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First report of powdery mildew caused by *Golovinomyces* sp. (*Euoidium* sp.) on the exotic ornamental plant *Solidago canadensis* (Asterales: Asteraceae) in India

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Solidago canadensis L., (Image 1a) commonly known as Goldenrod, after its inflorescence, is a herbaceous perennial ornamental plant belonging to the family Asteraceae. The plant is exotic to India and was introduced for its ornamental value from North America. This plant has replaced traditional indigenous ornamental plants and is widely naturalized in Indian gardens. It is an erect, robust perennial herb with slender leafy stems pubescent below the inflorescence, growing from long creeping rhizomes (5–12 cm long) that can form rosette leaves. Leaves are lanceolate, acuminate, serrate, 4–7 cm long, three-nerved, rough, hairy, lowest leaves small and soon fall off, numerous small yellow flower heads appear in narrow or broadly pyramidal terminal clusters on inflorescence axis in ascending order. It is often cultivated as an ornamental plant for its golden yellow attractive inflorescence that is largely used in bouquets. The flower clusters can be used to make a strong yellow dye (Royer & Dickinson 1996).

In September 2013, during a routine survey in the Botanical Garden of the Yashvantrao Chavan Institute of Science, plants of *S. canadensis* were found to be infected with powdery mildew (Image 1b). Voucher specimens were deposited in the mycological herbarium at the Agharkar Research Institute, Pune (M.S.), India, with Accession No. AMH-9614. The fungal material was mounted in lactophenol, stained with cotton blue and microscopically examined.

The sexual morph (chasmothecia) of this powdery mildew was not found. The asexual morph is characterized as follows: Mycelium amphigenous, in white patches, persistent, hyphae thin-walled, smooth, hyaline, hyphal appressoria solitary, nipple-shaped (Image 1f), conidiophores arising from the upper surface of hyphal mother cells, erect, foot-cells subcylindrical, straight (56±5 × 10±2 µm), followed by 1–3 shorter cells and 3-4 conidia in chains formed in basipetal succession (Image 1c), catenescent, edge line sinuate, doliiform (28±4 × 14±6 µm), lacking fibrosin bodies (Image 1d). Germ tube terminal or subterminal, 45±8

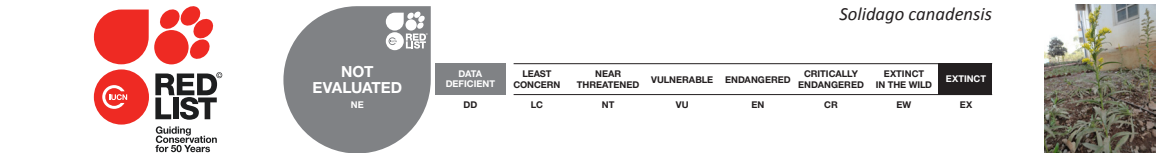

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Image 1 a–f. a - healthy habit of *Solidago canadensis* (host plant); b - infected leaf; c - conidia with conidiophore; d - conidia at 45x; e - germinated conidia; f - arrow indicates nipple shape of conidia

µm long (Image 1e). Based on the combination of these features this pathogen is readily identifiable as an asexual morph (*Euoidium* Y.S. Paul & J.N. Kapoor) of the genus *Golovinomyces* (U. Braun) Heluta. A survey of Indian powdery mildew literature (Bilgrami et al. 1991, Jamaluddin et al. 2004; Paul & Thakur 2006; Pande 2008; Hosagoudar & Agarwal 2009) shows that no powdery mildew has been so far reported on *S. canadensis* from India. Powdery mildew on *S. candensis* is common and widespread in North America and Europe and was previously subsumed under *Erysiphe cichoracearum* DC. s. lat. [now *Golovoniomyces cichoracearum* (DC.) Heluta] (Braun 1987). Braun & Cook (2012) revised the taxonomy of the *G. cichoracearum* complex and assigned the powdery mildew on various species of *Solidago* to *Golovinomyces asterum* var. *solidaginis*. However, the Indian collection is morphologically not in agreement with the latter variety, which is well characterized by having conidiophores with foot-cells distinctly curved at the base and larger conidia, 25–40(-50) × (12-)14–22 µm, width on average >15 µm (Braun & Cook 2012). Therefore, the Indian powdery mildew can currently only be referred to as *Golovinomyces* sp. (*Euoidium* sp.). Identifications of isolated powdery mildew anamorphs are difficult and mostly impossible. Molecular sequence analyses are necessary and helpful for identification purposes.

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