Biology and ecology of Coccinellidae

Some of the commonly seen ladybirds are brightly coloured and patterned, readily attracting the attention of home gardeners and small children. Most species are predatory, particularly on insects that are often pests of agriculture. Thus ladybirds have attracted the attention of biologists, too.

Various aspects of the biology and ecology of the Coccinellidae are covered by several thorough reviews and books that should be consulted. These include the works of Clausen (1940); Hagen (1962); Hodek (1967, 1973); Majerus (1994); Hodek and Honek (1996); and Kuznetsov (1997). Majerus' (1994) book is a formidable account of diverse aspects of the evolutionary biology of Coccinellidae, with a strong emphasis on the British fauna. From that perspective it has limited relevance to Australia, but it makes excellent reading. The topics discussed and the underlying evolutionary processes are universal biological phenomena fully applicable to the Australian fauna. Drea and Gordon (1990) reviewed the biology of ladybird species that prey on armoured scales (Hemiptera: Diaspididae), and Ponsonby and Copland (1997) reviewed the species feeding on soft scales (Coccidae). Dixon's (2000) book covers ecology of predatory Coccinellidae and their interactions with various prey groups. He also discusses consequences of various ecological traits in ladybirds for their successful application in biological control.

Life history

Ladybird beetles are holometabolous insects, undergoing a complete metamorphosis with four discrete life stages: egg, larva, pupa and adult beetle. Of these stages, only the adult beetle is very mobile. This stage is capable of covering vast distances, using wings for flight, to find new food sources or mating partners. The adult is also the stage that has a prolonged duration — counted in months; the others last only few or more days. Larva and adult are the stages that actively search and feed on various insects and other invertebrates, plant tissue or fungal hyphae and conidia.

Oviposition and egg stage

Coccinellidae eggs are 0.2–2.0 mm long; white, yellow to red, oval or spindle-shaped and are laid singly or in batches of various sizes, always with the long axis perpendicular to the substrate. The chorion is smooth with distinct microsculpture visible only in Epilachninae (Klausnitzer 1969). When freshly laid, an egg is usually white or creamy-yellow but during embryogenesis it changes colour, becoming darker — often very much darker. This stage lasts 2–18 days (Clausen 1940; Ahmad 1970; Hodek 1973; Richards 1981; Booth *et al*. 1995).

Most Coccinellidae that feed on scale insects lay their eggs singly or in small groups close to or directly on or beneath the female or immature scale (Ponsonby & Copland 1997). Oviposition under the scale was also reported by Richards (1981) for *Rhyzobius ventralis* (Erichson) preying on *Eriococcus coriaceus* Maskell in Australia. The long and heavily sclerotised female ovipositor of that species can be inserted inside the ovisac of the scale. The emerging larvae feed on the eggs, the crawlers and the female scale. Richards found that females of a related species, *Rhyzobius forestieri* Mulsant, have the