First report of rust caused by *Puccinia oxalidis* on *Oxalis debilis* in India

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Oxalis debilis, an ethnomedicinally important plant, grows naturally in Uttarakhand, India. In March 2021, typical rust pustules were observed on *O. debilis* in a reserve forest area of Forest Research Institute, Dehradun. Disease incidence was 100% and the infected plants withered and died. Uredinia were powdery, mostly growing on the undersurface of leaves, occasionally found on the stem, erumpent, and dark yellow-orange in color. Urediniospores were yellow-orange, subglobose to ellipsoidal, echinulate, and measured $15.26 - 20.17 \times 13.15 - 16.58 \mu\text{m}$ (mean $17.83 \times 14.96 \mu\text{m}$) ($n = 20$). Teliospores were not observed. Based on the host species and morphological characters, the rust fungus was identified as *Puccinia oxalidis*. DNA was extracted from the urediniospores using phenol–chloroform method. The internal transcribed spacer (ITS) and larger subunit (LSU) regions were amplified using primer pairs ITS 5 / ITS 4 and LROR / LR5, respectively. PCR products were sequenced by Biokart India Pvt. Ltd., Bengaluru. A BLASTn search with the ITS sequence (MZ442316) revealed > 99% homology with *P. oxalidis* from China (MW522517) and India (MK640668). Likewise, the closest match (> 99% homology) of the LSU region (MZ425499) was with *P. oxalidis* from Korea (MH325474, MH325473) and USA (KY798348). Phylogenetic analysis of the individual ITS and LSU sequences conducted using the MOLE-BLAST tool (<https://blast.ncbi.nlm.nih.gov/moleblast/moleblast.cgi>) and concatenated data set using maximum parsimony method, further confirmed the species as *P. oxalidis*. Five *O. debilis* plants, when inoculated by rubbing a piece of infected leaf on the abaxial side of healthy leaves, developed typical rust

symptoms 15 days post inoculation in a glasshouse at 25 °C and 90% relative humidity. The symptoms and morphology of the urediniospores were similar to those observed on the naturally infected plants. No symptoms developed on control plants, which were mock-inoculated by rubbing with healthy leaves. Recently, *P. oxalidis* reported for the first time on *O. debilis* var. *corymbosa* in Korea (Lee et al. 2019). In India, four *Oxalis* species, (*O. corniculata*, *O. corymbosa*, *O. dehradunensis* and *O. latifolia*) are well-known host for *P. oxalidis* (Farr and Rossman 2021; Verma et al. 2020). However, to our knowledge, this is the first report of *P. oxalidis* inciting rust on *O. debilis* in India and is an important addition to the molecular taxonomy of an Indian rust.

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Declarations

Conflict of interest The authors declare no conflict of interest.

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