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New Middle Jurassic kempynin osmylid lacewings from China

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Kempyninae are a subfamily of osmylid lacewings whose extant representatives are restricted to the austral continents. Three new osmylids, Jurakempynus sinensis gen. et sp. nov., J. bellatus gen. et sp. nov., and J. epunctatus gen. et sp. nov. are described from the Middle Jurassic Jiulongshan Formation of Daohugou Village, Inner Mongolia, China. The new genus Jurakempynus is assigned to the subfamily Kempyninae constituting its oldest known occurrence. It is allied to the Australian genus Kempynus, sharing two synapomorphies: extremely expanded MP space and distally forked MP₂ in the hindwing. The occurrence of Jurakempynus gen. nov. in China (Northern Hemisphere) implies a much wider geographic range of the Mesozoic osmylid lacewings in comparison to their modern counterparts.

Introduction

Up to now, all species of Kempyninae were reported from the Southern Hemisphere therefore the subfamily is considered as a strictly “austral” group of Osmylidae known to occur in Australia, New Zealand, and South America (Kimmins 1940; New 1983). The subfamily comprises five genera including four extant ones: Australsymus Kimmins, 1940, Clydosymus New, 1983, Euosmylus Krüger, 1913, and Kempynus Navás, 1912, and one fossil genus, Euporismites Tillyard, 1916, sharing three synapomorphies: distal forked costal cross-veins in forewing, expanded MP region and complicated distal MP₂ forks in hindwing. Another Miocene genus Lithosymus Carpenter, 1943 from North America was assigned to Kempyninae (Carpenter 1943), however, Lambkin (1987) redefined its type species and found out that actually it belongs to Osmylus (subfamily Osmylinae). A Cretaceous species (Cretosymus sibiricus Makarkin, 1990) collected from the Lower Cretaceous of East Siberia with an incompletely preserved forewing, was also attributed to Kempyninae (Makarkin 1990). We consider it lacks the synapomorphy of kempynines, and exclude it from the subfamily pending new evidence.

The kempynin genera are typically restricted to a single biogeographic region, except for the genus Kempynus, which is known from Australia, New Zealand, and South America (Navás 1912; Kimmins 1940; Adams 1971; New 1983; Oswald 1994). The fossils of Kempyninae are rare and only one Palaeocene species (Euporismites balli Tillyard, 1916) from Queensland unambiguously belongs to this group. Herein we describe a new genus with three new species from the Jiulongshan Formation in Daohugou, Inner Mongolia, China.

Systematic palaeontology

Order Neuroptera Linnaeus, 1758
Family Omylidae Leach, 1815
Subfamily Kempyninae Krüger, 1913

Included genera: Australsymus, Clydosymus, Euosmylus, Kempynus (extant genera), Euporismites (fossil, Palaeocene, Australia), Jurakempynus gen. nov. (fossil, Middle Jurassic, China).

Emended diagnosis.—Forewing elongated, outer margin occasionally with some modifications in some genera (Kempynus and Euosmylus); membrane commonly with some large fuscous spots exclusive of Australsymus (possessing fragmentary spots); costal cross-veins with many distal forked branches exclusive of Euosmylus; single cross-vein sc-r1 present at the wing base; cross-veins r1-rs numerous; Rs branches numerous, slightly sinuous close to the apex; cross-veins in radial area numerous, arranged irregularly, forming one row of gradate series at most; space between MP and Cu distinctly broadened in some genera (Kempynus and Clydosymus). Hindwing: costal cross-veins generally simple except for Australsymus; base of MA well defined, sinuous; MP space extremely expanded exclusive of Euosmylus.
of Euosmylus, forming 2–3 rows of cells (Kempynus, Clydosmylus, and Jurakempynus gen. nov.), which is similar to the Spilosmylinae that MP2 with a short additional vein at base (Tjeder 1957); MP2 forming many forks in distal half of forewing.

Remarks.—The subfamily Kempyninae was considered as a primitive member of Osmylidae (Kimmins 1940; New 1983), sharing many characters with other subfamilies (Osmylinae and Stenosmylinae). It is greatly similar to the subfamily Osmylinae in appearance, though the extant species of the both subfamilies are distinctly isolated in distribution i.e., Osmylinae belongs to an exclusively "northern group", occurring in Europe and Asia. The two subfamilies share the following characters: dichotomic costal cross-veins in forewing; one row of gradate series at most species (also present in Parosmylus (Needham, 1909); proximal MP fork in forewing; well-developed base of MA in hindwing. However, Kempyninae also possessed some features that can conveniently separate the two subfamilies: base of MP2 in hindwing with an additional vein in some genera of Kempyninae, while Osmylinae without the additional vein; MP space extremely expanded in hindwing, forming 2–3 rows of cells, while the space generally slightly expanded in Osmylinae, and only forming single row of cells; MP2 in hindwing branching complicatedly, while MP2 in Osmylinae usually simple. Kempyninae was allied to Stenosmylinae (New 1983), sharing with some characteristics: no more than one row of gradate series and MP2 forked distally in hindwing. However, Kempyninae can be differentiated from Stenosmylinae by following characters of wing: costal cross-veins forked distally in forewing, while Stenosmylinae commonly have simple cross-veins; MP forks close to wing base in forewing, while MP forks in Stenosmylinae beyond the half of wing; MA with a sinuous additional vein at base in hindwing, while Stenosmylinae generally without the additional vein.

Genus Jurakempynus nov.

Type species: Jurakempynus sinensis sp. nov., see below.

Etymology: From Jura and kempynus, referring to age of the specimen (the Middle Jurassic). Gender is masculine.

Diagnosis.—Forewing: membrane with many fuscous fragmentary spots; costal cross-veins forked distally; one cross-vein sc-r1 close to the wing base, oblique; some fuscous spots resembling cross-veins distributed between Sc and R1; CuA forked in middle, and each branch with complicated pectinate branches; CuP forming some distal complicated branches; A1 well-developed, forming many pectinate branches. Hindwing: membrane hyaline, with fuscous spots on the outer margin; MP region expanded, forming two rows of cells; MP2 with a thin additional vein at base; CuA long, CuP as long as the half of CuA, with 3–4 pectinate branches.

Remarks.—Jurakempynus has forked costal cross-veins in forewing, which can differentiate it from most other subfamilies (Protosmylinae, Spilosmylinae, Stenosmylinae, Porisminae, Eidoporisminae and Gumillinae). The only subfamilies that Jurakempynus is likely assigned to are Osmylinae and Kempyninae. However, the new genus exhibits some Kempynine-like features that are distinctly different from Osmylinae: MP space relatively expanded in hindwing, forming 2–3 rows of cells (MP space generally slightly broadened, but never forming multiple rows of cells in Osmylinae); MP2 branching complicatedly in distal half of hindwing (MP2 commonly simple, only with some distal simple branches in Osmylinae); base of MP2 with an additional vein (absence of the additional vein in Osmylinae). In Kempyninae three extant genera (Kempynus, Clydosmylus, and Australysmus) have the similar MP region in the hindwing, and MP region in Clydosmylus forms many rows of cells, highly similar to Jurakempynus. MP2 forms complicated distal forks, which is an autapomorphy of Kempyninae.
Based on aforementioned characters that *Jurakempynus* shares with Kempyninae, we consider *Jurakempynus* should be assigned to Kempyninae instead of erecting a new high level taxon.

**Key to species of *Jurakempynus* gen. nov.**

1. Wing immaculate, base of MP, connected without an additional vein in hindwing .................................................. *J. epunctatus* sp. nov.
   Wing distinctly spotted, base of MP, with an additional vein in hindwing .................................................. 2

2. Hindwing: MP, forming pectinate branches distally ......................
   Hindwing: MP, with many dichotomic branches distally .............

**Jurakempynus sinensis** sp. nov.

*Fig. 1, 2.*

_Etymology:_ The specific name _sinensis_ refers to China.

_Type material:_ Holotype: CNU-NEU-NN2010204-1 (part) (Fig. 1A), CNU-NEU-NN2010204-2 (counterpart) (Fig. 1B). The specimen consists of three well-preserved wings of which the left wings overlap partly. Paratype: CUN-NEU-NN2010205, CUN-NEU-NN2010206-1-2. A hindwing with the apex lost.

_Type locality:_ Daohugou Village, Shantou Township, Ningcheng County, Inner Mongolia, China.

_Type horizon:_ Jiulongshan Formation, Aalenian–Bajocian boundary, Middle Jurassic.

**Diagnosis.**—Forewing with many fragmentary fuscospots; some fuscospots distributing on the space between Sc and R1; CuA forked close to middle, each branch forming many complicated pectinate branches; hindwing with large fuscospot on the outer margin, but without any spots in centre; CuP relatively short, forming 4–5 pectinate branches.

**Description.**—Forewing is about 35.2 mm length as preserved, 11.7 mm width. Hindwing is about 32.3 mm length as preserved, 10.1 mm width (Fig. 1).

Forewing (Fig. 2A, B): membrane with many fragmentary fuscospots; some fuscospots present at the anterior margin; 5–7 spots resembling cross-veins present between Sc and R1; nygmata not detected; pterostigma fuscos, with hyaline patches; trichosors well defined on the margin; costal field relatively narrow, cross-veins forked distally; space between Sc and R1 relatively broad, with one oblique cross-vein; cross-veins r1–rs numerous; Rs branches numerous, each forming deep distal forks; cross-veins in redial area arranged irregularly, not forming the gradate series; MP forked with a short distance to the wing base, the both branches with simple distal forks; Cu forked at wing base; CuA long, biforked in middle, each branch forming complicated pectinate branches; CuP as long as the half of CuA, forming many pectinate branches, CuP as long as the half of CuA, with 4–5 pectinate branches; A1 well developed, forming some pectinate branches; A2 short, with 2–3 branches.

**Jurakempynus bellatulus** sp. nov.

*Fig. 3.*

_Etymology:_ The specific name _bellatulus_ refers to the delicate hindwing of new species.

_Holotype:_ CNU-NEU-NN2010207 (Fig. 3A). A hindwing with the apex lost.

_Type locality:_ Daohugou Village, Shantou Township, Ningcheng County, Inner Mongolia, China.

_Type horizon:_ Jiulongshan Formation, Aalenian–Bajocian boundary, Middle Jurassic.

**Diagnosis.**—Hindwing with large brown spots; the cells of MP region arranged regularly; CuP with 7–8 pectinate branches.

**Description.**—Only hindwing preserved, about 28.7 mm long, 11.2 mm wide (Fig. 3A). Membrane hyaline, with fuscos markings on the margin, forming triangular hyaline region on posterior margin; trichosors present on posterior margin and part of anterior margin, two nygmata distinct; costal region relatively narrow, cross-veins simple; Sc and R1 fused distally, cross-vein sc-r1 undetected; cross-veins r1–rs numerous; Rs

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with 23 branches, distal branches distinctly sinuous; cross-veins in radial area numerous, arranged irregularly; MA originating from the base of Rs-stem as most osmylids, base connected with a sinuous vein (Tjeder 1957); MP forks close to wing base, with a thin additional vein before the fork which is detected in extant Kempynus (Kimmins 1940); MP region dilated, forming two rows of cells; MP1 simple, MP2 bifurcated distally; Cu forked at base; CuA long, with pectinate branches from middle to terminal end; CuP short, bifurcated in middle, the longer branches forming pectinate branches, ending close to the middle of CuA; A1 short, with 3 branches; A2 with two branches; A3 single branch (Fig. 3B).

Remarks.—Jurakempynus bellatulus sp. nov. is separated from Jurakempynus sinensis sp. nov. based on the following characters: spots of J. bellatulus sp. nov. present on whole apex in hindwing, while spots in J. sinensis sp. nov. only restricted to the margin; MP2 with many distal dichotomic branches in J. bellatulus sp. nov., while MP2 of J. sinensis sp. nov. forming many pectinate branches; CuP with 7 pectinate branches in J. bellatulus sp. nov., while CuP in J. sinensis sp. nov. has 4–5 pectinate branches.

Jurakempynus epunctatus sp. nov.

Fig. 4.

Etymology: The specific name epunctatus refers to the immaculate hindwing of the new species.

Holotype: CNU-NEU-NN2010208 (Fig. 4A). Well preserved hindwing.

Type locality: Daohugou Village, Shantou Township, Ningcheng County, Inner Mongolia, China.

Type horizon: Jiulongshan Formation, Aalenian–Bajocian boundary, Middle Jurassic.

Diagnosis.—Only hindwing preserved; membrane hyaline, immaculate; cells in MP region arranged irregularly; CuP with 12 pectinate branches.

Description.—Only the hindwing preserved, 25.2 mm long, 7.5 mm wide (Fig. 4A). Membrane hyaline, nearly immaculate; pterostigma pale brown; nygmata not detected; trichosors well-defined in the posterior margin of wing; costal cross-veins simple; Sc and R1 entering the margin before the apex; cross-veins r1-rs numerous; Rs originated from R1, with 20 branches, distal branches slightly sinuous; cross-veins in radial area numerous, arranged irregularly; MA originated from Rs-stem as most osmylids; MP forks close to the wing base, MP region greatly broadened, forming two rows of cells, cells in MP region arranged irregularly, cross-veins slightly sinuous from middle to termination; MP1 and MP2 forming simple pectinate distal branches; CuA long, with 13 pectinate branches; CuP short, as long as the half of CuA, with 12 pectinate branches; A1 well-developed, with 7 pectinate branches (Fig. 4B).

Remarks.—Jurakempynus epunctatus sp. nov. is conveniently separated from other species by the following characters: hindwing immaculate, while other species commonly have large spots on margin; cells in MP region arranged irregularly, only forming two rows of cells in middle, while other species generally forming two rows of cells on the whole MP region.

Concluding remarks

The described herein new genus with three new species from the Jiulongshan Formation in Daohugou, Inner Mongolia, China are the oldest-known representatives of Kempyninae. They display the following apomorphies of the subfamily: (i) costal cross-veins forked distally in forewing; (ii) MP fork close to wing base in forewing; (iii) MP region extremely expanded, forming more than two rows of cells in hindwing; (iv) MP2 with many complicated distal forks in hindwing. Occurrence of Jurakempynus gen. nov. in China stands in opposition to the traditional concept that kempynines belong to an exclusively “austral” group. It shows that kempynines were present in the Northern Hemisphere during the Middle Jurassic (165 Mya) and were apparently much more widely distributed than at present. Nev-
ertheless due to the scarcity of the fossil record (only two other fossil species were known up to date) it is premature to argue on the actual origin of the kempynines. Nevertheless, we anticipate that true fossil kempynins are to be found from America in the future.

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References


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