



# First confirmed report of white blister rust disease caused by *Albugo candida* on *Isatis emarginata*

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*Isatis emarginata* Kar. & Kir. (syn. *I. violascens* Bunge) is an annual therophyte belonging to the Brassicaceae. It is distributed in Iran, Afghanistan, Pakistan, and East Anatolia. In April 2011, white blister rust disease symptoms including whitish sori, usually on the lower leaf surfaces of *I. emarginata*, were noticed in Mighan, Nehbandan, South Khorasan province of Iran. Recent phylogenetic analyses have revealed that besides *Albugo candida*, several specialised species are present in the genus *Albugo* (Ploch et al. 2010). Dried specimens of *I. emarginata* (voucher FR0046090) with white blister symptoms were examined in terms of the morphology of the pathogen and molecular phylogeny. Sporogenous hyphae were hyaline, cylindrical to clavate, thick walled, measuring (12–)12.1–13.9(–15)  $\mu\text{m}$  (mean 13  $\mu\text{m}$ ) in width, (22–)23.9–31.9(–35)  $\mu\text{m}$  (mean 27.9  $\mu\text{m}$ ) in length ( $n = 50$ ). Sporangia were arranged in basipetal chains, hyaline. Secondary sporangia were globose to oval and measured

(10–)11.8–16.6(–21)  $\mu\text{m}$  (mean 14.2  $\mu\text{m}$ ) ( $n = 50$ ). Primary sporangia and secondary sporangia were morphologically similar except that the former had slightly thicker walls than the latter. No oospores were found in infected tissue. The identity of the pathogen was further analysed by sequencing the mitochondrial locus *cox2* and the nuclear ribosomal internal transcribed spacers (ITS) (Mirzaee et al. 2013). The consensus sequences of ITS (MF580755) and *cox2* (MF580756) were identical with *A. candida* sequences in GenBank (100% identity to DQ418500 and DQ418511, for ITS and *cox2*, respectively). Therefore, the species causing white blister rust on *I. emarginata* could be identified as *A. candida*. There are reports of white blister rust (as *Cystopus candidus*, a synonym of *A. candida*) on *I. minima* and *I. violascens* from Uzbekistan in 1965 (Farr and Rossman 2017). However, the identity of the species cannot be evaluated, as oospore ornamentation was not reported. Thus, to our knowledge, this is the first report of white blister rust disease on *I. emarginata* in Iran, and the first confirmed report of *A. candida* on this host worldwide.

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