

**ELASMOTHEMIS GEN. NOV., A NEW GENUS RELATED TO
DYTHEMIS (ANISOPTERA: LIBELLULIDAE)**

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The larvae of *Dythemis cannaerioides* Calvert and *D. williamsoni* Ris are described, illustrated and compared. The genus *Elasmothemis* is erected for *cannaerioides*, *constricta* Calvert, *alcebiadesi* Santos, *schubarti* Santos, and *williamsoni*.

INTRODUCTION

The libellulid genus *Dythemis* was described by HAGEN (1861) to receive *Libellula rufinervis* Burmeister and three new species, *D. fugax*, *D. velox*, and *D. sterilis*. KIRBY (1889) designated *Libellula rufinervis* as the type of *Dythemis*. Eight other species have been described under *Dythemis*: *D. multipunctata* (KIRBY, 1894), *D. constricta* (CALVERT, 1898), *D. nigrescens* (CALVERT, 1899), *D. cannaerioides* and *D. maya* (CALVERT, 1906), *D. williamsoni* (RIS, 1919), *D. alcebiadesi* and *D. schubarti* (SANTOS, 1945). SANTOS (1945) in describing the last two species compared these with *D. williamsoni* and *D. constricta*, all four of which differed from other members of the genus in possessing an elongate plate-like anterior lamina in the males.

Many years ago I began receiving libellulid larvae from various neotropical places that were strikingly different from any others known to me. One unique character was their possession of long lateral spines on abdominal segments 6-9, which in all other libellulids known to me had no spine anterior to the 8th abdominal segment. Often these larvae were collected where adults of *D. cannaerioides* occurred. I began to suspect that these larvae were of that species. The

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wing pads were dissected from a full-grown larva and nothing was found in the venation to dispute this assumption so I decided that a new genus should be erected for this species.

CALVERT (1906) in his key to *Dythemis* separated *cannacrioides* from *velox*, *fugax*, and *maya* by one character, "Anterior lamina of the male more prominent than the genital lobe", as opposed to less prominent. RIS (1913) in the first couplet of his key to the adults of *Dythemis* separated *cannacrioides* and *constricta* from *fugax*, *maya*, *rufinervis* and *velox*. The first character used to separate the first two species was some specimens with two cubito-anal crossveins in the hind wing as opposed to regularly one. In the Florida State Collection of Arthropods (FSCA) there are 7 ♂ and 1 ♀ *D. constricta* from Brazil and 1 ♂ from Argentina, and all have only one cubito-anal. In the same collection there are 59 ♂ *D. cannacrioides* from Mexico, Costa Rica, Guatemala, Argentina, Bolivia, Ecuador, Peru and Trinidad; all but 6 (from Costa Rica) have two cubito-anals in both hind wings, but two from Bolivia and one from Costa Rica have a third in one wing. The second character used by Ris for males of the *cannacrioides* group is the anterior lamina very large, upright, and reaching or surpassing the end of hamule, as opposed to anterior lamina small, the hamule higher than it. The FSCA has 4 ♂ *D. alcebiadesi* and I have seen 1 ♂ *D. schubarti* which agree with *cannacrioides* and *constricta* in the characters of the genitalia, but all have only one cubito-anal crossvein in the hind wing.

From G.H. Beatty I learned that on the basis of adult characters Dr Karl Buchholz of Bonn, Germany was planning to describe new genera based on species of *Dythemis*. In 1962 I wrote to Dr Buchholz and told him what I had learned about the larvae of *cannacrioides*. He sent me copies of his figures of male *cannacrioides*, *multipunctata*, and *williamsoni*, the genitalia of the first two drawn from holotypes in the British Museum, and of *williamsoni* from a syntype in the Senckenberg Museum. In a key he differentiated three genera, *Dythemis*, a new genus for *cannacrioides* and its close allies, and a monotypic genus for *williamsoni*. He wanted me to co-author his paper, but I asked him to name the new genera and I would confirm his new genus for *cannacrioides* by describing the distinctive larva, but he died before the project was begun. Recently Dr R.W. Garrison sent me xerox copies of some pages from the incomplete, partially typed manuscript on *Dythemis* by Dr Buchholz which he had obtained from Jorge DeMarmels. This manuscript contained descriptions of four new species of *Dythemis*.

A former student at the University of Florida, Dr K.W. Knopf, reared *D. cannacrioides* from Trinidad in 1975 and gave it to me for description. GONZALEZ (1987) described the unusual ovipositing behaviour of a large form of *D. cannacrioides* in Mexico, further setting it apart from other *Dythemis* species in which oviposition behaviour had been recorded. After I concluded that my early larvae from Peru and elsewhere were *cannacrioides*, but before the

specimen from Trinidad reared by Dr Knopf was received, I had the Figure 2 in this paper made for a description but delayed publishing it hoping to rear the species and prove beyond any doubt the identity of the larva. ROBACK (1966)

published a photograph of a larva from Peru labeled *Dythemis* sp., which I had determined for him. In his description he referred to it as possibly *cannacrioides*, but stated that further rearing was needed to confirm this. He listed 29 specimens, many of them not mature. ARANGO & ROLDAN (1983) published a nice drawing of this species from Colombia as "*Dythemis* sp. 2".

I heard that colleagues were planning to name new species of *Dythemis*, some perhaps the same as Dr Buchholz was describing in his manuscript. In Madurai, India at the Ninth International Symposium of Odonatology I presented this paper January 19, 1988. In it I proposed a new genus which I named *Elasmothermis*. It is to receive *cannacrioides*, *constricta*, *alcebiadesi*, and *schubarti*, as well as the aberrant *williamsoni*, although Dr Buchholz and I considered

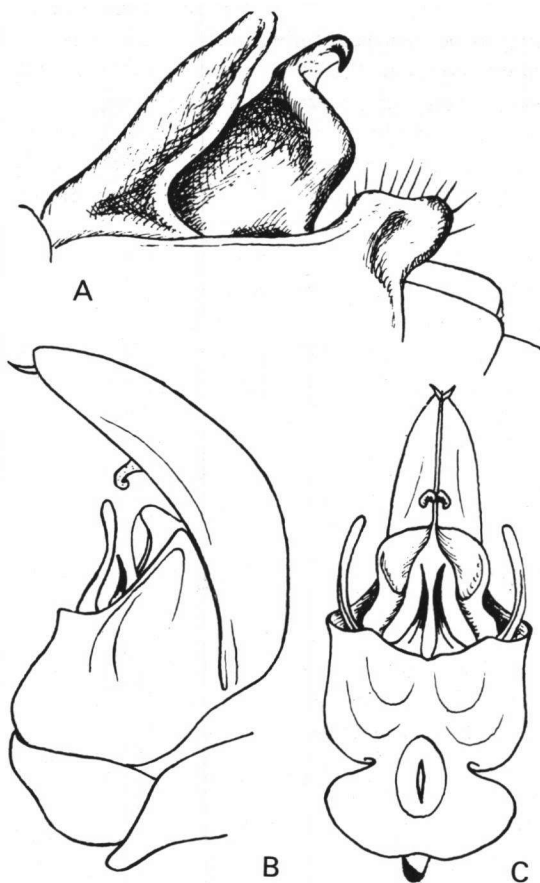


Fig. 1. Adult male structures of *Elasmothermis cannacrioides* (Calvert): (A) Lateral view of genitalia of abdominal segment 2; — (B) Lateral view of penis; — (C) Ventral view of penis.

putting it in a new monotypic genus. The larva of *williamsoni* is so similar to that of *cannacrioides* that I have left it in *Elasmothermis* despite the different adult characters. In the FSCA are specimens of all species presently recognized in *Dythemis* except *schubarti*, and I have seen a ♂ of that species from Brazil determined by Dr A.B.M. Machado.

CHARACTERS OF ADULT *ELASMOTHEMIS* GEN. NOV.

Type species: *Dythemis cannacrioides* Calvert 1906.

Species more robust than those in *Dythemis*; antenodal crossveins of fore wing $9\frac{1}{2}$ - $13\frac{1}{2}$ ($13\frac{1}{2}$ - $16\frac{1}{2}$ in *williamsoni*), 2 of 4 ♂ *alcebiadesi* have last antenodal in both fore wings complete; arculus between 1st and 2nd antenodals, rarely at 2nd, except *williamsoni* between 2nd and 3rd; triangle of hind wing usually at arculus as in *Dythemis* but occasionally proximal or distal to arculus by distance greater than width of a vein; 2 cubito-anal crossveins (rarely 3) in hind wing of *cannacrioides*, 1 in other species; 3-4 (usually 3) cell rows between A_3 and border of hind wing; terminal segments of abdomen if widened, then widened laterally; 4th segment of abdomen without a distinct supplementary carina except *williamsoni*; anterior lamina of male much thickened, plate-like, and higher than genital lobe (Fig. 1A); hamule with terminal thinner part shorter than wider basal part; penis with flagellae except *williamsoni*, partly covered by large lateral lobes (Figs 1B, C); vulvar lamina of female shorter than 8th tergite, with hind margin flat and rounded; 9th sternite flat, only distal half with a flat keel, "Griffelchen" (name after Ris) in middle of segment; usually only one strong bristle near apex of 3rd femur (rarely 2, but usually 2 in *williamsoni*, sometimes 1).

Etymology: *Elasmothemis* from the Greek "*elasmos*", a metal plate, in reference to the large plate-like anterior lamina of the males, + "*themis*", a common suffix in genera of Odonata.

DESCRIPTION OF LARVA OF *E. CANNACRIOIDES*

Described from the exuviae of a ♂ larva collected by Dr K.W. Knopf, August 2, 1975 on the Arima River at the Churchill-Roosevelt Highway $2\frac{1}{4}$ miles SSE of Arima, St. George Co., Trinidad, which emerged in September in Gainesville; another full-grown larva taken with the reared one; 2 exuviae collected by Dr D.C. Geijskes from right Coppename River, in Upper Falls, Surinam, October 1943; 5 exuviae collected by Dr S.W. Dunkle at the Yeguari River near Zamorano, 30 km ESE of Tegucigalpa, Dept. Francisco Morazan, Honduras, December 9-19, 1987. One half-grown larva collected by Dr W.L. and J.G. Peters in the Cuara River, Cuara Valley NW of Picaro airport, Trinidad, 500', December 17, 1968 was also seen in the FSCA. Figs 2A-D are from a mature larva listed from Rondos, Peru by ROBACK (1966).

Total length 17.4-20.0 mm; abdomen 10.8-12.8; hind femur 5.1-6.1; width of head 6.1-6.5; max. width of abdomen (at segment 6) 6.7-8.5.

General color light to dark brown; darker bar joining the compound eyes and darker along sides of head from eyes to postero-lateral corners; alternating light and dark longitudinal stripes on compound eyes; some specimens with obscure darker spots each side of middorsal line of abdomen.

Head: — Compound eyes protruding laterally, side margins narrowing to slightly swollen postero-lateral corners, these margins with short setae; 7-segmented antennae short, about 1.4 mm long; palpal lobes with teeth obsolete; palpal setae 7-8, premental setae 7-8 larger setae and 1-3 small setae at medial end of series (Figs 2A-D).

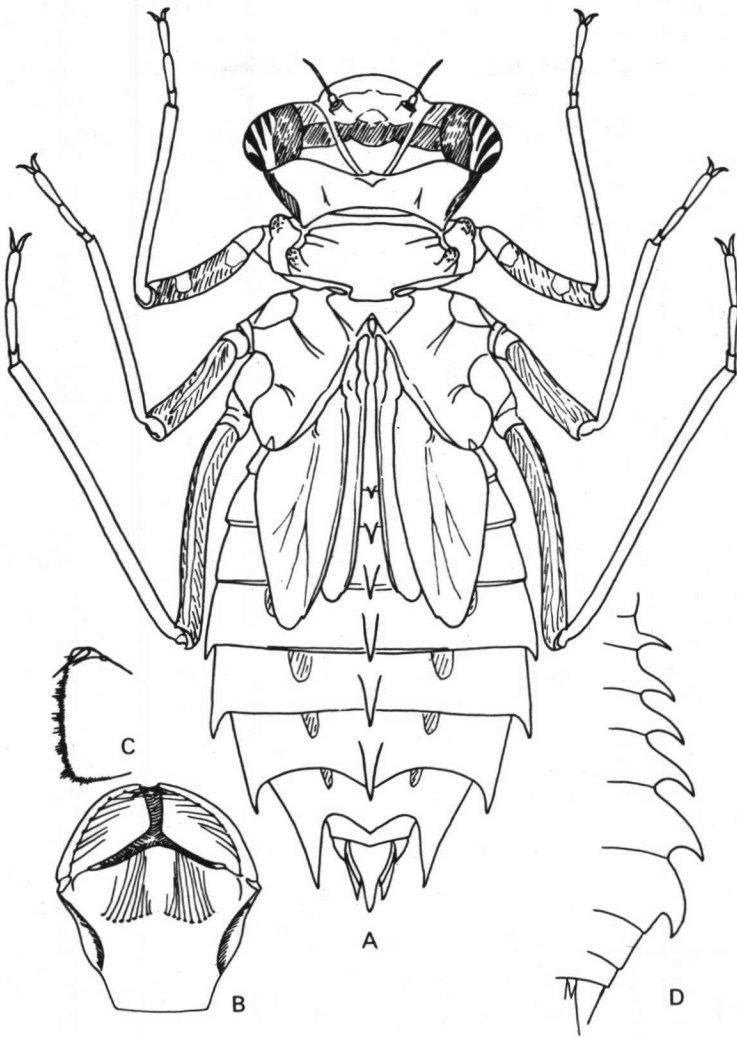


Fig. 2. Larva of *Elasmothermis cannacrioides* (Calvert): (A) Dorsal view; — (B) Dorsal view of labium; — (C) Inner margin of palpal lobe of labium; — (D) Left lateral view of abdomen showing dorsal hooks.

Thorax: — Lateral margins of prothorax above fore-leg bases prominent and spiny, especially anteriorly; lateral margins of pronotum upturned to form prominent "epaulets", each with darker scales on margin; synthorax with brown speckles, the posterior corners of nota slightly darker; femora darker than tibiae

and especially the tarsi; wing pads of full-grown larvae reaching middle of abdominal segment 7, or slightly less.

Abdomen: — Highly arched with strong dorsal hooks on segment 3-8; 9 and 10 with a middorsal ridge, no hooks; large lateral spines on 6-9, increasing in length posteriorly, on 6-8 tending to be incurved, on 9 pointing straight posteriorly, mesal margin almost straight and longer than middorsal length of segment 9, extending to or almost to end of paraprocts; epiproct markedly longer than paraprocts (Fig. 2A); cerci $\frac{1}{4}$ to $\frac{1}{3}$ length of epiproct; paraprocts in ventral view about 1.8 times as long as wide at base, the mesal margin slightly convex; brown speckles scattered over abdomen generally; long hairs especially on inner margins of lateral spines of segment 9.

CHARACTERS OF *DYTHEMIS* HAGEN

ADULT: — Species less robust than in *Elasmothemis*; antenodal crossveins $12\frac{1}{2}$ - $16\frac{1}{2}$ (sometimes last antenodal complete in one or both fore wings of *maya*); arculus between 2nd and 3rd antenodal crossveins or at 2nd; triangle of hind wing at arculus; usually 1 cubito-anal crossvein (rarely 2) in hind wing; terminal segments of abdomen if widened then widened dorso-ventrally; 4th segment of abdomen without a supplementary carina; anterior lamina of male always flat and much lower than genital lobe or hamule; terminal thinner part of hamule longer than wider basal part (Fig. 3A); genital lobe large, clearly higher than anterior lamina, and as high as hamule (Fig. 3A); penis without flagellae, ventral and distal parts of glans covering soft parts (Figs 3B, C); vulvar lamina of female as long as 8th tergite, hind margin with deep indentation; 9th sternite high vaulted and sharply keeled in its whole length, with "Griffelchen" near base of segment; 2-6 (sometimes 10) strong bristles on 3rd femur.

LARVA: — Larvae of this genus have lateral spines only on segments 8 and 9 of abdomen and dorsal hooks are low and present on segments 3-9; abdomen is

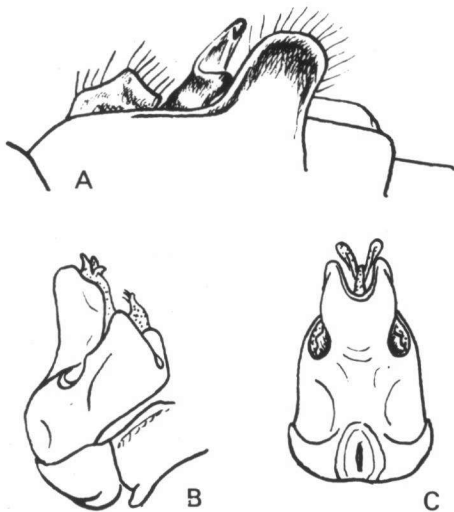


Fig. 3. Adult male structures of *Dythemis multipunctata* Kirby: (A) Lateral view of genitalia of abdominal segment 2; — (B) Lateral view of penis; — (C) Ventral view of penis.

longer compared to its width than in *cannacrioides* and *williamsoni* (which is discussed later). NEEDHAM & COCKERELL (1903) described exuviae from New Mexico attributed to *Dythemis* sp.?, said to have been collected where adults of *velox* were taken. The larva of *sterilis* was described and illustrated by GEIJSKES (1946), *nigrescens* by YOUNG & BAYER (1979), and *multipunctata* by DE MARMELS (1982). KLOTS (1932) described *rufinervis* by supposition, illustrating the labium only. NEEDHAM (1904) described *fugax* and *velox* by supposition, illustrating the end of the abdomen of the first, and with a photograph of the larva of the latter. There is a drawing of *rufinervis* in NEEDHAM & WESTFALL (1955), and fig. 317 is a photograph of *D. rufinervis*, not *Brachymesia furcata* as labeled.

REMARKS ON *ELASMOTHEMIS WILLIAMSONI* (RIS)

As mentioned earlier, Dr Buchholz planned to place this aberrant species in a monotypic genus, and at first I decided to go along with this. It differs in several respects from other members here placed in *Elasmothemis*, but since the larva is so similar to *cannacrioides* I have decided to leave it for the present in *Elasmothemis*.

The adult has a prominent supplementary carina on the 4th abdominal segment, but there is a faint suggestion of a carina at the same place in some of the other species, especially *cannacrioides* and *constricta*. The anterior lamina is shorter than in the other species, but it is nearly as high as the hamule. The penis is without flagellae which are present in all other species, the ventral surface is cleft, and there are two long lateral spines (Figs 4A-C).

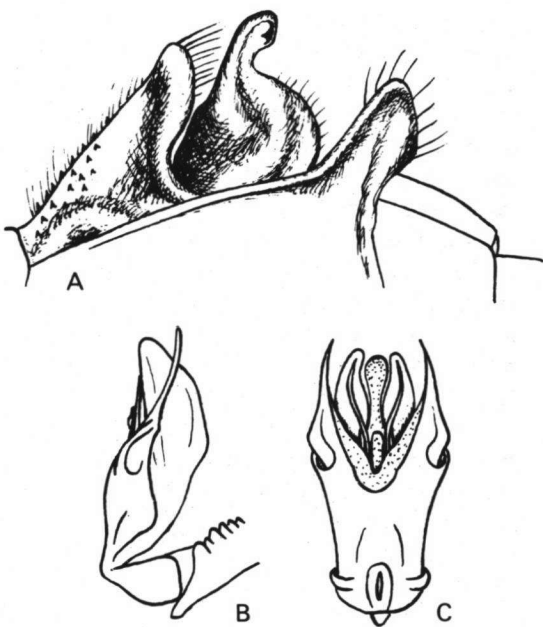


Fig. 4. Adult male structures of *Elasmothemis williamsoni* (Ris): (A) Lateral view of genitalia of abdominal segment 2; — (B) Lateral view of penis; — (C) Ventral view of penis.

The larva is similar to *cannacrioides*. In the FSCA there are 3 exuviae collected by Dr D.C. Geijskes in Surinam (including the exuviae of the reared ♀ described by GEIJSKES, 1964, collected as "ult nymph" November 29, 1953 and which emerged December 17, 1953). The latter was taken in the Upper Coropina creek near Zanderij; another from Coropina creek January 20, 1957; and a third from Powakka Savannah creek, October 12, 1962. The only differences from the above description of *cannacrioides* that I can detect are: lateral spines of abdomen slightly more divergent, thinner and more incurved at tips, that of 9 a little shorter than middorsal length of segment 9 (Fig. 5A): epiproct only as long as or only slightly longer than paraprocts which in ventral view have mesal margins straighter, and tips of paraprocts slightly convergent instead of divergent or parallel. All of these are only slight differences. The best difference is seen in a lateral view of the abdomen (Fig. 5B). In *williamsoni* the upper margin of abdominal segments 9 and 10 form a much greater angle with the venter than in *cannacrioides*.

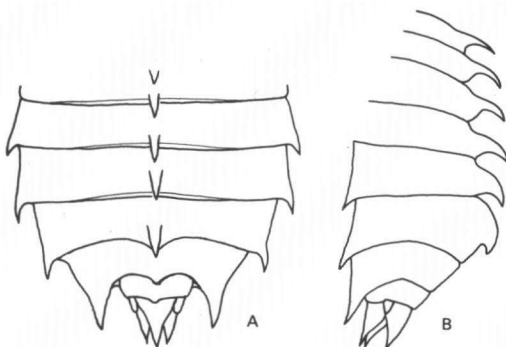


Fig. 5. Exuviae of reared female of *Elasmothermis williamsoni* (Ris): (A) Dorsal view of terminal segments of abdomen; — (B) Lateral view of abdomen.

HABITAT NOTES

Dr Geijskes in a letter to me dated May 10, 1979 wrote: "There is a striking difference in an ecological sense between the species of *Dythemis*: *williamsoni* breeds in bushcreeks of the savanna area, *cannacrioides* lives in the more open rivers in the interior, *multipunctata* is to be found on smaller creeks in the interior (mountainous streams) and around shaded parts on falls in rivers. There I found once the larvae in rock pools". In northwest Florida I have reared *velox* from larvae collected among roots at the edge of a small lake formed by damming of a stream.

GONZALEZ (1987) described the unusual oviposition behaviour of a large form of *D. cannacrioides* found in Mexico. His observations were made at a swiftly flowing river where overhanging roots of the liana *Cissus gossypifolia* Standley were constantly aerated at the water surface by the rapid water current. The female on a perch near the water prepared large masses of eggs which she then with one stroke deposited on the root. The masses were found to be strands

consisting of a central filament formed by numerous individual coiled fibers to which the eggs were attached individually or in clusters of 4-5 eggs. This is the only species of the Libellulidae which is known definitely to deposit eggs in a fibrous egg strand. Careful observations should be made of oviposition behaviour in the other species of *Elasmothermis*.

ACKNOWLEDGEMENTS

I wish to acknowledge the contribution to this paper by the late Dr KARL BUCHHOLZ who made the drawings of the adult males. ESTHER COOGLE, former staff artist for the Department of Zoology, made the drawings of the larva of *cannacrioides*, and the drawings of *williamsoni* were done by the present staff artist of the Department of Zoology, D. HARRISON, who also made photographs of the final illustrations. Specimens were sent by Drs S.W. DUNKLE, D.C. GEIJSKES, K.W. KNOPF, and by the late Dr S.S. ROBACK. J. VAN TOL of the Leiden Museum loaned the reared specimen of *williamsoni*. Dr R.W. GARRISON sent a copy of the Buchholz manuscript; he and Dr S.W. Dunkle made many valuable suggestions to improve the paper.

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