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First Report of *Leveillula cylindrospora* Conidial State on *Bassia indica*

[1]Ahmed I.S. Ahmed and [2]Ahmed M. Abdel-Azeem

[1]Plant Pathology Unit, Plant Protection Department, Desert Research Center, El-Matarya, Cairo, Egypt
[2] Systematic Mycology Laboratory, Department of Botany, Faculty of Science,
University of Suez Canal, Ismailia, 41522, Egypt

Abstract: The conidial stage of *Leveillula cylindrospora* U. Braun has been found on *Bassia indica.* The fungus is described, illustrated and discussed. The isolated fungus incited powdery mildew symptoms on the inoculated *B. indica* leaves, which proved Koch's postulates. It is, to our knowledge, the first formal report of a powdery mildew disease on *B. indica* in Egypt and the world.

Key words: Anamorph · Conidia · Erysiphales · *Leveillula cylindrospora* f. *kochiae* · Port Said

INTRODUCTION

Powdery mildew fungi are widespread pathogens and these parasitic Ascomycetes can infect more than 10,000 plant species, including many economically relevant crops and ornamentals [1]. Genus *Leveillula* is mainly distributed in arid and warmer areas of Africa adapted to xerophilic conditions and has the ability to infect a large and diverse number of plant hosts [2-4]. The genus *Bassia* belongs to the family Amaranthaceae and consists of about 20 species and represented by three species only in Egypt [5]. Various studies were carried out on *Bassia indica* by several Egyptian investigators e.g. Rezk and Sadek [6] on autocology, El-Beheiry [7], Zahran *et al.* [8], Shaltout and El-Beheiry [9] on productivity, Draz [10], Youssef *et al.* [11], Zahran and El-Amier [12] as non traditional fodder in salt affected lands. Recently, Ibrahim *et al.* [13] and Aboul-Enein *et al.* [14] studied *B. indica* as biological restorer of saline soil and as source of antioxidant and anticancer activities, respectively. A first report often provides important information for increasing our knowledge and understanding about these emerging plant pathogens. Hence, we felt it was imperative to study the incidence of powdery mildew on *B. indica* (Wight) A. J. Scott as new host in Egypt and worldwide.

MATERIALS AND METHODS

Fungal Samples: Infected plants of *B. indica* by powdery mildew were collected from different altitudes and locations and recorded by GPS (Global Positioning System) as N 31° 14' 20.2" E 32° 18' 51.2", N 30° 37' 20.7" E 32° 16' 14.5" and N 31° 25' E 31° 48' form Port Fouad, Ismailia and International coastal road, Egypt, respectively. Samples were collected from April 2011 to May 2013. As the disease progressed, abaxial leaf surface, stems and petioles were covered by cotton-like masses of mycelia and conidia (Fig. 1). Chasmothecia were not observed on sampled plants. Representative material of each of the examined samples is deposited as typical dried samples in the Mycological Herbarium of Royal Botanical Garden, Kew, UK.

Fig. 1: Symptoms of *Leveillula cylindrospora* on *Bassia indica* leaves

Morphological Characterization: Symptomatic leaves of all the powdery mildew samples were examined under ×100 to × 1,000 using bright field microscopy (Leitz Laborlux S, Germany). Measurements of conidia length and width

Corresponding Author: Ahmed I. S. Ahmed, Plant Protection Department, Plant Pathology Unit, Desert Research Center, El-Matarya, Cairo, Egypt.

were done using 500 primary and 500 secondary conidia that were collected from host plant described in the present investigation. Other morphological criteria of the fungal structures associated with the imperfect stages of powdery mildew fungi were observed including color of conidia, vacuoles and type of germination tube [15-20].

Greenhouse Inoculation and Pathogenicity Assay: *Bassia indica* (Wight) A.J. Scott were planted in the greenhouse of Botany Department Faculty of Science, University of Suez Canal, Ismailia, Egypt. Twenty plants in five pots (four plants per 30-cm pot) were used in the experiment. Six-week-old plants were dusted copiously with conidia (5 x10^6 conidia/ml) collected from infected *B. indica* plants until the young leaves had a white powdery appearance. Plants were maintained in a greenhouse with 20 to 25°C and watered daily at the base. Relative humidity was not controlled and fluctuated between 25 and 50%. Development of powdery mildew symptoms as evidenced by white powdery spots was observed and recorded at 2-day intervals for 3 weeks, then at weekly intervals until plants matured. The experiment was repeated once.

RESULTS

Observations revealed that mycelium is predominantly endophytic with the presence of conidiophores emerging through leaf stomata. Superficial mycelium well developed, dense, forming white patches covering the entire leave surface and persistent (Fig. 1). Microscopic examination revealed that conidiophores were erect, 160-175 x 5-7 µm, with cylindrical foot cells, bearing a single conidium. Some conidiophores were divided into two branches (Fig. 2). Two morphologically distinct conidia were observed primary and secondary conidia. Primary conidia ellipsoid-cylindrical, slightly wider towards the apex, apex usually obtuse, in young conidia occasionally somewhat pointed, but conidia usually not typically lanceolate, 48-65 x 12-22 um, mostly 50-60 x 15-20 um. Secondary conidia similar to the primary ones, but more cylindrical, mostly 45-60 × 15-22ìm. On both primary and secondary conidia surface wrinkling (Fig. 3). Conidial germination's (Fig. 3) pattern belongs to tribe Phyllactinieae according to the classification proposed by Cook and Braun [19].

Koch's postulates were fulfilled for *B. indica* healthy plants after 19 to 23 days. Symptoms and signs of powdery mildew developed on the foliage of inoculated plants. Fungal morphology on all samples was similar to that described for the imperfect stage of *Leveillula cylindrospora* [4]. The presence of the chasmothecial state was not observed in the leaf samples of any host plant throughout this investigation. Voucher samples were deposited in the Mycological Herbarium of Royal Botanical Garden, Kew, with an accession number is: K (M) 187860.

Fig. 2: *Leveillula cylindrospora* on *Bassia indica*, conidiophores and conidia. Bar = 1.25 µm.

Fig. 3: Conidial germination in *Leveillula cylindrospora* and wrinkled wall of conidia.

Recently the taxonomic status of species within the genus *Leveillula* has been the target of many studies, especially *L. taurica*, using molecular tools [21, 22] and some new species have been segregated from *L. taurica.* However, its taxonomical status remains controversial. In view of this and the fact that the size of the conidia of *L. taurica* on different host plants as well as on a single host is extremely variable [23, 24], we decided to adopt a conservative point of view about our specimens. This record represents the first report of *L. cylindrospora* on *B. indica* in Egypt and also the world. *Bassia indica*, as a wild weed, has future economic potential in Egypt as a fodder and in remediation of salt affected soils;

this host has a wide distribution throughout the country and it may be a reservoir of this pathogen for a diverse range of crops.

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