

RAPID OVER-WINTER DEVELOPMENT IN *AUSTROLESTES COLENSONIS* (WHITE) (ZYGOPTERA: LESTIDAE) AND *AESHNA BREVISTYLA* RAMBUR (ANISOPTERA: AESHNIDAE) AT PUKEPUKE, NEW ZEALAND

W.J. WINSTANLEY

Department of Zoology, Victoria University of Wellington, Private Bag, Wellington, New Zealand

Abstract — Records are presented of *A. colenisonis* and *Ae. brevistyla* completing larval development in a temporary pond in New Zealand in 187 days or less, mainly over the winter months. The development time for these spp. has previously been considered to be 2 yrs and 2-3 yrs respectively. Unusually eutrophic conditions may have enhanced growth rates.

The Habitat

The Pukepuke Wildlife Management Reserve is a wetland area administered by the Wildlife Branch, Department of Internal Affairs. It is a valuable habitat supporting nine species of Odonata: *Ischnura aurora* (Br.), *Xanthocnemis zealandica* (McL.), *Austrolestes colenisonis* (White), *Aeshna brevistyla* Ramb., *Hemianax papuensis* (Burm.), *Hemicordulia australiae* (Ramb.), *Procordulia grayi* (Sel.), *P. smithii* (White), and *Diplacodes bipunctata* (Br.).

The reserve is situated on consolidated sand dune country 14.5 km north of Foxton (40° 19'S, 175° 16'E). It comprises the main

Pukepuke Lagoon complex with a number of interconnected smaller ponds and drains and six discrete experimental ponds which have been excavated since January 1970 (GIBBS, 1973). Three of these ponds are deep and have permanent open water: New Pond, Four Islands West Pond and Four Islands East Pond. The other three, Clover Leaf North, Clover Leaf West and Clover Leaf East, are shallow and may dry out completely in summer. This occurred in the summer of 1977-1978.

Clover Leaf North at its maximum level covers about 0.2 ha. A band of raupo (*Typha orientalis* Presl.) grows about its margin and its bed is dominated by coarse rushes, mainly *Juncus articulatus* L. and *Scirpus lacustris* L. (K.J. Potts, pers.comm. June 13, 1979). This luxuriant rush growth detracts from the pond's value as a wildfowl habitat and when the pond is dry its bed is mown to prolong the duration of open water after the pond refills.

Clover Leaf North Pond dried out by January 30, 1978 and remained so for three months. Half of its bed was mowed on March

30, 1978 and the remainder on April 4, 1978, the mown material being left to rot in situ. It rained heavily during the afternoon of April 29, 1978 and the pond started to refill. It rained again on the night of April 30, 1978 after which water was present in the pond throughout the winter.

I visited Pukepuke next on September 30, 1978 on which day adults of all three zygopteran species were seen. Samples taken from Clover Leaf North Pond that day showed that it was supporting very high numbers of invertebrates. The mown material from earlier in the year probably acted as a massive 'hay infusion' which might account for a productivity even higher than would normally be expected in a temporary pond. Large numbers of damselfly larvae were noted in the samples but no attempt was made to obtain quantitative data.

Observations on *Austrolestes colenisonis* and *Aeshna brevistyla*

At the ponds with permanent water, I found the first exuviae of *Ae. brevistyla* on 18 October 1978. On 3 November 1978 at Clover Leaf North Pond, the exuviae of numbers of *A. colenisonis* were noted on rushes emerging from the water and one *Aeshna brevistyla* exuviae was also found in the same situation. Actual emergence from the pond may have been earlier than this since I had not previously examined it for exuviae. This information indicates a maximum larval development period of 187 days, mainly during the winter months.

No direct temperature records are held for Clover Leaf North Pond over this period but water temperatures recorded four hundred metres away at a small lagoon with a slow water flow are available from June 28, 1978 onwards. They are as follows (mean and range, in °C): June: 5.8 (4.0-8.0), July: 8.6 (4.5-15.0), August: 9.9 (8.0-12.5), September: 13.0 (9.0-17.0), October: 14.9 (9.0-21.5). The air temperatures at the same site for May and June 1978 were 12.0 (-1.0-24.0) and 6.8 (-4.0-18.0) respectively. Water temperatures in May and June would probably be similar to those recorded in August and July respectively.

Discussion

HODGKIN & WATSON (1958) recorded *Austrolestes* spp. breeding in temporary waters in Australia but *Ae. brevistyla* is not a species which WATSON (1962) found in such habitats. Within New Zealand, *Ae. brevistyla* has been believed to require 2-3 years to complete its larval development (PRESTIDGE, 1976). K.J. Deacon (pers. comm. June 22, 1979) found that *A. colenisonis* required two years to complete development in a bed of *Typha orientalis* at Lake Sarah (43°03'S, 171°47'E) in the Southern Alps of the South Island, where lower temperatures than at Pukepuke would normally be experienced.

Other studies have shown that the larvae of Odonata are able to survive in dried-up ponds under certain circumstances (WILLEY & EILER, 1972; HUTCHINSON & MORRISSETTE, 1977; MIDTTUN, 1977). Although this cannot be entirely discounted, it is unlikely to have occurred at Clover Leaf North Pond: the pond bottom was firm enough to support a tractor when it was mowed and the sandy substrate would hold little moisture. It should be noted that TILLYARD (1910) suggested that most Aeshnidae perish when the ponds they occupy dry. There is little likelihood that the larvae found emerging had walked overland to Clover Leaf North Pond; the nearest permanent water, Four Islands East Pond, is sixty metres away.

It is not certain whether the larval population in Clover Leaf North Pond was derived from eggs laid before or after the pond dried, or a combination of these. Adult *A. colenisonis* were still flying in moderate numbers on April 30, 1978, whereas *Ae. brevistyla* was not observed on that visit. However, *H. papuensis* was still flying on April 29, 1978 which may imply that *Ae. brevistyla* was about also.

Acknowledgements — My thanks are due to the Department of Internal Affairs for the use of its accommodation at Pukepuke and to the resident officer, Mr. A.S. GARRICK, for his hospitality and for information on the water-levels and temperatures in the experimental ponds. Mr. K.J. DEACON, Department of

Zoology, University of Canterbury, Christchurch, New Zealand, kindly read the early manuscript of this paper and made suggestions for its improvement.

References — GIBBS, G.W., 1973, *Proc. N.Z. ecol. Soc.* 20: 13-20; — HODGKIN, E.P. & J.A.L. WATSON, 1958, *Nature, Lond.* 181: 1015-1016; — HUTCHINSON, R. & R. MORRISSETTE, 1977, *Cordulia* 3 (4): 145; — MIDTTUN, B., 1977, *Norw. J. Ent.* 24 (1): 84-85; — PRESTIDGE, R.A., 1976, *Aspects*

of the biology of Aeshna brevistyla Rambur and Hemicordulia australiae (Rambur) (Odonata). M.Sc. thesis, Univ. Waikato, New Zealand; — TILLYARD, R.J., 1910, *Proc. Linn. Soc. N.S.W.* 35: 666-676; — WATSON, J.A.L., 1962, *The dragonflies (Odonata) of south-western Australia*. Western Austral. Naturalists' Club, Perth; — WILLEY, R.L. & H.O. EILER, 1972, *Am. Midl. Nat.* 87: 215-221.

Received July 17, 1979