

***Cylindroiulus dahli* Demange, 1970 (Julidae) and *Orthochordeumella pallida* (Rothenbühler 1899) (Chordeumatidae): two millipedes new to Britain and *Propolydesmus testaceus* (C. L. Koch, 1847) (Polydesmidae) a millipede new to Scotland.**

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Abstract

Two species of European millipede, *Orthochordeumella pallida* (Rothenbühler 1899) and *Cylindroiulus dahli* Demange, 1970, are reported as new to Britain, along with *Propolydesmus testaceus* (C. L. Koch, 1847) which is recorded from Scotland for the first time. All three species were found in the same public garden in Glasgow (Scotland).

Brief descriptions with illustrations are provided for *O. pallida* & *C. dahli* along with information on their European distributions and habitat preferences. A list of millipedes found in the garden is given and the possible origin of the new species is discussed in relation to the development of the garden on a post-industrial site.

Introduction

The Hidden Gardens is a public garden/urban green-space run by a Charity. It is located near the centre of Glasgow (NGR: NS581631), Scotland, just south of the formerly heavily industrialised River Clyde. The Gardens were established around 2003 on a former tram works and depot which operated from c.1894 to the 1960s. However it is believed that the area was used as a tree/shrub nursery in the early 19th C. to supply plants to the large domestic gardens and estates in the area (*thehiddengardens.org.uk*).

This survey evolved from RBW's involvement in public bioblitz events at the Gardens. With the assistance of Gardens volunteers, a series of pitfall traps was deployed from 1st March until 8th May 2017 in a variety of habitats, ranging from annual and perennial flower beds to recently established woodland. The catch was sorted by RBW and the millipedes were identified (with some expert assistance) by MBD in 2020. Further pitfall material was collected, over at least a year, and will become available for identification in due course.

Results

The survey produced the ten species of millipede listed in Table 1 and these are shown in order of abundance in Fig. 1. By far the most frequent millipede species in this pitfall trap survey were *Ophiulus pilosus*, *Polydesmus angustus* (both common species) and, perhaps surprisingly, *Propolydesmus testaceus*, previously unrecorded in Scotland, followed by *Orthochordeumella pallida*, a species previously unknown in Britain.

Propolydesmus testaceus was easily identified from descriptions in Blower (1985) and verified by Paul Lee. However, two other species did not appear to be identifiable using the current British identification keys and literature. The abundant chordeumatid initially appeared likely to be one of the two known British *Chordeuma* species (both of which occur in Scotland; Gregory, 2016). However the gonopod was not consistent with either species. Reference to Schubart (1934) and Demange (1981) indicated that it was most likely to be *Orthochordeumella pallida*, later confirmed by Henrik Enghoff. A single male

specimen of a *Cylindroiulus* was referred to Helen Read who recognised it as *Cylindroiulus dahli*, an Iberian species new to Britain.

Brief descriptions of *C. dahli* and *O. pallida* are given, based on this Scottish material, to assist with identification of specimens when they are inevitably found elsewhere in Britain.

Table 1: Species collected from the Hidden Gardens, Glasgow in 2017

GB IUCN Status: LC = least concern; NT = near threatened; DD = data deficient.

GB Rarity Status: NS = nationally scarce; NR = nationally rare.

Habitat: A = annual flower bed; P = perennial flower bed; W = woodland.

Species	Authority	Habitat in Gardens	Status/Comments
<i>Allajulus nitidus</i>	(Verhoeff, 1891)	P	LC/NS
<i>Cylindroiulus britannicus</i>	(Verhoeff, 1891)	P/A/W	LC
<i>Cylindroiulus dahli</i>	Demange, 1970	A	1st British Record
<i>Cylindroiulus punctatus</i>	(Leach, 1815)	P/W	LC
<i>Ophiulus pilosus</i>	(Newport, 1842)	P/A/W	LC
<i>Tachypodoiulus niger</i>	(Leach, 1814)	P/A/W	LC
<i>Polydesmus angustus</i>	Latzel, 1884	P/A/W	LC
<i>Propolydesmus testaceus</i>	(C. L. Koch, 1847)	P/A	NT/NR; 1st Scottish Record
<i>Melogona voigtii</i>	(Verhoeff, 1899)	W	DD/NR
<i>Orthochordeumella pallida</i>	(Rothenbühler, 1899)	P/A/W	1st British Record

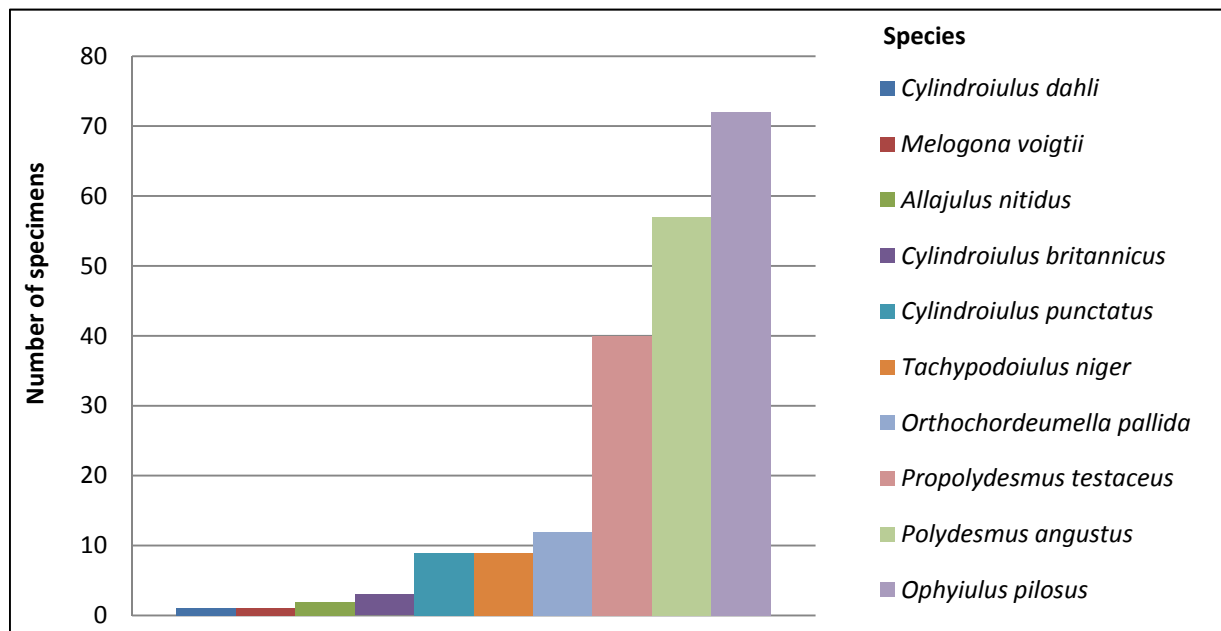


Figure 1: Species abundance

Description of *Cylindroiulus dahli* Demange, 1970

Cylindroiulus dahli is described (sp. nov.) by Demange (1970) from the Azores, while Read (2007) includes it in her key to the known *Cylindroiulus* species of north-west Spain.

Only a single adult male specimen of *C. dahli* was found in the pitfall material from this survey. No female or juvenile specimens were found. Attempts to identify it with existing British literature failed, ending up with *C. britannicus/latestriatus* as similar species.

However, it was noted that there were more than the required three setae on each anal valve. On dissection it was clear that the gonopod was different from other species on the British list, including recent finds from South Wales (e.g. Gregory & Owen, 2019). From photographs of the gonopod (Figs. 4 & 5), an identification as *Cylindroiulus dahli* was provided by Helen Read and confirmed by Henrik Enghoff.

Read describes *C. dahli* as being dark brown to black. The bleached colour of the preserved male pitfall trap specimen (Fig. 2) is unlikely to be representative of its live state and Demange describes it as grey, with darker head and pygidium (pre-anal ring) when preserved in alcohol. The single adult male collected in this survey measured as follows: length approx. 18 mm, diameter 1.4 mm. Demange gave the size of his holotype male as approximately 15 mm long.

The pointed telson extends a little over the valves - as described by Demange. In her key to the known *Cylindroiulus* of north-west Iberia, Read (2007) differentiates between *C. britannicus/latestriatus* (common British species and *C. dahli* with the former having 3 setae on each anal valve. Demange gives *C. dahli* 4 setae on each valve, while in the specimen from this study there appear to be 5 setae (one broken off) on the right valve and 4 on the left (Fig. 3).

In Fig. 4 note the hooked tip (a) to the promerite, forming an "eye" with the tip of the mesomerite (b). In the gonopod (Fig. 5) note the angular shape of the bachit (a), the backward pointing tip of the solenomerite (b), the angular phylacum (c) with a large lower tooth and the rounded coxite (d).

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Figure 2: *C. dahli* ♂.

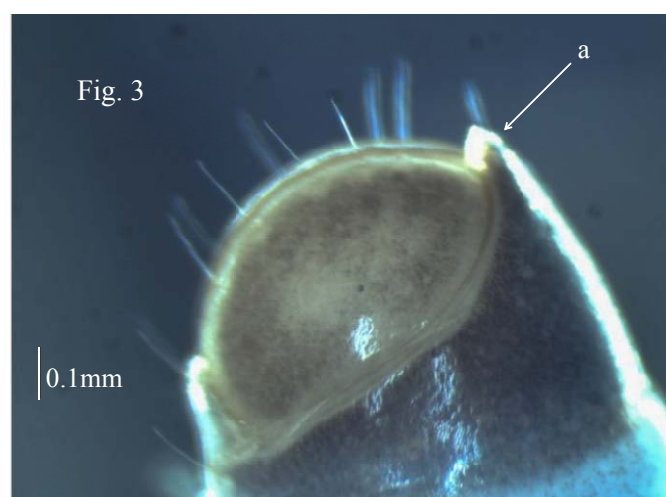


Figure 3: *C. dahli* 4+5 setae on anal valves and a) pointed telson extending over the valves.

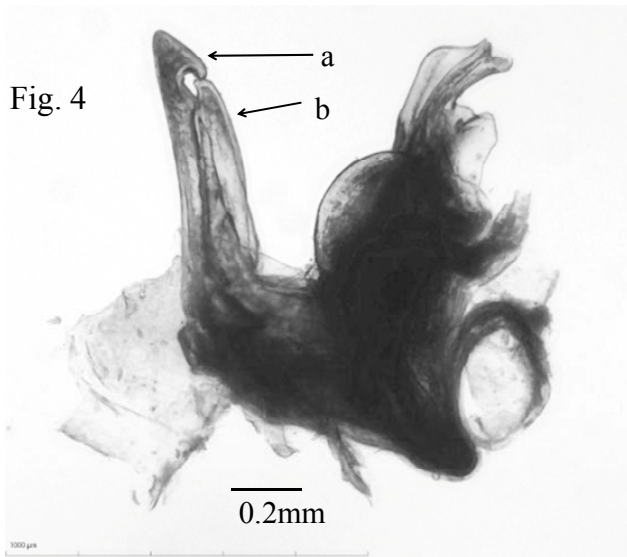


Fig. 4

Figure 4: *C. dahli* gonopod internal view
a) promerite, b) mesomerite.

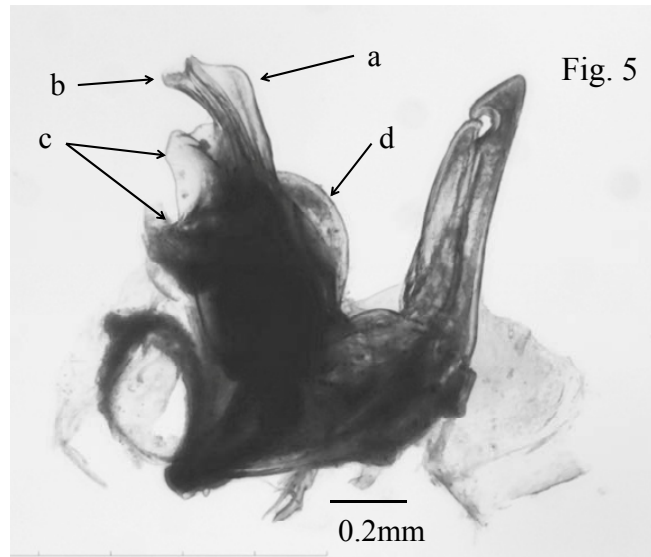


Fig. 5

Figure 5: *C. dahli* gonopod external view
a) brachit, b) solenomerite, c) phylacum,
d) coxite.

Description of *Orthochordeumella pallida* (Rothenbühler, 1899)

On initial examination (Fig. 6) it was assumed that these specimens would be one of the two *Chordeuma* species known to occur in Scotland. Indeed this is how they key out using British identification keys. However the gonopod area appeared wrong for these species and in fact it looked as if much of the gonopodal structure was missing. Following dissection it was obvious that it was only the anterior and posterior paragonopods that were visible in lateral view (Fig. 7) and that all other structures between were concealed within the body cavity.

Various of the paragonopod/gonopod structures are shown in Figs. 8-11 and correspond well with figures provided by Brolemann (1935), Demange (1981) and Schubart (1934). Of particular note is the bifid tip to the coxal process on the anterior paragonopod, illustrated in Fig. 8 a for the Glasgow specimens. Note the inner bulge on the peltogonopod telopodite (Fig. 8 b). The rostral pillars of the gonopod are fairly rectangular, flat topped with the exterior angle produced upwards and with a similar protrusion on the anterior face (Fig. 11 a, b). Of the examples/sub-species illustrated by Brolemann, his Fig. 726 of the gonopod from a specimen from the Meuse, Forest of Argonne (N.E. France), is perhaps the most similar to the Glasgow specimens.

In this study all specimens of this species were adult (approx. 7♂ 5♀) but not all were complete due to the variable preservation of the pitfall material. Therefore all measurements in Table 2 are approximate.

Table 2: Measurements of adult *Orthochordeumella pallida*

	Length mm	Diameter mm
Average size ♂ (n=5)	14.6	1.1
Average size ♀ (n= 5)	15.8	1.4

The length of these specimens is greater than that given by Brolemann (♂♀ 13.5mm) but consistent with the 13-18mm given by Schubart (dia. 1.2-1.8 mm). As its name suggests, the body is pale as in *Chordeuma*. In both sexes the number of ocelli was around 26-28 (cf. Brolemann's 27).

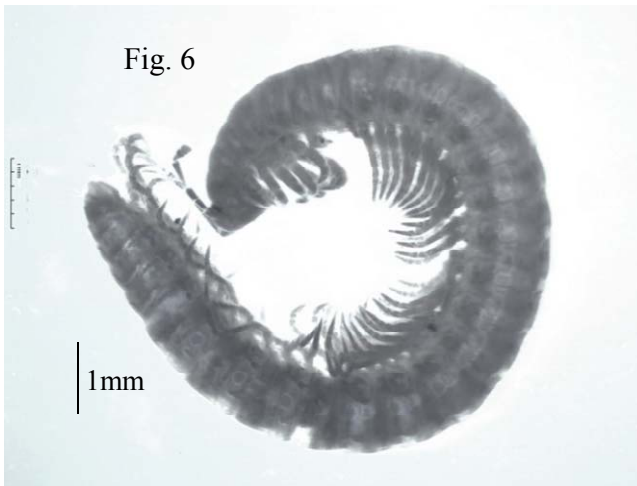


Figure 6: *O. pallida* ♂.

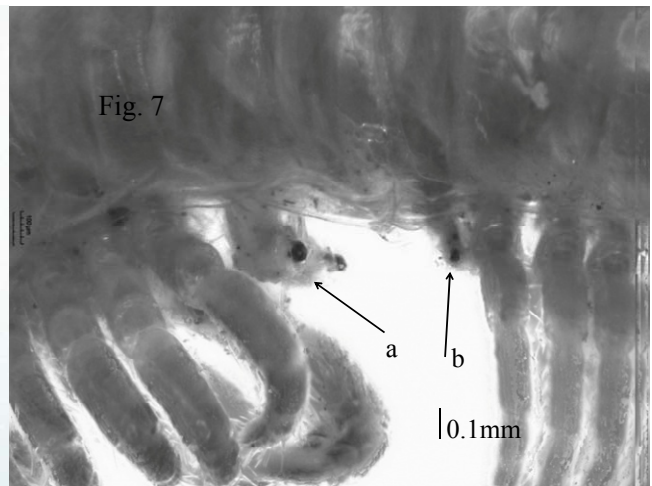


Figure 7: *O. pallida*.
a) anterior and b) posterior paragonopods.

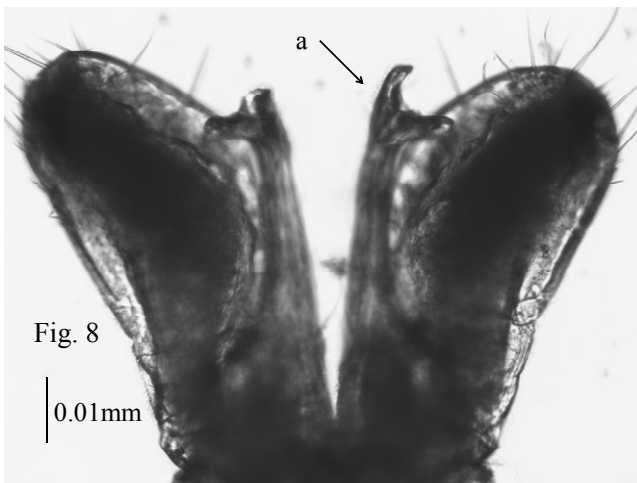


Figure 8: *O. pallida* anterior paragonopods.
a) bifurcate coxal process.

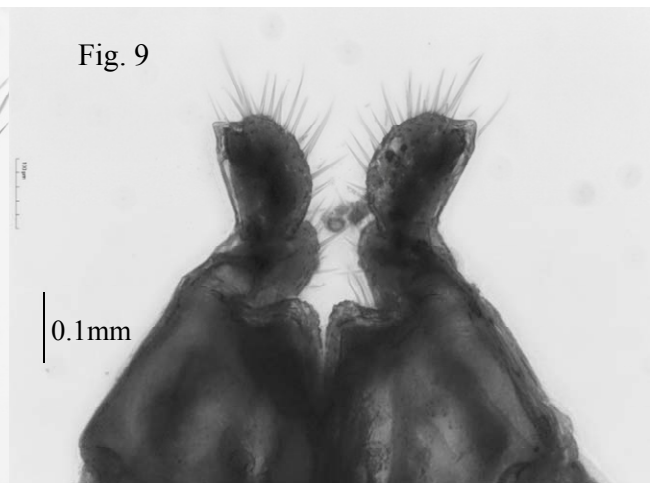


Figure 9: *O. pallida* posterior paragonopods.

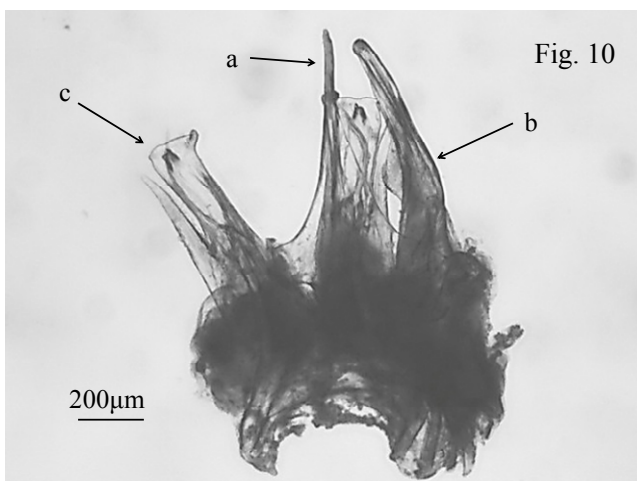


Figure 10: *O. pallida* peltogonopod.
a) colpoxal extension; b) telopodite;
c) gonopod structures: see Fig. 11.

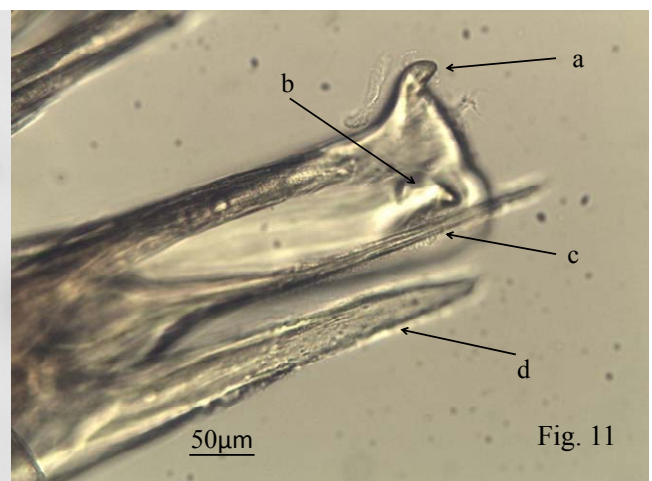


Figure 11: *O. pallida* gonopod showing:
a) & b) protrusions on the rostral pillar;
c) & d) external appendages.

Discussion

It seems very unlikely that the three species of millipede identified as additions to the Scottish (*P. testaceus*) and British millipede fauna (*O. pallida* & *C. dahli*) pre-date the creation of the Hidden Gardens. The probable source of introduction is likely to have been either through importation of soil or plants (most likely potted).

The transformation of the former tram works and depot to a garden presumably involved significant ground remediation and importation of soil. Unfortunately it is not recorded where the soil came from. However it is known that the plants used to establish the garden were obtained from two large commercial nurseries, one in Yorkshire and the other near Glasgow. The present management of the garden includes some importation of local municipal green-waste compost and some purchase of plants (pers. comm. Paula Murdoch).

This first list of millipedes from the Hidden Gardens numbers ten species (Table 1). Six of these are common and widely distributed in Britain. The remaining four are worthy of some comment.

Melogona voigtii has been known from a small number of sites in Scotland for about 25 years (Corbet, 1996) and was first recorded in Glasgow in 2013 (Davidson, 2013). It has recently been found in England for the first time, from West Lancashire (Gregory & Garnham, 2020). Lee (2015) considers its conservation status uncertain due to the limited data and possible past confusion with *M. gallica*. The Scottish records are largely from synanthropic sites or semi-natural woodland with evidence of human disturbance. Jeekel (2001), in his comparison of the Dutch and British millipede faunas, considers *M. voigtii* to be; "a primarily Central European species, which is gradually spreading through horticultural trade; this may also explain the recent discovery in Scotland". Of course with time, human and natural dispersal (e.g. by animal vectors) will bring the species to more natural habitats. Gregory and Garnham (2020) consider that the apparent lack of human influence at the Dalton Crag site, in West Lancashire, supports the view that this is an overlooked native species. However it is surprising how far into remote locations humans will take their garden and building waste to avoid tax.

Propolydesmus testaceus is already known from a number of sites in Britain (Lee, 2006), having been first discovered in Essex in 1903, with modern records in Kent, Oxfordshire, Suffolk and Monmouthshire. It has been found in a variety of habitats in Britain: including chalk downland, woodland and reclaimed industrial land.

Lee (2015) in his review of the conservation status of millipedes in Britain considered *P. testaceus* to be Near Threatened. Although at risk from development pressures on some of its sites, Lee considers it probably under-recorded. In a British context it is considered Nationally Rare. It is not known whether the Glasgow population has been imported from one of the English or Welsh sites or is, perhaps more likely, a new introduction from Europe.

In Europe, Kime & Enghoff (2011) consider it to be of Atlanto-Mediterranean distribution, extending east into parts of Central Europe. They describe it as calcicolous, thermophile and petrophile, most abundant in calcareous grassland but also in damp woodland and occasionally in gardens and reclaimed industrial land. The Swedish records are synanthropic and considered to be introductions and this is likely to be the case for the Glasgow record. Kime (2001) reports collecting "huge numbers of *P. testaceus* in Belgium and Luxembourg, mostly in pitfall traps in grassland and sometimes in rocky woodland". This was the third most common millipede in the Glasgow pitfall trap survey (Fig.1).

Cylindroiulus dahli is recorded for the first time in Britain and its synanthropic location is consistent with it being a recent introduction. It was first described from São Miguel (Demange 1970) and originally believed to be endemic to the Azores. Kime & Enghoff (2017) describe it as Lusitanian and give its distribution as including Mainland Spain (La Coruña, Orense, Pontevedra Provinces) and the

Azores (São Miguel) and suggest it will be found in Portugal. Habitats include: Woodland (*Quercus*, *Fraxinus*, *Pinus*), rocky shoreline with grassland, gardens and city parks. It is often found under stones or timber. Read (2007) gives its habitats in Spain as including oak woodland, coastal areas and synanthropic sites including gardens. It is now considered as an introduction to the Azores (Helen Read, pers. comm.).

Orthochordeumella pallida is also new to Britain and, as with *C. dahli*, is considered a recent introduction. At the time of writing, the third volume of the Atlas of European Millipedes is awaiting publication (Kime & Enghoff, submitted for publication). However, Henrik Enghoff has provided the following information, from the atlas, about this species:

Its distribution includes: Austria, Belgium, Switzerland, Germany, France, Luxembourg, Sweden. Its habitat is largely montane and also subalpine, up to 2740 m a.s.l. in Switzerland but found in lowland parts of north-east France and Belgium in particular. It is generally a woodland species. It has been found recently at synanthropic sites in Northern Germany and Sweden (2018). So it would appear that the Glasgow *O. pallida* is part of a wider European range expansion.

Given its long history of international trade it is perhaps not surprising that Glasgow is developing a cosmopolitan assemblage of non-native species, across various taxa, which have become established (e.g. Davidson & Merrett, 2014). However it seems quite remarkable that, having examined only a small amount of pitfall trap material from the Hidden Gardens site, three additions to the Scottish fauna, including two new to Britain have been found. All three are likely to be introductions via the horticulture trade. The Hidden Gardens and the wider Glasgow/Clyde area is worthy of greater investigation by natural historians.

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We are also grateful to Helen Read who recognised the mystery *Cylindroiulus* as *C. dahli*, to Paul Lee for verifying *Propolydesmus testaceus* and to Steve Gregory for information relating to *Orthochordeumella pallida*. Finally to Henrik Enghoff for verifying *O. pallida* and *C. dahli* for which he also supplied information on distribution and habitat.

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