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COURTSHIP DISPLAY IN *BELONIA CROCEIPENNIS* (SELYS), WITH NOTES ON COPULATION AND OVIPOSITION (ANISOPTERA: *LIBELLULIDAE*)

C.E. WILLIAMS
704 Foster Street, Marlin, Texas 76661, United States

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The courtship display, copulation and oviposition in *B. croceipennis* were studied each day from Sept. 24 through Oct. 18, 1976 at a small tributary of the City Park Lake, Marlin, Texas, United States, and are described in detail. This is one of the few known cases of male courtship display in Anisoptera.

INTRODUCTION

Belonia croceipennis (Selys) has been collected in the United States only from Arizona, California, Oklahoma and Texas, however, its range extends into Mexico and Central America.

Originally my only intention was to photograph an example of exophytic oviposition, but soon after arriving at the site I noticed that the males were exhibiting courtship display. I considered this worthy of further study, and spent many days there. CORBET (1962) stated that male courtship is evidently rare in Anisoptera.

DESCRIPTION OF SITE

B. croceipennis was studied at a small spring-fed stream which flows into the east end of the City Park Lake of Marlin, Texas, United States. This species was never seen along the lake shore. Observations were made daily from September 24 through October 18, 1976 along the stream from its mouth to a point 75 m upstream. Within these limits were a waterfall with a height of 1 m, and several widened pond-like areas. Above the waterfall the stream was densely shaded by trees and shrubs. Extending above and below the falls was a thick

growth of Giant Reed (*Arundo donax* L.), with its tiny rootlets exposed in the water. Below the waterfall, tall vegetation was sparse along the south bank, and sunlight was admitted to the stream. The bottom of the stream alternated between moss-covered rock and sand. In the deeper pools some mud and debris had collected.

At this site *croceipennis* had little or no competition from other Odonata. The only other species of Anisoptera seen was a *Plathemis lydia* (Drury) male, which made several hurried, non-stop flights up and down the stream. *Argia plana* Calvert and *A. immunda* (Hagen) were ovipositing in tandem in densely shaded areas above the waterfall, and *Telebasis salva* (Hagen) were ovipositing in tandem in the moss and rootlets of *Arundo donax*, in small patches of sunlit areas.

By November 1, *B. croceipennis* were absent at the site, and *Sympetrum vicinum* (Hagen) were abundant.

OVIPOSITION

Numerous individuals of *B. croceipennis* were in flight along this short section of the stream, and a few males were trying vainly to defend a territory; but mostly they flew together up and down the stream, dashing at each other along the way, and fiercely competing for the females. Females were furtively flying in to oviposit, and their task was difficult. As soon as a female began to oviposit, usually one or more males would see her and try to mate. Generally the sites for oviposition were either near the shore-line in the shallows of the pondlike areas, or in tiny isolated pools in shaded areas above the waterfall. Two females, facing upstream, oviposited at the edge of the waterfall where the current was swift, and several others over sunlit ripples of a narrow section of the stream. Under most conditions the female faced the shore and flew rapidly forward, dipped the abdomen (often throwing a jet of water on the shore) (Fig. 1), rose and flew backward, then downward and forward to repeat the procedure. The loops, 10 to 15 cm. in diameter, were repeated many times in the same location; then, if not disturbed, in several adjacent locations. Only one female was observed which was not molested by a male, and after 5 minutes of ovipositing, she flew away of her own accord. Almost all oviposition occurred between 11.00 a.m. and 2.00 p.m., and males seldom were seen flying after 3.00 p.m. No feeding was observed. Both sexes, upon leaving the stream, flew in and out of the densely shaded areas. On cloudy days males continued to fly, and females to oviposit, but to a lesser degree. During long periods of time, when no female was present, the males spent much time perched; but once a female was discovered and pursued by a male, the other males left their perches and renewed their patrols back and forth along the stream.

The manner of oviposition appears to be similar to that of *Belonia saturata*

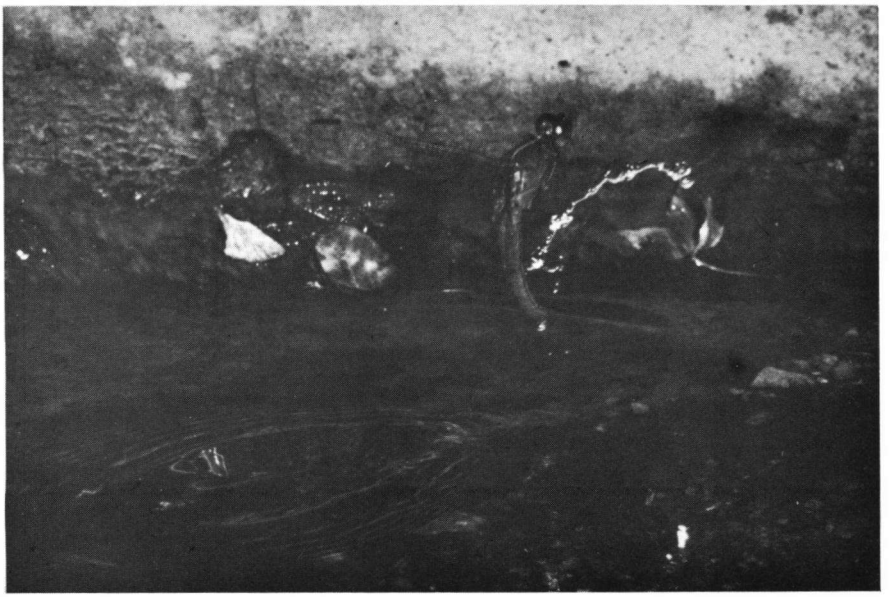

Fig. 1. *Belonia croceipennis* (Selys). The ovipositing female dips her abdomen as she flies rapidly forward, and a jet of water is propelled into the air.

(Uhler). GLOYD (1958) observed that females of that species "slapped the tips of their abdomens in the water and flipped up small drops as high as six or eight inches".

COURTSHIP DISPLAY

The roving males either ignored, or failed to see the females until they began to oviposit. Often only one male would detect an ovipositing female, and immediately he would descend to a level of 3 to 7 cm above the water. Then, with his bright red abdomen curved sharply upward, he very slowly approached the female, face to face when possible. If she was facing a large rock or vertical bank, he made a lateral approach (Fig. 2 a-b). When he arrived to within 15 to 20 cm from her, usually she attempted to fly away. If she did not, he made rapid, but very short darts toward her. which caused her to take off. Only then did he try to seize her. Apparently this was a courtship display, as the upturned abdomen would be clearly visible to the female. Often the female escaped and almost immediately returned, whereupon the procedure was repeated. These repeated performances drew the attention of other males, and as a result of the savage competition for the female, courtship display was abandoned. In such event, each male seized any opportunity to take the female directly. After a male had tried

unsuccessfully to catch a female, he returned again and again to the site and searched thoroughly for her, by flying back and forth and hovering over the area. Several times males were observed exhibiting courtship display while approaching some brown butterflies fluttering low over the water, and on other occasions the display was directed toward the *Argia*, which were ovipositing in tandem. In each event the error was soon discovered, and the male lowered his abdomen and renewed his patrol. Often a male was seen dipping his abdomen in a manner similar to oviposition, and possibly other males mistook him for a female. They descended and chased him away, however no courtship display was observed on such occasions. The pursued male sometimes exhibited "threat display", by curving his abdomen downward.

COPULATION

A total of 17 copulations were observed from start to finish, and in each case the male mated with an ovipositing female. Two copulations were completely accomplished in flight. One mating pair spent seven seconds in flight and the remaining 25 seconds at rest on the Giant Reed. Each of the other 14 made a brief landing on a tree overhanging the water, or on the Giant Reed. The durations of 9 copulations were 18, 21, 21, 22, 22, 25, 27, 30 and 32 sec; average, 24.2 sec. Sometimes the female was released from the landing site, and other times after a second brief flight. The mating flight, unless there was too much competition from other males, was confined to an area extending no more than 3 to 5 m from where the female was ovipositing when seized by the male. After being released, she immediately began to oviposit, often in precisely the same spot as before. For the first 20 to 30 seconds her mate chased away the interfering males; thereafter she was left to her own resources.

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Fig. 2 a-b. *Belonia croceipennis* (Selys). The male displays to an ovipositing female by curving his abdomen sharply upwards as he slowly approaches.

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