

The larva of *Libellula foliata* (Kirby, 1889) (Odonata: Libellulidae)

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Abstract The larva of *Libellula foliata* (Kirby) is described based upon mature larvae from the Biosphere Reserve of “El Triunfo” in the state of Chiapas. It belongs to the small group of species without dorsal protuberances, *L. composita* (Hagen), *L. comanche* Calvert and *L. saturata* Uhler. The following combination of characters permits the separation of *L. foliata* larva from the other aforementioned larvae: tergites 6–10 uniformly colored, no lateral spines on segments 8–9, 5–6 palpal setae and 3 long premental setae. After this finding, only the larvae of *Libellula gaigei* Gloyd and *L. nodisticta* Hagen remain undiscovered for the Mexican species of *Libellula*.

Keywords Odonata · Libellulidae · *Libellula foliata* · Larval description · Chiapas · Mexico

Introduction

The Holarctic genus *Libellula* L. comprises 30 species known to date (I have followed the criteria of Garrison et al. (2006) who consider *Ladona* Needham and *Plathemis* Hagen as subgenera of *Libellula* L.). In Mexico 12 species occur, of which the larvae of only 6 species have been formally described: *L. auripennis* Burm., *L. luctuosa* Burm.

and *L. lydia* Drury (Needham 1901), *L. herculea* Karsch (De Marmels 1982), *L. saturata* Uhler (Needham 1904), and *L. subornata* (Hagen) (Levine 1957). Larvae of *L. comanche* Calvert, *L. croceipennis* Selys, and *L. needhami* Westfall were keyed and tabulated by Needham and Westfall (1955), and keyed in Needham et al. (2000).

In this paper I describe the larva of *L. foliata* (Kirby) by supposition, based upon two mature larvae collected at the Biosphere Reserve of “El Triunfo” in the state of Chiapas. I collected these larvae in a small stream where several adults of *L. foliata* were reproducing; no other species of *Libellula* has been collected previously at this locality. Only three species of *Libellula* (*croceipennis*, *foliata*, and *herculea*) have been recorded in Chiapas (González-Soriano and Novelo-Gutiérrez 2007); the larvae described here differ greatly from *L. croceipennis* and *L. herculea* larvae, and thus I am reasonably confident they belong to *L. foliata*.

Libellula foliata (Kirby)

Material Two F0 larvae (females). Mexico, Chiapas; Municipality of Angel Albino Corzo, Reserva de la Biosfera “El Triunfo,” 15° 39' 51" N; 92° 48' 49" W, elevation 1,979 m asl, cloud forest, 14-V-2005, R. Novelo leg; deposited at Colección Entomológica del Instituto de Ecología, A.C., Xalapa (IEXA).

Description Larvae reddish yellow, hairy, mainly on legs, without any particular color pattern (Fig. 1).

Head Wider than long (Fig. 2), with moderately abundant, long, stiff, dark red setae mainly on clypeus and occiput; occipital margin almost straight, cephalic lobes rounded, not bulging, with longitudinal rows of combined short and long, stiff, red and yellow setae. Anterolateral compound eyes

This is a contribution to the Festschrift for Michael L. May.

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Fig. 1 Last larval stadium of *Libellula foliata*, dorsal view

small, extending dorsally above the surface of the cranium. Antennae seven-segmented (Fig. 3), seventh antennomere the longest, relative size proportion of antennomeres: 0.5, 0.5, 0.8, 0.5, 0.6, 0.8, 1.0, basal half of scape dark, remainder of antenna yellow, with some scattered, delicate, white setae along antennomeres. Labrum mostly reddish brown, with a mesobasal, oval, pale spot, apical margin moderately setose; clypeus bare, anteclypeus yellow, postclypeus mostly yellow with a reddish brown, irregular spot on lateral margins. Mandibles (Fig. 4), with formula $R\ 123\ y^- a\ b' b$ (Figs. 4a, c) / $L\ 1234\ 0\ a\ b' b\ b^2$ (Figs. 4b, d) (Watson 1956); teeth $b' b\ b^2$ on left mandible conform a vestigial, low, rounded molar crest (Fig. 4b). Ventral pad of hypopharynx subrectangular, transverse, more than twice wider than long, with long, stiff, robust setae on margins, and short, stiff setae on ventral surface (Fig. 5). Maxilla: galeolacinia with seven long, robust incurved teeth (Fig. 6), and a row of long stiff setae; palp incurved, ending in a robust spine, with

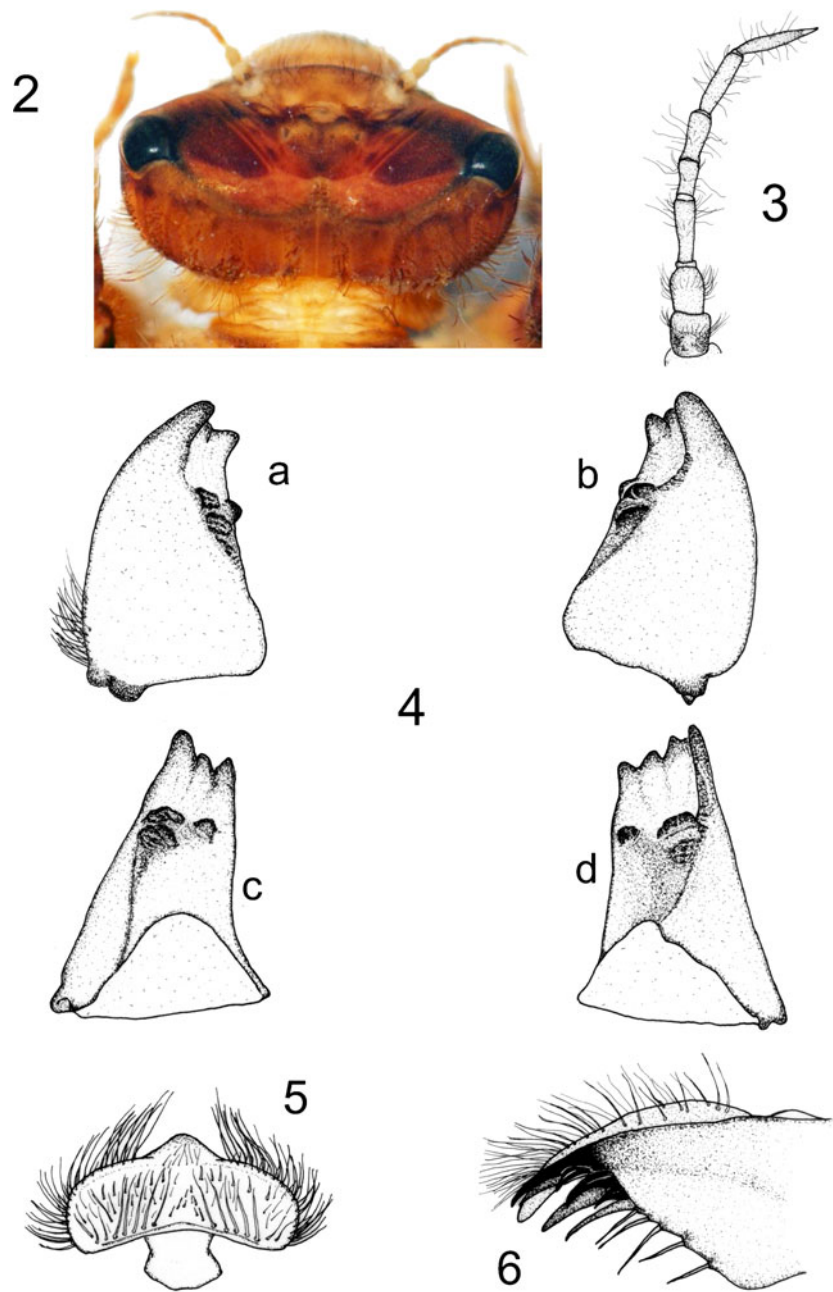
abundant, stiff, long setae on its external surface. Labium: prementum-postmentum articulation reaching posterior margin of procoxae. Prementum (Fig. 7a) subrhomboidal, with 3 long, laterodorsal setae to each side of prementum plus a series of 16–17 small setae arranged more or less in 3 longitudinal rows to each side of a basal, central, deep excavation (Fig. 7a); lateral margins slightly concave and widely divergent, with a row of 5–6 small, stiff setae on laterodorsal middle third, 5–6 short, stout, stiff setae and a tuft of delicate setae on base of palp articulation; ligula very prominent (Fig. 7b), its distal margin finely serrulated, with 24–25 small setae, its dorsal surface with numerous, minute, spiniform setae; labial palp (Figs. 7a, c) with 5–6 long setae, and numerous, minute spiniform setae on basal internal surface, dorsal margin with a row of 22–23 small, stout, spiniform setae, and a row of abundant, short, hair-like setae along the dorsoexternal border, distal margin with 11 crenulations moderately developed, each crenulation finely serrulated with 3–4 spiniform setae on the inner surface, inferior seta much longer than remaining setae; movable hook short and sharply pointed.

Lateral sclerites of neck enlarged, with lateral margins rounded and beset with a tuft of long, white setae.

Thorax Pronotal disc subrectangular, more than twice wider than long, anterior margin slightly concave, posterior margin convex, lateral margins rounded, anterior and posterior margins with short, reddish setae, lateral margins with long, abundant, yellow, stiff setae; most of dorsal surface bare except for a row of short, abundant, reddish setae along midline; inferior margin of propleura setose. Legs long (i.e., when fully extended, hind legs surpassing tip of abdomen), coxae, trochanters and tarsi yellow to reddish yellow, femora reddish to reddish brown, tibiae reddish, femora and tibiae with abundant, long, stiff, reddish setae, apices of tibiae with large and stout spine-like setae, also with bi- and tridentate setae on apicointernal surface of protibiae; pro- and mesotarsi with a double row of short, stout, spine-like setae, with intermingled long setae on distal tarsomere; metatarsi with an external row of long, robust, spine-like setae, and an internal row of tridentate setae; claws simple with a pulvilliform empodium. Wing pads mostly reddish, reddish brown basally; anterior wing pads reaching basal 0.50 of S5, posterior wing pads reaching posterior margin of S5.

Abdomen Little more than twice longer than its maximum width, more or less parallel-sided, reaching its maximum width at S6, S1–5 reddish yellow, S6–9 light reddish brown, S10 dark reddish brown, dorsal protuberances lacking, instead a tuft of long and short, red, stiff setae along midline of tergites 2–9 (Fig. 8), posterior margins of 4–10 with short, reddish setae; lateral margins lacking spines but those of 2–

Figs. 2–6 Details of the morphology of the larva of *L. foliata* **2**) Head, dorsal view **3**) Right antenna, dorsal view **4**) Mandibles: **4a** and **c**, right mandible; **4b** and **d**, left mandible (**a** and **b**, ventral view; **c** and **d**, internal view) **5**) Hypopharynx, ventral view **6**) Galeolacinia, ventral view



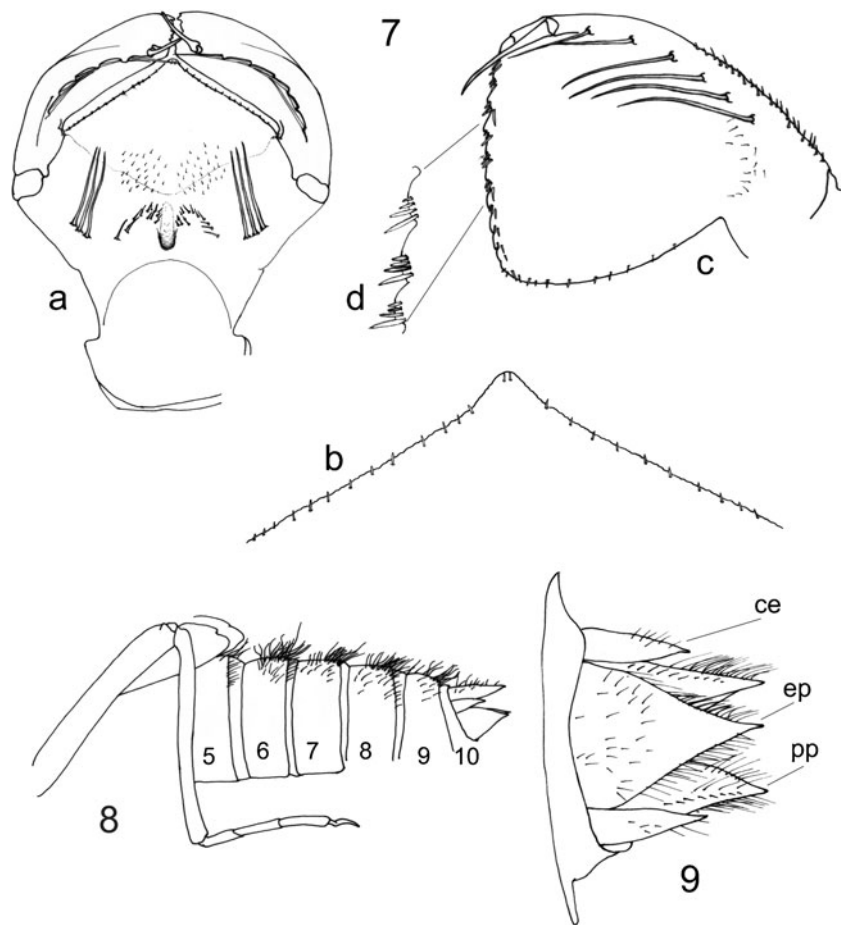
10 with rows of small, white setae. Sternites 1–9 yellow, 10 reddish brown, sternites 3–5 divided in 5 plates, sternites 2 and 6–9 divided in 3 plates. Caudal appendages pyramidal (Fig. 9), sharply pointed; epiproct reddish brown, with tip reddish yellow, basal width 0.78 its length, with long, reddish brown, stiff setae on dorsum, lateroventral margins with short, stout, yellow setae, lateral margins with long, white delicate setae; cerci and paraprocts yellow on dorsum and venter, dark brown at sides, tips yellow; cerci with short, reddish brown setae on surface; paraprocts with long, yellow setae on dorsal and lateral borders, and on ventral surface; relative size (measured

laterally along the midline): epiproct 1.0, paraprocts 0.83, cerci 0.56.

Measurements (in mm) Total length (including app.) 25.3–27.2; abdomen (ventral) 14.5–15.7; maximum width of head 6–6.2; hind femur (dorsal) 5.1–6.2; epiproct 1.6–1.8; cerci 1.0; paraprocts 1.5.

Remarks Larvae of *Libellula foliata* were found in a swampy area of an open small creek running through a deforested area of cloud forest, with abundant, emergent grasses, in a silt and mud substrate.

Figs. 7–9 Details of the morphology of the larva of *L. foliata* **7**) Labium: **7a**, prementum, dorsal view; **7b**, ligula; **7c**, right palp, dorsointernal view; **7d**, detail of palp crenulations, internal view **8**) Abdominal tergites 5–10 showing the tufts of setae on middorsal line, left profile **9**) Caudal appendages, dorsal view: ep, epiproct; ce, cercus; pp, paraproct



Discussion

The larva of *Libellula foliata* belongs to a small group of species without dorsal protuberances, comprised of *L. composita* (Hagen), *L. comanche* Calvert, and *L. saturata* Uhler. It is easily separated from these three species by [features of other species in brackets]: tergites 6–10 uniformly colored [a distinct brown stripe on either side of midline in *L. composita* (Needham et al. 2000)]; no lateral spines on segments 8–9 [short lateral spines present in *L. comanche* (Needham et al. 2000)]; 5–6 palpal setae and 3 long

premental setae [8–9 palpal setae and 4–5 long setae on prementum in *L. saturata*]. Furthermore, the larva of *L. foliata* can be separated from the other two species inhabiting Chiapas by features shown in Table 1.

After this finding, only the larvae of *Libellula gairgei* Gloyd and *L. nodisticta* Hagen remain undiscovered for the Mexican species of *Libellula*.

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Table 1 Larval features of some Mexican species of *Libellula*. *Recorded in Chiapas

Species/features	Palp setae	Long premental setae	Small premental setae	Abdominal dorsal protuberances	Abdominal lateral spines
<i>L. croceipennis</i> *	9–10	5–6	In one row	3–8	8–9 or minute
<i>L. herculea</i> *	9–10	6	In one row	3–8	8–9
<i>L. foliata</i> *	5–6	3	In three rows	Lacking	Lacking
<i>L. saturata</i>	8–9	4–5	In three rows	Lacking	Minute on 8–9

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