SOME OBSERVATIONS ON REPRODUCTIVE BEHAVIOR IN *BRECHMORHOGA VIVAX* CALV. (ANISOPTERA: LIBELLULIDAE)

While I was observing reproductive behavior in *Hetaerina cruentata* (Ramb.) in Xalapa, Ver., México in September 1992, I recorded some additional information for *B. vivax*, which occurred at high frequency in the study site. Observations were principally directed towards the timing and description of copulation and oviposition behavior as well as territorial behavior and interactions among males.

Recordings were made during five days: 6, 18, 19, 20 and 24 September. The study site was the Río Sordo (19°30'N 96°95'W). Twelve individuals were marked, using an ink pen and quickly releasing them, however, marked animals were never resighted.

B. vivax aggressively defended territories of variable size along the river, from 4-5 to 12-15 m, covering always the entire width of the river

(3-6 m), in sunny spots only. Their activity started approximately at 9:35 h (n=12) when sun began to illuminate the river, and ended at 14:40 h (n=10). On two days I saw two different males in distinct territories patrolling different areas for three hours. Males patrolled flying close to the water surface (15-30 cm) making frequent visits to sites of quiet water at the edges of the river, probably searching for ovipositing females. I saw a constant pattern of searching consisting of short flights opposed to the water current and hovering every 3 s on average (n=14), eventually returning to the origingal site. At times individuals advance, ascend and descend swiftly in a looping flight (Fig. 1), and continue flying in the same direction.

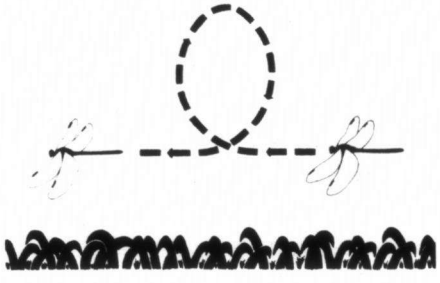

Fig. 1. Looping flight in *Brechmorhoga vivax*.

I could not detect feeding or interaction with other males associated with this behavior. I never saw a male perch until patrolling behavior ceased (after midday). This is interesting; it follows a similar pattern exhibited by other libellulids, where patrolling is the main behavior carried out at reproductive sites (J. ALCOCK, 1989, *J. Insect Behav.* 1: 49-62 and references therein). Some individuals flew to vegetation, for feeding, in a similar flight pattern to that described by M. TAGUCHI & M. WATANABE (1985, *Rep. Environ. Sci. Mie Univ.* 10: 109-117). For *Sympetrum pedemontanum elatum* Sel., which exhibits this behavior while searching for females (however, it can not be discounted that probably *B. vivax* search for females too). At around midday more interactions occurred, consisting essentially of two types. In the first, an "intruder" crosses the territory quickly and the "resident" flies directly to him. The "intruder" does not confront the "resident", and the "resident" returns after a few m of chasing. In the second type, a "resident" detects an "intruder" inside its territory and confronts him with an aggressive response, but I never saw that the "intruder" initiated encounters. On one occasion an "intruder" was not detected by the "resident", and both males patrolled opposite sides of the river for about 8 min. When the resident detects the intruder, the interaction produces ascendent-spiral, extremely fast flights, similar to that of *B. pertinax* (Hag.) (ALCOCK, 1989; ibid.), but the diameter of the circular flights never decreased during ascent, as Alcock has described; in addition, in several aggressive flights (n=18), the males flew to the surrounding vegetation. Both kinds of flights always end with one male escaping. This last finding, their aggressiveness, and the patrolled area suggest a well-developed territorial behavior. I could not determine which was the winner in these encounters. In one occasion I watched physical contact among two males. This occurred when a tandem pair was assaulted by a solitary male. The male in-tandem released the female which fell to the water, and both males continued in their aggressive interaction.

I recorded nine copulations with an average of 23±4.5 s (n=7). The males violently grasp females and rapidly assumed the copulatory position. I did not observe sperm transfer before tandem or copulation. Only once a pair in copulation was seen perched on vegetation. The copulation pair always flew near to oviposition sites. Oviposition lasted an average of 53.4±22.6 s (n=5) and was achieved with non-contact guarding. This was done in quiet water and disturbed water areas. On September 26, when territorial activity had decreased, two females were seen ovipositing without guarding males. Ovipositing females were frequently harassed by guarding males with rapid contact of wings. When the female had ended oviposition and flew to vegetation, she was chased by guarding males, trying again to take her in tandem position. These females flew in zig-zag, avoiding male contact and always close to the vegetation. On several occasions males guarding females chased aggressively other males that swiftly entered the territory trying to take ovipositing females in tandem. On two occasions, after aggressive male to male interactions, females rapidly finished oviposition

and flew to the vegetation. Ovipositions were made with rapid abdominal contacts on the water surface, however, once I saw an unguarded female ovipositing in emergent grass at 6 cm above the water surface.

Some behavioral differences exist between *B vivax* and *B. pertinax*. The former does not appear to engage in short patrolling flights although this could be an effect of the density as K.J. SHERMAN (1983, *Anim. Behav.* 31: 1107-1115) has found in males of *Pachydiplax longipennis*, which patrolled for longer times at low densities. Also male aggressive encounters rarely produced physical contacts in *B. vivax*. Copulation time is shorter in *B. pertinax* (6-17 s) (ALCOCK, 1989: *ibid.*). But the striking difference, as with some other libellulids, was that "resident" of *B. vivax* never perched when patrolling an area. This is an interesting behavior taking into account the high energy cost (M.L. MAY, 1984, *Adv. Odonatol.* 2: 95-116) and the time used defending the site by dragonflies.

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