

Mycobiota Associated with Sugarcane (*Saccharum officinarum* L.) Cultivars in Iraq.

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Abstract

During the study of the mycobiota associated with four sugarcane (*Saccharum officinarum* L.) cultivars (CO331, Co976, CP5-68, and Missan 1) currently cultivated for sugar production at sugarcane factory at Missan governorate, Southern Iraq, ten teleomorphic ascomycetes have been reported. These include *Arxiomyces zubairiensis*, *Chaetomium atrobrnneum*, *C.convolutum*, *C.elatum*, *C.globosum*, *C.murorum*, *C.spiralotrichum*, *Coniochaeta saccardoi*, *Kerinia nitida* and *Leptosphaeria sacchari*. All the identified species are reported for the first time on sugarcane plant in Iraq. A brief description along with photographs is provided for the reported species.

المخلص

خلال دراسة المجموعة الفطرية المصاحبة لاربعة أصناف لنبات سكر القصب المزروعة حالياً في حقول الشركة العامة لصناعة السكر في ميسان - جنوب العراق، تم تشخيص عشرة أنواع من الفطريات الكيسية وهي:

Arxiomyces zubairiensis, *Chaetomium atrobrnneum*, *C.convolutum*, *C.elatum*, *C.globosum*, *C.murorum*, *C.spiralotrichum*, *Coniochaeta saccardoi*, *Kerinia nitida* and *Leptosphaeria .sacchari*.

جميع الأنواع المشخصة تسجل لأول مرة على نبات سكر القصب في العراق. وصفت الأنواع المسجلة باختصار ومعززة بالصور الفوتوغرافية.

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Keywords: Sugarcane, Mycobiota, Ascomycetes, Iraq.

1. Introduction

Sugarcane (*Saccharum officinarum* L) is grown in tropical and subtropical regions of the world. The crop is introduced by the Arabs in the eight century A.D to the Mediterranean, Mesopotamia, Egypt, North Africa and Andalusia. By the tenth century, sugarcane cultivation was well established and some sources indicated that there was no village in Mesopotamia that did not grow sugarcane crop (Watson,1983). However, in recent Iraq, the production of the crop is restricted to Missan governorate, Southern Iraq (31 40 N-47 40 E). The first commercial production of the crop in Iraq was in 1965 after the building of a sugarcane factory at Al-Majar Al-Kabir town to the south of Missan governorate. The area cultivated with the crop is about 6000 hectar with average cane yield of 43.21 t/he which is far below the existing potential (Anonymous, 2002).

Several pathogenic and saprophytic fungi have been reported as a mycobiota associated with sugarcane plant in several parts of the world (Watanabe, 1974, 1975 a,b,c; Zummo,1986, Sivanesan and Walter,1986; Dosayla *et al.*,1993; Magarey,1986,1995; Mena Partalos *et al.*,1995; Fernandez *et al.*,1995; Egan *et al.*,1997; Lopez Mena *et al.*,1999; Aoki, 2000).

In Iraq, however, studies on the mycobiota associated with sugarcane crop were restricted to internal reports made by the staff of the Directorate of General State for Sugarcane Production at Missan on the incidence of sugarcane smut (*Ustilago scitaminea*) on the cultivar NCO310 at Missan fields (Karam, 1983,1987) and on the microbiota responsible for deterioration of sugarcane juice (Mansour *et al.*1979). More recently, Abdullah and Saleh (2010) reported 16 mitosporic fungi assigned to the genera *Alternaria* (5 species), *Bipolaris* (4 species), *Curvularia* , *Exserohilum* (3 species each) and *Drechslera* (1 species). This paper reports the identification of ten ascomycetous fungi.

2. Materials and Methods

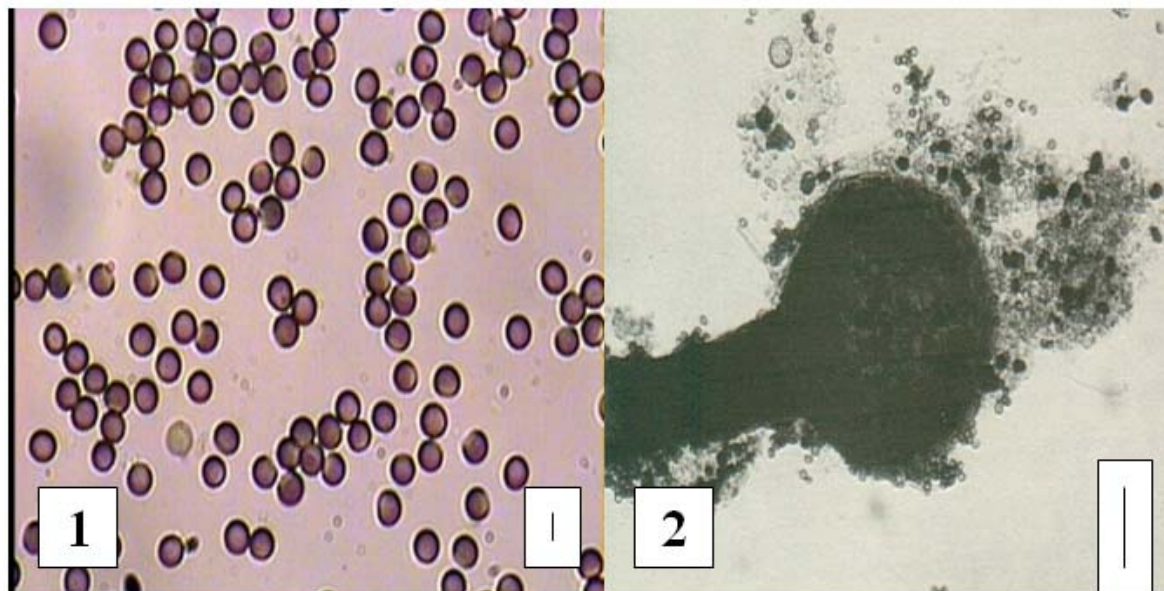
A total of 60 pieces of living and dead leaves and stems (2 cm long) from four sugarcane cultivars or hybrids (CO331, CO976, CP5-68 and Missan1) were washed for several times with tap water and then rinsed three times with sterile distilled water. Washed pieces were plated on moist blotter and in plates containing PDA medium (200g potato, 20g dextrose, 20g agar and 1L distilled water) with chloramphenicol (250 mg/l) and incubated under 12h of darkness alternating with 12h of cool white fluorescent light. Plates were examined every 3 d for 3 wk. To achieve pure cultures, ascospores were transferred from the natural substrates or from the PDA plates to new PDA plates.

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Identification of isolates was made according to Malloch and Cain (1971), Arx *et al.*, (1986), Sivanesan and Waller (1986), Checa *et al.*, (1988) and Abdullah and Al-Saadoon (1994). Specimens (dried cultures) of the reported species have been deposited at Basrah University herbarium (BSRA).

3. Results and Discussion

Arxiomyces zubairiensis Abdullah and Al-Saadoon. Marina Mesopotamica 9:246 (1994). Figs.1 and 2.



Figures (1 and 2). *Arxiomyces zubairiensis*, 1-ascospores, 2-ascomata.

Bar 1= 5µm Bar 2= 50µm.

Ascomata superficial to semi-immersed, were dark brown to black due to spore mass, globose, 170-250 µm, glabrous or slightly hairy, neck-pale, yellow brown, cylindrical, 40-80 X 35-40 µm. Asci 4-spored, broadly clavate, 9-11.5 X 13-16 µm, and evanescent. Ascospores in turn were globose to subglobose with a truncate base and rounded apex, 4-5 µm diameter, and at first hyaline becomes dark brown to black in mass, and smooth walled, with a single large basal germ pore, 3.5-4 µm diameter.

Specimen examined: BSRA 11155. On dead stem of cultivar C0331, November, 2001. This is the first record of the species on sugarcane plant. The type species was originally described from Iraq (Abdullah and Al-Saadoon, 1994) parasitizing *Stachybotrys* sp. on *Phragmites australis* dead stem collected from tidal zone of Khawr Al-Zubair canal, Southern Iraq. *A. zubairiensis* differs from two other known species in the genus (*A. vitis* (Fuckel) P.F. Cannon and D. Hawksworth and *A. campanulatus* Horie, Udagawa and P.F. Cannon) by its globose to subglobose ascospores, whereas the former two species are characterized by having ovoid to ellipsoidal ascospores.

Chaetomium atrobrunneum L.M. Ames. Mycologia 41:641 (1949). Figs. 3 and 4. Ascomata superficial, ostiolate, 60 – 150 µm. Terminal hairs arising around the ostiole, straight, septate, smooth brown in colour, tapering at end, 3-4 µm broad at base. Lateral hairs are similar but slightly shorter. Asci 8-spored, clavate, evanescent. Ascospores fusiform or elongate pyriform, grey brown at maturity, 9-15 X 4-7.5 µm, with subapical germ pore. Specimen examined: BSRA 11160. Isolated from stem of P52-68 cultivar, March, 2002.

This is the first record of the fungus on sugarcane plant in Iraq. However, the fungus has been repeatedly isolated from Iraq from soil at date palm plantation (Abdullah and Zora, 1993), from corn grains (Abdullah and Al-Mousawi, 2006), from medicinal plants (Abdullah *et al.*, 2002; 2008), from sediment of Shatt Al-Arab River and Southern marshes (Abdullah and Abbas, 2008; Abdullah *et al.*, 2010).

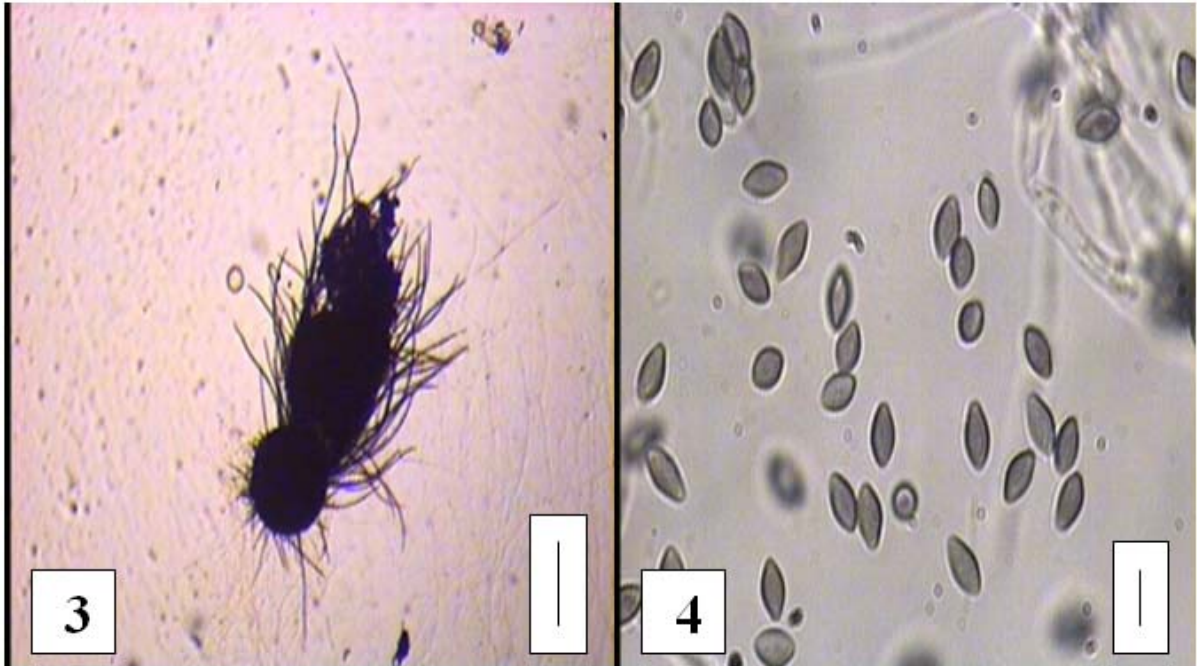
Chaetomium convolutum Chivers. Proc. Amer. Acad. 48:85 (1912). Figs. 5 and 6.

Ascomata obovate to ovate, dark brown, superficial 130-200 µm. Terminal hairs are spirally coiled, brown, septate, thick-walled, verrucose, or warty, and 4-5 µm thick. Lateral hairs are seta-like, olive to brown, shorter than terminal hairs. Asci 8-spored, clavate, evanescent. Ascospores limoniform, slightly apiculate at both ends, pale brown at maturity, bilaterally flattened, 6-9 X 4-7 µm.

Specimen examined: BSRA 11161. Isolated from dead stem of C0371 cultivar, May, 2001. This is the first record for the species from Iraq.

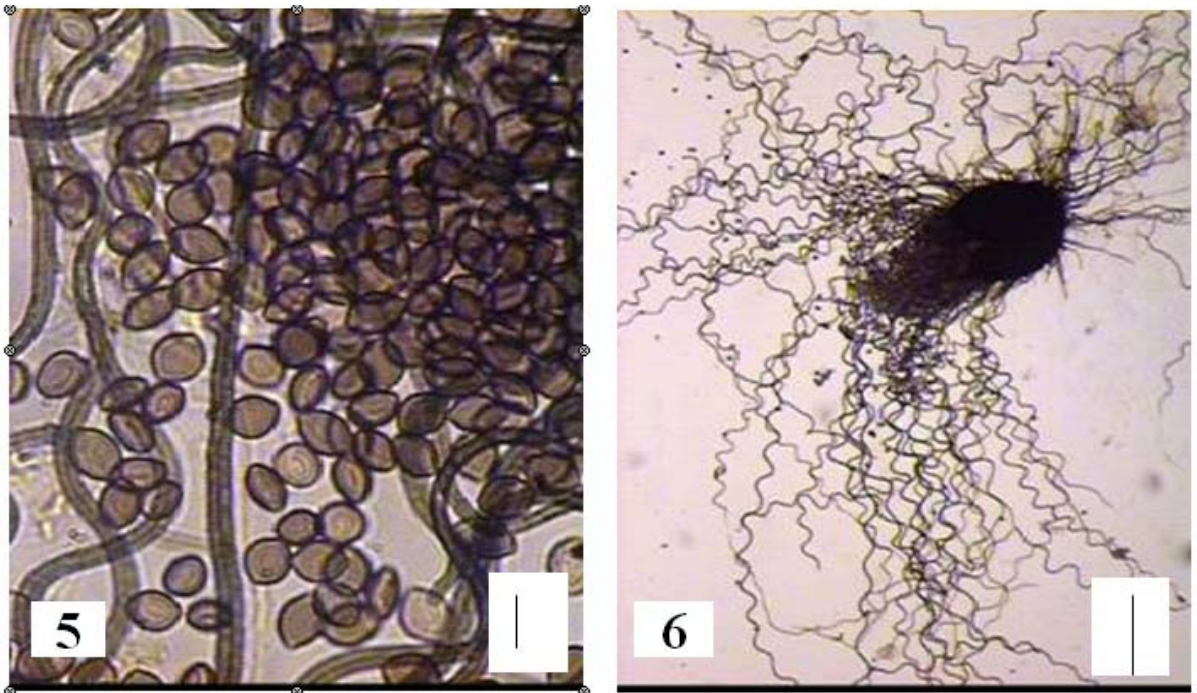
Chaetomium elatum Kunze, Mycol. Hefte 1:16 (1817). Figs. 7 and 8.

Ascomata are spherical or ovate, superficial, 170-350 µm. Hairs are long dichotomously branched, verrucose or warty, septate, 4-5 µm thick at base. Asci are 8-spored, clavate, evanescent, 30-40 X 12-18 µm. Ascospores are limoniform, thick-walled, 7-11 X 6.5-8 µm, bilaterally flattened, and brown at maturity, with an apical germ pore. Specimen examined: BSRA 11162. Isolated from leaves of C0331 cultivar, September 2001.



Figures (3 and 4). *Chaetomium atrobrunneum*, 3-ascomata, 4-ascospores.

Bar 3= 100 μ m. Bar 4= 10 μ m.



Figures (5 and 6). *Chaetomium convolutum*. 5-ascospores, 6-ascomata.

Bar 5=10 μ m. Bar 6= 100 μ m.



Figures (7 and 8). *Chaetomium elatum*. 7-ascospores, 8-ascomata.

Bar 7=10µm. Bar 8=100µm.

This is the first report for the fungus on sugarcane plant in Iraq. However, the fungus has been previously isolated from different habitats in Iraq (Abdullah and Zora,1993),

Abdullah and Al-Mousawi, 2006; Abdullah and Abbas, 2008).

Chaetomium globosum Kunze. Mykol.Hefte 1:16(1817).

Figs.9 and 10. Ascumata olive brown, ovate or obovate, ostiolate,superficial, 160-270 µm in size.

Ascumatal hairs flexuous, undulate or coiled, usually unbranched,septate, brownish, 3-5 µm wide. Asci 8-spored, clavate, 30-36 X 11-15 µm, evanescent. Ascospores liminiform usually basiapiculate, brownish at maturity, 9-12 X 8-10 µm, with an apiculate germ pore.

Specimen examined: BSRA 11163. Isolated from stem of Missan 1 cultivar, September,2001. The species is common to all cultivars. This is the first report for the species on sugarcane plant in Iraq. However the fungus has been reported from different habitats in Iraq, including desert soil (Abdullah *et al.*, 1986), corn grains (Abdullah and Al-Mousawi,2006), surface sediments of rivers and marshes (Abdullah and Abbas, 2008; Abdullah *et al.*, 2010) and herbal drugs (Abdullah *et al.*, 2002). The species has been reported on sugarcane in India and Pakistan (Sivanesan and Waller,1968) and from sugarcane in Cuba (Hernandez *et al.*, 1995).

Chaetomium murorum Corda. Icon.Fung. 1:24 (1837). Figs.11 and 12.

Ascumata superficial, spherical, dark olive, 145-230 µm. Ascumatal hairs long, flexuous or undulate, thick-walled, septate, brown, 4-6 µm thick. Asci 8-spored, clavate 30-45 X 10-20 µm, evanescent. Ascospores ellipsoidal, 10-15 X 7-9 µm, with a distinct apical germ

pore. Specimen examined: BSRA 11164. Isolated from leaves of cultivar C0331, January, 2001.

This is the first report for the species on sugarcane plant in Iraq. However, it has been isolated from other sources (Abdullah and Zora,1993; Abdullah and Abbas, 2008).

Chaetomium spiralotrichum Lodha. J.Indian Bot.Soc.43:134 (1964). Figs.13 and 14. Ascumata spherical to ovate, ostiolate, dark brown, 110-180 µm. Ascumatal hairs flexuous, or spirally coiled, often forming long coils, indistinctly septate. Asci evanescent, 30-38 X 13-16 µm. Ascospores ellipsoidal, olivaceous brown, 9-11 X 5-7 µm with a distinct apical germ pore. Specimen examined: BSRA 11165. Isolated from dead leaves of Missan 1cultivar, November, 2001. This is the first report for the fungus in Iraq.

Coniochaeta saccardoi (Marchal) Cain. Univ. Toronto Stud. Bot. Ser.38:65 (1934).Figs.15-18. Ascumata superficial,globose to pyriform, ostiolate, dark brown to black, 105 -280 µm, covered with setae, 20-80 X5-7 µm, swollen at base. Asci 8-spored, cylindrical, without distinct apical ring, 70-80 X5-8 µm. Ascospores uniseriate , one-celled, dark brown to black, narrowly ellipsoid, 8-10 X4-6 µm with longitudinal germ slit.

Specimen examined: BSRA 11166. Isolated from dead leaves and stems of Missan 1 cultivar. March, 2001.

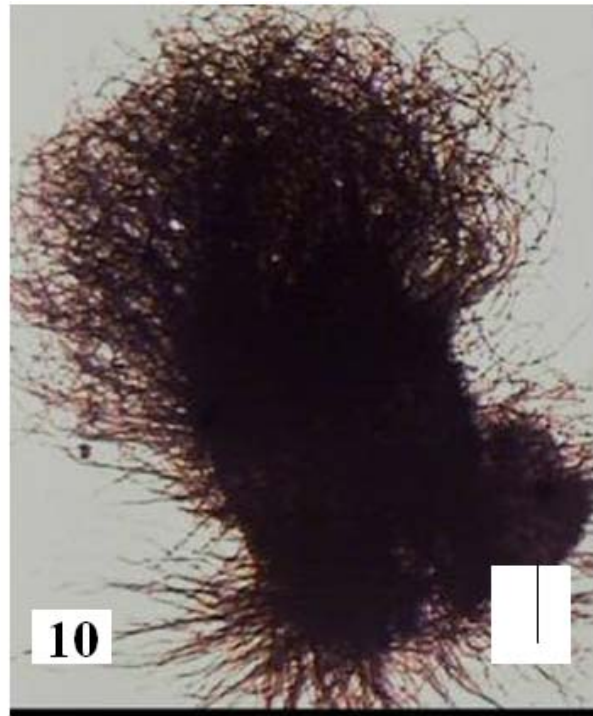
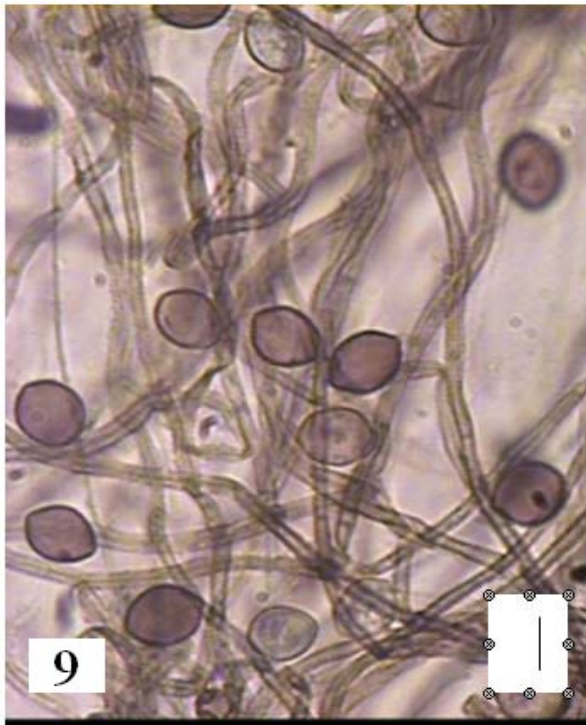
This is the first report for the fungus on sugarcane plant in Iraq. However, the species was previously reported on submerged dead palm leaves (Al-Saadoon and Abdullah,2001).

Kernia nitida (Saccado)Nieuwland. Amer. Midland Natur. 4:379 (1916). Figs,19 and 20.

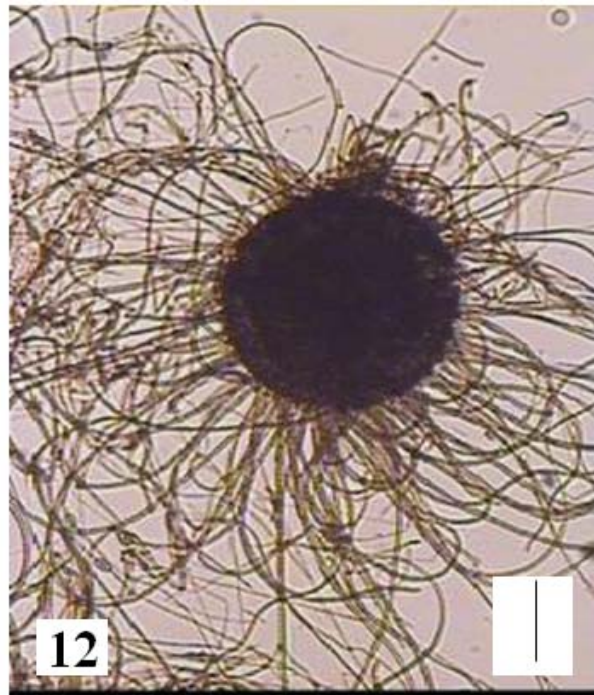
Ascumata varying in shape, irregular in outline, black opaque, non-ostiolate, 120-220 µm. Ascumatal appendages

arising in fascicles from two points, black, thick-walled, unbranched up to 1000 μm long and 5-7 μm wide. Asci 8-spored, ovoid to globose, evanescent. Ascospores 4-6 X3-4 μm , ellipsoidal, orange brown to copper-coloured in wet mass, thin-walled, smooth with a prominent de Bary

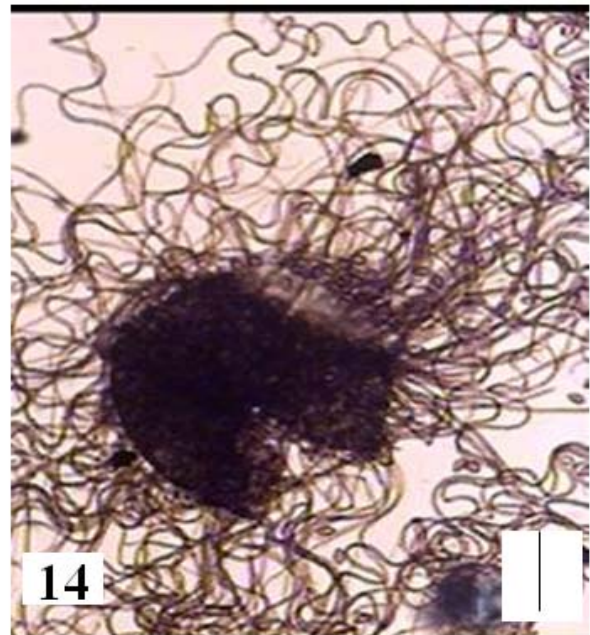
bubble, with germ pore at each end. Specimen examined: BSRA 11177. Isolated from dead stem of C0331 cultivar. March,2002. This is the first report for the fungus on sugarcane plant in Iraq.



Figures (9 and 10). *Chaetomium globosum*. 9-ascospores, 10-ascmata.
Bar 9= 10 μm . Bar 10=100 μm .



Figures (11 and 12). *Chaetomium murorum*. 11-ascospores, 12-immature ascmata.
Bar 11=10 μm . Bar 12=100 μm .



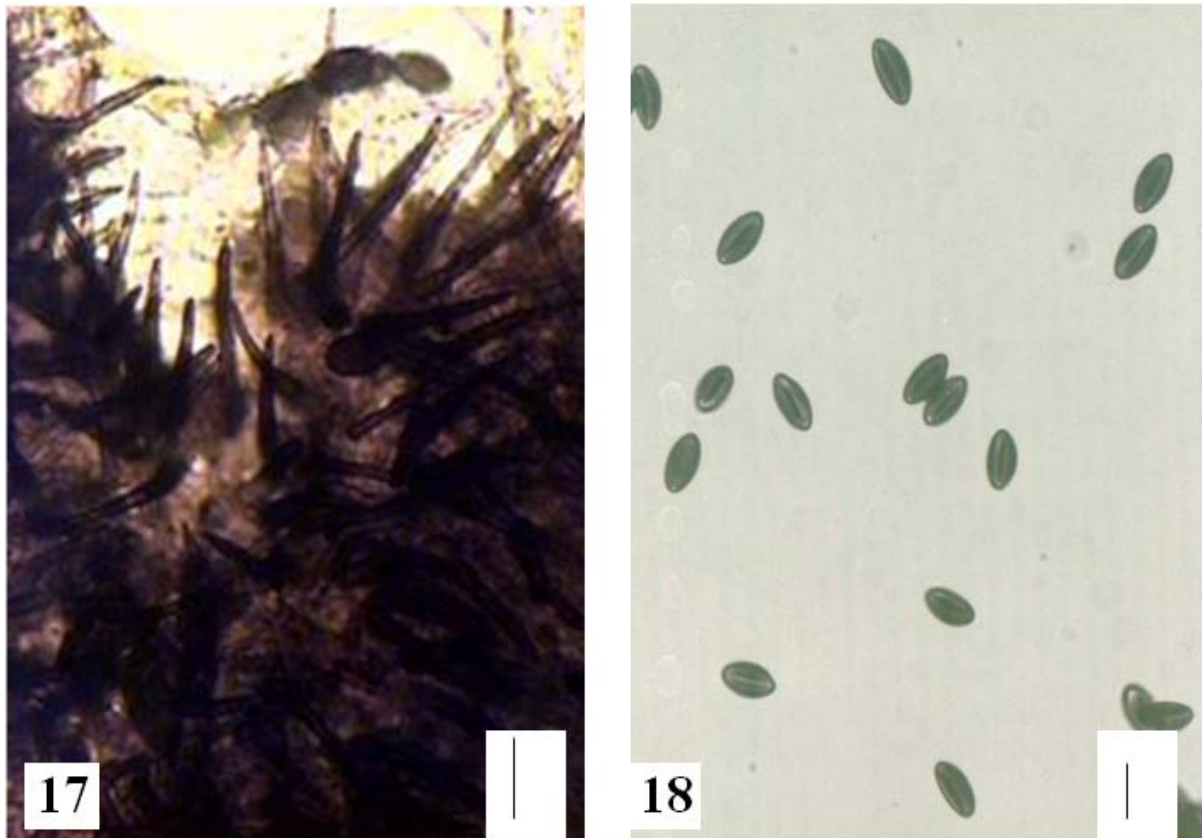
Figures (13 and 14). *Chaetomium spiralostrichum*. 13-ascospores, 14-ascomata.

Bar 13= 5 μ m. Bar14=100 μ m.



Figures (15 - 16). *Coniochaeta saccardoi*. 15-asci, 16- ascomata, 17-setae. 18-ascospores.

Bar 15=50 μ m, Bar 16=100 μ m, Bar 17= 50 μ m, Bar 18= 10 μ m.



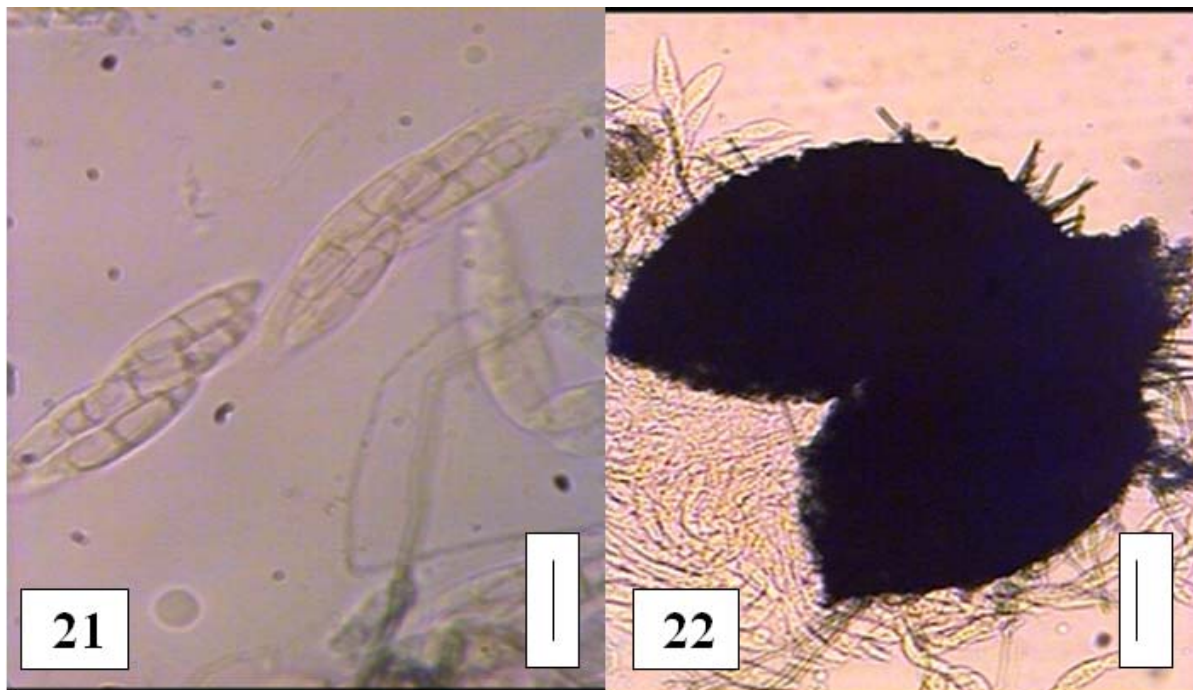
Figures (17 - 18). *Coniochaeta saccardoi*. 15-asci, 16- ascomata, 17-setae. 18-ascospores.
Bar 15=50µm, Bar 16=100µm, Bar 17= 50µm, Bar 18= 10µm.



Figures (19 and 20). *Kernia nitida* 19-ascospores. 20-ascomata.
Bar 19= 5 µm. Bar 20= 100µm.

The species is commonly found on dung of various herbivore animals as well as frequently isolated from soil and decaying plant materials (Malloch and Cain, 1971). In Iraq, however, the fungus was isolated from various dung

types (Abdullah, 1982), and from soil in several occasions (Abdullah *et al.*, 1986, 2007). *Leptosphaeria sacchari* Van Breda de Haan. Meded. Proefstat suilc. W. Jeva 3:25 (1892). Figs. 21 and 22.



Figures (21 and 22). *Leptosphaeria sacchari*. 21- asci and ascospores. 22- ascomata.

Bar 21= 10µm. Bar 22= 50 µm.

Ascomata globose to subglobose up to 200 µm size. Asci oblong-cylindric, 8-spored 40-60 X 8-12 µm. Ascospores oblong, fusoid, straight to somewhat curved, biseriate, subhyaline to light yellow brown, 3-septate, 18-23 X 3-5.5 µm. Specimen examined: BSRA11178. Isolated from living leaves of CO331, July, 2001.

This is the first record for the species in Iraq. The fungus was identified among the fungi causing ring spot of sugarcane leaf disease with a worldwide distribution (Hudson, 1962; Sivanesan and Waller, 1986).

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