

## **A NOTE ON THE LIFE CYCLE FEATURES IN TWO PERENNIAL POND COENAGRIONID ASSOCIATIONS (ZYGOPTERA)**

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**Abstract** — Life cycle features of *Ischnura elegans* (Vander L.), *Coenagrion puella* (L.), *C. scitulum* (Ramb.) and *Cercion lindenii* (Sel.) populations in 2 small perennial ponds in homogeneous environments, 2 km apart, are compared on a monthly basis. Significant pond-dependent differences in respective phenology and mutual exclusion are hypothesized for *I. elegans* and *C. lindenii*.

### **Introduction**

It is a known fact that life cycle features are one of the most important factors that regulate odonate associations (BENKE & BENKE, 1975). Several faunistic, ecological and ethological field studies on Odonata have been carried out over the past 40 years on the Presidential Estate of Castel Porziano near Rome (e.g. CONSIGLIO et al., 1974; UTZERI et al., 1977). They have now provided enough data for a clear des-

cription of the relative odonate fauna that is composed of 29 species, 7 of which Coenagrionidae. The species inhabit 16 small perennial ponds and 34 temporary pools with the common environmental features (climate, vegetation, substratum, anthropic influence) peculiar to that area.

These particular features make Castel Porziano a highly suited area for studies on the factors that regulate coexistence among the Odonata and especially among such similar species as the Coenagrionidae. This consideration induced us into analyzing life cycle features under two comparable coexistence conditions. Spatial separation of species was not studied because the two ponds examined were thought to be too small and too homogeneous.

#### Material and methods

This study was carried out at two perennial ponds (P2 and P5), approx. 20 m wide in diameter, situated at a distance of 2 km from each other, and inhabited by the following Zygoptera: *Coenagrion puella* (L.), *C. scitulum* (Ramb.), *Ischnura elegans* (Vander L.) and *Cercion lindeni* (Sel.).

Larvae were collected at several sampling stations over the entire pond area, using a 0.25 mm mesh-size hand-net. They were measured and identified alive according to CARCHINI (1979). Samples were taken from both ponds monthly: 14 times at P2 (Oct. 1975-Nov. 1976) and 13 times at P5 (May 1979-July 1980).

#### Observations

The 27 samples taken yielded a total of 1185 coenagrionid larvae. Figure 1 gives percentages of abundance of the four species in both ponds. Life cycle features are summarized as follows:

*Coenagrion puella* (Fig. 2) is clearly univoltine in both ponds. Larval growth in both populations is relatively fast and very synchronous; there is no evidence of larval diapause. The species is frequent in both ponds and is the most abundant in P2.

*Ischnura elegans* (Fig. 3) seems to be univoltine in P2 although development is asynchronous. This is probably due to a long egg-hatching period that presumably begins at the end of summer and goes on until winter. No evidence of a winter larval diapause was obtained. The emergence period appears to be very long, lasting from April to August. The species is very rare in P5 but ranks second for abundance in P2.

*Cercion lindeni* (Fig. 4) is univoltine. Growth in P5 is scarcely synchronous; this is probably caused by a long egg-hatching period that seems to take place from summer to autumn and at the end of winter. In winter the population shows an interruption of development. Emergence occurs from April to July. The growth is much slower in P2, where most individuals do not reach emergence, and the species is less common in this pond than in P5 where it is the most abundant species.

*Coenagrion scitulum* (Fig. 3). The larval population in P2 is not large and no larva was found in autumn 1976. No ultimate instar was ever collected, so it stands to reason that the population does not emerge. Data on this species

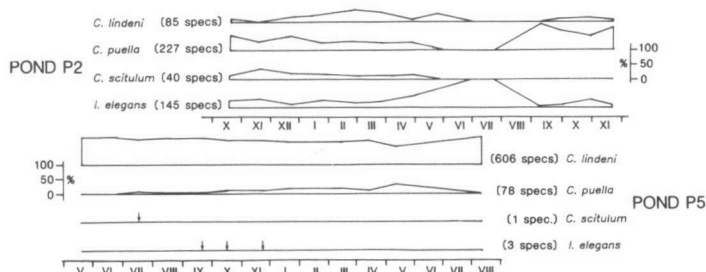


Fig. 1. Frequencies of the four coenagrionid species in each monthly sample. Arrows indicate single larvae.

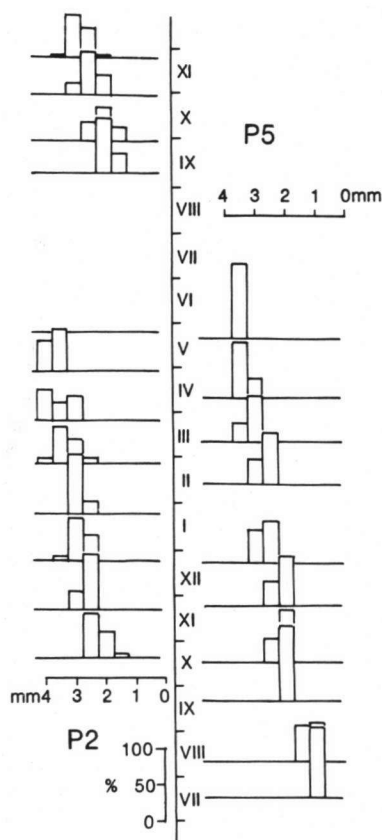


Fig. 2. Growth of *Coenagrion puella* in Ponds P2 and P5. Abscissa: head width in mm; ordinate: frequency per sample.

are too incomplete to draw any conclusion as to its life cycle features. Pond P5 yielded one specimen only.

#### Discussion

The biology of *C. puella* and *I. elegans* has been studied by various authors and particularly by PARR (1970) in Great Britain, where the two species show different life cycle features from those of the Castel Porziano populations. Both species in Parr's study area exhibit winter larval diapause and include a semi-voltine group. Such characters were not noticed in the P2 and P5

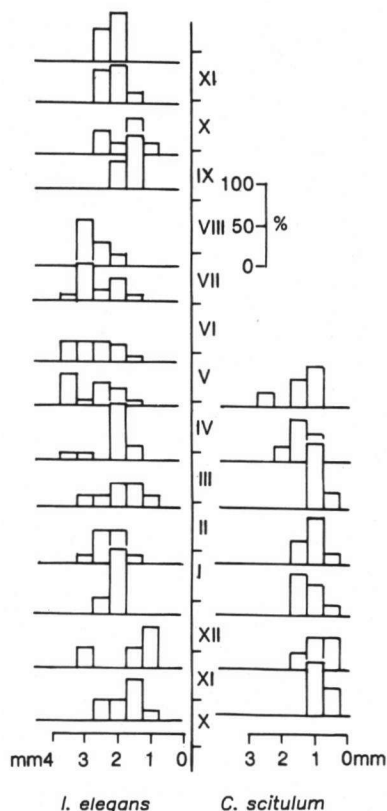


Fig. 3. Growth of *Ischnura elegans* and *Coenagrion scitulum* in Pond P2. Abscissa: head width in mm; ordinate: frequency per sample.

populations. In addition, the larval development of *C. puella* at Castel Porziano appears to be more synchronous than in British populations; each monthly sample exhibited a narrower size range. On the other hand, the P2 population of *I. elegans*, which has a wide larval size range, is less synchronous than the British populations of this species.

It is also interesting that in the odonate associations studied, *C. puella* coexists with the other three species and exhibits only slight abundance variations. Its life cycle is rather different from that of the others, exhibiting the fastest develop-

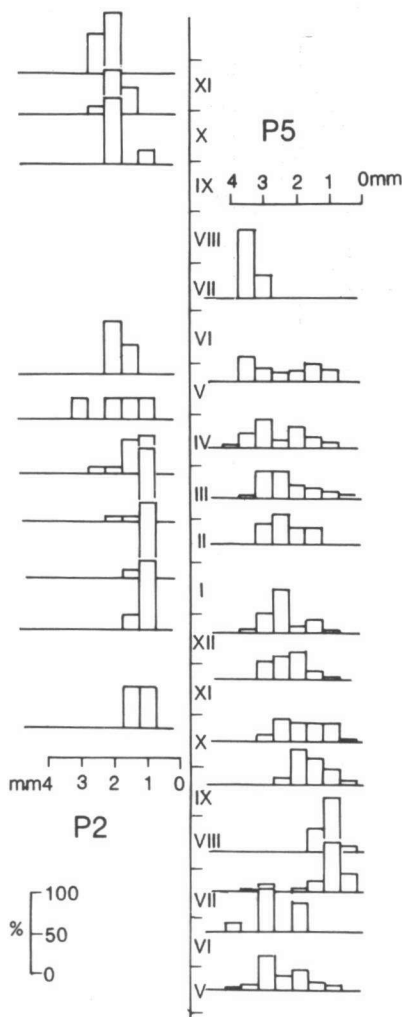


Fig. 4. Growth of *Cercion lindeni* in Ponds P2 and P5. Abscissa: head width in mm; ordinate: frequency per sample.

ment and the highest synchronization of all species in both ponds (Fig. 5).

Conversely, the life cycles of *C. lindeni* and *I. elegans* are similar (Fig. 5). These species seem to exclude each other. In P2 *I. elegans* is abundant and manages to complete its growth, whereas *C.*

*lindeni* is rare and does not reach emergence. In P5, *C. lindeni* is the dominant species and manages to grow fully, whereas *I. elegans* is very rare.

*C. scitulum* is quite a separate and intriguing case: this species does not appear to reach emergence either in P2 or P5.

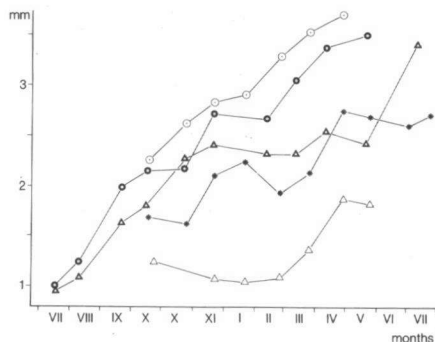


Fig. 5. Mean head widths of *Coenagrion puella*, *Cercion lindeni* and *Ischnura elegans* larvae in Ponds P2 and P5. Abscissa: time; ordinate: head width in mm.

In conclusion, we think that the recorded abundance and growth differences in the coenagrionid populations of the two ponds are affected by a mutual interspecific competition, conditioned by life cycle similarities. The effects of competition are highly evident in *C. lindeni* which does not attain emergence in Pond P2, but is the dominant species in Pond P5. Total competitive exclusion of an unfavoured species from one of the two ponds is probably not achieved on account of adult colonization from neighbouring ponds where such species presumably have a greater adaptive success. The presence of *C. scitulum*, in spite of its insufficient growth, may also be explained in this way.

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