

***Sphaerotheca fuliginea* (Schlect.) Poll, and *Erysiphe cichoracearum* DC.  
causing powdery mildews in Libya \***

S. S. EL-AMMARI AND M. W. KHAN <sup>1</sup>

ABSTRACT

The identity of the powdery mildew pathogens on different cucurbits cultivated outdoors and indoors in different parts of Libya was investigated. *Sphaerotheca fuliginea* was found to be predominant in outdoor and indoor cultivations in the different areas surveyed. *Erysiphe cichoracearum* was found infecting cucumber in several indoor cultivations in Benghazi.

INTRODUCTION

The cucurbit powdery mildew is attributed mainly to two fungal species of Erysiphaceae: *Erysiphe cichoracearum* DC. and *Sphaerotheca fuliginea* (Schlecht.) Poll. (1, 9, 16, 25, 26). *Leveillula taurica* (Lev.) Arnaud was reported as the causal agent of cucurbit powdery mildew only in a few countries. Recently, it was found infecting greenhouse cucumbers in different parts of Libya (El-Ammari and Khan under publication). *Leveillula taurica* can be easily distinguished from the other two species causing powdery mildew. In *L. taurica*, the mycelium is endophytic and the conidia are borne singly on the conidiophore (1, 20).

*Sphaerotheca fuliginea* and *Erysiphe cichoracearum* are easily identified according to the perithecial stage. The perithecium of *E. cichoracearum* contains several asci each with 2 spores, whereas the perithecium of *S. fuliginea* contains only one ascus of 8 ascospores (13, 14). However, perithecia are rarely formed in nature, and identification according to the conidial stage is not easy because both *E. cichoracearum* and *S. fuliginea* have superficial mycelium with conidia borne in a long chain. There is also no apparent distinction in the symptoms that they cause on different cucurbits. According to Khan (15), Salmon in 1900 was the first to observe the perithecia of *E. cichoracearum* on *Cucurbita pepo* L. and this led him to conclude that the powdery mildew of cucurbits is caused by this fungus.

As perithecia formation is rare and no other criteria were established to differentiate the two species, the records continued to identify the species causing powdery mildew on cucurbits as *E. cichoracearum*. In many countries the pathogen appears to have been traditionally identified as *E. cichoracearum* and so this species was generally considered the predominant casual agent in different parts of the world (9). In Libya, Pucci (23) regarded the powdery mildew fungus on watermelon as *E. cichoracearum*. Kranz (19) reported that powdery mildew on melon, watermelon and pumpkin in the Cyrenaica region is probably caused by *E. cichoracearum*.

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<sup>1</sup> Department of Plant Protection, Faculty of Agriculture, University of Al-Fateh, Tripoli, S.P.L.A.J.

Conidial characters that could be of value in differentiating the two species were sought. The shape of the germ tube and the presence or absence of fibrosin bodies were later used as diagnostic characters of the imperfect stage (3, 4, 7, 8, 10, 12, 22, 27). As a result, in several countries where *E. cichoracearum* was mistakenly presumed to be the causal organism was later found to be *S. fuliginea*. Khan (17) using the conidial characters reported the presence of *S. fuliginea* during a survey of cucumber powdery mildew in the Tripoli area.

The present work was undertaken to establish the identity of the causal agent of the powdery mildews on different cultivated cucurbits in the coastal belt and the desert regions of Libya.

## MATERIALS AND METHODS

A survey for powdery mildews in Zawia, Janzoor, Tripoli, Garabulli, El-Khoms, Misrata, Benghazi, El-Marj and Derna in the coastal belt region; and Jalo, Aujla, Kufra and Sebha in the desert region was made during the period from March to December, 1981. Crops included in the survey were: Cucumber *Cucumis sativus* L., muskmelon *Cucumis melo* L., squash *Cucurbita pepo* L., pumpkin *Cucurbita* spp., watermelon *Citrullus lanatus* L. and bottle gourd *Lagenaria siceraria* (Mol.) Standl.

Samples of infected plants brought to the laboratory were thoroughly examined for the presence or absence of the perfect stage. Conidia were examined for the presence or absence of fibrosin bodies, and subjected to a germination test.

For the conidial germination test, conidia were dusted on clean dry slides. The slides were placed on glass rods kept in petri dishes containing moistened cotton wool at the bottom, and then incubated at 20°C for 24 hrs. At the end of the incubation period, the morphology of the germinating conidia was examined after staining with cotton blue.

Conidia were examined after mounting in 3% aqueous potassium-hydroxide for the presence or absence of the fibrosin bodies (12).

## RESULTS AND DISCUSSION

No perithecia were present. Infection on different cucurbits cultivated outdoors (cucumber, squash, muskmelon, pumpkin, watermelon and bottlegourd) in the different areas surveyed was caused by the imperfect stage of *S. fuliginea*. At two locations, in the Benghazi area, cucumber in four greenhouses and in three plastic tunnels was found infected with the conidial stage of *E. cichoracearum*. Indoor cultivations, in Janzoor, Tripoli, El-Garabulli, El-Khoms, Benghazi, El-Marj and Derna were found infected with the conidial stage of *S. fuliginea*.

The conidial stages of both *E. cichoracearum* and *S. fuliginea* have a well developed superficial mycelium with conidiphores bearing conidia in chains. Conidia of *S. fuliginea* showed the presence of fibrosin bodies (Fig. 1), whereas those of *E. cichoracearum* were free of them (Fig. 2). This finding is in agreement with the findings of Blumer (2) and Homma (10) who reported that fibrosin bodies were present in the conidia of *S. fuliginea* but not in those of *E. cichoracearum*.

Upon germination, most of the conidia having fibrosin bodies produced forked germ tubes characteristic of *S. fuliginea* (Fig. 3). The conidia of *E. cichoracearum* germinated with simple germ tubes (Fig. 4).

These results are in agreement with the studies of Hirata (7, 8) and Zaracovitis (30) who claimed that the conidial germ tubes of *S. fuliginea* were often forked while those of *E. cichoracearum* were always simple.

Based on the characters of the imperfect stage, the cucurbit powdery mildew fungi were identified in Australia (4), Japan (7, 8, 10), the Netherlands (3), Hungary (21), Germany (6, 25), East Germany (11), France (29) and U.S.A. (12).

In Libya, Khan (17) recognized the presence of *S. fuliginea* infecting cucumber

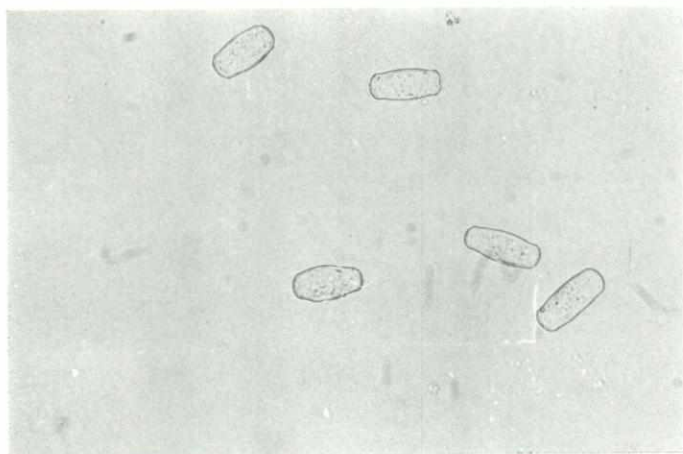


Fig. 1 — Conidia of *Sphaerotheca fuliginea* showing well-defined fibrosin bodies.

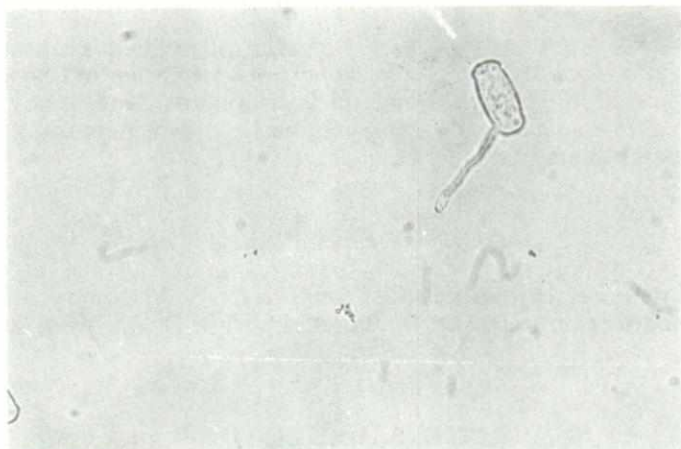


Fig. 2 — Conidia of *Erysiphe cichoracearum* without fibrosin bodies.

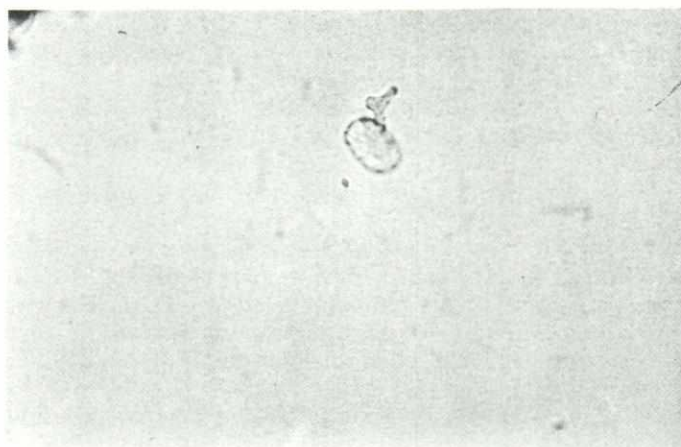


Fig. 3 — Germinating conidium of *S. fuliginea* showing forked germ tube.

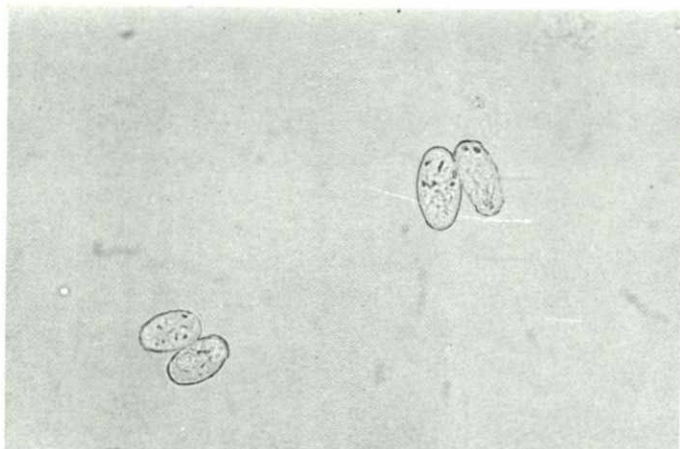


Fig. 4 — Germinating conidium of *E. cichoracearum* showing simple germ tube

plants but he did not preclude the possibility of the existence of *E. cichoracearum*. The present investigation indicates the presence of *E. cichoracearum* in Libya though to a lesser extent than *S. fuliginea*. Although identification of cucurbit powdery mildew fungi in Libya based on the conidial stage is established, further confirmation based on the perithecial stage should be sought.

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*Erysiphe cichoracearum* وفطر *Sphaerotheca fuliginea*  
يسببان مرض البياض الدقيقى على القرعيات فى ليبيا

م. صلاح سعيد العمارى  
د. محمد واجد خان

### المستخلص

يختص هذا البحث بالتعرف على مسببات مرض البياض الدقيقى على مختلف القرعيات المزروعة تحت الأغطية أو خارجها فى عدة مناطق من ليبيا. وقد وجد أن فطر *Sphaerotheca fuliginea* الذى سبق التعرف عليه كمسبب لمرض البياض الدقيقى على الخيار فى منطقة طرابلس هو النوع السائد على مختلف القرعيات سواء تحت الأغطية أو خارجها، كما اتضح ايضا وجود فطر *Erysiphe Cichoracearum* على نبات الخيار المزروع تحت الأغطية فى بعض المناطق بجوار مدينة بنغازى.