

Systematic palaeontology (Invertebrate palaeontology)

First Cordulephyidae dragonfly in America: A new genus and species from the Paleogene of Argentina (Insecta: Odonata)

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Abstract

Palaeophya argentina gen. et sp. n. is the first American representative of the Cordulephyidae. The fossil belongs to Neophyinae and is closely related to the unique genus *Neophya* present in the Early Oligocene of England and extant in Africa. This fossil record supports the evidence of a Cretaceous age and a wide ancient distribution in Palaeogene warm regions for the Neophyinae, which acquire the status of relict in recent intertropical Africa. **To cite this article:** J.F. Petrulevičius, A. Nel, C. R. Palevol 8 (2009).

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Résumé

Première libellule Cordulephyidae d'Amérique: un nouveau genre et une nouvelle espèce du Paléogène d'Argentine (Insecta : Odonata). *Palaeophya argentina* gen. et sp. n. est le représentant américain des Cordulephyidae. Ce fossile appartient aux Neophyinae et est étroitement apparenté à l'unique genre africain actuel *Neophya*, déjà connu de l'Oligocène basal d'Angleterre. Ce registre fossile est en faveur d'un âge Crétacé et d'une distribution dans l'ensemble des régions chaudes au Paléogène pour les Neophyinae qui peuvent être considérés comme un groupe relicté de la faune intertropicale africaine actuelle. **Pour citer cet article :** J.F. Petrulevičius, A. Nel, C. R. Palevol 8 (2009).

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Mots clés : Insecta ; Odonata ; Anisoptera ; Neophyinae ; *Palaeophya argentina* gen. et sp. n. ; Amérique du Sud ; Biogéographie

1. Introduction

The specimen studied here represents the first Cordulephyidae described in South America. Cordulephyidae are separated in two subfamilies, Cordulephyinae and

Neophyinae, with a recent distribution in warm humid Australia and intertropical Africa, respectively. One fossil species was recently found from the insect limestone in the Isle of Wight (Early Oligocene, England) [7]. The entire family *sensu* Bechly [1] has only two genera, *Neophya* Selys, 1881 and *Cordulephya* Selys, 1870 and two recent species, plus the fossil new species of *Neophya* described by Nel and Fleck [7].

The studied specimen was collected from an exposed section of Maíz Gordo Formation at 24° 20' S, 64° 28' W,

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in the province of Jujuy (Northwest Argentina). The section is composed of green siltstone and shale, and stromatolitic boundstone [9] and was deposited in the south-occidental margin of the Lomas de Olmedo depocenter [19]. The specimen was collected from the same layers that the dragonfly *Austrolibellula noroestenia* Petrulevičius and Nel 2003, and the damselflies *Promegalestes singularis* Petrulevičius and Nel 2004, *Latibasalia quispeae* Petrulevičius and Nel 2004 and *L. elongata* Petrulevičius and Nel 2004 [10,11,12,13].

2. Material and methods

The specimen was collected in 2000 and housed in the Departamento Científico Paleozoología Invertebrados, Museo de La Plata, La Plata, Argentina (MLP 29426). The specimen was originally partly covered, and was prepared with a pneumatic hammer.

We follow the wing venation nomenclature of Riek [16] and Riek and Kukalová-Peck [17], amended by Nel et al. [8] and Bechly [1]. The higher classification of fossil and extant Odonoptera, as well as familial and generic characters followed in the present work are based on the phylogenetic system proposed by Bechly [1].

3. Systematic palaeontology

Clade Cavilabiata Bechly, 1996

Family Cordulephyidae Tillyard, 1917

Subfamily Neophyinae Tillyard and Fraser, 1940

Genus *Palaeophya* gen. n.

Type species. *Palaeophya argentina* sp. n.

Etymology. Named after (*Neo*)*phy*a and “Palaeo”.

Diagnosis. Wing characters only; vein separating hypertriangle and discoidal triangle ending in MA at distal angle of discoidal triangle; only four antenodal cross-veins; four cross-veins in area between RA and RP basal of subnodus; two rows of cells in postdiscoidal area, two cells distal of triangle; anal area rather broad and large with five rows of cells between anal loop and posterior wing margin.

Palaeophya argentina sp. n. (Figs. 1 and 2)

Description. Preserved length of hind wing: 17 mm; wide of the wing at arculus level: 10 mm; distance from arculus to nodus: 5 mm; three complete antenodal cross-veins preserved, distal to the arculus, and certainly only one more ($A \times 1$) basally; sectors of arculus stalked and strongly curved (costal side of hypertriangle very convex); trigonal vein (separating hypertriangle and discoidal triangle) distinctly curved, and ending in MA at distal angle of discoidal triangle; discoidal triangle

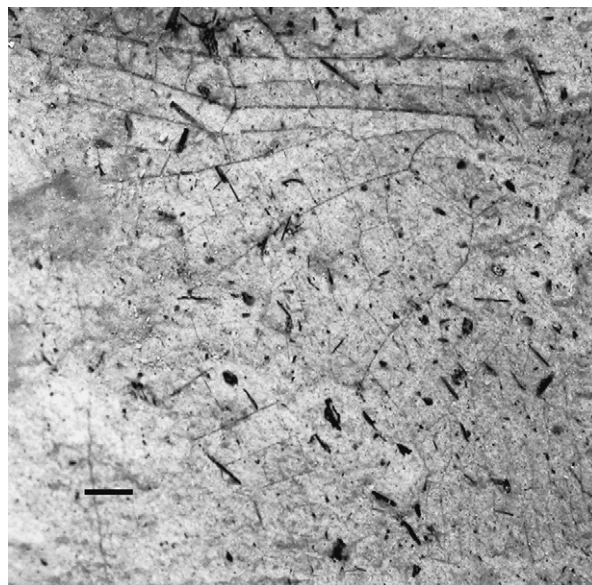


Fig. 1. *Palaeophya argentina* gen. et sp. n., holotype 29426, photograph of hind wing (scale bar represents 5 mm).

Fig. 1. *Palaeophya argentina* gen. et sp. n., holotype 29426, photographie de l'aile postérieure (échelle : 5 mm).

isosceles; median space probably free; anal loop elongate, with two rows of cells and a very distinct median rib (Cuspl), but even if it is incomplete, probably without toe; anal area rather broad and large with five rows of cells between anal loop and posterior wing margin; four cross-veins in area between RA and RP basal of subnodus; one Bqr cross-vein; oblique vein “O” just distal of base of RP2; postdiscoidal area with one row of large transverse cells just distal of triangle but with two rows of cells distally; only base of Mspl visible but probably rudimentary; four visible postnodal cross-veins not aligned with corresponding postsubnodal cross-veins, no postsubnodal cross-vein corresponding to two most basal postnodal cross-veins.

Holotype. Specimen MLP 29426 (isolated hind wing), stored at the Departamento Científico Paleozoología Invertebrados, Museo de la Plata, La Plata, Argentina.

Type locality and horizon. Province of Jujuy, El Fuerte, latitude 24° 20' S, longitude 64° 28' W, green shales, Maíz Gordo Formation, Late Paleocene [15,20].

Etymology. Named after the country, Argentina.

Diagnosis. As for the genus.

Discussion. The main remarkable structure of *Palaeophya* gen. n. is the anterior side of the discoidal triangle (of hind wing) distinctly curved. Only few groups within the Cavilabiata have this character, viz. some Libellulidae, the Mesozoic Araripelibellulidae:

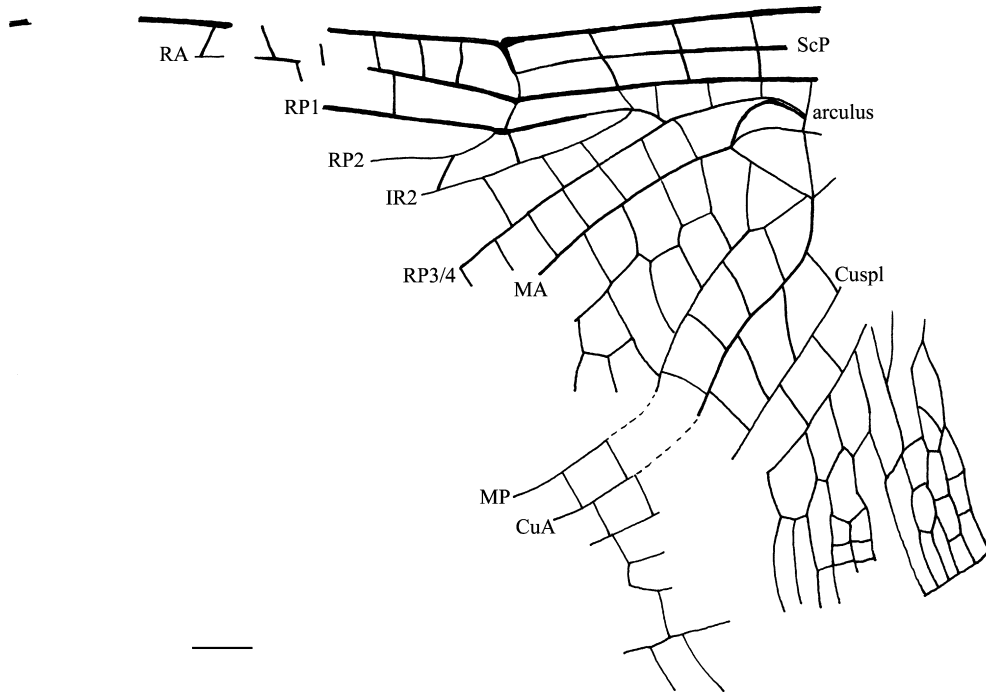


Fig. 2. *Palaeophya argentina* gen. et sp. n., holotype 29426, reconstitution of hind wing (scale bar represents 5 mm).

Fig. 2. *Palaeophya argentina* gen. et sp. n., holotype 29426, reconstruction de l'aile postérieure (échelle : 5 mm).

Araripelibellulinae Bechly, 1996 (especially the English Wealdian *Cretaneophya strevensi* Jarzembowski and Nel, 1996), and the recent *Neophya rutherfordi* Selys, 1881 (Cordulephyidae Tillyard, 1917 of the subfamily Neophyinae Tillyard and Fraser, 1940) [4]. The concerned Libellulidae (*Tetrathemis* Brauer, 1868, *Nannophlebia* Selys, 1878) have this vein less curved than in *Palaeophya* gen. n., and narrower anal area and anal loop [18]. The main differences between *Cretaneophya* and *Neophya* lie in the size and shape of the anal loop, 2–3 cells in *Cretaneophya* instead of transverse elongate with a median vein in *Neophya* and in *Palaeophya*.

Furthermore *Palaeophya* has the wing venation synapomorphies of the Neophyinae, i.e. sectors of arculus stalked and strongly curved (costal side of hypertriangle very convex); trigonal vein, separating the hypertriangle from the discoidal triangle, distinctly curved. The other characters of *Neophya* are unknown in our fossil, viz. Rspl absent; RP2 and IR2, as well as RP3/4 and MA distally converging. All the other characters present in *Palaeophya* are identical to those of the recent *Neophya rutherfordi*, except for the trigonal vein ending in MA at the distal angle of discoidal triangle instead of before this angle in *N. rutherfordi*, and the presence of only four antenodal cross-veins instead of six in *N. rutherfordi* (pers. obs. [5]). *Palaeophya* also

differs from *N. rutherfordi* in its broader anal area with five rows of cells between anal loop and posterior wing margin, instead of two.

The unique fossil taxon attributed to *Neophya* is from the Late Eocene–Early Oligocene, UK. *Palaeophya argentina* shares with the English fossil *Neophya* the presence of only four antenodal cross-veins, but the former differs from the latter in the presence of four cross-veins in the area between RA and RP basal of the subnodus, instead of two, and of two rows of cells in postdiscoidal area opposite the base of RP3/4, instead of only one in English fossil *Neophya* and *N. rutherfordi*. Lastly, *Palaeophya* differs from both the English fossil *Neophya* and *N. rutherfordi* in the presence of two rows of cells in postdiscoidal area, two cells distal of triangle.

Bechly [1] included in the Cordulephyidae the Australian genus *Cordulephya* and the Afrotropical *Neophya*. For this author, the sister group of the Cordulephyidae is the Haplohamulida Bechly, 1996 (= Oxygastridae Bechly, 1996 + Italoansida Bechly, 1996, i.e. Corduliidae, Hemicorduliidae and Libellulida). *Cordulephya* falls as sister group of the nominal gomphomacromiine *Pseudocordulia* in the molecular phylogeny of Ware et al. [21], but *Neophya* was not considered in this latter analysis. Nevertheless, both *Cordulephya* and *Neophya* certainly belong to clades that have more inclusive positions than the Libellulidae.

4. Palaeobiogeographic remarks

As the family Libellulidae is recorded from the Late Cretaceous [3], the lineage of Cordulephyidae could have been present at the same time. The antiquity of the Cordulephyidae is firstly supported by its recent distribution in Africa and Australia. Furthermore, the recent discovery of Neophyinae in the Paleocene–Eocene of Argentina and the Late Eocene of England [7] indicates a wide distribution in the Palaeogene and a recent relict distribution in Africa. These dragonflies were probably spread in the warm regions of the world during the Late Cretaceous and Paleogene and restricted in the Neogene to intertropical Africa. A similar situation occurs for the calopterygid genus *Sapho* Selys, 1853, also distributed in the forests of West and central Africa, and recorded from France in the Late Oligocene [2,6]. Also a similar Palaeogene distribution has been recently indicated for the anisopteran fossil family Palaeomacromiidae, recorded from the Paleogene of Argentina and Italy [13,14] but this taxon differs in becoming totally extinct at recent times.

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