

THE LARVA OF *BYRSOPTERYX MIRIFICA* FLINT, WITH AN ASSESSMENT OF THE PHYLOGENETIC PLACEMENT OF THE GENUS WITHIN THE LEUCHOTRICHIIINI (TRICHOPTERA: HYDROPTILIDAE)

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SUMMARY

The first detailed description and illustrations of the larva of *Byrsopteryx*, based on *B. mirifica* Flint from Venezuela and an undescribed species from Costa Rica, are provided. Mature final instar larvae are recognizable by their large, laterally compressed abdomens, heavily sclerotized thoracic nota and abdominal tergites, especially those of segments VIII and IX, paired depressed or lacunate areas located anterolaterally on the pronotum, and freely portable silken cases. Larvae and adults of *Byrsopteryx* share characteristics with both the Stactobiini and Leuchotrichiini and placement of the genus within the Leuchotrichiini is investigated.

INTRODUCTION

Flint (1981) established the genus *Byrsopteryx* for the Venezuelan species *B. mirifica*. In the same paper, he transferred the Dominican species *Alisotrichia septempunctata* Flint to *Byrsopteryx* and hesitantly placed the genus in the endemic New World tribe Leuchotrichiini. However, larvae of *B. mirifica*, here described in detail and illustrated for the first time, as well as adults of known *Byrsopteryx* (adults of *B. mirifica* are here diagnosed and reillustrated) display characters of both the Leuchotrichiini and the Stactobiini. These re-descriptions have allowed us to reevaluate the placement of the genus within the Leuchotrichiini. In addition to *B. mirifica* and *A. septempunctata*, we have four undescribed species from Costa Rica, indicating that the genus is more speciose than previously known. Specimens examined are deposited in the U.S. National Museum of Natural History (NMNH) and the University of Minnesota Insect Collection (UMSP).

BYRSOPTERYX FLINT

Type species: *Byrsopteryx mirifica* Flint 1981, by original designation.

Diagnosis: Adult *Byrsopteryx* are small, 2–3 mm total length, and easily recognized by the prominent white or greenish spots on the dark fuscous thorax and forewings. Also, the central area of the forewing is thickened and there is a distinct “line of weakness” (Flint 1981) separating a posterobasal area (Fig. 1I). Both wings have reduced venation and, in addition, the hind wing bears a patch of hooked setae near its middle costal border (Fig. 1I). Antennae are simple and 17 segmented, three ocelli are present, the mesoscutum has a transverse suture, and the metascutellum is subpentagonal (Fig. 1H). Spurs are 0-3-4 (Fig. 1G). Tergum X is lobe-like and membranous, the inferior appendages are fused and turned downward apically, the subgenital plate is thin and stylet-like, and there are sclerotized lateral processes (forked in *B. mirifica*) associated with segment IX (Fig. 1A–E). The phallic apparatus is short, broad, and cylindrical and has a constricted, complex medial area. For the sake of completeness, the female genitalia of *B. mirifica* are illustrated in Fig. 1F. In *B. mirifica* the bursa copulatrix is lightly sclerotized, oval in the center and narrow anteriorly. The posterior part of the structure is covered by a pair of large membranous lobes. As yet, we have not examined additional female *Byrsopteryx* so we are unable to determine any differences between species. Mature final instar larvae are recognizable by their large, laterally compressed abdomens, heavily sclerotized thoracic nota and abdominal tergites, especially those of segments VIII and IX, and the paired depressed or lacunate areas located anterolaterally on the pronotum. We found no obvious differences between the larvae of *B. mirifica* and larvae of an undescribed species from Costa Rica.

Biology: In Costa Rica adult *Byrsopteryx* rarely come to lights. They are most frequently encountered in the sunlight where they actively run in apparent zig zag or random fashion over rocks or vegetation adjacent to their larval habitat. This activity, coupled with their contrasting white and dark coloration, makes them

resemble tiny ants rapidly moving over substrate. When approached they quickly stop and freeze in position. We have not observed them actually flying. Larvae are madicolous and are found in the spray and splash zones of small waterfalls and mountain streams where they apparently scrape diatoms and associated periphyton from the substrate. The case is freely portable. Prior to pupation, larvae aggregate above the waterline in pits or depressions on the sides of boulders.

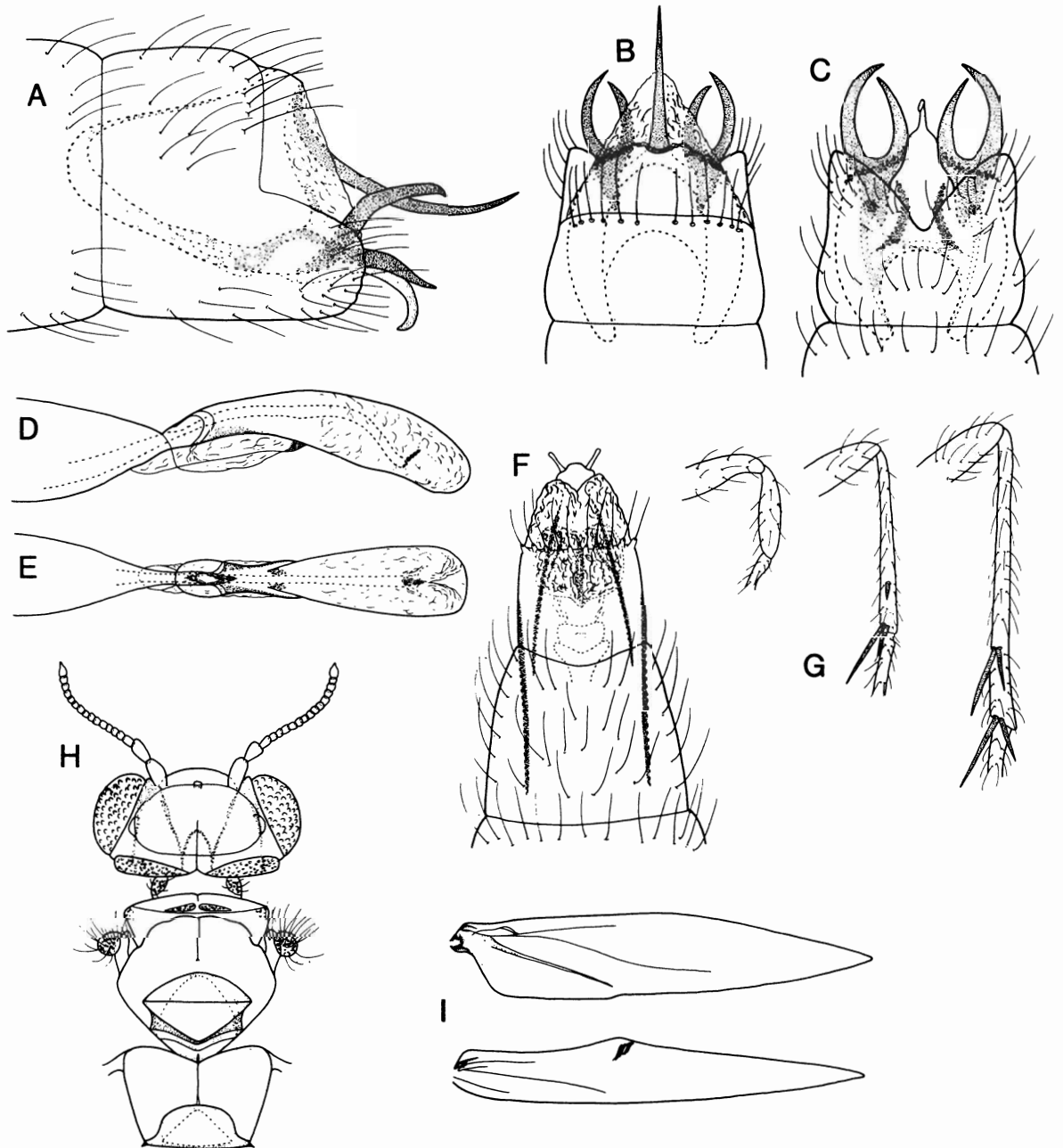


Fig. 1. *Byrsopteryx mirifica* Flint. A–C, male genitalia, lateral, dorsal, and ventral, respectively, D–E, phallic apparatus, lateral and ventral, F, female genitalia, ventral, G, legs, H, head and thorax, dorsal, I, wings.

BYRSOPTERYX MIRIFICA FLINT

Byrsopteryx mirifica Flint 1981: 27, fig. 121–126, male, female, larva, Venezuela, NMNH (type 76625).

Adult: For formal description see Flint (1981)

Larva: Head (Fig. 2A, 2B, 2I): oval, frontoclypeal and coronal sutures indistinct; microscopic setae forming reticulate pattern on dorsum and sides of head capsule (Fig. 2I, inset); head setal pattern as in Fig. 2I, seta 9 very long and prominent; antenna one-segmented with long terminal seta; mandibles somewhat elongate, with medial setal brush, without prominent teeth; head pigmentation unicolorous brown, unpigmented ventrally and around eyes. Thorax (Fig. 2A, 2B): thoracic nota heavily sclerotized, dark brown, each about as broad as long and bearing very long, slender anterolateral setae; pro- and mesonota with approximately medial, transverse sclerotized ridge, this ridge much less well developed on metanotum; pronotum with middorsal ecdysial line, pair of anterolateral depressed or lacunate areas, and pair of short, stout anterolateral setae, remaining pronotal setae short and distributed as in Fig. 2B; structure and setation of meso- and metanota as in Fig. 2B, each without middorsal ecdysial lines; meso- and metathoracic plura large, crecentric, heavily sclerotized; pair of very thin, elongate ventrolateral sclerites present intersegmentally between pro- and mesothorax and between meso- and metathorax; legs (Fig. 2E–G) short, stout, similar in size, shape, and setation. Abdomen (Fig. 2A): strongly laterally compressed, segments IV–VII especially so; all abdominal segments with tergal sclerites, abdominal tergites I and II especially heavily sclerotized, resembling thoracic nota, abdominal tergites III–VII lightly sclerotized, broader than long and bearing many setae, abdominal tergites VIII and IX very heavily sclerotized and platelike forming dorsal operculum closing the posterior opening of the case, their edges carinate, bearing lateral fringe of short setae as well as both long slender setae and short, stout setae on dorsal surfaces as illustrated in Fig. 2H; lateral sclerite of anal proleg (Fig. 2A, inset) large, quadrate, heavily setose; anal claw short, stout, with basal peglike seta. Length of larvae 2.1–3.0 mm (n = 10). Gut contents of larvae examined (n = 3) consisted almost exclusively of diatom skeletons and associated material.

Larval Case (Fig. 2C): Constructed entirely of silk with bits of detritus and mineral material incorporated; strongly laterally compressed, with poorly closed dorsal seam, ventral seam lacking; dorsal border undulate; anterior and posterior openings semicircular. Oval cocoon spun inside case at pupation. Length of case 2.2–3.0 mm (n = 10).

Material Examined: VENEZUELA: Aragua: Río Limón, Estación Piscicultura, 16.ii.1976, C.M. and O.S. Flint, Jr., ca. 70 larvae, pupae, male and female metamorphotypes (NMNH) (*B. mirifica*). **Other material examined:** COSTA RICA: Puntarenas: roadside seep, route 2, just west km 234, 8.976°N, 83.299°W, el. 100 m, 20.ii.1986, Holzenthal, Morse, Fasth, 20 larvae (UMSP) (*Byrsopteryx* n.sp.).

DISCUSSION

The phylogenetic position of *Byrsopteryx*, as noted by Flint (1981), is equivocal. Adults and larvae of the genus share characteristics typically assigned to either the Stactobiini or Leuchotrichiini (Marshall 1979) (Table 1). For example, the metascutellum of *Byrsopteryx* is subpentagonal resembling the shape found in leuchotrichiines (Marshall 1979, fig. 83). This sclerite is elongate subrectangular in stactobiines (Marshall 1979, fig. 62–64). Similarly, the phallic apparatus of *Byrsopteryx* has some similarity to the typical leuchotrichiine phallus, in that there is more complexity medially than in stactobiines, but it lacks the central “basal loop” and “window” (Marshall 1979, fig. 84). On the other hand, the head and antennae are unmodified in *Byrsopteryx* and most Stactobiini and these two taxa usually do not display the often bizarre male secondary sexual modifications seen in some Leuchotrichiini (Marshall 1979, fig. 90, 91). The unusual wing venation seen in *Byrsopteryx* has been observed in most stactobiine genera (Harris and Flint, unpublished data), although the medial setal patch of the hind wing has not been observed in stactobiines.

Larvae more closely resemble known stactobiines in that the abdomen and case are more laterally compressed and the case is freely portable as opposed to the very flat, fixed cases found in described leuchotrichiine larvae. Yet, *Byrsopteryx* larvae share with Leuchotrichiini the presence of median notal sutures on the prothorax only; all thoracic nota have median sutures in Stactobiini. Members of both tribes as well as *Byrsopteryx* are madicolous and share similar habits and habitats.

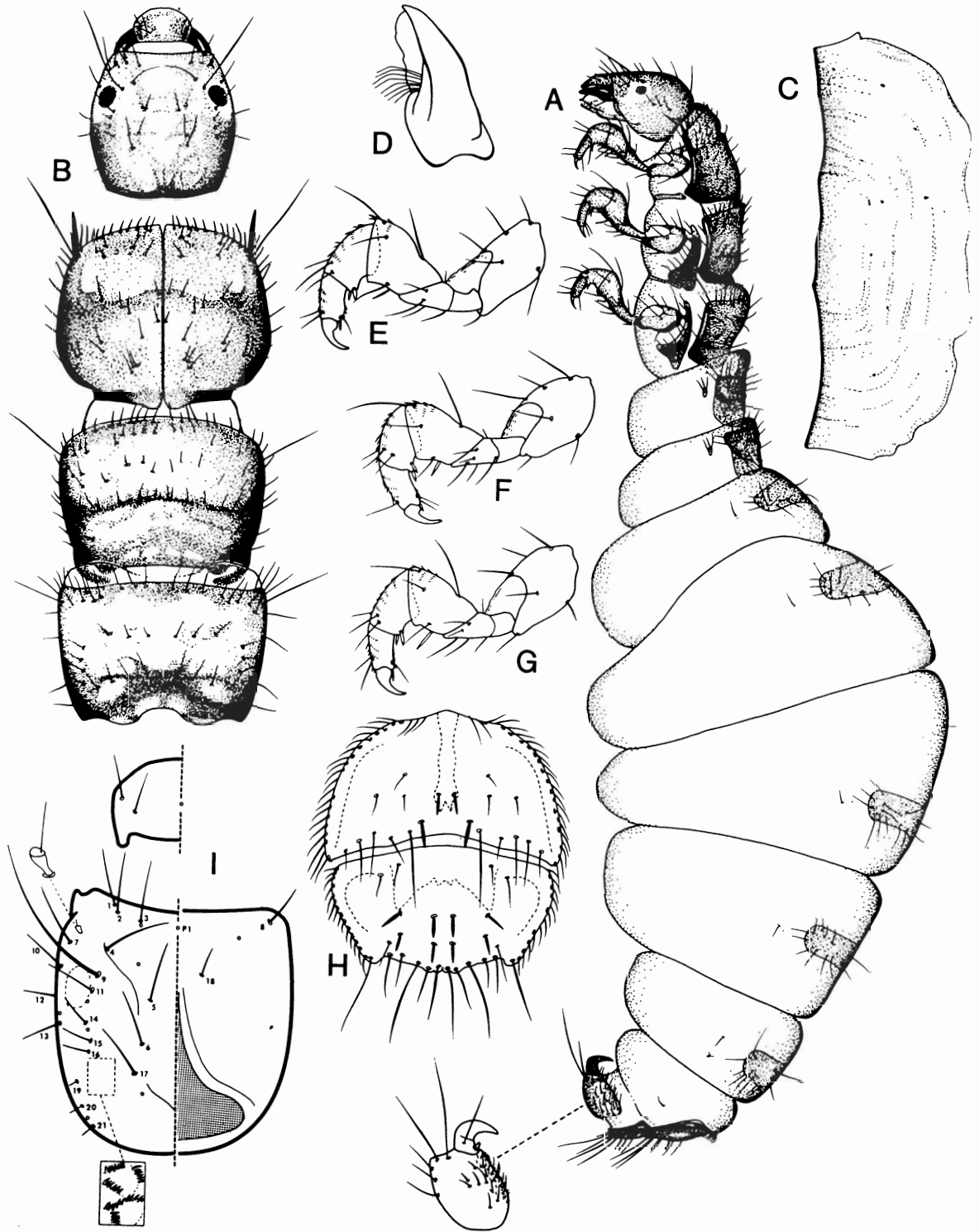


Fig. 2. *Byrsopteryx mirifica* Flint. Larva and case. A, larva, lateral, abdominal proleg and anal claw, inset; B, head and thorax, dorsal; C, case, lateral; D, right mandible, dorsal; E-G, fore, mid, and hind leg, respectively; H, abdominal tergites VIII-IX, dorsal; I, head and labrum setal pattern (labrum detached), left half dorsal, right half ventral.

Table 1. Distribution of selected characters in larvae and adults of Stactobiini, Leuchotrichiini and *Byrsopteryx*. (Marshall 1979; Harris and Flint, unpublished data).

Character	Stactobiini	Leuchotrichiini	<i>Byrsopteryx</i>
Adult			
Antennae	usually unmodified	basal segments often modified	unmodified
Head	usually unmodified	often modified in male	unmodified
Metascutellum	subrectangular	subpentagonal, triangular	subpentagonal
Phallus	simple elongate, apex often complex, no medial structures	complex medial structures, including "basal loop" and "window"	complex medially, but without "basal loop" and "window"
Spur Formula	variable, including 1-3-4 & 0-3-4	1-3-4	0-3-4
Ocelli	0, 3	2, 3	3
Wings	FW suture, HW setal patch basal	normal, basal bulla	FW suture, HW setal patch medial
Larva			
Body Shape	compressed, depressed	very depressed	compressed
Abdominal Tergites	present	present	present
Median Notal Sutures	all distinct	prothorax only	prothorax only
Case	laterally compressed- flattened, freely portable	flattened, fixed	laterally compressed, freely portable
Habitat	madicolous	madicolous	madicolous

We are puzzled, as was Flint (1981), as to the correct tribal placement of *Byrsopteryx* because of its mosaic of stactobiine and leuchotrichiine characters. Unfortunately, we do not yet know enough about the distribution of these and other character states within these taxa to determine with certainty which are uniquely derived in *Byrsopteryx*. In fact, few genera within Stactobiini and Leuchotrichiini have been defined based on synapomorphy and Marshall (1979) did not include a cladistic analysis of generic and tribal relationships. *Byrsopteryx* seems to form a monophyletic unit; the adult coloration, larval pronotal depressed areas, and larval chaetotaxy appear to be uniquely derived. Also, the male genitalia of the two described and four undescribed species conform closely to the same morphotype. Explanation for our uncertainty as to the correct tribal placement of *Byrsopteryx* is based partially on the fact that larvae are unknown for a majority of Leuchotrichiini genera and species groups and no one has subjected all species in this tribe to a cladistically based character analysis.

Other unanswered questions within this group of hydroptilids include the following. Are modifications of the male antennal scape and head useful generic discriminators or, as we suspect, are they more species or species group specific? Are larval characters useful in defining genera and resolving phylogenetic relationships or could they be convergent adaptations to a madicolous existence (A. Wells, pers. comm.)?

A thorough, phylogenetically based review of all known Leuchotrichiini is in order. Clear generic limits and a phylogenetic classification are needed to incorporate the scores of new species that are being discovered in the Neotropics and to provide the predictive framework for investigations into the biogeography and ecology of this most interesting group of microcaddisflies.

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