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Ampelomyces quisqualis – a remarkable mycoparasite on *Cucucrbita maxima* powdery mildew from Satara (M.S.) India

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Abstract

During routine mycological survey in Satara district of Maharashtra, India. A powdery mildew infection was observed on *Cucurbita maxima* Duchesne. Microscopic examinations revealed the identity of powdery mildew as *Fibroidium* sp. During mycological examinations powdery mildew infection was found to be mixed with brownish intercellular pycnidia. These brown coloured pycnidia were picked up with the help of a needle under dissecting microspore and mounted in lactophenol and stained with cotton blue. Critical examinations identified it as a mycoparasite namely *Ampelomyces quisquali* Ces.

Keywords – *Ampelomyces quisqualis* – *Cucurbita maxima* – mycoparasite – powdery mildew fungi

Introduction

Fungi are highly diverse and versatile organisms adapted to all kinds of environments. One of the interesting groups of fungi is 'Powdery Mildews'. Taxonomically, powdery mildew belongs to order Erysiphales which contains number of genera and species distributed worldwide with diverse host range. This disease affects variety of plants viz. grasses, vegetables, fruits, forest trees and agricultural crops, which results into massive annual yield loss every year.

A number of methods *viz.* physical, chemical and biological are now in practice to control this disease but, chemical control is practiced on a large scale for the management of this disease. However, this practice often becomes uneconomical and useless because the frequent application of these products has caused the emergence of resistant populations of fungi to fungicides. Nowadays, there is tendency of consumers to prefer healthy products without residue of agrochemicals. This trend combined with other factors, leads to the development of research and technologies of biological control of pathogens.

There are a number of biocontrol agents available in nature which help the plant to control fungal parasites. An example of such type of biocontrol association is mycoparasitism which simply an association of two fungi where one act as parasite over other. The term was introduced by Butler (1957) to elucidate the complex interrelationships between a fungal host and parasite.

Ampelomyces quisqualis is one of the naturally occurring mycoparasites which parasitize both sexual and asexual structures of powdery mildew. This mycoparasite colonizes a large area of

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the target site, competes for the plant substrates and nutrients there by causes the killing of pathogens due to starvation. It acts as a hyper parasite which penetrates the pathogen and infects it by forming pycnidia within powdery hyphae, conidiophores, conidia and cleistothecia.

During routine mycological survey in Satara district of (M.S.) India, a powdery mildew infection was observed on leaves of *C. maxima.* The morphological examinations of powdery mildew symptoms revealed variation in colour of fungal mycelium on leaves. After astute microscopic study, the infection was found mixed with another unknown mycoparasitic fungus. Therefore, the present study was carried out to study morphology and taxonomy of the powdery mildew disease and its mycoparasitic association.

Materials & Methods

Sample collection

The powdery mildew samples were collected during the phytopathological survey of study area in the year 2020. These infected plant parts were dried between sheets of blotting paper and preserve for further studies. Host plants were identified and confirmed by matching the collections with herbarium and by consulting botanists. The infected leaves of hosts were deposited at Geobotany Herbarium of the Institute of Botany, Department of Geobotany and Botanical Garden, Martin Luther University, Halle, Germany with accession number (HAL-2921).

Morphological and Microscopic Examinations

The fungal material was mounted in lactophenol, stained with cotton blue and microscopically examined. Microscopic observations were carried out to study the characteristics of mycelia on the host, appressoria, size and shape of conidia and conidiophores and chasmothecia. For examinations of mycoparasite, the infected leaves placed under stereomicroscope and observed for the presence of brownish intercellular pycnidia in the white powdery mildew mycelia. These brown coloured pycnidia were picked up with the help of a needle under dissecting microspore and mounted in lactophenol cotton blue stain.

A light microscope was used to examine fungal structures, images were captured. Micrometry measurements were carried out. The standard literatures were consulted for identification of powdery mildew (Paul & Thakur 2006, Braun & Cook 2012) and mycoparasite (Belsare et al. 1980, Hashioka & Nakai 1980, Kiss 1998).

Results

The disease was observed as white powdery mass on leaves, stems and other floral parts of *C. maxima*. The white powdery mildew infection was turned grayish in colour as the disease progresses. After microscopic examination of diseased samples revealed the presence of a fungus *Fibroidium* sp. Upon further mycological examinations at later stages of infection, brownish intercellular pycnidia were found parasitic on powdery mildew (Fig. 1c). Critical examinations revealed that it is an *A. quisqualis.* The mycoparsite is characterized as follows,

Hyphae of the hyper-parasite were hyaline and septate; present within the hyphae, conidiophores (Fig. 1d), and conidia of infected powdery mildews pathogen. Pycnidia were light brown in transmitted light and varied in shape from sub-globose to pyriform, measured 38.5–79.2 × 35.2–44 µm (Fig. 1e), with no distinct ostiolum. Conidia unicellular, hyaline, mostly guttulate conidia, 3.2–6.5 × 1.1–3.5 µm, dehiscence by apical rupture of pycnidium (Fig. 1f).

Discussions

The present study exposes mycoparasitic relationship between powdery mildew fungus *Fibroidium* sp. on *C. maxima* and *A. quisqualis*. The powdery mildew infection on *C. maxima* was appeared as white powdery mass but turned grayish upon mycoparasitic attack (Fig. 1a, b). *Ampelomyces quisqualis* is most studied mycoparasites of powdery mildew disease on various crops and observed as one of the important biological control agents (BCAs) of powdery mildew

disease. There are about 18 epithets recorded worldwide till date on variety of plant hosts (www.indexfungorum.com).

Ampelomyces quisqualis is reported earlier on powdery mildew of grapes (Falk et al. 1995), crops, weeds, medicinal plants (Belsare et al. 1980, Kiss 1998) and *Buxus* trees (Naseripour et al. 2014). Reports are available which shows that the mycoparasitism is not only restricted to powdery mildew; it can also parasitize on *Alternaria solani*, *Botrytis cinerea*, *Colletotrichum coccodes* & *Cladosporium cucumerinum* (Jarvis & Slingsby 1977).

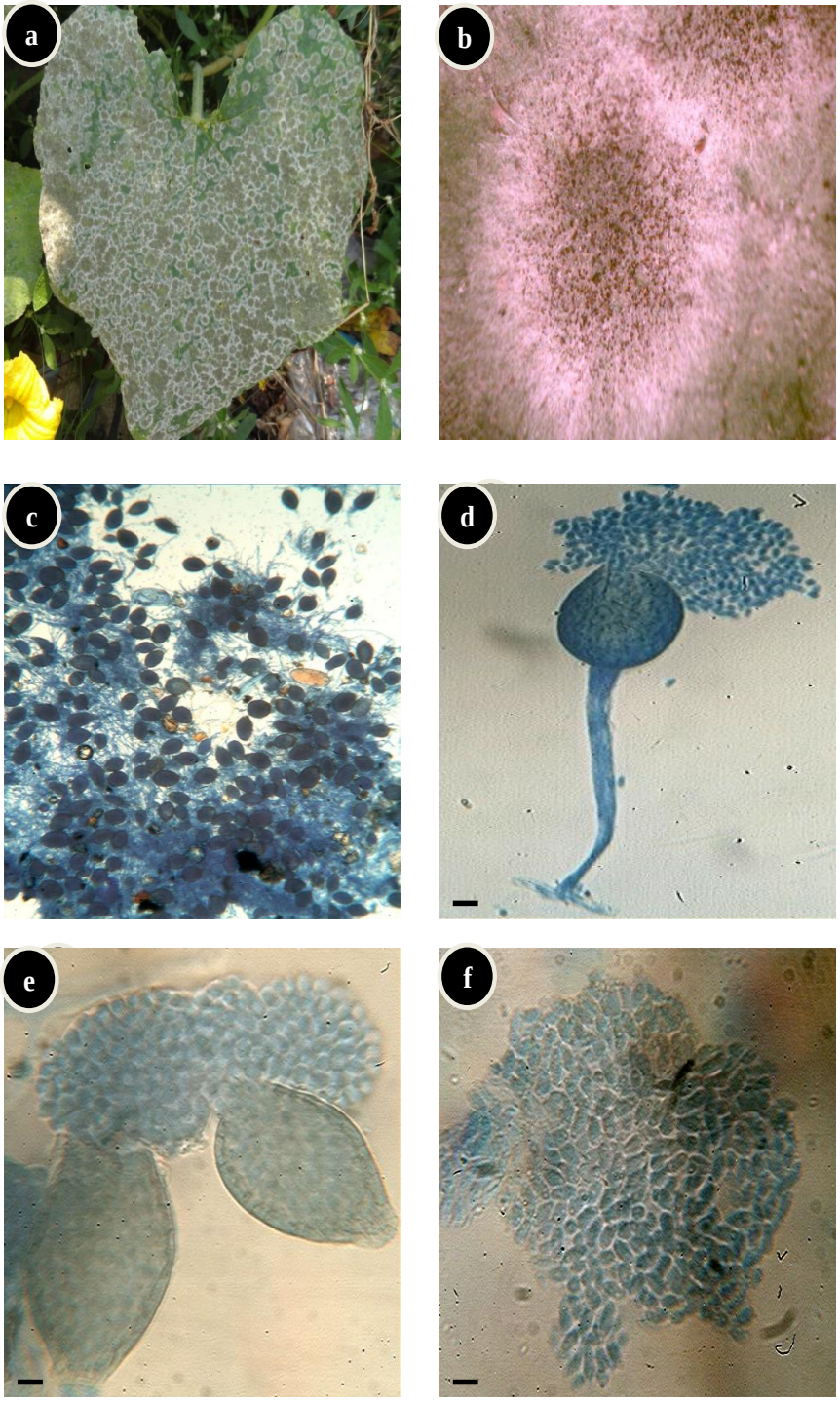

Fig. 1 – a Host showed powdery mildew infection mixed with mycpaprasite. b Arrow showed enlarged view of *A. quisqualis* colony within powedery mildew infection. c, d Mycelium, conidia, conodiophores of conodiophores of *Podosphera xanthii* parasitized by *A. quiaqualis*. e Pycnidia at 45x. f Condia at 45x. Scale bar = 20 µm.

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