Powdery Mildew of Melon (*Cucumis melo*) Caused by *Sphaerotheca fuliginea* in Brazil

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ABSTRACT

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Sphaerotheca fuliginea race 1, and not *Erysiphe cichoracearum* as previously reported, was identified as the causal agent of melon (*Cucumis melo*) powdery mildew in three Brazilian states. Identification of *S. fuliginea* was based on characteristics of the *Oidium* state as well as on reactions of standard race differentials.

Additional key word: muskmelon

Powdery mildew is one of the main fungal diseases of melon (*Cucumis melo* L.) in Brazil. The disease is especially severe during dry and warm periods, and serious yield losses can occur (13,14). Several species cause powdery mildew on melon and other cucurbitaceous hosts. Ballantyne (1) cites *Erysiphe cichoracearum* DC. ex Mérat, *E. communis* (Wallr.) Link, *E. polygoni* (DC.) St.-Am, *E. polyphaga* Hammarlund, *Leveilulla taurica* (Lév.) Arnaud, *Sphaerotheca fuliginea* (Schlecht. ex Fr.) Poll. as well as several records that refer to the imperfect *Oidium* sp. state only (1,11,13).

The two most important fungi causing melon powdery mildew are *E. cichoracearum* and *S. fuliginea* (1,2,13), and only reports on the former are found in Brazilian literature (4,7). Because there are no clear reports on the production of cleistothecial forms under our conditions, and considering that their corresponding imperfect forms share many similarities, the validity of most published records based on the conidial stages is doubtful.

The correct identity of the pathogen causing powdery mildew on melon is essential in programs for breeding for disease resistance. The controversy in the literature has reached such an extent that *E. cichoracearum* is placed as a synonym of *S. fuliginea* (8). The possibilities of these errors seem much higher in tropical countries, such as Brazil, where the sexual stages of the powdery mildew fungi are rarely or never found.

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The objective of this work was to identify the causal agent of melon powdery mildew using the prevalent (imperfect) stage under field conditions.

MATERIALS AND METHODS

Three isolates of the powdery mildew fungus from muskmelon, obtained in Anápolis, GO, on squash (*Cucurbita pepo* L.); in Bragança Paulista, SP, on cucumber (*Cucumis sativus* L.); and in Brasília, DF, on squash, were used in the study. Individual isolates were maintained on detached cotyledons of the muskmelon cultivar Amarelo Valenciano. The cotyledons were placed in petri dishes containing water agar with sodium azide (2 ppm) and incubated at 22 C (9) under continuous light.

The perfect stage of the fungus was identified from conidia of 7-day-old colonies by the criteria described by Ballantyne (1). Conidia were stained for 10 min with a 5-ppm yellow eosin solution (6) and examined under the microscope for the type of fibrosin bodies. Fibrosin bodies in *Erysiphe*, when present (3), are granular, but *Sphaerotheca* has cylindrical or conical ones.

To observe germination of conidia, these were transferred to sterilized slides covered with a thin film of water agar.

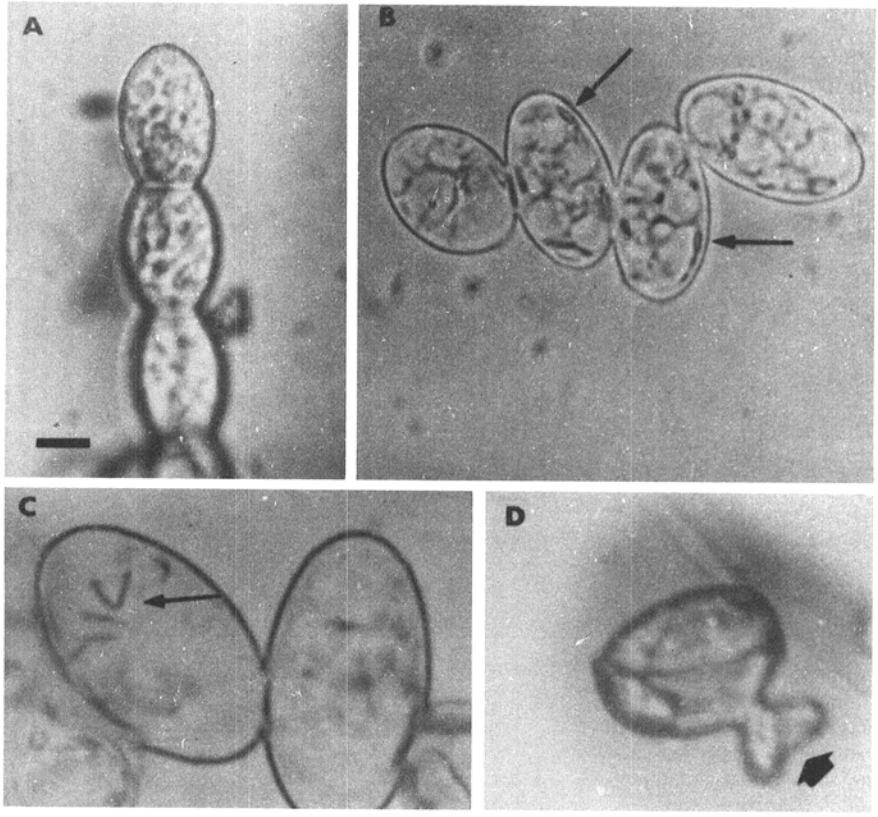

Fig. 1. Characteristics of the melon powdery mildew fungus: **(A)** *Oidium*-type conidiophore with chains of conidia, **(B)** fibrosin bodies (arrows) in mature conidia, **(C)** close-up of stained fibrosin bodies (arrow), and **(D)** forked germ tube (arrow). Scale bar = 10 μm in A, B, and D and 20 μm in C.

After inoculation, the slides were incubated for at least 10 hr (16) at 22 C under continuous light before observation. *E. cichoracearum* germ tubes are simple with inconspicuous appressoria, but *S. fuliginea* presents some that are forked (1,5,13,16).

Muskmelon cultivars Hale's Best Jumbo, PMR-45 (with *Pm*-1 gene), and PMR-6 (with *Pm*-1 and *Pm*-2 genes) were used as *S. fuliginea* race differentials (J. D. McCreight, *personal communication*). Greenhouse-grown 15-day-old plants of each cultivar were inoculated on the cotyledons with a cotton swab. Inoculations also were made as true leaves expanded. Initial observations (susceptible/resistant) were made 7 days after inoculation. Test plants for each isolate were kept in separate greenhouses.

RESULTS AND DISCUSSION

All three isolates of the fungus had similar characteristics with external mycelia and *Oidium*-type conidiophores with long chains of conidia (Fig. 1A), which limits the identity to either *E. cichoracearum* or *S. fuliginea* (1,3). Cylindrical fibrosin bodies were observed (Fig. 1B,C); these are characteristics of most *Sphaerotheca* and *Podosphaera* and some *Uncinula* species but are never present in *Erysiphe* (15).

About 17% of the conidia germinated, and in general, fewer than 1% presented forked germ tubes (Fig. 1D). According to Zaracovitis (16), the presence of forked germ tubes is unique to *S. fuliginea*.

On the basis of these characteristics, the isolates causing melon powdery mildew were identified as *S. fuliginea*, not *E. cichoracearum* as previously reported in the Brazilian literature (4,7). This is in agreement with recent reports that indicate *S. fuliginea* and not *E. cichoracearum* is the primary pathogen causing powdery mildew of cucurbits (1,13). The three isolates of the fungus infected only Hale's Best Jumbo (no powdery mildew resistance genes), which indicates they are race 1 of *S. fuliginea*.

A reevaluation of the fungi causing powdery mildew in other cucurbits in Brazil is necessary. The introduction and effective use of sources of disease resistance depend on the correct knowledge of the pathogen involved. Improper pathogen identification seems to be common with diseases of vegetable crops in Brazil (10,12).

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