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THE FEMALES OF *ENALLAGMA EISENI* CALVERT AND *E. SEMICIRCULARE* SELYS, WITH A KEY TO THE FEMALES OF THE MEXICAN MEMBERS OF THE GENUS (ZYGOPTERA: COENAGRIONIDAE)

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The females of *E. eiseni* and *E. semicirculare* are described, illustrated, and distinguished from females of all other known Mexican *Enallagma* spp. Brief notes on their ecology are also provided.

INTRODUCTION

In his treatment of the *Enallagma* damselflies of the western United States, GARRISON, (1984) did not include four extralimital species from Mexico: *E. eiseni* Calvert, *E. novaehispaniae* Calvert, *E. rua* Donnelly, and *E. semicirculare* Selys. Of these four, *E. rua* is similar to *E. praevarum* (Hagen) and may be only a southern geographic variant of the latter (we do not wish to relegate *rua* to synonymy here, only to suggest further study of these taxa). *Enallagma novaehispaniae* is a well known and widely distributed species; although originally described as a subspecies of the Antillean *E. coecum* Selys, and still so treated by DAVIES & TOBIN (1983), we consider *novaehispaniae* unequivocally distinct. The other two species, however, have received scant attention since their original descriptions. Their females have remained undescribed, and nothing has been written on their biology. Here, we describe and illustrate females of *E. eiseni* and *E. semicirculare*, compare them with females of similar species, and provide a key for females of all species of *Enallagma* from Mexico.

ENALLAGMA EISENI CALVERT
Figures 1, 2, 7, 10

Material examined (33 ♀) — MEXICO: Baja Calif. Sur: Los Parres, 6 Oct. 1923 (J.H. Williamson), 2 ♀; San Bartolo (Dam), 1 May 1947 (Ira LaRivers), 1 ♀; pond and arroyo at Rancho San Enrique at km 51, 51 km E of Villa Insurgentes, 1, 4 Oct. 1984 (R.W. & J.A. Garrison), 23 ♀ (19 in tandem with ♂); Primer Agua, 7 km W of Hwy 1 and 6 km S of Loreto at km 114, 2 Oct. 1984 (R.W. & J.A. Garrison), 1 ♀; temporary ponds below Microwave Tower Ligui by Hwy 1 at km 70, 50 km S of Loreto, 3 Oct. 1984 (R.W. GARRISON), 3 ♀; arroyo 14 km W of Hwy. 1 on rd to San Javier, SW of Loreto, 5 Oct. 1984 (R.W. & J.A. Garrison), 3 ♀, (1 ♀ in tandem with ♂).

FEMALE — As with many other species of *Enallagma* (GARRISON 1984), pale areas in females may be pale blue or tan.

Diagnosis: Little difficulty should be encountered in identifying females, because *E. eiseni* is endemic to Baja California and seems to be the only common *Enallagma* in that region; the only sympatric species is *E. civile* (Hagen). The mesostigmal plates of these two species are similar, but the lateral arms of the frame meet the posterior arms at an obtuse angle in *E. civile*, at an acute angle in *E. eiseni*. *Enallagma eiseni* will key to *E. cyathigerum* in GARRISON (1984), and the mesostigmal plates of the two species are not consistently distinguishable. However, all *E. eiseni* we have examined have a pale dorsal spot on the prothoracic median lobe divided by a thin black line (Fig. 10): *Enallagma cyathigerum* and *E. civile* lack such a spot. Secondly, the hind margin of the pronotum of *E. eiseni* is distinctly sinuate, forming a trilobate condition (Fig. 7), but the hind margins of *E. cyathigerum* and *E. civile*, as well as all other Mexican species, are gently convex throughout. Finally, the full-length black stripe on abdominal segment 8 that is distinctly narrower than the adjacent black areas of segments 7 and 9 is unique among North American *Enallagma* (Fig. 2).

Length (mm): total: 28-31; — abdomen: 21-25; — hindwing: 16-19.

Head: Dorsum black with elongate pale postocular spots confluent medially with pale area on rear of head and pale occipital bar; black on head extending anteriorly to level of antennae, thereafter pale; remainder of head ivory to tan; often with slight blue cast, except postclypeus black with pale margin. Antennal scape black dorsally, pale ventrally; remainder of antenna black.

Thorax: Pronotum (Fig. 10) black with following pale areas: a median spot on middle lobe divided by a fine longitudinal black line; large lateral spot on each side of middle lobe, bordered ventrally by black; margin of anterior lobe and posterior lobe. Propleura black along notopleural suture, ivory below. Posterior margin of prothorax (Fig. 7) distinctly sinuate, appearing trilobate. Pale areas of pterothorax with black markings typical of the genus (Fig. 1); broad black middorsal stripe interrupted by pale middorsal carina, anterior margin of antealar crest pale; pale antehumeral and black humeral stripes each about 0.5 as wide as middorsal stripe; remainder of thorax pale with small tearshaped spot at dorsal end of metapleural suture; upper third of mesinfraepisternum black. Legs pale except for streaks of black on extensor surfaces and on distal 0.5 to 0.75 of

femora and occasionally thin black line on outer angle of tibiae; armature black.

Abdomen: Pale with dorsal black as follows (Figs 1, 2): spot on basal 0.75 to entire dorsum of segment 1; segment 2 with stripe extending full length of segment, slightly expanded on distal 0.33; segment 3 with dorsal stripe extending full length of segment, pointed anteriorly, constricted at distal 0.33 and immediately expanded to form lateral flanges followed by contraction, finally widened to form distal annulus, black on annulus extending laterally only to level of widest part of flange; segments 4-6 like segment 3, but anterior point of each spot more attenuate, and constriction at distal 0.33 more pronounced; segment 7 similar to former segments, but distal constrictions reduced or absent, black not extending to extreme distal end of segment; segment 8 with narrow dorsal stripe usually extending full length of segment except for narrow distal pale annulus, sometimes widening posteriorly or reduced at distal 0.25, occasionally divided by pale ground color; segment 9 with dorsal stripe usually extending full length except narrow distal pale annulus, stripe distinctly wider at base than distal end of stripe on segment 8, narrowed distally, in some specimens black reduced to two dorsolateral posteriorly directed triangles occupying basal 0.66 of segment; segment 9 also sometimes with ventrolateral streaks on each side; segment 10 with dorsal stripe, usually widest basally. Cerci ivory.

Mesostigmal plates (Fig. 7) most similar to *E. cyathigerum* (Charpentier), lateral arms of frame forming an acute angle (75°-80°) with posterior arms. Each plate short, with anterior and posterior margins nearly parallel in medial 0.75, then abruptly tapered to lateral corner, with posteromedial and anterolateral ridges separated by wide trough-like depression, posterior margin distinct along entire length of plate.

Postnodal crossveins: forewing 9 (rarely 10), hindwing 8-9.

Biology — RWG found the species abundant along slow streams and stock ponds near Loreto, Baja California (GARRISON, 1986). We know of no records of *E. eiseni* north of Baja California Sur, and no one seems to have found it in company with any other species of *Enallagma*. However, *E. civile* has been collected at small stagnant ponds 27 km W of La Paz by Hwy 1. Thus, it should occur with *E. eiseni* at some localities.

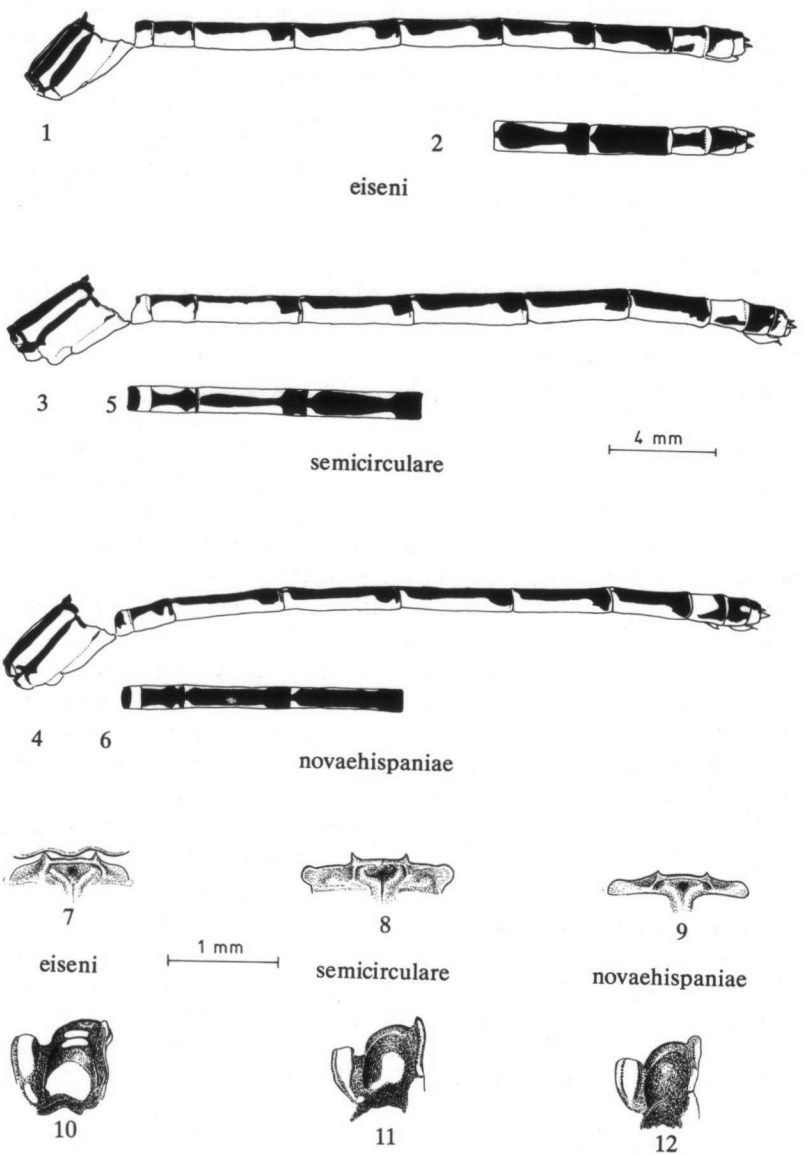
ENALLAGMA SEMICIRCULARE SELYS

Figures 3, 5, 8, 11

Material examined (7 ♀) — MEXICO: Sinaloa State: ponds 9.9 mi E Guasave turnoff on Mex. 15, 1 Sept. 1965 (D.R. Paulson), 1 ♀ in tandem with ♂; Veracruz State: vic. Lagunas Azul and Emilia, Estacion Biologia Tropical "Los Tuxtlas", UNAM, about 30 km NE of Catemaco, 18°34-36'N, 95°04-09'W, 150 m, 29 July 1982 (R.W. Garrison), 2 ♀, 1 ♀ in tandem with ♂; same data but 7 & 14 August 1982, 4 ♀ (3 in tandem).

FEMALE — Pale colors mostly pale violet or blue-gray, not tan or blue.

Diagnosis: Females of *E. semicirculare*, like *E. eiseni*, will key out to *E. cyathigerum* in GARRISON (1984), but overall pale coloration in *E. semicirculare* is violaceous, not blue or tan as in *E. cyathigerum*. The dorsal stripe on abdominal segment 3 in *E. semicirculare* is conspicuously narrower than those on



Figs 1-12. *Enallagma eiseni* Calvert (Figs 1, 2, 7, 10), — *E. semicirculare* Selys (Figs 3, 5, 8, 11), and — *E. novaehispaniae* Calvert (Figs 4, 6, 9, 12): (1, 3, 4) thorax and abdomen, dorsolateral view; — (2) abdominal segments 5-10, dorsal view; — (5, 6) abdominal segments 1-4, dorsal view; — (7, 8, 9): mesostigmal plates and hind margin of pronotum, dorsal view; — (10, 11, 12) prothorax, dorsolateral view.

succeeding segments (Fig. 5), a condition not expressed in *E.cyathigerum* or related species. The mesostigmal plates of *E.cyathigerum* lack the posterior tumid swellings on each plate typical of *E. semicirculare*. *Enallagma semicirculare* resembles *E. novaehispaniae* in general coloration. The latter species is distinguished by the absence of lateral spots on the middle lobe of the pronotum, the presence of a black band on the apex of abdominal segment 8, and by the distinctive curved projections near the anterior ends of the humeral stripes (Fig. 4).

Length: total: 29-30.5 mm; — abdomen 22.5-25; hindwing: 17-18.

Head: Similar to *E. eiseni,* but black on epicranium more extensive, almost separating oval pale postocular spots from pale occipital bar. Labrum pale with small black median spot at base.

Thorax: Dorsum of pronotum (Fig. 11) black with following areas pale: anterior lobe except at extreme base; large irregularly shaped lateral spot on each side of middle lobe, bordered ventrally by black, this pale spot with a long anteroventral extension almost touching base of anterior lobe. Propleura pale except black along notopleural suture. Posterior margin of prothorax straight or slightly convex. Pterothorax (Fig. 3) similar to *E. eiseni* but middorsal carina black, middorsal black stripe only about 0.33 width of mesepisternum, antehumeral stripe about 0.5 width of middorsal, and black humeral stripe narrower than pale antehumeral, especially so dorsally, upper half of mesinfraepisternum black. Black on femora more extensive than in *E. eiseni,* extending almost to coxae, black stripe well developed on outer angles of tibiae, tarsal joints black.

Abdomen: Pale with dorsal black as follows (Figs 3, 5): spot on basal 0.33 to 0.75 of segment 1; segment 2 with stripe extending full length of segment, in basal 0.5 narrowed posteriorly, then with a sharp lateral expansion on distal 0.33; segment 3 with narrow dorsal stripe, truncate anteriorly, tapered posteriorly sometimes to a mere line, then abruptly expanded laterally at distal 0.20; segments 4 and 5 similar to segment 3, but stripe attenuated anteriorly, otherwise distinctly wider and more broadly connected to distal expansion than on segment 3; segment 6 like segments 4 and 5 but stripe wider, not constricted before distal expansion; segment 7 like segment 6 but still wider; segment 8 with a dark ventrolateral streak, dorsally pale; segment 9 largely black with small pale area along posteroventral margin, sometimes with pale area divided, isolating a small pale lateral spot; segment 10 with dorsal black stripe extending basally along anterior margin. Cerci black above, pale below.

Mesostigmal plates (Fig. 8) similar to *E. cyathigerum* and *E. civile,* lateral arms of frame acute to posterior arms, or nearly so. Each plate rectangular, nearly flat, with an oval or circular tumid area at middle of posterior margin[1]; anterolateral

[1]T.W. Donnelly (pers. comm. 25 Sept. 1987) has two females from Sonora State (Rio del Fuente, 10 mi N Los Mochis) whose mesostigmal plates have a mesoposterior swelling near the lateral arm of the frame.

margin of plate often pronounced and almost semicircular (as in Fig. 8), or less distinct so that anterior margin of plate is linear.

Postnodal crossveins: forewing 10-11, hindwing 8-10.

Biology. RWG collected this species in company with *E. novaehispaniae* at a small lagoon in southern Veracruz (Estacion Biologia Tropical "Los Tuxtlas", UNAM, about 30 km NE of Catemaco, 150 m). Collection data for this poorly known species indicate a preference for ponds over streams. As with other species of *Enallagma*, females remain in tandem with males after copulation.

DISCUSSION

Of the 12 species of *Enallagma* known from Mexico, six (*basidens, boreale, carunculatum* [Baja Calif, Norte: La Mision, 1 ♂, in National Museum of Natural History], *cyathigerum, durum* [Tamaulipas State: 5 mi N of Tampico on Mante-Victoria Rd (D. Cuyler), 1 ♀, det. D.R. Paulson, in D.Cuyler collection], and *exsulans* [Nuevo Leon State:Rio Ramos, 500 m, 3 km S of Allende (T.W. Donnelly), 22♂, 1 ♀, in T.W. Donnelly collection and Florida State Collection of Arthropods]) are temperate zone species whose distribution in Mexico infringes along the northern tier of states or extends into the northern central massif. Of these, *E. exsulans* and *E. durum* are principally distributed in the eastern United States and are therefore not treated by GARRISON (1984), but JOHNSON (1972) keyed and illustrated diagnostic features. *Enallagma civile* and *E. praevarum* occur well into Mexico and are keyed by GARRISON (1984). The remaining species, *E. eiseni, E. novaehispaniae, E. rua,* and *E. semicirculare* are primarily Middle American in distribution, with *novaehispaniae* also penetrating southern Texas and northern South America. The following key will distinguish females of all the species known to occur in Mexico.

1 Forewing with no more than eight postnodal crossveins and with M_2 arising near fourth postnodal; each humeral stripe divided longitudinally by sharply-defined pale brown or blue line extending full length but less than 0.5 width of entire stripe; small pale spots present immediately anterior to lateral ocelli ..... ***basidens***

1' Forewing usually with nine or more postnodal crossveins and with M_2 arising near fifth postnodal; humeral stripe either entirely black or with light brown longitudinal line or spot without sharply defined edges, variable in length and width; pale spots not present immediately anterior to lateral ocelli 2

2(1') Hind lobe of pronotum with distinct pale median tubercle bearing a tuft of setae; mesostigmal plates each bordered posteriorly by distinct elongate pit; humeral stripe interrupted or divided longitudinally by light brown marking, sometimes entirely light brown ... ***exsulans***

2' Hind lobe of pronotum without a median tubercle or a distinct tuft of setae; mesostigmal plates not bordered posteriorly by a distinct pit; humeral stripe entirely black 3

3(2') Four or five antenodal postquadrangular cells in forewing; each mesostigmal plate with anteromedial border and lateral 0.5 elevated, forming a deep scooplike depression in medial 0.5; large and stocky, abdomen 29 mm or longer ..... ***durum***

3' No more than three antenodal postquadrangular cells in forewing; mesostigmal plates otherwise; smaller and more slender, abdomen usually shorter than 29 mm 4

4(3') Hind margin of pronotum distinctly sinuate, appearing trilobate (Fig. 7); abdominal segment 8 with narrow dorsal black stripe, usually extending full length of segment, but

distinctly narrower than corresponding stripes of segments 7 and 9 (Figs 1, 2); middle lobe of pronotum with a middorsal pale spot divided by a thin black longitudinal line (Fig. 10); pale thoracic color blue or tan. Endemic to Baja California ..... ***eiseni***

4′ Hind margin of pronotum linear or smoothly convex, not sinuate; abdominal segment 8 marked otherwise; middle lobe of pronotum usually lacking divided middorsal spot (Figs 11, 12); pale thoracic color variable 5

5(4′) Pale thoracic color violaceous; abdominal segment 8 usually with a ventrolateral dark stripe; either abdominal segment 3 or anteroventral part of humeral stripe with unusual color pattern, as described below 6

5′ Pale thoracic color blue or tan; abdominal segment 8 without a ventrolateral dark stripe; abdominal segment 3 and humeral stripe without unusual color pattern.....7

6(5) Posterior margin of mesostigmal plate with a circular or elongate tumid area near middle, or mesally near lateral arm of frame; remainder of plate planar (Fig. 8); anteroventral margin of black humeral stripe with no anteriorly directed offshoot (Fig. 3); constriction of black middorsal stripe on abdominal segment 3 much stronger than succeeding segments (Fig. 5); dorsum of abdominal segment 8 entirely pale (Fig. 3); a large distinct pale lateral spot on pronotum (Fig. 11)..... ***semicirculare***

6′ Mesostigmal plate with a diagonal ridge extending from posterior base of frame to anterolateral margin (Fig. 9), with no tumid area; anteroventral margin of black humeral stripe with a small curved extension almost touching posterior edge of mesostigmal plate (Fig. 4), or connecting with black border, thus isolating a small pale spot; medial constriction of dorsal black spot on abdominal segments 3 and 4 similar (Fig. 6); black on abdominal segment 8 connected dorsally along posterior margin; pale lateral spot on pronotum lacking or, rarely, present but quite small (Fig. 12)..... ***novaehispaniae***

7(5′) Posterior margin of each mesostigmal plate well defined by a narrow sulcus extending its entire length.....8

7′ Posterior margin of each mesostigmal plate indistinct over part of its length, the sulcus lacking or incomplete.....11

8(7) Mesostigmal plates with lateral arms of frame at least slightly convergent anteriorly and each plate with a distinct elongate depression confined to the anteromedial corner .... ***cyathigerum***

8′ Mesostigmal plates with lateral arms of frame parallel or divergent anteriorly and without such depressions 9

9(8′) Mesostigmal plates with lateral arms of frame usually only slightly divergent anteriorly, each plate lateral to lateral arm of frame flat or elevated only along anterolateral margin, forming a shallow depression running diagonally from anteromedial to posterolateral portion of plate; black spot on dorsum of abdominal segment 1 usually almost reaching apex of segment and of uniform width, stripe on dorsum of segment 8 usually not markedly constricted basally..... ***civile***

9′ Mesostigmal plates with lateral arms of frame strongly divergent anteriorly and thickened, and each plate with a prominent diagonal ridge running from about middle of posterior border to anterolateral corner, this ridge and lateral arm of frame delineating a distinct depression between them near middle of plate; black spot on abdominal segment 1 usually not nearly reaching apex of segment or, if so, constricted apically, stripe on dorsum of segment 8 usually constricted basally 10

10(9′) Mesostigmal plates each with anteromedial margin projecting less prominently, lateral corner slightly narrower and more tapered ..... ***praevarum*** [2]

10′ Mesostigmal plates each with anteromedial margin projecting more prominently, lateral corner sligthly more rounded and less tapered ..... ***rua*** [2]

[2]Based on DONNELLY (1968), who states that, "The females are not easily distinguished".

11(7') Mesostigmal plates each with lateral arm of frame raised to form an oval or elongate medial tubercle, and each plate with posterior border indistinct in medial 0.5 only and relatively straight; dorsum of abdominal segment 8 usually with pale area relatively more extensive than on segment 7, sometimes entirely blue ..... ***boreale***

11' Mesostigmal plates with lateral arm of frame not raised to form a tubercle, and each plate with posterior border indistinct along most of its length and more or less sinuate; abdominal segment 8 with pale area usually of about same relative extent as on segment 7, never entirely blue ..... ***carunculatum***

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