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Archaeopodagrion armatum sp. nov. from Ecuador (Odonata: Megapodagrionidae)

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Abstract

Archaeopodagrion armatum sp. nov. is described and illustrated (holotype ♂: Ecuador, Zamora Chinchipe Prov., forest S of Zamora (4°07'18"S, 78°58'22"W), 02 iv 2008, leg. KJT; in FSCA). The new species is distinct from *A. bicorne* and *A. bilobatum* by the pair of highly recurved processes on the hind margin of the prothorax of both sexes, and a hair pencil and preapical spike-shaped process on the dorsal surface of the male paraprocts.

Resumen

Archaeopodagrion armatum sp. nov. es descrita e ilustrada (holotipo ♂: Ecuador, Provincia de Zamora Chinchipe, selva al S de Zamora (4°07'18"S, 78°58'22"O), 02 iv 2008, leg. KJT; en FSCA). La nueva especie se diferencia de *A. bicorne* y *A. bilobatum* por el par de procesos fuertemente recurvados del margen posterior del protórax en ambos sexos, y por el pincel de pelos y el proceso preapical en forma de púa en la superficie dorsal de los paraproctos del macho.

Introduction

The genus *Archaeopodagrion* Kennedy, 1939 contains two poorly known species recorded only from Ecuador (Kennedy 1939, 1946). The first species known, *A. bicorne* Kennedy, 1939 was recently rediscovered near the type locality (Tennessen 2006), but *A. bilobatum* Kennedy, 1946 has not been found since its description and is known only from the type male (Garrison et al. 2003). While collecting Odonata in southern Ecuador, we encountered a third species of this enigmatic genus.

Material and methods

Illustrations were made with aid of camera lucida on a stereomicroscope. All measurements were made under a binocular microscope with an ocular micrometer. Total length measurements include the caudal appendages, in contrast to abdomen length measurements. Wing nomenclature follows Riek & Kukalová-Peck (1984). Pterostigma length was measured along the costa and includes the widths of the enclosing proximal and apical crossveins.

Abbreviations:

AL – abdomen length
DRP – Dennis R. Paulson, collection, Seattle, Washington, USA
FSCA – Florida State Collection of Arthropods, Gainesville, Florida, USA
HfL – hind femur length
HwL – hind wing length
JTJ – Jim T. Johnson collection, Vancouver, Washington, USA
KJT – Kenneth J. Tennessen
Pthx – prothorax
PtL – pterostigma length (hind wing)
RWG – Rosser W. Garrison collection, Sacramento, CA, USA
TL – total length

Archaeopodagrion armatum sp. nov.

(Fig 1; Plate IIIb)

Etymology

From Latin 'armatum' (armed), an adjective referring to the spike-shaped dorsal process on male paraprocts.

Specimens examined

Holotype ♂, Ecuador, Zamora Chinchipe Province, small forested stream S of Zamora (4°07'18"S, 78°58'22"W; 1,080 m), 02 iv 2008, leg. KJT (FSCA). — **Paratypes,** 5 ♂, 1 ♀, same locality and date as holotype, leg. JTJ, KJT (JTJ, RWG, DRP, FSCA).

Holotype

Head: Eyes in life dark brown dorsally, tan yellow ventrally; labium tan; labrum, base of mandible, and gena tan light blue; postclypeus mostly tan gray except

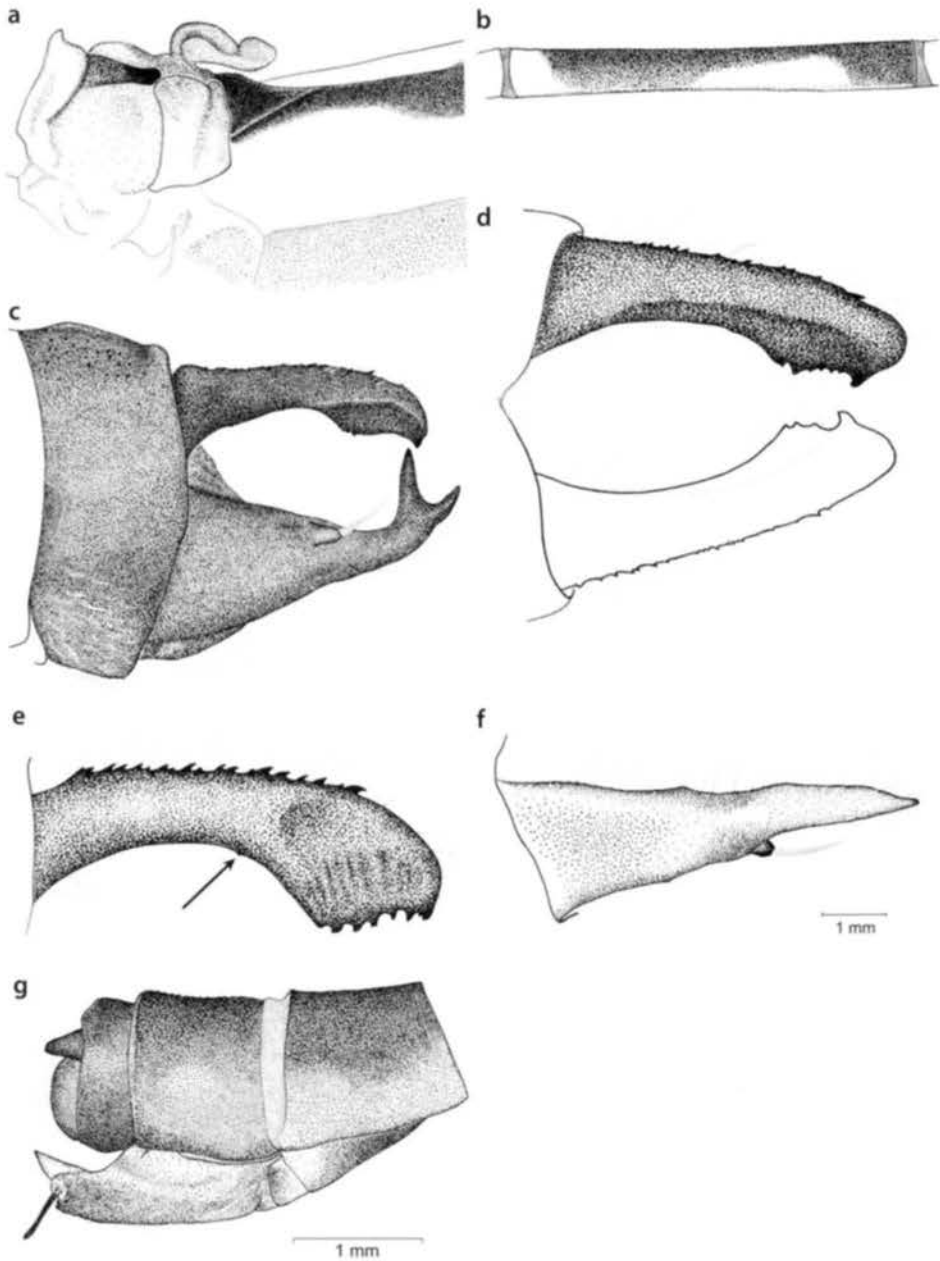

Figure 1: *Archaeopodagrion armatum* sp. nov., male holotype and female paratype — (a) male pronotum and anterior portion of pterothorax, dorso-lateral view; (b) male S4, left lateral view; (c) male S10 and anal appendages, lateral view; (d) male cerci, dorsal view; (e) male left cercus, ventrolateral view; (f) male right paraproct, ventral view; (g) female S8-10, right lateral view.

darker brown medially and with a black antero-lateral mark on each side; frons rounded, black; vertex, occiput, and rear of head black; antennomere 1 tan, antennomere 2 light brown at base but mostly dark brown, remainder of antenna dark brown.

Thorax: Prothoracic anterior and middle lobes tan dorsally, paler gray-tan laterally; middle lobe with deep medial depression extending to posterior portion of middle lobe; posterior lobe developed into a pair of large, recurved flaps, tan laterally, dark brown medially, projecting dorsally above level of Pthx (Fig. 1a). Middorsal carina of pterothorax black, middorsal black stripe narrow in basal half (0.35 mm wide at narrowest point), widening in distal half to 0.80 mm; antehumeral stripe tan with blue tinge, posthumeral stripe obscure brown, 0.65 mm wide at midlength; metepisternum blue tan, metapleural fossa dark brown, metepimeron yellow tan, venter tan with green tinge. Coxae yellow tan, femora mostly gray tan except apex black, tibiae darker tan, tarsal segments darker still, claws yellow-tan with distinct supplementary tooth; leg spines black, 2-4 times longer than spaces between bases of adjacent spines (spacing increases distally). — Wings stalked beyond level of CuP; greatest width of Hw 1/5 its length; no supplementary sectors between IR_1 and RP_2; Px 16-17 in Fw, 15-16 in Hw; Pt black-brown with very narrow pale edges next to enclosing black veins.

Abdomen: S1-10 black-brown dorsally, S1 yellow laterally and ventrally, S2-7 with narrow basal pale yellow mark connected to yellow lateral mark (Fig. 1b). Cercus black, in lateral view ca 1.8 times length of S10 measured along dorsum, slightly arched, narrowest about midlength (Fig. 1c), apex rounded with 7 or 8 preapical ventral teeth (Fig. 1e), in dorsal view curved inward slightly (Fig. 1d), a minute tooth near midlength visible only in ventrolateral view (Fig. 1e); numerous small stout denticles and short hairlike setae along entire dorsal length of cercus. Paraproct in lateral view slightly longer than cercus, with a dorsolateral, apically-directed hair pencil, 0.25 mm long (composed of 3 setae) based on an elongate tubercle at midlength of paraproct, and with a preapical, triangular, dorsally-projecting spike-like process approximately 0.25 mm long (Fig. 1c); paraprocts in ventral view tapering to acuminate apex, tubercle of hair pencil visible (Fig. 1f). Posterior hamule quadrate, flat. Genital ligula identical to that of *A. bicorne* (Kennedy 1939), segment 1 with a row of setae on each side, inner fold absent, and distal segment with a pair of long, apical, strap-like coiled filaments.

Measurements: TL 40.5; AL 32.3; HwL 24.0; HfL 4.0; PtL 1.55; cercus 0.98.

Female paratype

Coloration similar to holotype, with exceptions noted.

Head: Antennomeres 1 and 2 darker than holotype; postclypeus black medially.

Thorax: Color pattern of pterothorax similar to holotype except middorsal stripe not as narrow in anterior half, 0.45 mm anteriorly, 0.65 mm at widest posterior

point. Mesostigmal laminae hidden by large hind lobes of Pthx. Posthumeral stripe faint brown, rest of side of pterothorax green-tan. Femur tan with a series of small, light gray dorsal spots.
Abdomen: S8 without vulvar spine; S10 about 0.4 times length of S9. Cercus conical, apex rounded and extending slightly beyond broad paraprocts (Fig. 1g). Ovipositor mostly dark brown, apex of gonapophyses extending beyond tips of cerci and paraprocts, ventral edge of valves with 8 minute spinules, increasing in stature distally, and with numerous hairlike setae (Fig. 1g); left stylus broken, right stylus straight, slightly spatulate apically, 0.43 mm long.
Measurements: TL 36.5; AL30.6; HwL 26.0; HfL 4.2; PtL 1.60; cercus 0.35.

Variation in male paratypes

In four males, the postclypeus is mostly black with a small pale antero-lateral spot on each side, resembling *A. bicorne* (Kennedy 1939). The black middorsal stripe in all the paratype males is not as narrowed anteriorly as in the holotype. Minor variations in morphology include: (1) in two males, the small tooth on the ventro-medial margin of the cercus is indiscernible, whereas in two other males this small tooth is slightly more developed than in the holotype, although on one cercus the tooth is rounded; (2) the preapical spike-shaped process on the paraproct is slightly stouter at the base in two males, slightly longer in one, and the hair pencil is slightly shorter in two males.
Measurements: TL 37.5-41.0; AL 30.5-33.5; HwL 22.5-23.5; HfL 3.5-3.9; PtL 1.1.50-1.60; cercus 0.95-1.01. Px in Fw 15-18, in Hw 13-15.

Diagnosis

Archaeopodagrion possesses a combination of characters that distinguishes it from the nine other South American genera currently placed in Megapodagrionidae. The legs are relatively short (hind femur shorter than pterothorax) and the quadrangle is long (ratio maxL/maxW > 4.5), differentiating it from *Allopodagrion* Förster, 1910, *Megapodagrion* Selys, 1885, and *Teinopodagrion* De Marmels, 2001. The presence of highly developed prothoracic lobes that cover the mesostigmal laminae in both sexes separates *Archaeopodagrion* from the other genera except *Sciotropis* Rácenis, 1959. *Sciotropis* wings have three supplementary sectors between veins IR_1 and RP_2 (Rácenis 1959; Garrison et al. 2010) whereas *Archaeopodagrion* lacks supplementary sectors. In wing venation, the genus appears to be allied also to *Oxystigma* Selys, 1862 and *Philogenia* Selys, 1862 with a long quadrangle and petiolation beyond the cubito-anal crossvein (to mid-level of the quadrangle). The presence of two postquadrangular cells resembles *Philogenia*, whereas the open venation is more similar to *Oxystigma* (Lencioni 2005). However, both of these genera have supplementary sectors between IR_1 and RP_2.

In addition, the male paraprocts in *Philogenia* and *Oxystigma* are at most half the length of the cercus compared to longer than the cerci in *Archaeopodagrion*.

A. armatum males are most easily distinguished from the two other described species in the genus by the quadrangular, recurved processes on the prothorax (Fig. 1a), and by the sharp triangular dorsal projection and long hair pencil on the dorsal surface of the paraproct (Fig. 1c). Each hair pencil is comprised of three or four long, stiff but apically flexible, tapering setae. Hair pencils on the paraprocts are unusual structures within Zygoptera. To our knowledge, the only other megapodagrionid that has a paraproct with a dorsolateral tubercle and hair pencil is *Hypolestes* Gundlach, 1888 of the Antilles; however, the setae are very short (< 0.1 mm long) and not tightly clustered. Other New World Zygoptera that possess tubercles and hair pencils on the paraprocts are several genera of Calopterygidae (Garrison 1990, 2006).

The cercus of *A. armatum*, which resembles that of *A. bicorne* more than *A. bilobatum*, is only slightly curved in dorsal view; the medial tooth at midlength, which is large and visible in dorsal view in *A. bicorne*, is minute or absent in *A. armatum*, and if present it can be seen only in ventrolateral view (Fig. 1f). The cercus of *A. bilobatum* is highly arched in lateral view and has a small medial tooth between ¼ and ⅓ of its length; the paraprocts are longer than the cerci (Kennedy 1946). Females of *A. armatum* and *A. bicorne* can be distinguished by the distinctive shapes of the processes on the prothoracic hind lobe: in *A. armatum*, the processes are large, quadrate, recurved plates (as Fig. 1a) whereas in *A. bicorne* they are small, sub-triangular, barely curved lobes situated laterally (Kennedy 1939). The female of *A. bilobatum* is unknown.

Biological notes

Individuals of *A. armatum* are difficult to find because they blend in with their surroundings. Their mostly brown, somewhat mottled color pattern makes them almost undetectable as they perch on vegetation in the shade. We found them under closed canopy, a short distance (10-50 m) from a small shaded stream (< 1 m wide), around midday. They perched on narrow stems with wings spread out horizontally, abdomen oriented downward, within one meter of eye level on the upslope of a trail. They were not active and did not fly far upon disturbance; even in flight they were hard to detect. These observations might explain in part why the genus has been seldom found, although they are probably very local and rare forest damselflies susceptible to habitat disturbance. Other odonates found in the vicinity of the small stream were *Philogenia mangosisa* Bick & Bick, 1988, *Polythore procera* (Selys, 1869), and *Polythore terminata* Fraser, 1946.

J.J. Daigle (pers. comm.) found a male of *A. bicorne* at a small, shaded tributary of the Río Anzu, Ecuador, Pastaza Prov., 12 km N of Mera (1°25'5.3"S, 78°3'9.5"W; 1,215 m) perched in full sun ca 30 cm above ground on leaves of open bladed plant similar to wild potato. It was facing the stream, wings spread open. In life,

the thoracic stripe was greenish-yellow, blending to yellow on venter, and the eyes were dark brown/black above, light brown/green below. The only other species of Odonata we found at this stream were *Mnesarete hauxwelli* (Selys, 1869), *Ormenophlebia imperatrix* (McLachlan, 1878), *Heteragrion aequatoriale* Selys, 1886, *Philogenia redunca* Cook, 1989, and *Palaemnema* sp.

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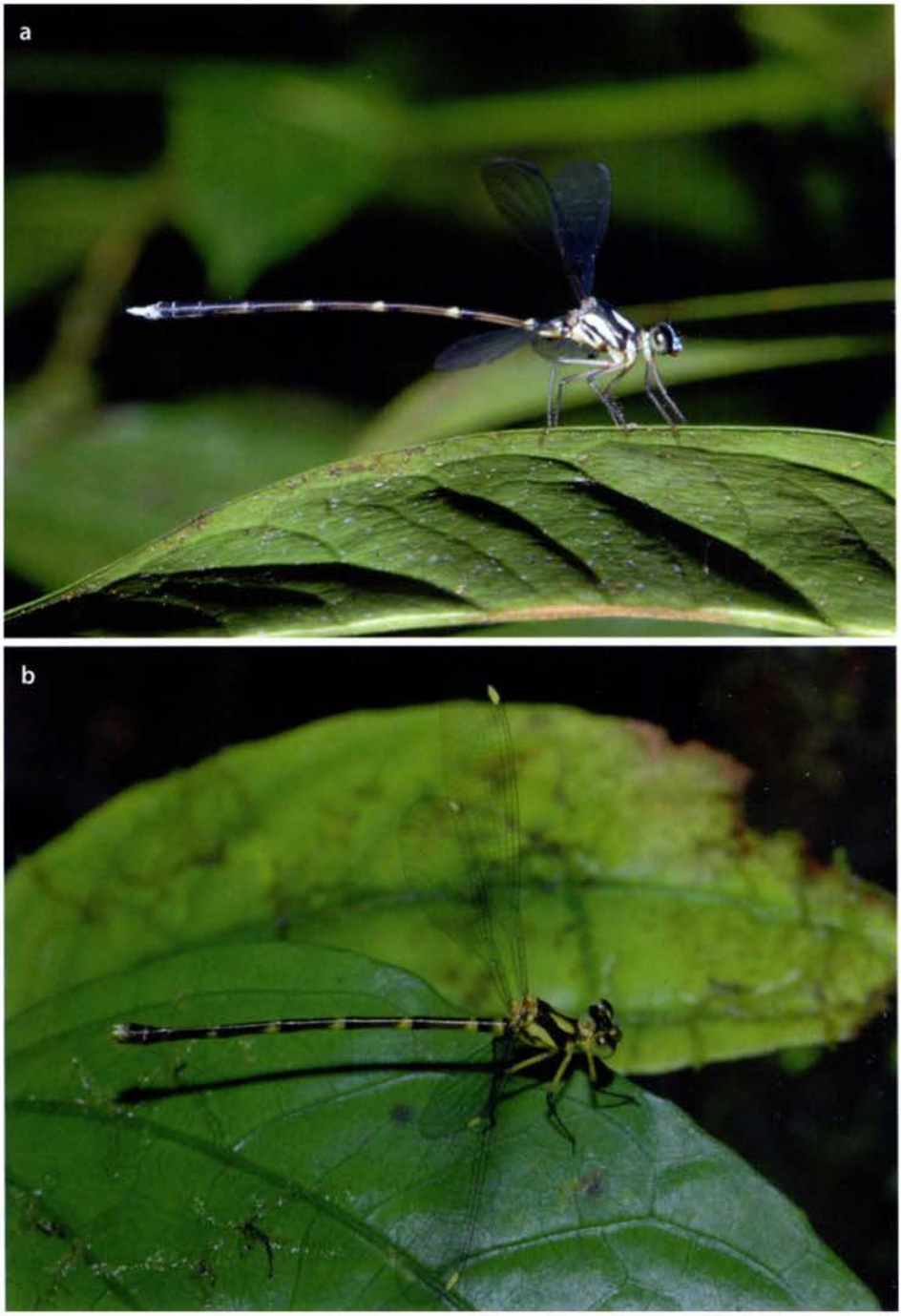
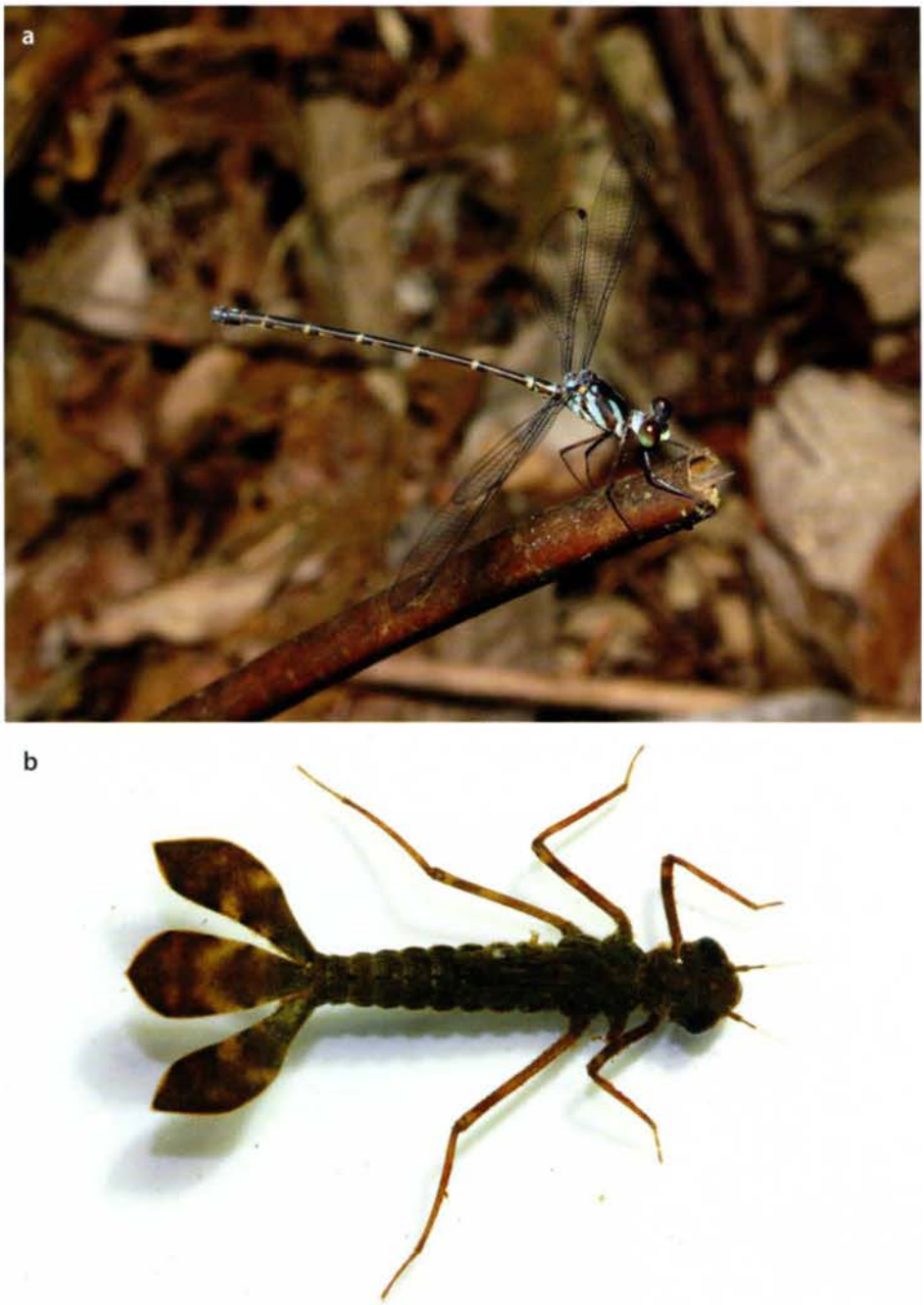
Colour plate I: *Coenagrion glaciale* in Europe — (a) male, near Khaimusovo (loc. 3); (b) female, near Maletino (loc. 2). Arkhangelsk oblast, European Russia, 7 July 2009. Photos by BD (a) and RB (b).



Colour plate II: *Argiolestes muller* sp. nov. — (a) male, Western Province, Papua New Guinea, 16 ii 2008; (b) female, same data. Photos by SJR.

Colour plate IIIa: *Argiolestes roon* sp. nov. — male, Indonesia, West Papua Province, Roon Island, 12 xi 2008. Photo by DAP.

Colour plate IIIb: *Archaeopodagrion armatum* sp. nov., male — small forested stream south of Zamora, Zamora-Chinchipe Province, Ecuador, 2 April 2008. Photo by JTJ.



Colour plate IV: *Podolestes orientalis* from West Malaysia — (a) mature male at a shady pool at Bangi Forest Reserve, 28 February 2009; (b) final stadium larva, 21 February 2009 collected from the same pool. Note the broad and flattened caudal lamellae of the larva that are horizontally inserted and oriented. Photos by CYC.