

In memoriam Günther Peters (1932 – 2023)

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Abstract. Personal recollections of Günther Peters, the world's leading expert on the Aeshnidae, and a brief outline of his life, his scientific career, and his expeditions are presented.

Update on distribution, habitat requirements, and vulnerability of *Onychogomphus boudoti* in Morocco (Odonata: Gomphidae)

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Abstract. Since its description, *Onychogomphus boudoti* Ferreira, 2014 has been known only from two localities in Morocco in a limited part of the Middle-Atlas Mountains. The status and the distribution of this rare and threatened dragonfly was established by an intensive search in June 2022. Twenty occupied localities were found in Khenifra Province, Morocco, in the south-western part of the Middle Atlas. These records not only confirm the known localities but also extend its known distribution from 100 ha to 15 500 ha. Based on these results, its habitat preference with climate and geologic associations and the main threats affecting its status are discussed.

Further key words. Dragonfly, Anisoptera, biogeography, habitat, Middle Atlas Mountains

Larval development and voltinism of rheophilous Odonata from a Mediterranean river in the north-eastern Iberian Peninsula

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Abstract. We describe the larval development and voltinism of nine species of running-water dragonflies and damselflies from the upper and middle reaches of the Tordera, a Mediterranean-climate river located in the north-east of the Iberian Peninsula. We sampled larvae between October 2020 and October 2022. We determined larval growth patterns and identified and estimated the sizes of the late developmental stadia by means of correlation graphs between pairs of body features, *i.e.*, head width and hind wing-sheath length, for *Calopteryx haemorrhoidalis*, *C. virgo meridionalis*, *C. xanthostoma*, *Pyrrhosoma nymphula*, *Platycnemis acutipennis*, *P. latipes*, *Boyeria irene*, *Onychogomphus forcipatus unguiculatus*, and *O. uncatus*. *Calopteryx virgo meridionalis*, *B. irene* and *O. uncatus*, characteristic of the upper course, exhibited bifurcations in the timing of their development (cohort splitting), generating patterns of mixed voltinism – 1–2 years per generation in the case of *C. virgo meridionalis* and 2–3 years in the case of *O. uncatus* and *B. irene*. The rest of the taxa, typical of the middle course, were largely univoltine. It is notable that *O. forcipatus unguiculatus*, hitherto reported as semi- or partivoltine (2–3 years) throughout its range, including the Maghreb, is exclusively univoltine in the Tordera river.

Further key words. Dragonfly, damselfly, winter critical size, diapause, oviposition and flight periods, spring and summer species

Are anal spines of anisopteran larvae an antipredator device? A case study in *Boyeria irene* (Odonata: Aeshnidae)

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Abstract. *Boyeria irene* larvae of different stages sampled at several localities in the headwaters of the Gardon River, Southern France, frequently showed malformations and injuries in their anal pyramid. The majority of these were broken or imperfectly regenerated tips of the anal spines. To quantify this phenomenon in a standardized way, exuviae of *B. irene* were sampled. In addition to running water habitats from the headwaters of the Gardon in France, exuviae from Lake Lucerne, Switzerland, were also analysed. In the Gardon river system, 9 to 26 % of the exuviae collected in 2008 showed damaged spines and para- or epiprocts. In Lake Lucerne, in 2006, 73 % of the exuviae were damaged. In most cases the tips of the epiproct or parapropoct were broken or malformed. We interpret the damaged and malformed spiny appendages as indicating successful defence against fish attacks. When disturbed, anisopteran larvae spread out the elements of their anal pyramid presenting a spiky crown-like target. We hypothesise that this behaviour helps reduce the risk of being swallowed by predaceous fish. Presumably, most injuries are caused by the stresses the elements are subject to when puncturing the fish's mouth.

Further key words. Dragonfly, Anisoptera, exuviae, female polymorphism, fish predation, morphological defence, teratology

Why do mature dragonflies migrate? A critical analysis of Corbet's chapter "Spatial displacement by flight" with reference to *Sympetrum striolatum* (Odonata: Libellulidae)

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Abstract. Migrating dragonflies coming in from the North Sea in north-western Germany in the autumn of 2021 prompted the authors to consider the cause and biological function of undertaking a risky crossing of the open sea. Individuals of the most prevalent species, *Sympetrum striolatum*, were all mature, while some sampled specimens were old. In Corbet's system of spatial displacement, published in his seminal book "Dragonflies: behaviour and ecology of Odonata", *S. striolatum* is provisionally treated as a species exhibiting seasonal flights to and from aestivation refuges but not as a migratory species. In fact, the species belongs to a group of autumn migrants that begin mass movements when mature. An analysis of our observations and the available literature led us to the conclusion that the chapter "Migration beginning in the reproductive period" of Corbet's book treats the subject inadequately. We argue that the flight type assessment of *S. striolatum* must be corrected accordingly: it is also a true autumn migrant whose mass flight is particularly noticeable in high mountain ranges and in coastal areas. However, there remain question marks over the biological significance and evolutionary benefits of mature dragonflies performing such risky mass flights over open sea.

Further key words. Dragonfly, Anisoptera, *Sympetrum* spp., autumn migration, trans-oceanic migration, tandem migration, wind dependence of flight direction

***Pinheyschna yemenensis*, a new species
for Saudi Arabia, with description of
the final instar larva and exuvia
(Odonata: Aeshnidae)**

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Abstract. During a short trip to south-western Saudi Arabia with a focus on the Asir Mountains in November 2022, a larva and several exuviae of *Pinheyschna yemenensis* (Waterston, 1984) were found. Molecular genetic analysis of the COI fragment from the larva confirmed its generic identity. *Pinheyschna yemenensis*, is a new species to the Odonata fauna of Saudi Arabia, and its larva and exuvia are described.

Further key words. Dragonfly, Anisoptera, Arabian Peninsula, Yemen

Reconsideration of three Odonata taxa described by A.N. Bartenev from the same place in West Caucasus

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Abstract. *Enallagma cyathigerum* var. *rotundatum* Bartenev, 1929, *Leucorrhinia circassica* Bartenev, 1929, and *Aeschna juncea* var. *atshischgho* Bartenev, 1929, were described by A.N. Bartenev (= Bartenef) in three papers published in 1929 and 1930. Their type locality was the same highland lake group near Krasnaya Polyana Town in West Caucasus, Russia, presently known as the Khmelevskie Lakes. Their type series most probably no longer exist. Topotypes of the two former taxa obtained in 2008 and 2013, respectively, were examined as well as a specimen supposedly of the third taxon, collected 36 km from the type locality. Based on these specimens, *E. cyathigerum rotundatum* is concluded to be a valid subspecies and the senior subjective synonym of *Enallagma risi* Schmidt, 1961, and *L. circassica* to be a junior subjective synonym of *Leucorrhinia dubia* (Vander Linden, 1825). The status of *A. juncea atshischgho* remains unresolved. Re-evaluation of available knowledge of the Palaearctic *Enallagma* spp. suggested downgrading *Enallagma deserti* (Selys, 1879) to the subspecies, *E. cyathigerum deserti*.

Further key words. Dragonfly, damselfly, junior subjective synonym, senior subjective synonym, subspecies

Taxonomic reassessment of the two supposed subspecies of *Leptogomphus sauteri* in Taiwan based on morphological and molecular characters (Odonata: Gomphidae)

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Abstract. *Leptogomphus sauteri* Ris, 1912, is a species endemic to Taiwan and is currently treated as having two subspecies, *L. sauteri sauteri* and *L. sauteri formosanus* Oguma, 1926. However, the two subspecies are difficult to distinguish due to morphological similarity or overlap. In this study, morphological and molecular methods are used to reassess the taxonomic status of the two subspecies. It can be confirmed that three morphological characters, namely body size, coloration, and the male accessory genitalia, and two molecular genetic markers, namely nuclear ITS1 and mitochondrial COI segments, fail to discriminate between the two subspecies. These results suggest that the splitting of *L. sauteri* into two subspecies is not justified. Therefore, the taxon *L. formosanus* is treated as a junior synonym of *L. sauteri*.

Further key words. Dragonfly, Anisoptera, taxonomy, ITS1, COI