

PROTRACTED OVIPOSITION BY *HE-TAERINA TITIA* (DRURY) (ZYGOPTERA: CALOPTERYGIDAE)

On 1 September 1985, while wading in the South Fork of Spring River at a point 10 km W Hardy, Sharp Co., AR, United States, I observed a female *H. titia* ("tricolor" type) approximately 5 cm below the water surface. She was ovipositing into the submerged portion of an inclined rotting log, which was in an area of moderate current. I continued to observe her until she emerged approximately 15 min later, at 1100 hrs CDT. She flew away almost immediately.

As I passed this same log at 1200 hrs, I noticed a pair of *H. titia* in tandem alighting at the water/log interface. As the female moved under the water, the male struggled, then disengaged and assumed a perch on an adjacent dead tree branch, approximately 10 cm above the water. The female began to oviposit almost immediately, moving over the submerged part of the log and descending to a maximum depth of 15 cm. On two occasions she approached the water surface, bending the surface film, but it did not appear to break. Oviposition continued both times, and after a few seconds she moved into deeper water. She finally emerged at 1400 hrs (120 min after submergence), sat for four sec, flew to a perch approximately one m away,

dried for a few sec, flew another two m, sat for a few min, then flew away.

The attending male was noticeably unaffected by my presence, even tolerating a sweep over his head in a vain attempt by myself to net a *Boyeria vinosa* (Say). It was at this point that I became aware of another male *H. titia* perched nearby, also being tolerant of my activities. I surmised that this must be an attending male, and after a few minutes' search, located a second ovipositing female on the submerged log. This female emerged at 1338 hrs, or after at least 98 min submergence. She, too, flew away almost immediately after emergence.

C. JOHNSON (1961, *Can. Ent.* 93: 260-266) reported certain aspects of breeding behavior and oviposition in *Hetaerina americana* (Fabr.) and *H. titia*. He never saw ovipositing *titia* females return to the surface, and therefore had no estimate of oviposition time. However, he noted that "tricolor" females oviposited in still water at stream's edge among thick vegetation and "tricolor" males attended for no more than two or three min, whereas typical *titia* females oviposited in rapidly flowing water where submerged vegetation was growing, and typical *titia* males guarded, or attended, for up to 40 min.

Breeding behavior and oviposition have also been observed in *H. americana*, *H. vulnerata* Sel. and *H. macropus* Sel. by G.H. BICK & D. SULZBACH (1966, *Anim. Behav.* 14: 156-158), J. ALCOCK (1982, *Anim. Behav.* 30: 99-107) and W.G. EBERHARD (1986, *Odonatologica* 15: 51-60), respectively. The female *H. americana* oviposited in red willow roots for 7-52 min, while the male attended. *H. macropus* females oviposited in small living stems and roots, one remaining submerged for 38 min, but whether the male attended was undetermined. The female *H. vulnerata* oviposited in waterlogged plant material, including pine needles, tree limbs and twigs, for 1-106 min, while the male usually attended. With regard to the behaviors discussed, my observations differ from those of JOHNSON (1961) for "tricolor" individuals, and *H. titia* appears to be most similar to *H. vulnerata*. Length of submergence during oviposition by *H. titia* rivals that reported by I. MESKIN (1985, *Notul. odonatol.* 2: 103-104),

who reported *Pseudagrion hageni* Karsch ovipositing for 79 min, partially emerging (head, thorax and wings above the water surface) for four min, then descending for an additional 72 min.

G.L. Harp, Department of Biological Sciences, Arkansas State University, State University, AR 72467, United States.