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Merlax bohemicus gen. n., sp. n., a new fossil dragonfly from the Lower Miocene of northern Bohemia (Odonata: Aeshnidae)

JAKUB PROKOP[1] and ANDRÉ NEL[2]

[1]Department of Palaeontology, Charles University, Albertov 6, CZ-128 43 Praha 2, Czech Republic;
e-mail: jprokop@natur.cuni.cz

[2]Laboratoire d'Entomologie, Museum national d'Histoire naturelle, 45 rue Buffon, F-75005 Paris, France;
e-mail: anel@mnhn.fr

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Abstract. Two aeshnid dragonflies are described from the Lower Miocene deposits in the Bílina mine in the north of the Czech Republic, including a new genus and species of Anactini, *Merlax bohemicus* gen. n., sp. n., and a further specimen assigned to the genus *Aeshna*.

INTRODUCTION

Fossil dragonflies have been found in the Tertiary deposits mainly at Pochlovice near Kynšperk, Sokolov and Jehličná near Sokolov in northern Bohemia (Handlirsch, 1907; Říha, 1977). Up till now all these fossils, both larvae and adults, belong to Libellulidae.

Recently different insect fauna was found in the Bílina mine, which is part of the Most Formation in northern Bohemia (Fig. 1) (Prokop, 1998). The vegetation and palaeoenvironment associated with the deposits were studied by Bůžek et al. (1992) and Sakala (2000). The insects are preserved in three different fossiliferous horizons (Lake Clayey Horizon, Delta Sandy Horizon, Clayey Superseam Horizon) in the Lower Miocene (Eggenburgian/Ottnangian) (Prokop, 1998). Palaeobotanical records suggest that the climate at that time was generally warm, very humid, perhaps with a slightly lower humidity during winter (Kvaček, 1998).

TAXONOMIC PART

Family Aeshnidae Leach, 1815

Genus *Merlax* gen. n.

Type species: *Merlax bohemicus* sp. n.

Diagnosis. Genus characterized by the following features: Discoidal triangles elongate, divided into 9 cells on forewings and 10 on hindwings; 4–5 rows of cells in the area between the forks of IR2 at its widest part; fork of IR2 distinctly distal to the base of the pterostigma; fork of IR2 well defined; areas between IR2 and Rspl and between MA and Mspl broad, with more than nine rows of cells; RP2 with a strong posterior curve opposite the distal side of the pterostigma; IR1 very short; anal loop large and broad; anal triangle of the male vestigial, very elongate, not triangular in shape, divided into three long cells; male anal membranule dark, triangular in shape and very broad and large; no anal angle in the male hindwing.

Etymology. *Merlax* (m.), after Merlin, a Celtic magician.

Merlax bohemicus sp. n.
(Figs 2–4)

Description. Both pairs of wings are nearly complete. Left wings partly covered by sediment, right wings with damaged apices. Wings dark fuscous with black spots near basal margin of hindwings.

Forewing about 66.5 mm long and 15.5 mm wide; distance from the base to the nodus, 30.2 mm; distance from the nodus to the apex, 32.4 mm; the nodus is nearly midway between the base and the apex; distance from the nodus to the pterostigma, 18.2 mm; distance from the pterostigma to the apex, 11 mm; the pterostigma is rather long, 4.3 mm long and 0.9 mm wide, covering approximately four cells; the pterostigmal brace is slightly obliquely aligned with the proximal side of the pterostigma. 27 visible antenodal crossveins not aligned with the corresponding crossveins between ScP and RA; 14 postnodal crossveins, not well aligned with subpostnodal crossveins; 18 secondary antenodal crossveins between Ax2 and the nodus, 4 subantenodal crossveins between Ax2 and Ax1; Ax1 is 6.2 mm and Ax2 is 12.9 mm from the wing base. Numerous crossveins between RA and RP basal of the subnodus. Median space free. Supratriangle crossed by about 7 crossveins. Submedian space crossed by 6 crossveins, including CuP; PsA is not stronger nor more oblique than other crossveins in the submedian space; there is no well defined subdiscoidal triangle. Discoidal triangle elongate and divided into 9 small cells, its costal side 9.2 mm long, distal side 8.3 mm long and proximal side 3.1 mm long. There is an intercalary vein in the postdiscoidal area beginning probably in the distal angle of the discoidal triangle; width of the postdiscoidal area just behind the discoidal triangle, 4 mm, probable width along the posterior wing margin, 11.4 mm. Mspl is well defined, nearly straight but rather short. Three rows between Mspl and MP and 5 rows between Mspl and MA. Two rows of cells between MA and RP3/4 in the distal part of this area. Five Bq crossveins. Oblique crossvein "O" slightly distal of the

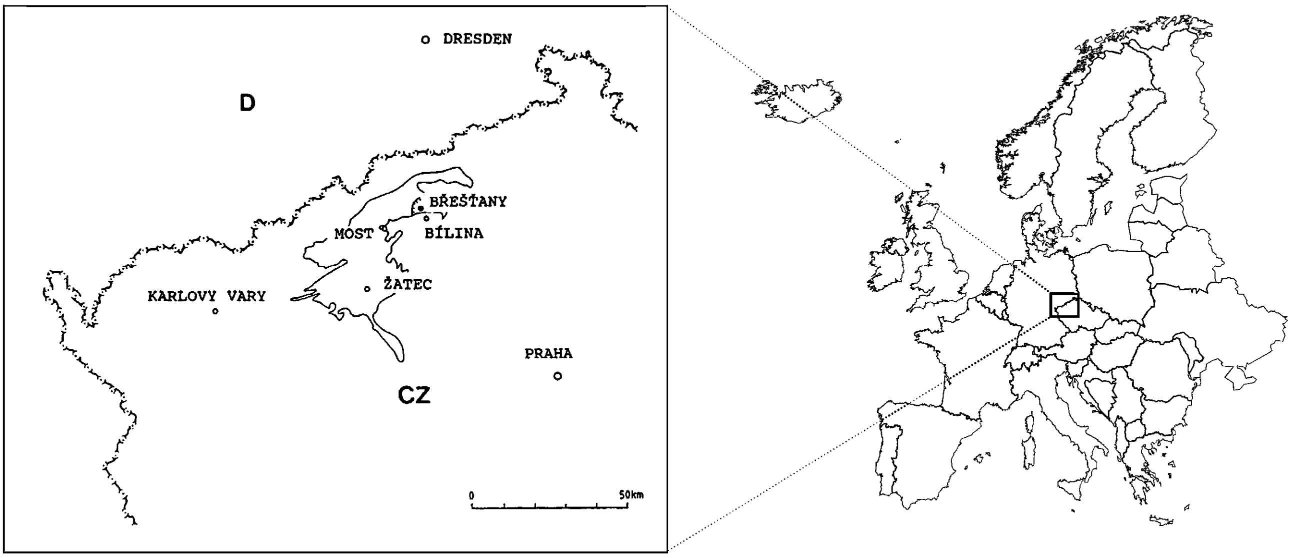


Fig. 1. Geographical position of the Bílina mine in Europe [according to Kvaček (1998), modified]. Uninterrupted line indicates boundary of the Most basin.

base of RP2. Rspl well defined and nearly straight. The area between Rspl and IR2 is very wide, with about 10 rows of cells at its widest part. IR2 is symmetrically forked, 1.2 mm distal of the basal side of the pterostigma, 4–5 rows of cells in the area between the forks of IR2 at its widest part. RP2 is strongly curved posteriorly opposite the distal side of the pterostigma. IR1 is present but very short, 6.8 mm long, and beginning 5.2 mm distal to the pterostigma. One row of cells between MP and CuA. CuAa with ten posterior branches directed towards the wing margin; the cubito-anal area is 1.9 mm wide; CuAb is directed towards the base of the wing and posteriorly closes a group of 6 cells with AA. Width of the anal area between AA and AP, 4.3 mm.

Hindwing about 65.5 mm long and 19.5 mm wide; distance from the base to the nodus, 24.6 mm; distance from the nodus to the apex, 38.4 mm; distance from the nodus to the pterostigma, 21.6 mm; distance from the pterostigma to the apex, 10.4 mm; the pterostigma is rather long, 4 mm long and 0.9 mm wide; the pterostigmal brace is not preserved. 17 postnodal veins, not well aligned with subpostnodal crossveins. 19 visible antenodal crossveins not aligned with the corresponding crossveins between ScP and RA. 6 secondary sub-antenodal crossveins between Ax2 and the nodus and 5 between Ax2 and Ax1; Ax1 is 4.6 mm and Ax2 is 10.9 mm from the wing base. Numerous crossveins between RA and RP basal of the subnodus. Median space free. Supratriangle crossed by 6 crossveins. Submedian space crossed by 6 crossveins, including CuP; PsA is not stronger nor more oblique than other crossveins in the submedian space; no well defined subdiscoidal triangle. Discoidal triangle very elongate and divided into 10 small cells, its costal side 7.8 mm long, distal side 7.4 mm long and proximal side 3.38 mm long; there is a strong intercalary vein in the postdiscoidal area beginning probably slightly below the distal angle of the discoidal triangle. Width of the postdiscoidal area just behind the discoidal triangle, 4.3 mm, probable width along the posterior wing margin, 10.5 mm. Well defined and curved Mspl with 8–9 rows of cells between it and MA. Two rows of cells between MA and RP3/4 in the distal part of this area. One visible Bq crossvein; the oblique crossvein "O" is slightly distal of the base of RP2. Rspl well defined and slightly curved. CuAa has six posterior branches directed towards the wing margin; the cubito-anal area is 8.3 mm wide; CuAb is directed towards the base of the wing and posteriorly closes the anal loop with AA; the anal loop is large and wide, 7.7 mm long and divided into 20 cells; the anal area is broad, 12 mm wide. There is no clear anal angle but a narrow anal triangle is present, divided into 3 long subcells. A large and broad dark anal membranule, 8.9 mm long and 2.2 mm wide.

Holotype. Specimen P419 (both pairs of wings well preserved), National Museum Prague, Czech Republic.

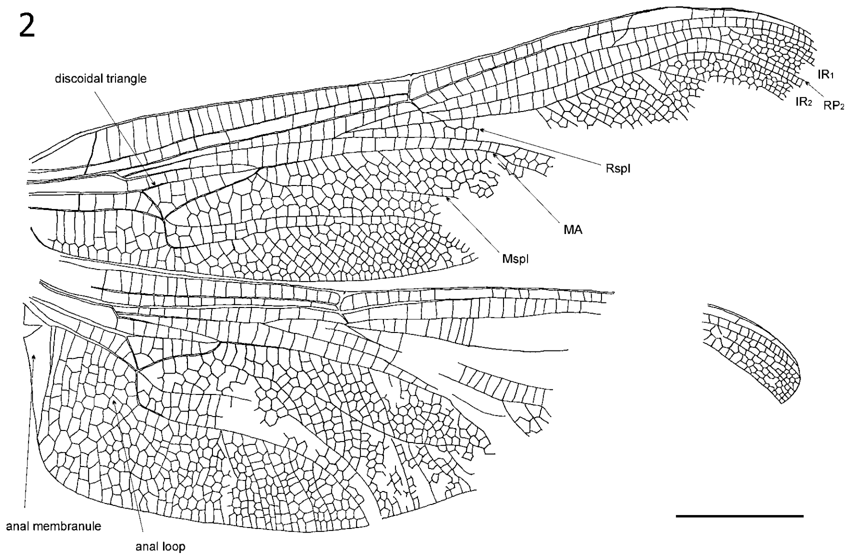
Type locality. Bílina mine, Bílina, Czech Republic.

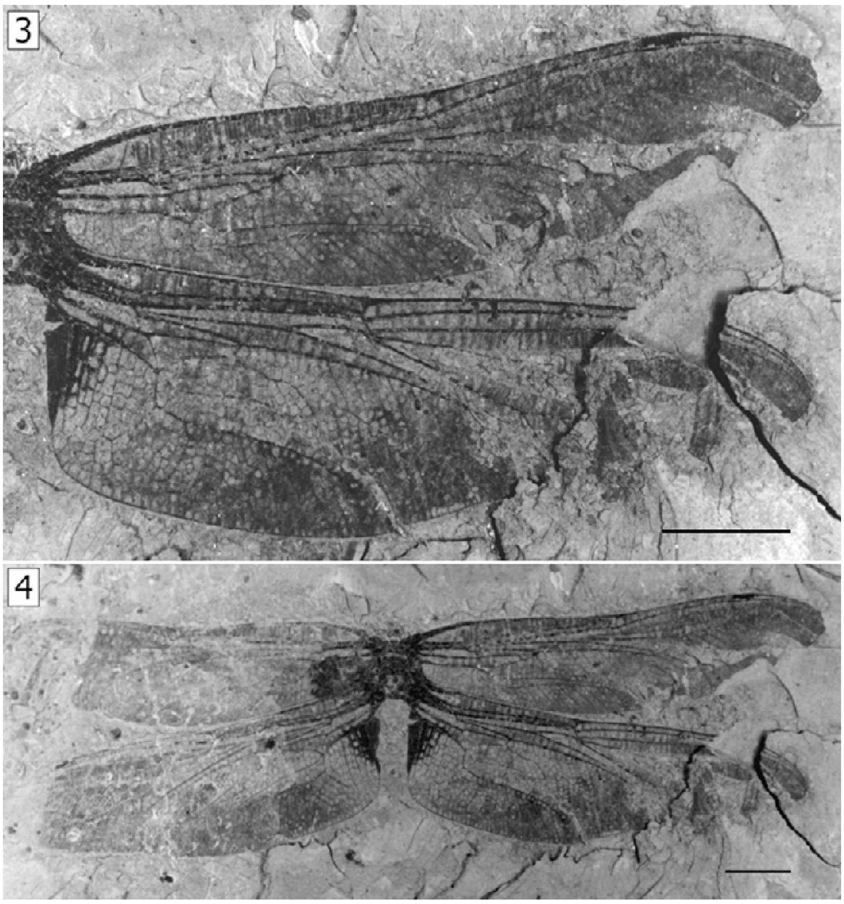
Type strata. Lower Miocene (Eggenburgian/Ottnangian), Clayey Superseam Horizon (dark grey claystone).

Etymology. After the name of country Bohemia.

Discussion. The nomenclature for the wing venation is that of Riek & Kukalová-Peck (1984) and Kukalová-Peck (1991) as amended by Nel et al. (1993) and Bechly (1995).

The structure of the discoidal cell, of the elongate pterostigma, the distally curved RP2, the narrow area between RP1 and RP2, and the bifurcation of IR2 show that *Merlax* belongs to the family Aeshnidae. The basal primary antenodal bracket Ax1 is more oblique in the forewing than in the hindwing, the sectors of arculus arising from its anterior half, with its posterior part prolonged, the curved Rspl are considered as potential synapomorphies with the Anactini by Bechly (1996). Furthermore, *Merlax* shares with the Anactini an elongate anal triangle, not triangular in shape and divided into long subcells by short transverse crossveins, no anal angle and

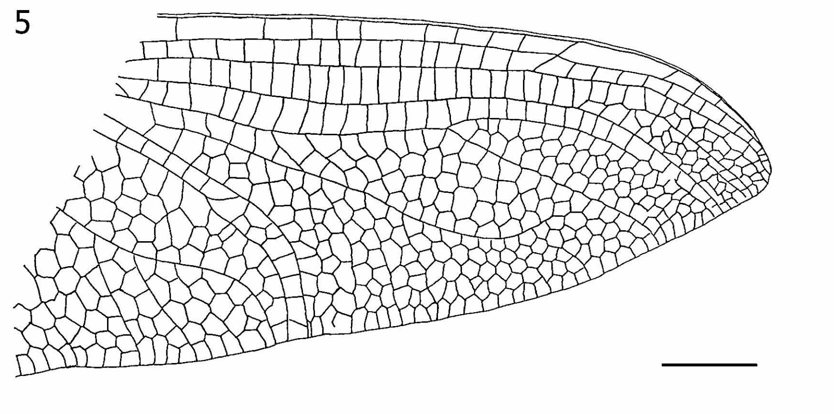


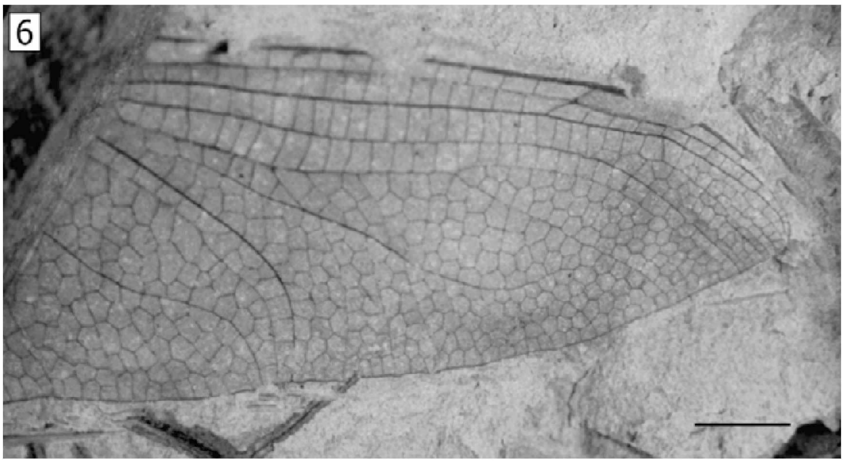


Figs 2–4: *Merlax bohemicus* gen. n. et sp. n. 2 – forewing and hindwing venation. 3–4: Holotype specimen No. P419. 3 – detail of right fore and hindwing; 4 – entire specimen. Scale = 10 mm.

a large dark membranule (male characters). These characters are synapomorphic with those of three recent genera *Anaciaeschna*, *Anax* and *Hemianax*. Therefore *Merlax* can be assigned to the subtribe Anactina sensu Bechly (1996). In common with other Anactina its RP2 is also strongly curved posteriorly.

It differs from *Anax* and *Hemianax* in having a distinctly forked IR2, with four rows of cells between the branches of IR2. This last character is also present in *Anaciaeschna*, but in this last genus, the fork of IR2 is distinctly basal to basal side of the pterostigma, unlike in *Merlax*. Also, the discoidal triangles of *Anaciaeschna* are





Figs 5–6: Hindwing of an undetermined species of Aeshnidae (?*Aeshna*). 5 – wing venation; 6 – specimen No. ZD9733. Scale = 5 mm.

smaller than those of *Merlax* and the anal loop of *Anaciaeschna* is distinctly smaller than that of *Merlax* (only 7 cells instead of 20 in *Merlax*).

Three fossils have been assigned to the tribe Anactini (Nel et al., 1994), all collected from the Upper Miocene deposit (Lower Messinian) at Monte Castellaro, Marches, Italy by Gentilini & Peters (1993). Two are attributed to the modern species *Anax parthenope* Sélys, 1839 and *Anax imperator* Leach, 1815, and the third species, *Anax cryptus* Gentilini & Peters, 1993, differs from *Merlax* in its discoidal triangle (only 6/5 cells instead of the 9/10 in *Merlax*), distal position of IR2 fork (it is more proximal in *Merlax*), 3 rows of cells in the area between the forks of IR2 at its widest part (4 in *Merlax*), 6 rows of cells between IR2 and Rspl and 4 rows between MA and Mspl, instead of the more than 9 rows of cells in *Merlax*, anal loop divided into 13 cells (20 in *Merlax*).

Genus undetermined (maybe *Aeshna* Leach, 1815)
(Fig. 5)

Description. Distal half of a hindwing. No trace of coloration is preserved. Length, about 27 mm, width, 12.5 mm; probable distance from nodus to pterostigma, 17 mm; probable width at the level of nodus, 14 mm; distance from pterostigma to apex, 5.3 mm; pterostigma is rather long, 4.3 mm long and 0.9 mm wide, covering approximately four cells and a half; distance between basal end of pterostigma and base of IR2, 3.6 mm; the oblique pterostigmal brace is opposite basal end of the pterostigma. 9 preserved postnodal crossveins, not aligned with the 17 subpostnodal crossveins. Numerous crossveins between RA and RP1. Some intercalary veins are present in the distal part of postdiscoidal area, probable width of postdiscoidal area along the posterior wing margin, 11 mm. Mspl is well defined, curved in distal part. 5 rows between Mspl and MA. One row of cells between MA and R3/4 in distal part. The distal part of MA is weak and there is a strong oblique crossvein between MA and RP3/4. Oblique crossvein "O" slightly distal to the base of RP2. Rspl is well defined and distally curved. The area between Rspl and IR2 is wide, nearly closed in distal part, with 5 rows of cells in its widest part. RP2 is slightly curved posteriorly opposite the distal side of the pterostigma. IR1 is present but short, 7.2 mm long, and beginning approximately below the middle of the pterostigma. IR2 is symmetrically forked, 3.7 mm basal of pterostigma. 4 rows of cells in the area between the forks of IR2 at its widest part.

Material. Specimen ZD9733 (well preserved distal part of hindwing), Doly Bílina coll., Bílina, Czech Republic.

Locality. Bílina mine, Bílina, Czech Republic.

Stratigraphy. Lower Miocene (Eggenburgian/Ottnangian), Delta Sandy Horizon (brown claystone).

Discussion. Despite the fact that the basal part of the wing is missing, it clearly belongs to the Aeshnidae because of the structure of its Rspl, the area between RP3/4 and MA, the fork of IR2, and the narrow area between RP1 and RP2. The generic affinities are much more difficult to determine. Nevertheless it shares many characters with the genera *Aeshna*, *Amphiaeschna* Selys and *Triacanthagyna* Selys, i.e., basal position of IR1 approximately below the middle of pterostigma; position of the fork of IR2 3 cells proximal to the basal part of pterostigma; 4 rows of cells in the area between the forks of IR2 at its widest part (3 rows in *Aeshna*); 5 rows of cells between Rspl and IR2, unlike the 4 rows in *Aeshna* and *Triacanthagyna*; 5 rows between Mspl and MA, unlike the 4 rows in *Aeshna* and the 6 rows in *Amphiaeschna*. There is no character that clearly distinguishes it from these genera.

This fossil differs from *Merlax bohemicus* in the following characters: Base of vein IR1 is 3 cells behind distal margin of pterostigma; RP2 is less oblique in its distal part; IR2 fork is about 3 cells before the basal margin of pterostigma; 5 rows of cells between IR2 and Rspl at its widest part (nine rows in *Merlax*).

The main interest of this fossil is that it is an addition to diversity of dragonflies that occurred at the Bílina mine locality in the Lower Miocene.

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