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**Case Study**

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# First Report of Powdery Mildew Caused by *Golovinomyces cichoracearum* Dahlia (*Dahlia variabilis*) from Himachal Pradesh (India)

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**A B S T R A C T**

Powdery mildew disease appeared for the first time in field-grown Dahlia (*Dahlia variabilis*) in Himachal Pradesh, India. With the advancement of the disease, the infected plants withered and died. In order to investigate the causal organism of this symptom disease, fungus was morphologically studied. The fungus showed conidiophore with85-118 X 6-10µm in size, composed of subcylindrical foot cell with a single constriction at the base, and 2-4 immature conidia in chains formed in basipetal succession. Conidia that were hyaline, barrel-shaped or ellipsoid or doliform, borne in chains of three to four and without distinct fibrosin bodies measuring 29-52µm X 14-19µm.The germination of conidia occurred terminally or sub terminally with moderately 43±8µm long germ tubes and swollen appressorium. The sexual morph (chasmothecia) of this powdery mildew was not found. These morphological characteristics confirmed the identification of powdery mildew causal organism as the anamorph of *Golovinomyces cichoracearum* (DC.) V.P. Heluta (syn. *Erysiphe cichoracearum* DC). This is the first report on the occurrence of powdery mildew on Dahlia (*D. variabilis*) caused by *G. cichoracearum* in Himachal Pradesh, India.

## Introduction

Dahlia (Family: Asteraceae), beautiful annual flowering plant grown for cut flower and for garden decoration purposes. Most of these plants have tuberous roots, while some have herbaceous stem. Dahlias are native to Mexico where they have been grown for centuries.

There are over 20,000 different species within the Aster family, it is the second largest family of flowering plants next to the orchid (Orchidaceae) family. This plant has been reported to be infected with diseases like powdery mildew, grey mould (*Botrytis cinerea*), Verticilliumwilt,dahlia smut(*Entylo macalendulae* f. *dahliae*), Phytophthora and some plant viruses which reduce the aesthetic value of the ornamental crop.

*Dahlia variabilis* Desf. Blooms with a single outer ring of florets in research farm of Department of Floriculture and Landscape Architecture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan

(Himachal Pradesh) were found to be infected with a powdery mildew disease during September, 2016.Powdery mildew causes high economic losses in northern India because of highly conducive climate.

## Symptoms

Disease symptoms included greyish white circular to irregular patches consisting of epiphytic mycelia and conidial sporulation on both surfaces of the leaves and on stems and flowers of infected plant giving appearance typical of powdery mildew. As the disease progressed, white mycelial growth completely covered the whole plant, including the inflorescence. Severely affected plants had small chlorotic leaves and reduced size compared to healthy ones. Infected leaves turned yellow, distorted, necrotic, died and eventually fall off. Infection was severe and resulted in the death of some plants (Fig.1). The severity of disease was recorded up to 19.4 percent.

## Pathogen

The powdery mildew pathogen was stripped off gently with help of painting brush and microscopic examination of pathogen was done by under Light microscope, Leica-DM1B. Mycelium was amphigenous, persistent and in white patches. Hyphae were superficial, hyaline, thin-walled, smooth, sub-straight to wavy, mostly branching at a right angle, with a septum near the branching point and produced nipple-shaped appressorium (Fig. 2). Conidiophores were hyaline, erect, unbranched, cylindrical, lack fibrosin bodies, 3-4 celled with 85-118 X 6-10µm in size, composed of sub cylindrical foot cell with a single constriction at the base, and 2-4 immature conidia in chains formed in basipetal succession with sinuate edge-line (Fig. 3). Conidia were hyaline, barrel-shaped or ellipsoid or doli form, borne in chains of three to four and without distinct fibrosin bodies. The length of the conidia was 29-52µm and the width was 14-19µm (Fig. 4). The germination of conidia occurred terminally or subterminally with moderately 43$\pm$8µm long germ tubes and swollen appressorium (Fig. 5). The perfect stage (chasmothecia) of this powdery mildew pathogen was not observed in the collected samples. These morphological characteristics confirmed the identification of powdery mildew causal organism as the anamorph of *Golovinomyces cichoracearum* (DC.) V.P. Heluta (syn. *Erysiphe cichoracearum* DC).

**Fig.1** Powdery mildew symptoms on *Dahlia variabilis*

**Fig.2** Microscopic examination of G. *cichoracearum* showing hyphae characteristic branching at a right angle (RAB) and septum near the branching point (S). Bar = 40µm

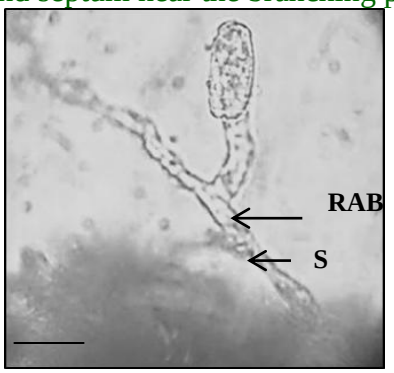



**Fig.3** Microscopic examination of *G.cichoracearum* showing conidiophore (CP) bearing immature conidia (IC) in chain, and conidia(C). Bar = 40µm

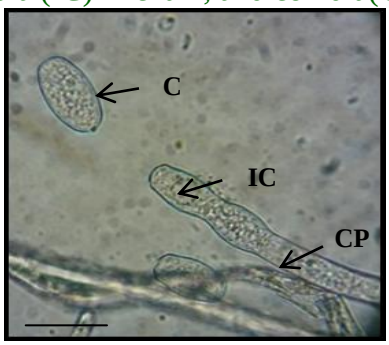



**Fig.4** Microscopic examination of *G. cichoracearum* showing characteristic Barrel-shaped (BSC) or ellipsoid (EC) conidia. Bar = 40µm

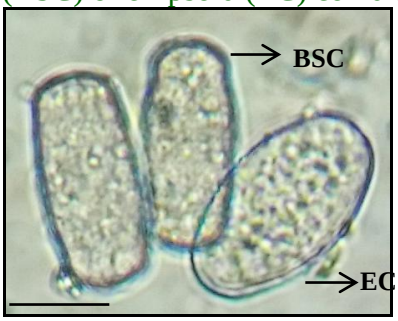
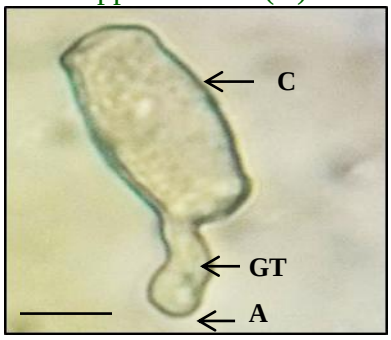



**Fig.5** Microscopic examination of G. *cichoracearum* conidia (C) showing germ tube (GT) And swollen appressorium (A). Bar = 40µm



The identification of powdery mildew causal organism as *Golovinomyces cichoracearum* (DC) V.P. Heluta was finally confirmed from National Centre of Fungal Taxonomy, New Delhi with reference No-8360.16. The culture was also deposited in culture collection of Department of Plant Pathology, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India) under the accession number HMPP-161.

## Pathogenicity assay

Pathogenicity assay was confirmed by dusting conidia on 5 healthy plants of Dahlia and three uninoculated plants served as controls. A sterile brush was used to transfer conidia from the affected leaves to fully expanded leaves of healthy plants (Correll *et al.,* 1987). The first powdery mildew signs and symptoms developed on leaves 7 days after inoculation which was identical to that of originally diseased plants, fulfilling the Koch's postulates. Fungal colony morphology on the leaves and the morphological characteristics were as described above. Earlier in India, powdery mildew on *Dalhia* sp. caused by *Erysiphe cichoracearum* has been reported from Madhya Pradesh (Sexsenaand Saksena, 1981). This is the first report on the occurrence of powdery mildew on Dahlia (*D. variabilis*) caused by *G. cichoracearum* in Himachal Pradesh, India (Prameela Devi *et al.,* 2013). However, in India, *G. cichoracearum* have been detected on different hosts viz., papaya, cucurbits and gerbera (Baiswar *et al.,* 2010; Gupta and Sharma, 2012; Kumar *et al.,* 2012).

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