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EDITH COWAN UNIVERSITY
Faculty of Health, Engineering & Science

EVOLUTION, SYSTEMATICS & GEOGRAPHIC PARTHENOGENESIS OF *Ilyodromus* (Crustacea, Ostracoda)

by

Rylan James Shearn, BSc Hons

A thesis submitted to Edith Cowan University in accordance with requirements for the degree of Doctor of Philosophy

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Most multicellular organisms reproduce sexually at some point in their life cycle. This is paradoxical because being asexual is theoretically far more advantageous. Asexual organisms do not need to find and court new mates, they reproduce at a faster rate, and with no males, all members of the population contribute toward population growth rate. With over 20, often mutually exclusive hypotheses, this paradox resists a synthesised explanation, and continues to represent one of the largest gaps in our understanding of fundamental evolutionary theory. Clearly, more real world studies are required that document the selective mechanisms underlying differences in evolutionary fitness between sexual and asexual organisms.

Some species can use either sexual or asexual reproduction, and remarkably, populations that use sexual reproduction can have distinctly different geographic distributions from those that use asexual reproduction. This phenomenon, whereby different distributions of reproductive mode can be observed within the same or closely related species, is called geographic parthenogenesis. These patterns hold promise in providing real world evidence for mechanisms leading to differences in evolutionary fitness between sexual and asexual lineages, because the two regions that sexual and asexual lineages occupy can be characterised by environmental tolerance ranges that in turn may be associated with selection pressure.

This thesis addresses the lacking real world evidence for selective mechanisms behind differences in fitness between sexual and asexual organisms, by seeking to develop and use a model system from which the importance of environmental parameters in explaining reproductive mode can be quantified. A freshwater crustacean (*Ilyodromus*, Ostracoda) occurring in rock outcrop pools along an ecological gradient in south western Australia was investigated. This crustacean employs both reproductive modes to varying degrees, such that the proportion of males in a population is indicative of the extent to which sexual reproduction is used. Unfortunately, since the systematics of this genus were poorly understood, one could not be sure of whether variation in reproductive mode observed between populations could also be
due to lineage divergence, and an extensive systematic revision was also nec-
ecessary for the development of this model system.

The key findings of this thesis are:

1. An improved understanding of the systematics of *Ilyodromus*, specifi-
cally:
   a) Revised characters that are considered typical of the genus.
   b) The boundaries between *Ilyodromus* and other similar genera.
   c) Detailed species descriptions for ten nominal species, and three
      as yet unnamed species.
   d) An improved ability to identify female-only populations

2. The model system constructed and used in this thesis enables the
   importance of environmental parameters in explaining reproductive
   mode to be quantified

3. Parthenogenesis tends to occur more in less stable (or more arid) habi-
tats, while sexual reproduction tends to occur more in more stable
   (higher rainfall) habitats.

4. This, alongside patterns of species distribution, suggests that variation
   in reproductive mode is closely linked with processes of speciation and
   adaptive response to emptied niches.
The declaration page
is not included in this version of the thesis
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