

## ANOTHER WAVE OF INVASION? FIRST RECORD OF THE TRUE SICILIAN SLUG *DEROCERAS PANORMITANUM SENSU STRICTO* FROM IRELAND, AND ANOTHER FROM WALES (EUPULMONATA: AGRIOLIMACIDAE)

Recently Reise *et al.* (2011) meticulously distinguished the ‘Tramp Slug’ *Deroceras invadens* Reise *et al.*, 2011 from a close relative, the true ‘Sicilian Slug’ *D. panormitanum* (Lessona & Pollonera, 1882). A worldwide review of museum collections, records, and interception reports of both species found that they have very different distributions (Hutchinson *et al.*, 2014). *Deroceras invadens*, which originates in Italy, has been introduced to nearly 50 countries or oceanic islands, including Britain since at least 1930 and Ireland since at least 1958. It is now widespread in both, where it was known as *D. panormitanum* auctt (e.g. Anderson, 2008). However, the species to which the name *D. panormitanum sensu stricto* is now restricted originates from Sicily (and/or Malta), and has spread far less widely. Hutchinson *et al.* (2014) found only four records of it outside Sicily and Malta, all of them recent: one from Liguria, Italy; two on Madeira; and an interception from São Miguel, Azores. The fourth, and only British record to date, was from an ornamental city park near a vegetable market in Cardiff, Wales, in 2012 (Rowson *et al.*, 2014a, b). Dozens of other British and Irish populations have been examined anatomically and/or sequenced by Hutchinson *et al.* (2014), ourselves or others, and all have proven to be *D. invadens*. We have carried out frequent opportunistic or targeted slug surveys in South Wales and Bristol (BR *et al.*) and Ireland (RA) in recent years but until now found no other *D. panormitanum* populations. Given this baseline of information, future records seem likely to represent the genuine spread of this species. This could be termed a second wave of invasion, because it post-dates the initial spread of *D. invadens* (although this does not necessarily imply that introductions of *D. invadens* to Britain or Ireland have ceased). There are several reports of *D. invadens* being a plant pest, but as yet no similar data on *D. panormitanum* (Hutchinson *et al.*, 2014), probably due to its rarity.

In Ireland, on 11 April 2015 a number of *D. panormitanum* were found under plant pots

on gravelly soil in a large public garden and plant sales area, at the Avoca Garden Centre, Kilmacanoge (O24281524), Co. Wicklow (H20), near Dublin. The centre includes nursery beds under plastic and is adjoined by a large garden with mature broadleaved and coniferous trees. A stream running through the area emerges from Carboniferous limestone rocks so the soil is likely to have a basic reaction. Around 50 pots were lifted, with *D. invadens* sheltering under the majority. Under four pots *D. panormitanum* was found sheltering very closely (almost in contact) with *D. invadens*. Other slugs present were *D. reticulatum*, *Arion distinctus*, *A. rufus*, *A. subfuscus*, *A. intermedius*, *Limacus maculatus*, *Limax maximus*, and *Ambigolimax valentianus*. The New Zealand Flatworm *Arthurdendyus triangulatus* [Tricladida: terricola] and the millipede *Polydesmus asthenestatus* [Diplopoda] were also present. This millipede is a recent introduction, apparently from northern Italy (Anderson, 2015).

In the UK, on 21 April 2015 a large number of *D. panormitanum* were unexpectedly found at night on close-mown grass around the western flowerbeds in Cwmdonkin Park, Swansea (SS63719331), Glamorgan (VC41). This large ornamental park is associated with the poet Dylan Thomas (e.g. Chatfield, 2015) and was refurbished before his centenary, with the beds being re-created and stocked from commercial nurseries in 2012–2013. Other slugs present around the beds included *D. reticulatum*, *Arion flagellus*, *A. rufus*, *L. maculatus*, *L. maximus*, *A. valentianus* and *Tandonia sowerbyi*. However no *D. invadens* were found in the vicinity of the beds on 21 April, or on 4 May during a follow-up visit when *D. panormitanum* was still present. At the Cardiff site, where the flowerbeds are supplemented twice a year with annual plants, *D. panormitanum* remained common in early 2015. However it has not yet been found at the central nursery in Bute Park, Cardiff where such plants are grown from seed or commercially supplied plugs.

In both the Kilmacanoge and Swansea slugs, the identity of the *D. panormitanum* was suspected immediately; like the Cardiff slugs illustrated in Rowson *et al.* (2014b: 87) they were relatively large at up to 32mm extended, and darker and more uniformly coloured than most British or Irish populations of *D. invadens*. Internally, the genitalia had one tapered and one blunt penial appendix, clearly conforming to *D. panormitanum* rather than *D. invadens* (Reise *et al.*, 2011; Rowson *et al.*, 2014b). The work of H. E. Quick, who treated both species under the synonym *Agriolimax caruanae* Pollonera, 1891, is worth review here especially because he worked in Swansea for many years (Stratton, 1968). Quick (1949; 1960) treated both species under *Agriolimax caruanae* Pollonera, 1891 (a name now synonymised with *D. invadens*; Reise *et al.*, 2011). Although two of Quick's figures (1960: Figs 12A–B) show genitalia of *D. invadens*, a third (12C) resembles *D. panormitanum*. Quick's (1960) account was based on material of "*A. caruanae*" from many places including Swansea, while Quick (1949) had noted that "around Swansea it is often found in parks". A long history of *D. panormitanum* in Swansea, or even Cwmdonkin Park, is thus possible.

The park and nursery habitats at which *D. panormitanum* occurs suggest its spread within Britain and Ireland is already underway, especially given that nurseries can facilitate the overland transport of molluscs (Bergey *et al.*, 2014). The apparent absence of *D. panormitanum* at many similar sites nearby may mean the spread is at an early stage, or has so far been slow. The UK National Biodiversity Network (NBN) has nearly 4500 records of *D. invadens* (including all pre-2011 records of *D. panormitanum* auctt.). Apart from the records from Cardiff (submitted via the Conchological Society scheme in 2014) there is only one other record of *D. panormitanum* s. s. This record, from a wildlife garden in central Shrewsbury (SJ498123), Shropshire (VC40), date range 1/1/2012–31/12/2012, remains unconfirmed. According to the recorder (C. du Feu, pers. comm.) it was recorded as *D. panormitanum* auctt., was not dissected, and was probably accidentally attributed to the rarer species after the NBN's names were updated in 2014. Nevertheless, southern urban gardens are evidently suitable sites for both species. Human-mediated spread of *D. panormitanum* would make interactions between it and *D. invadens* more frequent. Intriguingly Hutchinson

*et al.* (2014) suggested the two might exclude one another, with *D. panormitanum* appearing to replace *D. invadens* over time at the site in Liguria. This would be consistent with the failure of *D. invadens* to transfer sperm to *D. panormitanum* in cross-matings set up by these authors. If this leads to asymmetrical hybridisation, as seems to have occurred in other British *Deroceras* (Rowson *et al.*, 2014a), it could favour the spread of *D. panormitanum* and *D. panormitanum*-like hybrids. Although the two species occur together in Kilmacanoge (where slugs on pots are probably often moved) they appear not to at the Cardiff and Swansea sites where *D. panormitanum* already dominates.

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