## The Blue Land Planarian, *Caenoplana coerulea* Moseley (Tricladida: Geoplanidae), a Predator of *Ommatoiulus moreleti* (Lucas) (Diplopoda: Julidae) in Southern Australia

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**ABSTRACT** The blue planarian, *Caenoplana coerulea*, is a predator of the black Portuguese millipede, *Ommatoiulus moreleti*, an introduced nuisance pest in southern Australia. Some observations on the reproduction and early development of *C. coerulea* are included.

The black Portuguese millipede, Ommatoiulus moreleti (Lucas), is an introduced nuisance pest in southern Australia (Baker 1985a). Large numbers enter houses during autumn and spring, the seasons of peak activity (Baker 1979). As well as invading urban areas, O. moreleti is found in abundance in agricultural habitats (e.g. grasslands) and native Eucalyptus woodland (Baker 1978). It characteristically invades new habitats, reaches maximum abundance approximately 10-15 years later, and then declines in numbers (Baker 1985a). This "boom and bust" is accompanied by a decline in body size during the period of maximum abundance (Baker and Baez 1989).

Baker (1985a) and Baker and Baez (1989) suggested that the observed changes in population density and body size of *O. moreleti* following invasion might be explained by available food supply, whilst McKillup *et al.* (1988) argued that the changes in abundance were due to parasitism by the native rhabditid nematode, *Rhabditis necromena* Sudhaus and Schulte. Baker (1985b) searched for predators of *O. moreleti* in southern Australia, but found few (some spiders, beetles and a scorpion) in comparison to a diverse assemblage of voracious predators that he found in Portugal. Most of the Australian predators ate only a small portion of one millipede when maintained for a week in the laboratory.

Land planarians (or flatworms) are predators of a wide variety of invertebrates including snails, slugs, woodlice, beetle larvae, earthworms and velvet worms (Steel 1901; Jennings 1959; Barnwell 1978; Blackshaw and Stewart 1992). They have been used successfully as biological control agents against snails, most notably the giant African snail, Achatina fulica Bowdich (see references cited in Barker 1989). The blue planarian, *Caenoplana coerulea* Moseley, considered to be conspecific with Geoplana vaga Hyman by Ogren (1989), is native to eastern Australia. It has been introduced to New Zealand, U.S.A. and U.K. (Ogren 1989; Winsor 1991). Barnwell (1978) reported that C. coerulea fed upon snails and might prove useful for their control.

Individuals of *C. coerulea* were commonly found in a suburban garden in Kingswood, Adelaide along with another species, a yellow planarian, possibly *Fletchamia* sp. (L. Winsor, pers. comm.), and *O. moreleti*. Prompted by an apparently low abundance of *O. moreleti* in this garden compared with neighbouring properties, we investigated if these two planarians might feed upon millipedes and reduce population numbers.

Ten adult C. coerulea, 5-12 cm long (mean = 8cm), and seven *Fletchamia* sp. of similar size were collected from moist habitats (e.g. under plantpots, logs, stones) in the garden in early January 1993. Each was placed in an opaque, closed plastic container (diam. 9 cm; height 10 cm) and maintained at 20 °C. The bottom of each container was covered with 1 cm of garden soil which was kept moist by spraying regularly with water. Three living O. moreleti (stadia 6-9) were introduced into each container. The numbers of dead millipedes were recorded approximately every 24 h for 21 d and replaced with living individuals as required. Only one planarian died during the experiment; a C. coerulea at day 19. All 10 C. coerulea ate at least one millipede within the 21 d period. The exoskeletons of the dead millipedes were left "intact", with the soft tissues sucked out from all along the body cavity. Numbers of millipedes eaten per planarian ranged from 1 to 17 (mean = 0.3/d). The longest period that an individual planarian fasted was 20 d. The most millipedes eaten in 24 h was two. No millipedes were eaten by *Fletchamia* sp.

Five egg capsules were deposited by three C. coerulea (2, 2 and 1 each) during the experiment. These capsules were spherical and approximately 4 mm in diameter (cf 2.5-3.0 mm reported by Barnwell 1978). They were initially light brown in colour, gradually turning to a bright red-brown and then a maroon-red after 24 h. The capsules were deposited on the soil surface and covered in slime. Young planarians hatched from four of the egg capsules when they were maintained at 20 °C. Mean hatching time was 13.6 d (range 12-15 d). Barnwell (1978) reported a hatching time of 6 to 11 d (mean = 8.9 d), but did not indicate the environmental conditions under which his egg capsules were reared in the laboratory. He did. however, suggest that hatching time was the same

outdoors. Twenty offspring were reared from the egg capsules in the present study, 3-8 from each capsule (*cf* Barnwell's 1978 report of 22 offspring from four capsules). Upon emergence, the planarians were white, approximately 2-3 mm in length and 1 mm in diameter. They turned blue over a 4-d period. After 6-7 d, the juvenile planarians consumed *O. moreleti* (stadia 6-9) in a similar manner to their parents. They had been offered no other food.

Too little is known of the ecology of *C. coerulea* to suggest the degree of influence it might have on population densities of *O. moreleti* in natural habitats, but it is the most voracious predator thus far found in Australia. We have also observed that *C. coerulea* will feed upon the native millipede, *Oncocladosoma castaneum* (Paradoxosomatidae), terrestrial isopods and earwigs in the laboratory. *C. coerulea* did not feed upon earthworms, snails or slugs when offered them, but Barnwell (1978) reported snail predation by *G. vaga* in the U.S.A.

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