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A new species of *Cymatophlebia* (Insecta: Odonata: Anisoptera: Cymatophlebiidae) from the Solnhofen Lithographic Limestone (Upper Jurassic, Germany)

By Günter Bechly, Stuttgart

With 2 Figures

Summary

A new dragonfly species, *Cymatophlebia densa* n. sp. (Anisoptera: Aeshnoptera: Cymatophlebiidae), is described from the Upper Jurassic Solnhofen Limestone of Germany. It is the fourth species of this Mesozoic genus known from this famous fossil locality.

Zusammenfassung

Eine neue Großlibellenart, *Cymatophlebia densa* n. sp. (Anisoptera: Aeshnoptera: Cymatophlebiidae), wird aus den oberjurassischen Solnhofener Plattenkalken von Deutschland beschrieben. Es handelt sich um die vierte Art dieser mesozoischen Gattung, die für diese berühmte Fossilfundstelle nachgewiesen werden kann.

1. Introduction

Bechly et al. (2001) revised all Mesozoic aeshnoid dragonflies, including the family Cymatophlebiidae. They rejected the synonymy with *Libellulium* Westwood, 1854 and restored the genus *Cymatophlebia* for which they provided a complete synonymy and described five new species. They also proposed a new classification of the Cymatophlebiidae which they attributed to Aeshnoptera – Aeshnida Bechly, 1996 based on an extensive phylogenetic analysis. *Cymatophlebia longialata* (Münster in Germar, 1839) is one of the most common and well-known fossil dragonflies from the Upper Jurassic Solnhofen Lithographic Limestone (Bavaria, Germany) which is very much appreciated by fossil collectors because of its size and often attractive preservation. Including the here described new species, there are now four species of this Mesozoic genus known from this famous fossil locality.

2. Material and methods

The drawing was made with a camera lucida on a Wild M5 binocular microscope, and the photo was made by directly scanning the fossil with a flatbed scanner. The nomenclature of the dragonfly wing venation is based on the interpretations of RIEK & KUKALOVÁ-PECK (1984), amended by NEL et al. (1993) and BECHLY (1996).

3. Systematic Palaeontology

Class Insecta LINNAEUS, 1758 (= Hexapoda LATREILLE, 1825)
Pterygota BRAUER, 1885
Order Odonata FABRICIUS, 1793
Suborder Anisoptera SELYS in SELYS & HAGEN, 1854
Aeshnoptera BECHLY, 1996
Family Cymatophlebiidae HANDLIRSCH, 1906
Subfamily Cymatophlebiinae HANDLIRSCH, 1906

Genus *Cymatophlebia* DEICHMÜLLER, 1886

Type species: *Cymatophlebia longialata* (MÜNSTER in GERMAR, 1839), by original designation.

Further species: *C. standingae* (JARZEMBOWSKI, 1994), *C. zdrzaleki* (JARZEMBOWSKI, 1994), *C. suevica* BECHLY et al., 2001, *C. herrlenae* BECHLY et al., 2001, *C. purbeckensis* BECHLY et al., 2001, *C. pumilio* BECHLY et al., 2001, and *C. kuempeli* BECHLY et al., 2001. "*Cymatophlebia*" *mongolica* COCKERELL, 1924 was transferred by BECHLY et al. (2001) to Anisoptera incertae sedis.

Diagnosis. – See BECHLY et al., 2001.

Phylogenetic position. – See BECHLY et al., 2001.

Cymatophlebia densa n. sp.

Figs 1–2

Holotype: Specimen no. F 1192 at the Naturhistorisches Museum in Basel, Switzerland. It is an isolated hindwing of a female and the only known specimen of this new species.

Type locality: Solnhofen, southern Frankonian Alb, Bavaria, Germany.

Type horizon: Upper Jurassic, Malm ζ 2b ("oberer Weißjura"), Lower Tithonian, Hybonotum Zone, Solnhofen Lithographic Limestone.

Derivation of name: Named after the very dense pattern of cells in the wing venation.

Diagnosis. – This new species can be distinguished from the other species of the same genus by the following characters: Length of hindwing about 65 mm (like *C. longialata* and *C. kuempeli*), instead of less than 50 mm in *C. pumilio*, max. 55 mm in *C. purbeckensis*, about 70 mm in *C. zdrzaleki*, more than 77 mm in *C. standingae*, and more than 100 mm in *C. suevica*. It differs from *C. longialata* in the much larger number of postnodal crossveins between nodus and pterostigma (23 instead of only max. 15). It differs from *C. longialata* and *C. kuempeli* in having three rows of cells between RP1 and RP2 basal of the pterostigma, and six rows of cells between Rspl and IR2. It furthermore differs from the very similar species *C. kuempeli* (with which it shares the absence of a distinct Mspl) in having only two rows of cells between the distal parts of RP2 and IR2, and only three rows of cells in the basal part of the postdiscoidal area, just like *C. longialata* (contrary to *C. suevica*, *C. zdrzale-*

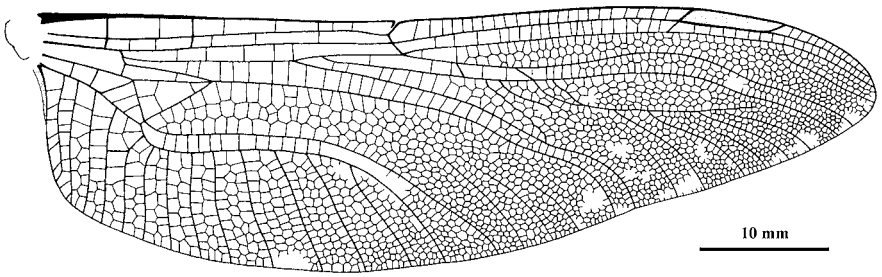

Fig. 1. *Cymatophlebia densa* n. sp., holotype F 1192, hindwing. Scale 10 mm.

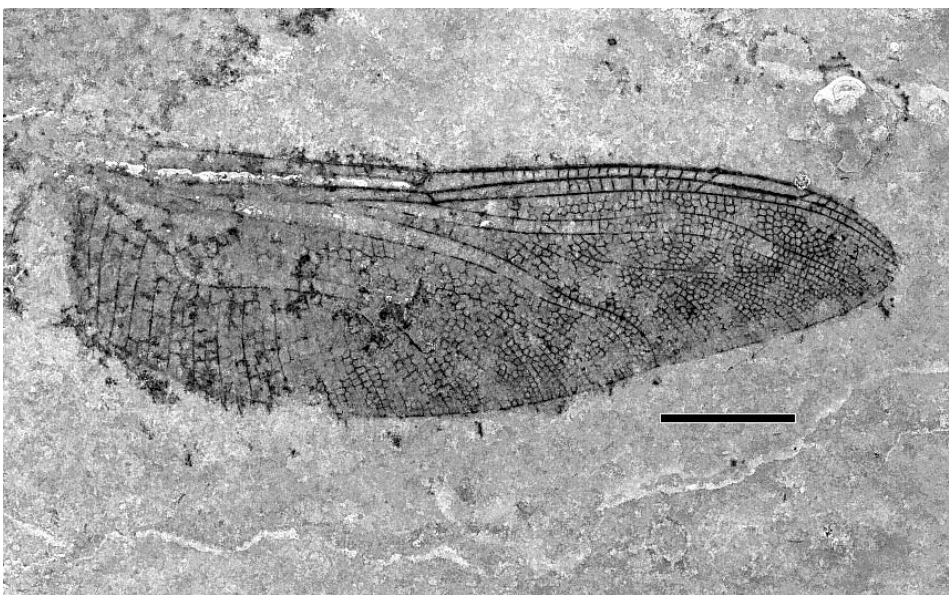

Fig. 2. *Cymatophlebia densa* n. sp., holotype F 1192, hindwing. Scale 10 mm.

ki, and *C. standingae*). It differs from *C. herrlenae*, of which the hindwing is still unknown, by the origin of IR2 on RP1/2 (instead RP3/4).

Systematic position. – This new species can be clearly attributed to the genus *Cymatophlebia* because of the following characters (compare BECHLY et al., 2001): Dense wing venation with numerous cells; two rows of secondary antenodal crossveins not aligned; postnodal crossveins and postsubnodal crossveins not aligned; pterostigma elongated and braced; apparent furcation of AA into an anterior secondary branch PsA and a posterior main branch AAa; Rspl always well-defined and strongly curved with several rows of cells between it and IR2; MA, RP3/4, IR2 and RP2 parallel but strongly undulated; there are several rows of cells between the distal parts of MA and RP3/4, and between IR2 and RP2; MA and RP3/4 reach the posterior wing margin at right angles; RP2 and IR2 reach the posterior wing margin at a very oblique angle; RP1 and RP2 closely parallel or even converging basal of the pterostigma, with 2–3 rows of cells in-between; two distinct anastomos-

ing secondary veins between IR2 and RP3/4 immediately basal of the origin of Rspl; two oblique veins 'O', with the second (more distal) one being much more oblique and longer than the basal one; discoidal triangle elongate and divided into several cells; hindwing subdiscoidal triangle divided into two or three cells; anal and cubito-anal areas very wide in the hindwing; CuAa with numerous posterior branches.

Description

An isolated but complete hindwing of a female dragonfly. The wing venation is very well-preserved and traced by iron-oxide dendrites.

Hindwing: Length 63.2 mm; width at nodus 19.0 mm (max. width 19.6 mm); distance between wing base and arculus 6.6 mm; distance between wing base and nodus 27.8 mm; distance between nodus and pterostigma 22.2 mm. Pterostigma 7.3 mm long and max. 1.1 mm wide, covering 6.5 cells and distinctly braced by an oblique crossvein. The basal brace Ax0 is not preserved. Numerous antenodal crossveins that are not aligned except for the two primaries. The two primary antenodal crossveins are stronger than the secondary antenodal crossveins. Ax1 1.2 mm basal of arculus, Ax2 is situated somewhat basal of the level of the distal angle of the discoidal triangle, 6.7 mm distal of Ax1. Between the two primary antenodal crossveins there were probably several secondary antenodal crossveins, but only one is preserved in the first row, and two in the second row, not precisely aligned. Five antesubnodal crossveins are visible between subnodus and arculus with a distinct gap near the arculus, but the apparent very long gap near the subnodus is probably due to incomplete preservation of the antesubnodal crossveins. 23 postnodal crossveins between nodus and pterostigma, not aligned with the corresponding postsubnodal crossveins. The arculus is strongly angled and the bases of RP and MA are distinctly separated at arculus. The hypertriangle is 7.0 mm long and max. 1.0 mm wide; it is traversed by at least one crossvein. The discoidal triangle is longitudinally elongated and divided into more than four cells (probably five or six); length of anterior side of discoidal triangle 6.0 mm; of basal side 3.2 mm; of distal side MAb 6.0 mm; the distal side MAb is straight and there is no trigonal planate. Median space free of crossveins. Submedian space traversed by CuP-crossing and a single crossvein. AA divided into a secondary anterior branch PsA and a posterior main branch AAa, delimiting a well-defined subdiscoidal triangle that is divided into three cells by two parallel crossveins. PsA nearly straight. Four posterior branches of AA between CuA and the anal margin. The anal margin is rounded without an anal angle or anal triangle, thus, it is a female specimen. A very narrow and short membranule is faintly visible at the wing base. The anal area is 9.9 mm wide (below PsA) with about nine rows of cells between AA and the posterior margin. AAa is fused with CuA shortly below the posterior angle of discoidal triangle, so that the free part of CuA (subdiscoidal veinlet) is only 0.4 mm long. The anal loop is posteriorly closed and four-celled. CuAb is slightly bent. CuAa with nine well-defined and parallel posterior branches. Cubito-anal area broad, max. 9.1 mm wide with up to sixteen rows of cells. CuAa and MP basally parallel with only a single row of cells in-between, but distally they become strongly divergent with nine cells in-between at the posterior wing margin. Three rows of cells in the postdiscoidal area directly distal of discoidal triangle, and this area is widened distally with 25 cells between these veins at the posterior wing margin (width of this area near discoidal triangle 4.0 mm, and along pos-

terior wing margin 9.5 mm). No distinct Mspl is visible. Three secondary longitudinal veins in the distal postdiscoidal area reach the posterior wing margin. MA and RP3/4 are distally undulated below the base of Rspl. MA and RP3/4 are mostly closely parallel with only one row of cells in-between, but they diverge near the posterior wing margin with four rows of cells in-between. Several bridge-crossveins Bqs (three are preserved) basal of the first oblique vein. Base of RP2 aligned with subnodus. Two oblique veins 'O', 4.3 mm and 8.8 mm distal of the subnodus; the distal oblique vein is more strongly oblique and longer than the basal one. One or two anastomosing secondary veins between IR2 and RP3/4 somewhat basal of Rspl. A strong Rspl with max. six rows of cells between it and IR2. Rspl does not reach the posterior wing margin; about five convex secondary longitudinal veins originate on Rspl and reach the posterior wing margin. IR2 and RP2 are basally closely parallel and straight with only a single row of cells in-between, but distally they are undulated and more widely separated with two or three rows of cells in-between, but still rather parallel. RP1 and RP2 are basally closely parallel and even converge near the pterostigma with three rows of cells in-between, but below the pterostigmal brace they begin to diverge. A pseudo-IR1 originating on RP1 slightly distal of pterostigma. Two or three rows of cells between pseudo-IR1 and RP1, and five rows of cells between pseudo-IR1 and RP2.

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Author's address:

Dr G. Bechly, Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart, Germany.
E-mail: bechly@gmx.de

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