ventral view; – (h) forewing; – (i) hindwing. – [Drawings by Philip O.M. Steinhoff]

considered the propleuron and the pronotum to be one structure and included the propleuron as part of the middle lobe of the combined structure.

T h o r a x markings and coloration almost identical as described by FRASER (1933) and drawn by ASAHINA (1969). Regarding the mesepisternum, FRASER (1933: 116) wrote that "... the outer border of the antehumeral stripes is very irregular". We found the antehumeral stripes resembling a pair of paddles, with indeed the outer (proximal) border less straight than the distal border, forming the "blade of the paddle" (Fig. 3 b). This specific marking pattern is also visible in Asahina's drawing.

We counted 17 Px in both Hw, the same that Fraser describes for the type specimen, but instead of 18 Px our specimen has 19 Px in the Fw (Fig. 3 h). Besides this, the wings resemble the descriptions of FRASER (1933) and ASAHINA (1969) respectively.

A b d o m e n and anal appendages as described by FRASER (1933). The drawings by ASAHINA (1969: 4, figs 2, 3) do not clearly show the black tips of the ventral spine of the superior appendages, or the black tips of the inferior appendages (see Fig. 3 c-e).

Genital ligula (Fig. 3 f-g). – First segment simple, distally curved in lateral view with distinct medial bend; second segment with sharp, spine-like internal fold and without terminal fold; third (terminal) segment very short but with two apically placed long flagella.

COELICCIA YAMASAKII ASAHINA, 1984

Figures 4 a-j

M a t e r i a l. – Total 5♂: 3♂, 5 March 2011; 2♂, 30 May 2012, Phu Quoc National Park, Kien Giang province, southern Vietnam, Do Manh Cuong leg.

C. yamasakii was described by ASAHINA (1984) based on specimens from Thailand. This species was recorded as new to Vietnam from Phu Quoc island (DO et al., 2011).

The figures of the genital ligula made by Asahina are somewhat misleading and do not show some important characteristics; new drawings are given here. Since the teneral form of *C. yamasakii* differs markedly from the mature form described by Asahina, we provide drawings and description of the teneral form here.

H e a d (Fig. 4 a). – Labium and labrum largely yellowish. Frons mostly black, antefrons fully deep black. Mandibles pale yellowish. Genae black, vertex and postfrons colored with a yellow bar, connecting ocelli with antenna bases.

T h o r a x (Fig. 4 b,c). – Prothorax black with bright yellow lateral markings, covering propleuron; anterior and posterior pronotal lobes deeply black, middle lobe dorsally black, laterally bright yellow (Fig. 4 b). Synthorax black with yellow antehumeral markings extending nearly to the wing bases, these pipe-shaped,

with the 'bowl of the pipe' oriented cranially (Fig. 4 c). Mesepimeron fully black. Metepisternum mostly bright yellow; second lateral suture covered by a black bar, reaching from wing base toward the head and extending into metepisternum as well as metepimeron. Metepimeron almost completely covered by large yellow

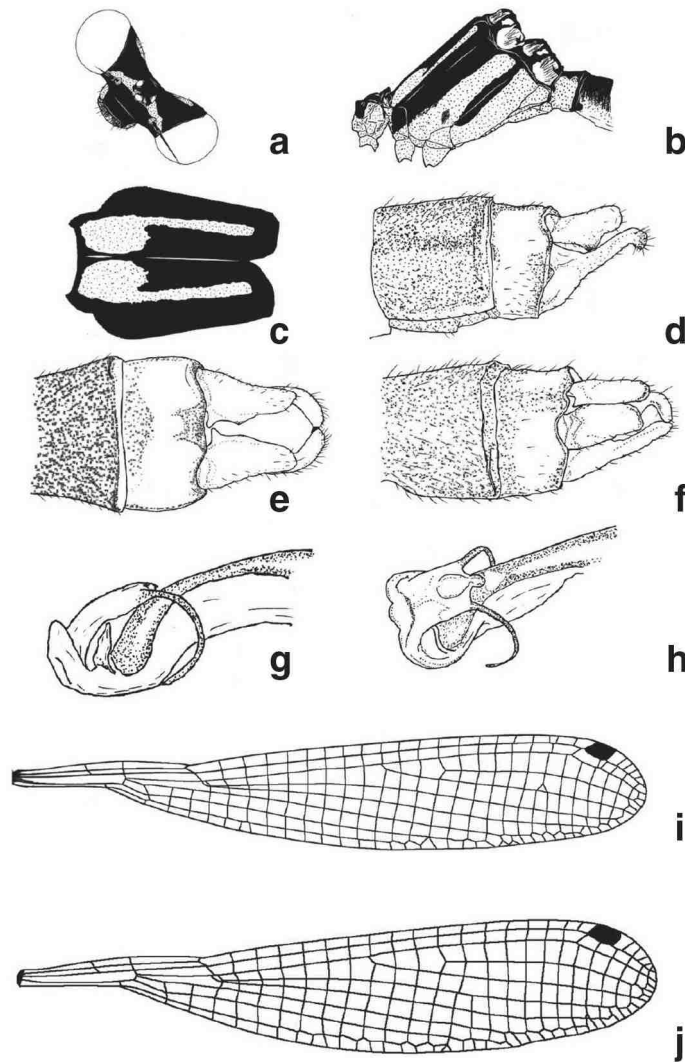


Fig. 4. *Coelliccia yamasakii* ♂: (a) head, oblique dorsal view; – (b) thorax, lateral view; – (c) synthorax, dorsal view; – (d) anal appendages, lateral view; – (e) anal appendages, dorsal view; – (f) anal appendages, oblique lateral view; – (g) penile organ, lateral view; – (h) penile organ, oblique dorsal view; – (i) forewing; – (j) hindwing. – [Drawings by Do Manh Cuong]

marking. Mesinfraepisternum black with small yellow spot above mesocoxa. Metinfraepisternum completely yellow. Metacoxa also yellowish, prothorax and synthorax ventrally dirty yellowish (Fig. 4 b).

Legs yellowish-white and black, femora with a black stripe along extensor surface, flexor surface yellowish-white; tibiae black. Ankles and tarsi black.

Wings (Fig. 4 i-j) hyaline with black pterostigma covering about 1 1/2 cells. Three postdiscoidal cells to level of subnodus in both Fw and Hw. Fw with 20 Px, Hw with 17 Px. RP2 arising proximal of 7th Px in Hw and proximal of 9th Px in Fw. IR1 arising distally of 10th Px in Hw and distally of 12th Px in Fw. RP3 arising slightly distal to subnodus in both wings. IR2 inserted at subnodal vein.

A b d o m e n. – Slender, dirty blackish and dark brown. S1 yellow. S2 with broad ventrolateral yellow spot; dorsally blackish, corresponding intersegmental zones black. S3-S8 dark brown, dorsally more blackish. S9 fully colored dark brown, S10 ochre. Sternites of S1-S10 brownish yellow.

Anal appendages (Fig. 4 d-f). – Terminal appendages brownish yellow. Anal appendages shaped as in Figure 4 d-f. Superior anal appendages about 1 1/5 times length of S10, broad and blunt in lateral view, with ventrally directed medial tooth and basal interior spine. Inferior anal appendages clearly longer than superior appendages, with small black apical tooth.

Genital ligula (Fig. 4 g-h). – Simple first segment, slightly curved distally in lateral view; second segment with sharp, prominent internal fold and broad, blunt terminal fold; the third (terminal) segment with characteristic apical projection (Fig. 4 h), because of its shape termed “head“ by ASAHINA (1984: 14), visible only in dorsal view. Two terminal flagella frame the apical projection and conceal it in lateral view. Flagella curved, ends pointing towards second segment.

M e a s u r e m e n t s (mm). – Fw: 32.5; Abdomen: 47 (including superior anal appendages).

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**THREE NEW SPECIES OF *TEINOBASIS* KIRBY
FROM PAPUA NEW GUINEA
(ZYGOPTERA: COENAGRIONIDAE)**

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T. chrysea sp. n. Holotype ♂: (NTM I008871), *T. lutea* sp. n. (Holotype ♂: (NTM I008876) and *T. macroglossa* sp. n. (Holotype ♂: (NTM I008877) are described from temporary bush camps, without permanent place-names, in the Sepik Basin. Characters of the available adults are illustrated, habitat conditions are given and their affinities are discussed.

INTRODUCTION

Teinobasis is by far the most species-rich coenagrionid genus occurring on New Guinea and nearby islands. V.J. Kalkman (pers. comm., updated list of New Guinea dragonflies) listed 34 species credited to SELYS (1877, 1878), FÖRSTER (1898), RIS (1913, 1915), CAMPION (1924), LIEFTINCK (1932, 1935, 1938, 1949, 1987), KIMMINS (1957), THEISCHINGER & RICHARDS (2007) and KALKMAN (2008). It is remarkable that only a single species of this vast genus, one of the 34 species known from New Guinea, is found in tropical Australia. The recent discovery by the second author of three more new *Teinobasis* species in PNG suggests that many more species await discovery there. Here we describe the new species and comment briefly on their habitats and affinities.

MATERIAL AND METHODS

Descriptive terminology largely follows CHAO (1953) and WATSON & O'FARRELL (1991). Coloration is given as detectable from the preserved material, supplemented with photographs of specimens taken in life. Measurements are given in millimetres (mm). All illustrations were done with the aid of a camera lucida and are not to scale. Material was collected at temporary bush camps, without permanent place-names, in the Sepik Basin. Coordinates are presented using the GPS datum WGS 84.

Type material is deposited in the Museum and Art Gallery of the Northern Territory (NTM), Australia.

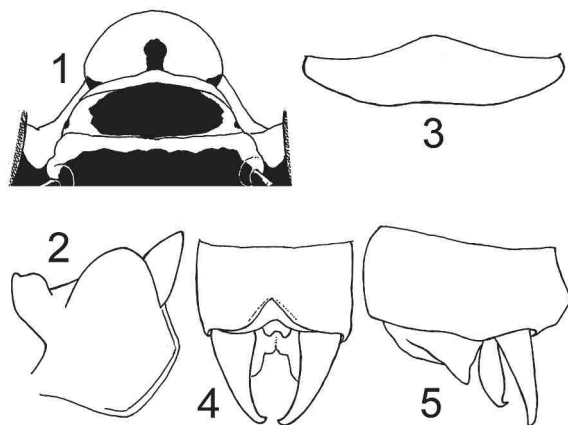
TEINOBASIS CHRYSSEA SP. NOV.

Figures 1-5, 15, 19

Material. – **Holotype** ♂ (NTM I008871): Papua New Guinea, 'Camp 3' (4°38.841'S, 141°47.876'E; 290 m asl), 6-II-2010, S.J. Richards (NTM). – **Paratypes:** 1 ♂ (NTM I008872), same as holotype on 5-II-2010; 1 ♂ (NTM I008873), 'Camp 7' (4°38.562'S, 141°44.602'E; 400 m asl), 5/8-XII-2009; both S.J. Richards; 1 ♀ (NTM I008874), same as holotype on 5-II-2010, C. Müller. – **Additional material:** 1 ♀ (identified by supposition) (NTM I008875), 'Camp 5' (4°42.859'S, 141°55.517'E; 135 m asl), 28-V-2010, S.J. Richards (NTM).

Etymology. – The specific name refers to the coloration of the species (chryseos = Greek for golden).

MALE. – **Head.** – Labium, base of mandibles, genae, anteclypeus and ventral portion of postgenae yellow; labrum yellow with small black laterobasal spots and larger black mediobasal patch; tips of mandibles black; postclypeus largely black, only lateral margins broadly, and basal margin very narrowly, yellow; a bar from eye to eye including anterior frons and outer portion of antennal bases yellow;



Figs 1-5. *Teinobasis chrysea* sp. n., male: (1) face, dorsal view; – (2) pronotum, lateral view; – (3) posterior lobe of pronotum, dorsal view; – (4-5) anal appendages, dorsal and lateral views, respectively.

antennae largely blackish brown to black, only an anterior streak on scape dull yellow and the apical ring of scape bright yellow; top of head, including most of frons, vertex, occiput and postocular lobes, and dorsal portion of postgenae black.

Thorax. – Prothorax with pronotum bright yellow, only a shade of grey on median portion of posterior lobe; posterior lobe closely adpressed to spiracular dorsum of synthorax, short and widely

rounded, lateral edges not prominent. Other pronotal and cervical sclerites yellow. Foreleg yellow with only spines and extreme apex of femur and tibia and all of tarsal segments black and claws brown.

Synthorax: pleura and poststernum almost all dark yellow, only a black median stripe, laterally slightly convex and covering centre of collar, mediodorsal carina, approximately median 1/3-1/2 of mesepisternum and antealar ridge and sinus, and a small spot dorsal to subalar ridge at each wing base and dorsal rim of metapostepimeron black. Terga black and yellow. Legs as given above (under prothorax).

Wings with basal sclerites yellow and black and venation black, membrane hyaline; postnodals 16/15-16; pterostigma black, very small, hardly longer than wide, overlying at most one cell, almost rhombic, slightly larger in forewing than in hindwing; Ac situated much closer to Ax2 than to Ax1. IR3 and R4+5 distinctly separated at their origin; R4+5 arising distinctly before the subnodus and strongly curved at origin; IR3 arising at subnodus; discoidal cell of fore and hindwing subequal in length; anterior border in forewing less than 1/2, in hindwing 3/5, as long as posterior border.

A b d o m e n. – Very slender. Tergum 1 yellow with only apical 1/3 largely black; tergum 2 dorsally black, laterally yellow; terga 3-9 dorsally black with only a tiny laterobasal greyish yellow spot, developed in tergum 3, hardly more than indicated in 4-7, and lateral edge pale greyish yellow; tergum 9 black; segment 10 dorsally and laterally black, ventrally pale brownish yellow. Sternum 1 and most of sternum 2 (secondary genitalia) yellow; sterna 3-anterior 1/4 of 7 yellowish grey; posterior 3/4 of sternum 7, and sterna 8 and 9 yellow. Superior anal appendages largely black, upper branch slender, conical, slightly longer than segment 10, apically hooked; lower branch 2/3 length of upper branch, rather stout, apically distinctly hooked; inferior appendages black and greyish yellow, about 1/2 length of upper branch of superior appendages.

M e a s u r e m e n t s (in mm). – Hindwing 27.0-29.4, abdomen (including appendages) 42.5-45.7.

FEMALE (including specimen identified by supposition).

H e a d. – Much as in male but the yellow somewhat paler.

T h o r a x. – Pronotum largely pale yellow, anterior edge of anterior lobe, sides of median lobe and most of posterior lobe black (posterior lobe of the paratype largely yellow with a low nipple-like black elevation each side, appearing somewhat unnatural); propleura largely black.

Synthorax much as in male, but with only the lateral area of the front vivid yellow, otherwise markedly paler; some additional black along subalar ridges and partly along the three synthoracic sutures, most prominent somehow encircling metastigma. Legs and wings much as in male; postnodals 15-17/15-16.

A b d o m e n. – Much as in male; ventral edge of terga 1-8 broadly pale greyish yellow, 2-5 with indication of yellow anterolateral spot, dorsal portion of apical edges of 7 and 8 and sides of 9 yellow; segment 10 black but paler ventrally.

Valves pale greyish yellow with tip black; anal appendages and ovipositor black.

M e a s u r e m e n t s (in mm). – Hindwing 33.0, abdomen (including appendages) 45.7.

HABITAT. – This species was found in closed-canopy, primary foothill forest where males and females were observed flying low (normally < 2 m high) through the forest in shady positions away from streams and pools. This species is known from several sites in the Sepik river catchment, and given the extent of suitable habitat in northern New Guinea it almost certainly has a broad distribution in the region.

DISCUSSION. – *T. chrysea* sp. n. closely resembles *T. sjupp* Kalkman, described from Yapen Island (KALKMAN, 2008). Whereas head and thoracic pattern make *T. sjupp* somewhat darker than *T. chrysea* sp. n., the small, simple rounded posterior lobe of the male pronotum and the stout lower branch of the superior anal appendages of *T. chrysea* clearly distinguish it from *T. sjupp*.

TEINOBASIS LUTEA SP. NOV.

Figures 6-7, 16

M a t e r i a l. – **H o l o t y p e** ♂ (NTM I008876): Papua New Guinea, 'Camp 7' (4°38.562'S, 141°44.602'E; 400 m asl), forest trail, 07-XII-2009, S.J. Richards (NTM).

E t y m o l o g y. – The specific name refers to the coloration of the species (luteus 3 = Latin for orange).

MALE. – **H e a d.** – Labium, genae, anteclypeus, anterior frons and much of mandibles pale brownish yellow; labrum intensive brownish yellow, finely dotted with black in a drop-shaped patch each side near base; tips of mandibles black; most of frons and all of postclypeus, antennae, vertex, occiput, postocular lobes and genae black.

T h o r a x. – Cervical sclerites yellow. All of prothorax intensive yellow; posterior lobe of pronotum closely adpressed to spiracular dorsum of synthorax, short and widely rounded, with lateral edges not prominent. Foreleg with coxa and trochanter orange yellow, femur orange yellow with black dorsal lining and black in distal 2/3; tibia, tarsal segments and claws black.

Synthorax. – Pleura largely light orange, with posterior half of metepimeron and much of metapostepimeron more yellow. Black is restricted to a median stripe, somewhat !-shaped, laterally slightly convex, and covering centre of collar, mid-dorsal carina and median 1/4-1/3 of each mesepisternum; and also antearlar ridge and a small spot dorsal to subalar ridge at each wing base and dorsal rim of metapostepimeron. Terga largely orange yellow with little black. Poststernum intensive yellow. Coxae and trochanters pale orange, femora pale orange, dorsally lined and tipped with black, and remainder of leg as given above under foreleg.

Wings with basal sclerites orange, edged with black, and venation black, membrane hyaline; postnodals 17-19/17; pterostigma black, small, hardly longer than wide, almost rhombic, overlying approximately one cell, slightly larger in fore-

wing than in hindwing; Ac situated very slightly proximal to Ax2; IR3 and R4+5 distinctly separated at their origin; R4+5 arising distinctly before the subnodus and strongly curved at origin; IR3 arising at subnodus; discoidal cell of fore and hindwing subequal in length; anterior border in forewing less than $1/2$, in hindwing $3/5$, as long as posterior border.

A b d o m e n. – Very slender. Tergum 1 intensive yellow with only apical edge black; tergum 2 dorsally black, laterally yellow confluent with what could be considered an indication of a laterobasal spot; terga 3-9 dorsally black with only lateral edge pale greyish yellow; segment 10 black, ventrally with slight pruinence.

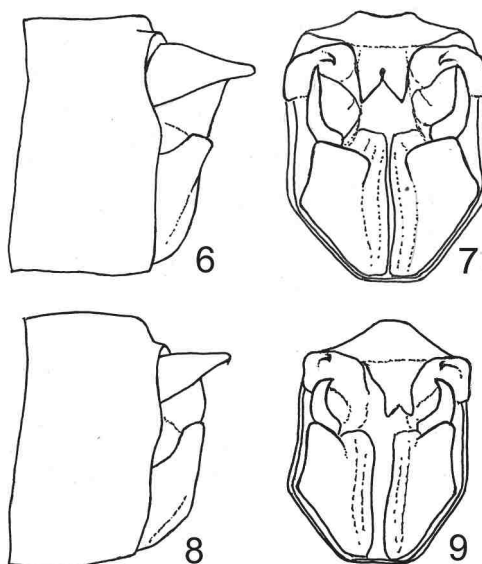
Sternum 1 and most of sternum 2 (secondary genitalia) yellow; sterna 3-9 anteriorly with some yellowish grey but largely black. Anal appendages black: Superiors with upper branch conical, about as long as segment 10, apically slightly hooked; lower branch $3/4$ length of upper branch, rather flat, bent, ending in a rather straight line as seen from lateral aspect. Inferior appendages black, widely truncate. Posterior median appendage of segment 10 broad, reverse M-shaped.

M e a s u r e m e n t s (in mm). – Hindwing 29.3, abdomen (including appendages) 45.5.

FEMALE unknown.

HABITAT. – The holotype and only known specimen of this species was found perched on a tree-branch about 2.5 m above the forest floor in foothill rainforest. Although it is currently known only from the type locality in the Sepik river catchment, given the extent of suitable habitat in northern New Guinea it almost certainly has a broad distribution in the region.

DISCUSSION. – *T. lutea* sp. n. closely resembles the markedly smaller *T. aurea* Liefstinck in coloration. The postclypeus is black in *T. lutea* sp. n., orange in *T. aurea*, whereas antealar sinus and abdominal tergum 2 are largely orange in *T. lutea*, but much more black in *T. aurea*. The black median stripe on the front of the synthorax of *T. lutea* is narrower than in *T. aurea*. *T. lutea* also has a markedly larger pterostigma than its close ally. The differences between the two species in the male terminalia are illustrated (*T. lutea*: Figs 6-7; *T. aurea*: Figs 8-9).



Figs 6-9. Male anal appendages in dorsal and lateral views: (6-7) *Teinobasis lutea* sp. n.; – (8-9) *T. aurea* Liefstinck.

TEINOBASIS MACROGLOSSA SP. NOV.

Figures 10-14, 17, 18, 20

Material. – **Holotype** ♂ (NTM I008877): Papua New Guinea, 'Camp 8' (4°32.739S, 141°57.588E; 90 m asl), 4-VI-2010, S.J. Richards (NTM). – **Paratypes:** 1 ♂ (NTM I008878), 3 ♀ (NTM I008879-81), data as in holotype; – 2 ♂ (NTM I008882-3), 1 ♀ (NTM I008884), same locality and collector as holotype, 2-VI-2010.

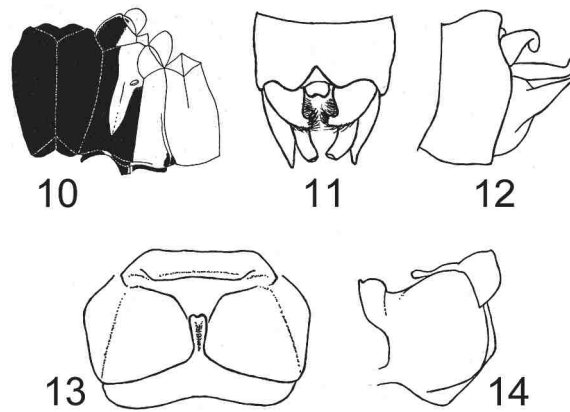
Etymology. – The specific name refers to the size and shape of the forward-directed narrow process of the posterior lobe of the pronotum in the female (macro = Greek for large; glossa = Latin for tongue).

MALE. – **Head.** – Labium whitish; mandible bases, anteclypeus, a medially pointing wedge each side on anterior frons adjacent to genae and anteclypeus and genae up to the base of antennae light blue; labrum, postclypeus, remainder of frons, antennae, vertex, occiput and postgenae black.

Thorax. – Prothorax with pronotum black and posterior lobe widely rounded, and propleura largely light blue.

Synthoracic pleura black with the following sections pale to light blue: posteroventral corner of mesokatepisternum, a large wedge covering posterior margin of mesepimeron, much of metepisternum and almost all of metepimeron and metakatepisternum. Poststernum blue. Legs with coxae light blue, trochanters and femora pale blue with black along upper face; tibiae, tarsi and claws greyish to blackish brown, paler on inner than on outer face; all spines black.

Wing membrane hyaline, venation black; pterostigma greyish black, distinctively longer than wide and overlying one cell; postnodals 15-16/14; Ac slightly proximal to Ax2; CuP fused with wing margin for at least the length of Ac.



Figs 10-14. *Teinobasis macroglossa* sp. n., Figs 10-12 male, Figs 13-14 female: (10) synthorax; – (11-12) anal appendages in dorsal and lateral views; – (13-14) pronotum in dorsal and lateral views.

Abdomen. – Terga 1, 2 and 9 dorsally black, laterally largely light blue; terga 3-7 black with hardly an indication of brownish spots at the very base and pale ventral margin; tergum 8 black with pale lateral margin wider than in preceding terga; segment 10 dorsally and laterally largely black, ventrally pale yellowish brown. Sterna yellowish to blackish grey, sternum 9 the palest. Superior anal appendages with dorsal

branch strongly bent and black and ventral branch very long and brownish yellow; inferior appendages brownish yellow to greyish brown.

M e a s u r e m e n t s (in mm). – Hindwing 20.5-21.5, abdomen (including appendages) 34.2-36.0.

F E M A L E. – *H e a d*. – Much as in male. The largely black labrum yellowish brown along anterior margin; a thin yellowish brown ray each side between lateral ocellus and base of antenna from approximately 1/5 to 3/5 this distance.

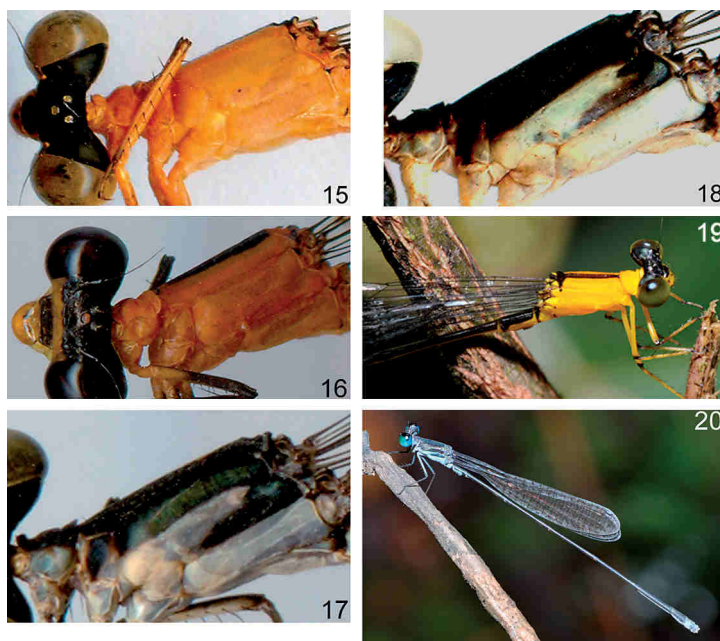
T h o r a x. – Much as in male. A long tongue-like process from posterior lobe across 1/2 the length of midline of median lobe.

Wings with 14-16/13 postnodals and CuP fused with wing margin for the length of Ac or less.

A b d o m e n. – Much as in male. Tergum 8 black with pale lateral margin much wider than in preceding terga, actually a lateral patch covering basal 4/5 of length of segment; tergum 9 and segment 10 including anal appendages dull black; valves and ovipositor dull to pale brownish- to greyish- and whitish yellow. Sterna yellowish- to brownish grey; sternum 8 dull yellowish white.

M e a s u r e m e n t s (in mm). – Hindwing 21.7-22.1, abdomen (including appendages) 33.6-34.4.

H A B I T A T. – This species was abundant at a number of sites where males and females perched for long periods on low vegetation in shady or dappled-sun loca-



Figs 15-20: Male head (dorsal view) and thorax (lateral view): (15) *Teinobasis chrysea* sp. n.; – (16) *T. lutea* sp. n. – Figs 17-18: *T. macroglossa* sp. n., thorax, lateral views: (17) male; – (18) female. – Figs 19-20: males in life: (19) *T. chrysea* sp. n.; – (20) *T. macroglossa* sp. n.

tions. Greatest concentrations were found near small forest pools and slow-flowing seepages, although many specimens were found in forest far from water. This species is known from the type locality and was also observed at several other sites in the Sepik river catchment, and given the extent of suitable habitat in northern New Guinea it almost certainly has a broad distribution in the region.

DISCUSSION. – *T. macroglossa* sp. n. closely resembles *T. scintillans* Lieftinck. Marked differences from *T. scintillans* include the colour pattern of the synthorax in both sexes, including the large black wedge covering much of the metepimeron and the lack of a black C-shaped mark at the dorsal end of it in *T. macroglossa* (vs generally just a black C-shaped mark at the dorsal end of the metepimeron in *T. scintillans*) and the much greater length of the median process of the posterior lobe of the pronotum in the female (several times as long as in *N. scintillans*).

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**LIFE AND WORK OF
MICHEL EDMOND DE SELYS LONGCHAMPS (1813-1900),
THE FOUNDER OF ODONATOLOGY**

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The life and times of the great Belgian odonatologist are outlined. The main sources of biographic information are his diaries (1823-1900). In addition to a sketch of his rich life, the information on his family, the castles he lived in, his travels in Europe, his immense natural history collections, on his disciples and on his contacts with contemporary odonatologists is given therein. Selys was a liberal politician, and devoted much of his time and energy to local, provincial and national political levels, as a senator and President of the Belgian Senate. He had a broad interest in natural history that far transcended the study of dragonflies. In odonatology, his work is of a particular importance: he did not only pioneer the field by describing over 700 valid spp., but he consequently used wing venation as the backbone of the taxonomical system of the order. In his Last Will, Selys earmarked a large sum of money in order to stimulate the work of various specialists on the description of his large zoological collections.

INTRODUCTION

The year 2013 marks the bicentennial of the birthday of baron Michel Edmond de Selys Longchamps. Most odonatologists will be familiar with his name, generally shortened as 'Selys', in taxonomic descriptions. But who was this man who shaped the classification of Odonata and who described over 700 species and established 134 valid genera within the Odonata? How important was his work for the development of contemporary odonatology? In this paper we provide an outline of his life and work by first providing some biographical background as then details about natural history and odonates.

MATERIAL AND METHODS

Of the utmost importance for this study was Selys' own diary, which he kept from the age of 10, in 1823, to a few weeks before his death, in 1900. This sizeable document has been recently published by CAULIER-MATHY & HAESSENNE-PEREMANS (2008)¹ and we subsequently refer to it as 'Diary' in this paper.

This work is further based on the biography by COEN (1982) and on ten biographies, necrologies, obituaries and miscellaneous studies, viz.: ANONYMOUS (1901), BLASIUS (1901), CALVERT (1901), DUBOIS (1901), LAMEERE (1902), MARTIN (1901), PLATEAU (1902), RIS (1901), SELYS & SELYS (1901)² and WATERMAN (2005)³. Additionally, we sought information from over 25 of Selys' articles, obituaries for colleagues and many other papers found on the internet as well as digitalized old Dutch newspapers⁴.

Selys' documents and letters are conserved in three archives, which are kept at different locations. The first archive, at the University of Liège, is in the general library, in the room "Marie Delcourt"⁵. A list of its contents has been published (CAULIER-MATHY & HAESSENNE-PEREMANS, 2010). A second archive was moved to the University of Liège in 1959 (YANS, 1961) and is now at the State Archives in Liège⁶. The third archive contains Selys' scientific correspondence and is kept at the Natural History Museum, RBINS, in Brussels⁷.

As a reference to the Odonata species described by Selys we used the species list by SCHORR & PAULSON (2013). While this list is not complete, with some subspecies treated as synonyms and some species described by Hagen in Selys given as if they were authored by Selys (M. Hämäläinen, pers. comm.), there is no better list available at present, however.

Selys wrote more than 300 scientific papers on many zoological subjects besides Odonata, on which he published about 130 studies. During his later life, he also published bibliographical notes on his own work (e.g. SELYS, 1897b); summaries of Selys' odonatological literature are provided also by DUMONT (1967) and BRIDGES (1994).

PARENTS

The family name, 'Selys', was already established in the 17th century when the family lived in Maastricht, The Netherlands (at the time this was Limburg, a region of Europe that encompassed The Netherlands, Belgium, and Germany) (COEN, 1982: 1). One of Selys' ancestors, Michel Selys (who passed away around 1622) called himself "lord of Opoeteren", a village in the Belgian part of Limburg (PLATEAU, 1902). The name Selys is one of the many variants (e.g. Celys, Celis, Sels) derived from Marcellus⁸. Consequently, Selys should be written without the French "accent aigu". Longchamps was incorporated to the family name after the family acquired a title of nobility over this village in the Liège area. Note that the general area where the family lived was situated in a politically sensitive region, with the city of Liège, and part of Limburg, independent and governed for a long time by a Prince-Bishop but allied with Germany, Luxembourg, and France. The French Revolution ended this situation. Michel Laurent de Selys Longchamps (Laurent), Selys' father, a wealthy aristocrat, held important political positions⁹ in Liège but his loyalty changed sides between the Prince-Bishop and the French revolutionaries on more than one occasion. From 1802–1809 he was representing the department of the Ourthe (including the city of Liège) in

the legislative body in Paris, under Napoleon (PLATEAU, 1902). Paris is also the place where he met his wife Marie-Denise Gandolphe, who was a widow¹⁰ with two children. They married on 9 May 1808. A portrait of the couple was painted by Jean-Joseph Ansiaux in 1809¹¹.

After 1809, Selys' father returned to spend most of his time in Liège and at his property in Longchamps in Waremme ('Borgworm' in Flemish). Around 1810, Selys' father built a chateau in early Empire style at Longchamps¹². In England such huge buildings would be called mansions (WASSCHER, 2012); in Belgium the French term 'chateau' (castle) is widely used.

Michel Laurent de Selys' admiration for Napoleon is evident from the west wing of the castle: the billiard room here is an imitation of the tent of Napoleon during his field campaign in Egypt. Nevertheless, Michel's admiration for Napoleon was not sufficient for him to name his son Napoleon, unlike other high ranking officials during that period. At the time of the Belgian Revolution in 1830 (bringing an end to about 15 years of a union with the Netherlands) Michel was one of the twenty-one members of a Committee advising the National Congress on the creation of an independent Belgium¹³.

YOUTH

Michel Edmond de Selys Longchamps ('Edmond') was born in Paris, the capital of Napoleon's Empire, on 25 May 1813 in the Rue Faubourg Saint-Honoré 130 (*Diary*: 1 July 1900)¹⁴. For reference this was just before Napoleon lost the Battle of Leipzig (16-19 October 1813) and at Napoleon's defeat at Waterloo in 1815, Selys was two years old. Born in the French Empire of Napoleon, Selys thus became a citizen of the United Kingdom of the Netherlands (roughly the Netherlands, Belgium, and the Grand Duchy of Luxembourg) despite remaining in Paris.

Selys had one sister, Amanda, four years older than him, and two half-sisters, Coralie and Laura Smits, thirteen and seven years older than him, respectively. His maternal grandmother also lived in Paris. As his father worked in Liège, Selys' spent his first nine years in Paris surrounded only by women. In 1816 (i.e. 3 years old), he made his first visit to Longchamps and saw his father for the first time (MICHEELS, 1914-1920: 192).

Selys begins writing a diary at the age of 10 (Fig. 1), on 27 August 1823, saying that he arrived from Paris. In the following months he visits Longchamps but leaves for Paris on the 8 September 1825 to live there for most of the next two years¹⁵. He returned to Longchamps before 1 July 1827¹⁶ (*Diary*: 25 December 1840; MICHEELS, 1914-1920: 192).

Notes on Selys' education started in September 1823, with music lessons by Théodore Coumanne. His private tutor Adolphe Hoffmann¹⁷, a lawyer, commenced his instruction in Paris (PLATEAU, 1902). Another tutor, sometime before



Fig. 1. Engraving of Edmond, aged 10, in 1823 [from CAULIER-MATHY & HAESSENNE-PEREMANS, 2008].

1828, was Tirelle de Modine, a teacher in Italian language (*Diary*: 7 April 1848). At the time the common language of diplomacy was French, but it is uncertain whether Selys ever acquired more than a passive knowledge of that language. A rather amusing entry in the diary refers to a visit by Mr and Mrs Kirby to Selys, where he states that he could not understand their English and they spoke not a single word of French! Yet, in 1849 he employed a governess, Miss Marie Claire Cook, as an English tutor for his children. She subsequently became like a member of the family, and remained closely associated with the Selys' until her death in 1894. She probably instructed Selys' daughter Caroline, his son Walthère, and certainly his grandson Marc (see below).

Marc became Professor of Zoology at the Free University of Brussels and was admired by his francophone colleagues for his excellent command of the English language (BRIEN, 1965).

From 1827 onwards, Selys' liberal parents allowed him to read whatever he liked and he never formally attended school or university (COEN, 1982: 21), though he took some courses at Liège University. In an unpublished document Selys complained at the age of 26 about his education and wrote "I am not responsible for my bad education" (SELYS 1841: 1). Nonetheless, numerous people and books influenced him. At first it was Henri Stephens (1799-1889), in 1828 a gardener at Liège University (PORTUGAELS, 2012), who sold him 'Système naturel' on 18 June 1829 and helped him later to arrange his herbarium according to Linné. This probably marks the start of his systematic work on Natural History.

CHATEAUS

In 1810, Selys' father bought and partly rebuilt a second chateau¹⁸ in Liège (on the Mont Saint Martin, with postal address Boulevard de la Sauvenière 34) (Fig. 2). It was a 'hotel' dating from the 15th century¹⁹. From the family of the mother of Selys the family inherited a third chateau at Colonster²⁰, south of Liège. In 2013, this was in use by the University of Liège. The Colonster chateau was inherited by his sister Amanda and was not as often visited as the two previous ones and the latter. The chateau at Halloy near Ciney that had belonged to his father-in-law, was the third place where Selys frequently lived (Fig. 2). His Odonata collections were first at Longchamps and later moved to the Liège chateau.

As with many aristocrats around Liège at that time, Selys spent his summers mostly in the countryside at Longchamps and the winters in Liège (CALVERT, 1901; CAULIER-MATHY & HAESSENNE-PEREMANS, 2008: xxiv). Selys often stayed in a rented accommodation in Brussels because of his work in the Senate; e.g. "Agreed to rent at the hotel de France for 3 francs a day, a room for four months in wintertime" (*Diary*: 10 November 1877). Later it was apparent that

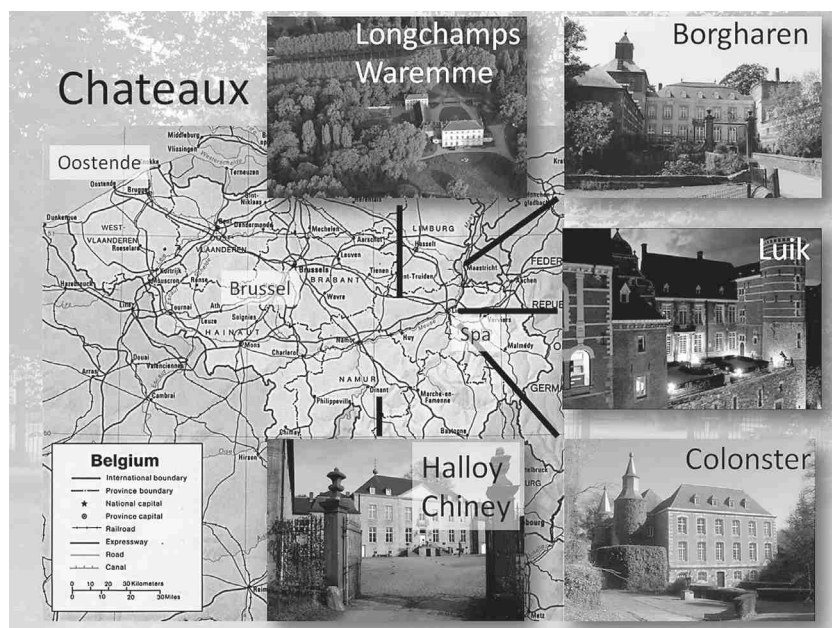


Fig. 2. Castles related to Selys, clockwise: L o n g c h a m p s at Waremme, the summer residence; – B o r g h a r e n (property of his son Raphaël); – M o n t S a i n t M a r t i n, winter residence (here was stored the Odonate collection during the last decades of his life); – C o l o n s t e r, S of Liège (inherited by his sister); – H a l l o y at Ciney (inherited by Selys from his father-in-law). – Brussels, were he often dwelled as senator; – Oostende and Spa, where he often spend holiday.

Selys did not like staying in Brussels because of “the precautions for my health on account of the frequent residence in Brussels during the bad season in winter” (CALVERT, 1901: 33). When in Belgium Selys visited places like Spa and Oostende, but was fondest of the direct surroundings of Longchamps and Liège. Sites that were frequently visited included the Kempen, Limburg (now eastern Belgium), a region rich in water bodies and thus comprised a large number of Selys’ collecting localities²¹.

FAMILY

Selys married Sophie d’Omalius d’Halloy, daughter of the famous Belgian geologist Jean Baptiste d’Omalius d’Halloy, in 1838. They had four children: Caroline in 1839, Raphaël in 1841, Walthère in 1846 and Marguerite in 1848. Selys ensured that the family obtained the inheritable title of ‘baron’ from Leopold II on 31 July 1867 (COEN, 1982: 26-28), but himself avoided the title for most of his life, even stipulating in his marriage contract that he would not use it (WATERMAN, 2005).

Life expectancy²² was 50 in wealthy families like that of the Selys. Selys’ father died in 1837 aged 78, a year before his marriage, and his sister Amanda died in 1838 aged 29 while Selys and Sophie were on their honeymoon in Italy. Selys’ greatest loss occurred, however, when his youngest daughter Marguerite died aged



Fig. 3. Edm. de Selys Longchamps and his family on his 80th birthday 25 May 1893. Selys in the first row left, next to him Raphaël (with mustache), Walthère (with large beard) in the last row right; – [From CAULIER-MATHY & HAESSENNE-PEREMANS, 2008].

four of meningitis in 1852 (WATERMAN, 2005; HÄMÄLÄINEN, 2013). His wife Sophie died of cancer relatively young, aged 51, in 1869 and his youth friend Michel Ghaye died not much later at the age of 59, in 1872 (SELYS, 1872b). Selys himself lived to the age of 87. In his family, only his father in law, Jean d'Oma-lius d'Halloy, with 92 years survived to an older age.

In his diary, Selys mentions his three surviving children equally often. His oldest child, his daughter Caroline, married a baron and a future senator. His oldest son Raphaël (see Fig. 3), became an officer of the cavalry and after 1875 an amateur photographer of considerable talent, whose pictures would later be published in a book (DE NAEYER, 1999; see e.g. Fig. 8); he married a French baroness and they lived in a chateau at Borgharen, North of Maastricht in The Netherlands (Fig. 2). Raphaël and his family inherited the chateaus at Longchamps and Liège. Selys' younger son, Walthère (later sometimes referred to as Walter), struggled with the towering personality of his father and was a bit of a rebel. Walthère (see Fig. 3) liked biology but eventually studied law in Liège. He also travelled in Brazil and la Plata in Argentina in 1872-1873 with the zoologists Eduard van Beneden and Eugene van Volxem on a commission from the Belgian Government (W. DE SELYS, 1875) and collected Odonata, of which a few were named after him (HÄMÄLÄINEN, 2013). Although this trip may have been an important act of self-confirmation for the son (the father never left the European continent), there was an intense correspondence between Walthère and his father. In 1875, however, Walthère wrote a letter to his father in which he confessed that he had made Philomène Joséphine, the cook at Longchamps, pregnant (WATERMAN, 2005). Selys was very upset about this (*Diary*: 22 February 1875). Walthère and Philomène left Longchamps and co-habited, unmarried, in Paris and later Genève, Switzerland. Apparently Selys kept pressuring his rebel son to end this situation. The couple finally got married on 13 October 1881 in Paris, but the union was backdated by 10 years, as if it took place on 13 October 1871. Indeed, their oldest son Marc (though born 30 June 1875, was never mentioned in Selys' diary before the marriage). Note that Marc would later study biology under August Lameere in Brussels and become a well-known Zoology Professor at the same institution. Marc's expertise was in the marine phyla Phoronidea and Tunicata (BRIEN, 1965). Walthère and his relatives inherited the chateau at Halloy; later Walthère became a senator like his father.

TRAVELLING EUROPE

Selys liked to travel. His longest voyage was his honeymoon trip (from 1 March to 10 August 1838) that brought him and Sophie as far South as Naples (Fig. 4). On this trip he visited the collections of small mammals in Paris, Lyon, Strasbourg, Frankfurt am Main, Rome, Pisa, Milan, Genève (COEN, 1982: 103). His furthest voyage was to Sweden (from 31 July 1874 to 24 August 1874) where he attended

a Congress of Anthropology and Archeology in Stockholm. The northernmost town he visited was Uppsala where he made a pilgrimage for Linnaeus and visited Linnaeus' tomb and his small estate Hammarby. The easternmost place Selys visited was Budapest, for a Congress of Statistics (voyage from 9 August to 19 September 1876). On this trip he visited collections at Strasbourg, Munich, Vienna, Budapest, Augsburg, Stuttgart and Darmstadt (COEN, 1982). In Vienna Selys stayed from 20 to 31 August and worked for several days with Friedrich Brauer. The southwestern most place visited was Biarritz, in 1858, and the northwesternmost site visited was Loch Katrine near Stirling (EVANS, 1905). This latter trip took place during the second half of June and July 1845, when visiting Scotland for the collections of Robert Greville and James Wilson at Edinburgh; later, he gave a presentation at Oxford²³ (SELYS, 1846). Selys visited London several times, including a trip to the collection of dragonflies of Linnaeus at the Linnaean Society on Soho square (*Diary*: 1 August 1851).

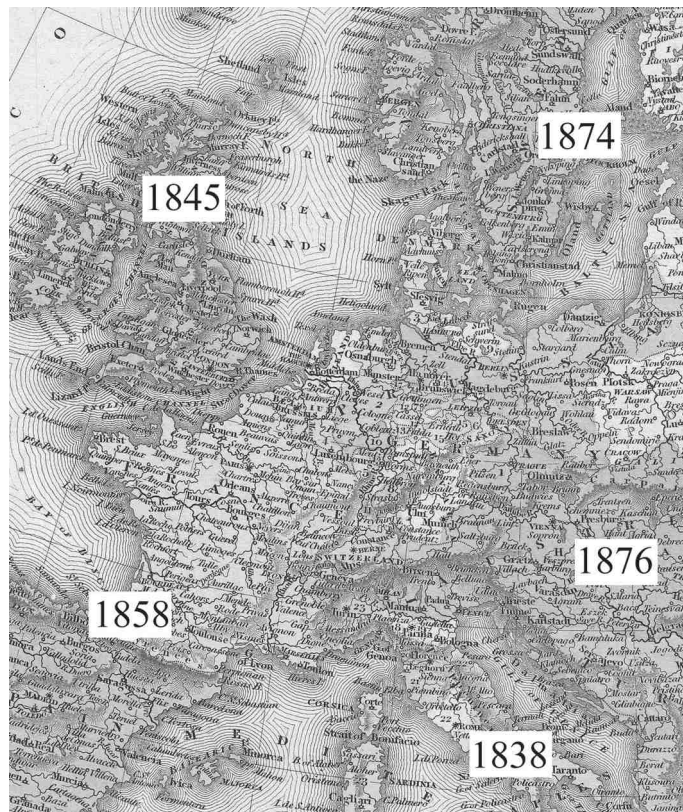


Fig. 4. Map of central Europe, with (dated) outer corners of his travels.

POLITICAL CARRIER AND HIGH CONNECTIONS

On 6 February 1843 Selys became a communal councilor of Waremme (COEN, 1982: 38) and was later a provincial councilor. For a short time, he was also a member of the Chamber of Representatives for Waremme. He attended the first Belgian Liberal Congress in 1846 and, as a liberal, was sent to the national Senate in 1855, to represent the district (“arrondissement”, in French) of Waremme. He maintained this office until a few months before his death in 1900. The Senate elected him Vice-president in 1879; in 1880 he was appointed President for four years (Fig. 5b). In his letters to Phillip Calvert, Selys frequently referred to the great amount of time consumed by his senatorial duties (CALVERT, 1901) and RIS (1901: 367) wrote that political work took a large share of his working time. Selys was a multi-millionaire by descent; he was a landowner who collected goods and rent from the farms on his land. As a member of the Senate, Selys was a nobleman amongst many other noblemen. To be eligible to join the Senate, one had to pay 1000 florins which meant that (at around 1830) only about 4000 persons in Belgium could be elected senator (WIKIPEDIA, 2012). Note that senators were not paid for their work.

Selys was a republican, like his father, and was disappointed when the newly-created Belgian state did not choose to be a republic. It took him a long time to accept the King as his sovereign. Shortly after the February Revolution in 1848, Selys went to “sniff the revolutionary air” in Paris (WATERMAN, 2005). On 15 May he wrote in his diary: “After 4 hours in the sun we could not enter the Assembly [in the Palais de Bourbon]. Bought entrée tickets earlier that morning. The tribunes were invaded by 150,000 people who arrived from over the bridge”. It was a workers protest and Louis Blanc and Alexandre Albert closed the general meeting and started a new government. That day Selys was in a place where world history was written.

A few weeks later, on 26 June 1848, the Belgian King, Leopold I, opened the Parliament. Selys wrote “Everyone applauded except me!”. On 5 July 1848 Selys refused to dine with the King: “I will not haunt the court”. A day later someone from the royal palace warned Selys they considered him to be too much of a republican. However, things eventually cooled down and Selys ended up in good terms with the royal family, and often dined with Leopold I and later with his son Leopold II. Selys occasionally dined with the Dutch King William III (‘Guillaume III’).

In January 1866, Selys was sent on a special diplomatic and royal mission. After the death of Leopold I on 10 December 1865, he was asked to return his Italian decorations to King Victor Emmanuel of Italy (BRIEN, 1968). On 14 and 18 January 1866 he dined with Victor Emmanuel in Florence, then the capital of Italy. They talked “about hunting, natural history and public works” (*Diary*: 18 January 1866). He took advantage of this visit to Italy to visit six Italian bird collections (SELYS, 1870b).

WHAT WAS SELYS LIKE?

COEN (1982) puts on the cover of his book on Selys a Jesuit dictum: ‘Fortiter in re, suaviter in modo’: gentle in manners, strong in deeds. Indeed, he seems to have been an amiable man. Leonie de Waha said about her uncle Selys: “he loves



Fig. 5. Some portraits of Edm. de Selys Longchamps: (a) lithography from circa 1843 [from CAULIER-MATHY & HAESSENNE-PEREMANS, 2008]; – (b) President of the Senate, painting after photograph, see *Diary* 30 March 1881; (c) – undated portrait [from COEN, 1982]; – (d) portrait from circa 1883 [from COEN, 1982]. The respectively age of Selys was ca 30, 67, 75 and 70 years.

the world, gaiety, children and dancing” (PORTUGAELS, 2012).

LAMEERE (1902: 5), the influential Zoology Professor at the Free University of Brussels, described his first meeting with Selys at an assembly of the Belgian Entomological Society on 7 February 1880; at the time Lameere was 15 and Selys was 66. “Great and solid, he was at the same time old and pleasantly young. His long hair hung over his ears on his collar and gave him an appearance as if he was from another century. I would have thought him to have stepped out of an old Dutch painting. When he began to talk to give an advice on the household of the society, his words made me guess that it was him”. Interestingly, this long hairstyle was likely a deliberate choice of image; for example, on a painting of the members of the Senate in 1888 (COEN, 1982: 185), one sees many moustaches, beards and whiskers, but no such long hair. Selys had long hair on a lithography dated back to when he was perhaps thirty (Fig. 5a). What LAMEERE (1902) suggested might be true: in appearance, he looked like his ancestor François de Selys (1626-1681; COEN, 1982: 6) on a painting that in 2012 still hangs on one of the walls of the Longchamps chateau.

Unassuming, simple in his habits, Selys went to bed early and did not drink wine until the age of forty, and even then only in moderation (WATERMAN, 2005). On the other side, Rudolf Blasius wrote that while he was on a visit to Selys’ home at Longchamps (12 August 1884), the servants at dinner were in great livery. Selys himself was very hospitable: he would have had Blasius and his wife stay for more than a day. The winter before, the ornithologist Henry Tristram even stayed for several weeks, lodging in a room on the second floor of Longchamps (BLASIUS; 1901: 368).

Selys was an active man, who liked to hunt, was a good horse rider and learnt to ride a bicycle after his eightieth birthday²⁴. But his diary indicates that he liked to smoke cigarettes and cigars and also to gamble. Selys often went to theater (visits 127 times mentioned), concerts (120 visits²⁵) and he loved opera (131 visits²⁶) (CAULIER-MATHY & HAESSENNE-PEREMANS, 2008: 1689-1695). He visited many zoological museums but also enjoyed museums of archeology, anthropology, culture and geology.

FRIENDS

At Longchamps, since 1823 he had a youth friend, Michel Ghaye (SELYS, 1872b). Unlike Selys, Ghaye went to school but they sometimes took lessons together in the evening (*Diary*: 11 October 1829). Later Ghaye became his ‘confidence man’ (LAMEERE, 1902: 4). From 1842 onwards, Selys and Ghaye published yearly on the phenology (‘the timing of periodic phenomena’) of plants and animals (e.g. SELYS, 1848), in the period 1842-1872 (animals), in the period 1849-1873 on 21th March, 21th April and 21th October (plants) (SELYS, 1897b; CAULIER-MATHY & HAESSENNE-PEREMANS, 2010: item 84). They were

stimulated to do so by Adolphe Quetelet, the “father of statistics” and Professor at the University of Gent, and they published on zoological statistics in Belgium in ANONYMOUS (1852); see BRACKE (2008).

Though Selys had many contemporary entomological friends in the Belgian Entomological Society, none of these specialized in the Odonata. Some collected Odonata for Selys, for example Martin Robyns (entomologist and colleague in the Senate, who captured at Geel, Northern Belgium, the holotype of *Soma-tochlora flavomaculata*, described by Vander Linden in 1825). Baron Joseph de Villenfagne de Vogelsanck²⁷, Ernest Candèze (1828-1898), Jules Putzeys (1809-1882), Camille van Volxem (1848-1875) and Edgard Claes (1856-1895) were other Belgian entomological friends; Adrien Maurissen from The Netherlands should also be cited here.

ODONATOLOGICAL FRIENDS

Selys’ best odonatological friend was Hermann Hagen (Tab. I). After they had both published papers on European Odonata in 1840, they started a correspond-

Table I
Friends, colleagues and disciples from Edmond de Selys Longchamps, interpreted mainly from the number of references in CAULIER-MATHY & HAESSENNE-PEREMANS (2008)

Name	Residence	Life-span	First contact	Number of page references in Diary
friends				
Hermann Hagen	Königsberg, Berlin (Germany), Cambridge (USA)	1817-1893	1841	98**
Robert Mac Lachlan	Lewisham (UK)	1837-1904	1855	106**
colleagues				
Herman Albarda	Leeuwarden (Netherlands)	1828-1898	1875	24*
Friedrich Brauer	Vienna (Austria)	1832-1904	1876	12*
Ferdinand Karsch	Berlin (Germany)	1853-1936	1891	8
William Kirby	Dublin, London (UK)	1844-1912	1883	4*
disciples				
Guillaume Séverin	Brussels (Belgium)	1862-1938	1888	72**
Friedrich Ris	Rheinau (Switzerland)	1867-1921	1885	54**
Friedrich Förster	Schopfheim (Germany)	1864-1918	1896	35**
René Martin	Le Blanc, Indre (France)	1846-1925	1893	32**
Philip Calvert	Philadelphia (USA)	1871–1961	1893	13*

*They met in person once or twice; – ** They met in person several times

ence in 1841 and they met in spring 1843 in Paris (CALVERT, 1901). They worked together on a European “Revue des odonates” (1850) and two large monographs on Calopterygidae and Gomphidae, published in 1854 and 1858 (Tab. II). After the monographs Hagen often added descriptions to the work of Selys until 1886. In 1867 Hagen came over for a long visit to Selys and his collection in Liège²⁸. How close they were can be illustrated by the last day of his visit: “My last morning with Hagen. He left at 15:45 for Cologne. I hugged him at the station. His last work, the train was ready to leave, had been the translation of the text of *Arvicola campestris* by Blasius”²⁹ (*Diary*: 17 September 1867). This was just before Hagen emigrated from Königsberg (now Kaliningrad, then part of Germany) to Cambridge³⁰ in the USA. After this separation they continued their close friendship, though they never again met in person.

His second best friend in odonatology was Robert McLachlan, a British entomologist and pioneer in the study of the world fauna of Trichoptera and Neuroptera. On the last group in northern Asia they published together in SELYS & McLACHLAN (1872). They first met on 23 July 1855 in Ostend, a town on the Belgian coast, and saw each other from time to time. At such occasions, they went on joint excursions e.g. to the Hautes Fagnes in Belgium. In his testament, Selys formulated the wish that Robert McLachlan should finish the description of his large odonate collection, and reserved a generous financial compensation for this. McLachlan, however, turned down the offer (see below).

Table II

The mayor work of Edm. de Selys Longchamps: monographs with H. Hagen (2) and synopses (26)

Title	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eight
Synopsis des calopterygines	1853	1859	1869	1873	1873	1879		
Monographie des calopterygines	1854							
Synopsis des gomphines	1854	1859	1869	1873	1873	1873	1878	
Monographie des gomphines	1858							
Synopsis des agrionines	1860	1860	1862	1862	1863	1865	1876	1877
Synopsis des cordulines	1871	1874	1878					
Synopsis des aeschnines	1883							
Revision du synopsis des agrionines	1886							

ODONATOLOGICAL COLLEAGUES

Perhaps surprisingly, contact with three important odonatologists in the 19th century, Hermann Burmeister, Pierre Rambur and Toussaint de Charpentier, is minimal. Burmeister is mentioned in the diary only once. Selys tried to visit a museum with the types of Hermann Burmeister in 1880, after a visit to Wilhelm Schlütter, who lived at Halle, but he found the museum closed (*Diary*: 28 September 1880). There are no records mentioning correspondence between Selys and Pierre Rambur, the most important contemporary French odonate specialist³¹; likewise, Rambur never mentioned any correspondence with Selys (RAMBUR, 1842: xvi-xvii). Similarly no correspondence with Toussaint de Charpentier is mentioned by Selys, either. The two European odonatologists that Selys corresponded with and met at least once were Herman Albarda and Friedrich Brauer (see Tab. I).

ODONATOLOGICAL DISCIPLES

In the last twelve years of his life Selys had several odonatological students, with the most important being Guillaume Severin who was very close to Selys. Severin was born as Wilhelm Peter Robert Severin on 25 August 1862 in The Hague (ANONYMOUS, 1862; BOONE & DE RUITER, 1994), where his Dutch (but originally German) father was a court photographer. On 26 February 1888, Severin³² is first mentioned in the diary of Selys “Mr Severin, a young entomologist, came to see my collection”. Selys was 75, Severin 26. Severin would become an ‘aide-naturaliste’ at the Royal Museum in Brussels in December 1890 and was promoted in 1899 to the post of curator of the Department of Arthropods (MISKHEL, 2011). He would paint the larger part of the plates from the odonate collection of Selys, the Anisoptera. Other odonatological disciples included Friedrich Förster³³, Friedrich Ris, René Martin, Philip Calvert and Ferdinand Karsch (see Tab. I).

THE FRENCH CONNECTION

Being born in Paris, that city was also the most frequently visited non-Belgian travel destination of Selys. Every now and then he went there and often he brought back birds, dragonflies and other insects he bought there. For example, in 1858 he wrote: “Bought Neuroptera from Veracruz [Mexico] at Emile Sallé, rue Guy Lambrosse 13; bought a *rustica* from Mr Pivot, a *pusilla* from Mr Lefèvre [both *Emberiza* birds, respectively Rustic and Little Bunting], and pins from Mr Evans.” (*Diary*: 14 October 1858). On some days he mentioned to have bought items from five different salesmen. He sometimes visited the Entomological Society of Paris (Fig. 6), e.g. on 26 June 1867.

On his honeymoon in 1838, he first visited the collections at Paris and Lyon after which he went to southern France where at Aix-en-Provence he twice (11 March and 12 March) met Etienne Boyer the Fonscolombe (who was 70 and Selys 24 years old). Boyer the Fonscolombe had just published a monograph on the Odonata in the surroundings of his hometown (BOYER DE FONSCOLOMBE, 1837)³⁴. In 1840 Selys dedicated a new *Sympetrum* to him: *S. fonscolombii*. In 1858 he went on a long excursion to the Southwest of the country in the surroundings of Biarritz (SELYS, 1858).

THE DUTCH CONNECTION

After Selys had published on the faunistics of the vertebrates of Belgium in 1841, he decided it would be necessary to visit collections in The Netherlands and the North of France (SELYS, 1883: 82). On 8 May 1841 he left Antwerp by stagecoach for The Netherlands, a trip that at that time still took several days to complete. On 10 May he arrived at Leiden and made a walk with Willem de Haan (the describer of *Lindenia*, 1826). The next day he met Coenraad Temminck and Herman Schlegel at the Leiden Museum, both very honourable ornithologists and mammalogists. He did not mention visiting the Odonata collection that year, but he collected dragonflies himself at Leiden, Amsterdam, Haarlem and Utrecht. On 21 April 1851 Selys once again traveled from Antwerp to The Netherlands. The next day in Leiden he noticed that the friendship between Schlegel and the 27 years older Temminck had ended³⁵. On 24 April 1851 he counted in the Leiden collection a total of 840 odonates referable to 350 species. Selys visited the Leiden collection on another four occasions: in September 1864, August 1879 (when he made a summary catalogue



Fig. 6. Edm. de Selys Longchamps as a member of Entomological Society of France, his first known photograph (probably 1855; see *Diary* 17 April 1855). – [From internet, at <http://gallica.bnf.fr/ark:/12148/btv1b84329382/f19.item>]

of the collection), in July 1885 and in 1895 at the third and very successful International Congress of Zoology. On the last occasion he presented a paper 'Le progrès dans la connaissance des odonates' (SELYS, 1895).

Herman Albarda, a Friesian lawyer, entomologist and birdwatcher, was a Dutch colleague, with whom Selys corresponded between 1875 and 1895. They met at least once: in 1878 Selys went to Liège to see Albarda (*Diary*: 25 August 1878). Albarda sent species from the Far East to Selys (e.g. Beijing, China; *Diary*: 12 August 1886) and described some himself³⁶.

Selys had a large influence on the Dutch Odonata faunistic literature in the second half of the nineteenth century. It is very likely that the publications by Selys were used as examples by the Dutch for writing their odonate faunistics (HERKLOTS, 1852; SNELLEN VAN VOLLENHOVEN, 1866). These authors both saw Selys two years before their publication in Leiden, respectively in 1850 and in 1864 (*Diary*, 22 April 1850 and 29 September 1864).

Since his eldest son, Raphaël de Selys Longchamps, became owner by marriage of the castle at Borgworm, just North of Maastricht in The Netherlands ('Haren' in the diary), Selys often visited this southern part of The Netherlands after 1886.

COMMERCIAL CONNECTIONS

While Selys collected as much material as he could, he also received collections from various sources (including his son Walter, see earlier) and purchased the larger part of his dragonfly collection, which depended on whatever specialized merchants had to offer. He had a special connection with Henry Bates, who travelled and explored Brazil from 1848 to 1859 for commercial collecting. On 9 August 1851 he first saw a new genus related to *Euphaea*³⁷ with Samuel Stevens captured at Ega, "which he got from Mr Bates (from the Amazon)". The British commercial naturalist Samuel Stevens is mentioned 16 times in the diary. The next time Selys mentioned Bates was on 23 January 1865: "At the customs authorities I picked up 500 dragonflies of the Amazon collected by Bates"³⁸. In 1871 at London, he had breakfast with 21 people, where the name Bates is underlined (*Diary*: 1 July 1871), showing that he was special to Selys.

With Alfred Wallace the relationship was less close. Wallace started collecting around Belem in Brazil together with Bates, but returned to England earlier; on his return on 9 August 1852 his ship caught fire and all of his specimens were lost. Many Odonata Wallace collected later in the Malay Archipelago were bought by Selys.

The German merchants most frequently mentioned in the diary are Hans Fruhstorfer ("Birthday party 85 years. Showed my big collection to Fruhstorfer with whom I spent two hours"; *Diary*: 25 May 1898). Another German seller whom he often mentioned was Otto Staudinger; whom he visited on 22 September 1880 at

Dresden in his villa Diana, with its splendid collection (*Diary*). He was an associate of Staudinger together with Ernst Heyne. These three (or their collections) are mentioned in his diary respectively 37, 19 and 23 times.

SELYS AS NATURALIST AND SCIENTIST

Selys' natural observations started at the age of 11. He shot an *Emberiza citrinella* (a Yellow bunting, bird), and caught butterflies and a damselfly for the first time (*Diary*, resp. 24 February, 10 July, 13 July 1824). On this last date he also mentions that baron Ferdinand [baron de Borchgrave d'Altena, his brother-in-law] had given him two months before this date a *depressa* [*Libellula depressa*] and a *virgo* [*Calopteryx virgo*] which Selys tried to feed. Soon after, he began to study the insect book of Latreille (*Diary*: 26 July 1824).

On the age of 15 Selys wrote his first article: a catalogue of non-winged insects, Neuroptera (including Odonata) and butterflies. While this was later published in the '*Dictionnaire géographique de la province de Liège*' (SELYS, 1831), virtually all names used in this article, including the 'new species', are wrong, and thus Selys still had a lot to learn. With his first mammal species descriptions in 1836, Selys begins his scientific career³⁹.

Though he is widely considered an autodidact, Selys became an erudite naturalist: "Duty called him into political service, and he fulfilled it with great devotion and success, but the study of nature was his passion" (WATERMAN, 2005). We know him as a devoted odonatologist but his interests extended to the Belgian fauna more generally to mammals, birds, trees and meteorological phenomena (CALVERT, 1901). Selys studied the animals of the interior and fresh water, and his contemporary and friend Pierre Van Beneden studied marine and coastal-terrestrial fauna (PLATEAU, 1902: 77; COEN, 1982: 104).

Table III

Some genera and species named after Edm. de Selys Longchamps, which are considered valid in 2013.
– [Species-group names in Odonata are not listed; for these see BRIDGES, 1994]

Plants: *Selysia* Cogniaux, 1881; **Odonata:** *Selysioneura* Förster, 1900 and *Selysiothemis* Ris, 1897
Ascalaphidae: *Colobopterus selysi* van der Weele, 1903, *Ameropterus selysi* (Van der Weele, 1909) and *Proctarrelabis selysi* van der Weele, 1909; **Plecoptera:** *Marthamea selysii* (Pictet, 1841); **Trichoptera:** *Sericostoma selysi* Pictet, 1865, *Glyphotaenius selysii* McLachlan, 1869 and *Hydropsyche selysi* Ulmer, 1907; **Formicidae:** *Formica selysi* Bondroit, 1918; **Mecoptera:** *Bittacus selysi* Esben-Petersen, 1917; **Megaloptera:** *Neurhermes selysi* (van der Weele, 1909); **Myrmeleontidae:** *Palpares selysi* Esben-Petersen, 1926; **Coleoptera:** *Platypus selysi* Chapuis, 1865 and *Tiracerus selysi* (Schaufuss, 1880); **Arachnidae:** *Corinna selysi* (Bertkau, 1880); **Fossil molusc:** *Fusiturris selysi* (De Koninck, 1837); **Psocoptera:** *Hemipsocus selysi* Banks, 1918; **Lepidoptera:** *Aglais selysi* Donckier de Douceel 1881 and *Celaenorrhinus selysi* Berger, 1955; **Orthoptera:** *Discotettix selysi* Bolívar, 1887; **Fossil bird:** *Vanellus selysi* Van Beneden, 1871; **Mammals:** a *Myotis* subgenus *Selysius* Bonaparte, 1841, occurring in southeast Asia and Australia, is now treated as junior synonym of *Myotis* (WILSON & REEDER, 2005).

Selys was interested in and he was a member of many different scientific organizations: anthropological, economic, geographical, geological, human rights, malacological, medical, statistical etc. (CAULIER-MATHY & HAESSENNE-PEREMANS; 2008: 1656-1658). He was a founding member (and served several terms as the President) of the Société Entomologique de Belgique in 1856. He was also active in the 'Académie royale des Sciences de Belgique', and was an honorary member of almost all European entomological societies.

Less expected might be his membership of the Botanical Society, 'Société royale de Botanique de Belgique'. Alfred Cogniaux, President of this Society, named a plant genus from Central and South America after him as *Selysia* Cogniaux, 1881, one of the 125 genera of the Cucurbitacea (COGNIAUX, 1881) (Tab. III).

HIS COLLECTIONS

As a teenager, Selys already had a cabinet with e.g. eggs of Buzzard (*Buteo buteo*), Golden Oriole (*Oriolus oriolus*), some minerals (*Diary*: 9 July 1824), a butterfly collection (*Diary*: 9 March 1828) and a herbarium (*Diary*: 17 October 1829). He enlarged his collections by collecting himself, getting additions from friends and family, and last but not least by commercial purchases. He continuously kept arranging his collections: "Together with Mr Stephens I have arranged my herbarium in the way of Jussieu." (*Diary*: 17 October 1829). And "I started with the rearrangements of my libellules after Brauer. ... They are now in 46 cases and 4 with *Cordulia* in 3 weeks." (*Diary*: January 1873).



Fig. 7. Edm. de Selys Longchamps with a Calopterygidae cabinet [From COEN, 1982]

CALVERT (1901) wrote: in the *Revue* in 1850, “Selys had given notice of his intention to extend his researches to the exotic forms. He had already acquired the collections of Latreille, Rambur, Audinet-Serville and Guerin-Meneville with this end in view”⁴⁰. Other collections acquired, and not mentioned on other places, where at least parts of those from Toussaint de Charpentier and Wilhelm Schneider⁴¹. Selys writes in 1858 he softened the dragonflies of both collections (*Diary*: 23 May 1858).

Selys’ collections⁴² (Fig. 7) became so large that he constructed an extra building to house them: it is the grey building right of the entrance (as his great-great granddaughter told the first author on a visit to the castle on 15 August 2012). The collections were visited not only by experts, but also by students from Waremme. His friend Charles Lucian Bonaparte (2nd Prince of Canino and Musignano and a nephew of Napoleon I, II and III) named his collections the ‘Museum Selysianum’ (BONAPARTE, 1850).

In 1895, having just returned from the Third International Congress of Zoology in Leiden on 23 September, he counted 1530 odonate species in his collection at Liège. At that time he lacked approximately 280 described known species. Kirby in 1889 (= probably KIRBY, 1890) said he knew 1830 types, Calvert at the end of 1892 knew 1982 types (*Diary*: 27 September 1895). In 1905 his collection contained 1854 out of the 2100 species known at the time (SEVERIN, 1905).

Shortly before 1905, the Selysian Odonata collection was moved from Liège to RBINS in Brussels (SEVERIN, 1905). The other collections were moved from Longchamps to RBINS in 1932 (ANONYMOUS, 1932). A butterfly collection was transferred to Brussels only in the 1970s, still in an impeccable state.

DESCRIBING ODONATA

Selys described several insects⁴³ beside odonates and several vertebrates⁴⁴. But Selys was the first true Odonata taxonomist and his work and large collection has been crucial for the later development of odonatology. Most essential was perhaps his insight in the importance of wing venation as an essential tool in taxonomy, and this remains valid in spite of the recent discovery of a number of wing vein homoplasies. Note that this idea was not entirely novel as BURMEISTER (1839) used wing venation too and Selys was also influenced by a publication by VAN DER HOEVEN (1828) that introduced the difference of the triangle direction

Table IV
Number of described odonate genera and species
(SEVERIN, 1919)

Year	Author	Genera	Species
1767	Linnaeus	1	20
1793	Fabricius	3	65
1839	Burmeister	6	159
1842	Rambur	33	350
1871	de Selys Longchamps	190	1357
1879	McLachlan		1700
1890	Kirby	313	1900
1891	Calvert	321	1922

as difference between the genera *Aeshna* en *Libellula* (SELYS, 1840: 20, 192).

According to CALVERT (1901), the literature written by Selys can be divided into three groups. The first group deals almost exclusively with European species and embraces the years from 1831 to 1851. The results of this are summarized in his chief work of this period, '*Revue des odonates ou libellules d'Europe*' which he wrote with Hagen in 1850. The second period is that of the monographic revision of the Odonata of the world, from 1853 to 1886 (see Tab. II). In SELYS & HAGEN (1854) the authors wrote in the preface: "It is in our thoughts only the commencement of a History of the Odonata, that we hope to bring to an end in a few years. Our project is to publish successively, under the form of monographs, the five or six subfamilies that constitute the Odonata, and of which we already know about a thousand species." In the end they published only two monographs⁴⁵, although Selys published by himself 26 issues of studies he called 'synopsis' (Tab. II). These were meant to "consist of the synoptical tables which he prepared for his own use whilst working upon a monograph of the Calopteryginae [...]. Each is intended in fact as a sort of prodrome to the larger work, and contains in a semi-tabular form, short characters of all divisions, genera and species which will be described more fully in the latter" (ANONYMOUS, 1854). The third group of Selys' dragonfly publications are chiefly faunal papers⁴⁶, and while they began as early as 1857, they did not occupy much of his working time, nor were they extensive until 1878-1879. Asia was relatively well covered by these papers but Africa less well so.



Fig. 8. Edm. de Selys Longchamps (right from the centre, aged 75) entering a coach 1888; [Photograph by Raphaël de Selys Longchamps, from DE NAIJER, 1999]

Selys' work contains no reference to evolution in the Odonata (CAULIER-MATHY & HAESSENNE-PEREMANS, 2008: xli), although he bought the French translation of Darwin's *Evolution by natural selection* in 1862 (*Diary*: 22 September 1862) and he was present at the appointment of Charles Darwin as an associated member of the 'Academie royale de Belgique' in 1870 (*Diary*: 15 December 1870).

DRAWING ODONATA

In most of his publications on Odonata, Selys does not provide figures. This is intriguing as Selys wrote in an article on barklice Psocidae: "Mr McLachlan said, it is very desirable that such drawings should be published, because we know by experience how difficult it is for a student, commencing his studies of the Psocidae, to follow description of the peculiarities presented by neuration [nervation], without the aid of figures" (SELYS, 1872a). Such considerations apply to odonates. Why then did Selys include so few illustrations in his publications? RAMBUR (1842: iii) was very critical about the drawings in one of Selys' early papers (SELYS 1840) and wrote: "In 1840 de Selys published a monographic work on the European libellulidées [...] and gave figures that are little accurate and less appropriate than those from de Charpentier". While Selys continued to use a few figures in some subsequent articles (e.g. SELYS, 1843) these comments likely affected him. His later publications contain drawings by Hagen (SELYS & HAGEN, 1854; 1858) or Severin (SELYS, 1889). An additional reason for a lack of illustrations, may be that he described species from collections he visited while travelling around Europe. However, as few of these could be accessed by further loans he had to hurry to complete the descriptions and probably was afraid of making mistakes in illustrations (SELYS, 1874).

Before his marriage with Sophie in 1838, she took a course for aquarelle painting (*Diary*: July-August 1837: 181). After her death in 1869 Selys started to draw aquarelles of Coenagrionidae although before that date he sometimes drew birds (e.g. hybrid-birds; *Diary*: 3 April 1867). One of the first known watercolours, dated 6 November 1874⁴⁷, painted at Halloy, is of *Agrion caeruleescens* Fonscolombe, 1838 (now: *Coenagrion caeruleescens*). The existence of these watercolours was known (e.g. CALVERT (1939) and one of us (HJD) but they were traced to RBINS, the natural history museum in Brussels, by Matti Hämäläinen (HÄMÄLÄINEN, 2009; WASSCHER, 2012). LAMEERE (1902: 12), wrote about the intentions Selys had in mind with the plates: "[Selys] had a dream to publish one day a great iconographic work on odonates". These plates have proven to be a very valuable addition to the Selys collection, particularly when holotypes have been broken or lost (HÄMÄLÄINEN, 2009; BOTA-SIERRA, 2012; WASSCHER & VAN 'T BOSCH, 2013).

TAXONOMIST

Selys was born in the year in which DE CANDOLLE (1813) introduced the words ‘taxonomy’ and ‘priority’⁴⁸ into biology. In 1842 SELYS (1842; iv) asked himself “Recognizing the right of priority seems the only way to understand each other and prevent that zoology soon becomes a chaos, a true Babel, as long as it is fixed at 1760, the period of the establishment of the binary nomenclature by Linné and of the publication of Brisson’s book for all the genera not adopted by Linné” (see DAYRAT, 2010). The first realistic code of zoological nomenclature was presented by STRICKLAND (1843) whom Selys probably knew quite well since Hugh Strickland and his wife visited in 1845 the collection at Longchamps (*Diary*: 30 September 1845). Thus, we may assume Selys was familiar with the first Code of Zoological Nomenclature⁴⁹.

On the first International Congress of Zoology in 1889 in Paris, the Code of Zoological Nomenclature was discussed. One of the participants in the discussions was Selys “I took much part in the discussions The matter of the priority will be discussed in three years time” (*Diary*: 10 August 1889). According to DAYRAT (2010) Selys “suggested that any rule adopted by the Congress should simply be regarded as some kind of advice, not as a law that would have authority over zoologists”. Others suggested “It was a good place and was the ideal opportunity to agree on common rules”⁵⁰.

ENVIRONMENTAL POLLUTION

Selys’ life began in an era of horse and wind power, with travelling taking place largely by stagecoach and/or ship. Nonetheless in 1838 there was a train connection between Waremmes and Brussels, and Selys made use of steamships, bicycles and cars as they became available during his lifetime. Many of the problems associated with increasing human population and industrial development were recognized by Selys. For example in 1882 he wrote about the problems of water pollution of small rivers (SELYS, 1882). Three years before his death, he gave a lecture at the Académie Royale on the subject of ‘Le déclin d’une faunule’, which was published in SELYS (1897a) (text see COEN, 1982: 115-119). This paper is a complaint on the destructiveness of ‘modern’ agricultural techniques and degradation of nature. He saw a decline of the fauna at a world level as well as locally: in the Hesbaye (in the surroundings of Longchamps) he saw species and their numbers collapse, he observed the pollution of the brook ‘Le Geer’ by industry and was worried about all this. Indeed, nature in this part of Belgium has suffered. While many parts of the civilized world were still in a pristine state, he saw happening, in the 19th century, in his very backyard, what the future would bring to large parts of the industrial world.

In the same year, he celebrated his 84 birthday with 19-20 people at the table.

There his friends McLachlan and Candèze informed him that the President of the Entomological Society of France had announced erroneously his death and praised him (*Diary*: 25 May 1897). But though nature was in decline, Selys himself was still going strong.

HIS LAST YEAR

Just before his 86th birthday, on 7 May 1900, Selys left the Senate in an emotional ceremony⁵¹ (LAMEERE, 1902: 5). His resignation, he wrote to an American correspondent, was due to “my age; the precautions for my health [...]; the desire to live in my family for the few years that remain to me; and above all to enjoy a little liberty which will permit me to work at my odonates, on which I am very much behindhand on account of the Senate” (letter of 8 June 1900) (CALVERT, 1901).

In June he attended an ornithological congress in Paris, being present at all meetings and other activities. He visited the world exhibition as well. Back at Longchamps he was very tired and did not work⁵² each day as he normally did (BLASIUS, 1901). His last letter was on 5 November 1900 to Williamson (GLOYD, 1983). In this, Selys wrote about Förster as being young, zealous, which was likely to start later a warm friendship between the two. On 4 December he left Longchamps for Liège to make a better treatment possible and on 8 December he went in a state of coma. He died on 11 December 1900 at 6:00 in the morning, at the age of 87 (BLASIUS, 1901: 363).

The funeral started on 14 December at his chateau in Liège, where seven honorable men spoke. The funeral procession went under a military salute to the St-Croix church next door, where a service was held and after that proceeded to the railway station of Guillemin⁵³. From here the train with his coffin left to Waremme under a second military salute. The next day he was interred in the family mausoleum on the local graveyard, the ground of which Selys had donated to the village of Waremme around 1850 (BLASIUS, 1901: 364). The Selys family mausoleum (see COEN, 1982: 198; WASSCHER, 2012) looks as if it was lifted from the graveyard Père Lachaise in Paris (for which the ground was donated by Napoleon I to the city of Paris). Likewise, the two ‘SL’ (de Selys Longchamps) marks that Selys had arranged above the front door of his chateau at Longchamps is nearly a copy of the ‘SL’ (‘Saint Louis’) mark in the ‘Dome des Invalides’ (now the mausoleum of Napoleon), are both nods to Paris, where he was born 87 years earlier.

DESCRIPTION OF THE COLLECTION OF SELYS

The testament of Selys contained the explicit wish that others should complete the description of his large collection. Clearly, Selys had in mind one of his

Table V

Titles of the Catalogue of Edmond de Selys Longchamps (*Catalogue systématique et descriptif des collections zoologiques du baron Edmond de Selys Longchamps*; see, e.g. TRIEMPONT, 2005), including the not published parts (see e.g. SEVERIN, 1919)

Publ.date	Fasc.No.	Author and subject
	1	Introduction
1913	2	BURR, M.: <i>Orthoptères</i> . 35 pp.
1912	3(1)	ENDERLEIN, G.: <i>Embiidinen</i> . 121 pp., 75 figs, 4 pls
1915	3(2-3)	ENDERLEIN, G.: <i>Copeognatha</i> . 55 pp., 10 figs, 5 pls DESNEUX, J.: Isoptera. 10 pp.
1912	4(1)	KLAPALEK, F.: <i>Plécoptères</i> . I. fam. Perlodidae (monographische Revision). 66 pp., 58 figs
1923	4(2)	KLAPALEK, F.: <i>Plécoptères</i> . II. fam. Perlidae (monographische Revision). 193 pp., 61 figs
1910	5(1)	VAN DER WEELDE, H. W.: <i>Megaloptera</i> (monographic revision). 93 pp., 70 figs, 4 pls
1921	5(2)	ESBEN-PETERSEN, P.: <i>Mecoptera</i> (monographic revision). 172 pp., 188 figs, 2 pls
1907	6(1)	ULMER, G.: <i>Trichopteren</i> . 102 pp., 132 figs, 4 pls
1907	6(2)	ULMER, G.: <i>Trichopteren</i> (Monographie der Macronematinae). 121 pp., 119 figs, 6 col. pls
	7	<i>Macronematines</i>
1908	8	VAN DER WEELDE, H. W.: <i>Ascalaphiden</i> (monographisch bearbeitet). 326 pp., 254 figs, 2 pls
1909	9	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 1-120, figs 1-89, col. pl. 1
1909	10	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 121-244, figs 90-152, col. pl. 2
1910	11	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 254-384, figs 153-232, col. pl. 3
1911	12	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 385-528, figs 233-317, col. pl. 4
1911	13	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 529-700, figs 318-407, col. pl. 5
1912	14	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 701-836, figs 408-491, col. pl. 6
1913	15	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 837-964, figs 492-555, col. pl. 7
1913	16(1)	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 965-1042, figs 556-604, col. pl. 8
1916	16(2)	RIS, F.: <i>Libellulinen</i> (monographisch bearbeitet). pp. 1043-1278, figs 605-692.
1906	17	MARTIN, R.: <i>Cordulines</i> . 4 pp., 99 figs, 3 pls
1908	18	MARTIN, R.: <i>Aeschnines</i> . pp. 1-84, figs, 1-77, col. pls 1-2.
1909	19	MARTIN, R.: <i>Aeschnines</i> . pp. 85-156, figs 78-156, col. pls 3-4.
1909	20	MARTIN, R.: <i>Aeschnines</i> . pp. 157-223, figs 157-219, col. pl. 5-6.
1953	21	FRASER, F.C.: <i>Gomphidae</i> . 36 pp., 11 figs
	22	<i>Gomphines</i> (not published)
	23	<i>Gomphines</i> (not published)
	24	<i>Caloptérygines</i> (written by R. MARTIN in 1912, but never published)
	25	<i>Caloptérygines</i> (idem.)
	26	<i>Agrionines</i> (not published)
	27	<i>Agrionines</i> (not published)
	28	<i>Agrionines</i> (not published)
	29	<i>Agrionines</i> (not published)
	30	<i>Lepidoptères</i> (not published)
1910	31	FRAIPONT, J.: <i>Oiseaux</i> . 130 pp., 2 col. pls
1907	32(1)	FRAIPONT, J.: <i>Mammifères</i> . 38 pp.
1907	32(2)	FRAIPONT, J.: <i>Reptiles et amphibiens</i> . 10 pp.
1907	32(3)	FRAIPONT, J.: <i>Poissons</i> . 27 pp.
	33	<i>Vertébrés de Belgique</i> (not published)

best odonatological friends, Robert McLachlan. The latter responded to Walthère, Selys' son (20 May, 1901): "To my utter surprise I found he had left me a considerable sum of money in return for which I was to work out the collections. This was utterly and totally impossible and I at once renounced all right to the money. From what I know of the collections I don't think any of the parties quite realize what they have undertaken to do ..." (CALVERT, 1927: 199).

Walthère de Selys wrote on 22 March 1901 to Calvert, offering an alternative solution: "In view of the persistent refusal of Mr McLachlan, a refusal founded, unhappily, on the state of his health (invincible insomnia), Dr Ris has been willing to accept the scientific direction of the work to be done for the publication of a methodical (and iconographic?) catalogue, with diagnoses of the new forms, of the collection of Odonata left by my father. My father, by his will, has imposed upon me, in spite of my incompetence, the heavy burden of the administrative direction (if I can so call it). Independently of my nephew Maurice, still an absolute novice in this branch and whose role in consequence can at first be only secondary, we believe we can count for the present in the number of collaborators of the projected work, René Martin and [Friedrich] Förster. If the Atlantic had not separated you from us we would not have been wanting in calling upon your collaboration also" (CALVERT, 1927). Guillaume Severin became after 1900 the "one who assumed the task of obtaining collaborators for the '*Catalogue des collections zoologiques de Edmond de Selys Longchamps*' and overseeing the publication of this valuable summary" (CALVERT, 1939).

The most important curator for Selys' Odonata became the Swiss Dr Friedrich Ris (1867-1931) director of a psychiatric clinic in Rheinau, Switzerland. He did the coordination and wrote on the libellulinen (Tab. V), about which Selys had not published a synopsis or monograph as they were too complicated. In addi-

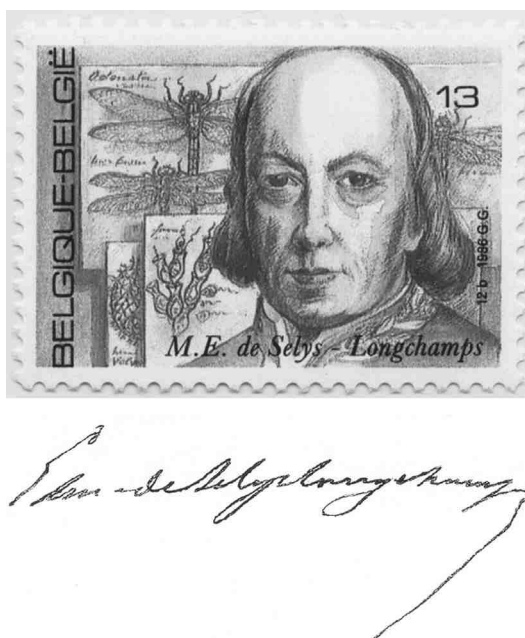


Fig. 9. Belgian postage stamp issued in Belgium on 29 September 1986; and the Selys' signature.

tion René Martin (1846-1925) wrote on the cordulines (published in 1908). In December 1904 Martin wrote to Calvert that the revision of the aeschnines was approaching completion, which was published in 1908-1909. In 1912 Martin submitted a manuscript on calopterygines series, but it was never published even though financial accounts indicated that it was actually written and presented to be printed (financial report of the Catalogue committee in 1912, vols xxiv-xxv; see SEVERIN, 1912). Furthermore, Matti Hämäläinen (pers. comm.) saw in 2012 labels of three unpublished manuscript names among Martin's Indochinese calopterygoid species in his former collection in Muséum national d'Histoire naturelle in Paris, which are still undescribed.

TILLYARD (1917) wrote about the Catalogue: "The Gomphinae, Lestidae and Agrionidae were unfortunately entrusted to three German authors. Not one of these has so far made any serious attempt to deal with his obligations, accepted now over thirteen years ago." He was not completely well informed. Two groups were indeed entrusted to Germans: the gomphids to Karl Grünberg and the agrionids to Friedrich Förster. Indeed none of these planned volumes (xxi-xxiii for the gomphines and xxvi-xxix for the agrionids; see SEVERIN, 1912) have been published. Not the Lestidae but the calopterygides were planned to be written by René Martin (see above).

After the First World War (1914-1918) Severin did ask for more people to sign in on the series (SEVERIN, 1919). Finally the last official part of the Catalogue was published in 1923⁵⁴. Most published volumes are still available through RBINS (TRIEMPONT, 2005).

CONCLUSIONS

Besides his odonatological work, Selys was a politician, a zoologist and a naturalist with a very broad range of interests. What probably many odonatologists are not aware of is his interest and taxonomical work on small mammals, birds and many insect groups other than dragonflies. Yet, Selys was the first true Odonata taxonomist and his work and his large collection have been cornerstones for later developments in odonatology. For this he used the wing venation as a fun-

Table VI
Data on new species descriptions by the five most prolific Odonata taxonomists

Author	Zygoptera	Anisoptera	Total	Synonyms	% Synonyms	Papers
Selys	399	308	707	176	20%	130
M.A. Lieftinck	330	191	521	27	5%	132
F.C. Fraser	178	188	366	141	28%	290
H. Hagen	103	143	266	95	26%	67
F. Ris	138	128	246	41	14%	72

dament of taxonomy. CORBET (1991: 28) stated that the ‘classifying strand [of Odonata study]’ started in 1820 by the Belgian Vander Linden; but in this [subject] Selys was ‘the undisputed odonatological giant’. No person has published more valid new species (just over 700) than Selys did (Tab. VI).

Importantly, his influence in Odonate studies reached beyond his death. The millions invested in the huge project ‘*Collections zoologiques Selys Longchamps*’ made it possible for a next generation within the Odonate community to travel to diverse collections and publish in the spirit of Selys. ‘There are few animal taxa, and fewer groups of insects, whose behaviour and ecology are well enough documented to permit the integrated, taxon-focused treatment attempted in this book’ (CORBET, 1999: 562). All these facts put the taxonomy of the group on a solid footing and provided the base to make Odonata one of the best studied animal groups known.

ACKNOWLEDGEMENTS

Many thanks to MATTI HÄMÄLÄINEN and WOLFGANG SCHNEIDER with whom we had a regular correspondence. Librarian ROBERT YOUNG searched the MCZ Archives Cambridge (USA) for the drawings made by Hermann Hagen for the never published Monograph on the agrionines. CÉCILE OGER from the library of the University of Liège helped the first author on several occasions. So did BASTIAAN KIAUTA, in whose library the first author could study the Selys material on 30 December 2012. TIENEKE DE GROOT and JOHAN VAN ‘T BOSCH commented on a draft version and PHILL WATTS gave many helpful comments on the manuscript.

FOOTNOTES

- ¹ 407 pages of text and 340 pages of indexes. It can be ordered from the Académie royale de Belgique at uc.moreau@cfwb.be.
- ² This is often cited as *Nomen nescio* (N.N.) (1901), but it is hereby regarded as most likely to have been compiled by his sons. It is a compilation of newspaper articles and speeches at his funeral; it is present e.g. in the library of Naturalis, Leiden.
- ³ To be complete: the articles which were not consulted: CAMERANO (1901) and MOURLON (1900).
- ⁴ To be found on [<http://kranten.kb.nl/>].
- ⁵ Place Cockerill 1, Liège, visited on 25-10-2012. It had been inherited by his son Walthère de Selys Longchamps, his grandson Edgard de Selys Longchamps and great-grandson Walthère de Selys Longchamps (1915-1987). This archive also contains the papers by the second son of Selys, Walthère de Selys Longchamps, and part of the correspondence on the Catalogue of the collections of Selys, which appeared between 1906 and 1923. About the situation found in Halloy: “The librarian in Liège told me that the papers were piled high in a room of the chateau, in such a deplorable state that they had to literally shovel many of them out” (WATERMAN, 2005).
- ⁶ Rue Du Chéra 79, Liège. This archive has not been seen by us. It had been inherited through his son Walthère de Selys Longchamps, by his grandson Maurice de Selys Longchamps and his great-grandson Michel de Selys Longchamps. This archive was stored at Longchamps and at Faulx-les-Tombes (the chateau belonging to the family of Michel de Selys Longchamps’ wife, baroness J. de Moffarts d’Houchenée).
- ⁷ Rue de Vautier 29, Brussels. Benno Hinnekint has looked long ago through this correspondence.

- ⁸ A frequent name among Roman legionnaires.
- ⁹ During his lifetime Laurent de Selys Longchamps served in Liège under four political regimes: the Prince-Bishops, the French domination, the Dutch government and the government of an independent Belgium (DUCHESNE, 1920).
- ¹⁰ Widow of Joseph Smith (1756-1806).
- ¹¹ See WIKIPEDIA (2013), though some say in the left lower corner of the painting of Denise Gandolphe appears “L’an.7”, meaning the year 7 (counting in years of the French Revolution, 1792 is the year ‘1’, so 7 would mean it was painted in 1799).
- ¹² The style originated in and takes its name from the rule of Napoleon I in the First French Empire, were it was intended to idealize Napoleon’s leadership and the French state.
- ¹³ In the elections of 4 June 1831, Laurent was one of the fourteen in favour of the regent, baron Erasme Surlet Chokier (who was a neighbour, living in a chateau at 10 km from Waremmes) as head of state, but it was Leopold I von Saksen Coburg who was chosen as King of the new kingdom of Belgium (DUCHESNE, 1914-1920).
- ¹⁴ This house stood in a green neighbourhood though in the centre of Paris, close to the later erected Arc de Triomphe. In 1880, his birth house was replaced by a large building which is still there (GOOGLE EARTH, 2012).
- ¹⁵ Likewise his parents thought it better for his education to have tutors in Paris rather than in Longchamps.
- ¹⁶ COEN (1982: 19) claims that the family moved in 1826 from Paris to Longchamps (after the death of his grandmother on mothers side). This must be considered incorrect.
- ¹⁷ Hoffmann as a tutor is mentioned for the first time at Longchamps from 4 September to 30 October 1827. His last lessons were given on 10 October 1829, after which Hoffmann left to Paris. He returned a year later for a few weeks to check the receivables of his former pupil.
- ¹⁸ According to CAULIER-MATHY & HAESSENNE-PEREMANS (2008: xxiv) Laurent had two other chateaus, in Flanders at Hasselbroek (in the village of Jeuk ‘Goyer’ on behalf of his mother the baroness of Bormans de Hasselbroeck) (DUCHESNE, 1914-1920) and in Ordingen (‘Orange’), respectively 4 and 13 km North of Longchamps.
- ¹⁹ Since September 2011 a five star hotel and a restaurant ‘Le Selys’ opened in this chateau. Though at some distance from the Boulevard de la Sauvenière, it is connected with it.
- ²⁰ It was near the chateau at Colonster that Selys collected a female *Cordulegaster* that he could not identify, but which he would later describe as *C. bidentata* Selys, 1843 (SELYS, 1843: 156) after he obtained a male from elsewhere.
- ²¹ His excursions are described in numerous articles in 1863, 1869, 1870, 1871, 1874, 1877 etc. (COEN, 1982: 104-105).
- ²² Around 1840 in Belgium and The Netherlands mean life expectancy was around 40 years, dropping to about 18 years in the poorest neighbourhoods of Brussels (at around 1830; SMELLINCKX, 2001)
- ²³ Selys planned to visit Belfast in autumn 1844 (THOMPSON, 1849: 283), but this trip did not materialize.
- ²⁴ Likely the bicycle was given him as a present on his 80th birthday on 25 May 1893. First he rode only one minute on the bicycle, while it was a bit heavy (*Diary*: 26 May 1893), a few days later he visited someone in the neighbourhood by bike (*Diary*: 30 May 1893).
- ²⁵ Most often La Mairaine (4 times).
- ²⁶ Most often Faust (19 times), but he was not always enthusiastic about the operas visited: both the Walkure (a 5 hour opera by Wagner; *Diary*: 1 April 1887) and Samson and Delaïla by Saint-Saëns (*Diary*: 26 January 1893) he found boring.
- ²⁷ Who is likely the one who recorded the list of four Odonata species at Vogelsanck on 5-25 May 1841 (*Diary*: p. 227-228), while Selys himself was in The Netherlands.
- ²⁸ He arrived on 11th September. Next day they studied myrmeleons and ‘Neuroptera non-odonates’. The 13th September they kept on studying the Neuroptera of Belgium, took a glance (‘coup d’oeil’)

- at the gomphids and started with the first decade of libellules. The 14th they studied the exotic agrions and took a glance on the second decade of libellules. The 15th they finished the real agrions and took a glance on *Telebasis* and *Cordulia*. The 16th they studied the libellules of Europe, the third decade of exotic dragonflies and a glance on the Orthoptera.
- ²⁹ Now: Common Vole, *Microtus arvalis* Pallas, 1778.
- ³⁰ He arrived at Cambridge on 12 October 1867 (CALVERT, 1893: 315).
- ³¹ Nevertheless he named three animal species after him: two odonates *Orthetrum ramburii* (Selys, 1848) (now regarded a subspecies or synonym of *Orthetrum coerulescens*), *Ischnura ramburii* (Selys in Sagra, 1857) and a cave barklice (*Psyllipsocus ramburii* Selys, 1872).
- ³² For the reason why he started studying insects see CALVERT (1939).
- ³³ Förster first contacted Selys before 15 February 1896. On this date, Selys send a reply to him, which gives an idea of how Selys planned and prepared the publication of his research (SCHNEIDER & SIMONS, 2012). Selys and Förster were since then regularly in touch with each other. Selys did much work for him, often checking his identifications and papers (e.g. *Diary* 5 October 1896 “Worked for Förster and wrote him a letter”). After the death of Selys, the tutor role was taken over by Edward Williamson with whom he exchanged many letters and specimens.
- ³⁴ Selys must have been given there a *Gomphus*, which he described in 1840 as *Gomphus similimus*, with type locality Aix-en-Provence. This species does not fly in March and cannot have been captured by Selys himself.
- ³⁵ The last letter had only put his name on the cover of a publication in the Japanese fauna collection by Philipp Von Siebold, while many people had cooperated in the project (BROUWER, 1953) and Schlegel did most of the descriptions. The Von Siebold collection would be the main source for the diverse publications by Selys of the Odonata of Japan, which numbered 67 species in his 1862 publication (SELYS, 1862).
- ³⁶ When the Dutch Entomological Society was invited by the Belgian Entomological Society to congratulate their honorary member Selys on his 80th birthday in 1893, Albarda offered he would deliver a letter of congratulation to him (ANONYMOUS, 1893).
- ³⁷ This must be the genus *Thore* (later *Polythore*).
- ³⁸ Bought for 25 pound sterling’ (which would probably be €1,25 a piece in 2013). On 11 November 1866 he completed the pinning of the dragonflies of Bates and 20 February 1867 he completed inserting the dragonflies of Bates in his collection.
- ³⁹ This new species descriptions were of two new small mammals and a new mammal genus (SELYS, 1836), of which the European pine vole *Microtus subterraneus* Selys, 1836 described from Belgium and occurring throughout central Europe, is still a valid species.
- ⁴⁰ On the first collection he wrote in 1841 he put on pin in his collection over 300 other Neuroptera (Névroptères) from the collection Latreille (*Diary*: 31 January 1841). The last three collections, were those from which RAMBUR (1842) described all odonate species. The [Neuroptera, including Odonata] collections of Rambur arrived at Longchamps in 1845, after half a year of delay (*Diary*: 23 March 1845). Rambur had described 129 odonate species, 25 subspecies and 123 synonyms.
- ⁴¹ Wilhelm Gottlieb Schneider (1814-1889; see Bridges, 1994: x.127).
- ⁴² His other holdings contained an extensive collection of European birds and mammals (CALVERT, 1901). From all world families he had representatives and he was most proud on his Great Auk (*Alca impennis*, now: *Pinguinus impennis*) and Hoopoe Starling (*Fregilupus varius*). His egg-collection, however, when visited by August Blasius in 1884, had not been looked at for 40 years (BLASIUS, 1901: 367). Since July 1877 he had engaged Georges Minnen (1836-1912) as curator (“conservator”) for his collection.
- ⁴³ The first three publications on Lepidoptera from Belgium were all by Selys, published in 1837, 1844 and 1857 (DE PRINS & STEEMAN, 2010). There he described some new species, but these turned out to be synonyms. One valid subspecies remains: *Melitaea athalia navarina* Selys, 1845. The collection mentioned earlier is composed entirely of Rhopalocera, and contains almost all Palaearctic species. He wrote five papers on Orthoptera and published at least one valid non-

- European species, *Acanthogryllus brunneri* (Selys, 1868), and two European forms: *Tetrix subulata attenuata* Selys, 1862 and *Chortippus parallelus explicata* Selys, 1862. All small insect groups in those days (except fleas) were placed in the 'Neuroptera'. Most people describing dragonflies studied those insects as well. So friends like Hagen and McLachlan, as well as Rambur, worked on Psocoptera. Selys named at least one cave barklice (*Psyllipsocus ramburii* Selys, 1872). Lastly, a valid Ascalaphidae described by Selys, is *Cordulecerus maclachlani* Selys, 1871.
- ⁴⁴ Among small mammals, he described several mice in the period 1836-1847. As valid species are considered *Microtus subterraneus* Selys, 1836, *M. savii* (Selys, 1838), *M. duodecimcostatus* (Selys, 1839). As valid subspecies *Microtus oeconomus arenicola* (Selys, 1841), the Dutch tundra vole. Selys also published about 15 invalid mammal species (WILSON & REEDER, 2005). He published three valid bird species and one subspecies: the Red Rail *Aphanapteryx bonasia* (Selys, 1848), the Réunion Swamphen *Porphyrio coerulescens* (Selys, 1848) and the extinct Réunion Ibis *Threskiornis solitarius* (Selys, 1848) and a subspecies of the Willow Tit, *Parus montanus borealis* Selys, 1843. Selys was the first to start making notes on the migration behavior of birds in the period 1841 to 1846 (SELYS & QUETELET, 1848). In this article he also included observations of many other Western European countries and much later this type of observations was followed by others e.g. in Russia (1855) and Germany (1874) (VORDERMAN, 1886). During his entire life Selys was involved with birds for his scientific career, his appointment as President of Honour of the International Congress on birds in Paris a few months before his death (*Diary*: 26 June 1900) must have been a great personal triumph.
- ⁴⁵ Hagen, who had drawn the illustrations for these two monographs, also made drawings for the projected 'Monographie des agrionines', which was never published. These drawings were taken to Cambridge (USA) by Hagen (CALVERT, 1901) and are still there at the MCZ Archives (librarian Robert Young, pers. comm. 2 April 2013).
- ⁴⁶ Fauna of: New Guinea, Philippines, Japan, the Palaearctic region, Asia Minor, Sumatra, Kirgizia, Burma and others (BLASIUS: 1901).
- ⁴⁷ Seen on 30 October 2012 in Brussels.
- ⁴⁸ Of the first described species over later described species.
- ⁴⁹ Although he might have preferred to use the French translation by GUÉRIN-MÉNEVILLE (1843).
- ⁵⁰ The text and discussion of this code was published by BLANCHARD (1889).
- ⁵¹ A day later he received the 'Grand cordon de l'Ordre de Léopold' and on 27 May 1900 he was succeeded in the Senate by baron Ancion (COEN, 1982: 129).
- ⁵² In his diary on 25 October he wrote notes on drawing of *Xanthagrion*'s of Chatham, which he returned to Maurice de Luchin.
- ⁵³ Before so often visited by him and in 2013 having the most futuristic railway station of northwestern Europe.
- ⁵⁴ FRASER (1953), on Australian gomphids, has been published in the series, but cannot be regarded as a real part of it.

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SHORT COMMUNICATION

DESCRIPTION OF THE LARVA OF
TELEBASIS GRIFFINII (MARTIN, 1896)
(ZYGOPTERA: COENAGRIONIDAE)

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A description and illustrations of the final instar larva are provided based on reared specimens collected in São Paulo State, Brazil. *T. griffinii* can be distinguished from other *Telebasis* species by the 6 palpal setae, 1 premental seta, no setae on antennae, and the shape of the foliaceous and lanceolate caudal lamellae.

INTRODUCTION

The exclusively New World genus *Telebasis* Selys, 1865 presently consists of 57 species (GARRISON, 2009; GARRISON et al., 2010; MACHADO, 2010; LENCIONI, 2010; PINTO & CARVALHO, 2012). Twenty five species are known from Brazil (MACHADO, 2010; LENCIONI, 2010; PINTO & CARVALHO, 2012) and five are common in the state of São Paulo (COSTA et al., 2000).

Although common in lentic environments of Brazil, the larvae of only four species have been described: *T. demarara* Williamson, 1917 (GEIJSKES, 1941), *T. simulata* Tennessen (GEIJSKES, 1943; as *T. sanguinalis* Calvert), *T. willinki* Fraser, 1948 (BULLA, 1970) and *T. obsoleta* Selys, 1876 (LOZANO et al., 2012). Here, we describe the final instar larva of *T. griffinii* Martin 1896, based upon a reared male. This species was recently synonymized with *T. limoncocha* Bick &

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Bick 1995 by GARRISON (2009), who also states that this species is closely related to *T. digiticollis*. Therefore, we also compared the larvae of *T. digiticollis* and *T. griffinii* to identify possible similarities between them (NOVELO-GUTIÉRREZ, R. & GÓMEZ-ANAYA, 2005).

METHODOLOGY

A male final instar larva was collected in a lake located in the Social and Urban Center in Assis, São Paulo, Brazil by RGF and is deposited in the Aquatic Insects Collection of the Aquatic Biology Laboratory (FCLA, State University of São Paulo). Relationship between adult and larva was ascertained by rearing the larva in the laboratory. The exuvia was preserved in 80% alcohol and the adult was placed in a plastic container allowing hardening of the exoskeleton. Mandibular formulae follow WATSON (1956). Abdominal segments are given as S1-S10. I follow NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA (2005) for their descriptions of *T. digiticollis* and LOZANO et al. (2012) for *T. obsoleta*. Illustrations were made using the software Adobe® Illustrator CS3© by vectoring pictures taken with a Motic® camera attached to a Carl Zeiss® stereoscope.

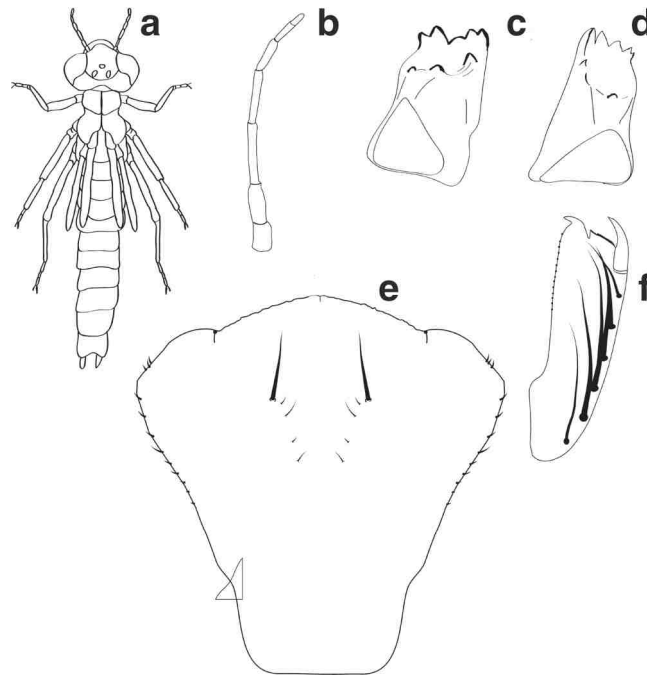


Fig. 1. *Telebasis griffinii*, details of morphology: (a) final instar larva, dorsal view; – (b) antenna; – (c) left mandible; – (d) right mandible; – (e) prementum; – (f) labial palp.

TELEBASIS GRIFFINII (MARTIN, 1896)

Figures 1-2

Material. – 1♂ final instar (reared), Assis, SP, Brazil (22°37'55"S, 50°25'10"W; alt. 522 m), 10-VII-2011, coll. R. Guillermo-Ferreira.

General colour dark brown.

Head. – About 1.6 as wide as long; occipital margin concave, rounded posterolateral margin covered with setae. Antennae 7 segmented (Fig. 1b), the third segment the longest; relative length of segments 0.50, 0.60, 1.0, 0.70, 0.50; no setae on antennae. Mandibular formula $L\ 1+2\ 3\ 4+5\ y\ a\ b\ R\ 1+2\ 3\ 4\ 5\ y\ a$ (Fig. 1c,d). Labium (Fig. 1e) with one premental seta and a row of four minute setae on each side; lateral margin with 9 spiniform setae; latero-distal margin with 3 spiniform setae; outer margin of labial palp (Fig. 1F): with 6 setae; external lobe with discernible denticles, movable hook about half the length of outer margin.

Thorax. – Wing pads reaching the middle of S4 (Fig. 1a). Legs (Fig. 2a): femora with two dark bands, with dorsal and lateral spines; tibiae with a brown band basally and a set of spines.

Abdomen. – Cylindrical, covered dorsally with spines on S7-10, margins of S7-10 with a row of spines, margins of S1-10 with a dark stripe along the distal margin. Caudal lamellae (Fig. 2b-c) type D (CORBET, 1999), lanceolate and foliaceous, with branched tracheae directed caudally. Lateral and medial caudal lamellae similar in shape, size and color pattern; without transverse suture; lateral lamella with 27 dorsal spines and 9 ventral spines; medial lamella with 9 dorsal and 6 ventral spines.

Measurements (mm, N = 1). – Total length (without caudal lamellae) 12.0. Head: max. length 2.05, max. width 3.20. Prementum: max. length 2.46, max. width 1.94. Thorax: femur I 1.73, femur II 2.41, femur III 2.85, tibia I 1.40, tibia II 2.33, tibia III 2.35; inner wing pads max. length 3.54, outer wing pads max. length 3.33. Abdomen: total length 7.10, S9 length 0.79, S10 length 0.64. Lateral caudal lamella: max. length 3.43, max. width 0.96, dorsal row of spines length 1.61, ventral row of spines length 1.69. Median caudal lamella: max. length 3.38, max width 0.96, dorsal row of spines length 1.64, ventral row of spines length 1.67.

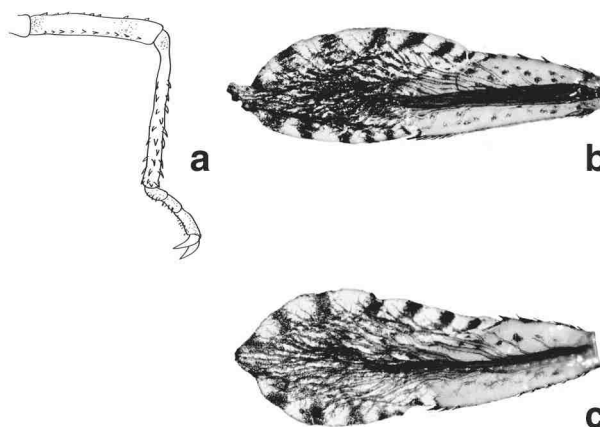


Fig. 2. *Telebasis griffinii*, final instar larva: (a) posterior leg; – (b) lateral lamella; – (c) medial lamella.

DISCUSSION

As stated by LOZANO et al. (2012), generic diagnoses of several species of *Telebasis* larvae are still not possible because larvae of most are still unknown. The caudal lamellae of *T. griffinii* present the typical shape of *Telebasis*, a trait that, so far, can help in larval identification.

T. griffinii larva can be distinguished from *T. demarara* and *T. obsoleta* by the presence of six palpal setae (five in *T. demarara* and *T. obsoleta*). The larva of *T. griffinii* closely resembles the larva of *T. digiticollis* (NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA, 2005), corroborating the similarity between adults (GARRISON 2009). One difference can be used to discriminate between these two species: the one known larva of *T. griffinii* does not have setae on antennae (setae present on *T. digiticollis*, according to NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA, 2005). However, we have been unable to find any discernible morphological difference between larvae of *T. griffinii* and *T. willinki* based on the published description of the latter species.

Telebasis are common inhabitants of lagoons, marshes, ponds, still waters and edge of streams (GARRISON, 2009; NOVELO-GUTIÉRREZ & GÓMEZ-ANAYA, 2005; LOZANO et al., 2012). The specimen was collected in the lake near the edge of a stream, where *Salvinia modesta* (Salviniaceae) and *Egeria densa* (Hydrocharitaceae) were abundant. The site is polluted and is inhabited by capybaras (*Hydrochoerus hydrochaeris* L. Hydrochoeridae) and American moorhens (*Gallinula galeata* Lichtenstei).

Other odonate species collected at the site (adults and larvae) were: *Ischnura fluviatilis* Selys, *I. capreolus* Hagen, *Erythrodiplax media* Borrer, *E. fusca* Rambur, *Miathyria marcella* Selys in Sagra, *Lestes paulistus* Calvert, *Acanthagrion aepium* Tennessen and *Perithemis mooma* Kirby.

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OBITUARY

ANATOLY YURYEVICH HARITONOV

A brief biography and appreciation of the odonatological work of Professor Dr A.Yu. Haritonov (Magnitogorsk 21 Sept. 1949 – Novosibirsk 4 Apr. 2013), Head of the Laboratory of Insect Ecology of the Russian Academy of Sciences (Novosibirsk) and one of the greatest and most prolific Russian odonatologists of all times, is followed by his odonatological bibliography (1971-2012). His disciples are conducting their odonate research in Siberia and elsewhere. *Ischnura haritonovi* Dumont, 1997 (syn. *I. aralensis* Haritonov, 1979) and *Sympetrum haritonovi* Borisov, 1983 are perpetuating his name in odonate taxonomy.



On 4 April 2013 Professor ANATOLY YURYEVICH HARITONOV has passed away after a prolonged illness. He was a highly respected biologist and odonatologist with an international reputation. For all his working life he was at the Institute of Systematics and Ecology of Animals of the Siberian Branch of the Russian Academy of Sciences (ISEA SB RAS, before 1993 named Biological Institute).

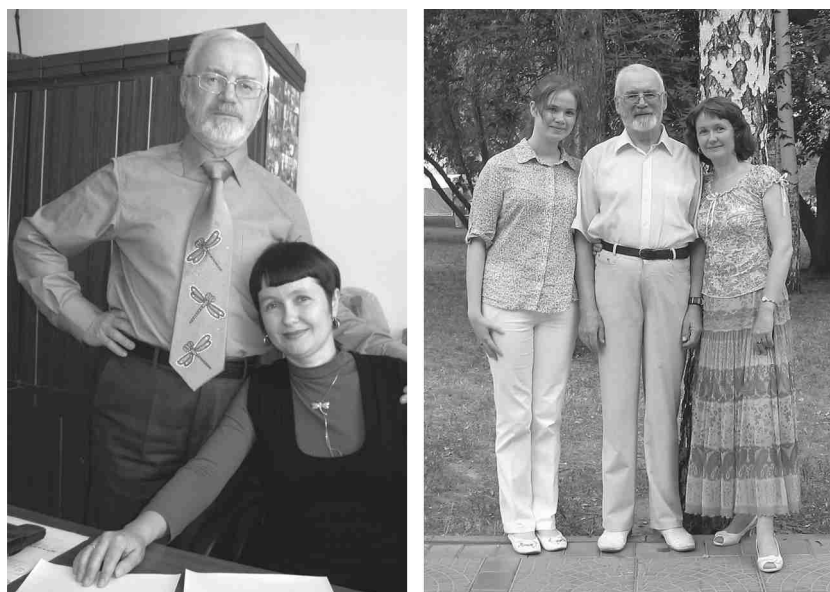
A.Yu. Haritonov was born on 21 September 1949, in the city of Magnitogorsk in South Ural, in a close-knit intellectual family. His mother was a phylologist by profession and from childhood encouraged her son in a love of literature and art, while his father introduced him to Nature, taking him on his expeditions and hunting trips. Still in his childhood, Anatoly realised that his destiny was biology.

In 1968 he entered the Biology and Geography Faculty of Chelyabinsk State Pedagogical Institute and, since the Second

Form, started his research activity. In childhood he used to dream of investigating birds but he started to investigate odonates instead. This choice was influenced by his teacher in parasitology, Professor Valentin Ivanovich OKOROKOV, who first attracted his attention to dragonflies as a convenient and fruitful object for quite diverse research. In 1971, his first publication, in co-authorship with V.I. Okorokov (“*Fauna and biology of dragonflies in South Ural and their role as intermediate hosts of helminths*”), was published in the “*Items of Zoology*” from the Chelyabinsk State Pedagogical University.

In 1972 A.Yu. Haritonov relocated to the Biological Institute at Novosibirsk and entered *aspirantura*, that is he became a post graduate student. He was under the supervision of Dr Boris Feodorovich BELYSHEV, the internationally known odonatologist, who became not only his supervisor but also his tutor and friend. For twenty years, until the death of B.F. Belyshev, they investigated odonates together and wrote a number of joint papers and books and so were perceived by the international community as an integrated unit.

In 1975, A.Yu. Haritonov defended a candidate dissertation (Ph.D. Thesis) “*Dragonflies of Ural and Transuralia (fauna, ecology, zoogeography)*”. In the same year he became a junior staff researcher in the Laboratory of Systematics and Phylogeny of Insects, and four years later, in 1979, he became its senior



Figs 2-3. Anatoly Yuryevich (“Tolya” for his friends): (2) with his wife and collaborator, Dr Olga Popova, in their study at the Institute of Animal Systematics and Ecology of the Russian Academy of Sciences, Novosibirsk, 7 October 2009; – (3) the Haritonov family, 24 July 2012, left: daughter Masha, right: Olga.

staff researcher. His passion were scientific expeditions; he loved to comprehend nature and the world in general and visited various habitats in his own large country and also abroad. From many years of such expeditions, a vast amount of material was obtained which contributed to his collection of world Odonata (stored in the Zoological Museum of the institute) and he published a number of papers and books. He used to call himself an eternal wanderer and hoped to meet the last moment of his life on his travels rather than in bed. He regretted so much that his dream did not come true. Besides his interest in new areas, he was strongly affected by certain places, such as Barabinskaya forest steppe in general and Chany Scientific Stationary of ISEA in particular: with their steppes, swamps and vast reed thickets. He worked regularly at Lake Chany for 30 years since 1982, visiting it every year, thereby achieving long term observations and accumulating data which comprised unique and invaluable ecological material.

In 1981, when he was still fairly young, he was elected Head of the Laboratory of Insect Ecology, which he then governed for 32 years. During this time, the laboratory team carried out a considerable amount of research, both fundamental and applied, which was used in the practice of forestry and agriculture, in the realisation of a number of nature conservation measures and in the compilation of a regional catalogue of animal species. The laboratory was one of the best in the institute and its Head was the moving spirit of its team.

In 1987 A. Yu. Haritonov was elected to be the first Scientific Vice-Director of ISEA SB RAS and he remained in this post for 22 years, until 2009.

For 30 years, from 1976 to 2007, he was a Scientific Secretary of the Dissertation Council at ISEA SB RAS, in which the defence of more than 200 dissertations was organized by him. He invested much effort and soul into this volunteer position. Grateful applicants for scientific degrees visited him for years after their defences on the basis of his nice personality rather than as a Scientific Secretary. With all his numerous occupations, Anatoly Yuryevich always found time for all visitors, for he loved people and said that communication with them was the greatest value in human life.

In 1991 A. Yu. Haritonov defended in the Dissertation Council of Moscow State University a doctoral (D.Sc.) dissertation, "*Boreal odonatofauna and ecological factors of geographical distribution of dragonflies*".

He authored and co-authored 184 scientific publications, including 5 monographs. The main direction of his studies was the ecological zoogeography and the evaluation of the role of amphibiotic insects in terrestrial ecosystems. His work on the study of different factors determining animal ranges made a sound contribution to zoogeography and clarified the role of competitive interactions in the genesis of animal communities and faunal complexes. His studies of population ecology and the trophic links of amphibiotic insects allowed the quantitative estimation of their role in substance turnover in semiaquatic ecosystems, since amphibionts are the main biogenic factor responsible for the return of a number of chemical elements

from water bodies in relief depressions to watersheds. According to his estimates, the biomass outflow from water bodies via amphibiotic insects for the entire Ob'-Irtys' Interfluvial system comprises as much as 240 thousand tons a year. His main model were odonates, their fauna, systematics and ecology. He participated



in finding out such interesting phenomena as their reproductive migrations in *Sympetrum*, spatial intra-population grouping, random effects in dispersal, increased activity in dispersal and their linkage with destabilisation of biosphaeric processes, etc. He proposed an original generalised classification of spatial movements of Odonata. He was a zoologist in a broad sense and felt at home with issues of contemporary zoological systematics and knew the finer details of biology and behaviour

Figs 4-6. Odonatological field work: (4) at a field trip in the Pohorje range, Slovenia, in the framework of the 14th International Symposium of Odonatology, Maribor, Slovenia, 12-23 July 1997; from left to right: Dr Haritonov, Mrs M. Kiauta, Dr O. Popova, Dr B. Kiauta [Photo by M. Bedjanič, reproduced from *Erjavecia* 22, p. 8]; – (5) with his wife, in the forests at the Inya river, Novosibirsk province, 7 June 2007; – (6) on an Altay odonate expedition, 18 July 2009.

of many animals, specially birds which he used to compare with dragonflies, finding much in common.

Research projects of A. Yu. Haritonov were supported by the Russian Fund for Fundamental Research (of 26 projects submitted, 17 were supported), in competitions for integrated projects of the Siberian Branch of the Russian Academy of Sciences, and also by the Biodiversity Federal Programme and such international granting bodies as NATO and the personal fund of Leopold III, the King of Belgium.

Anatoly Yuryevich was very much an in demand person in the scientific organisational life of the city of Novosibirsk. He was a member of the Joint Scientific Council of the Siberian Branch of the Russian Academy of Sciences in Biological Sciences, a member of the Dissertation Council of Novosibirsk State Agricultural University, a member of the Scientific and Technical Council on Ecology and Protection of Natural Resources of Novosibirsk Province, a member of the Expert Council on Science, Education and Ecology of Novosibirsk Provincial Council of People's Deputies, a member of the Presidium of the Society for Nature Conservation of Novosibirsk Province, the President of the Siberian Division of Russian Entomological Society and a member of many other commissions, committees and societies. He was a member of Editorial Boards of the journals *Odonatologica* and *Notulae odonatologicae*, a responsible editor of eight monographs and 14 collected scientific paper editions and an organiser of a number of conferences, symposia and workshops. By his initiative and under his Presidency, the 15th International Symposium of Odonatology took place in Novosibirsk in 2001, on the basis of ISEA SB RAS. It was the first experience of an international scientific event for the institute and it took place in a very difficult post-perestroika time. On this occasion he also started *Belyshevia*, journal of the Russian Branch of the Societas Internationalis Odonatologica, which unfortunately, was not continued.

He permanently went in for teaching both in higher educational organisations and in highschoools. He was a Head of the Chair of Zoology and Teaching



Fig. 7. With Masha in London, UK, 2 January 2012.

Methods at Novosibirsk State Pedagogical University, where he read his original lecture course on zoological local lore, a Professor-Consultant of the Zoological Chair of Kabardino-Balkar State University, a Professor of the Chair of Applied Mathematics and Cybernetics at the Siberian State University of Telecommunications and Informatics, a Volunteer Head of the Zoology Chair at the Novosibirsk Branch of Tomsk State University and a Professor of General Science Disciplines at M.I. Glinka Novosibirsk State Conservatoire where, for more than 10 days, he gave an original lecture course on the bases of natural history cognition of the world and read a course of ecology in one of the city high-schools. He invested a considerable effort into the formation of young scientists and actively formed his own scientific school: 16 candidate dissertations and 2 doctoral dissertations have been defended under his scientific supervision. All his disciples, from school pupils to graduate students respected and loved their tutor who not only taught but also inspired them.

In odonate systematics, Anatoly Yuryevich introduced the suborder Archeoptera BELYSHEV & HARITONOV, 1985a, the family Chorismagrionidae BELYSHEV & HARITONOV, 1985a, the subgenus *Chloragrion* HARITONOV & HARITONOVA, 1990b (for *Coenagrion armatum*), described *Ischnura aralensis* HARITONOV, 1979a and two *Enallagma* taxa that were subsequently shown to be mere synonyms of *E. c. cyathigerum*, viz. *E. belyshevi* HARITONOV, 1975d and *E. nigrolineata* Belyshev & Haritonov, 1975 in HARITONOV, 1975d.

Anatoly Yuryevich was a talented populariser of science and used to deliver for general public most complicated biological issues in a simple and concise language understandable by anyone listening. He possessed an encyclopedic knowledge and a clear way of speaking and writing. He never wrote texts for his speeches and was a master of improvisation: on the spot he was able to deliver an entire lecture on any matter, always spiced with friendly humour and inspiring optimism. In him there was a rare combination of a powerful intellect and a beautiful soul. For all his merits he was quite modest. Communicating with him was a great joy for anybody, and for somebody a happiness. So we will recollect him – mildly smiling and explaining something with his soft friendly voice...

In odonate taxonomy, *Ischnura haritonovi* Dumont, 1997 (synonym of *I. aralensis* HARITONOV, 1979a) and *Sympetrum haritonovi* Borisov, 1983 are perpetuating his name.

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* Transliteration and Engl. translation of titles by O.E. Kosterin

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- 2013g (— & S.N. BORISOV) Distribution and habitat characteristics of *Sympetrum haritonovi* Borisov, 1983 (Odonata, Libellulidae) in Central Asia mountains Tien-Shan, Pamir-Alai and Kopetdagh. *Evrasiatskiy entomologicheskii Zhurnal* 12: 213-216. — [Russ., with Engl. s.]

Portrait on p. 409 dated 4 April 2008

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ODONATOLOGICAL ABSTRACTS

1998

- (19716) GILBERT, P., 1998. *John Abbott: birds, butterflies and other wonders*. Holberton & Nat. Hist. Mus., London. Frontispiece, 128 pp., 60 col. pls incl. Hardcover, flappers (23.5 x 29.5 cm). ISBN 1-85894-064-8. — Price: £ 16.- net.
A monograph on the life and work of the naturalist J. Abbott (born London, 1751, deceased 1840?), presenting a summary of his activities as collector and artist. Several pp., with portrait, are devoted also to the activities of D. Drury (1725-1804). Dragonfly col. pls 5-7 are reproduced from Abbott's unpublished *Insects of Georgia*, vol. 12.
- (19717) MORAVEC, F. & B. ŠKORIKOVÁ, 1998. Amphibians and larvae of aquatic insects as new paratenic hosts of *Anguillicola crassus* (Nematoda: Dracunculoidea), a swimbladder parasite of eels. *Diseas. aquat. Org.* 34: 217-222. — (First Author: Inst. Parasitol., Acad. Sci. Czech Rep., Branišovská 31, CZ-37005 České Budějovice)
Coenagrion puella and Sympetrum sanguineum larvae were for the first time found to serve as paratenic hosts for the 3rd stage of this pathogenic swimbladder parasite of Anguilla anguilla.
- (19718) OU, Y., Q. CHEN & F. CHEN, 1998. A preliminary research report of Odonata insects in Heilongjiang province. *Nat. Sci. J. Harbin Normal Univ.* 14(6): 89-93. (Chin., with Engl. s.). — (Heilongjiang Nonken Teachers' Coll., Achen-150301, Heilongjiang, China).
A list of 46 spp., from 25 counties; — China.
- (19719) ROUSH, S.A. & D.J. BUMBARGER, 1998. Odonata of the Beaver Creek Wetlands, Greene county, Ohio: a preliminary survey. *Ohio J. Sci.* 98(3): 59-60. — (Dept Biol. Sci., Wright St. Univ., Dayton, OH 45435-0001, USA)
An annotated checklist of 36 spp., including 11 new county records.
- (19720) UNİYAL, V.P. & P.K. MATHUR, 1998. A study on the species diversity among selected insect groups in the Great Himalayan National Park. *Forestry Research Education and Extension Project (FREEP): The Great Himalayan National Park (GHNP)* 3(13): iii + 54 pp. — (Wildlife Inst. India, P.B. 18, Chandrabani, Dehra Dun-248001, U.P., India).
The Park is situated in Himachal Pradesh, W Himalaya (India), alt. ca 1500-6000 m. Anax guttatus, Orthetrum t. triangulare, Pantala flavescens and Sympetrum commixtum are reported from the altitudes of 1500-2000 m.

1999

- (19721) LABHART, T. & E.P. MEYER, 1999. Detectors for polarized skylight in insects: a survey of ommatidial specializations in the dorsal rim area of the compound eye. *Microsc. Res. Techn.* 47: 368-379. — (Zool. Inst., Univ. Zürich, Winterthurerstr. 190, CH-8057 Zürich).
Apart from the sun, the polarization pattern of the sky offers insects a reference for visual compass orientation. Using behavioural experiments, it has been shown in a few insect spp. (field crickets, honey bees, desert ants, and house flies) that the detection of the oscillation plane of polarized skylight is mediated exclusively by a group of specialized ommatidia situated at the dorsal rim of the compound eye (dorsal rim area = DRA). The dorsal rim ommatidia of these

spp. share a number physiological properties that make them especially suitable for polarization vision: each ommatidium contains 2 sets of homochromatic, strongly polarization-sensitive photoreceptors with orthogonally-arranged analyzer orientations. The physiological specialization of the DRA goes along with characteristic changes in ommatidial structure, providing actual anatomical hallmarks of polarized skylight detection, that are readily detectable in histological sections of compound eyes. The presence of anatomically specialized dorsal rim ommatidia in many other insect spp., belonging to a wide range of different orders, indicates that polarized skylight detection is a common visual function in insects. However, fine-structural disparities in the design of dorsal rim ommatidia of different insect groups indicate that polarization vision arose polyphyletically in the insects. In all studied odon. genera of 3 families, the ommatidia of the DRA differ markedly from the regular ommatidia of the dorsal eye region. They are strongly reduced in length and the untiered rhabdom is rectangular in cross-section exhibiting just 2 orthogonal microvilli orientations. In *Sympetrum*, the contrast between the short, compact-shaped dorsal rim rhabdoms and the 10 times longer and lobed regular dorsal rhabdoms is dramatic. In addition, in *Sympetrum* the optics of the DRA was found to be degraded since the ommatidia lack proper corneal lenses. – See also OA 9306.

2000

(19722) KRUŠNIK, C. & T. LAH, 2000. [*Composition of the cadaster of ditches of Ljubljana Moor according to their ecological significance*]. Natn. Inst. Biol., Ljubljana. vi + 179 pp. (Slovene). – (Publishers: Večna pot 111, SI-1000 Ljubljana).

Includes an assessment of odon. spp. abundance in the ditches, and a map showing the ditches of importance for the endangered odon. spp.

(19723) REICHHOLF, J.H., 2000. Früheres Vorkommen der beiden Quelljungfer-Arten *Cordulegaster bidentatus* und *Cordulegaster boltonii* an den "Dachwänden" am unteren Inn. *Mitt. zool. Ges. Braunau* 7(4): 327-328. – (Zool. Staatssammlung, Münchenhausenstr. 21, D-81247 München).

With reference to the paper listed in OA 9973, considerations are presented on the occurrence of the 2 spp. in the Lower Inn area, Bavaria, Germany.

2001

(19724) GAINO, E. & M. REBORA, 2001. Apical antennal sensilla in nymphs of *Libellula depressa* (Odonata: Libellulidae). *Invert. Biol.* 120(2): 162-169. – (Dipto Biol. Anim. & Ecol., Univ. Perugia, Via Elce di Sotto, I-06123 Perugia).

The description of ultrastructure in the final instar larva is provided. It is hypothesized that the larval coelomic sensillum might have a chemosensory function, responding to molecules that diffuse through the cuticle and the underlying granular and fibrillar layer, as no clear pore of pore-tubulae system is visible. Alternative functions are also explored on the basis of morphological details.

(19725) GALLIE, J.A., R.L. MUMME & S.A. WISSINGER, 2001. Experience has no effect on the development of chemosensory recognition of predators by tadpoles of the American toad, *Bufo americanus*. *Herpetologica* 57(3): 376-383. – (First Author: Dept Biol. Sci., Northern Arizona Univ., Flagstaff, AZ 86011, USA).

Although chemosensory recognition of predators by larval amphibians is well known, the extent to which experience plays a role in the development of this anti-predator behaviour is unclear. Here, this issue is addressed by exposing laboratory-reared (native) and wild-caught (experienced) *B. americanus* tadpoles to water-borne chemical cues of *Leptomis macrochirus*, *Anax junius* larvae and to adult *Notophthalmus viridescens*. Compared to controls, tadpoles exposed to chemical cues of *Leptomis* (bluegill sunfish) and *Anax* significantly decreased activity and significantly increased aggregation. However, the behaviour of tadpoles exposed to chemical cues of *Notophthalmus* (red-spotted newt) was identical to that of control tadpoles. Most importantly, no difference was found in anti-predator behaviour between laboratory-reared and wild-caught tadpoles. It is concluded, therefore, that larval experience with predators is unnecessary for the development of chemosensory predator recognition and that anti-predator behaviour in this sp. is largely innate.

(19726) MARTIN, D.C. & R.K. NEELY, 2001. Benthic macroinvertebrate response to sedimentation in a *Typha angustifolia* L. wetland. *Wetlands Ecol. Mngmt* 9: 441-454. – (Second Author: Dept Biol., Eastern Michigan Univ., Ypsilanti, MI 48197, USA). Fiberglass mesh enclosures (1 × 1 m²) in a *T. angus-*

tifolia marsh were employed to examine the effects of clay additions on the resident macroinvertebrate communities. The densities of odon. larvae (Coenagrionidae, Libellulidae) were consistently and significantly throughout the growing season lower in the sedimented enclosures, whereas Aeshnidae occurred only in the unsedimented control plots.

2003

- (19727) MATUSHKINA, N.A. & S.N. GORB, 2003. A checklist of substrate for endophytic oviposition of some European dragonflies (Insecta: Odonata). *Gaz. Kharkov ent. Soc.* 10(1/2): 108-118. (Russ., with Engl. s.). — (First Author: Dept Zool., Fac. Biol., Kiev Natn. Univ., Glushkova 2, korpus 12, UA-01680 Kiev).
The list is based on literature and on original observations, and covers 41 odon. spp.

2004

- (19728) AKAMATSU, F., H. TODA & T. OKINO, 2004. Food source of riparian spiders analyzed by using stable isotope ratios. *Ecol. Res.* 19: 655-662. — (Second Author: Dept Envir. Sci., Fac. Sci., Shinshu Univ., 3-1-1 Asalu, Matsumoto, 390-8621, JA).
The carbon and nitrogen stable isotope ratios are presented for "Agrionidae sp.", *Calopteryx virgo japonica*, *Orthetrum albistylum speciosum*, *Sympetrum frequens* and *S. pedemontanum elatum* from the middle reach of the Chikuma river, Sakaki, Japan.
- (19729) KOMPOSCH, B., H. BRUNNER, W.E. HOLZINGER, D. STREITMAIER, T. ROTTENBURG & W. PETUTSCHNIG, 2004. *Kärntens bedrohte Natur: Libellen*. Kärntner Landesregierung & Arge Naturschutz, Klagenfurt. 47 pp. Softcover (14.6 × 20.7 cm). ISBN none. Price: XX net. — (Publishers: Arge Naturschutz, Gasometergasse 10, A-9020 Klagenfurt; — the first 3 Authors: Ökoteam, Inst. Faunistik & Tierökol., Bergmannsgasse 22, A-8010 Graz).
An outline of odon. biology, with the account of odon. habitats and their characteristic fauna in Carinthia, Austria.
- (19730) LEOPOLD, P., 2004. *Ruhe- und Fortpflanzungsstätten der in Deutschland vorkommenden Tierarten nach Anhang IV der Flora-Fauna-Habitat-Richt-*

linie (FFH.RL) des Rates der Europäischen Gemeinschaften von 1992 (92/43/EWG). Grontmij, Koblenz. 202 pp. — (Rüdigerstr. 79/A, D-53179 Bonn).
The odon. are dealt with on pp. 17-30. The roosting and oviposition sites in Germany are described for *Sympetma paedisca*, *Aeshna viridis*, *Gomphus flavipes*, *Ophiogomphus cecilia*, *Oxygastra curtisii*, *Leucorrhinia albifrons*, *L. caudalis* and *L. pectoralis*.

2005

- (19731) CHOONG, C.Y., 2005. Oviposition behaviour of *Euphaea impar*. *Malaysian Naturalist* 59(1): 46-48. — (Sch. Envir. & Nat. Resour. Sci., Fac. Sci & Technol., Univ. Kebangsaan Malaysia, Bangi-46300, Selangor, Malaysia).
Field observations on oviposition behaviour (Univ. Kebangsaan Malaysia, Bangi campus).
- (19732) DENK, T., H. SEEHOFER, H.-M. BERG, M. BRAUN, T. HOCHEBNER & M.A. JÄCH, 2005. Biotoperhebung Garnisonsübungsplatz Völtendorf bei St. Pölten, NO. Vegetationskundliche und faunistische Kartierung 2000-2001. *Wiss. Mitt. niederöst. Landesmus.* 17: 183-264. (With Engl. s.). — (First Author: Haus 1/ Top 1, PF 28, Landhausboulevard, A-3109 Pölten).
The odon. fauna (20 spp.) of the military training ground Völtendorf (Lower Austria) is described (pp. 230-239), and the composition of assemblages at various ecologically different types of habitat is analysed.
- (19733) JOHNSON, K.E. & L. EIDIETIS, 2005. Tadpole body zones differ with regard to strike frequencies and kill rates by dragonfly naiads. *Copeia* 2005(4): 909-913. — (First Author: Program Biol., Kraus Nat. Sci. Bldg, Univ. Michigan, Ann Arbor, MI 48109-1048, USA).
Strike frequencies and kill probabilities of *Anax junius* larvae against *Rana sylvatica* tadpoles were assessed. Strikes fell into 5 categories according to their placement on the tadpole body: anterior head/body, posterior head/body, head/body-tail intersection, anterior tail, and posterior tail. The kill probability was calculated for each category as the number of kills divided by the number of contacts made in that category. These probabilities varied: a higher probability was found for both the anterior and posterior head/body, and values declined for successively posterior categories. Neither the kill probability nor the size

of the body zone influenced the number of strikes to that zone. Surprisingly, the dragonfly larvae struck most frequently at the relatively narrow region of the head/body-tail intersection, suggesting that they may aim at a specific target.

- (19734) MARTYNOV, V.V. & A.V. MARTYNOV, 2005. To the knowledge of dragonflies (Insecta: Odonata) of the Nature Reserve "Medobory" and surrounding areas. *Gaz. Kharkov ent. Soc.* 12(1/2): 23-24. (Russ., with Engl. s.). – (Dept Zool., Fac. Biol., Donetsk Natn. Univ., Shchorsa 46, UA-83050 Donetsk).

The reserve is located in Gusiatskiy distr. of the Ternopol region, the Ukraine. Its odon. fauna (25 spp.) is listed and briefly discussed.

- (19735) McCREADIE, J.W., D.T. IHLE & P.H. ADLER, 2005. Biodiversity of larval damselflies and dragonflies (Insecta: Odonata) in the lower Mobile/Tensaw Delta, Alabama. *SEast. Nat.* 4(2): 321-334. – (First Author: Dept Biol. Sci., Life Sci. Bldg, rm 124, Univ. South Alabama, 307 University Blvd, Mobile, AL 36688-0002, USA).

16 spp. representing 9.2% of Alabama's odon. fauna (USA), were collected from flowing waters 10-450 m wide in the poorly surveyed Mobile/Tensaw Delta of Baldwin co. over a 1-yr period. The number of spp. was positively correlated with the number of specimens per site, with sites nearest Mobile Bay having fewer spp., possibly reflecting higher salinities. Odon. assemblages in large flows of the Delta are unpredictable in terms of species co-occurrence, and fit a model of non-equilibrium community structure.

2007

- (19736) CALLE, P., G. DE KNIJF, G. KURSTJENS & B. PETERS, 2007. Present and historic biodiversity of dragonflies in the Grensmaas floodplain. *Natuurh. Maandbl.* 96(10): 269-277. (Dutch, with Engl. s.). – (First Author: Van Broeckhuysenstraat 46, NL-6511 PK Nijmegen).

The stretch of the Meuse river between Maaseik (Belgium) and Maastricht (the Netherlands) is known as the Grensmaas. The development of the odon. fauna during 4 periods (prior to 1950, 1950-1989, 1990-1997, 1998-2006) is outlined and discussed. At present, more than 38 spp. were recorded in the Grensmaas floodplain. As a result of the recent large-scale floodplain restoration project, it is expected that

the odon. diversity is still to increase slightly and the population sizes are likely to grow.

- (19737) CAMOUSSEIGHT, A. & A. VERA, 2007. Current state of knowledge of Odonata (Insecta) of Chile. *Boln Mus. nac. Hist. nat. Chile* 56: 119-132. (Span., with Engl. s.). – (First Author: Mus. Nac. Hist. Nat., Casilla 787, Santiago, Chile).
An annotated catalogue of 47 spp., with bibliography.

- (19738) GABROVŠEK, K., 2007. [Technical basis for establishment of the Landscape Park Ljubljana Moor]. *Zavod Republike Slovenije za varstvo narave, Ljubljana*. 36 pp. (Slovene).

48 odon. spp. were at that time recorded from the Ljubljana Moor (central Slovenia), the 12 red listed are mentioned here.

- (19739) KEFFORD, B.J., J. SALTER, C. CLAY, J.E. DUNLOP & D. NUGEGODA, 2007. Freshwater invertebrates' response to gradients of salinity and turbidity: using preference as a rapid sub-lethal test. *Australasian J. Ecotoxicol.* 13: 131-142. – (First Author: Biotechnol. & Envir. Biol., Sch. Appl. Sci., RMIT Univ., P.O. Box 71, Bundoora, Vic-3083, AU).
The odon. were (to be) represented by *Ischnura aurora* and *I. heterosticta*. The former sp. appeared unsuitable for preference testing in the experimental device used. *I. heterosticta* did not show any evidence for turbidity preference. No other information related to the odon. is provided.

- (19740) OCHARAN LARRONDO, F.J., H. MORTERA PIORNO & A. TORRALBA BURRIAL, 2007. Invertebrados insectos. *In: C. Nores Quesada & P. Garcia-Rovées Gonzalez, [Coord.], Libro Rojo de la Fauna del Principado de Asturias*, pp. 70-114, 121-127, Gobierno del Principado de Asturias & Obra Social "la Caixa", Oviedo. ISBN 84.96050-15-7. – (First Author: Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).
The Odon. treated are: *Coenagrion caerulescens*, *C. mercuriale*, *C. scitulum*, *Aeshna juncea*, *Brachytron pratense*, *Oxygastra curtisii*, *Macromia splendens* and *Sympetrum flaveolum*.

- (19741) SCHRACK M. & U. STOLZENBURG, 2007. Die Libellenfauna im Töpfergrund in der Radeburger Heide. *Veröff. Mus. Westlausitz Kamenz* 2007 (Sonderheft): 167-180. – (First Author: Hauptstr. 48/A, D-01471 Radeburg).

The study area is located N of Dresden, Germany. Its odon. fauna (41 spp.) is listed and discussed.

- (19742) SVENSSON, E.I., K. KARLSSON, M. FRIBERG & F. EROUKHMANOFF, 2007. Gender differences in species recognition and the evolution of asymmetric sexual isolation. *Curr. Biol.* 17: 1943-1947. – (Sect. Anim. Ecol., Ecology Bldg, Lund Univ., SE-22362 Lund).
Closely related sympatric spp. are expected to evolve strong species discrimination because of the reinforcement of mate preferences. Fitness costs of heterospecific matings are thought to be higher in ♀♀ than in ♂♂, and ♀♀ are therefore expected to show stronger species discrimination than ♂♂. Here are investigated gender and spp. differences in sexual isolation in a sympatric spp. pair, *Calopteryx splendens* and *C. virgo*. This genus is one of the classic examples of reproductive character displacement in evolutionary biology, with exaggerated interspecific differences in the amount of dark wing coloration when spp. become sympatric. Experimental manipulation of the extent of dark wing coloration revealed that sexual isolation results from both ♀ and ♂ mate discrimination and that wing melanization functions as a species recognition character. ♀ choice of conspecific ♂♂ is entirely based on wing coloration, whereas ♂♂ in one sp. also use other sp. recognition cues in addition to wing colour. Stronger species discrimination ability in ♂♂ is presumably an evolutionary response to an elevated ♂ predation risk caused by conspicuous wing coloration. Gender differences in species discrimination and fitness costs of ♂ courtship can thus shed new light on the evolution of asymmetric sexual isolation and the reinforcement of mate preferences.
- (19743) TORRALBA BURRIAL, A. & F.J. OCHARAN, 2007. Biogeographical composition of the Iberian Odonata, with particular emphasis on Aragonese dragonflies. *Boln Soc. ent. aragon.* 41: 179-188. (Span., with Engl. s.). – (Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).
The checklist of the Iberian Odon. is updated (76 spp. now) and distribution areas and estimated secondary centres of origin and dispersal are analysed. The Iberian odon. fauna is composed of Mediterranean (66%, mainly Ibero-Maghrebian), northern (21%, Eurosiberian and Holarctic) and some Ethiopian (13%) elements. The Aragonese odon. fauna is biogeographically analysed and compared with that of the other Iberian regions.
- (19744) TORRALBA BURRIAL, A. & F.J. OCHARAN, 2007. Dragonflies caught by plants (Odonata: Libellulidae). *Entomol. gener.* 30(4): 301-305. (With Span. s.). – (Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).
The observation is reported of a ♂ *Crocothemis erythraea* caught by *Silene inaperta* (Caryophyllaceae). This plant presents sticky secretions on the stem, which are likely to serve as a protection against herbivores. Other cases of capture of dragonflies by non-insectivorous plants are reviewed.
- (19745) VAN SCHAIK, V.A. & R.P.G. GERAEDS, 2007. *Somatochlora flavomaculata* along the Venbeek brook. *Natuurh. Maandbl.* 96(7): 198-201. (Dutch, with Engl. s.). – (First Author: St Luciaweg 20, NL-6075 EK Herkenbosch).
12 sightings of *S. flavomaculata* along the brook (Limburg, the Netherlands) are reported (2005, 2006, all in June) and an annotated list is presented of 28 other spp. encountered there.

2008

- (19746) BOROS, E., L. FORRÓ, G. GERE, O. KISS, L. VORÓS & S. ANDRIKOVICS, 2008. The role of aquatic birds in the regulation of trophic relationships of continental soda pans in Hungary. *Acta zool. Acad. Sci. hung.* 54(Suppl. 1): 189-206. – (First Author: Naturglob, Kossuth L. u. 76, H-1196 Budapest).
The natural shallow intermittent sodic alkaline pans represent a unique type of inland saline waters. They occur worldwide in the border of arid zones with steppe vegetation and are important as stop-over sites for several migratory waterbirds. By a foraging experiment is here demonstrated that the filter-feeder wildfowl *Anas acuta*, *A. crecca*, *A. penelope*, *A. platyrhynchos* and *A. querquedula* can successfully and completely remove all the odon. larvae from these habitats.
- (19747) BOULTON, A.J., L. BOYERO, A.P. COVICH, M. DOBSON, S. LAKE & R. PEARSON, 2008. Are tropical streams ecologically different from temperate streams? In: D. Dudgeon, [Ed.], *Tropical stream ecology*, pp. 257-284, Academic Press, San Diego, ISBN 978-0-12-088449-0.

- Includes various references to the Odon. Among the interesting suggestions is the possibility that the increased odon. diversity in tropical streams could be due to their occupation of the niche vacated by the scarcity of large carnivorous Plecoptera.
- (19748) BRAUNE, E., O. RICHTER, D. SÖNDGERATH & F. SUHLING, 2008. Voltinism flexibility of a riverine dragonfly along thermal gradients. *Global Change Biol.* 14: 470-482. – (Last Author: Inst. Geoökol., Techn. Univ. Braunschweig, Langer Kamp 19/c, D-38106 Braunschweig). Potential effects of future warming should be reflected in life history patterns of aquatic organisms observed in warmer climates or in habitats that are different in ambient temperature. In the special case of *Gomphus vulgatissimus* previous research suggests that voltinism decreases from S to N. Here, data on voltinism were analysed from 11 sample sites along a latitudinal gradient from about 44°N to 53°N, comprising small streams to medium-sized rivers. Furthermore, to simulate different conditions and to allow projections for future climate change scenarios, a population dynamic model was developed based on a projection matrix approach. The parameters of the model are dependent on temperature and day length. Field results indicate a decrease in voltinism along the latitudinal gradient from southern to northern Europe and a corresponding increase of voltinism with higher temperatures. An increase in voltinism with width of the running water implies an effect of varying habitat temperature. Under the impact of global warming, this model predicts an increased development speed, particularly in the northern part of the latitudinal gradient, an extension of the northern range limit and changes in phenology of *G. vulgatissimus*, leading to an extension of the flight season in certain regions along the gradient.
- (19749) BRODIN, T., 2008. Behavioral syndrome over the boundaries of life, carryovers from larvae to adult damselfly. *Behav. Ecol.* 2008, 8 pp.; – DOI: 10.1093/beheco/arn111. – (Dept Ecol. & Envir. Sci., Umeå Univ., S-90187 Umeå). Activity is an important behavioural trait that mediates a trade-off between obtaining food for growth and avoiding predation. Active individuals usually experience a higher encounter rate with food items and suffer higher predation pressure than less active individuals. Here it was investigated how activity of *Lestes congener* is affected by larval state and predator presence and if larval behavioural type (BT) can be used to predict larval boldness, foraging success, and adult BT. Activity level of individual larvae was studied without predator at 2 different physiological states (hungry and fed) and in 2 predator treatments: familiar predator cues and unfamiliar predator cues. Larvae did not adjust their activity depending on state or when subjected to unfamiliar predator cues, but a general reduction in activity was seen in the familiar predators treatment. Hence, active individuals remained active compared with their conspecifics, independent of state or predator treatment. Active individuals were also bolder and more efficient foragers than their less active conspecifics. Furthermore, both adult activity and boldness were correlated with larval BT. The results illustrate that BT of a larvae is carried over many different situations keeping active larvae active even in maladaptive situations, demonstrating how a behavioural syndrome may constrain behavioural plasticity. Furthermore, they showed that behavioural syndromes can carry over from larvae through metamorphosis and dictate the BT of the adult.
- (19750) DOMEK, P., T. JONIAK & R. PIOTROWICZ, 2008. Spatial and seasonal variation of macrozoobenthos in disharmonic lakes of the Drawa National Park. *In: R. Goldyn et al., [Eds], The functioning and protection of water ecosystems*, pp. 39-44, Dept Water Protection, Univ. Poznan, Poznan. – (Dept Water Protection, Fac. Biol., A. Mickiewicz Univ., Umultowska 89, PO-61-614 Poznań). The Park is located in NW Poland. From 3 post-glacial mid-forest lakes, 4 identified odon. spp. and *Aeshna* sp. are reported.
- (19751) FAGUNDES, C.K., E.R. BEHR & C.B. KOTZIAN, 2008. Diet of *Iheringichthys labrosus* (Siluriformes, Pimelodidae) in the Ibicui river, southern Brazil. *Iheringia (Zool.)* 98(1): 60-65. (With Port. s.). – (Third Author: Depto Biol., Univ. Fed. Santa Maria, Campus Universitario, Faixa de Camobi km 9, BR-97105-900 Santa Maria, RS). The Alimentary Index values of Odon. (cumulatively for Aeshnidae, Gomphidae and Libellulidae) in the diet of this benthic-feeding fish in the Ibicui river (Rio Grande do Sul, Brazil) are provided per 4 seasons (Dec. 1999 - Jan. 2002) and per type of habitat (lentic, lotic).
- (19752) KHAN, M.S., 2008. Biology and distribution

of geckos of the genus *Indogekko* Khan, 2003 (Sauria: Gekkonidae). *Russ. J. Herpetol.* 15(2): 87-92. – (D-206 West, Landsdowne Towers Apartments, 776 Providence Rd, Aldan, PA 19018, USA).

The zygopterans are reported among the diet items of the Pakistani *Indogekko fortmunroi*, *I. indusoani* and *I. rohtasfortai*. – [Abstractor's note: In Kathmandu (Nepal), the geckos (sp. unknown) are often seen on walls near a lamp, catching the insects attracted by light, among which incidentally a *Ceriagrion azureum*].

- (19753) PRINCIPE, R.E., 2008. Taxonomic and size structures of aquatic macroinvertebrate assemblages in different habitats of tropical streams, Costa Rica. *Zool. Stud.* 47(5): 525-534. – (La Selva Biol. Stn, Organization for Tropical Studies, Puerto Viejo de Sarapiquí, Heredia-41001, Costa Rica).

The study was conducted in 2 streams in La Selva, on the Caribbean slope of Costa Rica near sea level. The hydrological properties are stated, viz.: the width, depth, bottom structure, velocity, pH, and water-temperature. The coenagrionids were restricted to riffle sections and the gomphids to runs, whereas the libellulids occurred in both types of habitat. The largest individuals (Gomphidae, Libellulidae) occurred in run sections. The names of spp. are not provided.

- (19754) TORRALBA BURRIAL, A. & F.J. OCHARAN, 2008. Odonata of the fluvial network of Teruel province (Spain). *Boh Soc. ent. aragon.* 42: 325-335. (Span., with Engl. s.). – (Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo). A commented list of 33 spp. *Chalcolestes viridis*, *Lestes sponsa* and *Sympetrum sinaiticum* are new for the province. The records of *Coenagrion mercuriale* are of particular interest.

- (19755) ŽALOHAR, J. & T. HITIJ, 2008. How the oldest fossils of seahorses in the world were discovered in Tunjice. *Kamniški Zborn.* 19: 319-330. (Slovene, with Engl. s.). – (First Author: Koroška 12, Kranj, Slovenia).

Based on field diary, the discovery of *Sloveniatrum robici* (summer 2007) is outlined and a photograph of the fossil is included; – Tunjice Hills, Slovenia.

2009

- (19756) ABBOTT, J.C., 2009. Odonata (dragonflies and damselflies). In: G.E. Likens, [Ed.], *Encyclopedia*

of inland waters, Vol. 2, pp. 394-404, Elsevier, Oxford. – (Sect. Integrative Biol., Univ. Texas, Austin, TX 78712, USA).

A concise presentation of the order including the headings "Paleontology", "Systematics", "Characterization and morphology", "Biology", and "Conservation".

- (19757) BREDEHAND, E. & M.J. SAMWAYS, 2009. Impact of dam on benthic macroinvertebrates in a small river in a biodiversity hotspot: Cape Floristic Region, South Africa. *J. Insect. Conserv.* 13: 297-307. – (Dept Conserv. Ecol. & Ent., Univ. Stellenbosch, P/Bag XI, Matieland-7602, SA).

Suitable reservoirs and monitoring methods are needed to manage scarce water supplies in dry countries. Here, the impact on aquatic macroinvertebrates is assessed of the only dam in the Eerste river, which runs through the heart of a biodiversity hotspot. The dam and associated activities were the only forms of disturbance in this otherwise pristine area. Over 20,000 macroinvertebrate individuals were sampled, illustrating some categorical effects of the impoundment and its effects on macroinvertebrate assemblages, incl. 5 odon. fam. Differences upstream vs downstream in relative abundance of Ephemeroptera, Plecoptera, Coleoptera, Trichoptera and Annelida were highly significant, but those in relative abundance of Odon. (Synlestidae, Coenagrionidae, Aeshnidae, Gomphidae, Libellulidae), Hemiptera, Diptera and Crustacea were not significant.

- (19758) COLLIER, K.J., M. HAMER & W.L. CHADDERTON, 2009. A new substrate for sampling deep river macroinvertebrates. *N. Z. nat. Sci.* 34: 49-61. – (First Author: Environment Waikato, P.O. Box 4010, Hamilton, NZ).

The macroinvertebrate communities, colonising multiplate samplers constructed from perspex or tempered hardboard (wood) with an alternative artificial substrate constructed from folded coconut fibre matting (coir) enclosed in nylon netting, were compared. Substrates were incubated for 62 d (Jan.-March 2007) at 6 sites over 240 km along the Waikato river, North Island, New Zealand. The 3 substrates supported similar numbers of invertebrate taxa (27-29), but coir samples contained 71% of total invertebrate numbers of all substrates combined, compared with <17% for each type of multiplate sampler. While *Xanthocnemis* occurred on all substrate types, *Hemicordulia* was found on coir samplers only.

- (19759) COURANT, S. & C. TESSIER, 2009. Compte-rendu des prospections odonatologiques dans le massif forestier de Beaulieu-sur-Layon. *Lettre Naturalistes angevins* 20:1: 4. – (c/o Naturalistes Angevins, La Fardelière, F-49125 Tierce). 31 spp. were observed and are listed; – Maine-et-Loire, France.
- (19760) CUPSA, D., M. BIRKAS & I. TELCEAN, 2009. Studies upon the structure and dynamics of the benthic macroinvertebrate communities from two habitats of the Ier river's channel (Romania). *Bihorean Biologist* 3(1): 59-70. – (First Author: Dept Biol, Fac. Sci., Univ. Oradea, Universităţii 1, RO-410087 Oradea). 6 odon. spp. are listed from 2 habitats; – Romania.
- (19761) EVANGELISTA, M., 2009. Segnalazioni faunistiche italiane: Coenagrion scitulum (Rambur, 1842) (Odonata: Coenagrionidae). *Boll. Soc. ent. ital.* 141(2): 113. – (Mus. Civ. Stor. Nat., Parco Cascina Vigna, C.P. 89, I-10022 Carmagnola/TO). 3 ♂ and 1 ♀ from Poirino (Torino) of 15-V-2008 are brought on record; – Piemonte, Italy.
- (19762) FIORENZA, T. & I. PECILE, 2009. The Pygmy damselfly *Nehalennia speciosa* is still part of the odonate fauna in Italy (Insecta, Odonata, Coenagrionidae). *Bull. Mus. civ. Stor. nat. Venezia* 60: 17-27. (With Ital. s.). – (First Author: Via Morosina 17/C, I-33100 Udine; – Second Author: Via Galvani 12/2, I-33010 Reana del Rojale, UD). A synthesis is presented of the known occurrence of the sp. in Friuli (NE Italy). In 2007 and 2008, *N. speciosa* was recorded from 5 sites in the municipalities of Pagnacco, Moruzzo and Ampezza, all in the province of Udine. A detailed description and photographs of the habitat are provided.
- (19763) GUERBAA, K., G. DOUCET, E. HENNEQUIN & N. LOLIVE, 2009. Les odonates de l'étang de Landes (Lussat, 23). *Bull. Soc. Etude Prot. Oiseaux Limousin* 78: 32-40. – (Authors' address not provided). A commented list of 46 spp.; – France.
- (19764) HENNIGE, K., 2009. Odonate sightings April 1 to August 31, 2009. *Blue Bill / Q. JI Kingston Field Nat.* 56(3): 105-107. – (Kingston Field Naturalists, P.O. Box 831, Kingston, ON, K7L 4X6, CA). The first season sightings are presented for 76 spp. In the Kingston area, Ontario (Canada), *Anax junius* was on the wing as early as on the 26th of April (Menzel & Bayview Bog).
- (19765) OHBA, S.-Y., 2009. Ontogenetic dietary shift in the larvae *Cybister japonicus* (Coleoptera: Dytiscidae) in Japanese rice fields. *Envir. Ent.* 38(3): 856-860. – (Lab. Insect Ecol., Grad. Sch. Envir. Sci., Okayama Univ., Tsushima, Okayama, 700-8530, JA). In the field, *C. japonicus* larvae of the first instar prey only on insects (40% zygopteran and libellulid larvae), they do so also in the second instar (100% libellulid larvae), but in the third instar they feed on insects, tadpoles and fish (zygopteran, aeshnid and libellulid larvae 28.5%).
- (19766) PADILLA, M.B., F. OCHARAN, D. OTUMURO & A. TORRALBA-BURRIAL, 2009. *Anaciaeschna isosceles* (Müller, 1767) in the Ibero-Balearic area (Odonata: Aeschnidae). *Boln Soc. ent. aragon.* 44: 365-374. (Span., with Engl. s.). – (First Author: c/Caldereras 14 1ºB, ES-13300 Valdepeñas). All known Iberian localities of the sp. are reviewed and 6 new are added. From the map it is apparent, *A. isosceles* is thermophilous. Phenology data indicate a continuous flight season: from March to early Aug., peaking in early summer, with late records in mid Oct. European and N African data on phenology and biology are compared with the Iberian ones. The conservation status of the sp. in the Iberobaleares area is outlined, and several priority actions to further clarify its biology and conservation status in the area are suggested.
- (19767) PIZZO, L., 2009. Contributo alla conoscenza degli odonati del Veneto: libellule del Quartier del Piave (Treviso, Italia nord-orientale) (Odonata). *Bull. Mus. civ. Stor. nat. Venezia* 59: 31-54. (With Engl. s.). 21 spp. are listed, of which *Onychogomphus forcipatus* is new for Veneto and *Ischnura pumilio* and *Somatochlora metallica* are recorded for the first time from the province of Treviso.
- (19768) TORRALBA BURRIAL, A., 2009. Los odonatos de Extremadura. In: A. Sanchez Garcia et al., [Eds], *Odonatofauna ibérica y cambios recientes*, pp. 310-317, Conservajería de Industria, Energía y Medio Ambiente. ISBN 978-84-6606-480-8. – (Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).

A brief overview of the fauna of Extremadura (Spain), with a checklist of 79 spp.

- (19769) TORRALBA-BURRIAL, A. & I. MEZQUITA, 2009. Partner recognition failure in dragonflies: five inter- and intraspecific intrasexual tandems (Odonata: Lestidae, Coenagrionidae, Gomphidae). *Boln Soc. ent. aragon.* 44: 522-524. (Span., with Engl. s.). – (First Author: Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).
The intraspecific intrasexual tandems are recorded in *Ischnura pumilio* and *Lestes sponsa*, and the interspecific intrasexual tandems in *L. sponsa* × *L. barbarus*, *L. sponsa* × *Chalcolestes viridis* and *Onychogomphus uncatatus* × *O. forcipatus unguiculatus*.

2010

- (19770) BARBOSA DOS SANTOS, S. et al. [10 joint authors], 2010. Current knowledge of the non-marine invertebrate fauna of Ilha Grande (Angra dos Reis, RJ). *Oecologia australis* 14(2): 504-549. (Port., with Engl. & Span. s's.). – (Depto Zool., Inst. Biol., UERJ, rua San Francisco Xavier 524, Sala 525/2, Maracaña, BR-20550-900 Rio de Janeiro).
List of 39 odon. spp.; – Rio de Janeiro, Brazil.
- (19771) BARROS, P., P. MOREIRA & S. FERREIRA, 2010. Contribution to the knowledge of the Odonata fauna of northern Portugal. *Boln Soc. ent. aragon.* 46: 533-539. (With Span. s.). – (First Author: Lab. Ecol. Aplicada, Univ. Tras-os-Montes e Alto Douro, Quinta de Prados, PT-5001-801 Vila Real).
The known distribution of 32 Portuguese spp. is extended with 220 records from 50 localities.
- (19772) CALLE, P. & F. BIRD, 2010. *A study of the relationship between some fauna groups (butterflies, dragonflies and reptiles) and vegetation succession at dry biotopes in the Eastern Rhodopes, Bulgaria.* Calle, Nijmegen. 68 pp. – (First Author & Publisher: Ecol. Consultancy, Begijnenstr. 36, NL-6511 WP Nijmegen).
12 odon. spp. were encountered, incl. *Leucorrhinia pectoralis* and *Ophiogomphus cecilia*. The latter is a new sp. for E Rhodopes.
- (19773) COLLIER, A., V. NAIR, S. TAYLOR & J. ZETTLER, 2010. Apparent risk of predation by dragonfly naiads (Odonata: Libellulidae) inhabits tadpole growth (*Rana sphenoccephala*). *Bios* 81(2):

45-54. – (First Author: Dept Biol., Armstrong Atlantic St. Univ., 11935 Abercorn St., Savannah, GA 31419, USA).

120 *R. sphenoccephala* tadpoles were reared in 1.5 long chambers (10 tadpoles per chamber) made from vinyl rain gutters. The chambers contained predatory late-instar *Pachydiplax longipennis* larvae, confined at one end in clear tubes drilled with aeration holes. The number of confined predators varied between control (n = 0), low (n = 1), and high density conditions (n = 5). Tadpoles were free to swim throughout each chamber, although food was isolated at one end adjacent to the predator tubes. In an additional high density predator condition, food was isolated at the opposite end of the chamber away from the predator tubes. There were a total of 3 replicates for each of the 4 conditions. Tadpoles from each condition were individually weighed and their total length was recorded at regular intervals throughout the trial. Tadpoles raised in the high density condition with multiple predators surrounding their only food source were significantly shorter in length and weighed significantly less than those reared in all other conditions. When multiple predators and larval food were isolated at opposite ends of the chamber, tadpole growth did not statistically differ from that of control animals. Tadpoles raised with multiple predators surrounding their food also possessed slightly deeper tails, although these results were not statistically significant. The above suggests that the inhibition of tadpole growth observed in this study may be linked to behavioural changes when perceived predation risks are high.

- (19774) FASCHINGER, C., 2010. Zur Evolution der Linse in verschiedenen Augen: Erstaunliches. *Spektrum Augenheilk.* 24: 174-180. (With Engl. s.). – (Univ.-Augenklinik, Mediz. Univ., Auenbruggerplatz 4, A-8036 Graz).
The evolution is outlined from the epithelial cells to eye spots (which can detect light) and on to the compound or single-chambered eyes. The real improvement in creating a good picture was the evolution of the lens. Lenses have the main property of refraction of the light and are found on top of the compound eyes as chitin lenses or crystalline cones. The structure of the odon. eye is emphasized.
- (19775) KEFFORD, B.J., L. ZALIZNIAK, J.E. DUNLOP, D. NUGEGODA & S.C. CHOY, 2010. How are macroinvertebrates of slow lotic systems

- directly affected by suspended and deposited sediments? *Envir. Pollution* 158: 543-550. – (First Author: Biotechnol. & Envir. Biol., Sch. Applied Sci., RMIT Univ., P.O. Box 71, Bundoora, Vic-3083, AU). The effects of suspended and deposited sediments on the macroinvertebrates are well documented in upland streams but not in slower flowing lowland rivers. Using spp. found in lowland lotic environments, mechanisms for sediments to affect macroinvertebrates are here experimentally evaluated and, in one experiment, it was also examined whether the salinity alters the effect of suspended sediments. Suspended kaolin clay reduced feeding of *Ischnura heterosticta* at high turbidity (1000-1500 NTU) but had no effects on feeding of *Hemianax papuensis*. In freshwater (0.1 mS/cm), survival of *Ischnura aurora* was poor in clear water, but improved with suspended kaolin. Growth and feeding of *I. aurora* were unaffected by suspended sediments and salinity. Settling sediments may pose greater risk to lowland lotic invertebrates than suspended sediments.
- (19776) LEHOUX, H., 2010. *Limnologie et entomologie tropicales. Pré-projets pour le monitoring des rivières de la région d'Esquinas, Costa Rica*. Centre de Recherche Biologique Tropicale, La Gamba, Costa Rica. iv + 36 pp., Engl. abstract excl. + Annexes, ii + 32 pp. – (Author: 6 rue Duboys des Sauzais, F-35150 Corps-Nuds).
This model study in La Gamba (Costa Rica) shall show the impact of human activities on the biological integrity in the Esquina drainage basin. While the first part of the study deals with the geographical structure of the river network as well as with the general chemical and physical features of its water, the second (and main) part of the study assesses the different population structures of Odon. in different habitats within the draining basin. Odon. samples were taken from primary forest (4 sites), at forest margin (2 sites) and in cultivated areas (4 sites). In total, 26 spp. were identified during the 20 sampling periods (Apr.-June 2010). The species' assemblages were compared and different sampled parameters were tested in order to explain the distribution differences. The study leads to a discussion about the suitability of various protocols for monitoring. – In the *Annexes*, among other documentation, a sample is presented of the information to be provided for each sp., based on *Hetaerina occisa* (in Fr.), *Dythemis sterilis* (in Engl.) and *Acanthagrion inexpectum* (in Span.).
- (19777) NEL, A., P. NEL, J.F. PETRULEVICIUS, V. PERRICHOT, J. PROKOP & D. AZAR, 2010. The Wagner parsimony using morphological characters: a new method for palaeosynecological studies. *Annls Soc. ent. Fr.* (N.S.) 46(1/2): 276-292. (With Fr. s.). – (First Author: Entomologie, Mus. Natn. Hist. Nat., 45 rue de Buffon, F-75005 Paris).
The limits and difficulties related to tools currently in use for palaeosynecological comparisons of faunas and floras of different geological periods are discussed. The new method of the Wagner parsimony Applied to Palaeosynecology Using Morphology (WAPUM) is defined and tested on morphological characters gathered from Odonatoptera (121 characters) and Thripida (35). The difficulties related to monophyly of the taxonomic groups used in the more traditional approaches are no longer a problem using the WAPUM method. In the WAPUM, a character is the "presence versus absence of species bearing a morphological structure". The results obtained by WAPUM minimize the number of changes among character states. The application of this method could reveal signals to confirm or to object to the currently available scenarios for the global changes in the evolution of the past diversity and disparity of organisms.
- (19778) STROBBE, F., M.A. McPEEK, M. DE BLOCK & R. STOKS, 2010. Fish predation selects for reduced foraging activity. *Behav. Ecol. Sociobiol.* 2010: 7 pp.; – DOI: 10.007/s00265-010-1032-y – (First Author: Lab. Aquat. Ecol. & Evol. Biol., Dept Biol., Univ. Leuven, Debériotstraat 32, B-3000 Leuven).
Despite the importance of foraging activity for the growth/predation risk trade-off, studies that demonstrated predator-induced survival selection on foraging activity under semi-natural conditions are relatively rare. Here, it was tested for fish-induced selection for reduced foraging activity in *Enallagma geminatum* and *E. hageni*, using a field enclosure experiment. Fish imposed considerable mortality in both spp. and survival selection on foraging activity could be detected in *E. geminatum*, but not in *E. hageni*, probably because the latter sp. already was not eating very much in the absence of fish compared to *E. geminatum*. Both spp. responded strongly to the presence of predators by reducing their foraging activity. The documented survival selection on foraging activity was detected despite the already low activity levels in fish lake prey spp. and despite strong predator-induced plasticity in this trait.

- (19779) SUHONEN, J., J. HONKAVAARA & M.J. RANTALA, 2010. Activation of the immune system promotes insect dispersal in the wild. *Oecologia* 162: 541-547. – (Dept Biol., Univ. Turku, FIN-20014 Turku).
The dispersal has important ecological and evolutionary consequences but is a poorly understood behaviour. Here, it was tested experimentally whether activation of the immune system affects dispersal in *Calopteryx virgo* ♂♂ from 3 natural populations in southern Finland. It is shown that ♂♂ equipped with an experimentally inserted artificial pathogen, a nylon monofilament implant, had higher dispersal rates and flew further than control ♂♂. It is suggested that dispersal may reduce the risk of further infections if immune system activation indicates high parasite infection risk in the present habitat, and that parasites may play an important role in the evolution of host dispersal.
- (19780) WALTER, J., 2010. *Nassau-Idstein florilegium*. Bibl. Natn. France & Bibl. de l'Image, Paris. 112 pp., softcover (24.0 × 32.0 cm). ISBN 978-2-7177-2459-2 (Bibl. Nat. Fr.) & 978-2-8144-0010-8 (Bibl. de l'Image). (Engl.).
Pls 40 and 46 are compositions with dragonflies. The taxonomic names of the spp. are stated, but one is hard to identify and the other is wrong.
- 2011**
- (19781) ABDEL-GAWAD, F.K., N.M. LOTFY, M.A. HASSANIEN & S.M. BASSEM, 2011. Evaluation of DNA damage in fish and aquatic insects induced by environmental pollutants in river Nile. *World appl. Sci. J.* 14(7): 1085-1090. – (First Author: Water Pollution Res. Dept, Natn. Res. Cent., El-Bohuth, Dokki-Gizza, 12662, Egypt).
Enallagma vansomereni is recorded from the main stream of the Nile, (probably) in Qalubya governate (Egypt).
- (19782) ANDREW, R.J., P. VARMA & M.K. RATHODI, 2011. Post-ovipositional changes in the egg chorionic ultrastructure of the dragonfly *Pantala flavescens* (Fabricius) (Insecta: Odonata: Anisoptera). *Biol. Forum* 3(2): 22-24. – (First Author: Dept Zool., Hislop Coll., Nagpur-440001, MS, India).
The unsculptured endochorion of *P. flavescens* is described.
- (19783) BARRY, M.J., 2011. Effects of copper, zinc and dragonfly kairomone on growth rate and induced morphology of *Bufo arabicus* tadpoles. *Ecotoxicol. environ. Safety* 74: 918-923. – (Biol. Dept, Sultan Qaboos Univ., P.O. Box 36, Al Khod, Muscat 123, Oman).
It is well documented that many amphibian spp. can detect chemical signals from predatory invertebrates and subsequently develop alternate phenotypes that are protective against predation. The effects of metallic pollutants on the development of predator-induced morphology have not previously been reported. Tadpoles of the toad *B. arabicus* were exposed for 20 days to copper (0, 10 or 100 µg/L), zinc (0, 10 or 100 µg/L) and kairomones of larval *Crocodylus erythraea* (1 dragonfly/12 L) in a fully crossed design. The effects of these treatments of growth and body shape were measured. Measured copper concentrations after 24 h were 4.25 µg/L ± 1.30 (10 µg/L nominal) and 34.9 µg/L ± 2.15 (100 µg/L nominal). Measured zinc concentrations were 3.04 µg/L ± 0.1 (10 µg/L nominal) and 26.3 µg/L ± 12.3 (100 µg/L nominal). Tadpoles exposed to 34.9 µg/L copper were significantly lighter and had a shorter body length than other groups. There was no direct effect of zinc on growth or tadpole shape. Tadpoles exposed to dragonfly kairomones were heavier, wider and had deeper bodies when viewed laterally and had longer tails but overall length was not affected. At 4.25 µg/L copper differences between the control and predator-exposed phenotypes increased but at 34.9 µg/L the phenotypes converged, indicating that copper may inhibit the induced response.
- (19784) BÖHRE, P., 2011. Weidebeek juffer – [*Calopteryx splendens*]. *Grasduinen* 2011 (July): 4-6. (Dutch). – (P.O. Box 41000, NL-2130 MK Hoofddorp).
An encounter with this sp. in Drenthe (The Netherlands), with notes on its biology.
- (19785) BOTERO-BOTERO, A. & H. RAMIREZ-CASTRO, 2011. Trophic ecology of *Brycon henri* (Pisces: Characidae) in the Portugal de Piedras river, upper Cauca basin, Colombia. *Revta MVZ Cordoba* 16(1): 2349-2355. (Span., with Engl. s.). – (First Author: Fundación Neotropica-Colombia, UNELLEZ, La Tebaida, Quindio, Colombia).
The libellulid and other (unidentified) odon. larvae are listed as an item of minor importance in the diet of the sabaleta.

- (19786) BOUTON, N., A. ISERBYT & H. VAN GOSSUM, 2011. Thermal plasticity in life-history traits on the polymorphic blue-tailed damselfly, *Ischnura elegans*: no differences between female morphs. *J. Insect Sci.* 11(112): 11 pp. – (Available online: insectscience.org/11.112). – (Evol. Ecol. Gr., Dept Biol., Univ. Antwerp, Groenenborgerlaan 171, B-2020 Antwerp).
♀ polymorphism is observed in various animal spp., but is particularly common in Zygoptera. The maintenance of this polymorphism has traditionally been explained from frequency and density dependent sexual conflict, however, the role of abiotic factors has recently attracted more interest. Here, the role of ambient temperature in shaping life-history was investigated for the 3 ♀ morphs of *I. elegans*. Eggs were obtained from the 3 mature ♀ morphs for 2 populations in the Netherlands. Using a split-brood design, eggs of both populations were divided between a cold and a warm treatment group in the laboratory, and egg survival and hatching time were measured. Significant thermal plasticity was found in both hatching time and egg survival between both temperature treatments. However, individuals born to mothers belonging to different colour morphs did not differ in their response to temperature treatment. Independent of colour morph, clear differences in both life-history traits between the populations were found, suggesting local adaptation. Specifically, individuals from one population hatched faster but had lower egg survival in both thermal regimes. The selection force establishing fast hatching could be (facultative) bivoltinism in one of the populations compared to univoltinism in the other. This would be in line with the more southern (and more coastal) location of the presumed bivoltine population and the inverse relation between voltinism and latitude known from earlier studies. However, other natural forces, e.g. deterioration of the aquatic habitat, may also drive fast hatching.
- (19787) BYERS, E. & S. NORRIS, 2011. *Climate change vulnerability assessment of species of concern in West Virginia*. W. Virginia Div. Natural Resour., Elkins. 69 pp. – (Publishers: P.O. Box 67, Elkins, WV 26241, USA).
6 odon. spp. at-risk were assessed as to their climate change vulnerability in W Virginia (USA), viz. *Leucorrhinia glacialis* (highly vulnerable), *Calopteryx amata*, *Telebasis byersi*, *Aeshna mutata* (all moderate vulnerable), and *Gomphus fraternus* and *Cordulegaster erronea* (both presumed stable).
- (19788) CLIMATE CHANGE UNIT, IUCN Global Species Programme, 2011. *A synthesis of existing species data of the West Africa region*. UNEP-WCMC technical report, Cambridge. 25 pp. ISBN none. – (Available from: UNEP World Conservation Monitoring Cent., 219 Huntingdon Rd., Cambridge, CB3 0DL, UK).
Orderwise maps are presented of the distribution of odon. richness (297 spp.), threatened spp. (18 spp.), density of regionally (36 spp.) and nationally endemic spp. (10 spp.) in W Africa.
- (19789) CONZE, K.-J., N. MENKE & M. OLTHOFF, 2011. Libellen und Klimawandel in Nordrhein-Westfalen. *Natur Nordrhein-Westfalen* 36(4): 20-26. – (First Author: Listerstr. 13, D-45147 Essen).
The effects of climate change in Germany are described on the examples of *Cordulegaster bidentata* and *Somatochlora arctica*. An analysis of sensitivity is presented for 73 spp.
- (19790) FAIRWEATHER, A.D. & D.F. McALPINE, 2011. History and status of the Natural History Society of New Brunswick entomology collection: 1897-1931. *J. acadian ent. Soc.* 7: 14-19. – (New Brunswick Mus., 277 Douglas Ave, Saint John, NB, E2K 1E5, CA).
Includes a short account on the odon. collections, brought together by A.G. Leavitt (1902-1907), P.R. McIntosh (1897-1902) and W. McIntosh (1897-1930). The portraits of AGL and WMCI are also provided.
- (19791) GANAI, A.H., S. PARVEEN, H.R.A. MOLA, U. AHMAD & H.A. KABIR, 2011. Diversity and community structure of aquatic insects in some derelict waterbodies of Aligarh, Uttar Pradesh, India. *J. curr. Sci.* 16(1): 155-163. – (Limnol. Res. Lab., Dept Zool., Aligarh Muslim Univ., Aligarh, U.P., India).
A few data on seasonal abundance (Feb. 2009-Jan. 2010) in 2 ponds are presented for water-dwelling individuals (larvae and adults, where applicable?), pertaining to Coleoptera, Diptera, Ephemeroptera, Hemiptera, Odon. and Trichoptera. Hardly any name is stated of any taxon beyond the order. The densities of odon. population ranged between 3 ind/m² in Nov. and 63 ind/m² in June.

- (19792) GLADYSHEV, M.I., A. Yu. KHARITONOV [KHARITONOV; deceased 4 Apr. 2013], O.N. POPOVA, N.N. SUSHCHIK, O.N. MAKHUTOVA & G.S. KALACHEVA, 2011. Quantitative estimation of dragonfly role in transfer of essential polyunsaturated fatty acids from aquatic to terrestrial ecosystems. *Dokl. Biochem. Biophys.* 438: 141-143. – (First Author: Inst. Biophysics, Siber. Br., Russ. Acad. Sci., Akademgorodok, Krasnoyarsk-660036, Russia). This is the first study to determine the concentrations of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in the biomass of adult amphibiotic insects. It is shown that odon. transfer to terrestrial ecosystems not only a significant amount of biomass (energy) from aquatic ecosystems, but also high quantities of essential long-chain polyunsaturated fatty acids (PUFAs).
- (19793) GROS, P., 2011. Endlich ein Beitrag zur eindeutigen Untermauerung des ehemaligen Vorkommens der Vogel-Azurjungfer *Coenagrion ornatum* (Selys, 1850) aus der Stadt Salzburg (Insecta: Odonata). *Mitt. Haus Natur Salzburg* 19: 95-97. (With Engl. s.). – (Haus der Natur, Museumplatz 5, A-5020 Salzburg). *C. ornatum* was listed from the province of Salzburg (Austria) by D. St. Quentin (1959, *Catalogus faunae Austriae* 12/c: *Odonata*, Springer, Wien), but no specimen was known from there. Recently, a ♂ was found in the Haus der Natur collection, collected on 22-VI-1941 from Bergheim nr the city of Salzburg by L. Schüller.
- (19794) KHARITONOV [KHARITONOV; deceased 4 Apr. 2013], A. Yu. & O.N. POPOVA, 2011. Migration of dragonflies (Odonata) in the South of the West Siberian plain. *Ent. Rev.* 91(4): 411-419. – (Second Author: Inst. Anim. Syst. & Ecol., Siber. Br., Russ. Acad. Sci., Frunze 11, Novosibirsk-630091, Russia). This is an Engl. edn of the paper listed in *OA* 19332, where the duration and the scope of the studies are stated. The spatial redistribution of dragonflies is regarded as a balance of homing and wandering behaviour. Homing results in a relative stability of local dragonfly populations and assemblages, while wandering leads to dispersal of dragonflies from their emergence sites and colonization of new habitats; the latter is especially important due to the ephemeral nature of many shallow reservoirs where the larvae develop. The formation of more or less constant migration routes is a peculiar variant of wandering activities. A special type of dragonfly migration is mass exodus from native habitats, triggered by excessive population growth and leading to elimination of all or most individuals. Such migrations not only optimize the size of dragonfly populations but also facilitate removal of nutrients and organic matter from eutrophic water bodies. An original generalized classification of dragonfly migrations is proposed.
- (19795) LEJFELT-SAHLÉN, A., 2011. *Sympetrum pedemontanum*, ny trollslända i Sverige. – [*Sympetrum pedemontanum*, a new dragonfly for Sweden]. *Fauna Flora*, Uppsala 106(3): 40-41. (Swed.). – (Author's address not provided). The sighting of 4-IX-2011, ca 15 km NE from Huskvarna is brought on record and 2 photos are also provided.
- (19796) LÜDERITZ, V., T. SPEIERL, U. LANGHEINRICH, W. VÖLKL & R.M. GERSBERG, 2011. Restoration of the Upper Main and Rodach rivers: the success and its measurement. *Ecol. Engineering* 37: 2044-2055. – (First Author: Dept Water & Waste Mngmt, Univ. Appl. Sci., Breitscheidstr. 2, D-39114 Magdeburg). 11 odon. spp. are listed from restored and non-restored sections of the 2 rivers in N Bavaria (Germany), illustrating the results of the restoration.
- (19797) MUNIER, V. & R. ALBLAS, 2011. Lezersfoto's – [Photographs by the readers]. *Grasduinen* 2011 (Aug.): 24-27. (Dutch). – (c/o Eds: P.O. Box 41000, NL-2130 MK Hoofddorp). Comments by members of the jury on the composition and other artistic aspects of 5 dragonfly photographs, presented in the monthly contest organized by the magazine.
- (19798) ŠPANIĆ, R., A. CIPČIĆ, T. BOGDANOVIĆ & M. FRANKOVIĆ, 2011. State of research into the dragonflies (Odonata) of Karlovac county, Croatia, with special reference to Natura 2000 species. *Entomol. Croat.* 15(1/4): 209-211. (With Croat. s.). – (Last Author: Oboj V, odvojak 10/1, HR-10000 Zagreb). Lists 49 spp., incl. *Ophiogomphus cecilia*, *Cordulegaster heros* and *Leucorrhinia pectoralis*, with comments on their conservation status.
- (19799) STRAND, L. & M. JOHANSSON, 2011. Trollsländans förvandling. – [Dragonfly metamor-

phosis]. *Fauna Flora*, Uppsala 106(3): 36-40. (Swed.).
– (Authors' addresses not provided).
General, in popular style.

2012

- (19800) ÁLVAREZ, M.A., A.M. RUBIO, J. BUENO, I. NOVAL, C.C. SUÁREZ & A. TORRALBA-BURRIAL, 2012. First records of *Aeshna affinis* Vander Linden, 1820 (Odonata: Aeshnidae) from Asturias (northern Iberian Peninsula). *Boln Soc. ent. aragon*. 51: 357-358. (Span., with Engl. s.). – (Last Author: Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).
The 2008, 2009 and 2012 records are listed from 3 localities, all concerning ♂ ♂.
- (19801) ÁLVAREZ, M.A. & A. TORRALBA-BURRIAL, 2012. First record of *Sympetrum meridionale* (Selys, 1841) (Odonata: Libellulidae) from Asturias (northern Iberian Peninsula). *Boln Soc. ent. aragon*. 51: 346. (Span., with Engl. s.). – (First Author: Depto Química Organ. & Inorgan., Univ. Oviedo, ES-33071 Oviedo).
1 ♂, Llodero, 7-X-2012.
- (19802) ÁLVAREZ GANDARA, J. & R. ESTÉVEZ RODRIGUEZ, 2012. First records of *Orthetrum brunneum* (Fonscolombe, 1837) for the province of Lugo (Galicia, NW Iberian peninsula) (Odonata, Libellulidae). *Arqs ent*. 7: 161. (Span., with Engl. s.). – (First Author: Barrio do Souto 10/8, ES-36740 San Salvador de Tebro, Tomiño, Pontevedra).
6 ♂ from Lugo-Monforte (alt. 357 m a.s.l.), 12-VII-2012, are brought on record; – Spain.
- (19803) ANDREW, R.J., P. VERMA & M.K. RATHODI, 2012. Egg chorionic ultrastructure of the dragonfly *Gynacantha bayadera* Selys (Insecta: Odonata: Anisoptera). *Int. J. Biotech. Biosci*. 2(3): 213-216. – (First Author: Dept Zool., Hislop Coll., Nagpur-440001, MS, India).
G. bayadera is depositing the eggs in dry mud banks of a water body. The morphology of its egg is compared to that of some other aeshnids having the endophytic mode of oviposition.
- (19804) BECHLY, G., 2012. An interesting new fossil relict damselfly (Odonata: Zygoptera: Coenagrionoidea) from Eocene Baltic amber. *Palaeodiversity* 5: 51-55. (With Germ. s.). – (Staat. Mus. Naturk., Rosenstein 1, D-70191 Stuttgart).
Balticoagrion paulyi gen. n., sp. n. (fam. incerte sedis) is described and illustrated. It does not fit into any fossil or recent family-group taxon and is here tentatively considered as a relict and a potential stem group representative of Coenagrionoidea.
- (19805) BO, T., S. FENOGLIO, M.J. LÓPEZ-RODRIGUEZ & J.M. TIERNODE FIGUEROA, 2012. Trophic behaviour of the dragonfly *Cordulegaster boltonii* (Insecta: Odonata) in small creeks in NW Italy. *Entomologica fenn*. 22: 255-261. – (Second Author: Dipto Sci. Ambiente, Univ. Piemonte Orientale, Via Tersi Michel 11, I-15121 Alessandria).
The gut contents of 211 larvae from the Rocchetta Tanaro Natural Park (Piemonte, Italy) were analyzed. Aquatic insects dominated in their diet, while crustaceans, annelids, molluscs and terrestrial invertebrates occurred sporadically. An ontogenetic shift in the diet was observed, small larvae consumed different prey than the older ones. *C. boltonii* is one of the dominant predators in the Piemonte lowland small streams, which are devoid of fish and plecopterans.
- (19806) BUCZYŃSKI, P., 2012. Dragonflies (Odonata) of the left-bank Bug river valley between Włodawa and Koden (middle-eastern Poland). *Acta biol. Univ. Szczecińskiego* 19(728): 47-69; tab. 1, figs 1-5 & photographs 1-9 excl. (With Pol. s.). – (Dept Zool., UMCS, Akademicka 19, PO-20-033 Lublin).
The key sites of this study are the oxbows, the Bug river and its tributaries. A total of 40 spp. were recorded and a review of the earlier research conducted in the upper Bug valley is included. The results of the current and historical surveys combined yield 54 spp.
- (19807) BUCZYŃSKI, P. & A. ŁEBEDZKI, 2012. Landscape Park of "Janowskie Forests" as a hotspot of dragonfly (Odonata) species diversity in Poland. In: K.H. Dygus, [Ed.], *Natural human environment: dangers, protection, education*, pp. 151-174, Univ. Ecol. Mngmt, Warsaw, ISBN 978-83-62057-53-5. (With Pol. s.). – (First Author: Dept Zool., UMCS, Akademicka 19, PO-20-033 Lublin).
The Park has a surface of 40.000 ha and 58 spp. were recorded. The fauna is described in detail and discussed; – Poland.
- (19808) CARLSON, B.E. & T. LANGKILDE, 2012.

- A common marking technique affects tadpole behavior and risk of predation. *Ethology* 119: 167-177. – (Dept Biol., Pennsylvania St. Univ., 209 Mueller Lab., University Park, PA 16802, USA).
The consequences of the use of common larval amphibian marking technique (staining with methylene blue) for *Lithobates sylvaticus* tadpole behaviour and survival from (mostly) *Anax junius* larvae predation were examined. The marking suppressed the increase in movement rate that typically occurred in unmarked tadpoles in the presence of predator cues. Marked tadpoles were significantly more likely to be captured, though this effect could not be attributed to the difference in movement rate.
- (19809) CORSO, A., O. JANNI, M. PAVESI, M. SAMMUT, A. SCIBERRAS & M. VIGANO, 2012. Annotated checklist of the dragonflies (Insecta Odonata) of the islands of the Sicilia Channel, including the first records of *Sympetrum sinaiticum* Dumont, 1977 and *Pantala flavescens* (Fabricius, 1798) for Italy. *Biodiv. J.* 3(4): 459-478. – (First Author: MISC, Via Camastra 10, I-96100 Siracusa).
The information is presented on the occurrence of 24 spp. in the Pantellaria and Pelagie islands (both Italy; 20 spp.) and in the Maltese Archipelago (18 spp., with *Trithemis arteriosa* deleted from the list).
- (19810) DAVID, S. & V. JANSKÝ, 2012. [Revision of the M. Trpiš Odonata collection deposited in the Slovak National Museum in Bratislava (preliminary communication)]. *Zborn. Prisp. ved. Kongr. "Zoologia 2012"*, Zvolen, pp. 44-46. (Slovak, with Engl. s.). – (First Author: Katedra Ecol. & Envir. Stud., Univ. Nitra, Hlinku 1, SK-94974 Nitra).
A general description of the collection is presented rather than its species inventory. It was brought together during 1951-1961 from 121 localities in Slovakia. The 906 specimens are referable to 39 spp. Some of the original identifications were erroneous, the corrections are shown in a table. In the collection, the historical occurrence of a number of spp. in Slovakia is documented, e.g. *Coenagrion hastulatum*, *Gomphus flavipes*, *Somatochlora alpestris*, *Crocothemis erythraea*, *Sympetrum depressiusculum* and *S. fonscolombii*.
- (19811) DE SANTOS LOUREIRO, N. & L. PONTES, 2012. The *Trithemis nigra* (Odonata: Libellulidae) of Principe island, Gulf of Guinea. *Afr. J. Ecol.* 51: 180-183. – (First Author: Cent. Envir. Biol., Fac. Ciên., Univ. Lisboa, Campo Grande, Ed. C2, PT-1749-016 Lisboa; – Second Author: Terreiro Velho, Ilha do Principe, Rep. de São Tomé e Príncipe).
T. nigra is endemic to Principe island and was hitherto known from 2 ♂, collected in Dec./Jan. 1932/1933, deposited in Mus. Nat. Hist., London. Here, the results are presented of 2 surveys, conducted in 2011. Several adults of both sexes are brought on record from 5 out of 15 localities visited. No attempt was made to find the larvae, whereas the search for exuviae was not successful. The features of the habitats are outlined. Since the human population of the island is relatively small, vegetation cover intact, waters practically unpolluted and the odon. are of no commercial or other interest to the inhabitants, the sp. is at present not threatened.
- (19812) ENDERSBY, I.D., 2012. Etymology of the dragonflies (Insecta: Odonata) named by R.J. Tillyard, F.R.S. *Proc. Linn. Soc. N.S.W.* 134: 1-16. – (56 Looker Rd, Montmorency, Vic-3094, AU).
RJT described 26 gen. and 130 specific or subspecific odon. taxa from the Australian region. The etymology of the taxonomic name of each of these is given or deduced.
- (19813) ERBIDA, N., 2012. [Report of Dragonfly Observation Group, 2010]. In: I. Kodele Krašna, [Ed.], *Biološko raziskovalna tabora "Kodreti 2010" in "Kodreti 2011"*, pp. 7-13, Zavod RS za varstvo narave, Ljubljana, ISBN none. (Slovene). – (Škofjeloška 25, SI-1215 Medvode).
Records of 25 spp. from 16 localities in the Vipava region, W Slovenia.
- (19814) GNANAKUNAR, M., B.R. ANSIL, P.O. NAMEER & S. DAS, 2012. Checklist of odonates of Chimmony Wildlife Sanctuary. *Malabar Trogon* 10(1/2): 3-6. – (First Author: Malabar Nat. Hist. Soc., Susheela Mandir, B.G. Rd, Nadakavu Post, Calicut-673011, India).
The Sanctuary is located in Thrissur distr., Kerala, India. A checklist of 55 spp. is presented.
- (19815) GOVEDIČ, M., A. LEŠNIK, K. POBOLŠAJ, P. PRESETNIK, F. REBEUŠEK, A. ŠALAMUN & B. TRČAK, 2012. [Technical groundwork for the management plan for Landscape Park Ljubljana Moor]. CKFF, Ljubljana. 91 pp. (Slovene). – (Publishers: Klunova 3, SI-1000 Ljubljana).
Presents a very good and commented overview of

- the odon. fauna of the Moor, central Slovenia (pp. 25-37), with emphasis on *Coenagrion ornatum*, *Cordulegaster heros* and 10 other threatened and/or insufficiently known spp.
- (19816) HOLZINGER, W.E. & B. KOMPOSCH, 2012. *Die Libellen Kärntens*. Naturw. Ver. Kärnten, Klagenfurt. 336 pp. [Natur Kärnten, Vol. 6]. Softcover (15.3 × 22.8 cm). ISBN 978-3-85328-060-7. (With Engl. s.). – (Publishers: Museumgasse 2, A-9020 Klagenfurt).
The research history of the odon. fauna of Carinthia (Austria) is traced from 1859 to 2010. For each of the 63 regional spp., a concise identification paragraph is followed by brief sections on behaviour, habitats, distribution (with a map) and the adult phenology graph is included. An updated provincial Red List is also supplied. The photographs of all spp. and their characteristic habitats are provided and a comprehensive regional bibliography is appended.
- (19817) HUNGER, H. & F.-J. SCHIEL, 2012. Description of *Protallagma hoffmani* sp. nov. from the Peruvian Andes (Odonata: Coenagrionidae), including description of its larva. *Zootaxa* 3202: 28-50. – (INULA, Inst. Naturschutz u. Landschaftsanalyse, August-Ganther-Str. 16, D-79117 Freiburg/Br.).
The new sp. is described, illustrated and diagnosed from a series of ♂♂, ♀♀ and larvae, collected at Laguna Querococha. Holotype ♂: Ancash region, Peru, alt. 3980 m, 18-II-2007, deposited in MNHL.
- (19818) KANAI, K., T. MORIYAMA & K. NAKAMINE, 2012. The recorded insects on Kuroshima (Osumi Islands) in October of 2010. *Bull. Kagoshima pref. Mus.* 31: 73-78. (Jap., with Engl. title). – (Authors' addresses not transliterated).
A list of 5 odon. spp.
- (19819) KOLEČEK, J., 2012. A new record of *Leucorrhinia pectoralis* (Odonata, Libellulidae) in the district Vsetin (eastern Moravia, the Czech Republic). *Acta carpat. occid.* 3: 117-118. (Czech, with Engl. s.). – (Dept Zool., Univ. Palackeho, 17-listopadu 50, CZ-771-46, Olomouc).
Several ♂ are reported from an abandoned gravel pit (15-VI-2012) and the importance of abandoned gravel pits for some odon. spp. is emphasized.
- (19820) MACHADO, A.B.M., 2012. A new species of *Ischnura* (Odonata: Coenagrionidae) from high altitude eastern Andes of Colombia. *Zoologia* 29(6): 598-600. – (Depto Zool., Inst. Ciên. Biol., Univ. Fed. Minas Gerais, Av. Antonio Carlos 6627, Caixa Postal 486, BR-31270-901 Belo Horizonte, MG).
I. mahechai sp. n. is described and illustrated from both sexes based on both sexes. Holotype ♂: Colombia, E Andes, Guatavita, alt. 3600 m, 16-XI-1989; deposited in Depto Zool., ICB, UFMG.
- (19821) MACHADO, A.B.M., 2012. *Carajathemis simone*, new genus and species from Brazil (Odonata: Libellulidae). *Anais Acad. brasil. Ciên.* 84(4): 1039-1049. (With Port. s.). – (Depto Zool., Inst. Ciên. Biol., Univ. Fed. Minas Gerais, Av. Antonio Carlos 6627, Caixa Postal 486, BR-31270-901 Belo Horizonte, MG).
The new gen. & sp. are described and illustrated based on 22 specimens of both sexes. Holotype ♂: Brazil, Pará, Parauapebas, Foresta Nacional de Carajas, 12-XI-1994; deposited in Depto Zool., ICB, UFMG.
- (19822) MATUSHKINA, N.A., D.D. BUY & N.N. BORYSENKO, 2012. Current status of the dragonfly fauna (Insecta: Odonata) of the Kaniv Nature Reserve and vicinities. *Nature Reserves in Ukraine* 18(1/2): 87-91. (With Russ. & Ukr. s's). – (First Author: Dept Zool, Fac. Biol., Kiev Natn. Univ., Glushkova 2, korpus 12, UA-01680 Kiev).
Based on literature and on recent records, 40 spp. are listed, of which 3 spp. are reported for the first time from the Reserve. Notes on biographic affinities, ecology and behaviour of these are provided. All the recent records are listed in detail and information is given on habitats and habits of the spp. concerned.
- (19823) MOLOZZI, J., M.J. FEIO, F. SALAS, J.C. MARQUES & M. CALLISTO, 2012. Development and test of a statistical model for the ecological assessment of tropical reservoirs on benthic macroinvertebrates. *Ecol. Indicators* 23: 155-165. – (First Author: Lab. Limnol., Depto Biol. Geral, Inst. Ciên. Biol., Univ. Estad. Paraiba, Rua Baraúnas 352, Campina Grande-PB, BR-58429-500 Minas Gerais, MG).
The study is based on data collected from 90 sites in 3 reservoirs located in the Paraopeba river watershed, Minas Gerais, SE Brazil. The abundance and frequency of "Gomphidae" is stated.
- (19824) MÜLLER, J., 2012. Zur Prädation geschützter FFH- und Rote Liste-Libellen-Arten (Odonata)

- durch Fische im Gebiet der Helmeniederung. *Ent. Mitt. Sachsen-Anhalt* 20(2): 57-61. – (Frankenfelde 3, D-39116 Magdeburg).
Deals with the damage caused by anglers to the habitat and oviposition sites of legally protected odon. spp. and advocates an integral protection of the entire animal food chain up to and incl. the cormorants. The impact intensity of the presence of fish on an odon. population depends on the fish- and odon. spp. involved and on the density of fish population.
- (19825) OLIVER, X., 2012. [First data on odonate communities of the Garrotxa]. *Anmls Delegat. Garrotxa Inst. cat. Hist. nat.* 5: 67-78. (Catalan, with Engl. s.). – (C/Fontanella 3, ES-17800 Olot).
An attempt is made to characterize the odon. communities in a large number of different types of habitat in La Garrotxa (Catalonia, Spain). Data was gathered from 42 stations. Species richness, densities and the phenology of the communities are analyzed and the characteristic spp. of each habitat are stated.
- (19826) OLTHOFF, M. & D. IKEMEYER, 2012. Dragonflies of a peat bog in northwestern Turkey (Odonata: Anisoptera, Zygoptera). *Zool. Middle East* 57: 142-146. – (First Author: Martin-Luther-Str. 1/A, D-48147 Münster).
The locality is located at Yenicaga lake, Bolu prov. In total, 37 spp. are listed, of which 21 are indigenous, 14 potentially indigenous and 2 spp. were classified as guests.
- (19827) PADILLA, M.B., F.J. OCHARAN, D. OUTOMURO & A. TORRALBA-BURRIAL, 2012. Odonata from Cabaneros National Park (Ciudad Real, central Spain) (Insecta: Odonata). *Boln Soc. ent. aragon.* 50: 341-344. (Span., with Engl. s.). – (First Author: c/Caldereras 14 1ºB, ES-13300 Valdepeñas).
A list of 37 spp., with detailed capture data and some comments.
- (19828) PUGH, A.R., 2012. Effects of restoration of the waterways in the Styx river catchment. *Weta* 44: 28-40. – (Address incomplete: Dept Ent., Lincoln Univ., NZ).
Xanthocnemis sp. is reported from the riparian unrestored Kaputone stream, Christchurch area, New Zealand, whereas no odon. were found in samples from the restored Styx river and Smacks creek.
- (19829) RÁKOSY, L., M. HEISER, C.-O. MANCI & T. SCHMITT, 2012. Strong divergences in regional distributions in Romania: recent ecological constraints in dragonflies (Odonata) versus ancient biogeographical patterns in butterflies (Lepidoptera: Rhopalocera). *Insect Conserv. Div.* 2012, 10 pp.; – DOI: 10.1111/j.1752-4598-2012-00197.x – (Last Author: Biogeographie, Fachber. 6, Gebäude N, Raum 303, Univ. Trier, D-54286 Trier).
While the biogeographical structuring of Europe as a whole is relatively well understood, patterns at the more regional scale are still poorly explored. Especially the influence of different ecological demands among species groups on regional distribution patterns is mostly unresolved. Here, the distribution of strictly terrestrial butterflies are compared with those of semi-aquatic Odon. Based on an analysis of regional distribution in 196 butterfly and 68 dragonfly taxa in Romania, with cluster- and principal component analysis, the different faunal regions and faunal elements were worked out for that country. Clear regional structuring was obtained for butterflies, but only a vertical structuring in odon. from the Danube lowlands to the elevations of the Carpathians. This structure implies a recent distribution trigger based on ecological and climatic constraints in dragonflies, with water and energy availability being of high importance. The more ancient biogeographical pattern in butterflies reflects the different biogeographical elements of Europe and the connections of the Carpathian regions to the Balkan and E European steppes, with energy being of considerably higher importance for butterfly occurrences than water availability.
- (19830) RODRIGUEZ-MARTINEZ, S. & A. TORRALBA-BURRIAL, 2012. Teratology in the right paraprot of *Aeshna cyanea* (Müller, 1764) exuviae (Odonata: Aeshnidae). *Boln Soc. ent. aragon.* 51: 321-322. (Span., with Engl. s.). – (Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).
A description and illustrations of teratology of caudal appendages in an exuviae from El Franco, Asturias, Spain (17-VII-2009).
- (19831) TIPPLE, A.D., 2012. Dragonflies and damselflies (Odonata: Insecta) of the Achanakmar-Amarkantak Biosphere Reserve in Chhattisgarh and Madhya Pradesh, with their status in central India. *Int. J. Biotech. Biosci.* 2(1): 97-101. – (Dept Zool., Vidyabharti Coll., Seloo, Wardha-442104, Maha-

- rashtra, India).
A briefly commented list of 70 spp.
- (19832) TIPLÉ, A.D., 2012. Odonata (damselflies and dragonflies) fauna of Tadoba National Park and surroundings, Chandrapur, Maharashtra (central India). *Bionano Frontier* 5(2): 149-152. – (Dept Zool., Vidyabharti Coll., Seloo, Wardha-442104, Maharashtra, India).
A briefly commented list of 64 spp., with annotations on their abundance.
- (19833) TORRALBA-BURRIAL, A. & E.H. TOLEDO, 2012. Confirmation of the current presence of *Onychogomphus costae* (Selys, 1885) (Odonata: Gomphidae) in Madrid (central Iberian Peninsula). *Boln Soc. ent. aragon.* 51: 347-348. (Span., with Engl. s.). – (First Author: Depto Biol. Organismos y Sistemas, Univ. Oviedo, ES-33071 Oviedo).
The sole previous record of this sp. from Madrid was published by L. Navas (1907, *Broteria* [Zool.] 6: 42-100. Here, 1 ♂ and 1 ♀ are brought on record from rio Tajo, 16-VIII-2012).
- (19834) VANDER POORTEN, N. & K. CONNIF, 2012. The taxonomy and conservation status of the dragonfly fauna (Insecta: Odonata) of Sri Lanka. In: D.K. Weerakoon & S.W. Wijesundara, [Eds], *The national Red List 2012 of Sri Lanka: conservation status of the fauna and flora*, pp. 1-10, Ministry of Environment, Colombo: ISBN 978-955-0033-55-3. – (Second Author: c/o ICIMOD, Khumaltar, Lalitpur, G.P.O. Box 3226, Kathmandu, Nepal).
A brief account of the history of research is followed by an overview of the present status of knowledge on the odon. fauna of Sri Lanka, under the headings: "Taxonomy", "Distribution", "Threats", "Conservation", "Research gaps" and "Conclusions and recommendations". An annotated checklist of the hitherto known 118 spp. is appended. The endemic taxa are emphasized and the IUCN categories and criteria are stated for all spp.
- (19835) VINKO, D., 2012. [Report of Dragonfly Observation Group, 2011]. In: I. Kodele Krašna, [Ed.], *Biološko raziskovalna tabora "Kodreti 2010" in "Kodreti 2011"*, pp. 14-20, Zavod za varstvo narave, Ljubljana, ISBN none. (Slovene). – (Slovenska 14, SI-1234 Mengeš).
A checklist of 30 spp. recorded in the Vipava region, W Slovenia, without precise locality data.
- (19836) VUKELIČ, E., [Ed.], 2012. *Ptice okoli nas*. DOPPS, Ljubljana. 70 pp., ISBN 978-961-6674-17-1. (Slovene). – (Publishers: Tržaška 2, SI-1000 Ljubljana).
Includes photographs of *Calopteryx splendens* and *Pyrrhosoma nymphula*; – Slovenia.
- (19837) YAKOVLEV, V.A., A.V. YAKOVLEVA & A.R. ILYASOVA, 2012. Insects in the invertebrate communities of the upper reaches of the Kuybyshev reservoir, Russia. *Uchen. Zap. kazan. Univ.* (Estest. Nauki) 154(4): 1-11. (Russ., with Engl. s.). – (Authors' postal addresses not stated).
Based on the 1999-2008 benthic invertebrate surveys in the upper reaches of the Volga, Kama, Volga-Kama and the Tatyushi of the Kuybyshev reservoir, 9 odon. taxa are listed, incl. *Coenagrion armatum*, *Anax parthenope* and *Gomphus vulgatissimus*. *Coenagrion pulchellum* was the most abundant sp.
- (19838) ZHANG, H. & M. HÄMÄLÄINEN, 2012. *Matrona annina* sp. n. from southern China (Odonata, Calopterygidae). *Tijdschr. Ent.* 155: 285-290. – (First Author: Inst. Hydrobiol., Chin. Acad. Sci., Donghunanlu Rd, Wuchang, Wuhan city, Hubei prov., China).
The new sp. is described and illustrated from both sexes. Holotype ♂: China, Guangdong prov., Qingyuan city, Yingde co., Shimentai Nature Reserve (alt. ca 180 m), 27-VIII-2011; deposited in RMNH, Leiden. It differs from the sympatric *M. basilaris* by its brown wings, reduced bluish-white reticulation at wing base and in details of the structure of the superior anal appendages.
- (19839) ZORMAN, T. & S. STURM, [Eds], 2012. [*Guide along the Škocjan school-path*]. Škocjanske jame / Slovenia. 163 pp. ISBN 978-961-6490-29-0. (Slovene).
On p. 112, reference is made to *Libellula depressa* and a photograph is presented of *Sympetrum fonscolombii*, living in karst ponds in the Škocjan area, Slovenia.
- (19840) ZVRŽINA, T., 2012. [Dragonflies, the winged pearls]. *Vrtnar* 21(1): 52-53. (Slovene). – (Author's address not provided).
General on dragonflies, in the magazine of the Arboretum Volčji potok, Slovenia.

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- (19841) **ÁLVAREZ GÁNDARA, J., J. FERREIRO GARRIDO & J. VILAS SOUTO**, 2013. *Orthetrum brunneum* (Fonscolombe, 1837), a new record for the province of Pontevedra (Galicia, NW Iberian Peninsula) (Odonata: Libellulidae). *Arqs ent.* 8: 287-288. (Span., with Engl. s.). – (First Author: Barrio do Souto 10/B, ES-36740 San Salvador de Tebre, Tomiño, Pontevedra).
After almost a century, a small population was re-discovered in the province (rio Mino, 4-X-2012).
- (19842) **ANBALAGAN, V., M.G. PAULRAJ & S. IGNACIMUTHU**, 2013. Odonata diversity (Insecta: Arthropoda) in rice and vegetable fields in a north-eastern district of Tamil Nadu, India. *J. Res. Biol.* 3(4): 977-983. – (Ent. Res. Inst., Loyola Coll., Chennai-34, India).
From Tiruvallur district 32 spp. are recorded. *Pantala flavescens* was the most dominant sp. throughout the yr. Diversity indices show that odon. diversity was higher in vegetable fields than in rice fields.
- (19843) **BARBOSA, K.W.C., J.M.F. RIBEIRO & C.R.M. DOS SANTOS**, 2013. Imaturos de Odonata (Hexapoda: Insecta) em igarapés de unidades de conservação da Amazonia oriental. Abstract only. *19 Seminario Iniciação scient.-PIBIC*, Belém, p. 127 – (Last Author: Zoologia, Mus. Paraense Emilio Goeldi, Av. Perimetral 1901, Terra Firme, Belém, PA, Brazil).
1221 larvae were collected from 6 (listed) localities in E Amazonia (Brazil) and identified to 22 gen. The most abundant were *Perilestes*, *Progomphus*, *Aphyla*, *Planiplax* and *Tramea*.
- (19844) **BECHLY, G. & G. POINAR**, 2013. *Burmaphlebia reifi* gen. et sp. nov., the first anisozygopteran damselfly (Odonata: Epiophlebioptera: Burmaphlebiidae fam. nov.) from Early Cretaceous Burmese amber. *Historical Biol.* 2012(1): 5 pp.; – DOI: 10.1080/08912963.2012.753884. – (First Author: Staatliches Mus. Naturkunde, Rosenstein 1, D-70191 Stuttgart).
The new sp. is described as the second fossil odon. from Early Cretaceous Burmese amber. Its phylogenetic position is discussed. It is probably closely related to the recent Epiophlebiidae.
- (19845) **BOLETIN DE LA RED DE OBSERVA-**
DORES DE LIBELULAS DE ANDALUCIA (ROLA), ISSN 2254-5727, No. 2 (May 2013).
Prunier, F.: Editorial (pp. 1-2, Engl.); – *Brochard, C., E. van der Ploeg, R. Seidenbusch & D. Chelmick*: The identification of the exuviae of the genus *Trithemis* (Libellulidae) found in Europe (pp. 5-25); – *Ocaña, J.C.S., F. Prunier & S. Vieira*: Faunística de odonatos en la red fluvial de la cuenca Guadalimar (pp. 26-45, with Engl. s.); – *Rubio, A. et al.*: Odonatos de la provincia Albacete (pp. 46-47); – *Venhuis, C. & J. Ripoll*: *Diplacodes lefebvrei* (Rambur, 1842) in the province of Malaga (pp. 48-54); – *Moreno-Benitez, J.M. et al.*: *Libellula depressa* (Linnaeus, 1758), nuevas observaciones en la provincia de Málaga (pp. 55-59, with Engl. s.).
- (19846) **CAYASAN, R.D., D.E. LIMITARES, J.V.S. GOMID, O.M. NUÑEZA & R.J.T. VILLANUEVA**, 2013. Species richness of Odonata in selected freshwater systems in Zamboanga del Sur, Philippines. *Int. J. Bioflux Soc.* 6(4): 378-393. – (Last Author: D3C Gahol Apt, Lopez Janens St., Davao-8000, Philippines).
36 spp. are listed from 12 sampling sites (Mindanao) and their relative abundance and species richness at these sites are discussed.
- (19847) **CHAHN, J., G. DORRINGTON & A. MIZUTANI**, 2013. The dragonfly flight envelope and its application to micro UAV research and development. *Proc. 15th Austral. Aeronaut. Conf. [AIAC15-AERO]*, 10 pp. – (First Author: Defence & Systems Inst., Univ. Sth Australia, Mawson Lakes, South Australia-5095, AU).
A quantitative analysis is presented of 3-dimensional trajectories of dragonflies under free flight conditions. The trajectories were captured while ♂♂ were engaged in their normal behaviour of combat to protect oviposition sites along the stream. For the first time are available unambiguous measurements of speed, acceleration and turn rate of large dragonflies and the means by which comparative studies can be done against other spp. and in different environments. Using physical scaling laws, means are proposed by which this data set can be used to provide a comparison for larger flapping wing UAV concepts. The ultimate goal is to provide a robust standard against which flapping wing aircraft performance can be compared so that appropriate evolutionary pressure can also be applied to technological developments, thus freeing resources for the truly viable designs.

- (19848) CHUNG, A.Y.C., S.K.F. CHEW, R. MAJAPUN & R. NILUS, 2013. Insect diversity of Bukit Hampuan Forest Reserve, Sabah, Malaysia. *J. threatened Taxa* 5(10): 4461-4473. – (First Author: Forest Res. Cent., Sabah Forestry Dept, P.O. Box 1407, Sandakan-90175, Sabah, Malaysia). 4 identified odon. spp. are listed.
- (19849) *CRENATA*. Organ of the Finnish Dragonfly Society. ISSN none. Vols. 1 (2008), 2 (2009), 3 (2010), 4 (2011), 5 (2012), 6 (2013). (Finn., from Vol. 3 onwards some papers with Engl. s., whether or not with the translation of the title). – (c/o Finnish Dragonfly Soc., J. Mäkinen, Metsänhoitajankatu 12 B 16, FI-00790 Helsinki; – Editor: S. Karjalainen, Neidonpuistontie 6 D 8, FI-02400 Kirkkonummi). Among the odonatological periodicals, this is the most beautifully produced magazine (ca. 40 pp. per issue, 20.5 × 27.7 cm), every issue with a different dragonfly photograph on front- and back covers, and richly colour illustrated throughout. Ca 7 papers per issue pertain to the Finnish fauna, but many of these are of extralimital importance. – For technical reasons, the titles and abstracts cannot be published here this time.
- (19850) DAS, S.K., P.K. SAHOO, N. DASH, S. MARATHE, S. MAHATO, A. DASHAHARE, P.S. MISHRA, A. PRASAD & R. RANA, 2013. Odonates of three selected tiger reserves of Madhya Pradesh, central India. *Check List* 9(3): 528-532. – (First Author: Wildlife Inst. India, P.O. Box 18, Chandrabani-248001, Dehradun, India). 47 spp. are recorded from Kanha, Pench and Banhavgarh tiger reserves, i.e. 44, 41 and 37 spp., respectively. In winter, the most abundant sp. was *Agriocnemis pygmaea*.
- (19851) DE BLOCK, M., K. PAUWELS, M. VAN DEN BROECK, L. DE MEESTER & R. STOKS, 2013. Local genetic adaptation generates latitude-specific effects of warming on predator-prey interactions. *Global Change Biol.* 19: 689-696. – (Last Author: Lab. Aquat. Ecol., Evol. & Conserv., Univ. Leuven, Debériot str. 32, B-3000 Leuven). The observed signals of local adaptation in both predators and prey may inform about effects of global warming in open systems that would not have been revealed using heating experiments with predators and prey from a single latitude. First, comparisons of foraging rates and growth rates at 24°C predicts latitude-specific invasion success of northward moving Zygoptera. The higher foraging rates of southern compared to central zygopterans may translate in central populations being outcompeted by southern invaders, although this may not be the case when central populations invade the northern latitude given the similar foraging rates of central and northern spp. However, factors such as the lower cold resistance of southern spp. may currently limit their northward movements.
- (19852) *FAUNISTIC STUDIES IN SOUTH-EAST ASIAN AND PACIFIC ISLAND ODONATA* (ISSN 2195-4534), Vol. 4 (30 May 2013). – (c/o M. Schorr, Schulstr. 7/B, D-54314 Zerf). *Marinov, M. & P. Pikacha*: On a dragonfly collection from the Solomon Islands with overview of fauna from this Pacific archipelago (Insecta: Odonata) (pp. 1-48).
- (19853) GEISTER, I., 2013. Rani plamenec *Pyrrhosoma nymphula*. *Gea*, Ljubljana 23(Apr.): 13. (Slovene). – (Kocjančiči 18, SI-6276 Pobjegi). A concise outline of its behaviour and biology, in the belles-lettres style, with a photograph in nature.
- (19854) *IDF-REPORT*. Journal of the International Dragonfly Fund (ISSN 1435-3393), Vols 60 (23 June 2013), 61 (20 Aug. 2013). – (c/o M. Schorr, Schulstr. 7/B, D-54314 Zerf). [Vol. 60]: *Villanueva, R.J.T. & H. Cahilog*: Odonata fauna of Balabac Island, Philippines with descriptions of two new species [*Mortonagrion astamii* sp. n., *Prodasineura poncei* sp. n.] (pp. 1-34); – [Vol. 61]: *Fleck, G., J. Li, M. Schorr, A. Nel, X. Zhang, L. Lin & M. Gao*: *Epiophlebia sinensis* Li & Nel, 2012 in Li et al. (2012) (Odonata) newly recorded in North Korea (pp. 1-4).
- (19855) ISHIZAWA, N., 2013. *Monitoring survey of flora and insect fauna at Bodaigi in 2012*. Privately circulated. 32 pp. – (1644-15 Yamaguchi, Tokorozawa, Saitama pref., 359-1145, JA). The area (surface ca 3 ha) is located on the eastern fringes of the Sayama Hills (Tokorozawa, Japan). A list is presented of 38 odon. spp. known from the locality, with annotations on their conservation status. In 2012, 29 spp. were recorded and the first and last dates of their adult appearance are stated. Notes on the abundance and the variation in body size are provided for some spp.

- (19856) JOHNSTON, P.R. & J. ROLFF, 2013. Immune- and wound-dependent differential gene expression in an ancient insect. *Dev. comp. Immunol.* 40(3/4): 320-324. – (Second Author: *Evol. Biol., Inst. Biol., Free Univ. Berlin, Königin Luise Str. 1-3, D-14195 Berlin*).
2 of the main functions of the immune system are to control infections and to contribute to wound closure. Here, the results are presented of an RNAseq study of immune- and wound-response gene expression in *Coenagrion puella*, a representative of the odon., the oldest taxon of winged insects. De novo assembly of RNAseq data revealed a rich repertoire of canonical immune pathways, as known from model insects, including recognition, transduction and effector gene expression. A shared set of immune and wound repair genes were differentially expressed in both wounded and immune-challenged larvae. Moreover 3-fold more immune genes were overexpressed only in the immune-challenged treatment. This is consistent with the notion that the immune-system reads a balance of signals related to wounding and infection and that the response is tailored accordingly.
- (19857) KALKMAN, V.J. & A.G. ORR, 2013. Field guide to the damselflies of New Guinea. *Brachytron* 16(Suppl.): 3-120. (Bilingual: Engl./Bahasa Indonesian). – (Available from: MangerEco, Sloetmarke 41, NL-8016 CJ Zwolle).
Made up as an attractive book and marvelously illustrated with 41 col. pls of structural features (over 550 drawings) by Dr A.G. Orr and with 16 col. phot. taken in the field by Dr S. Richards, it covers New Guinea, the satellite isls and the Bismarck Archipelago (with emphasis on the lowlands of northern N. Guinea) and enables the identification of adult ♂♂ at least to the genus level. For further information on identification of New Guinean Zygoptera, see the work described in *OA* 19662. – (Note: As apparent also from his other recently published books, Dr Orr is without any exaggeration the greatest odon. art-illustrator of all times!).
- (19858) KIN, A., M. GRUSZCZYŃSKI, D. MARTILL, J.D. MARSHALL & B. BLAJOWSKI, 2013. Palaeoenvironment and taphonomy of Late Jurassic (Late Tithonian) from central Poland. *Lethaia* 46: 71-81. – (First Author: *Inst. Geol. Sci., Jagiellonian Univ., Oleandry 2/A, PO-30063 Kraków*).
A reference to and a fig. of *Eumorbaeschna* sp. n. from the Owadow-Brzezinski quarry are presented. The sp. is not described.
- (19859) KRIŽNAR, M., 2013. [Simon Robič in the paleontology of Slovenia]. *Geol. Zborn.* 22: 77-80. (Slovene). – (*Nat. Hist. Mus. Slovenia, Prešernova 20, SI-1000 Ljubljana*).
Includes a reference to *Sloveniatrum robici* from the Lower Sarmatian (Miocene) of the Tunjice Hills, Slovenia.
- (19860) KULKARNI, A.S. & K.A. SUBRAMANIAN, 2013. Habitat and seasonal distribution of Odonata (Insecta) of Mula and Mutha river basins, Maharashtra, India. *J. threatened Taxa* 5(7): 4084-4095. – (Second Author: *Zool. Surv. India, M-Block, New Alipore, Kolkata-700053, India*).
The fauna (40 spp.) is listed and discussed. There was a difference in species composition across land use types and seasons, with the highest diversity and abundance during the post-monsoon period. The highest odon. diversity was observed in urban areas, followed by forests and agricultural land.
- (19861) LOZANO, F., 2013. Description of three females of the genus *Acanthagrion* (Odonata: Coenagrionidae) with a key to the females of Argentina. *Zootaxa* 3646(1): 23-38. – (*Cent. Reg. Estud. Geonomicos, UNLP, Av. Calchaqui 1888, Florencio Varela, Buenos Aires, Argentina*).
A. aepiolum and *A. minutum* ♀♀ are described for the first time and *A. ascendens* is redescribed. Distribution maps and new records are provided for the 3 spp. and a key to *Acanthagrion* ♀♀ of Argentina is supplied.
- (19862) MAHBOB, M.A.E. & H.H. MAHMOUD, 2013. The first report of preliminary list of the insect fauna of the Elkharaga city, New Valley, Egypt. *J. Ecol. nat. Envir.* 5(7): 125-132. – (First Author: *Dept Math. & Sci., Fac. Educ., Assiut Univ., New Valley, Egypt*).
Ischnura evansi and *I. senegalensis* are brought on record from 3 localities each in the New Valley (alt. 300-400 m) in the western desert, Egypt.
- (19863) MARINOV, M. & S. RICHARDS, 2013. Notes on the female colour of *Synthemis miranda* Selys, 1871 (Odonata: Synthemistidae) in New Caledonia. *Aust. Ent.* 40(2): 57-64. – (First Author: *Sch. Biol. Sci., Univ. Canterbury, P.B. 4800, Christ-*

- church-8140, NZ).
2 ♀ specimens with strikingly different morphological features (mainly wing coloration) were collected in sympatry in Province Nord, New Caledonia. Both appear to be mature adults. The different colour patterns have previously been reported in literature, but here is provided the first record of their co-existence. The patterns are described, illustrated and discussed.
- (19864) MONSTER, L. & P. VAN GAALEN, 2013. Vleugels van libel zijn natuurraadsel: kunst- en vliegwerk. *Landleven* 18(5): 54-57. (Dutch). – (Authors' addresses unknown).
A richly illustrated article on dragonfly wings, directed at countryside residents, with photographs of some Dutch spp., and using Dutch vernacular names.
- (19865) MÜLLER, J., L. BUTTSTEDT, H. BOCK & R. STEGLICH, 2013. Vorläufige Kurzmitteilung zur Libellenfauna (Odonata) im Projektgebiet südöstlicher Unterharz (MTB 4433 Wippra). *Ent. Mitt. Sachsen-Anhalt* 21(1/2): 54-57. – (First Author: Frankefelde 3, D-39116 Magdeburg).
A list of 28 spp. (recorded 1994-2012), with annotations on *Cordulegaster boltonii*, *Crocothemis erythraea*, *Sympetrum danae* and *S. flaveolum*.
- (19866) OUTOMURO, D., D.C. ADAMS & F. JOHANSSON, 2013. The evolution of wing shape in ornamented-winged damselflies (Calopterygidae, Odonata). *Evol. Biol.* 40: 300-309. – (First Author: Dept Ecol. & Genet., Evol. Biol. Cent., Uppsala Univ., Norbyvägen 18/D, S-752-36 Uppsala).
♂♂ of 36 spp., pertaining to gen. *Archineura*, *Atrocalopteryx*, *Caliphaea*, *Calopteryx*, *Echo*, *Hetaerina*, *Matrona*, *Matronoides*, *Mnais*, *Neurobasis*, *Phaon*, *Psolodesmus*, *Sapho*, *Umma* and *Vestalis*, that differ in wing pigmentation which is used in sexual displays, were examined. Geometric morphometrics and phylogenetic comparative approaches were used to analyse whether wing shape and wing pigmentation show correlated evolution. It was found that wing pigmentation is associated with certain wing shapes that probably increase the quality of the signal: wings being broader where the pigmentation is located. These results also showed correlated evolution between wing pigmentation and wing shape in hind wings, but not found in front wings, probably because hind wings are more involved in signalling than front wings. The results imply that the evolution of diversity in wing pigmentations and behavioural sexual displays might be an important driver of speciation due to important pre-copulatory selective pressures.
- (19867) PETERNEL PEČAUER, H., 2013. Nasi morski konjički postali svetovne zvezde. *Delo* 55(117): 22. (Slovene). – (Author's address unknown).
In a national daily, reference is made to *Sloveniatrum robici* from the Lower Sarmatian (Miocene) of the Tunjice Hills, Slovenia.
- (19868) RAKAR, B. [Ed.], 2013. *DOPPS ve letu 2012* – [Annual report of the Society for Bird Observation and Study, 2012]. DOPPS, Ljubljana. Not paged, ISBN none. (Slovene). – (Publishers: Tržaška 2, SI-1000 Ljubljana).
Includes a reference to the discovery of *Sympetrum pedemontanum* (new for Istria) and *Selysiothemis nigra* (new for Slovenia), both from Nature Reserve Škocjanski zatok, SW Slovenia.
- (19869) SMETANIN, A.N., 2013. On the insect fauna of the Kichiga river basin, northeastern Kamchatka. *Ent. Review* 93(2): 160-173. (Originally published (2012) in Russ.: *Ent. Obozr.* 91(3): 540-558). – (Kamchatka Br., Russ. St. Univ. Tourism & Service. Petropavlovsk-Kamchatsky, Russia).
Includes a list of 7 odon. spp., with comments.
- (19870) SUBRERO, E., S. POMA & M. CUCCO, 2013. Gli odonati come indicatori delle condizioni ambientali in aree di riqualificazione ambientale del Parco fluviale del Po. *Riv. piemont. Stor. nat.* 34: 127-146. (With Engl. s.). – (First Author: Univ. Piemonte Orientale, DISIT, Via T. Michel 11, I-15121 Alessandria).
The odon. were examined from the viewpoint of their bioindicative role in restoration of the Po River Park, Italy. The Correspondence Analysis showed that the odon. population is related to land use and aquatic vegetation, while physico-chemical parameters were less important.
- (19871) VERSHININA, V., 2013. [The dominant dragonfly species of the Horticya island]. *Zbir. nauk. Prac "Moloda Nauka-2013"* 2: 22-23. (Ukr.). – (Author's address not provided).
22 spp. of 12 gen. were documented during 2011-2012. All gen. and some spp. are listed; – the Ukraine.

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COWLEY, J., 1935. Remarks on the names of some odonates. *Entomologist* 26: 154-156.

FRASER, F.C., 1957. *A reclassification of the Odonata*. R. zool. Soc. N.S.W., Sydney.

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