First report of powdery mildew on Dahlia (*Dahlia variabilis*) caused by *Golovinomyces cichoracearum* in Lahore, Pakistan

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Abstract *Dahlia* (*Dahlia variabilis* Desf.) plants infected by powdery mildew were collected from different areas of Lahore Pakistan, in April 2011. Infected plants leaves surfaces were covered with white mycelium. The powdery mildew patches were slightly whitish gray with cylindric to doliform, hyaline conidia borne in chains. The conidia were 30–50 µm long×14–20 µm wide. Conidiophores were unbranched, 110–220 long×6–13 µm wide, composed of a foot cell and three to eight barrel-shaped conidia. Foot cells were 55–90 µm long and 6–13 µm wide, slightly swollen with constriction at the base. The cleistothecia were not observed. Fibrosin bodies were absent in conidiophores and conidia. Morphological characteristics and pathogenicity test confirmed the identification as *Golovinomyces cichoracearum* (DC.) V.P. Heluta. This is thought to be the first report of *G. cichoracearum* on *D. variabilis* in Pakistan.

Keywords Conidia · *Golovinomyces* · *Dahlia variabilis* · Powdery mildew

In April 2011, a severe outbreak of powdery mildew on *Dahlia* (*D. variabilis* Desf.) plants was observed in different areas of Lahore and University of the Punjab, Lahore Pakistan. Disease symptoms included grayish white circular to irregular patches consisting of epiphytic mycelia and conidia on stem, bud and leaves (Fig. 1a&b).

As the disease progressed, leaves were covered by a gray powdery fungal mass, and older leaves became necrotic. A voucher specimen (IR00026) has been deposited in First Fungal Culture Bank of the Pakistan (FCBP), Institute of Plant Pathology, University of the Punjab, Lahore, Pakistan. Fresh hyphae, conidiophores and conidia were stripped off the leaf surface with clear adhesive tape, mounted on a microscopic slide with water and examined using a light microscope (Correll et al. 1987).

Hyphae were hyaline, sub-straight to wavy, occasionally geniculate, 40–90 µm long, 4–7 µm wide, mostly branching at a right angle, with a septum near the branching point. Hyphal appressoria were simple, sometimes nipple-shaped, and single (Fig. 1c). Conidiophores were unbranched, cylindrical, erect and arising singly on a hyphal cell, 110–220 long×6–13 µm wide, composed of a foot cell and three to eight barrel-shaped conidia formed in chains with a sinuate edge, followed with a basal septum at the branching point or slightly displaced from the mycelium. Foot cells 55–90 µm long and 6–13 µm wide, slightly swollen with constriction at the base (Fig. 1d). Conidia were cylindric to doliform in shape measured 30–50 µm long×14 to 20 µm wide and produced in chains (Fig. 1e). Length/breadth ratio of conia was 1.8–2.6. Fibrosin bodies were absent in conidiophores and conidia. No cleistothecia were observed. During germination, conidia produced simple germ tubes on the peripheral position (Fig. 1f–g). Identification of the causal agent as *Golovinomyces cichoracearum* (DC.) V.P. Heluta (synonym *Erysiphe cichoracearum*) based on morphology with the help of literature (Braun 1987; Belanger et al. 2002). Some times *G. cichoracearum* is confused with *G. orontii*

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Fig. 1 Powdery mildew infections of *Dahlia variabilis* by *Golovinomyces cichoracearum*. **a** Severe infections on the plants (**b**) Close-up view of infections on leaves (**c**) Hyphae with nipple-shaped

appressoria. **d** Conidiophore producing conidia in chains. **e** Shapes of conidia. **f–g** Germinating conidium

(*Erysiphe orontii*), due to close resemblance but on the basis of straight foot cells, it can be easily identified.

G. cichoracearum applies to a species complex restricted in host range to the Asteraceae (Braun 1987). Phylogenetic analysis of the *G. cichoracearum* complex also has showed some lineages of which appeared to be co-evolving with the tribes Anthemidae, Astereae, Cardueae and Heliantheae in the Asteraceae (Matsuda and Takamatsu 2003).

Pathogenicity was confirmed by dusting conidia on 3 healthy plants of *Dahlia* and 3 non-inoculated plants served as controls. A sterile brush was used to transfer conidia from the affected leaves to fully expanded leaves of healthy plants. A plastic bag was placed around each plant for a week and then removed. Non-

inoculated controls were stroked with a sterile brush, placed in a plastic bag and kept separate in the greenhouse. Inoculated plants developed visible white spots of powdery mildew on the leaves of all inoculated plants whereas control plants remained healthy. Fungal colony morphology on the leaves and the morphological characteristics were as described above. *Golovinomyces cichoracearum* has been reported (as *Erysiphe cichoracearum*) from *Cucurbit* (*Cucumis melo*) along with other powdery mildew causing fungi in Pakistan (Burni et al. 2010). But none of those records included the host species documented in the present study. *Sphaerotheca fuliginea* has also been reported as mildew fungi in *Dahlia* (Husain and Akram 1996) in India. To our knowledge, this is the

first report of powdery mildew caused by *G. cichoracearum* on Dahlia (*D. variabilis*) in Pakistan.

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