

First report of the powdery mildew *Erysiphe diffusa* on soybean in Australia

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Abstract A powdery mildew with a *Pseudoidium* anamorph was found on *Glycine max* in south-east Queensland, Australia. Morphological examination and molecular identification determined this species as *Erysiphe diffusa*, which is reported for the first time from Australia.

Keywords Erysiphales

Cultivated soybean, *Glycine max* (L.) Merr. (Fabaceae), is thought to be native to North East China (Mabberley 2008). In Australia the seeds are used in the production of soymilk, soyflour and Asian soy-food products (McGee 2011).

Several leaves infected with powdery mildew were collected on *G. max* near Bowenville, Qld in March and deposited in the Plant Pathology Herbarium as BRIP 55388. The anamorphic state of the fungus present on infected leaves was identified as *Pseudoidium*, characterised by conidiophores that produced single conidia that germinated with lobed appressoria. Mature conidia were dolii-form, 27–38×13–15 µm and lacked fibrosin bodies (Fig. 1).

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Two powdery mildew fungi with *Pseudoidium* anamorphs are considered pathogens of *Glycine*, namely *Erysiphe diffusa* (Cooke & Peck) U. Braun & S. Takam. and *E. glycinis* F.L. Tai (Braun and Cook 2012). A third species, *E. pisi* DC, has a broad occurrence on hosts in the Fabaceae worldwide. These three pathogens are morphologically differentiated by the appendages present on the ascomata, which were lacking on the collected material. The anamorphic stage could not further distinguish between these three species.

DNA was extracted from plant material using the Qiagen PureGene Kit and the Internal Transcribed Spacer (ITS) region of ribosomal DNA was amplified using the primer sets ITS1/PM6 and PM5/ITS4 (Takamatsu and Kano 2001; White et al. 1990). Reactions were performed with Phusion mastermix (Finnzymes) according to the manufacturer's protocol and with an annealing temperature of 60 °C. Clean-up and direct sequencing of the PCR product was completed by Macrogen (Korea). Sequence reads returned 376 bases of the ITS region, which was deposited in GenBank (GenBank JX136797). The sequence had 100 % identity to *Erysiphe diffusa* (GenBank numbers: FJ378880, EF196666-EF196675), which has been reported in Brazil (Almeida et al. 2008), China (Tsay et al. 2011) and the United States (Attanayake et al. 2010), and 100 % identity to *Oidium* sp. (GenBank numbers: AB078800-AB078813) reported on soybean in Japan, South Korea, the United States and Vietnam (Takamatsu et al. 2002). Takamatsu et al. (2002) were reluctant to identify the Japanese powdery mildew incursion as *Erysiphe diffusa* without reference to ascomata. A maximum likelihood search recovered the Australian specimen in a strongly supported clade with these GenBank records from different countries

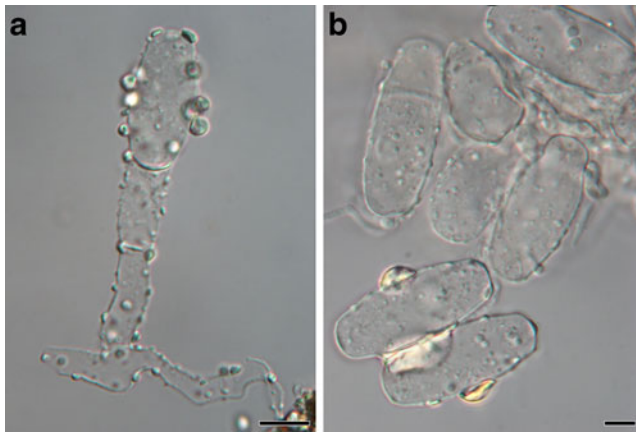
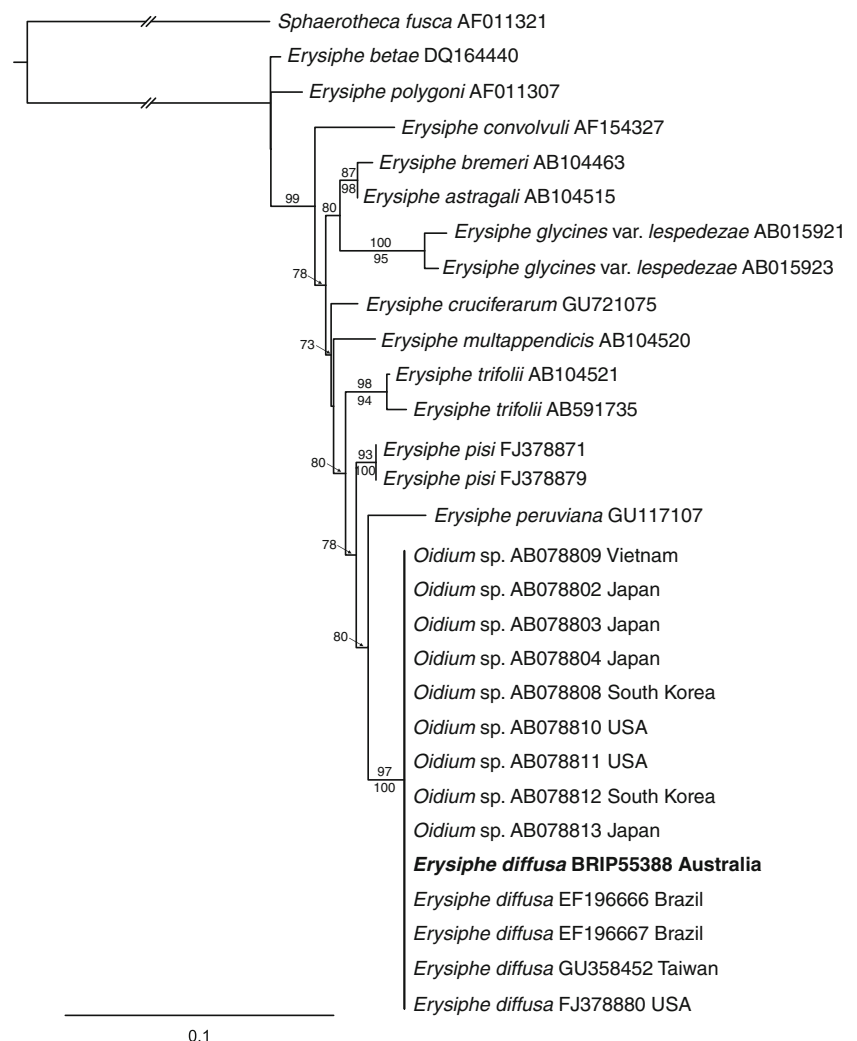


Fig. 1 *Erysiphe diffusa* (BRIP 55388). **a** *Pseudoidium* conidiophore bearing conidium, **b** conidia. Bars=10 µm

(Fig. 2) and is best named *Erysiphe diffusa*. A description of the Australian specimen (BRIP 55388) follows.

Fig. 2 Phylogram recovered from a maximum likelihood search in PhyML with an alignment of the ITS region. aRLT values >70 % shown above nodes and bootstrap values >70 % from a maximum likelihood search in RAxML shown below nodes



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