

## In memoriam Jean Legrand (1944 – 2020)

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**Abstract.** Personal recollections and memories of a life-long professional friendship with Jean Legrand are given. His odonatological bibliography and lists of species connected with his name are appended.

**Further key words.** Dragonfly, Odonata, Muséum national d'Histoire naturelle, MNHN, obituary

# Biogeography and relationship of the Gomphidae of Europe, North Africa, and the Middle East (Odonata)

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**Abstract.** Around 27 species of predominantly riverine Gomphidae occur in the vast region encompassing Europe as far as the Urals, the Maghreb, the Mediterranean Basin, and the Middle East up to the west side of the Indus valley, including Arabia, Iran, and Baluchistan. They are the remains of a pre-Pleistocene fauna that we estimate at twice the current number. We analyse the relationships, losses, and their causes at the molecular level and, not surprisingly, confirm the widely held opinion that the ice age is overwhelmingly responsible. Much extinction of European-West Asian and North American species took place in Beringia, presumably in an early phase of the glaciation. Recolonization between glacial stages can be evaluated for the final stage, the Würm-Wisconsin glaciation. Differences in the orientation of mountain chains allowed more species to survive in North America than in Eurasia. They recolonized Canada, Europe, the Russian Far East, and Japan. From China, 16 additional gomphids are moving west through Siberia. Some reach the Ob valley but in others disjunctions persist. There are, for example, no *Stylurus* species in Pakistan, India, Bangladesh, and Thailand. Numerous preglacial survivors currently occur in Mediterranean and Middle Eastern refuges. Beside ice, aridity played a role in limiting the fauna. Oriental species advanced into the Middle East and Anatolia, but there was apparently never enough running water in Baluchistan to allow a large-scale movement of gomphids towards Europe. Rather to the contrary, the southeastern-most gomphid is *Gomphus amseli*, with type locality at the Heri Rud in Afghanistan, which forms a cline towards the west. Pakistan is even more impoverished in gomphids than Europe but is home to one small genus, *Anormogomphus*, that extends from northern India to eastern Anatolia. Africa also contributed little to the Palaearctic fauna. No *Gomphus* extends further south than the Maghreb, where several endemic species occur. *Paragomphus sinaiticus* is a desert species that does not occur south of the Sahara. The richest populations are situated in Oman. Two colonies coincide with the position of the shores of Lake Megachad, in the foothills of the Sahara-Sahel moun-

tains of Aïr, Tibesti and Ennedi. Perhaps biotic factors like interspecies competition explain its range better than environmental factors. Around 8500 BP, the most recent riverine contact with the Nile via the Wadi Howar facilitated contact and crossing of the Red Sea, but Saharan populations could be older. Arabia was presumably invaded via the Sinai Peninsula, *terra typica* of the species.

**Further key words.** Dragonfly, Anisoptera, distribution, *Anormogomphus*, *Gomphus*, *Onychogomphus*, *Ophiogomphus*, *Paragomphus*, *Stylurus*

# Wing-clapping in the damselfly *Mnesarete pudica* – a mating call? (Odonata: Calopterygidae)

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**Abstract.** Wing-clapping is a conspicuous and poorly understood behavioural trait in damselflies. Its function has long been debated and several hypotheses have been proposed to explain why damselflies clap their wings, even when there is no other damselfly nearby. Here, I outline the existing hypotheses: (i) the territorial declaration hypothesis, which suggests that wing-clapping is used by males to proclaim territorial ownership to rivals; (ii) the thermoregulation hypothesis, which suggests that wing-clapping cools the body; and (iii) the courtship hypothesis, which suggests that wing-clapping is integral to the courtship behaviour of males. To these I add a fourth hypothesis, the mating call effect, which states that males use wing-clapping as a conspicuous signal to attract mates, prior to courtship. I tested these hypotheses in the neotropical calopterygid *Mnesarete pudica*. The investigation was conducted in the field in Minas Gerais and São Paulo, Brazil, with frequencies of different behaviours being recorded by direct observation of marked individuals. The results show no support for the territorial, thermoregulation, or the courtship hypotheses. A strong association between wing-clapping and other potential signals such as brief flights and perch shifts is evident. I conclude that wing-clapping behaviour in *Mnesarete pudica*, and perhaps in other damselflies, may increase male conspicuousness to females and attract them to territories.

**Further key words:** Dragonfly, Zygoptera, sexual selection, ethology, behavioural ecology, evolutionary ecology, animal communication

## First record of gynandromorphism in *Trithemis aurora* (Odonata: Libellulidae)

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**Abstract.** A gynandromorphic individual of *Trithemis aurora* is reported from a garden in Palakkad district, Kerala state, India. Its eyes, thorax, legs, wings, and abdomen show mosaic gynandromorphy. The abdomen is mostly gynochromic with the tip bearing female appendages. Detailed study of the specimen shows that female characters predominate but significant areas exhibit male characters.

**Further key words.** Dragonfly, Anisoptera, mosaic gynander, androchromism

# Gynandromorphism and intersexuality in Odonata: a review

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**Abstract.** Gynandromorphism is a rare phenomenon among insects, and as measured by the number of publications, particularly so in Odonata. The first case of gynandromorphism in the order was reported in 1866, the second in 1917. To date, 56 chimeric individuals have been described in 45 papers. Bilateral gynandromorphs account for about a third of all cases, the remainder consisting of phenotypical mosaics of male and female characters exhibited in wing patterns, genitalia, or other body parts. There are no patterns of gynandromorphism exclusive to Odonata. Here, as a basis for future work, we provide an overview as complete as possible of the known cases in the order of gynandromorphism in a broad sense, including intersexuality. This is the third review on this topic: the first dates from 1929 and the second from 1971, supplemented in 1975. In the last ten years, all new records have been based on photographic evidence rather than collected specimens, a practice which has its limitations and may skew the data by recording only the most obvious of cases. For future research it is recommended that specimens should not only be photographed in the field but also collected and preserved for detailed description and analysis in the laboratory. In addition, researchers should be alive to the possibility of finding gynandromorphs in final instar larvae and exuviae.

**Further key words.** Dragonfly, phenotypic mosaics, andromorphic females, gynomorphic males, intersex, hermaphroditism

***Brechmorhoga goncalvensis* sp. nov.**  
**from south-eastern Brazil**  
**(Odonata: Libellulidae)**

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**Abstract.** *Brechmorhoga goncalvensis* sp. nov. (♂ holotype: Brazil, Minas Gerais, Gonçalves, APA Fernão Dias, 22.7363 S, 45.8191 N, 1670 m a.s.l., 14-x-2019, deposited in coll. UFMG) is described and diagnosed based on specimens collected in Minas Gerais and Rio de Janeiro states, south-eastern Brazil. The new species can easily be separated from other congeners by the posterior hamule with a truncated base bearing two basal projections, cercus with a carina of 4–5 small denticles on the apical ventral margin, and its unique body coloration of double stripes on each side of the abdominal segments. **Further key words.** Dragonfly, Anisoptera, South America, *Brechmorhoga tepeaca*

***Gynacantha chaplini* sp. nov.,  
a new dragonfly from Bangladesh  
(Odonata: Aeshnidae)**

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**Abstract.** *Gynacantha chaplini* sp. nov. is described based on a male collected from the north-eastern region of Bangladesh. Distinguishing features of the adult male are illustrated and discussed. *Gynacantha chaplini* sp. nov. is distinguished from its congeners by a dark brown trapezium-shaped mark on the postfrons. An updated key is provided to identify the males of the *Gynacantha* species known from South Asia (Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka).

**Further key words:** Anisoptera, taxonomy, conservation, diversity and distribution, South Asia



**Description of the female  
*Atratothemis reelsi* Wilson, 2005,  
from central Vietnam, with notes on the male  
(Odonata: Libellulidae)**

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**Abstract.** Illustrations of both sexes of *Atratothemis reelsi* Wilson, 2005, including a description of the female based on specimens from central Vietnam are presented.

**Further key words.** Dragonfly, Anisoptera, Southeast Asia

**Longinos Navás's Odonata species from China:  
Notes on three synonymies in Platycnemididae,  
including the synonymy of  
*Pseudocopera tokyoensis* (Asahina, 1948)**

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**Abstract.** Based on the study of the relevant type specimens and other material, the following synonymies in Platycnemididae are established: *Pseudocopera tokyoensis* (Asahina, 1948) is a junior synonym of *Pseudocopera rubripes* (Navás, 1934) (comb. nov.), *Platycnemis foliosa* Navás, 1932 is a junior synonym of *Platycnemis phyllopoda* Djakonov, 1926, and *Platycnemis pierrati* Navás, 1935, is a junior synonym of *Copera marginipes* (Rambur, 1842). The present taxonomic status of the 30 new Odonata species and one variety described by Longinos Navás from China is presented in a table and briefly discussed, pointing out a few poorly known, or dubious taxa in need of further study.

**Further key words.** Dragonfly, damselfly, Zygoptera, taxonomy, *Platycnemis foliosa*, *P. pierrati*

## A remarkable new species of *Papuagrion* Ris, 1913 from New Guinea (Odonata: Coenagrionidae)

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**Abstract.** A new species of the coenagrionid damselfly genus *Papuagrion* is described from the lowlands of the Purari River basin in Gulf Province, Papua New Guinea. *Papuagrion forceps* sp. nov. is a large (abdomen + appendages 46.5–47.2 mm) slender species with a predominantly black and brown abdomen. The male is unique in the genus in having superior appendages that are minute in comparison to the inferior appendages, with lower branches that are not visible in profile. The new species is currently known only from the type locality, where a male and a female were perched among low foliage in a remnant patch of lowland rainforest.

**Further key words.** Damselfly, Zygoptera, taxonomy, *Papuagrion forceps* sp. nov., Gulf Province, Papua New Guinea

# Molecular phylogenetics of *Petalura* Leach, 1815 (Odonata: Petaluridae)

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**Abstract.** DNA sequence data was derived for all five described species of *Petalura* Leach, 1815, for eight gene fragments from the mitochondrial and nuclear genomes. Phylogenetic analyses suggest that there are only four clearly distinct species in the genus. They are *Petalura gigantea*, *P. hesperia*, *P. ingentissima*, and *P. litorea*. *Petalura pulcherrima* Tillyard, 1913, is found to group with *P. ingentissima* Tillyard, 1908, and is formally synonymized with this species.

**Further key words.** Dragonfly, Anisoptera, *Petalura pulcherrima* syn. nov.