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First report of *Podosphaera macrospora* on *Heuchera* in the United Kingdom

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Heuchera are important ornamental herbaceous plants providing year-round coloured foliage. During January 2015 *Heuchera* cultivars 'Caramel', 'Galaxy', 'Marmalade' and 'Obsidian' at RHS Garden Wisley, Surrey, were observed with symptoms associated with powdery mildew. Infected plants generally exhibited symptoms on less than half the leaves of the plant. In extreme cases symptoms were observed on all leaves. Empirical evidence suggested that introduction of a symptomatic *Heuchera* 'Marmalade' plant to a glasshouse with clean tissue culture plants in May 2015 resulted in all plants exhibiting symptoms within 12 weeks.

Braun & Kummer in Ale-Agha *et al.* (2008) found *Podosphaera alpina* f. *alpina* and *P. alpina* f. *macrospora* to be distinct morphologically and raised f. *macrospora* to species level as *P. macrospora*. *P. alpina* f. *macrospora* was described initially from North America on *Saxifraga* (Braun, 1985) and was reported subsequently from North America on *Heuchera*, *Tellima*, *Tiarella* and *Tolmiea* (Braun, 1987) and in Europe on *Tellima*, *Tiarella* and *Tolmiea* (Braun & Cook, 2012). Braun & Kummer in Ale-Agha *et al.* (2008) reported that *P. alpina* occurs on two species of *Saxifraga* in Europe. Bolay (2005) recorded *P. alpina* on *Heuchera sanguinea* in Switzerland but did not distinguish between *P. alpina* f. *alpina* and f. *macrospora* although this material was subsequently determined by Braun & Kummer in Ale-Agha *et al.* (2008) to be *P. macrospora*. To our knowledge there are no records of powdery mildew on *Heuchera* in the UK.

Abundant amphigenous greyish white, later yellow-brown, mycelia were observed on leaf surfaces (Figs. 1, 2) with branched, hyaline hyphae (n=8) 8-13 µm wide (mean 9 µm). Appressoria were indistinct. Conidiophores (n=178) were 191-289 x 10-13 µm (mean 229 x 11 µm) with straight foot cells (n=47) of 71-144 x 10-13 µm (mean 98 x 11 µm) (Fig. 3). Conidia (n=87) were catenulent, and broadly obovoid-ellipsoid with rounded apices and almost truncated bases, 33-45 x 15-22 µm (mean 39 x 19 µm), length/width ratio 1.7-2.7 (mean 2.1). Chasmothecia (n=20) were initially cream-yellow and later dark brown measuring 84-122 µm (mean 106 µm) with irregularly shaped peridial cells 20-56 µm and a thick wall 3-5 µm (Fig. 3). Appendages (n=35) were unbranched, mycelioid, measuring 156-742 µm (mean 387 µm) and brown though paler towards the apices. The single ascus (n=25) per chasmothecium was round to obovoid-saccate, 90 x 73 µm and 6-8-spored with walls (n=25) 1.3-2.8 µm thick (mean 1.9 µm). Ascospores (n=46) were broadly ellipsoid-ovoid, 16-39 x 13-23 µm

(mean 28 x 18 µm), and colourless.

No sequences of the ITS region of *P. macrospora* have been deposited previously in GenBank. The ITS region of three samples of *P. macrospora* from *Heuchera* was analysed and deposited in GenBank (Accession Nos. KP966080-KP966082). These were augmented by sequencing of five further samples of *P. macrospora* on host *Tellima grandiflora* from Kew Fungarium (Kew Accession Nos. 171016, 171193, 171927, 187918 & 188271) (KX032527-KX032536). Sequences matched via the GenBank BLAST.

Ascospore lengths >20 µm, asci wall thickness <3 µm, progression of mycelial colour from white to yellowish-brown and ITS DNA identify the causal fungus as *P. macrospora*. This is the first record of powdery mildew on *Heuchera* in the UK. *Heuchera* are widely grown in nurseries throughout Europe and trade may have facilitated movement of *P. macrospora* and thus may threaten other hosts. The annual value of UK production of herbaceous perennials, including *Heuchera*, is estimated at £97m (Denny, 2014) and prompt recognition and treatment of disease helps to sustain this market.

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Figure 1



Figure 2

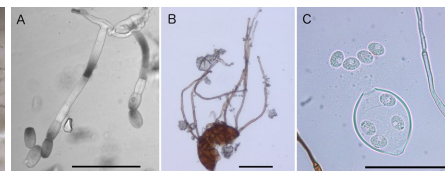


Figure 3

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