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Sphaerotheca fuliginea Causing Powdery Mildew of Cucumber—a New Record for Libyan Jamahiriya

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ABSTRACT

This paper presents, for the first time, the record of *S. fuliginea* in Libyan Jamahiriya as a causal organism of powdery mildew of cucumber in indoor and outdoor cultivations. *Erysiphe cichoracearum* DC., hitherto considered as the causal organism of cucumber powdery mildew, was not observed in included locations. This is also first report of occurrence of *S. fuliginea* on a cucurbit in the country. *S. fuliginea* is suggested to be recognised henceforth as causal organism of powdery mildew of cucumber in Libyan Jamahiriya.

INTRODUCTION

Powdery mildew of cucurbits is caused predominantly by two species of Erysiphaceae viz. *Sphaerotheca fuliginea* (Schlecht.) Poll. and *Erysiphe cichoracearum* DC. A few other species are occasionally reported to infect cucurbits in certain areas of the world (2,11). In some countries, *S. fuliginea* is responsible for the disease, while in others *E. cichoracearum* is reported as the causal organism. At the same time, in several instances, both species have been reported to exist on cucurbits in many countries (2,10). And now reports from an increasing number of countries indicate the existence of both species on cucurbits.

Since they produce almost identical symptoms, have an overlapping host range among cucurbits, form perithecia rarely, and show much similarity in conidial structure, certain identification becomes difficult. Under such circumstances, *E. cichoracearum* was generally presumed to be the causal organism of powdery mildew of cucurbits in many parts of the world. Certain records of *E. cichoracearum* in perithecial stage on cucurbits (21,23) have largely contributed to this belief. But during the last two decades, *S. fuliginea* has also been identified as causing powdery mildew of cucurbits in many parts of the world (2,10,11). In some of these countries, *E. cichoracearum*, mistakenly presumed as causal organism, was later found to be *S. fuliginea*.

The identity of the causal organism of powdery mildew of cucurbits is not established in Libya. Pucci (17) regarded powdery mildew on watermelon as *E. cichoracearum*. An *Oidium* sp. was enlisted to infect watermelon, melon and pumpkin (1). *Oidium* sp. was also claimed on cucurbitaceae by Pucci (18). Kranz (13) remarked that powdery mildew, a serious problem of melon, watermelon, and pumpkin in the Cyrenaica region, is probably caused by *E. cichoracearum*. Ben Halim and Wadi (3), while studying the effect of certain fungicides for the control of powdery mildew of cucumber, reported that, under Libyan conditions, powdery mildew of cucurbits caused by *E. cichoracearum* is particularly destructive to cucumber. So far, there is no

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available report of perithecia of powdery mildew on any cucurbit in Jamahiriya. Therefore, it is apparent that *E. cichoracearum* has been presumed a causal organism of powdery mildew in cucumber, along with other cucurbits in general, largely because of its occurrence in other parts of the world, absence of perithecial production, and lack of any pursuance to establish its identity in the Libyan Jamahiriya.

Cucumber is a cash crop of high value in Libya and is grown in greenhouses, plastic tunnels, and outdoor field plots. Powdery mildew appears on the crop every year, both in indoor and outdoor cultivations, and causes substantial damage; sometimes this leads to eventual failure of the crop, particularly in greenhouses and plastic tunnels. The idea for establishing the identity of its causal organism stemmed from a routine survey of vegetable crops. It is clear that because of the annual recurrence of this damaging disease, and lack of information regarding the occurrence of *S. fuliginea* in this country, its study is of prime importance. The ecological requirements of both cucurbit powdery mildew species are different (14), and this feature adds significance to an attempt to establish their identity.

MATERIALS AND METHODS

Samples of infected plants of cucumber, *Cucumis sativus* L. were collected from plastic tunnels from Ainzara, Swani, Janzoor, Azzahra and Tajora. Other samples were collected from field plots from Janzoor, Amriya and Tajora. Samples brought to the laboratory, both in the form of leaves and stems, were thoroughly examined for the presence of perithecia. Characteristics of the conidial stage were microscopically studied and dimensions of conidia were measured. Conidia from each sample were subjected to germination tests (25), and presence and absence of fibrosin bodies were investigated (9).

For germination tests, conidia were dusted over dry, clean glass slides. The slides were then kept on glass rods placed in petri dishes containing distilled water. Such 'incubation chambers' were kept at 25°C for 24 hours. At the end of the incubation period, conidia were stained with cotton blue and the morphology of the germ tubes was examined.

In order to examine presence or absence of fibrosin bodies, conidia were mounted in 3% aqueous potassium-hydroxide and were microscopically examined (9).

RESULTS AND DISCUSSION

The symptoms on the plants collected from outdoor and indoor cultivations were identical to those described for the disease. Symptoms initially appeared as sparsely distributed amphiphyllous white circular patches which gradually coalesced and spread to cover the entire laminar surfaces with a white, fluffy powdery mass of superficial mycelium and conidia (Fig. 1). Similar developments were noticed on stems. Severity was comparatively much higher in indoor cultivations. The morphological features of the conidial stage of the powdery mildew from each location resembled *Sphaerotheca fuliginea*. Mycelium was well developed, superficial; conidiophores held long chains of conidia. Conidia were generally ellipsoidal. They measured 23.5–42.5 × 11.5–21.5 μ (29.96 × 17.75 μ). No perithecial stage was observed.

Fibrosin bodies were invariably present in conidia from all the samples (Fig. 2). Most of the germ tubes, emerging from the conidia, exhibited forking at the base, from which hyphae eventually developed (Fig. 3).

E. cichoracearum and *S. fuliginea* are similar in many respects. They exhibit similar symptoms, produce large chains of conidia, have an overlapping host range in cucurbitaceae, and rarely produce perithecia in nature. But similarity ends here; they differ markedly in other respects. There is remarkable difference in their perithecial stages

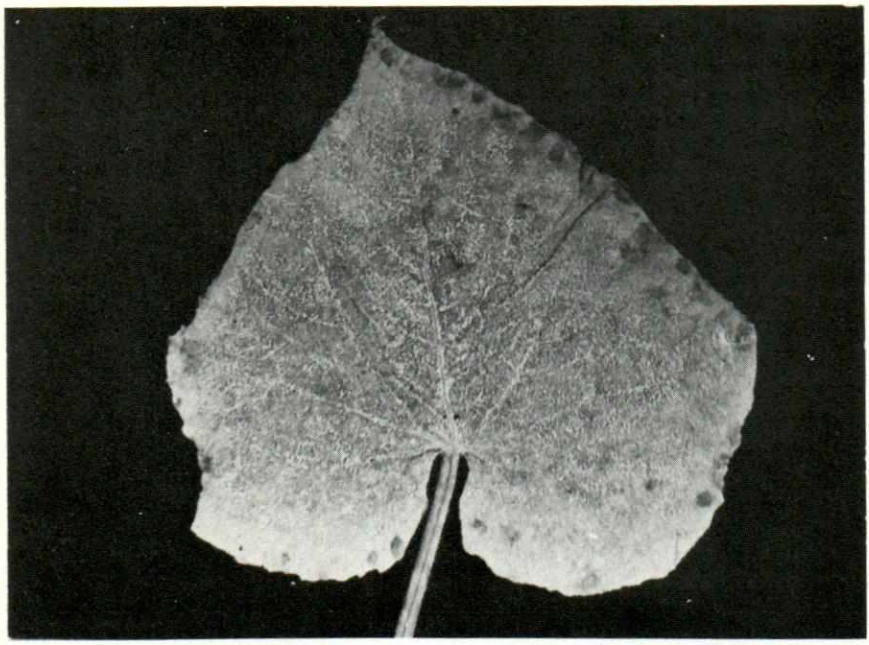

Fig. 1. A cucumber leaf severely infected with *Sphaerotheca fuliginea.*

with regard to number of asci and ascospores. *E. cichoracearum* is recognised by numerous 2-spored asci in contrast to solitary 8-spored ascus in *S. fuliginea.* The conidia of *E. cichoracearum* are slightly cylindrical and form well-differentiated appressoria whereas those of *S. fuliginea* are more ellipsoidal and on germination produce characteristic forked germ tubes (25) (Fig. 3). The conidia of *S. fuligniea*

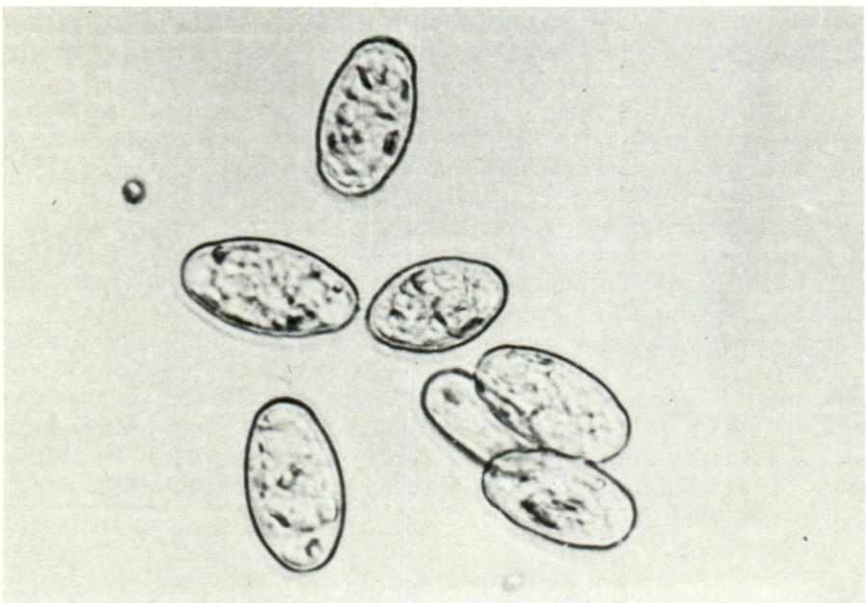

Fig. 2. Conidia of *Sphaerotheca fuliginea* from cucumber, with characteristic shape, showing number of fibrosin bodies in each.

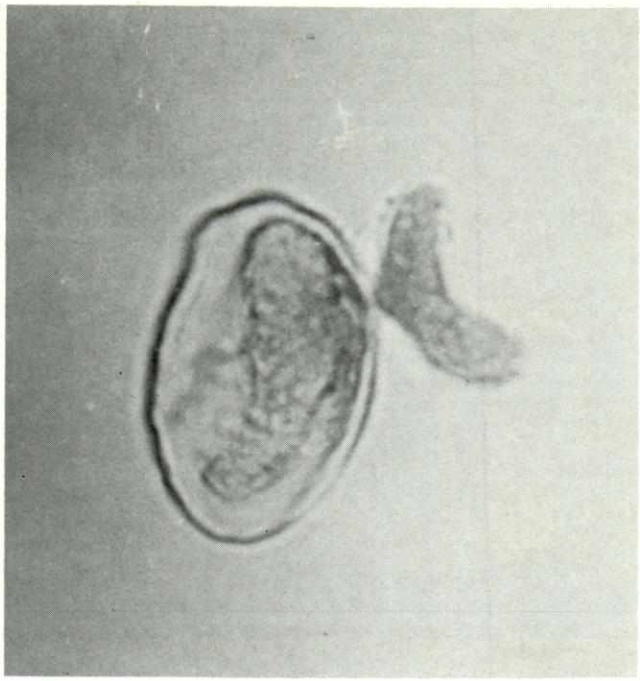

Fig. 3. Conidium of *Sphaerotheca fuliginea* from cucumber showing forked germ tube.

additionally possess fibrosin bodies which are lacking in *E. cichoracearum*. (Fig. 2). These characteristic differences have now been successfully employed to distinguish these two species in the absence of perithecia.

Blumer (4) and Homma (8) recognised the significance of fibrosin bodies in distinguishing the oidial stages of *E. cichoracearum* and *S. fuliginea* on cucurbits and this feature has helped in establishing the identity of powdery mildew of cucurbits in many countries (2,10). Hirata (6,7) and Zaracovitis (25) claimed that the shape of the germ tube was characteristic of the species of powdery mildew. The apparent difference in the morphology of the germ tube of *E. cichoracearum* and *S. fuliginea* is of special significance in distinguishing them.

S. fuliginea has been found in perithecial stage on cucumbers in many countries (12,16,20). In Africa, its existence on cucurbits is known in Sudan (15), and South Africa (5). Cucumber is also reported to be infected by *E. cichoracearum* in several countries and its perithecial development is on record (19,21,22,24).

S. fuliginea is not recorded on any cucurbit in Libya. It is also not reported on any non-cucurbitaceous plant. Present investigations indicate that a powdery mildew, having the features of the imperfect stage of *S. fuliginea*, is a causal organism of powdery mildew of cucumber in the examined locations. However, it is rather difficult to preclude the possibility of the existence of *E. cichoracearum* on cucumber in Jamahiriya, in view of its established occurrence on cucumber in other parts of the world, until thorough investigations prove otherwise.

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Sphaerotheca fuliginea كمسبب جديد لمرض البياض الدقيقى على الخيار فى الجماهيرية العربية الليبية الشعبية الاشتراكية

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المستخلص

Sphaerotheca fuliginea يعتبر المسبب لمرض البياض الدقيقى على القرعيات فى عدة دول من العالم . وفى هذا البحث يسجل لأول مرة هذا الفطر كمسبب لهذا المرض بالجماهيرية فى الحقل وتحت الصوبات الزجاجية .

ومن المعروف أن *Erysiphe cichoracearum* يعتبر حتى الآن هو المسبب لمرض البياض الدقيقى على الخيار ولكنه لم يلاحظ بالجماهيرية ولكن وجد أن *S. fuliginea* هو المسبب .