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A taxonomic revision of the genus *Arcynopteryx* Klapálek, 1904 (Plecoptera, Perlodidae)

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Abstract

Four known *Arcynopteryx* species are redescribed from the types and newly acquired material. Illustrations of the male and female genitalia, head and pronotal patterns and eggs are used to support species descriptions. *Dictyopteryx compacta* (McLachlan, 1872) is transferred to *Skwala* Ricker, 1943 with the valid name *Skwala compacta* (McLachlan, 1872) **comb**. **nov**., and *S. pusilla* (Klapálek, 1912) is placed as a junior synonym of that species. For genus *Arcynopteryx* type species is fixed (under Article 70.3 of the Code) as *Arcynopteryx dichroa* (McLachlan, 1872), misidentified as *Arcynopteryx compacta* (McLachlan, 1872) in the original designation by Klapálek (1912).

Key words: Plecoptera, Perlodidae, *Arcynopteryx*, *Skwala*, holotype

Introduction

Genus *Arcynopteryx* was erected by Klapálek (1904) with type species *A. compacta* (McLachlan, 1872). Extending previous research, Ricker (1952) defined the diagnostic details of *Arcynopteryx*. The genus was 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 interiorly of the cowl; both adults and nymphs with submental gills; and abdominal segments 1-3 divided by pleural folds. 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 (Stark & Szczytko 1988).

Presently, five species of *Arcynopteryx* are recognized: *A. amurensis* Zhiltzova et Levanidova, 1978, *A. compacta* (McLachlan, 1872), *A. jezoensis* (Okamoto, 1912), *A. polaris* (Klapálek, 1912), and *A. sajanensis* Zapekina-Dulkeit, 1960 (DeWalt, Neu-Becker & Stueber 2012). According to Uchida (1992), *A. jezoensis* is most likely a junior synonym of *Skwala pusilla* (Klapálek, 1912). This conclusion was made on the basis of examining the type of *A. jezoensis* and comparison with specimens of *S. pusilla* collected in the Russian Far East (Uchida 1992).

A. dichroa (McLachlan, 1872), first described as *Dictyopteryx dichroa* (McLachlan 1872), was undeservedly forgotten, although during the first half of the 20th century *A. dichroa* was considered a distinct species (Klapálek 1912, Koponen 1949, Brinck 1949). The studies of this genus have often been limited by scarce material and by limited access to types. These factors have produced a degree of confusion. Klapálek (1912, fig. 8, page 13), for example, provides an illustration of "*Arcynopteryx compacta* McLachlan", which is actually *A. dichroa* (McLachlan). Zhiltzova (1966) formally synonymized *A. dichroa* with *A. compacta*, although the evidence for this decision was not furnished. Zwick (1973) accepted the synonymy as definite.

This study presents a revision of the genus *Arcynopteryx*. The approach used in the research includes the study of types, literature descriptions, older pinned specimens and fresh material. The methods used involve aedeagal extrusion and detailed examination of the epiproct, hemitergal lobes, aedeagus and eggs with a dissecting microscope and scanning electron microscopy.

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***Arcynopteryx dichroa* (McLachlan, 1872)**
(Figs 1–12)

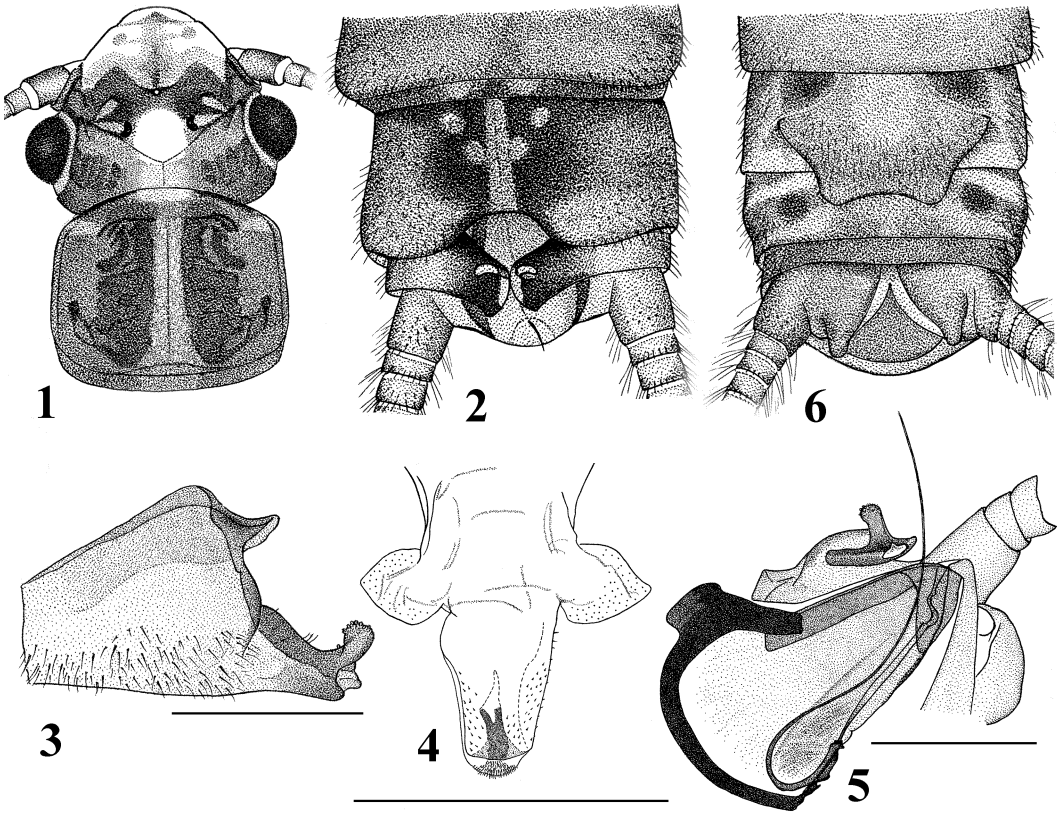
McLachlan 1872: 52−53, pl. I, figs 4−4a, 5−5b (*Dictyopteryx dichroa*); Klapálek 1912: 14–16, fig. 8 (*Arcynopteryx compacta*); Brinck 1949: 58−60, figs 4 A–F (*Arcynopteryx compacta*); Brinck 1956: 66–71, figs 6A–D (*Arcynopteryx compacta*); Zhiltzova 1966: 539 (*Arcynopteryx compacta*); Illies 1966: 353 (*Arcynopteryx dichroa*); Kimmins 1970: 340 (*Arcynopteryx dichroa*); Zwick 1973: 224 (*Arcynopteryx compacta*); Stark & Szczytko 1988: 156 (*Arcynopteryx compacta*); Kondratieff 2004: 166, figs 8.1–8.3 (*Arcynopteryx compacta*); Stewart & Oswood 2006: 182 (*Arcynopteryx compacta*); Teslenko & Zhiltzova 2009: 26, figs. 118−121 (*Arcynopteryx compacta*). The additional synonyms are presented in Brinck's (1949), Ricker's (1952), Illies's (1955) papers, on the Plecoptera species file website (DeWalt, Neu-Becker & Stueber 2012).

Diagnosis. *A. dichroa* can be distinguished by a shape of the hemitergal lobes which bear lobe apices directed posteriorly, apical margins prolonged and rounded, well sclerotized (Fig. 3); the hemitergal lobes are in contact mesoanteriorly (Figs 2 & 7). Each hemitergal lobe bears a knob erected above a membranous patch close to the anterior hemitergal margin (Figs 2, 3 & 8). Epiproct is very distinct from that of the other *Arcynopteryx* species, the stylet of the epiproct resembles a strong, long, fine bristle directed upward and forward (Fig. 5). The shape of female subgenital plate is variable: the posterior margin of the subgenital plate has a shallow notch that separates two small lobes (Fig. 6); sometimes there are two shallow notches with three small lobes. Egg is distinguished by chorionic structure which is presented by a pattern of hexagonal follicle cell impressions (FCI's), flat floors which contain often 12 shallow punctations (Fig. 12).

Adult habitus. The head, pronotum and abdomen are brown, the meso- and metanotum dark brown. Head (Fig. 1) with wide, transverse, M-shaped dark brown band between antennal bases, delimited by epicranial suture posteriorly. In front of the distinct M-shaped band, an indistinct darkish spot projects onto the clypeus; the frontoclypeus is broadly truncated and pale laterally; the tentorial pits are dark (Fig. 1). The interocellar area exhibits a pale spot rounded anteriorly that does not reach the median ocellus, a pale spot continues to the medial surface of the occiput. Two tentorial pits in front of the lateral ocelli and two small oval patches laterally to the lateral ocelli are pale. Behind each compound eye is a posterolateral spot with brown callosities (Fig. 1). The antennae and palpi are brownish; the basal antennal segments are brown. The submental gills are long and thin. The pronotum is the same width as the head width under the compound eyes, brownish, quadrangular, with rounded angles; the lateral margins are straight; a broad, median yellow band is present, slightly wider in its posterior third (Fig. 1). The pronotal rugosities are dark brown. The lateral fields are slightly darker than the median stripe, and the pronotum callosities are sometimes indistinct. The arms of the mesosternal ridge meet the anterior corners of the furcal pits. The abdomen is covered by colorless hairs, pronounced on the abdominal terga posterolaterally. The legs are brown; the distal end of the femur and the basal part of the tibia are dark brown. The cerci are longer than the abdomen, with long brownish hairs; the basal cercal segments are brown. The distal half of the apical cercal segments is dark brown. The females are macropterous. The males usually have very shortened wings, or their wings reach to the end of the abdomen or slightly past it. The forewing is long, narrow, and transparent, with brown veins and a pale yellow C vein. The venation includes an irregular net near the apex, sometimes consisting of three rows of cells. The hind wing anal area is large, and A2, A4 and A5 are forked. Brachypterous and long-winged specimens occurred together at the same sampling site.

Male. Body length 10.2−19.5 mm, forewing of full-winged male 12.0−12.7 mm, wingspan 25.4–27.0 mm; forewing of male with shortened wings 4.3−6.0 mm, wingspan 10.1–13.5 mm. Abdominal tergum 9 exhibits a thin, transversal, membranous, pale median line and two pairs of small pale spots: one pair of spots is close to the line medially; the second pair of spots is situated close to the anterior margin of tergum 9 (Fig. 2). The posterior margin has a medial arcuate notch, which runs ⅓ of the length of tergum 9, and two submedial, transversely elongated, and rounded swellings. These swellings are covered by small stout setae close to the notch and by long fine colorless hairs posteriolaterally (Figs 2 & 7). Sternum 9 is scoop-shaped, extended backward and curved upward. Tergum 10 is divided into two hemiterga (Fig. 2). The hemitergal lobes in a dorsal view are wide, with lobe apices directed posteriorly, apical margins prolonged and rounded, well sclerotized; the lobes are in contact mesoanteriorly (Figs 2, 3 & 8). Their mesal edges are membranous and resemble prolonged small white oval patches. Each hemitergal lobe bears a knob erected above a membranous patch close to the anterior hemitergal margin (Figs 2 & 8). The knob is ovular, membranous ventrally, sclerotized and rounded dorsally, and covered by a few small, stout setae (Figs 3 &

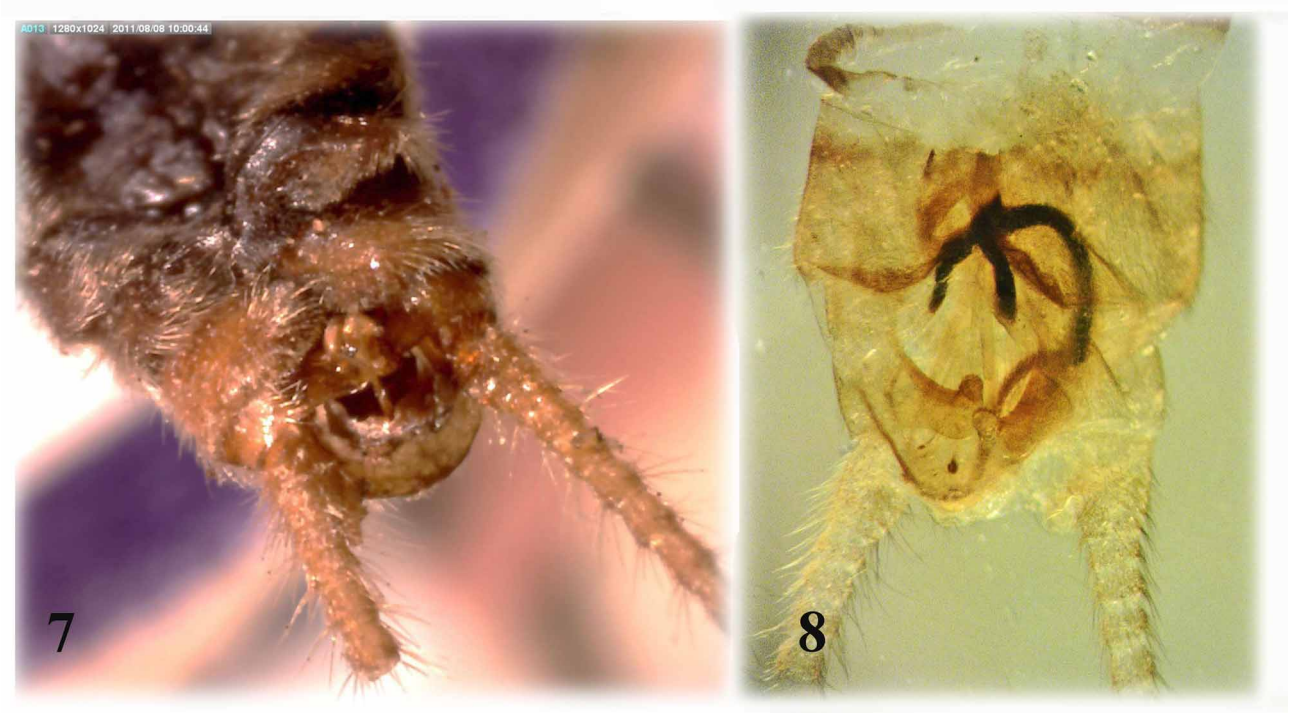
8). The cowl is membranous, folded, resembles a deep pouch between and under the hemitergal lobes and is attached around the base of the epiproct and the internal basal anchor (Figs 5 & 8). The dorsolateral edges of the cowl are supported by flat and darkly sclerotized paragenital plates. Otherwise, in a lateral view, the lever arm of the epiproct is arcuate and is found at the bottom of the deep cowl; and terminates in a basal sclerite ventrally, the top of which serves as a place for the attachment of the loop of the stylet and sclerotized bands (Fig. 5). The stylet of the epiproct resembles a strong, long, fine bristle directed upward and forward; the basal plate of the loop of the stylet is thin (Fig. 5). Two lateral sclerotized bands are narrowed at the base, and each band has a deep rounded notch on the inner edge in the last third of its length. In a dorsal view, the everted aedeagus is large and membranous, with a pair of lateral lobes at dorsolateral margins (Fig. 4). The lobes may not be fully everted. One large prolonged lobe is narrowed to the apex. Fine, erect, clear spinules are visible ventrally and dorsally on the prolonged lobe. The swollen rounded apex of the aedeagus is without spinules (Fig. 4).



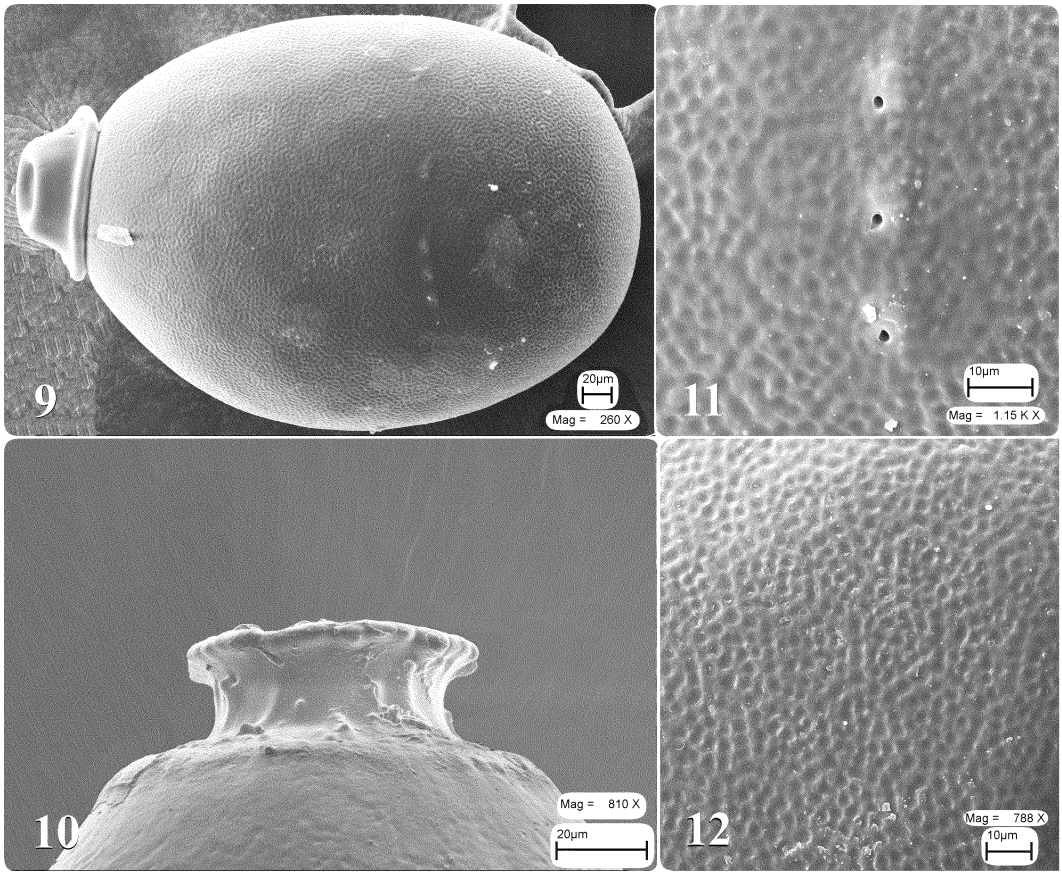
FIGURES 1–6. *Arcynopteryx dichroa*: 1. Head and pronotum of male. 2. Male abdominal tip, dorsal. 3. Male left hemitergal lobe, dorsal. 4. Aedeagus, dorsal. 5. Cowl: sclerites of the internal basal anchor, lever arm, the paragenital plate, hemitergal lobe with knob, stylet and loop of the epiproct, and two lateral sclerotized bands, lateral. 6. Female abdominal tip, ventral. Scale (mm): 3–5 = 1.0.

Female is macropterous, larger and darker than male. Body length 11.0−20.5 mm, forewing 11.0–18.4 mm, wingspan 24.0−39.2 mm. Sternum 8 bears two brown spots close to the anterior margin (Fig. 6). The subgenital plate is wide, relatively short, and pale mesoanteriorly, extending laterally from the sides of sternum 8 and reaching almost half the length of sternum 9 (Fig. 6). The posterior margin of the subgenital plate has a shallow notch that separates two small lobes. The subgenital plate covered with small, brownish setae. The shape of the subgenital plate is variable. Sometimes there are two shallow notches with three small lobes. Sternum 9 is pale medially, with two brown circular spots mesolaterally (Fig. 6).

Egg is ovular and circular in cross-section, 370 X 238 µm. Anchor mushroom-shaped covers the collar completely (Fig. 9). The collar is stalked, its rim flanged and irregularly incised (Fig. 10). The sides of collar has irregular meshwork and projections; shoulder is low (Fig. 10). The chorion is covered with hexagonal FCI's (Figs 9 & 12); the FCI walls are slightly raised with thin, shallow furrows; flat floors often contain 12 shallow punctations (Fig. 12). Row of micropyles subequatorial; orifices small without lips, some set on low micropylar mounds are occasionally surrounded by rosettes (Figs 9 & 11). Eclosion line is absent.



FIGURES 7–8. *Arcynopteryx dichroa*, type: 7. Male abdominal tip, dorsolateral, pinned. 8. Same, dorsal, cleaned. (Photograph by D. Goodger).



FIGURES 9–12. *Arcynopteryx dichroa*, egg: 9. Habitus: anchor, chorion structure, row of micropyles, lateral. 10. Collar, lateral. 11. Micropylar orifices and mounds, dorsal view. 12. Chorion structure, dorsal view.

Material examined. Lectotype male (pinned), *D. dichroa* McLachlan (*Dictyopteryx*), [McL. label] / Sibir. orient. (Maa(c)k) / dichroa McL. / *Dictiopteryx dichroa* McL. The type-series in BMNH includes one male and one female paralectotypes (Kimmins 1970). Russia: Altai Mountains, 12 males, 2 females, Chuya River, near Iodro settlement, 18.05.1989, coll. E. Makarchenko; Khabarovskiy Region, 10 males, 2 females, Khor River, Ussuri R. Basin, Amur R. Basin, 31.05.1961, coll. I. Levanidova; Tuva: 3 males, 2 females, Kara-Hol' Lake, Baj-Taiginskyi District, 23.06.2003, coll. M. Zasypkina; Kamchatka Peninsula, 6 males, 3 females, Avacha R., below Krutaya R. mouth, 20.06.1969, coll. I. Levanidova; Chukotka Peninsula, 1 male, Levaya Rechka, 105 km on the road between Egvekinot and Iultin settlements, 3.07.1973, coll. I. Chereshnev; 1 male, 1 female, Pravaya Rechka, 105 km on the road between Egvekinot and Iultin settlements, 10.07.1973, coll. I. Chereshnev; 1 male, Lena River, Lenskie Stolby, 1.06.1974, coll. I. Levanidova.

Distribution. *A. dichroa*, is a Holarctic circumpolar species primarily of the northern latitudes of Europe, Asia, and North America, occurring in streams, but also lakes throughout its range. The species inhabits northern Europe (Zhiltzova 1966, Lillehammer 1974, Loskutova 2006), in Central and Southwest Europe *A. dichroa* has a disjunct boreomontane distribution with Pleistocene relict populations (Illies 1955, Zwick 2004). The species is widespread in Asia including Mongolia, Siberia and the Russian Far East. In North America *A. dichroa* also occurs in alpine zones of Central Rocky Mountains (Ricker 1964, Stewart & Oswood 2006). Populations of *A. dichroa* have been recorded from Alaska, Alberta, British Columbia, Montana, Colorado, Maine, New Hampshire, Saskatchewan and Wyoming (Stewart & Stark 2002).

Remarks. *Arcynopteryx dichroa* has been described based on male and female specimens as *Dictyopteryx dichroa* (McLachlan 1872). The description has omitted the date, locality and the structural details of the epiproct complex. However, the stylet of the epiproct was noted and illustrated (McLachlan 1872, pl. I. Fig. 4). *Dictyopteryx dichroa* type is well associated with newly acquired material in the shape of the hemitergal lobes and knobs on them. These characters suggest that the species *D. dichroa* belongs to *Arcynopteryx* Klapálek, 1904 with the name *Arcynopteryx dichroa* (McLachlan, 1872).

Klapalek designated *Arcynopteryx compacta* (McLachlan, 1872) as type species of genus *Arcynopteryx*. However, he was mistaken and misidentified, when provided (Klapálek 1912, fig. 8, page 13) an illustration of "*Arcynopteryx compacta* McLachlan", which was actually *A. dichroa* (McLachlan), thus both taxonomic species actually were involved in the misidentification (International Code of Zoological Nomenclature 1999). 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 Klapalek (1912).

The shape of the female subgenital plate of *Arcynopteryx dichroa* is variable (Brinck 1949, Illies 1955, Zhiltsova 1964, Rauser 1968). In the East Palaearctic and Nearctic Regions the females without associated males are difficult to separate from those of *Skwala* or *A. polaris*, since their subgenital pates are similar, and both genera have the arms of mesosternal ridge meet anterior corners of furcal pits (Stewart & Oswood 2006).

Wide variations in body size, wing length and color pattern are observed throughout the distribution of the species (Illies 1955, Lillehammer, 1988). For example, Despax (1951) described three forms of the species with different wing lengths from the Pyrenees. In the population from Kara-Hol Lake in Asia (Tuva, Siberia, Russia), the head and pronotum of males are generally pale, with an indistinct brownish pattern. On the Chukotian and Kamchatka peninsulas (the Far East of Russia), the stoneflies have a dark brown body pattern, and the males are usually brachypterous. Both the males and the females from the Ussuri River (Amur R. Basin) have long wings (Levanidova & Zhiltzova 1979).

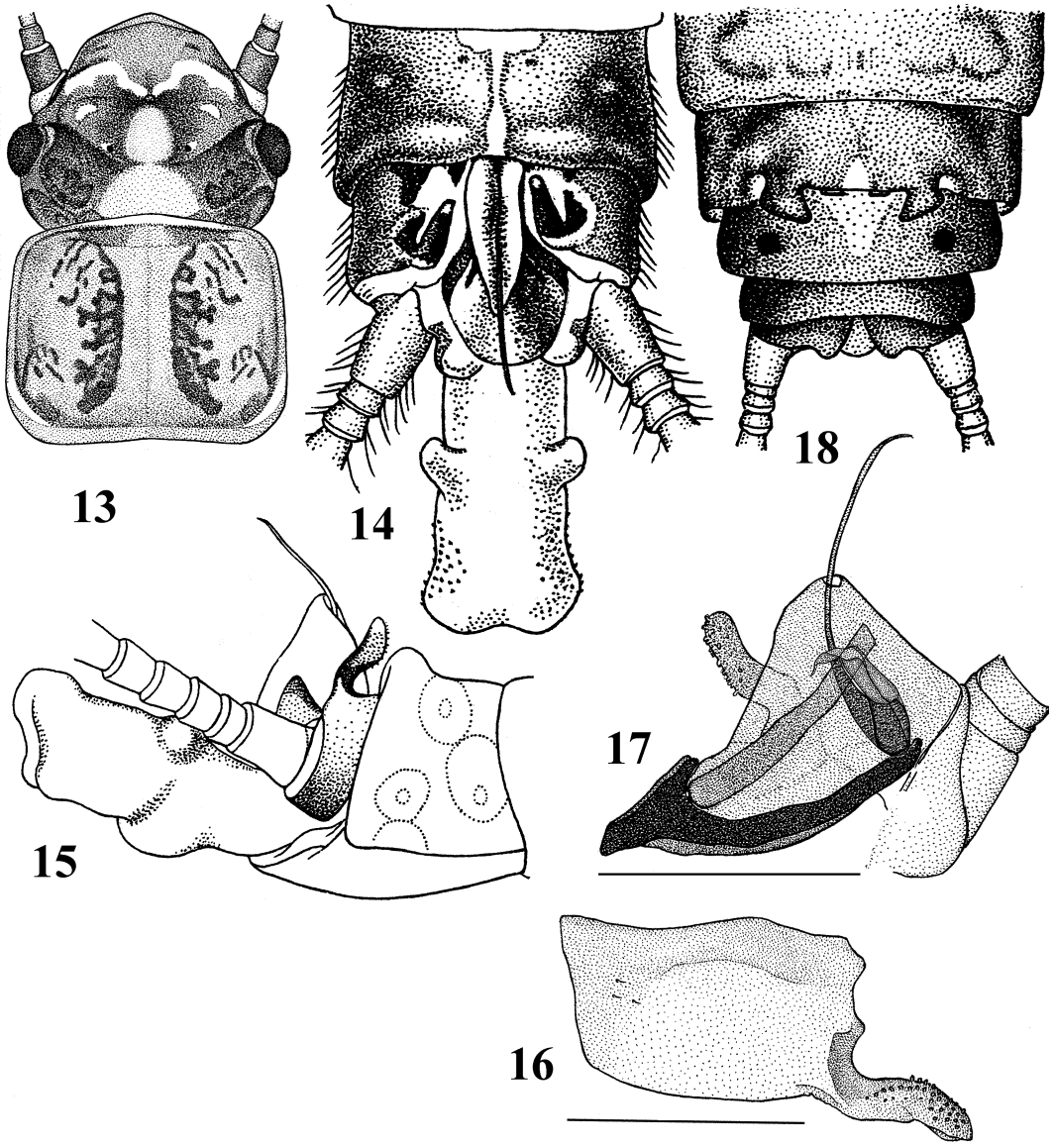
Arcynopteryx amurensis Zhiltzova et Levanidova, 1978.

(Figs 13–21)

Zhiltzova & Levanidova 1978: 11−13, figs 13−15; Zhiltzova & Zapekina-Dulkeit, 1986: 182, figs 4, 9; Teslenko & Zhiltzova, 2009: 26, figs 129−131.

Diagnosis. The submental gills are very small or almost completely reduced in both sexes. *A. amurensis* can be distinguished by the shape of the hemitergal lobe, which is elongated, fingerlike, directed forward and upward, and narrowed to the tip (Figs 14−17). A knob is absent. The cowl of the epiproct is shallow; the lever arm is stout, short and slightly curved (Fig. 17). The lateral sclerotized bands resemble a small folded leaf, with the pointed tip

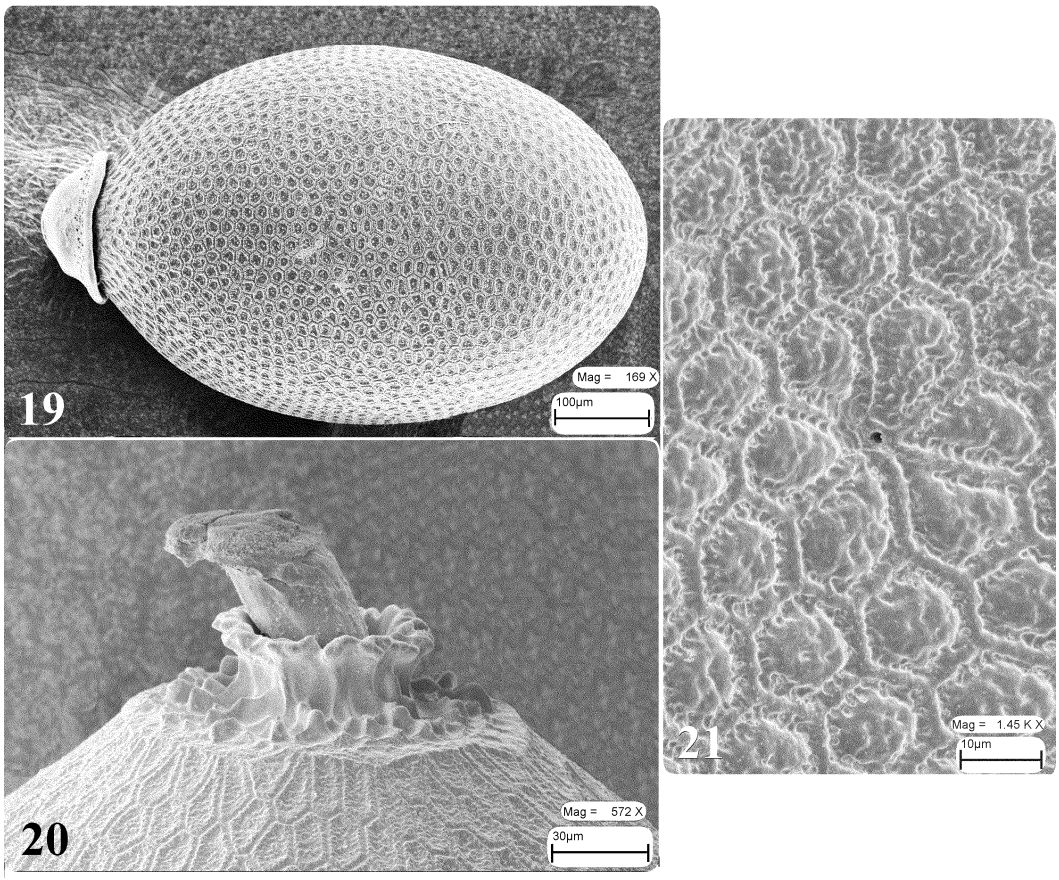
directed upward and downward; the stylet of the epiproct is short, without a loop, and the base is oval, wide and well sclerotized (Fig. 17). The top of the stylet of the epiproct in *A. amurensis* is directed upward and backward, similar to *A. polaris* and *A. sajanensis*. The aedeagus is large, membranous, sac-shaped, with two small fingerlike rounded lobes dorsolaterally; one transverse swelling presents ventrally; the apex is weakly widened, with two large rounded swellings, and bears fine, erect, clear spinules dorsolateraly (Figs 14 & 15). The female can be separated from females of other species by the shape of the lobes on the posterior margin of the subgenital plate, which are short, widely placed, and slightly transverse; the rear edge of each lobe is straight; the lobes are slightly sloping, and the medial angle of each lobe is slightly elongated (Fig. 18). The egg is large; collar with several sharp longitudinal carinae, continued to the shoulder; the margin of the shoulder is rough (Fig. 20); the chorion is covered with hexagonal FCIs (Figs. 19, 21); the FCI walls are tuberous, raised with thick furrows; the floors contain 7–13 tubercles (Fig. 21).



FIGURES 13–18. *Arcynopteryx amurensis*: 13. Head and pronotum of female. 14. Male abdominal tip with aedeagus, dorsal. 15. Same lateral. 16. Male left hemitergal lobe, dorsal. 17. Cowl: sclerites of the internal basal anchor, lever arm, paragenital plate, hemitergal lobe, stylet of the epiproct, and two lateral sclerotized bands, lateral. 18. Female abdominal tip, ventral. Scale (mm): 16, 17 = 1.0. Figures 14, 15, 18 after Zhiltzova & Levanidova 1978.

Adult habitus. The general body pattern is brown, with dark spots on the head and thorax. The pigment patterns of the male and the female differ in certain respects, especially in the color of the head and pronotum. On the head of the female (Fig. 13), the M-line, frontal callosities, interocellar area and medial part of the occiput are pale,

with very diffuse outlines. On the head of the male, the general pattern is also pale and then grades into brownish; a dark spot is clearly distinguishable between the M-line and the median ocellus; dark patches are located around the compound eyes and occiput laterally; darkish patches are present in front of the median ocellus and along the anterolateral edges of the clypeus. The palpi and submentum are light brown, and the submental gills are not developed; only short triangular projections are visible in their places. On the pronotum of the male, a pale medial band is well pronounced, expanding anteriorly and posteriorly; on the pronotum of the female, the medial band is brownish, somewhat lighter than the lateral fields (Fig. 13). The pronotum is slightly transverse, with rounded corners. The mesanotum of the male bears a pale stripe, expanding to the anterior and posterior margins. The female has a pale stripe on the prescutum of the mesonotum only. The wings are shortened, the venation somewhat changed: the apical branches of the veins are very short, with a network of crossveins in the RS and sometimes in the M, Su1 and Cu2. The female has brown legs, the male brown-yellow legs. The abdomen of both the male and the female is brown dorsally and pale ventrally. The cerci are longer than the abdomen, brown, covered with small brown setae and long strong brown hairs. Each cercal segment bears a narrow pale ring basally.



FIGURES 19–21. *Arcynopteryx amurensis*, egg: 19. Habitus: anchor, chorion structure, row of micropyles, lateral. 20. Collar and pedicel, lateral. 21. Chorion structure and micropylar orifice, mounds, and pentagon rosettes, dorsal view.

Male. Body length 16.0−19.0 mm, the length of shortened forewing 3.5–6.0 mm. The abdominal sterna are pale with brown lateral margins; sternum 9 is completely brown, scoop-shaped, extended backward and curved upward. Tergum 9 is lighter than the other abdominal terga, with a pale membranous stripe along the median line, expanding anteriorly; the posterior margin with submedial, transversely elongated and rounded swellings, densely covered by small stout setae and fine colorless hairs posterolaterally (Fig. 14). Tergum 10 is divided into two hemiterga (Fig. 14); the posteromedial edge of each hemitergal lobe is elongated, finger-like, curved and directed forward and upward, narrowed to the tip, dark with a light, slightly curved tip, covered by small, stout setae dorsally (Figs 14−17); a knob is absent. The cowl is membranous, folded, resembles a shallow pouch between and under the hemitergal lobes, is attached around the sclerites of the internal basal anchor (Fig. 17). The cowl opens dorsally in a slit. The dorsolateral edges of the cowl are large, supported by darkly sclerotized paragenital plates. In

a lateral view, the arrow-like sclerites of the internal basal anchor are black, fragile, and hidden under tergum 9 (Figs 14 & 17). The lever arm is stout, hollowed, and relatively short and slightly curved (Fig. 17). Two sclerotized lateral bands and the stylet of the epiproct are fastened ventrally to the lever arm directly. The lateral sclerotized bands resemble a small folded leaf with the tip directed upward and downward; the base of each lateral band is wider than the top (Fig. 17). The stylet of the epiproct is short, without a loop, visible as a strong bristle directed upward and backward or obliquely backward and downward; the base of the stylet is oval, wide and well sclerotized (Fig. 17). The everted membranous aedeagus is large, sac-shaped, with two small finger-like rounded lobes dorsolaterally, directed forward, covered by small spines; one transverse swelling presents ventrally; the apex is weakly widened, with two large rounded swellings, and bears fine, erect, clear spinules dorsolateraly (Figs 14 & 15).

Female. Body length 18.4−21.0 mm; wings are shortened, the length of forewing 6.8−18.5 mm. The subgenital plate is indistinctly detached from the lateral parts of sternum 8; the posterior margin of the subgenital plate bears two short, widely placed, slightly transverse lobes, the rear edge of each lobe is straight (Fig. 18); the lobes are slightly sloping, and the medial angle of each lobe is slightly elongated. Sternum 9 bears two dark spots mesolaterally (Fig. 18). Tergum 10 is triangular posteriorly and deeply depressed medially.

Egg is ovular (Fig. 19), circular in cross-section and large 572-643 X 365-396µm. Anchor mushroom-shaped with short and strong pedicel (Figs 19 & 20) and two or three rows of globular bodies close to the margin of the anchor plate. The margin of the anchor covers the collar completely (Fig. 19). The collar is stalked, its rim flanged and irregularly incised. The sides of the collar bear sharp longitudinal carinae continued to the shoulder; the margin of the shoulder is rough (Fig. 20). The chorion is covered with hexagonal FCIs (Figs 19, 21); the FCI walls are tuberous, raised with thick furrows; the floors contain 7–13 tubercles (Fig. 21). Row of micropyles is subequatorial; orifices small with indistinct lips are surrounded by pentagon rosettes (Fig. 21).

Material examined. Holotype, male. Russia. Khabarovskyi Region, Silinka River, Amur River Basin, 19.07.1974. Paralectotypes: 1 female, the same place; coll. T. Kuznetzova. Magadan Region, 1 male, Olen' stream, Sibit-Tyellach settlement, Aborigen station, 4.07.1977; 2 females, Ozernyi stream, the same place, 4. 07.1977.

Distribution. Russia, Far East (South of the Magadan Region, Khabarovskyi Region).

Arcynopteryx polaris Klapálek, 1912.

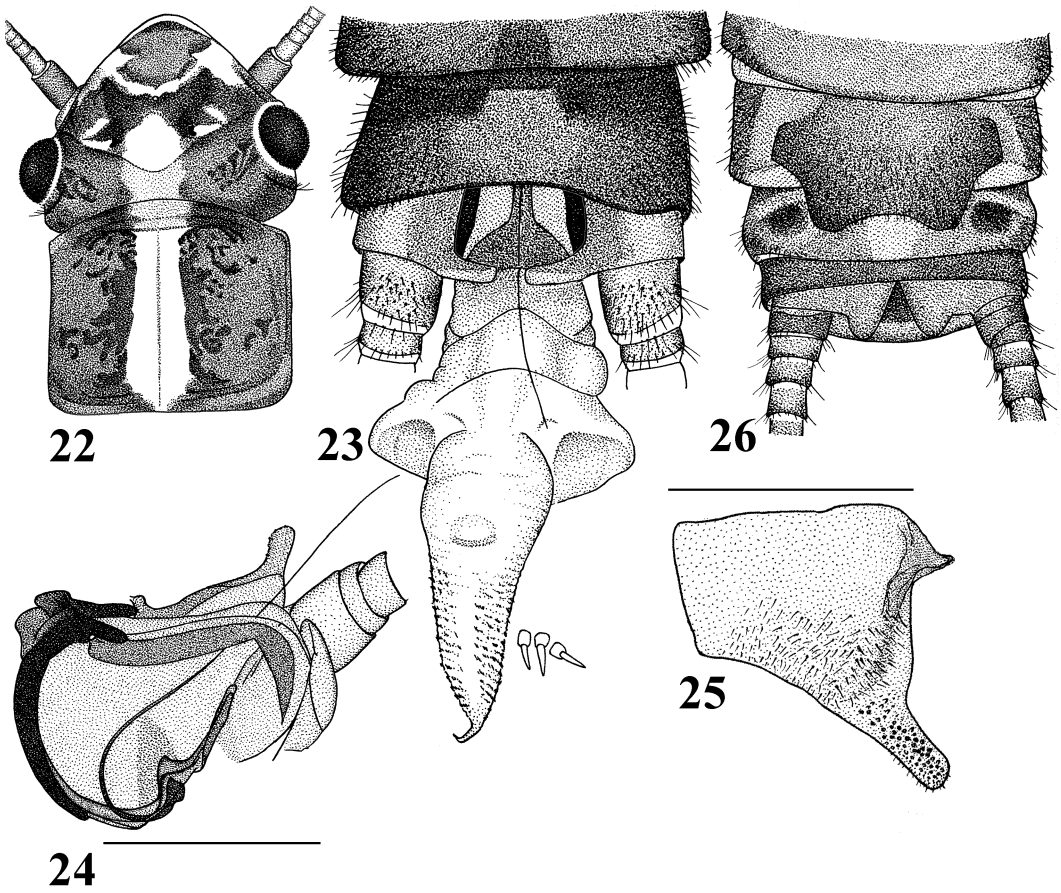
(Figs 22–29)

Klapálek 1912: 20 (*Arcynopteryx dichroa* var. *polaris*); Zapekina-Dulkeit 1960: 667, 668, figs 6−10 (*Arcynopteryx altaica* sp. nov.); Zhiltzova & Zapekina-Dulkeit, 1986: 182, figs 2, 3, 5, 6 (*Arcynopteryx altaica*); Zhiltzova 1995: 7 (*Arcynopteryx polaris* Klapálek, 1912=*Arcynopteryx altaica* Zapekina-Dulkeit, 1960, syn. nov.); Teslenko & Zhiltzova 2009: 26, figs 126−128.

Diagnosis. Tergum 9 is rather smooth without notch posteriorly (Fig. 23). *A. polaris* can be distinguished from other species by the simple shape of hemitergal lobe, which is elongated, flattened, directed medially. A knob is absent (Fig. 25). Each lateral sclerotized band interiorly of the cowl of the epiproct is widened basally, with a triangular-rounded extension medially (Fig. 24). The stylet of the epiproct resembles a long, fine bristle directed upward and backward; is arched in a loop with well sclerotized, triangular-shaped base, and is attached between triangular extensions of the lateral sclerotized bands at the bottom of the cowl (Fig. 24). The aedeagus (Fig. 23) is large, with pair of large lateral lobes dorsolaterally; one prolonged carrot-shaped lobe presents between lateral lobes and bears a small swollen knob dorsomedially; the membranous apex resembles a small hook. The carrot-shaped lobe is covered with fine erect clear spinules which are grouped below the small swollen knob laterally, except for a mesal membranous narrow band. Egg is smaller than other *Arcynopteryx* species. The sides of collar appear knitted; shoulder is not pronounced (Figs 27 & 28). The chorion is covered with hexagonal FCI's; flat floors contain 7−13 punctations the same depth as on the walls (Fig. 29).

Adult habitus. The head (Fig. 22) is wide, transverse, with M-shaped dark brown band between antennal bases, M-line is pale. In front of the M-line a distinct arrow-shaped brown spot projects onto the clypeus, the tentorial pits are brown, lateral margins of the clypeus are pale. The interocellar area exhibits a pale spot pointed anteriorly that does not reach the median ocellus and continues to the occiput medially. Pair of the tentorial pits in front of the lateral ocelli and pair of small oval patches laterally to lateral ocelli is pale. Behind each compound eye is a posterolateral spot with brown callosities (Fig. 22). The antennae and palpi are brownish; the basal antennal seg-

ments are brown. The submental gills are rounded and short or very short. The pronotum is the same width as head width under compound eyes, brownish, quadrangular, with rounded angles, the lateral margins are straight; a median pale band occupies 1/5 of pronotal width, expanding posteriorly (Fig. 22). The pronotal rugosities are dark brown, lateral fields are light brown. Meta- and mesonotum are brown with thin incomplete pale band medially. Arms of mesosternal ridge meet anterior corners of furcal pits. The abdomen is covered by colorless hairs, pronounced on the last abdominal terga posterolaterally. The anterior margin of femur is dark brown, the distal edge is pale; tibia is light brown with thin dark brown stripe basally. The cerci are longer than abdomen, with brownish hairs; the basal cercal segments are brown, segments in the middle of the cercal length are brown with narrow pale basal ring. The forewing is long, narrow, transparent, and sometimes clay-colored, with brown veins. The venation includes an irregular net near the apex, occasionally consisting of three rows of cells. The hind wing anal area is large, and A1 and A5 are forked. Brachypterous and long-winged specimens occurred together the same sampling site.

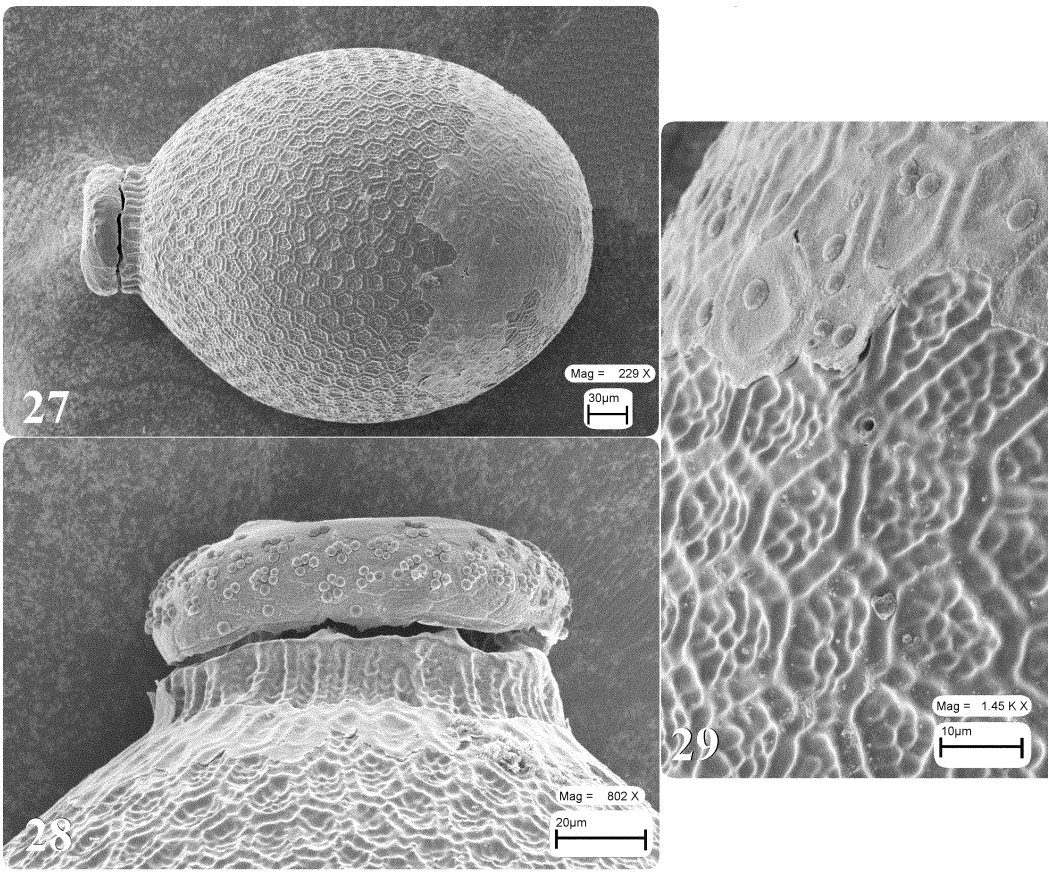


FIGURES 22–26. *Arcynopteryx polaris*: 22. Head and pronotum of male. 23. Male abdominal tip with aedeagus, dorsal. 24. Cowl: sclerites of the internal basal anchor, lever arm, paragenital plate, hemitergal lobe, stylet and loop of the epiproct, and two lateral sclerotized bands, lateral. 25. Male left hemitergal lobe, dorsal. 26. Female abdominal tip, ventral. Scale (mm): 24, 25 = 1.0.

Male. Body length of full-winged male 11.2−15.2 mm, forewing 9.1−13.0 mm, wingspan 19.2–27.5 mm; forewing of male with shortened wings 2.5−6.0 mm, wingspan 6.6–13.5 mm. Abdominal tergum 9 is straight posteriorly, without notch (or with very shallow medial notch); two weak submedial swellings are present. These swellings are covered by small stout setae and long fine colorless hairs posteriolaterally (Fig. 23). Sternum 9 is scoop-shaped, extended backward and curved upward, posterior margin is pale medially. Tergum 10 is pale, divided into two hemiterga. The hemitergal lobes in a dorsal view are simple, elongated, flattened and directed medially. The knobs are absent (Figs 23 & 25). The posterior margins of the hemitergal lobes are smooth and pale, less sclerotized than anterior ones, mesal edges bluntly rounded (Fig. 25). The cowl is membranous folded resembles a deep pouch between and under hemitergal lobes, and is attached around the base of epiproct and the internal basal anchor. The dorsolateral edges of the cowl are supported by flat and darkly sclerotized paragenital plates. In

dorsal view, the arrow-like sclerites of the internal basal anchor are black, fragile, hidden under tergum 9, and reach the tergal margin anteriorly. In lateral view, the lever arm is stout, hemispherical, and hollowed (Fig. 24). Two sclerotized lateral bands are fastened to the lever ventrally and support the cowl ventrolaterally. Each lateral sclerotized band is widened basally, has a triangular-rounded extension medially (Fig. 24). The stylet of the epiproct resembles a long, fine bristle directed upward and backward. The stylet is arched in a loop, the basal plate of the loop is a triangular-shaped, well sclerotized, and attached between triangular extensions of the lateral sclerotized bands at the bottom of the cowl (Fig. 24). In dorsal view, everted aedeagus (Fig. 23) is large, membranous, wide medially, with pair of lateral rounded lobes at dorsolateral margins, lobes not be fully everted; one prolonged carrot-shaped lobe is between lateral lobes and bears a small swollen knob dorsomedially and ends by a small hook-shaped membranous apex. The carrot-shaped lobe is covered with fine, erect, clear spinules which are grouped below the small swollen knob laterally, except for a narrow mesal membranous band (Fig. 23).

Female. Body length 11.8−18.5 mm, full-winged, length of forewing 12.8−16.5 mm, wingspan 27.1–33.9 mm; shortened wings, length of forewing 4.6−5.3 mm, wingspan 10.6–12.3 mm. Sternum 8 without spots anteriorly, the subgenital plate is large, relatively short, extends laterally from the sides of sternum 8, and does not exceed half of the length of the sternum 9 (Fig. 26). The posterior margin of the subgenital plate is straight or exhibits a shallow notch that separates two triangular, short, sloped laterally, and rounded lobes. The subgenital plate is covered with small, colorless setae. Sternum 9 is pale medially, with two brown circular spots mesolaterally (Fig. 26).



FIGURES 27–29. *Arcynopteryx polaris*, egg: 27. Habitus: anchor, chorion structure, lateral. 28. Collar and anchor, lateral. 29. Chorion structure, micropylar orifice, mound, and pentagon rosettes, dorsal view.

Egg is ovular (Fig. 27) and circular in cross-section, smaller than other *Arcynopteryx* species, 395 x 293µm. Anchor mushroom-shaped does not cover the collar (Fig. 27), the globular bodies are grouped closely to the margin of the anchor plate. The collar short, sides of collar appear knitted; shoulder is not pronounced (Figs 27 & 28). The chorion is covered with hexagonal FCI's (Figs 27 & 29); the FCI walls are raised with thin, deep furrows; flat floors often contain 7-13 punctations, the depth of flat floor's punctation is the same as the wall's depth (Fig. 29).

Row of micropyles is subequatorial; orifices small with indistinct lips, some set on very low micropylar mounds are surrounded by pentagon rosettes (Fig. 29).

Material examined. Type, male, lectotype, male, Lena River, mouth, Bykov peninsula, 14.07.1902, coll. Brusneva, det. Klapálek. Paralectotypes: female, the same place, 12.07.1902; 2 males, 1 female, Priayanskaya tundra, 25−26.06.1902, coll. Brusneva. Khabarovskiy Region, 12 males, 3 females, Uyka River, 0.5 km from Ayan Airport, 21-26.07.1999, coll. T. Tiunova; 7 males**,** 6 females, Bulginka R., Okhota R. Basin, Bulgin settlement, 26.06.1999, coll. T. Tiunova; 17 males**,** 7 females, the same place, 3.07.1999, coll. T. Tiunova; 5 males**,** 1 female, Petin stream, Nemptu R. Basin, Amur R. Basin, 21.06.1998, coll. V. Teslenko; Chukotka peninsula, 11 males, 2 females, Nevedimka stream, Whalen settlement vicinity, 11.08.1973, coll. I. Chereshnev.

Distribution. *A. polaris* extends to Siberia (Altai and Sayan Mountains) the Russian Far East, including Wrangel Island, as well as in Mongolia, China (Teslenko 2006), and Korea (Zwick 2010).

Arcynopteryx sajanensis Zapekina-Dulkeit, 1960

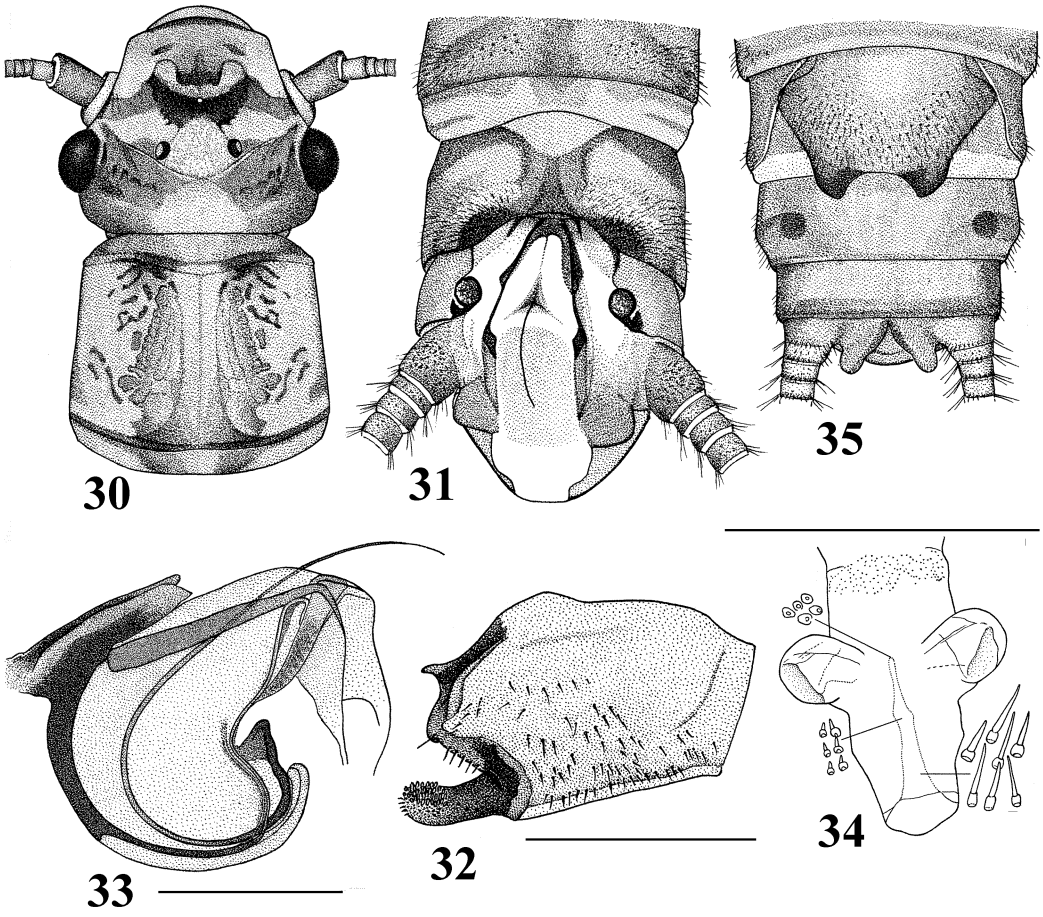
(Figs 30–38)

Zapekina-Dulkeit 1960: 666, 667, figs 1−5; Illies 1966:354; Teslenko & Zhiltzova 2009: 26, figs 122−125.

Diagnosis. *Arcynopteryx sajanensis* is distinguished from other species by the shape of the hemitergal lobe, which is short, bears a small rectangular projection on the inner mesal edge, and short, rounded knob directed medially and upward (Figs 31 & 32). The cowl is larger than other *Arcynopteryx* species, paragenital plates are darkly sclerotized with rough outer edges. The arrow-like sclerites of the internal basal anchor are longer, than other *Arcynopteryx* species, theirs apex extended to the level of the rectangular projections on the inner mesal edges of the hemitergal lobes. Two lateral sclerotized bands are long, petal-shaped with thin base and wide rounded top (Fig. 33). The aedeagus (Fig. 34) is large, membranous, narrowed to the apex; with a pair of large rounded lobes at dorsolateral margins. The apex of aedeagus is thin with two small swellings laterally, and bears fine, erect, clear spinules of different sizes.

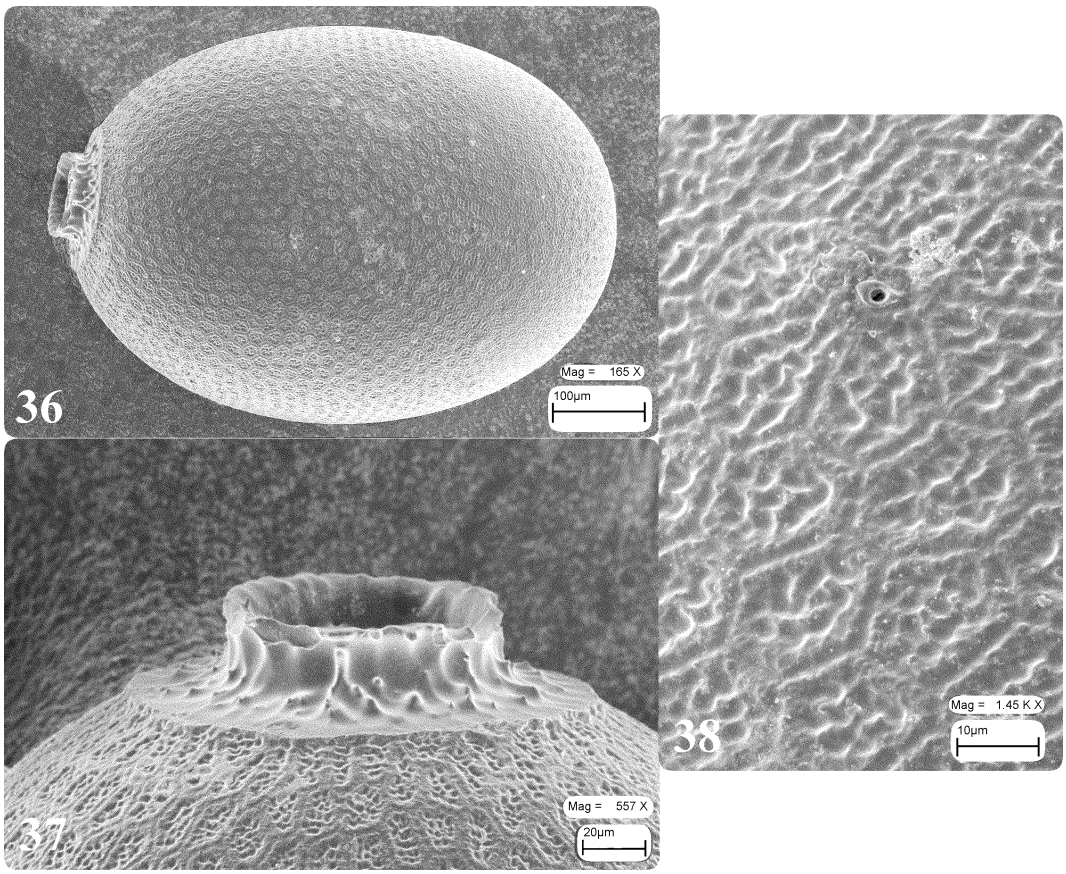
The posterior margin of the female subgenital plate smooth medially, with two small triangular, well sclerotized lobes laterally (Fig. 35), the top of each lobe directed to the middle. Egg is large, sides of collar with sharp longitudinal carinae; shoulder with smooth margin and small, short and sharp tubercles situated close to collar sides (Figs. 36-38). Chorion is covered with hexagonal FCI's; flat floor often contain 7-10 punctations.

Adult habitus. The head (Fig. 30) is wider than pronotum, with pale M-line; the clypeus is slightly darkened, the tentorial pits are brown. A thin dark stripe connects the lateral ocelli with median one. A wide U-shaped dark brown band below the median ocellus is diverged laterally and connected with a pair of brownish bands which are spread the M-line posteriorly. The tentorial pits are pale in front of the lateral ocelli; interocellar area exhibits a triangular pale spot, merging with a large hemispherical pale spot in the middle of the occiput. A brown band extends from each compound eye along the postfrontal suture to the coronal stem. A posterolateral spot with dark brown callosities presents behind each compound eye (Fig. 30). M-shaped pattern on the head is not always clearly expressed both in males and females (especially in light specimens). The submental gills are very small and short. The antennae and palpi are brownish; the basal antennal segments are brown. The pronotum is slightly longer in width than in length, the angles, anterior and posterior margins are rounded, the lateral margins are straight; a median pale band is slightly expanded anteriorly. The pronotal rugosities are brown, X-shaped, and reach the lateral fields in the first and the last thirds of the pronotal length (Fig. 30). The mesanotum is brown with pale patches on the prescutum, scutum, and scutellum (usually in males). The metanotum is entirely brown. The abdominal segments are light brown, covered by short colorless hairs, pronounced on terga posterolaterally. The legs are pale, the femur is brown anteriorly. The cerci are longer than abdomen, pale, with light brown hairs; each cercal segment is darkened distally. The forewing is pale; veins are brownish, and then grades into colorless to the margins, C vein is pale yellow. The venation includes an irregular net near the apex, occasionally consisting of two rows of cells. The hind wing anal area is large, and A1 and A5 are forked. Brachypterous and long-winged specimens co-occurred at the same sampling site.



FIGURES 30–35. *Arcynopteryx sajanensis*: 30. Head and pronotum of female. 31. Male abdominal tip, dorsal. 32. Male right hemitergal lobe, dorsal. 33. Cowl: sclerites of the internal basal anchor, lever arm, paragenital plate, stylet and loop of the epiproct, and two lateral sclerotized bands, lateral. 34. Aedeagus, dorsal. 35. Female abdominal tip, ventral. Scale (mm): 32 – 34 = 1.0.

Male. Body length 12.0−18.0 mm, forewing of full-winged male 12.0−14.5 mm, wingspan 27.0−30.5 mm; the length of shortened wings 3.5–5.0 mm. Abdominal tergum 9 is light brown with dark brown band anterolaterally, the posterior margin exhibits a medial elevated notch which runs half of the length of tergum 9, and two submedial, rounded swellings. These swellings are dark brown and densely covered by small stout setae and fine colorless hairs posteriorly (Fig. 31). Sternum 9 is scoop-shaped, extended backward and curved upward, the posterior margin rounded and pale medially. Tergum 10 is divided into two hemiterga (Fig. 31). Each hemitergal lobe is short, bears a small rectangular projection on the inner mesal edge and a rounded knob directed medially and upward (Figs 31 & 32). In dorsal view, a knob is slightly membranous at the top, heavy sclerotized from below, and covered by small, stout setae (Fig. 32). The knobs are very short, do not touch each other. In dorsal view, the cowl is larger than other *Arcynopteryx* species, and is supported by flat and darkly sclerotized paragenital plates with rough outer edges. The sclerites of the internal basal anchor are arrow-like, longer than other *Arcynopteryx* species, and fragile, and black (Fig. 33), they extended posteriorly to the level of the rectangular projections on the hemitergal lobes. In lateral view, the lever arm of the epiproct is stout, hemispherical, hollowed, and is divided into two thin well sclerotized stripes ventrally (Fig. 33). Two lateral sclerotized bands are fastened to the lever arm ventrally and support the cowl ventrolaterally; each lateral sclerotized band is long, petal-shaped with a thin base and wide rounded top (Fig. 33). The stylet of the epiproct resembles a long, fine bristle directed upward and backward. Inside the cowl the stylet is curved in a loop, the basal plate of the loop is triangular, well sclerotized and attached to the lateral bands at the bottom of the cowl (Fig. 33). In dorsal view, the everted aedeagus (Fig. 34) is large, membranous, narrowed to the apex; with a pair of large rounded lobes at dorsolateral margins. The lobes may not be fully everted; the apex of aedeagus is thin with two small swellings laterally, and bears fine, erect, clear spinules of different sizes. In Fig. 34, the apex of aedeagus is not fully everted.



FIGURES 36–38. *Arcynopteryx sajanensis*, egg: 36. Habitus lateral. 37. Collar, lateral. 38. Chorion structure, micropylar orifice, mound, lip and pentagon rosettes, dorsal view.

Female. Body length 15.0−21.0 mm, forewing of full-winged female 16.5−19.0 mm, wingspan 37.0−39.5 mm. Length of shortened wings 5.0–6.0 mm. Sternum 8 is without spots. The subgenital plate is large, relatively short, extends laterally from sides of sternum 8, and does not exceed half of sternum 9 (Fig. 35). The posterior margin is smooth medially, with two small triangular lobes laterally (Fig. 35). The top of each lobe is directed to the middle. Lobes are more sclerotized than the rest surface of subgenital plate, and covered with conspicuous colorless setae. Sternum 9 is pale medially, with two brown circular spots mesolaterally (Fig. 35).

Egg is large, ovular, and circular in cross-section, 567.0 x 413.5 µm (Fig. 36). The collar is stalked, its rim flanged and irregularly incised. The sides of collar bear several sharp longitudinal carinae; the margin of shoulder is smooth; short sharp tubercles are situated close to the collar sides (Fig. 37). The chorion is covered with hexagonal FCI's (Figs 36−38); FCI walls are raised with thin, shallow furrows; flat floors often contain 7-10 punctations (Fig. 38). Row of micropyles is subequatorial; theirs orifices are small with distinct lips surrounded by pentagon rosettes (Fig. 38).

Material examined. Lectotype, male. Russia. Sayan Mountain, Bolshoi Arzybai River, tributary of Malka River, Yenisei River Basin, 24.08.1953, coll. G. Dulkeit. Paralectotypes: 1 male, 2 females, the same place; 4 males, 2 females, Dezo River, left tributary of the Mana River, 7.07.1955, coll. G. Dulkeit. Trans-Baikal Region: 10 males, 6 females, Khamar-Daban Mountains, car Osinovyi, 1400-1600 m, alpika, Osinovaya River, upstream, 1250 m, 20.07 − 4.08.20009, coll. Yu. Sundukov.

Distribution. *A. sajanensis* is restricted in Russia by the Altai, Sayan and the Khamar-Daban Mountains (Teslenko *et al*. 2010).

***Skwala compacta* (McLachlan, 1872) comb. nov.**
(Figs 39–48)

McLachlan 1872: 52−53, pl. I, figs 6, 7−7b (*Dictyopteryx compacta*); Klapálek 1912: 15 (*Arcynopteryx compacta* var. *pusilla* nov.); Koponen 1949: 12−13, figs 10 A−C (*Arcynopteryx brevis*); Illies 1966: 510 (sp. inquirenda); Raušer 1968: 352−354, figs 47−57 (*Arcynopterygoides vernalis*, syn. n.); Zwick *et al*. 1971: 852−853, figs 6−8 (*Skwala brevis*); Zwick 1973: 239 (*Arcynopteryx brevis*); Stark & Szczytko, 1981: 61−63, figs 1−4 (*Skwala brevis*); Zhiltzova 1982: 116 (*Skwala pusilla*=*S. brevis*); Zhiltzova & Zapekina-Dulkeit 1986: 184, figs 4−6 (*Skwala pusilla*); Teslenko & Zhiltzova 2009: 17, figs 49−53 (*Skwala pusilla*).

Diagnosis. Abdominal segments 1−2 are divided by a pleural fold. The submental gills are long and conical. The arms of the mesosternal ridge meet the anterior corners of the furcal pits, the transverse suture is absent. The stylet of the epiproct as a long, fine bristle is absent. The male of *Skwala compacta* **comb. nov**. can be distinguished by the shape of the hemitergal lobes, which are simple, cylindrical, wide, short, flat and slightly curved upward along the posterior margin. The hemitergal lobes are directed towards the middle transversely, and covered by small, stout setae (Figs 40−43). The lever arm is short, stout and slightly curved; the epiproct is short, blunt and spoon shaped, with a soft distal part and a finger-shaped top (Fig. 44), the top is densely covered with thin, clear spines. The lateral stylets are attached laterally to the folds of the cowl only the pointed sclerotized tips are clearly pronounced (Fig. 44). The everted aedeagus is large and membranous, with a pair of distinct lateral rounded lobes at the dorsolateral margins; one large lobe rounded dorsally is present between the lateral lobes; one small knob is located apically; two broadly rounded swellings project posteriolaterally and slightly below the large lobe; tiny, clear, erect spinules densely cover the aedeagal surface ventrally and laterally; reddish spinules are grouped in a triangle on the dorsal surface of the large lobe basally and continue dorsomedially to the small knob (Fig. 42). The female has a large subgenital plate, its posterior margin slightly rounded and sclerotized, with two shallow notches medially; the plate is covered with small, darkish setae (Fig. 45). The egg is spindle-shaped (Fig. 46). The collar is stalked; the sides of the collar bear several sharp longitudinal carinae (Fig. 47). The chorion is covered with closely packed hexagonal FCIs (Figs. 46−48); the FCI walls are thin, consisting of shallow furrows; the floors are flat with 4-8 small punctations medially (Fig. 48).

Adult habitus. The head is brown, with a yellow spear-shaped spot in the interocellar area, not reaching the median ocellus and continued to the occiput medially, where the spot is slightly enlarged (Fig. 39). A dark brown spot projects onto the clypeus in front of the brownish M-line. The tentorial pits are brown; the lateral margins of the clypeus are pale. The pair of tentorial pits in front of the lateral ocelli and the pair of small oval patches lateral to the lateral ocelli are brown. A posterolateral spot with brown callosities is weakly recognizable behind each compound eye. The antennae and palpi are brown. The pronotum is almost square or slightly longer in width than in length, brown with a yellow medial band and prominent dark brown rugosities (Fig. 39). The medial band expands in the last quarter of the length of the pronotum. The meso- and metanotum are dark brown. The anterior margin of the femur is dark brown. The tibia is light brown with a thin dark brown stripe basally. The wings of the male and female are slightly shortened and extend to the top of the abdomen. The RS of the forewing has three or more branches; the apex exhibits a random network of cells formed by the transverse veins and branches of the RS. The cerci are longer than the abdomen, ringed, and covered with long colorless hairs. Each cercal segment is pale basally and blackish distally. The apical cercal segments are completely blackish with the exception of the pale bases (Fig. 39). The submental gills are long and conical. The arms of the mesosternal ridge meet the anterior corners of the furcal pits, a transverse suture is absent.

Male. Body length 11.5−14.5 mm, forewing 8.0−11.0 mm, wingspan 17.2–23.5 mm. Abdominal tergum 9 exhibits a thin, transversal, membranous, brownish median band and one indistinct small pale spot anteromedially (Figs. 41 & 42). The posterior margin of tergum 9 bears a notch along 1/3 of the length of tergum 9 and two transversely elongated and rounded swellings, which are covered by small stout setae and fine colorless hairs posteriolaterally (Fig. 41). Sternum 9 is scoop-shaped, extended backward and upward, pointed at the top (Figs 40 & 41). Tergum 10 is divided into two hemiterga. The hemitergal lobes in dorsal view are simple, cylindrical, wide, short, flat and slightly curved upward along the posterior margin, directed towards the middle transversely, and covered by small, stout setae (Figs 40−43). The cowl is membranous, folded, resembles a pouch between and under the hemitergal lobes, attached around the sclerites of the internal basal anchor. The cowl opens dorsally with a slit. The dorsolateral edges of the cowl are supported by flat, band-like sclerotized paragenital plates (Fig. 42). In a lateral

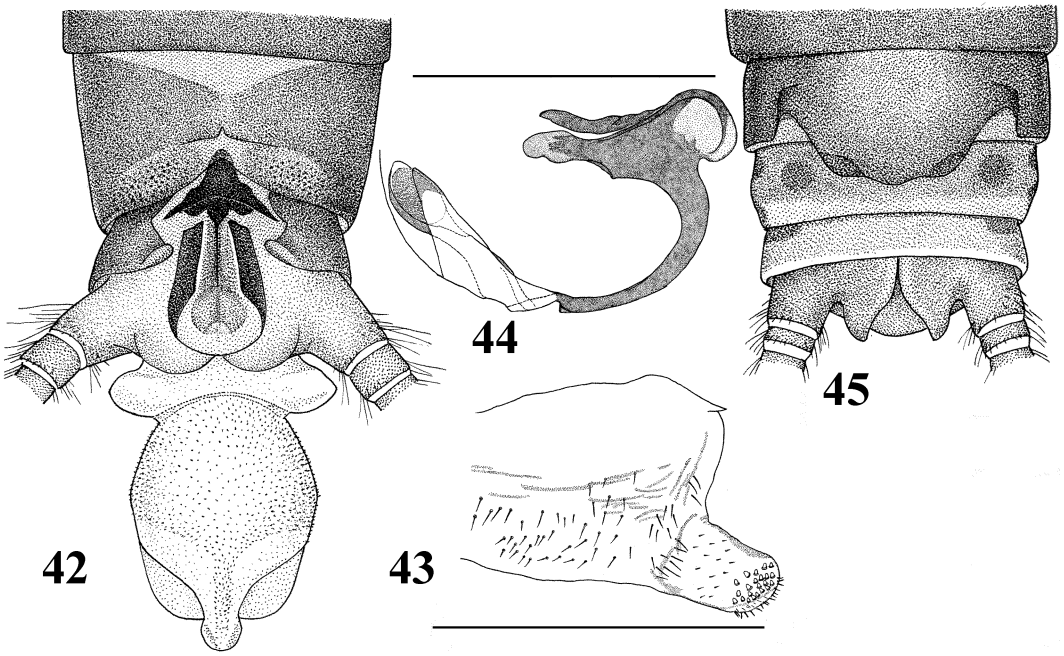
view, the internal basal anchor is rounded anteriorly, the arrow-like sclerites are black and hidden under tergum 9 (Fig. 42). The lever arm is short, stout, slightly curved, hollowed and connected to the epiproct distally (Fig. 44). The epiproct is short, blunt, spoon shaped, sclerotized basally and ventrally; its distal part is soft (Fig. 44). The top of the distal part is finger-shaped, densely covered with thin, clear spines. Lateral stylets are attached to the folds of the cowl laterally; their acute sclerotized tops clearly pronounced (Fig. 44). The everted aedeagus is large and membranous, in a dorsal view with a pair of finger-like lobes at the dorsolateral margins; one large dorsally rounded lobe is set between the lateral lobes; one small rounded knob located apically; two broadly rounded swellings project posteriolaterally and slightly below the large lobe; tiny, clear, erect spinules densely cover the aedeagal surface ventrally and laterally; reddish spinules are grouped in a triangle on the dorsal surface of the large lobe basally and continued dorsomedially to the small knob (Fig. 42).

FIGURES 39–41. *Skwala compacta*: 39. Habitus (Photograph by M. Tiunov). 40. Type, male abdominal tip, dorsal, pinned. (Photograph by D. Goodger). 41. Same, recent material, dorsal. (Photograph by T. Tiunova).

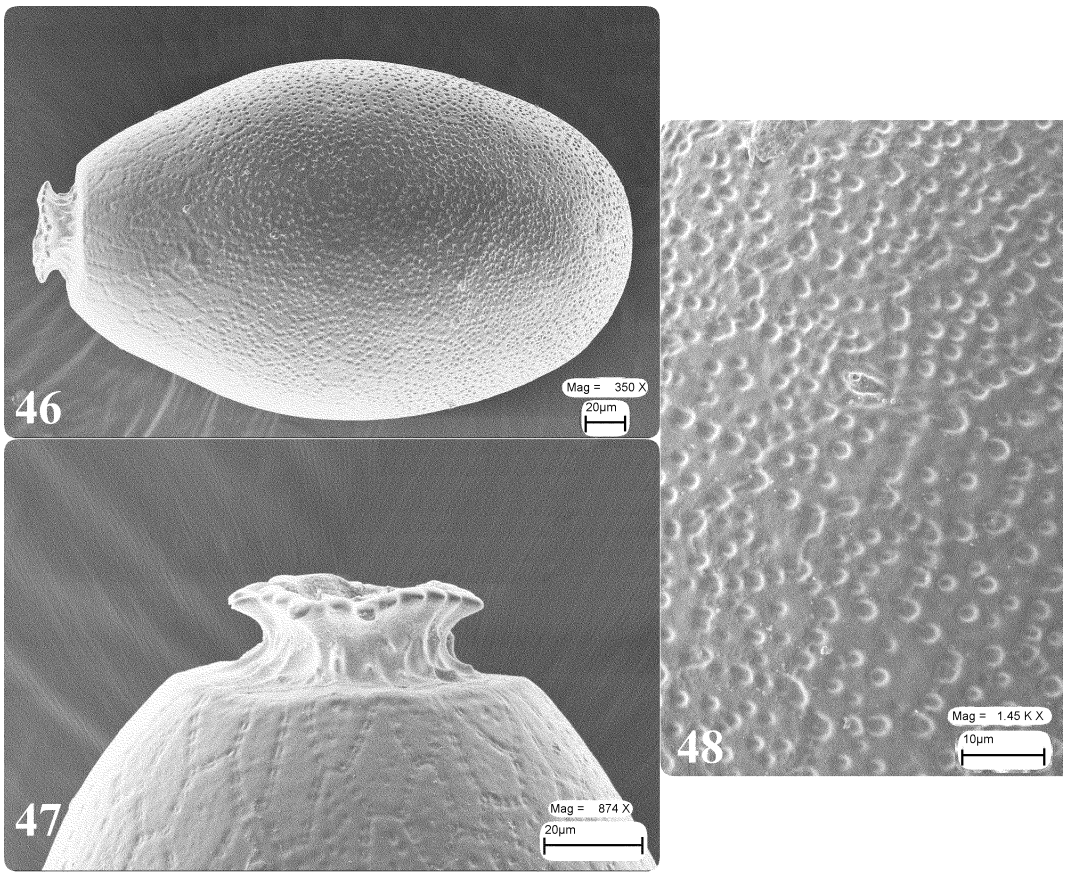
Female is larger than male and similar to male in shape and color. Body length 12.0−16.2 mm, forewing 14.0−17.5 mm, wingspan 30.0−37.0 mm. Sternum 8 is pale medially. The subgenital plate is large, extends laterally from the sides of sternum 8, and reaches almost half the length of sternum 9; the posterior margin is slightly rounded and sclerotized, with two shallow notches medially (Fig. 45). The subgenital plate is covered with small, darkish setae. Sterna 9, 10 are pale, sternum 9 with two brownish rounded spots mesolaterally (Fig. 45).

Egg is spindle-shaped (Fig. 46) and circular in cross-section, 315–350 x 229–250 µm. The collar is stalked, its rim irregularly incised; the sides of collar bear several sharp longitudinal carinae; the shoulder is low (Fig. 47). The

chorion is covered with closely packed hexagonal FCIs; the FCI walls are thin, consisting of shallow furrows; the floors flat with 4-8 small punctations medially (Fig. 48). The row of micropyles is subequatorial; their orifices are small with indistinct lips, some set on micropylar mounds and surrounded by pentagonal rosettes (Fig. 48).



FIGURES 42–45. *Skwala compacta*: 42. Male abdominal tip and aedeagus, dorsal. 43. Male left hemitergal lobe, dorsal. 44. Cowl: sclerites of the internal basal anchor, lever arm, epiproct, lateral stylet, lateral. 45. Female abdominal tip, ventral. Scale (mm): 43, 44 = 1.0.



FIGURES 46–48. *Skwala compacta*, egg: 46. Habitus lateral. 47. Collar, lateral. 48. Chorion structure, micropylar orifice, mound, and pentagon rosettes, dorsal view.

Material examined. Lectotype, male (pinned), *D. compacta* McLachlan (*Dictyopteryx*), [McL. label] / Sibir. orient. (Maa(c)k) / *compacta* McL. / *Dictyopteryx compacta* McL. The type-series in BMNH includes three paralectotypes (Kimmins 1970). Siberia, Eastern Sayan Mountains, Krasnoyarskyi Region, 12 males, 6 females, Bazaikha River, Yenisey R. Basin, 20.05.1959, coll. I. Levanidova. Far East, Prymorskyi Region, 18 males**,** 10 females, Partisanskaya River, near Frolovka settelment, 29.04.1989, coll. E. Makarchenko.

Distribution. Russia (Siberia, Far East), Mongolia, Japan.

Remarks. The Lectotype of *D. compacta* is in close agreement with the description of this species by McLachlan (1872). The type of *D. compacta* is in poor condition, the abdomen fragmented during cleaning, making a study of the internal structure of the epiproct impossible. However, the shape of the hemitergal lobes, lateral stylets present, and the short, blunt, spoon shaped epiproct (Fig. 40) suggests that the species should be transferred to *Skwala* Ricker 1943 with the valid name *Skwala compacta* (McLachlan) **comb. nov.** *Skwala pusilla* (Klapálek, 1912) is therefore a subjective junior synonym of *Skwala compacta* (McLachlan, 1872) **syn. nov.**

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References

Brinck, P. (1949) Studies on Swedish stoneflies (Plecoptera). *Opuscula Entomologica*, 11, Lund, 250 pp.

Brinck, P. (1956) Reproductive system and mating in Plecoptera. *Opuscula Entomologica*, 21, 57–127.

Despax, R. (1951) Plécoptères. *Faune de France*, 55, 280 pp.

DeWalt, R., Neu-Becker, U. & Steuber, G. (2012) *Plecoptera Species File Online*. Version 1.1/4.0, http://Plecoptera.SpeciesFile.org

Illies, J. (1955) Steinfliegen oder Plecoptera. *Die Tierwelt Deutschlands*, 43, 150 s.

Illies, J. (1966) Katalog der rezenten Plecoptera. *Das Tierreich, Berlin*, 82, 632 s.

International Code of Zoological Nomenclature. (1999) *The International Trust of Zoological Nomenclature, Fourth edition*, London, xxix + 306 pp.

Kimmins, D. (1970) A list of the type-specimens of Plecoptera and Megaloptera in the British Museum (Natural History). *Bulletin of the British Museum (Natural History) Entomology*, 24, 335−361.

Klapálek, F. (1904) Evropske druhy čeledě Dictyopterygidae. *Rozpravy Česke Akademie (Praha)*, 2, 1−10.

Klapálek, F. (1912) Plécoptères I. Fam. Perlodidae. *Collections Zoologiques du Baron Edmond de Sélys-Longchamps. Bruxelles*, 4, 1–66.

Kondratieff, B. C. (2004) Perlodidae-Perlodinae (The Springflies). *In*: Stark B.S. & Armitage B.J. (Eds.), *Stoneflies (Plecoptera) of Eastern North America*. *Vol. 2. Chloroperlidae, Perlidae, and Perlodidae (Perlodinae)*. Ohio Biological Survey, pp. 149–180.

Koponen, J. (1949) Neue oder wenig bekannte Plecoptera. *Annales Entomologici Fennici. Helsinki*, 15, 1–21.

Levanidova, I. & Zhiltzova, L. (1979) An annotated list of the stoneflies (Plecoptera) of the Soviet Far East. *Internationale Revue der Gesamten Hydrobiologie*, 64, 551–576.

Lillehammer, A. (1988) *Stoneflies (Plecoptera) of Fennoscandia and Denmark. Fauna Entomologica Scandinavica*. Brill E.J. & Scandinavian Science Press Ltd., Leiden, 165 pp.

Lillehammer, A. (1974) Norwegian stoneflies I. Analysis of the variations in morphological and structural characters used in taxonomy. *Norsk Entomologisk Tidsskrift*, 21, 59–107.

Loskutova, O. (2006) *Fauna of the European North-East of Russia. Stoneflies.* 9. Nauka Publishing House, Sankt-Petersburg, 224 pp (in Russian).

McLachlan, R. (1872) Perlides. *In*: Non-Odonates (Second part, Materiaux pour une fauna nevropterologique de l'Asie septentrionale), by de Selys-Longchamps & McLachlan. *Annales de la Société entomologique de Belgique* (Bruxelles), 15, 47−55.

Okamoto, H. (1912) Erster Beitrag zur Kenntnis der Japanischen Plecopteren. *Transactions of the Sapporo Natural History Society,* 4 (1911-1912), 105–170.
Raušer, J. (1968) Plecoptera. Ergebnisse der zoologischen Forschungen von Dr. Z. Kazsab in der Mongolia. *Entomologische Abhandlungen Staatliches Museum fur Tierkunde in Dresden*, 34, 398 s.
Ricker, W. (1943) Stoneflies of Southwestern British Columbia. *Indiana University Publications, Science Series 12*. Indiana University Press, Bloomington, 145 pp.
Ricker, W. (1952) Systematic studies in Plecoptera. *Indiana University Publications, Science Series 18*. Indiana University Press, Bloomington. 200 pp.
Ricker, W. (1964) Distribution of Canadian stoneflies. *Gewasser und Abwasser*, 34/35, 50–71.
Stark, B. & Szczytko, W. (1981) *Skwala brevis* (Koponen) from Japan (Plecoptera: Perlodidae). *Aquatic Insects*, 3, 61−63.
Stark, B. & Szczytko, W. (1988) Egg morphology and phylogeny in Arcynopterygini (Plecoptera: Perlodidae). *Journal of the Kansas Entomological Society*, 61, 143−160.
Stewart, K.W. & Stark, B.P. (2002) *Nymphs of North American Stonefly Genera (Plecoptera).* 2nd edition, The Caddis Press, Columbus, Ohio, pp. 1–510.
Stewart, K. & Oswood, M. (2006) *The stoneflies (Plecoptera) of Alaska and western Canada.*The Caddis Press, Columbus, Ohio. pp. 1–325.
Teslenko, V. (2006) Review of the stonefly fauna (Plecoptera) of the East-Manchurian Mountains. *In*: Makarchenko E.A (Ed.), *Flora and Fauna of "Kedrovaya Pad" Reserve*, Dalnauka, Vladivostok, pp. 63–90 (in Russian).
Teslenko, V. & Zhiltzova, L. (2009) *Keys to the stoneflies (Insecta, Plecoptera) of Russia and adjacent countries. Imagines and larvae.* Dalnauka, Vladivostok, 1–382 pp (in Russian).
Teslenko, V., Bazova, N. & Matafonof, D. (2010) Stoneflies (Insecta, Plecoptera) of the Eastern tributaries of Baikal Lake. *Eurasian Entomological Journal*, 9, 331–340 (in Russian).
Uchida, S. (1992) Taxonomic problems on the stoneflies (Insecta: Plecoptera) from the Far East of Russia, Korea and Japan. *Studies of the structure and function of river ecosystems of the Far East. Report of the work supported by Japan Society for Promotion of Sciences*, 1991, 2−3.
Zapekina-Dulkeit, J. (1960) Three new species of Plecoptera in the mountain Altai and Sayan Mountains. *Revue d'Entomologie de I'URSS*, 39, 666−670 (in Russian).
Zhiltzova, L. (1964) Order Plecoptera – Stoneflies. *In:* Bei-Bienko, G. Y. (Ed.), *Keys for the insects of the Europian part of USSR. I. Apterygota, Palaeaodictyoptera, and Hemimetabola.* Nauka Publishers, Moscow-Leningrad, pp.177–200 (in Russian).
Zhiltzova, L. (1966) The stoneflies (Plecoptera) of the European part of USSR (without Caucasus). *Entomological Review,* 45, 525−549 (in Russian).
Zhiltzova, L. (1982) New data on stonefly fauna (Plecoptera) of Sakhalin. *Biology of the freshwater animals of the Far East.* FESC AS USSR. Vladivostok, 115–124 (in Russian).
Zhiltzova, L. (1995) Catalog of type specimens in the collection of the Zoological Institute, Russian Academy of Sciences. Plecoptera. Zoological Institute. Sank Petersburg, 38 pp. (in Russian).
Zhiltzova, L. & Levanidova, I. (1978) New species of stoneflies (Plecoptera) from Far East. *Trudy Zoologicheskogo instituta AN USSR*, 61, 3−29 (in Russian).
Zhiltzova, L. & Zapekina-Dulkeit, Y. (1986) Order Plecoptera – stoneflies. *In:* P.A. Ler (Ed.), *Key for Insects of the Soviet Far East. I. Apterygota, Palaeaodictyoptera, and Hemimetabola.* Nauka Publishers, Leningrad, pp.172–234 (in Russian).
Zwick, P. (1973) Insecta: Plecoptera. Phylogenetisches System und Katalog. *Das Tierreich. Walter de Gruyter, Berlin,* 94, i-xxxii+465 pp.
Zwick, P. (2004) Key to the West Palaearctic genera of stoneflies (Plecoptera) in the larval stage. *Limnologica,* 34, 315–348.
Zwick, P. (2010) New species and new records of Plecoptera from Korea and the Russian Far East. *Illiesia,* 6, 75–97.
Zwick, P., Levanidova, I. & Zhiltzova, L. (1971) On the fauna of Plecoptera from the Soviet Far East. *Revue d'Entomologie de I'URSS*, 50, 849–869.