1st June 2016

In memoriam Norman Winfrid Moore (1923–2015)*

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Received and accepted 24th February 2016

Abstract. A short biography of Dr N.W. Moore, the 'Father of global dragonfly conservation', is presented with emphasis on and a brief appreciation of his odonatological work.

* Largely based on an obituary by the same author, published in *Tombo* 58 (2016), Matsumoto, Japan.

1st June 2016

Long-time effect of an invasive fish on the Odonata assemblage in a Mediterranean lake and early response after rotenone treatment

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Received 22nd August 2015; revised and accepted 10th March 2016

Abstract. Over a thirty year period from 1977 to 2007, 16 Odonata species were recorded in the Nature Reserve "Laguna de Zóñar", Cordova, Andalusia, Spain. Thermophilic dragonflies with wide distribution in the African continent were dominant in recent years. In 1985, Common carp *Cyprinus carpio* L., 1758 were introduced in an uncontrolled and illegal action, and aquatic macrophytes and benthonic macroinvertebrates of the lake practically disappeared within ten years. One of the most successful tools for controlling and eradicating invasive fish is the use of chemical compounds such as rotenone. This compound adversely affects aquatic organisms with gill respiration by inhibiting oxygen intake at the cell level. Here, we analyse the effect on the Odonata assemblage of this lake after treatment with rotenone intended to eradicate the carp population. During the first year after treatment, nine Odonata species were recorded, and at least six of them obviously had completed their life cycle in the lake. We also carried out the determination of the five last growth stadia in *Orthetrum cancellatum* larvae, and we propose that, in the southern Iberian Peninsula, this species has a univoltine life cycle with asynchronous emergence.

Further key words. Dragonfly, conservation, invasive species control, Mediterranean area, life cycle.

1st June 2016

Body size, reproductive behaviour, and microhabitat use of two sympatric *Trithemis* species – what might allow their sympatry? (Odonata: Libellulidae)

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Received 18th August 2015; revised and accepted 29th March 2016

Abstract. Sympatric territorial species are subject to interference competition when they share the same resources. The interaction becomes stronger when the coexisting species share similar traits, which is often the case in congenerics. In this study, we investigated the body size, reproductive behaviour, and microhabitat use of two congeneric dragonflies, *Trithemis annulata* and *T. arteriosa,* in Northeast Algeria from September to November 2012 in order to assess the potential factors that allow their coexistence in the same system. Even though *T. annulata* was larger than *T. arteriosa*, mistaken recognition was often observed. The behavioural sequence of both species exhibited broadly similar patterns in reproductive behaviour but they differed in mate guarding tactics and male-male interference. Copulation duration was shorter in *T. annulata* than in *T. arteriosa*. Oviposition bouts lasted longer in *T. arteriosa* but dipping was faster in *T. annulata*. Analysis of microhabitat choice showed

that *T. arteriosa* males preferred vegetated areas to establish their territories while *T. annulata* used a wide array of habitats including terrestrial ones. Our data suggest that, although the two congeneric species are phenotypically similar and demonstrate low interspecific recognition abilities, they can coexist syntopically because they differ slightly in their habitat use and reproductive behaviour.

Further key words: Dragonfly, interspecific competition, copulation, mate guarding, habitat selection.

1st June 2016

Aeshna viridis is an early bird – matutinal matings in a crepuscular species (Odonata: Aeshnidae)*

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Received 26th November 2015; revised and accepted 7th February 2016

Abstract. The hitherto unknown mating activities of *Aeshna viridis* at dawn are described and photographically documented. At first morning light both sexes arrived at the breeding pond flying over dense stands of *Stratiotes aloides*. Their flight style was of two types: the well-known feeding flight and a slow, low, linear and non-aggressive cruising flight. Cruising individuals sometimes formed mating wheels and the couples left the pond. Shortly before sunrise numerous males started to search for receptive females in the tall herbaceous vegetation near the pond. This non-aggressive flight mode was slow and at knee-height, characterised by intrusion into dense thickets; we term it searching flight. It ceased within a period of 45–70 min after sunrise. We assume that the terrestrial vegetation represents the main rendezvous site and that searching flight leads to the majority of matings. One male was recorded grasping a resting female. Wheel formation was completed while perching without further flight, resulting in a distinctive twisted wheel position. Further observations confirmed that such twisted wheels found in the morning are typical. There are also records of occasional matings during the period from noon until late afternoon. The restriction of most mating activities to the period around sunrise rejects the myth of *A. viridis* being a late riser. The mating behaviour of this species with its combination of mainly sunrise-limited searching flight and wheel formation with resting mates seems to be unique in Odonata. In referring to twilight activities – at dawn and dusk – we use the term 'crepuscular' in the general sense and eschew the term 'eocrepuscular', making a distinction between morning and evening with the terms 'matutinal' (at dawn) and 'vespertine' (at dusk).

Further key words. Dragonfly, Anisoptera, mating behaviour, diel activity pattern, flight patterns, searching flight, cruising flight, twisted wheel position.

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* Dedicated to Günther Peters, the expert on aeshnids and our inspiring example, mentor and friend.

1st June 2016

Space use in territorial and non-territorial male *Calopteryx splendens* (Odonata: Calopterygidae)

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Received 30th June 2015; revised and accepted 5th February 2016

Abstract. In *Calopteryx* damselflies male territorial and non-territorial alternative mating tactics are identified. Territorial males are believed to secure more copulation. With increasing age, males starve and become non-territorial that only occasionally manage to copulate. However, space use of territorial and non-territorial males is not known in detail. We present the data on space use of individually marked male *Calopteryx splendens* (Harris, 1780), obtained during two field seasons in Vladimir Oblast, Russia. Each damselfly was captured, marked and the wing length was measured. During observation sessions of 2–4 hours per day, each male was characterised as either territorial or non-territorial and encounter locations were mapped. The probability of being territorial declines with the male's age. Territorial *vs* non-territorial tactic in a given day strongly influences tactic retention on the next day. We identified the territorial and non-territorial phases in the life of a male, which occur consequently and have roughly similar duration. We define the territorial phase as all days until the last record of a male as a territorial individual. The subsequent days were defined as the non-territorial phase. During the territorial stage, males may (1) occupy a single territory; (2) be non-territorial in some of the days and then return to his previous territory or (3) after staying within a certain territory for several days change it and occupy another territory on the next day or several days later. The transition from the territorial to the non-territorial phase is gradual. It may suggest this transition caused by exhaustion. Thus, space use changes predictably during the life of a male. Characteristics of individual lifetime trajectory – number of days when the male was recorded as territorial, number of territories occupied, etc. – did not depend on wing length.

Further key words. Dragonfly, damselfly, Zygoptera, behaviour, Russia.

1st June 2016

Colour polymorphism and ontogenetic colour changes in *Ischnura rufostigma* (Odonata: Coenagrionidae)

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Received 12th November 2015; revised and accepted 15th February 2016

Abstract. We describe female colour morphs and ontogenetic colour changes of *Ischnura rufostigma* in three populations from China. Females showed two colour morphs, one androchrome, identical to males, and one gynochrome, with orange coloration when immature and green to brown thorax when mature. Population frequencies show that gynochrome females are the most common morph (71-97 %). In addition, we found high variability in the extent of the blue coloration on the tip of the abdomen of males and androchrome females. We discuss the possible causes of this colour variation and propose that previously described intraspecific forms of *I. rufostigma annandalei,* solely based on the variation of this blue coloration, have no taxonomic relevance.

Further key words. Dragonfly, damselfly, Zygoptera, *Ischnura rufostigma* group, melanism, China.

1st June 2016

Cytogenetic report on *Gynacanthaeschna sikkima* from India (Odonata: Aeshnidae)

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Received 14th July 2015; revised and accepted 25th December 2015

Abstract. Spermatogonial and primary spermatocyte chromosomes of *Gynacanthaeschna sikkima* (Karsch, 1891) collected from Dalhousie (Himachal Pradesh, India) are described cytogenetically for the first time. The species possesses 2n (♂) = 25 as the chromosome number and X0(♂)/XX(♀) type sex determining mechanism. The chromosome number is less than the modal number (2n = 27) of the family which originates from by the fusion of autosomes. All the autosomal bivalents except m bivalent show terminal C-bands while large autosomal bivalent possesses two interstitial and terminal C-bands. X chromosome shows large C-band only on one side. Similarly, terminal NOR bands are present on the one side of 9 autosomal bivalents including m bivalent while X chromosome possesses large interstitial NOR band.

Further key words. Dragonfly, Anisoptera, chromosomes, C-banding, silver nitrate staining.

1st June 2016

The type material of Calopterygidae in the Museum für Naturkunde in Berlin (Odonata)

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Received 23rd October 2015; revised and accepted 17th February 2016

Abstract. A catalogue is presented listing all species-group names associated with type specimens of the family Calopterygidae (Odonata) currently housed in the entomological collection of the Museum für Naturkunde – Leibniz Institute for Evolution and Biodiversity Science in Berlin (Germany). Information on the current status of the species-group names, transcriptions of data labels and references to the original descriptions are provided.

Further key words. Zygoptera, catalogue, collecting locality, collector, verbatim label, type.

1st June 2016

Daily egg production in *Pantala flavescens* in relation to food intake (Odonata: Libellulidae)

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Received 13th October 2015; revised and accepted 16th February 2016

Abstract. The migratory dragonfly, *Pantala flavescens* (Fabricius, 1798), arrives in Japan from tropical regions every spring. Although the population increases as autumn nears, it dies in the winter cold. The adults often form foraging swarms above open grasslands when feeding on small insects, while oviposition occurs at diverse open water bodies throughout the day. Although oogenesis requires a daily intake of nutrition from prey, there has been little consideration of the relationship between food intake and the number of eggs produced. In the early morning, females of reproductive age were captured from foraging swarms in grasslands. Immediately after capture, an artificial oviposition technique was applied to each female to release all mature eggs loaded. Then, the females were kept until death, up to 5 days, in envelopes in the laboratory. They were starved but hydrated daily, and the dry weight of faeces excreted during 24 h after capture was measured. Females excreted 8.4 mg of faeces within 24 h after capture. Then, they released about 840 mature eggs at 24 h after capture, suggesting that when females take in a sufficient amount of daily food, they can oviposit a large number of eggs every day. The rapid egg production might enable the population of *P. flavescens* to grow. A positive correlation was found between the food intake on the previous day and the number of eggs produced within a 24 h of capture. The act of ingesting fresh nutrients derived from the prey might promote rapid release of reserves in the female fat body, resulting in the oogenesis. Females able to encounter available foraging sites might produce a large number of mature eggs in the subsequent day to be laid.

Further key words. artificial oviposition technique, faeces, fertility, inter-clutch interval, mature egg.

1st June 2016

Description of larvae of two species of *Coeliccia* Selys, 1865 from Sarawak, identified using DNA barcoding (Odonata: Platycnemididae)

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Received 25th December 2015; revised and accepted 22nd February 2016

Abstract. The final stadium (F) larva of *Coeliccia flavostriata* Laidlaw, 1918, is described and illustrated based on a mature male specimen, collected at Gunung Serapi, Sarawak, East Malaysia. The larva of *Coeliccia campioni* Laidlaw, 1918, is described from an immature (F-2?) female specimen from Gunung Mulu, Sarawak, East Malaysia. Larvae were identified by matching the mitochondrial marker COI with that of known adult specimens from several localities throughout Sarawak. The specimens presented close matches with all adults in this gene. Despite the disparity in maturity of the specimens several morphological differences, likely to be reflected in the mature larva of *C. campioni*, are identified. Comparisons with known larval descriptions of other *Coeliccia* species are provided. It is concluded that molecular analysis will eventually provide the most reliable practical method of determining the species of larvae of many species from this diverse genus.

Further key words. Dragonfly, damselfly, Zygoptera, *Coeliccia campioni, C. flavostriata*, larval taxonomy, COI sequencing, Borneo.