

# Isophlebiid Dragonflies from the Late Mesozoic of Eastern Transbaikalia (Odonata: Isophlebiidae)

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**Abstract**—Based on the study of more than 300 isophlebiid specimens from several Late Mesozoic sites in eastern Transbaikalia (Ukurei, Tergen<sup>?</sup>, Glushkovo, and Byankino formations), new genera and species are described: *Xeta olovica*, *Dahurium draco*, and *Sinitisia sophiae*. The insect-bearing deposits are dated Late Jurassic according to analysis of their odonatofauna.

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**Key words:** Odonata, Isophlebiidae, dragonflies, Jurassic, Asia, new taxa, faunal assemblages.

## INTRODUCTION

The family Isophlebiidae of the extinct Mesozoic suborder Heterophlebiina (= Anisozygoptera Handlirsch pro parte, = “Mesozoic Anisozygoptera” auct., see Pritykina, 1989) is the most typical and widespread Late Jurassic group of Odonata. Isophlebiids are distinctive in their especially large size, their wings frequently being about 10 cm long. Several representatives of the family have been described from Solnhofen and Karatau (Hagen, 1866; Handlirsch, 1906–1908; Pritykina, 1968) and reported from the Uda Formation, central Transbaikalia (Pritykina, 1985). In addition, based on preliminary identifications, odonatan assemblages of several other Late Jurassic sites in eastern Asia consist almost exclusively of various isophlebiids. These are Markha in the Vilyui River basin (Markha Formation; collection of the Paleontological Institute of the Russian Academy of Sciences, Moscow (PIN), no. 1303) and Bahar (Bed 328, Bayan-Uul sequence of the Bahar Formation, collection PIN, no. 3791), Hutuliyn (Ulugei Formation, collection PIN, no. 4288), and Houtiyn-Hotgor (Ulaan-Ereg Formation, collection PIN, no. 3688) in Mongolia.

Therefore, the stratigraphic range of Isophlebiidae is almost restricted to the Late Jurassic, but their geographic range was quite broad, from Solnhofen in the west to the Vilyui Basin in the northeast and Mongolia in the southeast. A regional peculiarity of the Late Jurassic odonatofauna in warm temperate eastern Asia was the absolute dominance of isophlebiids, whereas, in the polydominated tropical assemblages of Karatau and Solnhofen, this family played a minor role.

Several isophlebiid assemblages are found in deposits of disputable age. In particular, isophlebiids of western Transbaikalia were described from the Ichetui Formation (Pritykina, 1985), dated either Early Jurassic

(Skoblo, 1968; Zherikhin, 1978; Kalugina and Kovalev, 1985; Sinichenkova, 1987), or Late Jurassic (Srebrodol'skaya and Kozubova, 1976, 1977), or even Late Jurassic-(?)Neocomian (Srebrodol'skaya and Teslenko, 1979). Earlier we doubted the Early Cretaceous age estimate of Ichetui deposits (Pritykina, 1985), and below we return to the question of the age of these deposits.

Using the data on Odonata in biostratigraphy has some peculiarities. Owing to the enormous diversity of the Mesozoic fauna, the distribution of genera and species often appears too limited. Nevertheless, assemblages of the major chronostratigraphic divisions (epochs and periods) are easily distinguishable by their dominating higher taxa, from families to suborders. Therefore, analyzing assemblages of Odonata to clarify the age of insect-bearing beds, one should operate chiefly with families. The presence of common genera and species in the assemblages compared makes conclusions on their similar age more reliable, but the opposite is not true, i.e., even the assemblages endemic at the generic level may be synchronous. For instance, the largest Late Jurassic assemblages of Karatau and Solnhofen, which are similar in family composition, virtually lack common genera.

Isophlebiids are absent from all sites of undoubted Early or Middle Jurassic age in Eurasia, including the Irkutsk Basin and Mongolia, which are geographically close to western Transbaikalia (Pritykina, 1985). At the same time, no other Early or Middle Jurassic odonatan family is recorded from the Ichetui Formation. Therefore, the composition of the odonatofauna of these two adjacent territories is mutually exclusive.

According to generally accepted opinions, in the Jurassic, the territory to the east of Lake Baikal possessed a mountainous or even volcanic relief and a cool

climate, differing from the warm temperate plains of Cisbaikalia. However, the sharp faunal differentiation of Cis- and Transbaikalia cannot be explained by the influence of landscape and climatic factors. It is known that unfavorable conditions (cold, mountainous relief) result in impoverishment of odonatofauna without a shift of dominance, or the total replacement of components as in the case considered. The pattern observed is can also hardly be explained by presuming a biogeographical boundary at Baikal in the Early Jurassic. In the Mesozoic, the main direction of odonatan migrations was eastwards. Therefore, comparing synchronous faunal assemblages of adjacent paleobiogeographical divisions the more eastern one constantly appears seemingly "older," while the western one seems "younger." In the case discussed, the relationship is quite the opposite, the Cisbaikalian fauna is typical for the Early and Middle Jurassic, while the Transbaikalian fauna is typical for the Late Jurassic. Taking into account the above facts and considerations, a Late Jurassic age appears more acceptable for the insect sites of the Ichetui Formation.

The material of Odonata (322 specimens), including the type series of new taxa described below, was collected in the last decades, mainly by paleontological field parties of PIN and by S.M. Sinitsa (Chita State University) in the lake deposits of Ukurei, Tergen', Glushkovo, and Byankino formations, developed in depressions in eastern Transbaikalia.

The age of these deposits is still disputable in a wide interval from Late Jurassic (Sinitsa, Starukhina, 1986) to Albian inclusive (Oleinikov, 1975; Zherikhin, 1978; Sukatsheva, 1982; Sinitshenkova, 1987). So far, as the collection contains only Isophlebiidae without admixture of other families, our data support a Late Jurassic age for the insect-bearing deposits.

In contrast to the Jurassic, the Early Cretaceous faunas of Eurasia (including Transbaikalia) are absolutely dominated by dragonflies of the extant suborder Anisoptera. The Heterophlebiina show all the signs of decline in that time and are extremely rare. The huge material of Neocomian Odonata from Eurasia contains the only isophlebiid species of the genus *Nacholonda* (originally assigned to Karatawiidae, see Pritykina, 1977). This species is found in the only transbaikalian site, Baissa, and is extremely rare there, no more than one find per thousand anisopteran dragonflies. In the collection studied, the majority of larvae and adults are fragmentary and can only be identified to family level, although this family is easily recognizable even from partial, poorly preserved specimens. Judging from the high diversity of adult Isophlebiidae, one of the evolutionary trends in the family (and in Heterophlebiina as a whole) was a broadening of the ecological range of adults. Therefore, we can expect that our classification based on wing characters reflects, to a considerable extent, the actual relationships of the taxa. Identification of larvae to genus or species is obstructed by their

rather uniform morphology and the absence of reliable diagnostic characters. We can only state that larvae and adults are conspecific when they co-occur in the same bed, are comparable in size, and lack incompatible morphological features.

Larval Isophlebiidae, as judged from their appearance and quite regular occurrence in lake deposits, were typical limnobionts. They are very similar to larval *Samarura* Br., Rdtb., Gglb. (Camptrophlebiidae, see Pritykina, 1985), differing mainly in their larger size and the shape of the caudal lamellae.

New genera and species are described below. Geographical and stratigraphical data on the beds with dragonflies are from Sinitsa and Starukhina (1986) and Zherikhin (1990). The types and other material are housed in PIN.

## SYSTEMATIC PALAEONTOLOGY

### Family Isophlebiidae Handlirsch, 1906

#### Genus *Xeta* Pritykina, gen. nov.

*E t y m o l o g y.* Arbitrary combination of letters.

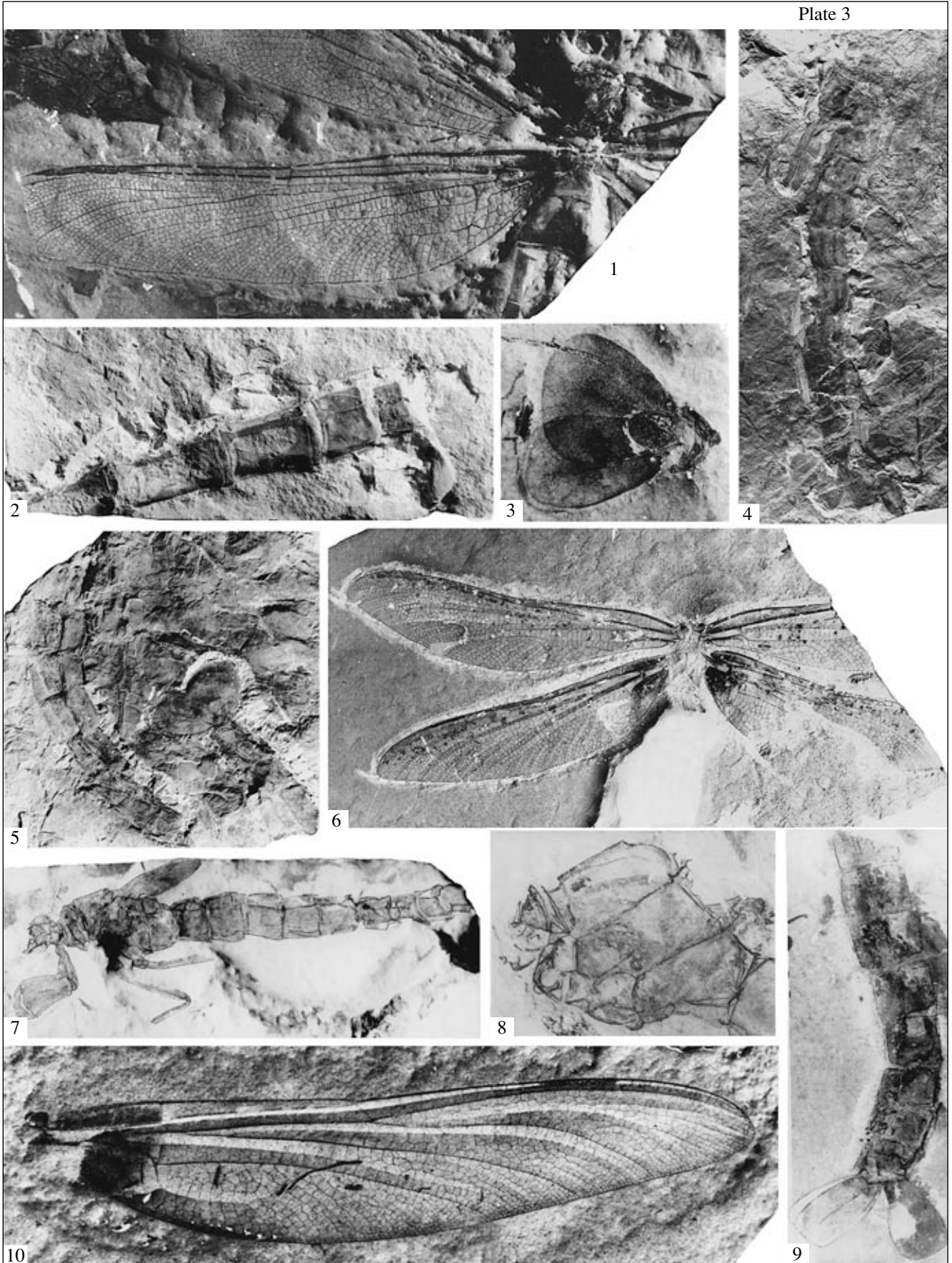
*T y p e s p e c i e s.* *X. olovica* sp. nov.

*D i a g n o s i s.* Adult. Large dragonflies, with moderately broad hind wings; distance from posterodistal corner of discoidal cell (*dc*) to posterior wing margin no more than three times as long as outer side of *dc*. Pterostigma of typical shape for family, long, only slightly shorter than distance from its proximal side to node (*N*); no veins between it and *R*<sub>2</sub>; areas between main longitudinal veins near wing tip occupied by network of polygonal cells, without intercalary veins; second marginal area distal to pterostigma with two cell rows; several weak antenodal veins in costal series present. Discoidal cell in fore wing not closed; subdiscoidal cell (*sdbc*) in hind wing crossed; discoidal area in basal third wide, with two cell rows, narrow in middle, with one cell row, widened distad, becoming twice as wide near wing margin than at base. Branches of 1A well developed in fore and hind wings; in hind wing, basal part of 1A inclined relative to outer side of *dc*; base of cubital area 1.5 times wider than base of discoidal area; cells in cubital area distal to 1A rather large, differing little in size near CuP and near wing margin.

*L a r v a.* Abdomen massive. Lobes of caudal lamellae angulate, triangular; epiproct shorter and wider than paraprocts, its posterior side shorter than upper side and longer than lower side; cerci lamellate, broadly ovate.

*C o m p o s i t i o n.* Type species.

*C o m p a r i s o n.* The wing tip is indistinguishable from that of *Dinosamarura* Pritykina (a more detailed comparison is impossible due to the incompleteness of the only wing of *Dinosamarura*), but larvae differ in the more angulate caudal lamellae and ovate cerci. The new genus differs from other genera of the family (excluding *Isophlebia* Hagen) chiefly in the shape and structure of the discoidal area, which is wide and has two cell



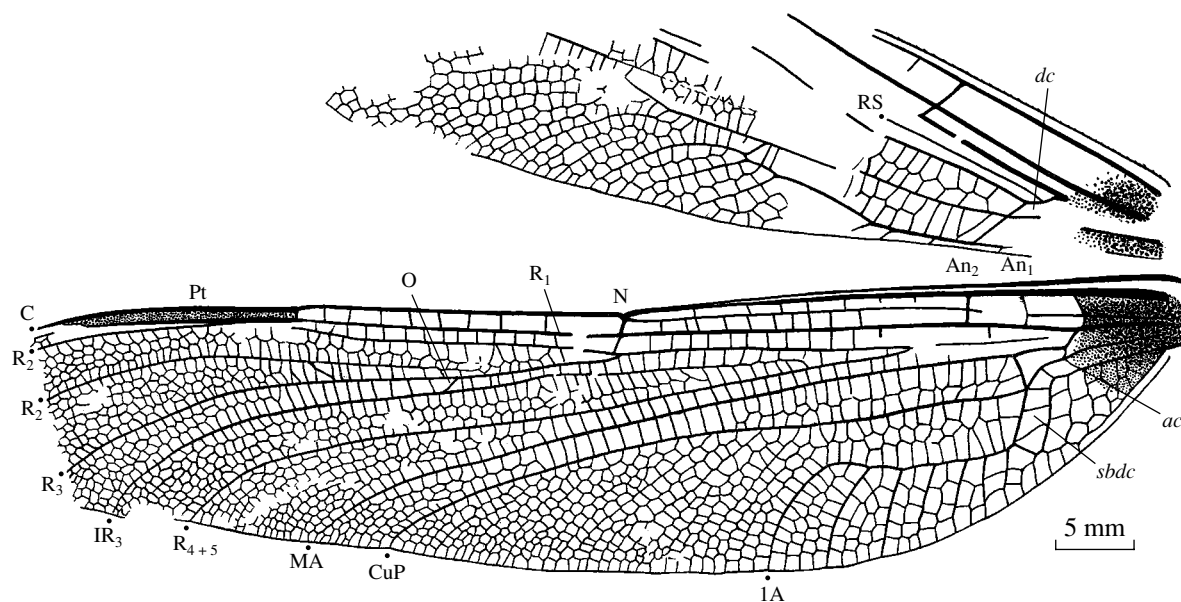


Fig. 1. *Xeta olovica* sp. nov., holotype PIN, no. 3795/427, incomplete left pair of wings of female.

rows in the basal third, narrow with one cell row in the middle third, twice as wide near the margin as at the base. It is distinct from *Isophlebia* in the comparatively narrow base of the cubital area, the absence of intercalary veins between  $R_2$  and  $IR_2$  proximal to pterostigma, and in the open *dc* in the fore wing.

*Xeta olovica* Pritykina, sp. nov.

Plate 3, figs. 1–5

**E t y m o l o g y.** From the Olov Depression.

**H o l o t y p e.** PIN, no. 3795/427, incomplete body and wings of a well-preserved female; eastern Transbaikalia, Chita Region, Chernyshevskii District, right bank of the Kuenga River, railroad between Ukurei and Shev'ya stations (railroad mark 6561.4 km), Shev'ya site, outcrop 12; Upper Jurassic, Ukurei Formation.

**D e s c r i p t i o n** (Fig. 1). The bases of fore and hind wings approximately up to the level of  $An_1$  dark, opaque; six costal and no less than eight subcostal antenodal veins are present. The bifurcation of *RS* is twice closer to the arculus than to the nodus; the base of  $IR_3$  is approximately 1.5 times closer to the nodus than to the arculus; the vein *o* is equidistant from the nodus

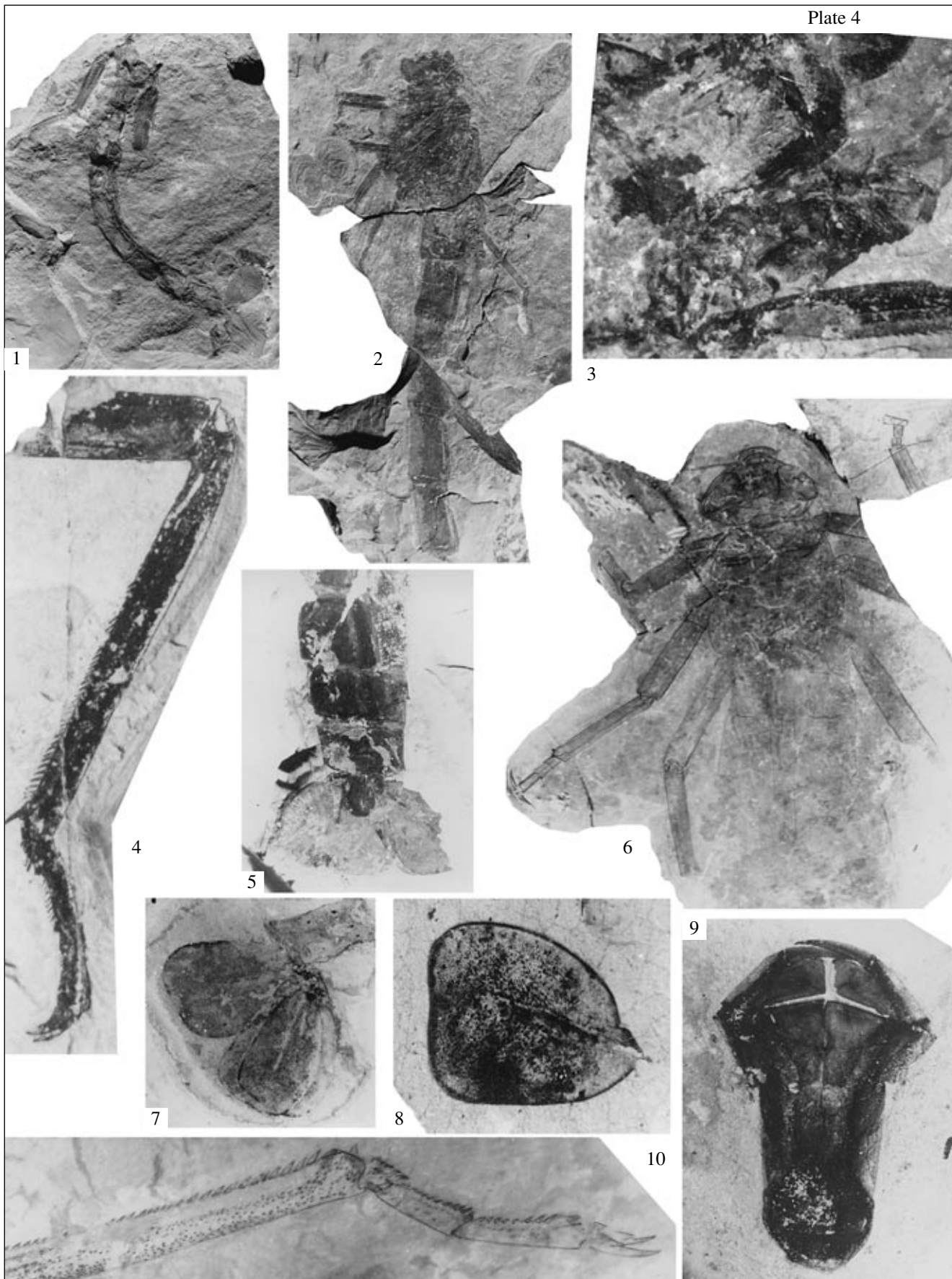
and pterostigma. Under the middle of the pterostigma, there are three cell rows between  $R_2$  and  $IR_2$  and four between  $IR_2$  and  $R_3$ ; the duplication of cell rows between  $IR_2$  and  $R_3$ ,  $R_3$ , and  $IR_3$  starts at the same level, somewhat distal to the proximal side of the pterostigma. In the hind wing, the base of the cubital area between *CuP* and *IA* is wider than the base of the anal area, the latter has three cell rows; the minimal distance from *CuP* to *IA* is equal to the width of the discoidal area at this place; four veins are present in the subdiscoidal cell.

The abdomen is long, cylindrical; its surface is smooth, without sculpture or pubescence. The abdominal segments have longitudinal (medial and two lateral) and transverse (anterior and posterior) ribs. In addition, weak transverse ribs are seen in the middle of the segments on both sides of the medial rib; all ribs are black. Abdominal segments II–VIII bear a uniform pattern of contrasting pale and dark spots; the dark color is in the anterior and posterior areas of each segment plus narrow longitudinal lines at some distance from the lateral ribs and along the medial rib. The dark lines expand caudally and merge before the posterior transverse rib. The pale lines are narrow, located on the sides of the

Explanation of Plate 3

**Figs. 1–5.** *Xeta olovica* sp. nov.: (1) holotype PIN, no. 3795/427, imprint of the incomplete left pair of wings, and base of abdomen of female,  $\times 1.4$ , Shev'ya site; (2) specimen PIN, no. 3795/405, fragment of adult abdomen,  $\times 1$ , Shev'ya site; (3) specimen PIN, no. 2815/66, caudal lamellae of mature larva,  $\times 2$ , Olov Depression (Kuenga) site; (4) specimen PIN, no. 3795/398, imprint of almost complete mature larva,  $\times 0.6$ , Shev'ya site; and (5) specimen PIN, no. 2815/39, 40, two mature larvae,  $\times 1$ , Olov Depression (Kuenga) site.

**Figs. 6–10.** *Sintisia sophiae* sp. nov.: (6) specimen PIN, no. 3063/390, four incomplete wings of female,  $\times 1.2$ , Unda site; (7) specimen PIN, no. 2815/20, incomplete imprint of young larva (traced photograph),  $\times 1.5$ , Olov Depression (Kuenga) site; (8) specimen PIN, no. 3015/391, isolated adult synthorax (traced photograph),  $\times 2.5$ , Unda site; (9) specimen PIN, no. 3015/392, incomplete mature larva of female (traced photograph),  $\times 2.5$ , Unda site; and (10) holotype PIN, no. 3063/895, complete hind wing of female,  $\times 2.5$ , Daya site.



segments (just above the lateral ribs) and there are two large oblong spots on either side of the medial rib (extending from the anterior transverse rib to the caudal quarter of a segment). Segment I is entirely dark; segment IX with dorsal pale spots is very short, triangular and lacking lateral pale lines; segment X is entirely dark. The cerci are in the shape of oval plates, dark, with a pale medial streak.

**Measurements**, mm. Adult (holotype): hind wing length as preserved, 73 (reconstructed full length, 90); minimal length of pterostigma, 15; length of abdominal segments VI–X (specimen no. 3795/405), 48; mature larva: length of wingpad, up to 22–25; epiproct length, 12; paraproct length, 15; cercus, 5.

**Occurrence**. Upper Jurassic, Ukurei Formation; eastern Transbaikalia, sites Olov Depression (Kuenga) and Shev'ya.

**Material**. In addition to the holotype, 38 specimens from the same locality: PIN, nos. 3795/398–401, 404–407, 409–416, 418–422, 425, 426, 428–433, 435, 438, 440, 441, 444, 447, 449, 454, 455 (incomplete larvae and adults) and 47 specimens from the Olov Depression (Kuenga) locality: PIN, nos. 2815/14–19, 21, 22, 25–28, 32–40, 42–44, 49–54, 58–73 and no. 2816/20 (larvae).

#### Genus *Sinitzia* Pritykina, gen. nov.

**Etymology**. In honor of the paleontologist S.M. Sinitza.

**Type species**. *S. sophiae* sp. nov.

**Diagnosis**. Adult. Moderately large dragonflies with relatively narrow hind wings. Pterostigma poorly developed, very narrow and short, one-third as long as distance from its proximal side to node; no more than two crossveins in area below Pt; cells between  $R_2$  and  $IR_2$  irregular and polygonal, or arranged in rows separated by intercalary veins; second marginal area distal to pterostigma with single cell row; no antenodal veins in costal area. Discoidal cell in fore wing not closed; subdiscoidal cell in hind wing free from veins; discoidal area for most of its length uniformly narrow, with single cell row. Branches of 1A well developed in fore wing, obscured in hind wing; in hind wing, basal part of 1A inclined relative to outer side of *dc*; bases of cubital

and anal areas of subequal width; cells in cubital area distal to 1A much smaller near wing margin than near CuP.

**Larva**. Abdomen relatively slender. Lobes of caudal lamellae angulate, of subequal length; epiproct triangular, paraprocts rectangular in outline; cerci conical.

**Composition**. Type species.

**Comparison**. Adults differ from other isophlebiids in their smaller size, the presence of one or two veins under the distal end of the pterostigma, single cell row distal to the pterostigma, and in the narrow discoidal area with a single cell row extending for most of its length. The new genus is also distinct from *Isophlebia* and *Anisophlebia* Handlirsch in the open *dc* of the fore wing. The rectangular paraprocts of larvae are only known in the new genus.

#### *Sinitzia sophiae* Pritykina, sp. nov.

Plate 3, figs. 6–10, Plate 4, fig. 1

**Etymology**. After the first name of the paleontologist S.M. Sinitza.

**Holotype**. PIN, no. 3063/895, complete, well-preserved female hind wing (part and counterpart); eastern Transbaikalia, Chita Region, Shelopuginskii District, left bank of the Daya River 3 km upstream of the Shiviya Creek mouth, Daya locality, outcrop 66/3; Upper Jurassic, Glushkovo Formation.

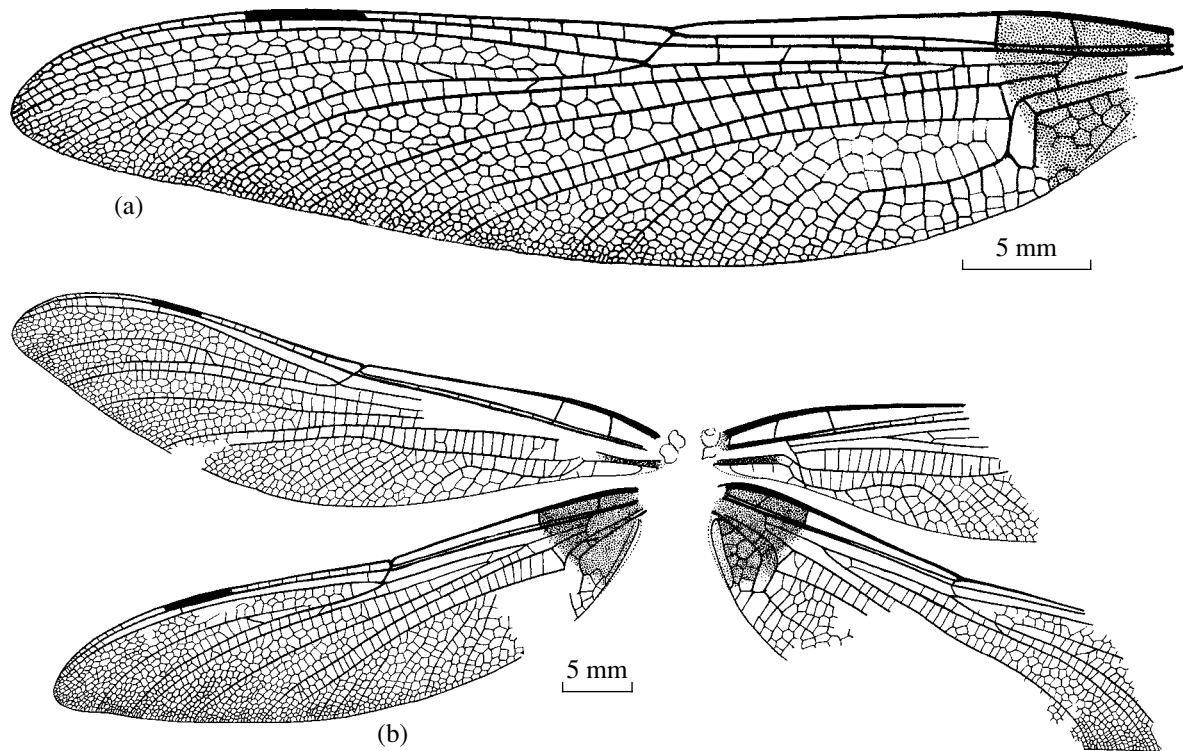
**Description** (Fig. 2). Adult. The synthorax is stout, of anisopteran type, without pubescence; the broad mesostigmal plate consists of two (elongate dorsal and triangular ventral) sclerites; the dorsal and antealar carinae are high and robust, the collar carina is moderately developed; the interpleural suture is reduced above the metastigma. The legs are strong, moderately long, the tibial spines are moderately long. The base of the fore wing has dark subcostal and cubital areas proximal to  $An_1$ ; the base of the hind wing approximately to the level of  $An_2$  and the distal quarter of *dc* are dark, opaque. The fore wing has four or five subcostal antenodal veins, the hind wing has three or four; the fore wing has eight postnodal veins, while the hind wing has nine. The bifurcation of RS is almost thrice closer to the arculus than to the nodus; the vein *o* is 1.5 times closer to the nodus than to the pterostigma. Under the middle of the pterostigma, three or four cell rows are between  $R_2$  and  $IR_2$  in both fore and hind

#### Explanation of Plate 4

**Fig. 1.** *Sinitzia sophiae* sp. nov., specimen PIN, no. 2815/41, incomplete larva,  $\times 1$ , Olov Depression (Kuenga) site.

**Figs. 2–7 and 10.** *Dahurium draco* sp. nov. Daya site: (2, 3) specimen PIN, no. 3063/914: (2) incomplete body and wings of male,  $\times 2$ ; (3) male copulatory apparatus,  $\times 5.5$ ; (4) specimen PIN, no. 3063/187, adult fore leg (traced photograph),  $\times 5.5$ ; (5) specimen PIN, no. 3063/1028, three terminal abdominal segments of mature larva with caudal lobes,  $\times 1.6$ ; (6) specimen PIN, no. 3063/903, incomplete mature larva (traced photograph),  $\times 2$ ; (7) specimen PIN, no. 3063/893, abdominal apex of young larva with caudal appendages,  $\times 2.2$ ; and (10) Fig. 10. *Dahurium draco* sp. nov., specimen PIN, no. 3063/914, incomplete hind tibia and tarsus of male (traced photograph),  $\times 6.5$ .

**Figs. 8 and 9.** *Isophlebiidae* incertae sedis, Daya site: (8) specimen PIN, no. 3063/181, isolated epiproct,  $\times 4$ ; and (9) specimen PIN, no. 3063/179, isolated labium of larva,  $\times 4$ .



**Fig. 2.** *Sinitisia sophiae* sp. nov.: (a) complete hind wing of female, holotype PIN, no. 3063/895, and (b) four incomplete wings of females, specimen PIN, no. 3063/390.

wings; the duplication of cell rows between  $IR_2$  and  $R_3$  starts about the level of the proximal end of pterostigma, between  $R_3$  and  $IR_3$  under its middle or more distally, between  $IR_3$  and  $R_{4+5}$  distal to the node. The bifurcation of  $CuP-A$  slightly is close to the posterodistal corner of  $dc$ ; the vein  $ac$  is distal to the inner side of  $dc$ .

**Measurements, mm.** Adult wings: fore wing length, 48–50; its width, 11; pterostigma length, 3.5; hind wing length, 44–52; its width, 10–12; pterostigma length, 5–5.5; mature larva: wingpad length, 10–10.5; length of abdomen without two basal segments, 30; length of epiproct, 7.5; paraproct, 9; cercus, 2; reconstructed total length of larva, 65.

**Occurrence.** Upper Jurassic, Glushkovo, Tergen', Ukurei formations; eastern Transbaikalia, sites Daya, Olov Depression (Kuenga), Savina, Shev'ya, Talangui, and Unda (Zmeinyi).

**Material.** In addition to the holotype, 25 incomplete larvae and adults: Ukurei Formation: Olov Depression (Kuenga), PIN, nos. 2815/20, 30, 41, 45, 46, 48, larvae; Shev'ya, no. 3795/446 (outcrop 10/3), larva, PIN, nos. 3795/402, 408, 417, 436, 446, 1316, 1319 (outcrop 12), larvae, ? 3795/1363 (outcrop 463/12), larva, PIN, nos. 3795/1319, 1320 (outcrop 822), larvae; Glushkovo Formation: Daya, nos. 3063/902, 904 (outcrop 66/4), adults; Savina, PIN, no. 3015/1858 (out-

crop 18/16), larva; Unda (Zmeinyi), PIN, nos. 3015/392, 390, 391 (outcrop 63), 1 larva, 2 adults, PIN, no. 3015/1945 (outcrop 63/4), adult; Tergen' Formation: Talangui, PIN, no. 4076/81 (outcrop 133/6), larva.

#### **Genus *Dahurium* Pritykina, gen. nov.**

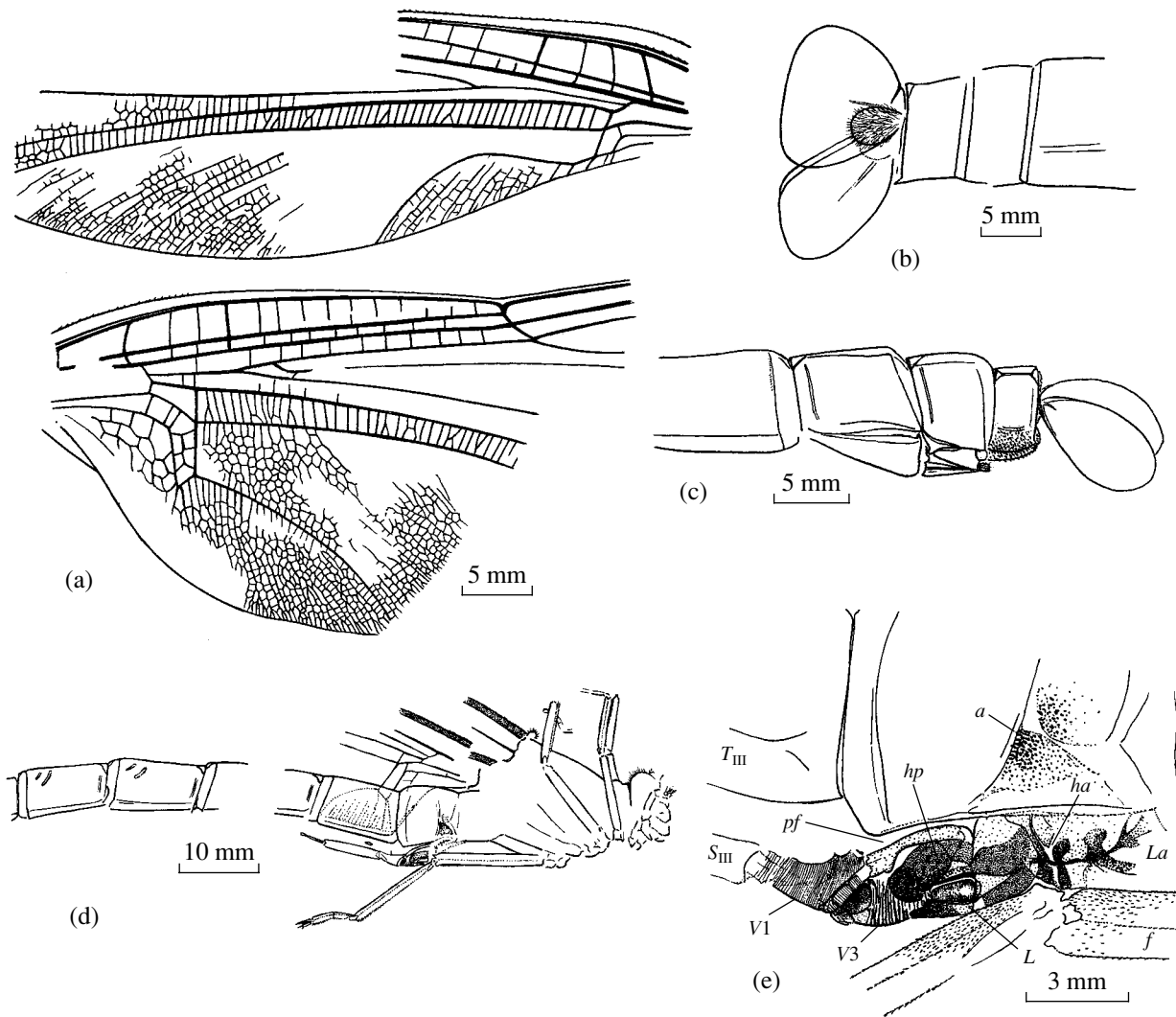
**Etymology.** From Dauriya, a settlement in the Chita Region.

**Type species.** *D. draco* sp. nov.

**Diagnosis.** Adult. Large dragonflies with very broad hind wings. Antenodal veins of costal series present. Discoidal cell in fore wing not closed; subdiscoidal cell in hind wing crossed; discoidal area for most of its length uniformly narrow, with single cell row almost up to wing margin. Branches of 1A in fore and hind wings reduced; in hind wing, base of 1A forming straight line with outer side of  $dc$ ; base of cubital area wider than that of anal area; cells near posterior wing margin (in hind wing, caudal to  $CuP$ ) much smaller than others, irregularly shaped, forming dense network like archdictyon.

**Larva.** Abdomen massive. Lobes of caudal lamellae angulate, triangular; epiproct shorter and wider than paraprocts, its posterior side longer than upper and lower sides; cerci flat, broadly ovate.

**Composition.** Type species.



**Fig. 3.** *Dahurium draco* sp. nov.: (a) incomplete fore and hind wings of female, holotype PIN, no. 3063/913; (b) three terminal abdominal segments of mature larva with caudal lobes, specimen PIN, no. 3063/1028; (c) apex of female abdomen, specimen PIN, no. 3063/900; (d, e) specimen PIN, no. 3063/914: (d) incomplete body of male and (e) copulatory apparatus. Designations: (a) auriculus, (ha) hamulus anterior; (hp) hamulus posterior, (f) femur, (La) lamina anterior, (T<sub>III</sub>) tergum III, (S<sub>III</sub>) sternum III, (L) ligula, (pf) posterior frame, and (V1, V3) vesicula spermalis 1, 3.

**Comparison.** Adults differ markedly from other genera of the family in the very broad wings with narrow discoidal area, the reduced branches of 1A, and unusually dense venation. Larvae are very similar to those of *Xeta* gen. nov., differing only in the broader, rounded epiproct.

*Dahurium draco* Pritykina, sp. nov.

Plate 4, figs. 2–7 and 10

**Etymology.** From the Latin *draco* (dragon).

**Holotype.** PIN, no. 3063/913, incomplete body and wings of moderately preserved female (part and counterpart); eastern Transbaikalia, Chita Region, Shelopuginskii District, left bank of the Daya River 3 km

upstream of the Shiviya Creek mouth, Daya site, outcrop 66/4; Upper Jurassic, Glushkovo Formation.

**Description** (Fig. 3). Adult. The wing membrane is transparent, uncolored. An<sub>1</sub> is slightly proximal to the arculus, An<sub>2</sub> in the hind wing is slightly distal to the outer side of *dc*; crossveins are developed between An<sub>1</sub> and An<sub>2</sub>; nine subcostal antenodal crossveins are present in the hind wing. The bifurcation of RS thrice nearer to the arculus than to the nodus; the base of IR<sub>3</sub> is twice nearer to the arculus than to the nodus. CuP has no conspicuous bends in the fore and hind wings. In the hind wing, the inner side of *dc* is one-third as short as the outer side, and one-fourth as short as the anterior side; in both fore and hind wings, the base of the discoidal area is approximately half as nar-

row as the base of the anal area; in the hind wing, the base of the anal area has four or five cell rows. CuP and 1A markedly diverge towards the wing margin, and the cubital area near the apex of 1A is three or four times wider than at the base; CuP and 1A in the hind wing is arcuate; the cubital and anal areas of the hind wing have very dense network of small cells, the same area of the fore wing has a much sparser venation; the subdiscoidal cell has nine veins and two cell rows in its posterior part.

The body is black. The abdomen is stout, densely covered with black hairs, ornamented with fine transverse grooves. Abdominal segments bear longitudinal (medial, lateral, and ventral) and transverse (anterior and posterior) ribs. Female abdominal sternite VIII is markedly swollen, the ovipositor is short with three pairs of valvulae; the styli of the third valvulae slightly surpass the margin of segment IX; the venter of segment X is densely covered with short spines. The cerci are lamellate, ovate, with dark marginal stripe.

**Measurements**, mm. Adult: holotype hind wing length as preserved, 40 (reconstructed total wing length, 80); width near nodus, 22; length of female abdomen (excluding appendages), 88; cercus length (specimen PIN, no. 3063/900), 9; length of hind femur in male (specimen PIN, no. 3063/914), 15; tibia, 13; tarsus, 9; mature larva: length of abdominal segments VI–X (specimen PIN, no. 3063/1028), 35; length of epiproct, 10; paraproct, 12; cercus, 3.5; length of fore wing pad (specimen PIN, no. 3063/903), 18; length of hind femur, 15; tibia, 13; tarsus, 8.

**Occurrence**. Upper Jurassic, Glushkovo and Ukurei formations; eastern Transbaikalia, sites Daya, Glinyanka, Shev'ya, Unda (Zmeinyyi).

**Material**. In addition to the holotype, 21 specimens from the same site: nos. 3063/179, 184–187, 4 larvae, 1 adult; nos. 3063/888, 899, 903, 907–909, 920, 1028, 1029 (outcrop 66/4), larvae; nos. 3063/900, 901, 914 (outcrop 66/4), adults; PIN, nos. 3063/889, 892–894 (outcrop 66/2), larvae. From other sites of the Glushkovo Formation: 28 specimens from Unda (Zmeinyyi): PIN, nos. 3015/1, 957 (outcrop 63/4), larvae; PIN, nos. 3015/1241–1243 (outcrop 63/1), 2 larvae, 1 adult; no. 3015/1246, larva, PIN, nos. 3015/1551–1555 (outcrop 63/3), larvae; PIN, nos. 3015/1557–1568, 1572–1575, 1559 (outcrop 63/2), 16 larvae, 1 adult; 17 larvae from Glinyanka: PIN, nos. 4075/7, 8, 15, 20–23, 29, 30 (outcrop 137); nos. 4075/33–37, 374–376 (outcrop 137/9). Two adults (isolated abdominal segments) from Ukurei Formation, Shev'ya site, PIN, nos. 3795/443, 448 (outcrop 12, railroad mark 6561.4 km) are also assigned to *D. draco* sp. nov.

A considerable proportion of the isophlebiid specimens from Byankino, Ukurei, Tergen', and Glushkovo formations can be identified only as Isophlebiidae incertae sedis (Plate 4, figs. 8, 9). These are 1 adult from Savina (outcrop 118/16) and numerous larvae from

Bichektui (outcrop 684/4, 1 specimen; outcrop 628, 1 specimen; outcrop 633/2, 1 specimen), Shev'ya (outcrop 9/10, 1 specimen; outcrop 9/12, 1 specimen; outcrop 9/25, 1 specimen; outcrop 9, 1 specimen; outcrop 10/3, 4 specimens; outcrop 12, 4 specimens; outcrop 463/12, 1 specimen; outcrop 822, 1 specimen; outcrop not specified, 5 specimens), Volch'ya (outcrop 119/2, 2 specimens), Glinyanka (outcrop 137/9, 17 specimens; outcrop 137, 22 specimens), Daya (outcrop 66/2, 2 specimens; outcrop 66, 2 specimens; outcrop 186/2, 1 specimen), Zhidka (1 specimen), Morgogonikha (outcrop 138, 1 specimen), Talangui (outcrop 133/2, 1 specimen), Unda (outcrop 63/1, 3 specimens; outcrop 63/2, 4 specimens; outcrop 63/4, 1 specimen; outcrop 63, 4 specimens), Bolboi (outcrop 7, 1 specimen; outcrop 11, 4 specimens; outcrop 84/1, 49 specimens; outcrop 84, 3 specimens; outcrop 85, 4 specimens; outcrop 93/3, 1 specimen; outcrop 107, 2 specimens; outcrop 101, 1 specimen), and Narynskaya Creek (1 specimen).

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