

Fig. 1. *Otala punctata* from Bahrija, Malta. Scale bar 10 mm. (Photo: S. Camilleri)



Otala punctata was noted to have colonised three sectors along the Bahrija valley system, and, at the time of survey, the species occupied an overall area of approximately 0.6 km², with a mean abundance of 0.4 individuals per m². It now appears that the alien helicid has not, thus far, affected the population of *Eobania vermiculata*, as the population density of the native species remained more or less constant within the plots investigated along the valley watercourse (seasonal run-off conduit), regardless of incidence and abundance of the alien species. The density of *Otala punctata* was highest (1.98 individuals per m²), close to the presumed site of initial introduction at Bahrija (35°53'28"N, 14°20'40"E), where the first individuals were recorded (Cilia, 2012). We estimate that the yearly rate of expansion of the area of occupation of *Otala punctata* at Bahrija is 0.075 km² per year. This was calculated in terms of area at the end of a time period (T) divided by the number of years since its first occurrence (Y); therefore, T/Y = rate of expansion per year.

Otala punctata was most abundant in low virescent vegetation. In contrast, *Eobania vermiculata* was most abundant in areas where dry vegetation, mostly grasses, were predominant. This suggests a degree of habitat segregation between the alien and native snails. *Otala punctata* also showed a preference for aestivating attached to tree stumps (Fig. 2) and trunks, as well as to vines (*Vitis vinifera*), presumably to avoid predation and to evade the scorching heat at ground level (Albrecht, 2001; Herbert, 2010).

Shell measurements indicated a higher abundance of juvenile *Otala punctata* at the extremities of its distribution at Bahrija. This could indicate that the snails are actively dispersing outwards, possibly as population density increases and therefore intraspecific competition increases at the centre of the area of occurrence. The outward expansion of the *Otala punctata* population also appears to have been hindered by physical barriers, including steep escarpments, country roads, fallow or abandoned agricultural land where extensive tracts of xerophytic vegetation occur and built-up areas. It was further noted that vegetables grown at Bahrija for the local market, including cabbage (*Brassica oleracea* var. *capitata*) and broccoli (*Brassica oleracea* var. *botrytis*), often had juvenile *Otala punctata* attached. This suggests that the alien stands a good chance of being transported with agricultural produce from Bahrija to markets elsewhere, and therefore there is a high potential for the alien species to colonise new areas in the Maltese Islands.

FURTHER SPREAD OF THE ALIEN GASTROPOD *OTALA PUNCTATA* (MÜLLER, 1774) IN MALTA

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The helicid *Otala punctata* (Müller, 1774), native to the western Mediterranean (Martinez-Ortù & Robles, 2001), was introduced into a plant nursery near Mosta, in central Malta, with imported horticultural material sometime around 2003 (Mifsud *et al.*, 2003). From here it dispersed to establish a breeding population in the area surrounding the nursery (Barbara & Schembri, 2008, 2010)

A second population of *Otala punctata* (Fig. 1) subsequently established itself at Bahrija, a rural agricultural area, some 7 km distant from the original site of introduction. The authors investigated the distribution and abundance of *Otala punctata* at the Bahrija site, as well as that of the native helicid *Eobania vermiculata* (Müller, 1774), which has a similar ecology to that of the alien species under study and which, therefore, may be negatively affected by the introduction.



Fig. 2. An aggregation of (mainly) *Otala punctata* aestivating attached to newly grafted *Citrus aurantium* on the upper reaches of Bahrija valley. (Photo: J. Camilleri)

Although we found that the establishment of a population of the alien *Otala punctata* does not seem to have affected the population of its closest indigenous relative (*Eobania vermiculata*), this does not mean that it may not have a negative impact on this and other local species in the future or that it will not become an agricultural pest. The spread of the alien therefore needs to be monitored and possibly controlled.

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