

**DESCRIPTION OF THE LAST INSTAR LARVA OF
ARGIA BARRETTI CALVERT
(ZYGOPTERA: COENAGRIONIDAE)**

R. NOVELO-GUTIÉRREZ

Departamento de Entomología, Instituto de Ecología, A.C. Apartado Postal 63,
MX-91070 Xalapa, Veracruz, Mexico
rodolfo.novelo@inecol.edu.mx

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The larva of *A. barretti* is described for the first time and compared with those of *A. harknessi* from Mexico and *A. joergenseni* from Argentina. Based upon larval characters these 3 spp. appear closely related, mainly by features such as: similar colour pattern of antennae, femora and caudal lamellae; mandibular formula; size of ligula; one palpal seta; shape of male and female gonapophyses, and the presence of claviform setae on abdominal sternite 8 and gonapophyses.

INTRODUCTION

Despite being one of the most speciose odonate genera in the New World (about 110 species [GARRISON, 1994]), not much work was done with the immature stages of *Argia* Rambur during the last 15 years. The larvae of only five species were described in this period, viz. *A. pima* Garrison and *A. sabino* Garrison (HOEKSTRA & SMITH, 1999), *A. funcki* (Selys) (NOVELO-GUTIÉRREZ & GOMEZ-ANAYA, 2006), *A. adamsi* Calvert (DE MARMELS, 2007), and *A. joergenseni* Ris (VON ELLENRIEDER, 2007). WESTFALL & MAY (1996) keyed some species but without providing a formal description. In this paper, I describe and illustrate the previously unknown last instar larva of *A. barretti* Calvert.

***ARGIA BARRETTI* CALVERT, 1902**

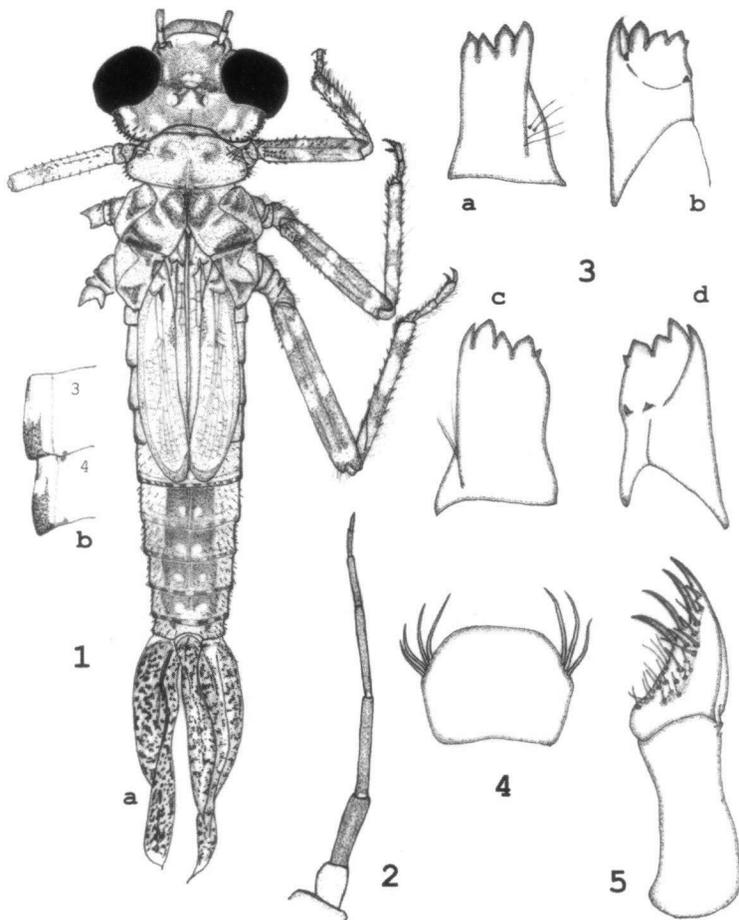
Figures 1-12

M a t e r i a l. – 7 last instar larvae (4♂, 3♀), 4 exuviae (2♂, 2♀) (emerged in the field), 4 penultimate instar larvae (2♂, 2♀), 5 younger instars. MEXICO: Puebla; Municipality of Tlacuilotepec, Km 1 road 130, Río San Marcos (180 m asl), 24-VII-1987, 6♂, 4♀; – 30-IV-1991, 5♂, 5♀, all R.

Novelo leg. Deposited in Colección Entomológica del Instituto de Ecología, A.C. (IEXA), Xalapa, Mexico.

DESCRIPTION. — Exuviae yellow, larvae light brown to brown, caudal appendages notoriously darker than body; body stout and short.

Head. — Wider than long, posterior margin widely concave, dorsal color pattern as in Fig. 1a. Cephalic lobes rounded with a laterodorsal, wide, pale band; posterolateral margins bearing stout spiniform setae. Labrum setose, brown;



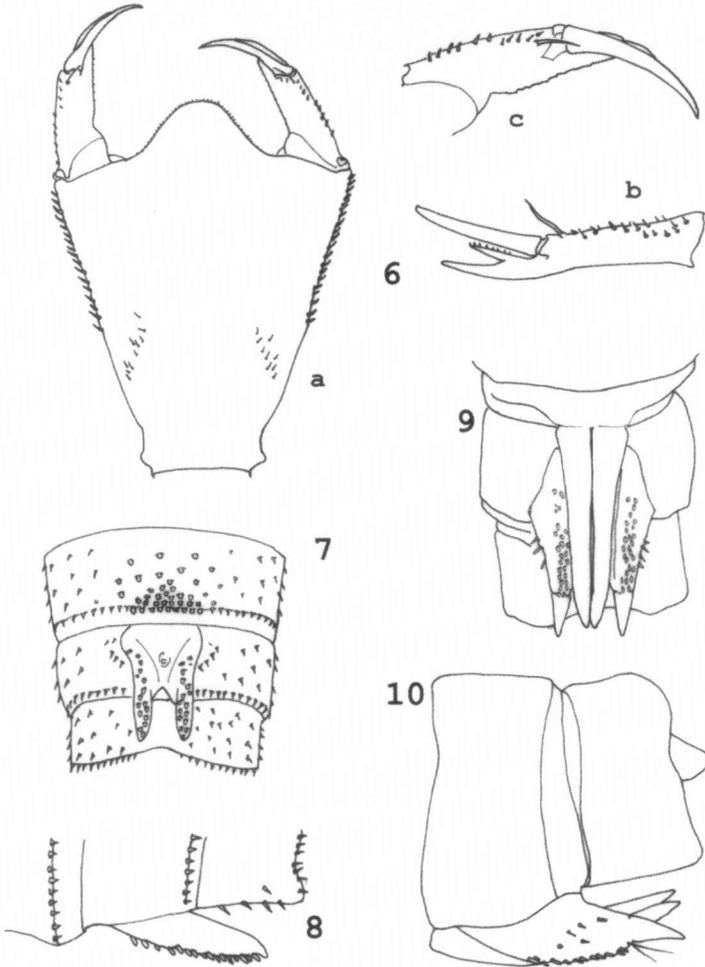
Figs 1-5. *Argia barretti* larva: (1a) last instar, dorsal view (left legs and antennal flagellomeres omitted); — (1b) detail of lateral margin of sternites 3-4, ventral view; — (2) left antenna, dorsal view; — (3) mandibles: (a-b) right mandible, external and ventrointernal view, respectively; (c-d) left mandible, external and ventrointernal view, respectively; — (4) hypopharynx, ventral view; — (5) left galeolacinia, ventral view.

clýpeus smooth, pale. Antennae 7-segmented (Fig. 2), longer than head, scape short and pale, remainder antennomeres brown; size proportion of antennomeres (from basal to apical): 0.4, 0.6, 1.0, 0.8, 0.5, 0.3, 0.15. Mandibles (Fig. 3) with molar teeth but lacking molar crest, with following formula (sensu WATSON, 1956): L 1'1234 0 a b, R 1'1234 y a 0. Ventral pad of hypopharynx subquadrangular, with a tuft of 6-7 long setae located subapically to each anterolateral corner, and a transverse row of smaller setae on anterior margin (Fig. 4). Maxilla: Galeolacinia (Fig. 5) with 6 teeth, three dorsal teeth approximately of the same size, three ventral teeth of different size, apical one the longest, a row of stiff setae preceding both ventral and dorsal teeth. Labium pale to light brown. Prementum-postmentum articulation reaching posterior border of procoxae. Prementum 0.75 times as wide as long (Fig. 6a), with a row of 19-21 spiniform setae along distal half of lateral margins, and a group of 10-11 basidorsal spiniform setae; ligula very prominent (2.5 times wider at its base than long), with closely set minute claviform setae on distal margin. Premental palp with two end hooks shorter than movable hook, the ventral one (medial) the longest (Fig. 6b); internal margin of palp finely serrate, external margin of the smaller end hook with a row of minute, sharp denticles; palp with one long setae basal to movable hook, and an irregular row of 18-20 short, stout, claviform setae along dorsal margin (Fig. 6c).

T h o r a x. — Pronotal disc with some scattered, long setae and spiniform setae on anterodorsal surface; lateral margins strongly convex, dark, and covered with spiniform setae. Synthorax mostly pale, with one large, dark spot on each mesepisternum, and a transverse dark band on each mesepimeron along interpleural suture (Fig. 1a). Wing sheaths pale, anterior pair reaching basal half of tergite 4, posterior pair surpassing posterior margin of tergite 4. Legs rather short (i.e. tip of tibia not reaching posterior margin of tergite 10 when fully extended), pro- and mesotibiae longer than respective femora, metafemora and metatibiae of the same length. Femora with three external, wide, dark bands usually connected with each other by a thin line at middle, the apical band forms a complete ring around the femora, the pale intervening spaces very reduced (Fig. 1a); tibiae with three dark rings narrower than intervening pale spaces; dorsal and ventral borders of femora, external surface of profemora, and internal and external borders of tibiae with robust spiniform setae, these spiniform setae intermingled with long setae on tibiae; apicointernal border of tibiae with some large, robust, reddish, claviform setae intermingled with abundant, tridentate setae.

A b d o m e n. — Wider at base and gradually narrowing caudally. Tergites with a variable, complex, color pattern, but usually pale at sides with a wide, parallel sided, dark band along the midline; this band with pale dashes as shown in Fig. 1a. Lateral margins of segments 1-6 with a dark blotch on apical half (Fig. 1b); lateral margins of tergites 1-5 slightly convex, straight on 6-10; tergites 1-4 smooth, 5-10 with spiniform setae, scattered on 5 and increasingly abundant caudally; a

tuft of long white setae along midline of tergites 3-10. Sternites 1-5 smooth, 6 smooth at middle with scattered spiniform setae at sides, 7 with spiniform setae, and claviform setae only on posterior margin, 8 with spiniform setae at sides and abundant claviform setae on the middle, as well as on posterior margin, 9-10 with spiniform setae only (Fig. 7). Male gonapophyses (Figs 7-8) long, parallel, spat-

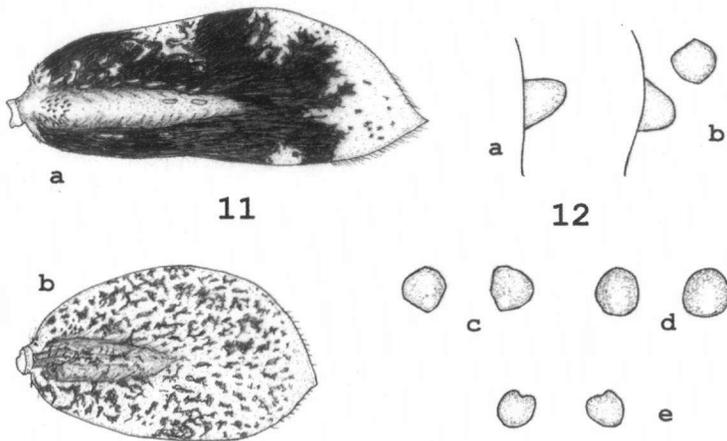


Figs 6-10. Details of the morphology of *A. barretti* larva: (6) labium: (6a) prementum, dorsal view; – (6b) frontal view of left palp; – (6c) dorsal view of left palp; – (7) sternites 8-10 of male showing the distribution of claviform and spiniform setae, and gonapophyses in ventral view; – (8) left lateral view of segments 8-10 of male showing gonapophyses; (9) sternites 9-10 of female showing gonapophyses in ventral view; – (10) left lateral view of segments 9-10 of female showing gonapophyses and cerci.

ulate, extending posteriorly to basal 0.60 of sternite 10, tips blunt and slightly divergent; ventral border with 16-24 stout, claviform setae. Female gonapophyses (Figs 9-10) exceeding posterior margin of 10 by 0.25 length of 10; laterals, in ventral view (Fig. 9), with tips blunt, ventral border with 23-29 stout, claviform setae on basal 0.80; in lateral view as in Fig. 10; central ones smooth and slightly shorter than lateral ones. Gills (Fig. 11): With moderately acuminate tips. Lateral gills (paraprocts) strongly inflated on basal 0.50 on external side (Fig. 11a), apical 0.50 laminar, 2.5 times longer than its widest part; lateroexternal carina with an ambarine tint, extending along basal 0.20 of length of gill and bearing stout, long, spiniform setae; dorsal and ventral borders smooth, with some whitish, delicate setae on apical 0.20, remainder lacking any kind of stout setae except at very extreme base where a subbasal ring of spiniform setae is present; two color patterns are exhibited: (1) Most of the gill with a dark coloration with some well defined pale areas (Fig. 11a), and (2) a mottled pattern, in which a pale background is more or less uniformly spattered with dark dots (Fig. 11b). Central gill (epiproct) slightly inflated at basal 0.40 on both sides (Fig. 11b), almost 2 times longer than its widest part; lateral carinae extending on basal 0.15 of length of gill and bearing stout spiniform setae; dorsal and ventral borders and color pattern as described for lateral gills. Male cerci short (Fig. 12), globulous, roundly pointed. Female cerci triangular in dorsal view, cylindrical in lateral view (Fig. 10).

Measurements (in mm). — Only last instar larvae (N=7): total length (without gills): 12.2-14.7; maximum width of head: 3.8-4.1; hind femur: 3.6-4.3; gills: laterals, 3.0-5.6; central 2.9-4.2.

REMARKS. — *A. barretti* larvae inhabit open, wide, shallow streams. At Río San Marcos they were found crawling under cobblestones where the water flow



Figs 11-12. Details of the morphology of *A. barretti* larva: (11) caudal lamellae: (11a) left lamella (paraproct); — (11b) central lamella (epiproct); — (12) male cerci: (a) lateral view; — (b) laterodorsal view; — (c) caudal (posterior) view; — (d) dorsal view; — (e) ventral view.

was very slow or none, and close to the shoreline. Three individuals (1♂, 2♀) were observed at the time of emergence which occurred on small rocks, in vertical position, between 12:15 and 13:47 h in a sunny day during the dry season (30-IV-1991).

DISCUSSION

Argia barretti falls into the group of *Argia* larvae with very prominent ligula and one palpal seta (sensu NOVELO-GUTIÉRREZ, 1992). It shows a great resemblance to larvae of *A. harknessi* Calvert (NOVELO-GUTIERREZ, 1992) and *A. joergenseni* Ris (VON ELLENRIEDER, 2007), sharing with them the following features: Antennal scape pale, remainder antennomeres brown; ligula strongly prominent; premental palp with one seta; femora with dark bands wider than intervening pale spaces; sternite 8 with abundant claviform setae on the middle; male gonapophyses spatulate, bluntly pointed, beset with claviform setae on ventral border; female gonapophyses bluntly pointed, lateral valvae slightly longer than central valvae and with abundant claviform setae on ventral border; male cerci globulous; caudal lamellae (gills) inflated basally, with a short acuminate tip, ventral and dorsal borders free of stout spiniform setae.

On the other hand, the larva of *A. barretti* can be separated from that of *A. harknessi* by the following features (those of *A. harknessi* in parentheses): sternite 6 with scattered spiniform setae mainly at sides, posterior margin with a row of small spiniform setae (sternite 6 lacking setae or sometimes 2 or 3 setae at sides, posterior margin quite smooth); posterior margin of sternite 7 with abundant claviform setae on the middle third and close-set spiniform setae at sides (posterior margin of sternite 7 smooth on middle third, scattered spiniform setae at sides). Likewise, the larva of *A. barretti* can be distinguished from that of *A. joergenseni* mainly by the color pattern of abdominal tergites: light brown at sides with a complex pattern of dark spots along dorsal midline in *A. barretti* (Fig. 1a), dark brown with a medio-longitudinal pale stripe in *A. joergenseni* (VON ELLENRIEDER, 2007, fig. 2). Also, according to figure 2 of VON ELLENRIEDER (2007), the width of abdominal segments is more or less uniform in *A. joergenseni*, but wider at basal segments and gradually narrowing caudad in *A. barretti*.

Judging by the great morphological resemblance of the larvae of these three species, and their preference for a similar habitat (they inhabit rocky streams crawling under stones), I think they conform a natural group also including to *A. pipila* Calvert and *A. insipida* Hagen, the other two species closely related to *A. barretti* according to GARRISON (1994).

Based exclusively upon the larvae, I consider *A. barretti* and *A. harknessi* as the closest relatives, and according to their present distribution, a vicariant process of speciation appears as the most plausible. *A. barretti* is found in the northern part of the states of Puebla, San Luis Potosí, Tamaulipas and Nuevo León

(GONZÁLEZ-SORIANO & NOVELO-GUTIÉRREZ, 2007), following to the North through southern Texas in the USA (GARRISON, 1994). It is an eastern species. *A. harknessi* occurs mainly along the Pacific states (Oaxaca, Guerrero, Nayarit) and Morelos, being rather a western species. Thus, the principal mountain chains of Mexico (Sierra Madre Oriental, Sierra Madre Occidental and Transversal Neovolcanic Axis) could have been acting as barriers, triggering the speciation. The discovery of the *A. pipila* and *A. insipida* larvae will provide evidence to support or reject this hypothesis.

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