



Article

A new rare species of *Arcynopteryx* (Plecoptera: Perlodidae) from the basin of Lake Baikal (Russia)

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Abstract

A new species of Plecoptera *Arcynopteryx angarensis* sp. n. is described, illustrated and compared with congeners. *Arcynopteryx angarensis* is known only from historical records at the source of the Angara River (Lake Baikal Basin). It has not been collected since 1930.

Key words: Plecoptera, Perlodidae, *Arcynopteryx*, Russia, Angara River, Lake Baikal

Introduction

The genus *Arcynopteryx* was erected by Klapálek (1904), and is characterized by an erect knob on the male hemitergal lobes; a well sclerotized, slender and needle-like stylet of the epiproct; a median and two adjacent lateral sclerotized bands inside the cowl; both adults and nymphs with submental gills; abdominal segments 1–3 divided by pleural folds; and the serrate mandibular cusp of nymphs. The arms of the mesosternal ridge meet the anterior corners of the furcal pits. The eggs are ovoid with a collar on low shoulders, and the chorion is covered with hexagonal follicle-cell impressions (FCIs); the flat floors contain punctations (Ricker 1952, Stark & Szczytko 1988, Zwick 2004). According to recent study (Teslenko 2012) the type species of *Arcynopteryx* is fixed (under Article 70.3.2 of the Code) as *Arcynopteryx dichroa* (McLachlan, 1872), misidentified as *Arcynopteryx compacta* (McLachlan, 1872) in the original designation by Klapálek (1912).

Four species of *Arcynopteryx* are currently recognized: *A. dichroa* (McLachlan, 1872), *A. amurensis* Zhiltzova & Levanidova, 1978, *A. polaris* (Klapálek, 1912), and *A. sajanensis* Zapekina-Dulkeit, 1960. Three of them inhabit exclusively the Eastern Palearctic: *A. polaris* extends to the Altai and the Russian Far East, including Wrangel Island, as well as in Mongolia, China and Korea (Zhiltzova & Zapekina-Dulkeit 1986, Teslenko 2006, Zwick 2010); *A. amurensis* is confined to the south of the Magadan and Khabarovsk territories (Zhiltzova & Zapekina-Dulkeit 1986); *A. sajanensis* is restricted to the Altai (the Mongolian Altai also), Sayan and Khamar-Daban mountains (Zhiltzova & Varykhanova 1984, Teslenko *et al.* 2010). Only *A. dichroa* is Holarctic and is the most variable of all the *Arcynopteryx* species, with distribution in the northern latitudes of Europe, North America, and Asia including Mongolia, Siberia and the Russian Far East (Illies 1955, Ricker 1964, Zhiltzova 1966, Lillehammer 1974, Stewart & Stark 2002, Zwick 2004, Stewart & Oswald 2006). Herein, the description and illustrations of a new rare species *A. angarensis* is presented.

Material and methods

The material consists of dry and alcohol-preserved specimens, collected in the upper part of the Angara River in early June and July 1924, 1925, and 1930 deposited in the Zoological Institute, Russian Academy of Sciences, St. Petersburg. Male genitalia were illustrated after KOH treatment. Aedeagus and egg structures were described

according to the terminology of Ricker (1952) and Stark & Szczytko (1988). Eggs were placed in 95% ethanol, cleaned in an ultrasonic cleaner; air dried and fixed on specimen stubs with double-sided tape. Eggs were gold coated before examination with a LEO-430 scanning electron microscope.

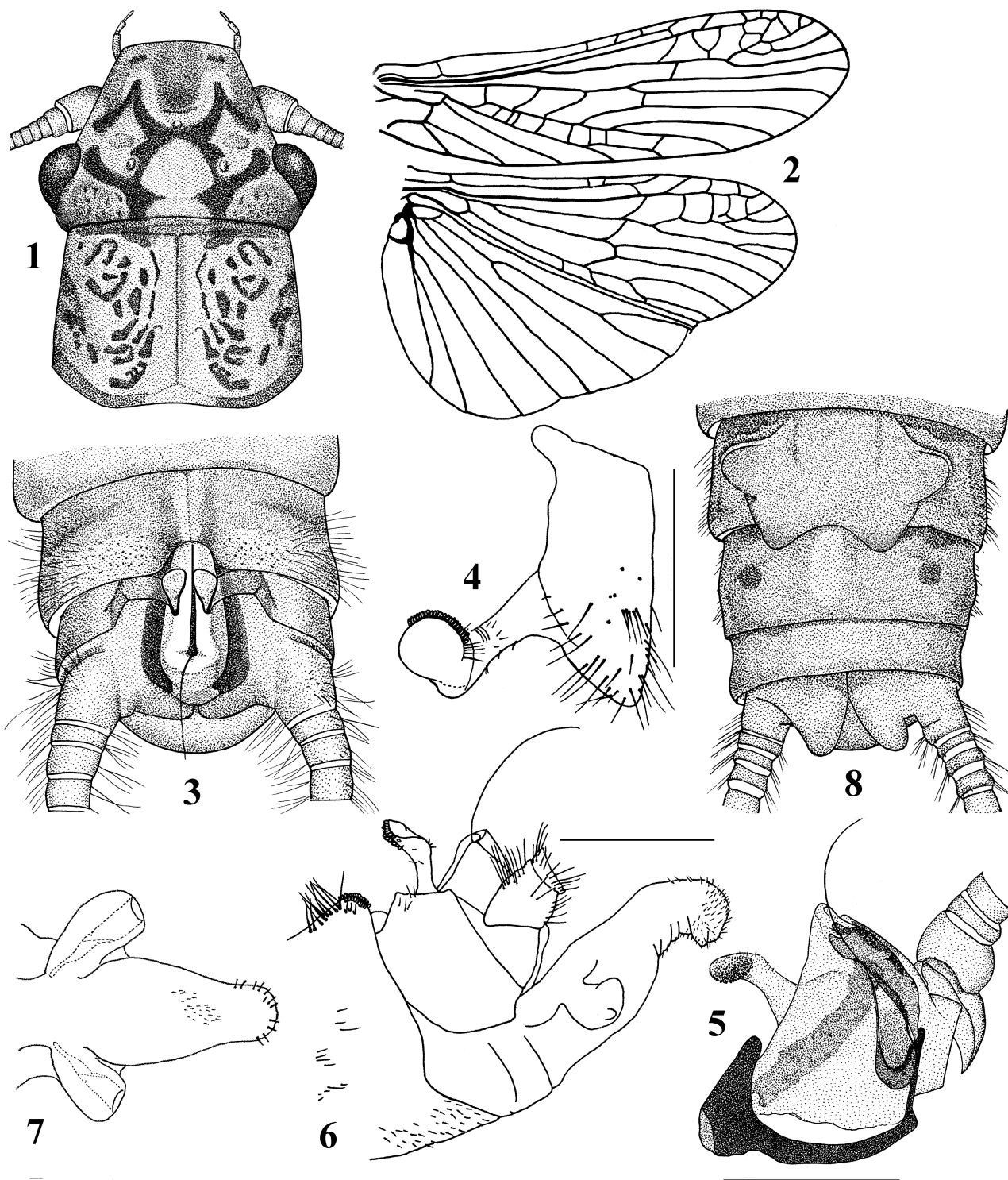
Arcynopteryx angarensis Teslenko & Zhiltzova, sp. n.

(Figs 1–12).

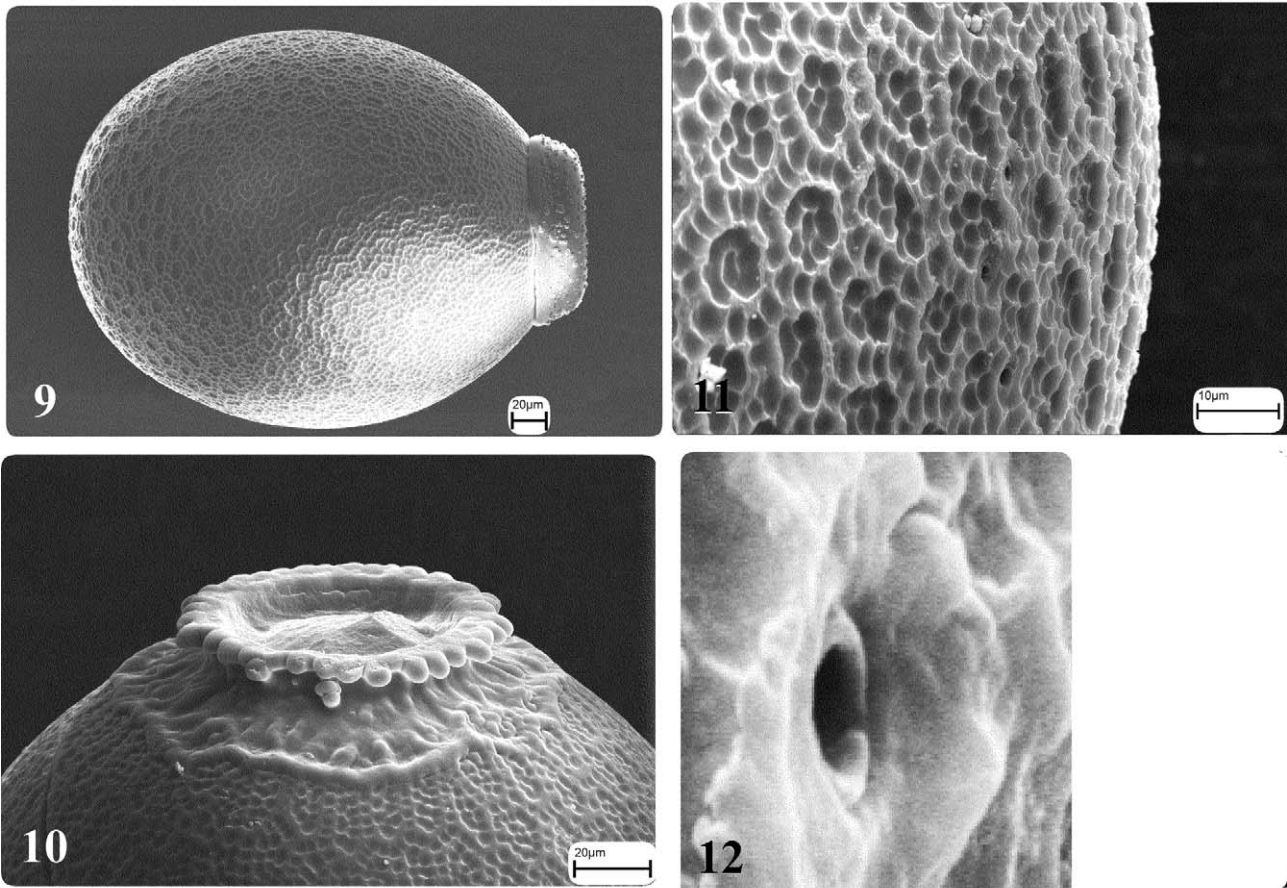
Description of the general body color is given for dry, pinned specimens; descriptions of male, female, and egg for alcohol-preserved specimens. The head and pronotum are yellowish-brown, contrasting with the maroon meso- and metanotum and the dark brown abdomen. In front of the pale M-line, a dark spot projects onto the clypeus. This spot is more pronounced in females than males (Fig. 1). Behind the pale M-line, a brown M-shaped band is present, the lateral branches of which are light brown, and medially dark brown. Dark brown stripes connect the anterior and lateral ocelli. The interocellar area exhibits a triangular pale spot that is connected to a semicircular pale spot on the occiput medially. Two oblique, brown bands with a curlicue at the apex extend from the occiput along the epicranial suture towards the compound eyes, but these bands do not quite reach the eyes (Fig. 1). The tentorial pits in front of the lateral ocelli are pale. Behind each compound eye is a dark posterolateral spot, with slightly darkened occipital lateral margins (Fig. 1). The female has a monochrome brown occiput, except for a medial semicircular pale spot. The antennae and palpi are grayish-brown, and the basal antennal segments are brown. The submental gills are long. The pronotum is yellowish-brown, with thin, blackish margins, and a broad, median yellow band that is widest in its basal third (Fig. 1). The pronotal rugosities are dark brown. The meso- and metascuta are maroon. The mesosternal Y-arms reach the anterior corners of the furcal pits. The abdomen is dark brown, each dorsal segment covered by long, grayish hairs positioned posterolaterally. Legs are brown, tarsi – dark brown. The cerci are longer than the abdomen, with long colourless hairs; the basal cercal segments are brown, the apical cercal segments are blackish in their distal half. Males and females are macropterous. The forewing is long, narrow, pale gray, transparent, yellowish apically, with brown veins, and pale yellow C. The venation includes an irregular net near the apex, sometimes consisting of three rows of cells (Fig. 2). Three cross veins occur between C and Sc, and four apical veins occur between Sc and R₁. Rs have four apical branches. Four veins occur between M and Cu₂; three anal veins are present. The hind wing anal area is large, and A2 and A5 are forked (Fig. 2).

Male. Body length 14.3–16.2 mm, forewing 12.8–14.6 mm, wingspan 28.1–32.3 mm. The abdominal tergum 9 exhibits a thin, membranous, pale median line (Fig. 3). The posterior margin has a medial arcuate notch which runs 1/3 of the length of tergum 9, and two submedial, transversely elongated and rounded swellings, which are covered by small stout setae close to the notch, and by long fine colorless hairs posterolaterally (Fig. 3). Sternum 9 is light brown medially, scoop-shaped, extended backward and curved upward (Fig. 6). Tergum 10 is divided into two hemiterga (Fig. 3). The hemitergal lobes in a dorsal view are elongated, flattened, directed medially, and are not in contact mesoanteriorly (Figs 3 & 4). Each hemitergal lobe bears a tear-shaped knob that is widest anteriorly (Figs 3 & 4). The knob is dorsally flat and pale, ventrally darkly sclerotized, and covered by a few small, stout setae (Figs 3–6). The cowl opens dorsally in a slit; the cowl is membranous, folded. It resembles a deep pouch between and under the hemitergal lobes and is attached around the base of the epiproct and the internal basal anchor (Figs 3, 5 & 6). The dorsolateral edges of the cowl are large, supported by flat sclerotized paragenital plates and by tops of the lateral sclerotized bands (Figs 3 & 5). In lateral view, the lever arm of the epiproct is slightly arcuate and terminates in a vertical, long, slightly sclerotized plate, the top of which serves as a place for the attachment of the loop of the stylet and two sclerotized bands (Fig. 5). The stylet of the epiproct resembles a strong, long, fine bristle directed upward and backward; the base of the loop of the stylet is wide (Fig. 5), and occupies half of the length of the vertical plate (Fig. 5). The two lateral sclerotized bands narrowed at the base, are more sclerotized dorsally than laterally, and have a small mesal mound on the dorsal surface; the tops of the lateral sclerotized bands are narrowed and rounded, directed obliquely forward (Fig. 5). The everted aedeagus is membranous, bears a large median lobe, and two small dorsolateral lobes. A large prolonged median lobe is narrowed to the tip, which is rounded and down curved. In lateral view, the aedeagal apex resembles a rounded claw, covered by fine, erect, clear spinules dorsolaterally and ventrally (Figs 6 & 7). A pair of small dorsolateral lobes directed backward, the lobes are not fully everted (Fig. 6).

Female. Body length 16.0–17.3 mm, forewing 17.0–17.3 mm, wingspan 37.0–37.6 mm. The subgenital plate is large and pale, extends laterally from the sides of sternum 8, sometimes reaching almost half the length of sternum 9 (Fig. 8). The posterior margin of the subgenital plate has a deep notch that separates two triangular, laterally sloped, and rounded lobes. The subgenital plate is covered with small, colorless setae. Sternum 9 is pale medially, with two dark brown circular spots mesolaterally (Fig. 8).



FIGURES 1–8. *Arcynopteryx angarensis* sp. n.: 1. Head and pronotum of male. 2. Wings of male. 3. Male abdominal tip, dorsal. 4. Right hemitergal lobe, dorsal. 5. Hemitergal lobe and cowl: sclerites of the internal basal anchor, lever arm, paragenital plate, stylet and loop of the epiproct, and two lateral sclerotized bands, lateral. 6. Male abdominal tip with aedeagus, lateral. 7. Aedeagus, dorsal. 8. Female abdominal tip, ventral. Scale (mm): 4–7 = 1.0.



FIGURES 9–12. *Arcynopteryx angarensis*, egg: 9. Habitus: anchor, chorion structure, lateral. 10. Collar and shoulder, lateral. 11. Chorion structure with micropile row, dorsal. 12. Micropylar orifice and lip, dorsal view.

Egg oval, circular in cross-section (Fig. 9), 303–345 x 230–255 µm. The mushroom-shaped anchor covers the collar completely (Fig. 9). The collar sits on a flattened, shelf-like area surrounded by a basal ring (Fig. 10). The collar is stalked, its rim flanged and fairly regularly incised, with low shoulder (Fig. 10). The chorion is covered with hexagonal FCIs (Figs. 9 & 11). The FCIs are delimited by shallow punctate walls. Their punctures are less deep than the 7–8 punctations that often occur on the flat floors of the FCIs (Fig. 11). The row of micropyles is sub-equatorial; orifices are small and lipped, without micropylar mounds (Fig. 12). There is no eclosion line.

Material examined. Holotype, male. Russia. Angara River, vicinity of Mikhalevo settlement, Irk. (utskaya) g. (uberniya) (52°4.10'N 04°26.51'E), 7.06.1925, coll. Vereshchagin. Paratypes: 5 males, 2 females, the same locality as holotype; 4 males and 3 females, at the source of Angara River, 11.07.1930, coll. P. Rezvov (alcohol); 9 males and 7 females, Irkut. (skaya) g. (uberniya) and u. (ezd) Angara isls. (islands) between Pashkovo and Mikhalevo settlements, 20.06.1924, coll. Vinogradov (pinned).

Etymology. The name refers to the type locality, the beautiful Angara River (Lake Baikal Basin), where the types were collected.

Distribution. The species is known from the source of Angara River, the river which outflows from the deep and ancient Baikal Lake, situated in the southern part of Eastern Siberia within the Republic of Buryatiya and 'Irkutsk oblast' of Russia. *Arcynopteryx angarensis* is considered a rare species, with a local area of distribution in the source of the Angara River. No specimens are known to have been collected since 1930.

Diagnosis. *Arcynopteryx angarensis* can be readily separated from the other four described *Arcynopteryx* species by the shape of the aedeagus, lateral sclerotized bands in the cowl, and the hemitergal lobes. In particular, the tear-shaped knob on the top of each male hemitergal lobe (Figs. 3–6) is distinctive. The male hemitergal lobes of *A. polaris* and *A. amurensis* are simple, without knobs (Teslenko 2012, figs. 14, 16, 23, 26). The male hemitergal lobe of *A. sajanensis* is short, bears a small rectangular projection on the inner mesal edge, and short, rounded knob (Teslenko 2012, figs. 31, 32). The hemitergal lobes of *A. dichroa* are wide, with lobed apices, apical margins pro-

longed and rounded, well sclerotized; the lobes are in contact mesoanteriorly; each hemitergal lobe bearing an erect knob close to the anterior hemitergal margin (Stark & Szczytko 1988, Kondratieff 2004, Teslenko 2012, figs. 2, 3 & 5). *Arcynopteryx angarensis* males are similar to those of *A. amurensis*, *A. polaris*, and *A. sajanensis*, with the stylet of the epiproct directed upward, backward and downward (Figs. 3 & 6) (Zhiltzova & Levanidova 1978, Klapálek 1912, Zapekina-Dulkeit 1960). The top of the stylet of the epiproct in *A. dichroa* is directed upward, or upward and forward, with a direction very different from that of the other *Arcynopteryx* species. The female subgenital plate of *A. angarensis* is distinguished from other *Arcynopteryx* species by the deep notch that separates two triangular, sloped laterally, apically rounded lobes (Fig. 8). The shape of the subgenital plate of *A. dichroa* is variable, but the posterior margin of the plate has a shallow notch that separates two small lobes, or two shallow notches with three lobes. The posterior margin of the *A. polaris* subgenital plate is straight or exhibits a shallow notch that separates two triangular, short, sloped laterally, and rounded lobes. The subgenital plates of *A. amurensis* and *A. sajanensis* are very specific, however their posterior margin is medially smooth (Zhiltzova 1978, Zapekina-Dulkeit 1960). The eggs of *A. angarensis* differ from those illustrated for *A. amurensis*, *A. dichroa*, *A. polaris* and *A. sajanensis* (Stark & Szczytko 1988, Teslenko 2012) by the very short collar and the number of punctations in the flat floors. The egg of *A. angarensis* is reminiscent of the egg of *A. polaris* in similar shape, size, and irregular hexagonal FCI's on the chorion surface, but differ in depth of punctations on the FCI walls and flat floors. The FCI walls of *A. polaris* are raised with thin, deep furrows; the flat floors often contain 7–13 punctations, of the same depth as punctures on the walls. The punctations on the flat floors of *A. angarensis* are deeper than those on the walls (Fig. 11). Flat floors often contain 7–8 punctations. *Arcynopteryx angarensis* is distinguished also by the pigment pattern on the head; especially by two oblique, brown bands with a curlicue at the apex that extend along the epicranial suture towards but not reaching the compound eyes (Fig. 1).

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