IDENTITY OF POWDERY MILDEWS OF CUCURBITS IN LIBYA.

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Abstract

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The study attempted to establish the identity of causal organism (s) of powdery mildew of indoor and outdoor cucurbits in Libya. A survey conducted both in the coastal belt and the desert regions of the country revealed the occurrence of three species: *Sphaerotheca fuliginea, Erysiphe cichoracearum* and *Leveillula taurica* on cucurbits. *S. fuliginea* was most frequent and predominant both on indoor and outdoor cucurbits throughout the country. Its perithecial stage on squash at some places was also recorded. *E. cichoracearum* and *L. taurica* were found in conidial stage on indoor cucumbers only at few locations. It is claimed that *S. fuliginea* is chiefly responsible for the disease but *E. cichoracearum* and *L. taurica* also exist on cucurbits in Libya. Nevertheless, cucurbits powdery mildew in Libya is essentially caused by three different powdery mildew species.

Additional key words: powdery mildew, cucurbits, Libya.

Introduction

Coastal belt in Libya extending for nearly 1900 km from Tunisia to Egypt has Mediterranean climate supposedly congenial for powdery mildews. Cucurbits in Libya suffer substantially every year due to powdery mildew disease both in indoor and outdoor cultivations. The identity of the causal organism (s) is not established in the country. *Erysiphe cichoracearum* DC. and *Oidium* sp. were enlisted to infect cucurbits in Tripolitania (19). *E. cichoracearum* was supposed to be responsible for the disease in Cyrenaica (17). The basis of identification of the causal organism as *E. cichoracearum* was, however, not provided (17, 19). Khan (14) emphasized that from these informations it was apparent that *E. cichoracearum* has been presumed as powdery mildew of cucurbits because of its occurrence in other parts of the world, absence of perithecial stage record and lack of any pursuance to establish the identity of cucurbit powdery mildew in Libya. Khan (14) for the first time, recognized *S. fuliginea,* based on conidial characters, as causal organism of powdery mildew on cucumbers in Libya. Under prevailing situation inadequate knowledge of the pathogen (s) and the disease has limited the local control programmes to save the cucurbitaceous crops from the damage. The situation dictated through study of the powdery mildew disease problem of cucurbits in Libya. This impelled us to identify the causal organism (s) and to establish the identity of powdery mildew pathogen (s) of cucurbits in the country.

Materials and Methods

A survey of indoor and outdoor cucurbits was conducted in different localities in the coastal belt and desert regions of the country (tables 1, 2). Indoor cucurbits (cucumber, cantaloupe, watermelon, squash and pumpkin) grown in glasshouses and plastic tunnels and outdoor cucurbits (squash, pumpkin, cucumber, cantaloupe, longmelon, snapmelon, watermelon and bottlegourd) grown in outdoor field plots were surveyed from April 1981 to March 1982 in the coastal belt and from June to October, 1981, in the desert region.

During the survey, cucurbits were visually observed thoroughly for the presence of powdery mildew, and symptoms on infected plants were carefully noted. Samples from the infected plants were collected at random from each cultivation unit in different areas. Different structures of the powdery mildew pathogen in the samples were critically examined. In samples where perithecia were found, morphological characteristics of the different stuctures were studied and their dimensions were measured. The identification of the pathogen from all other samples was based on the characters of conidial stage. For inoculation studies, inocula from different areas of both regions were maintained on young seedlings of cucumber in glasshouse in separate chambers with regulated temperature (20 - 25°C) and relative humidity (60 - 80%). The following methods were employed to identify the powdery mildew species from the samples having only conidial stage.

1. **Germination tests:** To study the morphology of germtubes, conidia were dusted on clean dry glass slides and slides were placed on glass-rod triangle kept in petridishes containing moistened cotton wool at the botton. Then such pstridishes were kept in an incubator at 20°C for 24 hrs. At the end of the incubation period, the morphology of the germtubes of the germinating conidia were studied (12).

2. **Fibrosin bodies test:** To test the presence of fibrosin bodies in conidia, conidia were treated on glass slides with 3% aqueous potassium hydroxide solution and examined under the microscope (11).

3. **Differential host test:** *Lagenaria leucantha* and *Coccinia cordifolia* differential hosts for *Sphaerotheca fuliginea* and *Erysiphe cichoracearum* suggested by Khan (13) were grown in pots containing sterilized soil in glasshouse. Cotyledonary leaves as well as young leaves of both plants were inoculated by dry dusting of conidia. Inoculated plants were kept in glasshouse chamber at temperature of 20 - 25°C and relative humidity of 60 - 80%. Plants were regularly observed for the appearance of symptoms of the disease.

Results

Throughout the survey, apparently there was no marked difference in symptoms of the disease on cucurbits except on certain indoor cucumbers collected from El-Khoms in Western coast in May 1981, and from Benghazi in April 1982 and from Derna in Eastern coast in July 1981. At all the three locations leaves of cucumbers were in different stages of drooping and drying. The powdery mildew fungus on these cucumbers was identified as *Leveillula taurica* (Lev.) Arn. based on specific symptoms, endophytic mycelium, branched conidiophores and two distinct types of conidia (cylindrical and navicular) born singly at the tips (Table 1). Some of these cucumber leaves, however, showed pustules of powdery mildew dissimilar to *L. taurica* also. In rest of the samples powdery mildew was either hypophyllous, epiphyllous or amphiphyllous. Luxuriant growth of white powdery mass covered almost the entire foliage. Stems, petioles and tendrils or even fruits in some cases were also infected in several samples. Ectophytic mycelium observed in these samples showed conidia born in chain on simple conidiophores.

Conidia were oval to elliptical except from cucumbers collected from three plastic tunnels at Hawari and four glasshouses at Ghare-Younes near Benghazi in the Eastern coast.

In germination test, conidia from most of the cucurbits obtained from different localities usually produced forked germtubes, characteristic of *S. fuliginea*. Conidia from indoor cucumbers from Hawari and Ghare-Younes in Benghazi, however, formed simple germtubes with inconspicuous appressoria, characteristic of *E. cichoracearum* (Tables 1, 2).

In fibrosin bodies test, conidia invariably exhibited well developed fibrosin bodies. However, these were absent from the conidia produced on indoor cucumbers collected from Hawari and Ghare-Younes in Benghazi (Tables 1, 2).

Conidia germinated from pustules dissimilar to those of *L. taurica* present on cucumber leaves infected with *L. taurica* that also showed the presence of fibrosin bodies and a number of them produced forked germtubes on germination.

Perithecia were present on only *Cucurbita pepo* samples collected from Hawari (Benghazi) in Eastern coast in January, 1982 and Tripoli in Western coast in January, 1983. Perithecia were scattered to mostly gregarious profusely developed on petioles and leaf lamina. Perithecia were globose to subglobose, 90 - 99 μm in diam, with mycelioid brown, tortuous appendages interwoven with mycelium. Each perithecium contained single broadly elliptical to subglobose ascus measuring 55 - 85 × 30 - 55 μm. Each ascus contained

Table 1. Identification of powdery mildews of cucurbits on conidial characters in the coastal belt of Libya.

	Eastern coast						Western coast									
	Derna		El-Marij		Benghazi		Misrata		Gharabuli		Tripoli		Zawia		El-Khoms	
Cucurbits	No.	Pathogen	No.	Pathogen	No.	Pathogen	No.	Pathogen	No.	Pathogen	No.	Pathogen	No.	Pathogen	No.	Pathogen
Cucumber (outdoor)	10	S f	10	S f	25	S f	10	S f	10	S f	35	S f	3	S f		
Cucumber (indoor)	3	L t	10	S f	2	L t	5	S f	5	S f	20	S f	2	S f	4	L t
	5	S f			20	S f										
					40	E c										
Squash (indoor & outdoor)	25	S f	35	S f	35	S f	30	S f			70	S f	15	S f		
Pumpkin (indoor & outdoor	24	S f	15	S f	20	S f	15	S f			35	S f	30	S f		
Cantaloupe (indoor & outdoor)	10	S f			30	S f	10	S f			25	S f				
Watermelon (indoor & outdoor)											5	S f				
Bottlegourd (outdoor)											15	S f				
Longmelon (outdoor)	10	S f					6	S f			75	S f				

No: Number of samples analysed.

S.f: *Sphaerotheca fuliginea* — Fibrosin bodies present, germe-tube forked.

E c: *Erysiphe cichoracearum* - Fibrosin bodies absent germ tube simple.

L t: *Leveillula taurica*.

Table 2. Identification of powdery mildews of cucurbits growth in the open field on the basis of conidial characters in the desert region of Libya.

Cucurbits	Jalo and Aujela		Kufra		Sebha	
	No.	Pathogen	No.	Pathogen	No.	Pathogen
Cucumber	4	S f	18	S f		
Squash	6	S f	18	S f	4	S f
Pumpkin	20	S f	20	S f	12	S f
Cantaloupe			10	S f	5	S f
Watermelon			24	S f		
Bottlegourd					10	S f
Longmelon					5	S f
Snapmelon	24	S f	15	S f	12	S f

No: Number of samples analysed

S.f: *Sphaerotheca fuliginea* – fibrosin bodies present, germ-tube forked.

8, ellipsoidal to spherical ascospores 13 – 25 ×11 – 19 μm. Based on these characters, perithecia were identified as those of *S. fuliginea* (Schlecht.) Poll. (15).

In differential hosts test, conidia from all the samples identified to have *S. fuliginea* infected *L. leucantha*, in artificial inoculations. Similarly conidia from indoor cucumbers collected from Hawari and Ghare-Younes and identified to contain *E. cichoracearum* infected *C. cordifolia*. In glasshouse inoculations, *E. cichoracearum* also infected all other cucurbits.

Discussion

S. fuliginea, E. cichoracearum and *L. taurica* were identified as the causal organisms of powdery mildew of cucurbits in Libya. *S. fuliginea* was present on all cucurbits both in indoor and outdoor cultivations. *E. cichoracearum* was confined to indoor cucumbers only at certain locations in the Eastern coast. *L. taurica* was found on indoor cucumbers both in Western and Eastern coasts. Indoor cucumbers at certain locations also showed concomitant infection of *S. fuliginea* and *L. taurica*.

Currently, *S. fuliginea* is recognised as the causal organism in several countries including the Netherlands, Australia, South Africa and Saudi Arabia (15). *E. cichoracearum* was recognised earlier as the causal organism in the Netherlands, Australia, South Africa and Saudi Arabia but its existence on cucurbits in these countries is now doubted (1, 3, 4, 5, 10). In Libya, *E. cichoracearum* was also claimed as the causal organism by Pucci (19) and Kranz (17). Khan (14), however, observed that *S. fuliginea* is responsible for powdery mildew on cucumbers in Libya. The present study clearly establishes existence, pre-dominance and widespread distribution of *S. fuliginea* on cucurbits in Libya. Existence of *S. fuliginea, E. cichoracearum* an *L. taurica* on cucurbits in known in certain countries (15); Libya is a new addition to this list of countries. The occurrence of *L. taurica* on cucurbits is reported in quite a few countries like Sudan (20), Kenya (2), Bulgaria (8), Rumania (7), U.S.S.R. (9, 18) and India (21). *L. taurica* infects large number of plants in Central Asia and in Mediterranean region and is recognized in several countries of the area as major pathogen of economically important crops (6). *L. taurica* is known to occur in Libya on peppers, eggplant and tomato (16, 17, 19). The presence of *L. taurica* on cucumber in Libya further adds up the importance of the organism as potential pathogen of cucurbits in view of its records in eastern Europe, Africa and Asia. Furthermore, its occurrence on cucurbits in Libya in addition to Sudan adds importance to this pathogen in North Africa.

Morphology of both conidial and perithecial stages present in various samples, conidial germination test, fibrosin bodies test and differential host test were found to be reliable criteria in distinguishing those three species. Perithecia of *S. fuliginea* were recorded on squash for the first time in Libya. *E. cichoracearum* and *L. taurica* are limited in distribution and are confined to indoor cucumbers. In artificial inoculation, *E. cichoracearum* successfully infected all the cucurbits in glasshouse. So it is potential danger to other cultivated cucurbits in Libya besides cucumber.

الملخص

العماري، س. س. و م. و. خان. 1987. الفطريات المسببة لمرض البياض الدقيقي على القرعيات في ليبيا. مجلة وقاية النبات العربية 5 : 89 - 92

حاولت هذه الدراسة معرفة مسبب مرض البياض الدقيقي على نباتات القرعيات المزروعة في البيوت البلاستيكية أو الزجاجية وفي الحقل في ليبيا. بعد إجراء مسح في المنطقة الساحلية والمنطقة الصحراوية، تبين وجود الفطريات التالية: *Leveillula taurica*، *Sphaerotheca fuliginea* و *Erysiphe cichoracearum*. الفطر *S. fuliginea* موجود في أغلب أنحاء

البلاد على القرعيات إن في الحقل أو في البيوت الزجاجية والبلاستيكية. ولوحظ في بعض المناطق أن هذا الفطر الموجود على الكوسى هو بطور البرتيسيا (perithecial stage) بينما وجد النوعان *E. cichoracearum* و *L. taurica* في طور الكونيديا (conidial stage)، في مناطق قليلة، على الخيار المزروع في البيوت الزجاجية أو البلاستيكية. وتبين أن الفطر *S.fuliginea* هو المسبب الرئيسي للمرض إضافة إلى وجود الفطرين *E. cichoracearum* و *L. taurica* في ليبيا. وبذلك فإن القرعيات في ليبيا تصاب بثلاثة أنواع من البياض الدقيقي.

كلمات مفتاحية: البياض الدقيقي، القرعيات، ليبيا.

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