

## Underwater and epilithic oviposition by Australian Aeshnidae (Odonata)

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### ABSTRACT

In this article we report underwater oviposition and epilithic oviposition in Anisoptera. We observed *Notoaeschna sagittata* totally submerged ovipositing on bare rock in the fast current of a rapid. *Dendroaeschna conspersa* oviposited also underwater, but into wood submerged in very clear water.

### INTRODUCTION

Normally, aeshnids oviposit endophytically, i.e. laying eggs into plant material or mud and have a functional cutting ovipositor (Tillyard 1917; Corbet 1999: tables A 2.5, A 2.6). In contrast, nothing is documented about the oviposition mode and behaviour of the Australian relatives *Notoaeschna sagittata* (Martin) and *Dendroaeschna conspersa* (Tillyard). Both species have been attributed to a separate family Telephlebiidae by Bechly (1996) but are treated as Brachytroninae in the conventional systematics (e.g. Theischinger 1982, von Ellenrieder 2002). Here we describe ways of their oviposition, possibly usual or exceptional.

## OBSERVATIONS

### *Notoaeschna sagittata*

While collecting Odonata along the Snowy Creek, 1.5 km upstream of Mitta Mitta (36°32'S, 147°22'E; 280 m a.s.l.) on 20 January 2003, we observed a female flying over a fast flowing riffle area created by a rocky outcrop in the moderately fast flowing river. The female flew around the riffle site, making at least two passes, before flying directly into the water and alighting on a submerged rock in the fast current. Her body and wings (held horizontally) were completely immersed under the water (Fig. 1), although, due to the disturbed nature of the flow, one or both pairs of wings would occasionally become momentarily exposed to air. The head and abdomen were more or less permanently submerged during the oviposition period. After securing her position on the rock the female bent her abdomen, in a typical oviposition action and appeared to commence laying on the vertical surface of the rock. She continued this behaviour for at least two minutes, before we captured her for confirming identification. On later examination of the rock we could not find any other substrate, such as moss or soft material. However, from the posture and movement of the body we could assume that she was in fact laying eggs. Two exuviae of *N. sagittata* were collected from the side of the stream immediately adjacent to the oviposition site.

### *Dendroaeschna conspersa*

At a tributary of the Buckenbowra River, ca 15 km west of Batemans Bay (35°43'S, 150°10'E), on 28 April 1986, in early afternoon, a female was detected (by GT) completely submerged in very clear water; she was sitting with wings approximately half open at the base of a tree trunk, 15-25 cm below the water-surface. When disturbed the female rose out of the water and flew away. Due to the position of the female it was assumed that she was ovipositing; at the time males were occasionally flying some 10-20 m away.

## DISCUSSION

The observations described here enlarge the known spectrum of oviposition modes of anisopterans in two different aspects.

Both observed cases are unusual with respect to the posture of the female. While Zygoptera commonly submerge during oviposition we do not know about other examples of females being totally underwater during oviposition in Anisoptera. Corbet (1999: 30) states: "During what Ohgai (1994) reported as underwater oviposition in *Boyeria maclachlani*, only parts of the fore and hind wings (which were open to about 30-90°) were submerged; the head and thorax remained above the water". Fraser (1936) reported *Anax immaculifrons* Rambur to oviposit in montane streams, and preferring sluggish brooks, by inserting eggs into reeds, and remarked the female, "at times is entirely submerged during the act of oviposition". In contrast, both *Notoaeschna sagittata* and *Dendroaeschna conspersa* were totally

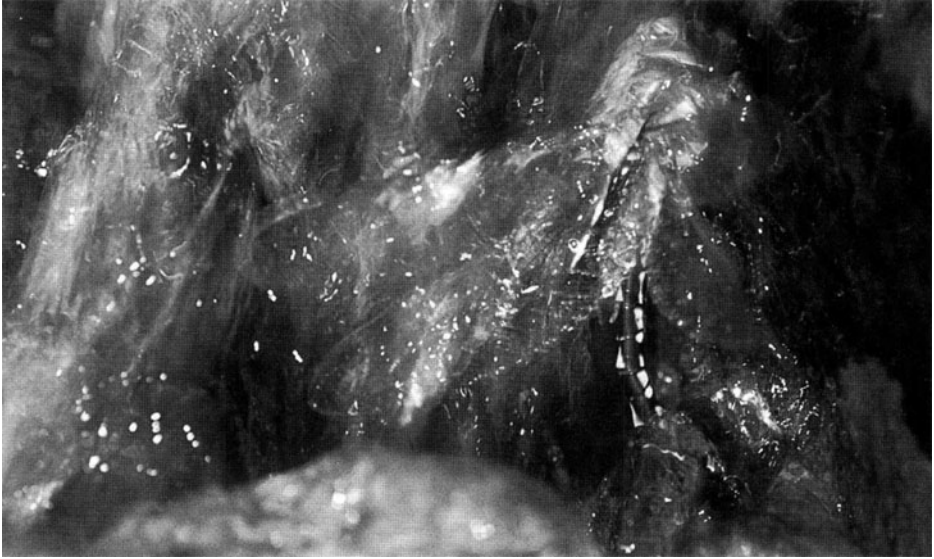


Figure 1: Female of *Notoaeschna sagittata* ovipositing on a rock being totally underwater in the Snowy Creek, Australia. Photo by Keith Wilson. See also the colour picture on front cover.

submerged. Underwater oviposition is normally interpreted as avoiding of conspecific males. This may be true for *D. conspersa*, a species since observed apparently ovipositing without being submerged. In the case of *N. sagittata* the underwater oviposition may also be correlated to the oviposition substratum (see below): oviposition on rock above the water surface may lead to desiccation of the eggs. However, there are only some exceptional cases of Anisoptera ovipositing fully, as in our case, or partly submerged. The major reason may be that the outstretched wings of Anisoptera normally might impede the female's smooth passage across the water surface (Corbet 1999: 30). All exceptions from this 'rule' concern aeshnids, which oviposit endophytically. During their oviposition they may be able to cross the water surface by just clinging down the substrate, which is also the normal way in Zygoptera.

The oviposition of *N. sagittata* is also unusual with respect to the substrate. Oviposition onto or into rock is reported only for some few species of odonates (Corbet 1999: 592; Martens 2001). Females of *Zygonyx natalensis* (Martin), a waterfall dweller, stick the eggs onto a layer of roots and Bryozoa covering the rocks in the spray zone alongside a waterfall (Corbet 1962). In contrast, the oviposition habitat of *N. sagittata* in the case described here was really epilithic, i.e. on submerged bare rock in the current, which is the known larval habitat (Hawking & Theischinger 1999).

The ovipositor of *N. sagittata* is significantly reduced in length compared to that of other aeshnids (Tillyard 1916; Theischinger 1982). Segment 10 shows underneath a rudiment of what was probably once a dentigerous plate (Tillyard 1916). The ovipositor therefore lost its cutting or rasping function. Tillyard (1916) reported that after netting a female, she almost immediately exuded a small cluster of large

elongate-oval eggs followed by some more eggs, totalling in all over 20. Such 'hand-held' oviposition being common in libellulids and some gomphids is not typical for species with endophytic oviposition. Tillyard (1916) from his observations already mentioned that *N. sagittata* might have thrown over the normal oviposition mode of its relatives of the Aeshnidae. The reduction of the ovipositor may have been evolved as a trait for epilithic oviposition, for which a cutting ovipositor is not useful. Other oviposition habitats such as plants, tree roots or wooden debris are rare in the habitats of *N. sagittata* or may often be used by several other species of the family that are common in those streams, namely *Austroaeschma* spp. This observation demonstrates again the evolutionary success of Odonata adapting to different ecological conditions.

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