

DRAGONFLIES OF THE CAVE AND BASIN HOT SPRINGS, BANFF NATIONAL PARK, ALBERTA, CANADA

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Abstract — Of 12 spp. observed flying at the Cave & Basin Hot Springs, only *Argia vivida* Hag. and *Libellula quadrimaculata* L. were collected as larvae, and only *A. vivida* is known to complete its life cycle in the warm water.

Introduction

The dragonflies are predominantly a tropical group of insects; the oldest fossils are found in Paleozoic equatorial beds and the greatest diversity still occurs in tropical regions. Nevertheless the dragonfly fauna of temperate regions is substantial, some species even existing in the Low Arctic. These temperate zone species must ultimately have had tropical ancestors, and in order to survive the winter in their current environments they must have developed appropriate strategies, different from those of their tropical ancestors. These strategies fall under four headings in increasing adaptiveness to the temperate zone climate: (1) Migration; (2) Habitat selection and seasonal adjustment of the life cycle; (3) Cold tolerance in some stage(s) and seasonal adjustment of the life cycle; (4) Cold tolerance in all stages (PRITCHARD, 1982).

The commonest of these strategies in Canadian dragonflies is the third wherein "the basic life history (is) modified so as to ensure that the winter is survived in a suitably resistant stage, and that the adult coincides with the warm season" (CORBET, 1962). Strategy number (4) is unknown and strategy number (1) is rare. The Cave & Basin Hot Springs (see

PRITCHARD, 1971; PRITCHARD & PELCHAT, 1977) are of particular interest with respect to strategy number (2), since the high water temperature (20-30°C) allows eggs and larvae to survive year-round, although the life cycle must still be synchronized with air temperatures since the adults are terrestrial. The purpose of this study was to determine to what extent this strategy is employed by the dragonflies that frequent the Cave & Basin area.

Methods

Visits to the site were made on 17 June, 26 July and 20 December, 1985. On the first two occasions the species of adult dragonflies at the site were identified, either by observation at a distance or after capture with a hand-net. On the third occasion, samples of substrate and aquatic vegetation were removed and searched for larvae in the laboratory.

Results

Adults of 12 species of Odonata were recorded during the two summer visits, viz. Zygoptera (Coenagrionidae): *Amphiagrion abbreviatum* (Sel.), *Argia vivida* Hag., *Coenagrion resolutum* (Hag.), *Enallagma boreale* Sel., *E. cyathigerum* (Charp.), *E. hageni* (Walsh), *Ischnura cervula* Sel., Anisoptera (Aeshnidae): *Aeshna eremita* Scudder, *A. interrupta* Walker, *A. juncea* (L.), *A. palmata* Hag., and (Libellulidae): *Libellula quadrimaculata* L.

The Zygoptera were seen mainly around streams, although *A. vivida* was seen also at the

so-called Mineral Water Pool, and *I. cervula* was seen at the marsh at the bottom of the site, where the hot spring water merges with the cold water of the Bow River. *A. eremita* and *A. juncea* were seen only at the Mineral Water Pool, while *A. palmata*, *A. interrupta* and *L. quadrimaculata* were seen almost exclusively at the marsh. *A. vivida* were seen as teneral (indicating recent emergence from the adjacent water) and in copulation and oviposition. *A. eremita* and *A. palmata* were also seen in copulation.

Samples for larvae were taken only from the Mineral Water Pool and the streams, since the accessible portions of the marsh consist largely of flocculent, dead organic substrate which is difficult to process and unlikely to contain dragonfly larvae. Except for two *L. quadrimaculata* larvae found in the Mineral Water Pool, *A. vivida* was the only species found in these samples and it was common at both sites. The distribution of age classes was similar to that found in previous samples taken during December (PRITCHARD & PELCHAT, 1977).

Discussion

It has been known for some time that *Argia vivida* breeds at the Cave & Basin (PRITCHARD, 1971). There was some concern that its status had been endangered by the recent reconstruction of the swimming pool and upgrading of the interpretive site, but happily this appears not to have been so. The genus *Argia* achieves its highest species diversity in Central and South America and *A. vivida* occurs from Mexico to Banff and is one of only two species in the genus that occurs in western Canada. The Cave & Basin population is the most northerly known breeding population in this genus of tropical dragonflies. It is able to live at this latitude through its ability to live in thermal waters and to regulate its life cycle through a

delayed development strategy that synchronizes adult emergence with summer conditions (PRITCHARD & PELCHAT, 1977; PRITCHARD, 1982).

The genus *Aeshna* is especially associated with northern regions but its ability to survive is associated with strategy number (3) — cold tolerance in some stages and seasonal adjustment of the life cycle. Although copulating pairs were seen at the Mineral Water Pool, no larvae were found there. Possibly larvae occur in the further reaches of the Marsh where winter temperatures are much lower.

Libellula quadrimaculata is clearly able to develop, at least partially since the two specimens were only about half grown, in thermal water. Whether it can complete its life cycle in warm water is not known. It is tolerant of cold conditions, being able to breed in non-thermal habitats throughout Canada.

Conclusions

Only *Argia vivida* is known unequivocally to complete its life cycle in the water influenced by geothermal activity in the Cave & Basin area. The other 11 species of Odonata recorded from the site are presumed to breed in the marshy area adjacent to the Bow River where lower water temperatures, fairly typical for this latitude, prevail. The physiology of the various species, especially their responses to temperature, would repay further study.

References — CORBET, P.S., 1962, *A biology of dragonflies*, Witherby, London; — PRITCHARD, G., 1971, *Can.Fld. Nat.* 85: 187-188; — 1982, *Adv. Odonatol.* 1: 227-241; — PRITCHARD, G. & B. PELCHAT, 1977, *Can. Ent.* 109: 1563-1570.

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