Zootaxa 3616 (6): 597–600
www.mapress.com/zootaxa/

Correspondence

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3616.6.6
http://zoobank.org/urn:lsid:zoobank.org:pub:C0F88A59-072C-4E4A-AD30-19D25774853C

A new Frenguelliidae (Insecta: Odonata) from the early Eocene of Laguna del Hunco, Patagonia, Argentina

JULIÁN F. PETRULEVIČIUS[1,3] & ANDRÉ NEL[2]

[1]*Museo de La Plata - UNLP - CONICET, División Paleozoología Invertebrados, Paseo del Bosque s/n, 1900 La Plata, Argentina. E-mail: levicius@museo.fcnym.unlp.edu.ar* [2]*CNRS UMR 7205, Muséum National d'Histoire Naturelle, CP 50, Entomologie, 45 rue Buffon, F-75005, Paris, France. E-mail: anel@mnhn.fr*
[3]*Corresponding author*

Abstract

The discovery of a new specimen of Frenguelliidae, attributed to the new species *Frenguellia iglesiasi*, in Patagonia, Argentina, is noteworthy for the knowledge of the diversity within this little-known family.

Key words: Insecta, Odonata, Epiproctophora, Frenguelliidae, Eocene, Patagonia, Argentina

Introduction

The family Frenguelliidae is based on its type species *Frenguellia patagonica* Petrulevičius and Nel, 2003. The type specimen was an isolated wing considered by its morphology as a forewing. More recently we found a second isolated wing attributed to the same species and considered as a hindwing because of the basally closed discoidal cell (Petrulevičius and Nel, 2007). Here we present a third specimen of the family, discovered in the same outcrop at Laguna del Hunco as for the two previous ones. We attribute it to a new species because of its wing morphology.

Frenguellia is a very interesting genus that was considered as a basal Epiproctophora, a clade that also comprises the modern Anisoptera (Petrulevičius and Nel, 2003, 2007). As several more advanced Epiproctophora are Late Triassic, this Paleocene family also belongs to a very ancient lineage of Triassic age. The gap in the fossil record of this group between the Triassic and the Paleocene is not necessarily problematic because the recent Epiophlebiidae, another relatively basal epiproctophoran family, has no fossil record. The fossil record of these Odonata is cryptic, maybe in relation to highly specialized biologies as for *Epiophlebia superstes* and *Epiophlebia sinensis* that inhabit the headwaters in rainforests of Japan and North China (Shimura, 2005; Li *et al.*, 2011).

Females of *Epiophlebia superstes* lay their eggs in terrestrial plants such as mosses and *Elatostema umbellatum* on banks of the heads of mountain rivers (Shimura, 2005).

The localities of the Eocene of Patagonia have begun to show a nice diversity of odonate records from ovipositions to nymphs and adults (Petrulevičius, in press). The odonate oviposition traces from Laguna del Hunco were originally considered to be made by Coenagrionidae and Lestidae (Sarzetti *et al.*, 2009), but we cannot exclude their attribution to the odonates present in the locality, as the Frenguelliidae, and in accord to their morphology comparable to that of the basal Epiproctophora Epiophlebiidae (Petrulevičius *et al.*, 2011; Shimura, 2005).

Material and methods

The new specimen of Frenguelliidae is housed in the Museo Paleontológico Egidio Feruglio (MPEF-PI 1006), Trelew, Argentina. The specimen was originally partly covered by sediments and was prepared with a pneumatic hammer.
We follow the wing-venation nomenclature of Riek and Kukalová-Peck (1984), amended by Kukalová-Peck (1991), Nel *et al.* (1993) and Bechly (1996). The abbreviations of names of wing structures used throughout the work are: CA: costa anterior, CP: costa posterior, ScP: subcosta posterior, Ax1 and Ax2: principal antenodals, SN: subnodus, RP: radius

Accepted by D. Paulson: 10 Jan. 2013; published: 25 Feb. 2013

posterior, IR1 and IR2: intercalary veins of radial area, MAb: median anterior b, CuA: cubitus anterior. The higher classification of fossil and extant Odonatoptera, as well as familial and generic characters followed in the present work are based on the phylogenetic system proposed by Bechly (1996). See Petrulevičius and Nel (2007) for discussion and conclusions on the phylogenetic relationships of the Frenguelliidae.

Systematic palaeontology

EPIPROCTOPHORA Bechly, 1996

FRENGUELLIIDAE Petrulevičius and Nel, 2003

Genus *Frenguellia* Petrulevičius and Nel, 2003

***Frenguellia iglesiasi* sp. nov.**
(Figs. 1–2)

Etymology. Named after Ari Iglesias, friend and outstanding paleobotanist, also remarkable for his savoir faire in the collection of fossil insects.

Material. MPEF-PI 1006, Museo Paleontológico Egidio Feruglio, Trelew, Chubut, Argentina. **Type locality and horizon**. Pyroclastic debris, caldera lake bed, Laguna del Hunco, province of Chubut, Patagonia Argentina, latitude 42° 30' S, longitude 70° W. Early Eocene (52.2 Ma) (Wilf *et al*. 2003, 2005; Wilf, 2012).

Diagnosis. Wing distinctly larger than in *Frenguellia patagonica*; hindwing discoidal cell with a much less oblique distal side MAb than in *F. patagonica*; two rows of cells in cubitoanal area well basal of level of subnodus in hindwing; plus maybe hindwing hyaline (but this could also be a female character).

FIGURE 1. General habitus of hindwing of *Frenguellia iglesiasi*, MPEF-PI 1006; scale bar represents 2 mm.

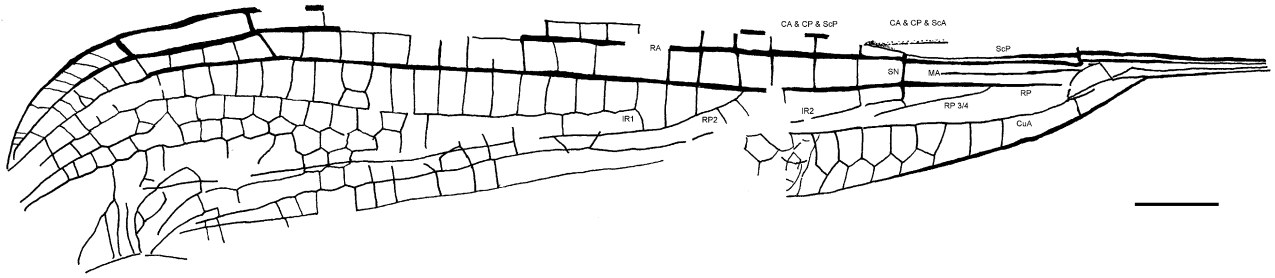

FIGURE 2. Reconstruction of general habitus of hindwing of *Frenguellia iglesiasi*. Scale bar represents 2 mm.

Description. A nearly complete wing, wrinkled and with some veins missing; wing hyaline; petiole long, about 3 mm; wing 30.06 mm long; distance between base and arculus 4.0 mm, between arculus and nodus 5.7 mm, between nodus and pterostigma 14.2 mm, between pterostigma and apex 3.8 mm; nodus basally recessed; pterostigma long and broad, 3.3 mm long, 0.75 mm wide, covering four cells; anterior side of pterostigma not oblique, nearly parallel to postnodal cross-veins; pterostigma brace slightly more oblique than anterior side of pterostigma; antenodal cross-veins

not well preserved but if Ax1 and Ax2 are present there seems to be no secondary antenodal cross-veins, Ax1 well basal of arculus, Ax2 opposite base of MAb; discoidal cell basally closed, broad, anterior side 0.5 mm long, posterior side 1.1 mm long, basal side 0.42 mm long, distal side 0.77 mm long; base of RP3/4 2 mm basal of subnodus and 4.6 mm distal of arculus, nearly midway between the two structures; base of IR2 below subnodus; base of RP2 three cells and a half, 3.77 mm distal of subnodus; base of IR1 three cells, 2.5 mm distal of that of RP2; nodal cross-vein and subnodus vertical; point of fusion of ScP with costal margin only partly preserved but very similar to that of the holotype of *Frenguellia patagonica*; 19 postsubnodal cross-veins, not well aligned with postnodals; one 'lestine' oblique cross-vein, five cells distal to base of RP2; cubito-anal area broad, with two rows of cells between CuA and posterior wing margin in its distal part, four cells distal to discoidal cell; postdiscoidal area and areas between MA and RP3/4, RP3/4 and IR2, and IR2 and RP2 not well preserved; area between RP2 and IR1 distally widened with three longitudinal secondary veins; area between IR1 and RP1 with one row of cells and distally narrowed because IR1 bents forward.

Discussion. The new specimen is similar to the type (a forewing, 23.6 mm long) of *Frenguellia patagonica* Petrulevičius and Nel, 2003 and to the second described specimen (MPEF-PI 999, a hindwing, 24.5 mm long) (Petrulevičius and Nel, 2003, 2007). The main differences are as follows: 1) Wing longer (30.06 mm long, instead of 23.5*et al*.24.5 mm long). This difference in size is hardly compatible with intraspecific variability. 2) Discoidal cell basally closed as in specimen MPEF-PI 999, while it is narrow and basally opened in the holotype forewing of *F. patagonica*; the two other specimens are hindwings, as already indicated in Petrulevičius and Nel (2007). 3) Wing hyaline. This difference could be due to sexual dimorphism, viz. hindwing hyaline in female while it is coloured in male, as frequently occurs in damselflies. Petrulevičius and Nel (2007) also noted that the forewing of the type of *F. patagonica* is hyaline while the hindwing specimen MPEF-PI 999 has a dark apical spot. 4) Hindwing discoidal cell with a much less oblique distal side MAb than in the specimen MPEF-PI 999. 5) presence of two rows of cells in cubito-anal area well basal of subnodus level, as in the holotype of *F. patagonica*, while this situation happens distal of subnodus in MPEF-PI 999.

The differences of the new specimen from the holotype of *F. patagonica* and MPEF-PI 999, second specimen of this last taxon, are sufficient to attribute it to a different species.

Acknowledgements

We thank the CONICET (National Research Council of Argentina) PIP CONICET 0377 and NSF (National Science Foundation, USA) DEB-0345750 and DEB-0919071 for the funds provided for this research. Thanks are also due to Rubén Cúneo and Eduardo 'dudu' Ruigómez for loaning the specimen for study, and María Celina Digiani for valuable help and discussion.

References

Bechly, G. (1996) Morphologische Untersuchungen am Flügelgeäder der rezenten Libellen und deren Stammgruppenvertreter (Insecta; Pterygota; Odonata), unter besonderer Berücksichtigung der Phylogenetischen Systematik und des Grundplanes der Odonata. *Petalura*, Special Volume 2, 402 pp.

Kukalová-Peck, J. (1991) Chapter 6: Fossil history and the evolution of hexapod structures. pp. 141–179. In: Naumann, I. D. (ed.). *The insects of Australia, a textbook for students and research workers* (2nd ed.), 1, (Melbourne University Press, Melbourne), 542 pp.

Li, J.-k., Nel, A., Zhang, X-p., Fleck, G., Gao, M-x., Lin, L. & Zhou, J. (2011) The third species of the relict damsel-dragonfly family Epiophlebiidae discovered in China (Insecta: Odonata: Epiproctophora). *Systematic Entomology*, 37, 408–412. http://dx.doi.org/10.1111/j.1365-3113.2011.00610.x

Nel, A., Martínez-Delclòs, X., Paicheler, J.-C. & Henrotay, M. (1993) Les 'Anisozygoptera' fossiles. Phylogénie et classification (Odonata). *Martinia*, Numéro Hors Série 3, 1–311.

Petrulevičius, J.F. (In press) Libélulas (Insecta: Odonata) del Eoceno de Patagonia, Argentina y su aporte al paleoambiente de Laguna del Hunco y Confluencia. *Ameghiniana*, 49(4) Suplemento Resúmenes.

Petrulevičius, J.F. & Nel, A. (2003) Frenguelliidae, a new family of dragonflies from the earliest Eocene of Argentina (Insecta: Odonata): phylogenetic relationships within Odonata. *Journal of Natural History*, 37, 2909–2917. http://dx.doi.org/10.1080/0022293021000007543

Petrulevičius, J.F. & Nel, A. (2007) Enigmatic and little known Odonata (Insecta) from the Paleogene of Patagonia and northwest Argentina. *Annales de la Société Entomologique de France*, (N.S.), 43, 341–347.

Petrulevičius, J.F., Wappler, T., Nel, A., & Rust, J. (2011) The diversity of Odonata (Insecta) and their endophytic

ovipositions from the Upper Oligocene Fossillagerstätte of Rott (Rhineland, Germany). In: Shcherbakov, D., Engel, M. y Sharkey, M. (eds.), Advances in the Systematics of Fossil and Modern Insects: Honouring Alexandr Rasnitsyn, 542 p. *Zookeys*, 130, 67–89.

Riek, E.F. & Kukalová-Peck, J. (1984) A new interpretation of dragonfly wing venation based upon Early Carboniferous fossils from Argentina (Insecta: Odonatoidea) and basic characters states in pterygote wings. *Canadian Journal of Zoology*, 62, 1150–1166. http://dx.doi.org/10.1139/z84-166

Sarzetti, L.C., Labandeira, C.C., Muzón, J., Wilf, P., Cúneo, N.R., Johnson, K.R., & Genise. J.F. (2009) Odonatan endophytic oviposition from the Eocene of Patagonia: the ichnogenus *Paleoovoidus* and implications for behavioral stasis. *Journal of Paleontology*, 83, 431–447. http://dx.doi.org/10.1666/08-121.1

Shimura, S. (2005) Internet homepage. http://tombon.com/ENGS002.htm. Wilf, P. (2012) Rainforest conifers of Eocene Patagonia: attached cones and foliage of the extant southeast-Asian and Australasian genus *Dacrycarpus* (Podocarpaceae). *American Journal of Botany*, 99, 562–584.

Wilf, P. (2012) Rainforest conifers of Eocene Patagonia: attached cones and foliage of the extant southeast-Asian and Australasian genus *Dacrycarpus* (Podocarpaceae). *American Journal of Botany* 99, 562-584.

Wilf, P., Cúneo, N.R., Johnson, K.R., Hicks, J.F., Wing, S.L. & Obradovich, J.D. (2003) High Plant Diversity in Eocene South America: Evidence from Patagonia. *Science* (Reports), 300, 122–125. http://dx.doi.org/10.1126/science.1080475

Wilf, P., Johnson, K.R., Cúneo, N.R., Smith, M.E., Singer, B.S. & Gandolfo, M.A. (2005) Eocene Plant Diversity at Laguna del Hunco and Río Pichileufú, Patagonia, Argentina. *The American Naturalist*, 165, 634–650. http://dx.doi.org/10.1086/430055