

**ELASMOTHEMIS ALICIAE SPEC. NOV.,  
A NEW DRAGONFLY FROM MEXICO, BELIZE AND  
COSTA RICA WITH A DESCRIPTION OF ITS LARVA  
AND A KEY TO THE KNOWN LARVAE OF THE GENUS  
(ANISOPTERA: LIBELLULIDAE)**

E. GONZÁLEZ-SORIANO <sup>1</sup> and R. NOVELO-GUTIÉRREZ <sup>2</sup>

<sup>1</sup>Instituto de Biología, UNAM, Departamento de Zoología, Apartado Postal 70-153,  
MX-04510, D. F., México  
esoriano@ibiologia.unam.mx

<sup>2</sup>Instituto de Ecología A. C., Departamento de Entomología, Apartado Postal 63,  
MX-91000 Xalapa, Veracruz, México  
novelor@ecologia.edu.mx

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The new sp. and its larva are described and illustrated from specimens collected in Mexico (states of San Luis Potosí and Veracruz), Belize (Toledo distr.) and Costa Rica (Heredia prov.). Holotype ♂ and allotype ♀ (in copula): Mexico, Veracruz state, Rio La Palma, 25 km N of Catemaco, 28-VIII-1988; deposited at UNAM, Mexico. The sp. is closely related to *E. cannaerioides* Calv. with which it was formerly confused. Adults of the former are larger than those of the latter. The larva is also easily distinguished from *E. cannaerioides* by its larger size and differences in the shape of the dorsal protuberances. Notes on biology and distribution are provided and the known larvae of the genus *Elasmothemis* Westfall are keyed.

## INTRODUCTION

*Elasmothemis* Westfall, 1988 includes six species of neotropical libellulid dragonflies (GARRISON, 2002). To date, the larvae of three have been described: *E. cannaerioides* (Calvert) (PUJOL-LUZ & COSTA, 1987; WESTFALL, 1988); *E. constricta* (Calvert) (PUJOL-LUZ, 1990), and *E. williamsoni* (Ris) (WESTFALL, 1988). Field collections in Mexico done by the authors and by colleagues elsewhere yielded adults and larvae of a new species from San Luis Potosí and Veracruz states, México, and Belize. The new species had previously been confused with *E. cannaerioides* (Calvert) for some time.

Acronyms for collections are as follows: CNIN (Colección Nacional de Insectos, UNAM, México City); FSCA (Florida State Collections of Arthropods, Gainesville); IEXA (Instituto de Ecología, Xalapa); IORI (International Odonate Research Institute, Gainesville); JJD (Jerrell J. Daigle private collection), RWG (Rosser W. Garrison collection, Azusa).

*ELASMOTHEMIS ALICIAE* SP. NOV.

A d u l t

Figures 1-8

**Material.** — **Holotype** ♂: MEXICO: Veracruz state, Río La Palma, 25 km N Catemaco (18°34'N, 95°3'W, 10 m), 28-VIII-1988, E. González leg (in copula with allotype) (CNIN); — **Allotype** ♀: same locality as holotype (in copula with holotype) (CNIN). — **Paratypes** (40 ♂, 4 ♀): MEXICO: San Luis Potosí State, Nacimiento del Río Coy, Mpio. Ciudad Valles (98°58'6", 21°43'9", 60 m), 4 ♂, 27-V-1987, E. González leg. (CNIN); — Nacimiento del Río Huichiuayán, Mpio. de Huehuetlán (98°58'52", 21°27'6", 100 m), 2 ♂, 15-V-1989, E. González leg. (CNIN); — Río El Salto, Mpio. de Ciudad del Maíz. (99°58'52", 21°27'6", 1260 m), 1 ♂, 30-V-1987, (CNIN); — Veracruz State: Río Otapa, 8 km S of La Tinaja (96°26'24", 18°45'0", 90 m), 1 ♂, 13-VIII-1976 (RWG); — Arroyo Agua Caliente E Sontecomapan (18°21', 95°1'), 2 ♂, 31-V-1979, G. Jimenéz & V. Barreto leg. (1 ♂ FSCA, 1 ♂ CNIN); — same, 3 ♂, 7-VII-1979, E. González & G. Jimenéz leg. (2 ♂ FSCA, 1 ♂ CNIN); — same, 2 ♂, 9-VII-1979, E. González leg. (1 ♂ FSCA, 1 ♂ CNIN); — same, 1 ♂, 10-VII-1979, G. Jimenéz leg. (FSCA); — same, 1 ♂, 9-VII-1980, E. González leg. (CNIN); — same, 2 ♂, 30-VIII-1988, R. Garrison & E. González leg. (1 ♂ FSCA, 1 ♂ RWG); — Río Coxcoapan, 6 km E Sontecomapan, 1 ♂, 16-VII-1992, T.W. Donnelly leg. (FSCA); — E. Coxcoapan, East trib. to Río Coxcoapan, 1 ♂, 16-VII-1992, W.F. Mauffray leg. (FSCA); — Río La Palma, 25 km N Catemaco, 7 ♂, 4-VIII-1982, R. Garrison & E. González leg. (1 ♂ CNIN, 6 ♂ RWG); — same, 2 ♂, 1 ♀ (in copula with ♂), 5-VIII-1982, R. Garrison & E. González leg. (1 ♂ CNIN, ♂ ♀ RWG); — same, 2 ♂, 28-VIII-1988, M.J. Westfall leg. (FSCA); — Estación de Biología Tropical Los Tuxtlas (18°34', 95°04'), 1 ♀, 3-VII-1985, on UV trap, E. Ramírez leg. (CNIN); — Los Tuxtlas, Río Máquinas, 1 ♂, 24/25-V-1984, E. González leg. (CNIN). — BELIZE: Toledo district, Blue Creek Village, Blue Creek, 2 ♂, 2 ♀, 5-VI-1993, W.F. Mauffray leg. (1 ♀ FSCA, 1 ♂, 1 ♀ IORI, 1 ♂ JJD), one pair in copula; — Toledo district, San Antonio, Crique Jute below "The Falls", 1 ♂, 6-VI-1993, W.F. Mauffray leg. (IORI); — Toledo district, Medina Bank; southern Hwy & Deep River, 1 ♂, 7-VI-1993, W.F. Mauffray leg. (IORI). — COSTA RICA: Heredia prov., Finca La Selva, 1.5 mi S Puerto Viejo (10°28'N, 84°1'W, 60 m), 1 ♂, 21-IX-1966, D.R. Paulson leg. (RWG); — same, 1 ♂, 20-VII-1988, C. Esquivel leg. (RWG).

**Etymology.** — We dedicate this species to our beloved and unforgettable friend Alicia Rodríguez Palafox (†), an enthusiastic and dedicated student of the Vespidae (Hymenoptera).

**MALE holotype.** — Body reddish brown in acetoned specimens (luteous in live specimens).

**Head.** — Face luteous excepting mandibles which are greenish at base and dark brown apically; anteclypeus greenish and occiput pale brown; face with sparse brown hairs; antennae dark brown.

**Thorax.** — Reddish brown.

**Wings.** — Nodal formula 14:16/15 ½:13 in FW and 13:11/11:15 in HW. Arculus at second antenodal on FW and slightly before second antenodal in HW, FW tri-

angles two celled, subtriangles three celled, HW triangles free, trigonal interspace in both FW and HW beginning with three row of cells, paranal cells in FW 7, 3 in HW, antecubital crossveins one (two in RHW), bridge crossveins one (FW) and two (HW). Legs dark brown, becoming black at distal part of femora, tibiae and tarsi black. Hind femora with a row of short denticles on its external surface, ending in a large spine on its distal end.

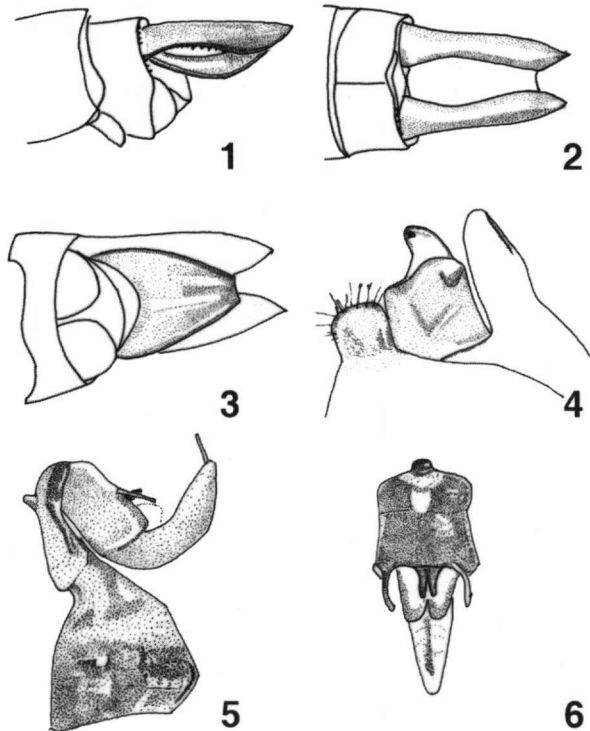
**A b d o m e n .** — Reddish brown, unspotted, yellowish from segments 1-3, dorsoapical corners of 8-9 with a dark brown tint; base of abdomen

greatly enlarged on segs 2-3. Abdominal appendages (Figs 1-2): cercus dark brown, epiproct reddish-brown. In dorsal view (Fig. 2) cerci swollen and converging at 0.71 of its length with tips acute and diverging; in lateral view (Fig. 1) ventral margin slightly concave on its basal 0.64 and with a row of 11-12 denticles extending 0.60 of its length; epiproct (Fig. 3) extending 0.82 length of cerci, in ventral view very wide at base, tapering apically, truncated and slightly excavated in its apical margin.

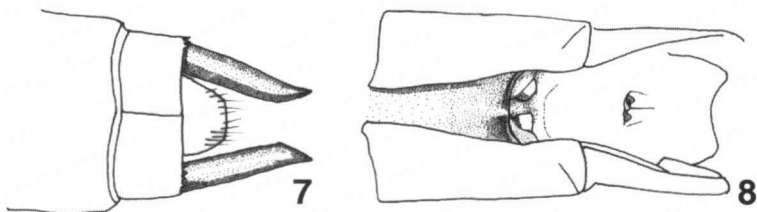
Secondary genitalia (Fig. 4). — Anterior lamina large and erect, slightly higher than hamulus. Hamulus with internal branch erect, ending in a mesoanteriorly directed hook, basal part flat; genital lobe subquadrate with apical margin straight. Vesica spermalis (penis) as in Figs 5-6.

**M e a s u r e m e n t s** (in mm incl. app). — Body length 53; abdomen 36.5; HW 46; cerci: 2.54; epiproct: 2.10; pterostigma FW: 4.8 in FW and 5.0 in HW (measured along costal side).

**FEMALE allotype.** — Coloration as in male. Venation: Nodal formula 12:16 1/2 /



Figs 1-6. *Elasmotheremis aliciae* sp. n., holotype male: (1-3) abdominal appendages, lateral, dorsal and ventral views; — (4) secondary male genitalia, lateral view; — (5-6) vesica spermalis (penis), lateral and ventral views.



Figs 7-8. *Elasmothermis aliciae* sp. n., allotype female: (7) cerci, dorsal view; — (8) abdominal segments 8-9, ventral view including vulvar laminae.

16  $\frac{1}{2}$ :12 FW and 12:11/11:13 HW. Other venational characters as in male excepting 2 row cells in trigonal interspace in HW, one cubitonal crossvein and one bridge crossvein in all wings. Cerci as in Figure 7. Vulvar lamina lacking (Fig. 8).

**Measurements** (in mm incl. app). — Body length 57; abdomen 39.5; HW 47, cercus: 2.03; pterostigma FW 5.55 and HW 5.5.

**REMARKS.** — The following variation was observed among paratypic series: Venation males: antenodals in forewing (FW) 11-15: 13(35%), 12(33.7%), 14(17.5%), 11(7.5%), 15 (6.25%); in hindwing (HW) 11-16: 13(50%), 12(22.5%), 14(15%), 15(6.25%), 11(5%), 16(1.2%); postnodals (FW) 14  $\frac{1}{2}$ -18: 16  $\frac{1}{2}$  (30%), 17 (21.2%), 15  $\frac{1}{2}$  (18.7%); 17  $\frac{1}{2}$  (11.2%); 16 (10%), 14  $\frac{1}{2}$  (6.2%); 17(3.6%); 15(1.2%); 18(1.2%) (HW) 10-13: 12(58.7%), 11(32.5%), 10(3.7%), 13(5%); cells in triangles (FW) 1-3: 2(77.5%), 3(15%), 1(7.5%), (HW) 1-3: 1(65%), 2(33.7%), 3(1.2%); subtriangles (FW) 3-5: 3(57.5%), 4(36.2%), 5(6.2%), cubitoanal crossveins (FW) 1-2: 1(98.7%); 2 (1.3%); (HW) 1-2: 1 (96.3%); 2(3.7%).

Venation females: antenodals (FW) 10-13: 11(37.5%), 13(37.5%), 10 (12.5%); 12 (12.5%); (HW) 11-14: 12(37.5%), 13(37.5%), 11(12.5%), 14(12.5%); postnodals (FW) 15  $\frac{1}{2}$ -18: 15  $\frac{1}{2}$  (37.5%), 16  $\frac{1}{2}$  (37.5%), 18 (25%); (HW) 11-13: 11 (50%), 12(37.5%), 13 (12.5%); cells in triangles 2-3 (FW) 2 (87.5%), 3 (12.5%); (HW) 1-3: 1(50%); 2 (25%), 3(25%); subtriangles (FW) 3-4: 3 (87.5%), 4(12.5%); cubitoanal crossveins (FW) 1(100%), (HW) 1(50%), 2 (50%).

**Measurements** (in mm). — Males: total length average including cerci (range in parentheses) 53.9 (45-56.5); abdomen 35.8 (30-42); hindwing 45 (40-49); cerci 2.65 (2.41-2.82); epiproct 2.07 (1.83-2.3); pterostigma (FW) 5.20 (4.92-5.73); (HW) 5.04 (4.73-5.3). Females: total length average 54.6 (53.3-57); abdomen 35.8 (32-39.5); hindwing 46.2 (42-49.5); cerci 1.80 (1.65-1.97); pterostigma (FW) 5.8 (5.79-6.0), (HW) 5.7 (5.6-5.92). Males from Costa Rica are distinctively smaller (e.g. TL=45-46, ABD=30-31, HW=40 respectively N=2)) than those from Belize and Mexico (TL=51-56, ABD=33-42, HW=41-49, N=38).

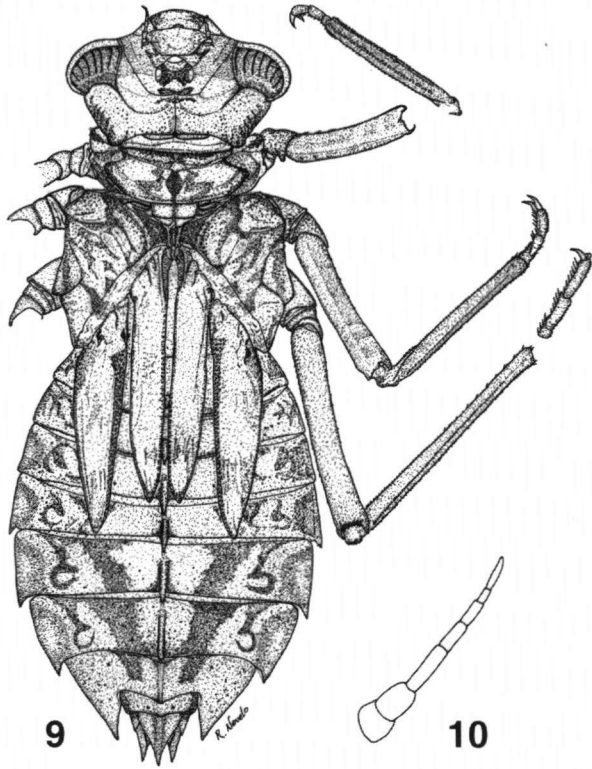
## Larva

Figures 9-18

**Material.** — 1 exuviae (♀, not reared), 3 last instar larvae [2♂, 1♀], 1 probably antepenultimate instar larva [♀]. MEXICO: Veracruz State; Los Tuxtlas, Río La Palma 25 km N Catemaco, 13-V-1983, R. Novelo leg. [♂, ♀], 22-IV-1984 [♀, antepenult. instar], 25-V-1984 [exuviae]; 14-VI-1985, N. Villalobos leg. [♂], deposited at IEXA, Xalapa, México.

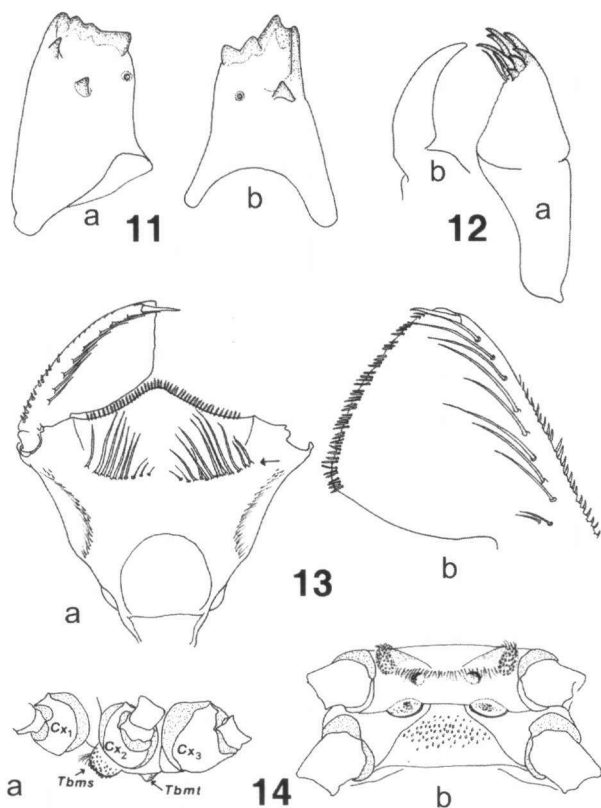
Larvae yellowish-brown or reddish-yellow, exuviae dark brown; integument appearing granular due to scattered small scale-like setae; body robust, abdomen strongly convex laterally and strongly arched (Fig. 9).

**Head.** — Twice as wide as long, narrowing posteriorly, posterolateral margins convergent and ending in a small swollen posterolateral corner covered dorsally and ventrally with rows of small scale-like setae; occiput broadly concave approximately straight at middle. Compound eyes protruding laterally, with alternating light and dark longitudinal



Figs 9-10. *Elasmothermis aliciae* sp. n.: (9) last instar larva of male, dorsal view; — (10) right antenna, lateral view.

stripes. Anterior margin of frons slightly sinuate. Antenna 7-segmented, very short, about 1.5 mm (Fig. 10), third segment the longest, 1st and 6th the shortest; relative size of antennomeres: 0.4, 0.7, 1.0, 0.7, 0.5, 0.4, 0.7. Labrum densely setose except for large, transverse, oval medial glabrous area; clypeus glabrous. Mandibles (Fig. 11) with four incisor cusps, an additional small cusp at base of ventral cusp on right mandible, molar area with two low acute cusps. Maxillae: Galeolacinia with seven teeth of different size and robustness, three short slightly incurved teeth on ventral margin, three long slightly incurved teeth on dorsal margin of which the basal one is thinner, scarcely thicker than preceding long setae (Fig. 12), apical tooth the largest; maxillary palp robust, slightly shorter than galeolacinia, ending in a robust blunt spine. Labium: Prementum-postmentum articulation reaching basal half of mesosternum; prementum subrhomboidal (Fig. 13a), with 6+3, 7+2, 7+4 or 8+3 long setae, sometimes two extra setae on external part of right side series (see arrow Fig. 13a); lateral margins flattened and expanded over the dorsal



Figs 11-14. Details of the larval morphology of *E. aliciae* sp. n.: (11) mandibles: a, right mandible, ventrointernal view; b, basalinternal view of left mandible; — (12) maxilla: a, stipes and galeolacinia of left maxilla, ventral view; b, left maxillary palp, dorsal view (setae omitted in both structures except the last seta on galeolacinia [notice the thickness of this setae as compared to the basidorsal tooth]); — (13) labium: a, prementum, dorsal view (right palp detached; arrow indicates the two occasional extra setae); b, detail of the right palp, dorsointernal view; — (14) thorax: a, left lateral view of inferior part of thorax showing the ventral tubercles (Cx1, Cx2 and Cx3 = pro-, meso- and metacoxae respectively; Tbms: mesosternal tubercle; Tbmt: metasternal tubercle); b, ventral view of meso- and metasternum showing meso- and metasternal tubercles, furcal pits and transversal row of setae on mesosternum, and mediosternite of metasternum with scale-like setae.

surface, slightly concave, with a dense row of setae on the dorsal margin of this expansion, widening to distal margin; a group of 5-6 short, stout spiniform setae on the base of palpal articulation; ligula prominent, its distal margin finely serrulated, with a row of 38-40 short setae, 4 or 5 of them at tip. Labial palp (Fig. 13b) with 7-8 long setae, 2 small setae on basal internal surface, dorsal margin with a row of setae increasing in length but decreasing in robustness from base to apex of palp; distal margin straight, finely serrulated, without crenulations, with stout spiniform setae arranged in groups of 4-5 setae; movable hook short and slender.

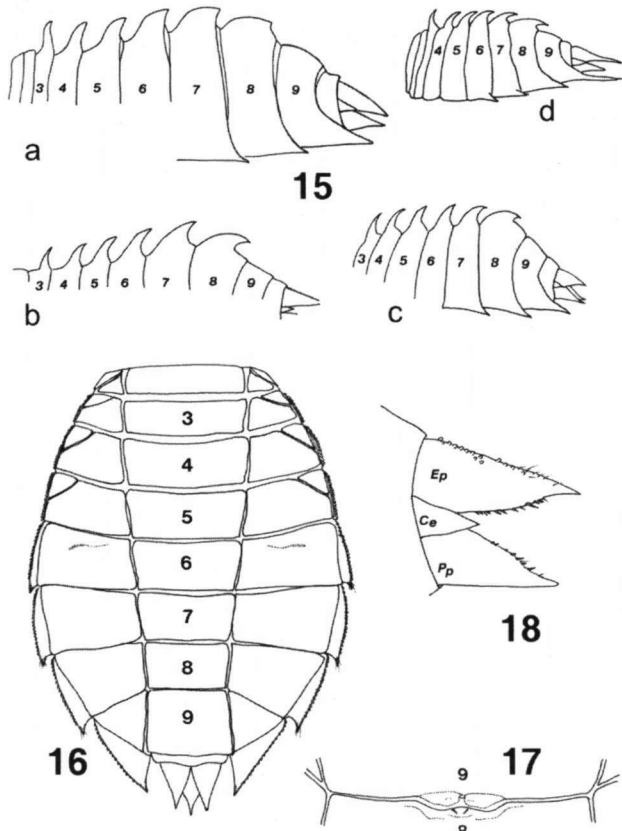
**Thorax.** — Pronotal disc with an irregular, longitudinal dark band at middle, pale on sides, lateral margins rounded and upturned to form prominent epaulets, with

short, close-packed scale-like setae on posterolateral areas; proepisternum with a tuft of long setae on its inferior corner, proepimeron with short, robust scale-like setae, mainly on its anterior margin. Synthorax irregularly mottled, with very short,

sparse scale-like setae. Legs long (e.g. when fully extended, hind legs surpassing tip of abdomen), uniformly colored, covered with short scale-like setae on surfaces and borders; tarsi with a double row of short, robust spiniform setae on ventral surface. Wing pads uniformly colored, except for the darker borders of anterior wing pads, anterior wing pads reaching basal 0.60 of abdominal segment 5, posterior ones reaching posterior margin of 6. Mesosternum with an anterolateral, well-developed tubercle on each side (Fig. 14, Tbms), contiguous to articulation of mesocoxae, covered with small setae and scale-like

setae; a transversal row of long setae connecting both tubercles just in front of the furcal pits (Fig. 14b). Metasternum with a pair of low tubercles on its anterior margin, not contiguous to the articulation of metacoxae (Fig. 14b), covered mainly with short scale-like setae; mediosternite with short, moderately abundant scale-like setae.

**A b d o m e n .** — Oval, sides strongly convex, highly arched resembling a turtle's shell, reaching its maximum width at segment 6 (Figs 9, 16); a complex color pattern consisting of irregular, dark spots and dots to each side of midline on 4-8,



Figs 15-18. Details of the larval morphology of *Elasmothermis*: (15) left lateral view of abdomen of: a, *aliciae*; b, *cannacrioides*; c, *williamsoni*; d, *constricta*; — (16-18) *aliciae*: (16) ventral view of abdomen (see explanation in text); — (17) detail of the vestigial gonapophyses of female larva (8 and 9, sternites); — (18) left lateral view of anal pyramid (Ep: epiproct; Ce: cercus; Pp: paraproct). — Figs 15b, 15c after WESTFALL (1988); Fig. 15d after PUJOL-LUZ (1990).

and a full-length, longitudinal, dark band to each side of midline on 7-8, which extends rearward on basal 0.75 of 9 (Fig. 9); tergites 3-10 with small, sparse, scale-like setae; lateral margins of 3-9 with small, closed-packed scale-like setae (Fig. 16), ending in a spine on 6-9 which increase in size and robustness posteriorly, on 6-7 divergent, on 8 incurving, on 9 pointing straight posteriorly and with its mesal margin straight and slightly longer than middorsal length of segment 9, not reaching the tips of paraprocts; dorsal protuberances present on tergites 3-8 as strong hooks and covered with small scale-like setae (Fig. 15a), tergites 9-10 with a middorsal ridge but no hooks; in lateral view, the hook on 3 almost vertical, on 4-5 gradually directed backward, on 6-7 with their dorsal margin straight and parallel to the ventral line of abdomen, dorsal margin of hook on 8 slightly convex (Fig. 15a). Sternites mostly smooth, some scattered scale-like setae on 1-5, irregularly mottled, sternites 5-9 with a large, mesobasal dark spot; sternites 3-5 divided on five plates, remaining on three plates (Fig. 16); longitudinal sutures gradually converging from sternite 2 to posterior margin of 7, almost parallel on 8, then slightly divergent on 9 (Fig. 16); laterosternites on segment 6 with a very narrow, deep slanting sulcus related to an apodeme (Fig. 16); posterior margins of sternites 9 and 10 sinuate, slightly concave at middle on 9, convex on 10. Male gonapophyses lacking, only a small dark dot as gonopore; female gonapophyses vestigial, macromiid-like (Fig. 17), gonopore as small dark dot. Caudal appendages (Fig. 18): Epiproct and paraprocts pyramidal, sharply pointed; basal width of epiproct 0.80 its length, with scale-like setae on dorsal surface, spiniform setae on ventral surface; basal width of cercus 0.65 its length, smooth; paraprocts widely diverging at tips, dorsal and ventrolateral margins with spiniform setae; relative size: epiproct 1.0, paraproct 0.90, cercus 0.42.

Measurements (in mm). — Total length (including caudal appendages) 23.2-25.8; abdomen 14.5-15.5; hind femur (dorsal margin) 7.5-7.7; maximum width of head 7.1-7.2; maximum width of abdomen (ventral) 9.9-10.5; epiproct 1.7-1.9; paraproct 1.6-1.7; cercus 0.7-0.8; lateral spine on 6, 0.3-0.4; on 7, 0.4-0.5; on 8, 0.6; on 9, 1.7-1.9.

## DISCUSSION

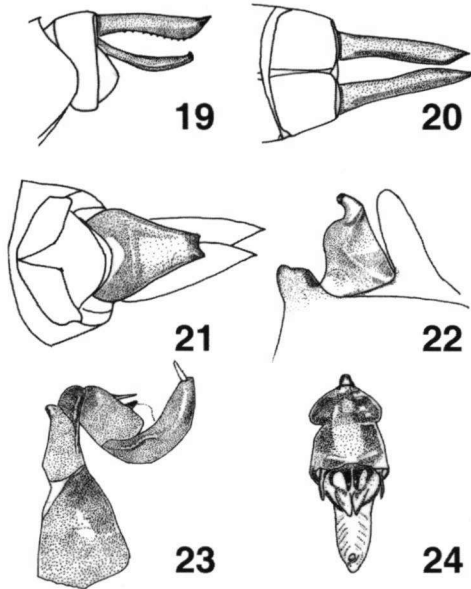
*Elasmothemis* was recently erected (WESTFALL, 1988) to include six species formerly placed within *Dythemis* viz. *E. alcebiadesi* (Santos), *E. cannaerioides* (Calvert), *E. constricta* (Calvert), *E. kiautai* (De Marmels), *E. schubarti* (Santos) and *E. williamsoni* (Ris). One character common unique for the genus is the large plate-like anterior lamina of male genitalia. WESTFALL (1988) also pointed out that the vulvar lamina in females is "shorter" than 8<sup>th</sup> tergite. However, females of both *E. aliciae* sp. nov. and *E. cannaerioides* lack a vulvar lamina (Figs 8, 26), thus exposing the genital opening. This is also true for *E. williamsoni* (GEIJSKES, 1964). The absence of this structure in *E. aliciae* and *E. cannaerioides* (and perhaps in *E. williamsoni* as well) may be correlated to the method of oviposition employed by females (GONZÁLEZ-SORIANO, 1997) which deposit eggs in string-



like filaments. For several years, *E. aliciae* was confused with the closely related *E. cannacrioides* due to its overall resemblance (e.g. GONZÁLEZ-SORIANO, 1997). It can be separated from the latter by its larger size, the color of the face as well as by differences in male genitalia (Figs 22-24). In *E. cannacrioides*, the frons, post- and anteclypeus are brown while the labrum is usually (but not invariably) yellow. In both species the hamular processes are not 2-parted with only inner branch visible (Figs 4, 22). However, in *E. aliciae* the basal part of hamulus is subquadrate (Fig. 4) and that of *E. cannacrioides* (Fig. 22) has a more rounded posterior margin. Finally in this area 96% of *E. aliciae* (N=40) has one cubitoanal crossvein in HW, while 100% of the males of *E. cannacrioides* (N=12) have two cubitoanal crossveins in in this area.

The larva of *E. aliciae* differs in several respects to the other three known larvae of *Elasmothermis*. The larva of *E. aliciae* is the largest, the dorsal protuberances of abdomen are hook-like and more vertical in *E. cannacrioides* (Fig. 15b), *E. constricta* (Fig. 15d) and *E. williamsoni* (Fig. 15c) than in *E. aliciae* (Fig. 15a). The dorsal protuberance of tergite 8, and the size proportion of the epiproct respect to paraprocts are notoriously larger in *E. constricta* (Fig. 15d) than in *E. aliciae* (Fig. 15a), *E. cannacrioides* (Fig. 15b) and *E. williamsoni* (Fig. 15c). Likewise, the dorsal margins of abdominal segments 9 and 10, in lateral view, form a greater angle with the venter in *E. aliciae* and *E. williamsoni* than in other two species.

Several features of the larva of *Elasmothermis* not described by PUJOL-LUZ & COSTA (1987) nor by WESTFALL (1988) and PUJOL-LUZ (1990), which we consider diagnostic from *Dythemis* are (features of this last genus in parentheses): the almost complete lack of long setae in all the body including the legs (long setae in several parts of the body), presence of hypertrophied tubercles on meso- and metasternum, those on mesosternum the largest (Fig. 14) (vestigial on mesosternum, lacking on metasternum), abdominal ventral sutures converg-



Figs 19-24. *Elasmothermis cannacrioides*, male (Chiapas state, Nueva Tenochtitlán, 24-IV-1983, R. Novelo leg.): (19-21) abdominal appendages: lateral, dorsal and ventral views; — (22) secondary male genitalia, lateral view; — (23-24) vesica spermalis (penis): lateral and ventral views.

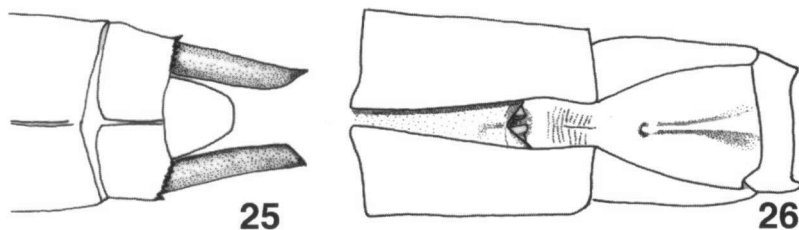
ing gradually from base of the abdomen until the 7th sternite, then parallel on 8, and slightly divergent on 9 (parallel on all segments), the molar area of right mandible with only two cusps (with three cusps), and the remnants of the vulvar plates in the female which are not yet known for larvae of any other genera of Libellulinae and is lacking in the adult female.

#### BIOLOGY

Notes on the reproductive behaviour of *E. aliciae* including oviposition were described by GONZÁLEZ-SORIANO (1987) under the name of *E. cannacroioides*. *Elasmothemis cannacroioides* has apparently the same habitat requirements and same ovipositing behavior as *E. aliciae* since both species were observed together on the same section of the river in Belize (J.J. Daigle pers. comm.) and by D. Paulson (in litt.) who commented that *D. cannacroioides* occurred "almost always at fairly swift streams but sometimes at larger, slower rivers ... What I thought was (*D.*) *cannacroioides* flew over the large, wide, not very fast Rio Tambopata in Peru". Regarding oviposition he mentioned that in Costa Rica on June 1967 he saw (italics added): "few males at river; female ovipositing with male above her, *in rootlets at surface ca. 2' from shore in swift section; flew very slowly along, dragging abdomen tip along root*". This oviposition behavior is the same as described by GONZALEZ SORIANO (1987) for *E. aliciae* in Los Tuxtlas, Veracruz.

The antepenultimate instar larva of *E. aliciae* was found in tangles of overhanging roots of the liana *Cissus gossypifolia* (Standley) (Vitaceae); the last instar larvae were collected at river's edge near to a tall riparian tree. According to estimated larval age coupled with appearance and color of the wings of adults, emergence probably takes place close to the end of the dry season (end of May). The earliest dates for reproductive adults (males) in Mexico were from mid-May (El Salto); the individuals collected by this time (in both the Veracruz and the SLP localities) had glisteny wing reflectance indicative of an early emergence. The latest dates were from the end of August (Veracruz localities)

*E. aliciae* ranges from Costa Rica (Heredia prov., Finca La Selva, 10°28'N,



Figs 25-26. *Elasmothemis cannacroioides*, female (Chiapas state, Río Cabuacán, km. 3 Carr. Tapachula-Tuxtla Chico, 28-IV-1983, R. Novelo leg.): (25) cerci, dorsal view; — (26) abdominal segments 8-9, ventral view including vulvar lamina.

84°1'W, 60 m) north to El Salto (Río El Salto, Mpio. de Ciudad del Maíz. 21°27'6"N, 99°58'52"W) in the state of San Luis Potosí, Mexico. Elevation ranges from almost sea level (30 m at Río La Palma) to 1300 m (El Salto, San Luis Potosí).

## KEY TO THE KNOWN LARVAE OF *ELASMOTHEMIS* WESTFALL

- 1 Dorsal protuberance on tergite 8 long, reaching basal 0.5 of tergite 9 (Fig. 15d); epiproct 1.5 times longer than paraproct; lateral spine on abdominal segment 9 three times longer than its basal width (measured dorsally) ..... *constricta*
- Dorsal protuberance on tergite 8 short or moderately developed (e.g. not extending over the dorsal margin of tergite 9) (Figs 15a-c); epiproct 1.2 times longer or less than paraproct; lateral spine on abdominal segment 9 two times longer or less than its basal width ..... 2
- 2 Apex of the dorsal protuberance on tergite 8 reaching posterior margin of abdominal segment 8 (Fig. 15b); epiproct 1.2 times longer than paraproct; lateral spine on 9 two times longer than its basal width ..... *cannacrioides*
- Apex of the dorsal protuberance on tergite 8 short, not reaching posterior margin of abdominal segment 8 (Figs 15a, c); epiproct as long as or slightly longer than paraproct ..... 3
- 3 Dorsal protuberances on tergites 6-7 stout, not hook-like, that on 7 with its dorsal margin straight and parallel to ventral line of abdomen (Fig. 15a); lateral spine on 9 1.2 times longer than its basal width ..... *aliciae*
- Dorsal protuberances on tergites 6-7 hook-like, that on 7 with its dorsal margin convex and not parallel to the ventral line of abdomen (Fig. 15c); lateral spine on 9 1.6 times longer than its basal width ..... *williamsoni*

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