

NEW RECORDS OF FUNGI ON WHEAT GRAINS FROM IRAQ

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ABSTRACT

The present study recorded eight fungal species on wheat grains for the first time in Iraq. These included *Arthrimum phaeospermum*, *Bipolaris sorokiniana*, *B.spicifera*, *Chaetomium elatum*, *Emericella rugulosa*, *Eurotium herbariorum* *Nigrospora* state of *Khuskia oryzae* and *Ulocladium alternariae*. Brief descriptions with photographs are provided for the newly recorded species.

INTRODUCTION

Fungi associated with seeds are responsible for both pre-and post-emergence damping-off of grains thus causing a reduction in germination. They can also causing mycotoxicoses in live-stock, poultry and humans (Agrawal and Sinclair, 1987). Seed –borne pathogens may also causes seed abortion, seed rot, seed necrosis and production of metabolites (such as toxins) which may alter grain composition or metabolism or render it unfit for human or animal consumption (Christensen and Kaufman, 1969, 1974; Naraiah *et al.*,1986). Moreover, close association with seeds facilitates the long term survival, introduction into a new areas and widespread dissemination of pathogens (Agrawal and Sinclair, 1987).

Therefore, the study of seed-borne fungi is very important to determine the health of grains and to protect them from seed-borne pathogens (HGCA, 2012).

During our continuous survey on seed-borne fungi from different economic crops growing in Iraq (Abdullah and kadhum, 1987; Abdullah and Al-Mosawi, 2006, 2009, 2010; Haleem *et al.*,2013), several interesting fungal species newly recorded on wheat grains from Iraq have been identified and briefly described along with photographs.

MATERIALS AND METHODS

Sample sources

Twenty six samples of wheat grains were obtained from official sources in Duhok provine (Department of field crops, Faculty of Agriculture and Forestry, Duhok University and from directorate of agricultural research, Duhok) and from silos at Shikhan and Zakho. Fourteen samples were belonging to soft wheat (*Triticum*

aestivum L.) and twelve samples of durum wheat (*T. durum* Desf.).

Detection of seed-borne fungi

Fifty grains were taken randomly from each sample (total of 1300 grains) and were surface disinfected with 1% sodium hypochlorite for 5 minutes, then washed twice with sterilized distilled water. The seeds were dried on sterilized filter paper and placed on two media (Potato dextrose agar (PDA) (Himedia laboratories, India) and Oat meal agar (OTA):30 g oat (Quiker oat), 15 g agar 1L water in five replicates for each medium, each replicate contains 10 grains . Chloramphenicol (50 mg/L) was added to each medium to inhibit bacterial growth. Plates were incubated at 25°C for 6-10 days under near ultraviolet (NUV) light at 12 hours interval of alternation with darkness (Mathur and kongsdal, 2003). Pure cultures from growing colonies were obtained by transferring fungal colonies individually on different fresh media plates (MEA (Himedia laboratories, India), PDA and OTA) for identification.

Fungal Identification

All species identifications were according to the keys and descriptions provided by Ellis (1971, 1976); Arx *et al.* 1986; Sivanesan, 1987; Klich (2002); Watanabe (2002) and Guarro *et al.*, (2012).

RESULTS AND DISCUSSION

Five mitosporic fungi and three teleomorphic ascomycetes have been identified, briefly described and discussed as below:

Arthrimum phaeosprmmum
(Corda) M.B. Ellis

Mycol. Pap. 103:8 (1965). Figure 1.

Colonies on PDA are at first hyaline, becoming brown to dark brown when conidia are produced, reaching 44 mm diam in 2 weeks at 25°C. Mycelium are mostly superficial, septate. Conidiophores are micronematous, unbranched, subhyaline to pale brown, varying in length up to 60 µm long and 1-5 µm wide. Conidigenous cells are discrete, 5-9×3-5 µm. Conidia are often found in tight clusters along a narrow conidiophore, lenticular, and smooth, pale brown to brown, 9-11×5-7 µm in size with longitudinal germ slit.

Specimens examined:

The species is very common on both soft wheat and durum wheat grains. Representative

dried and living cultures have been deposited at mycology bank, Plant Protection Department, Faculty of Agriculture and Forestry, Duhok university.

This is the first report for the species in Iraq. However, the species has been reported from wheat grains in Scotland (Flannigan, 1970) and from freshly harvested wheat from Argentina (Broggi *et al.*, 2007). An *Arthrinium* sp was also reported common on soft white winter wheat grains from Ontario, Canada (Clear and Patrick, 1993). The species was also detected from spelt wheat (*T.spelta* L.) grains in Poland (Kurowski and Wysocka, 2009).



Figure 1: *Arthrinium phaeosprum* conidia and conidiophores. Scale bar = 10 µm.

Bipolaris sorokiniana (Sacc.) Shoem. Can. J. Bot. 37: 884 (1959) Teleomorph: *Cochliobolus sativus* (Ito & Kurib) Drechsler ex Dastar. Ind. J. Agric. Sci. 12: 733 (1942). Figure 2

Colonies on PDA are dark brown growing rapidly reaching 65 mm in 2 weeks at 25 °C. Mycelium in forming a velvety layer, dark brown, smooth on veruculose. Conidiophores are erect, pale to dark brown up to 200 µm long and 6-10 µm wide and bearing 1-6 conidia at short distances in the upper half. Conidia are curved to straight smooth, olivaceous brown, fusoid to broadly ellipsoidal, terminal partly each cell subhyaline, 3-12 (mostly 6-10) septate, 40-120×20-28 µm.

Specimen examined: The species has been isolated in one occasion for each of soft wheat and durum wheat; dried and living cultures have been deposited at mycology bank, at Plant Protection Department, Faculty of Agriculture and Forestry, Duhok University.

This is the first record for the species on wheat grains in Iraq. However, the fungus was recently isolated from a naturally infected roots of a winter wheat plants collected from commercial field in Diwaniya governorate, middle Iraq (Sarhan, 2013).

Bipolaris spicifera (Bainier) Subram., Hyphomycetes 756 (1971).

Teleomorpha : *Cochliobolus spicifer*
Nelson , Mycologia 56 : 198 (1964). Figure 3

Colonies on PDA are dark brown to black , rapidly growing reaching 70 mm and 2 weeks at 25 C° .Conidiophores are pale to med brown with obvious and numerous scars , up to 250 um long at 4-8 um wide . Conidia are straight, cylindrical, rounded at ends, smooth, 3- septate, golden brown, 20-38 × 9 - 13 um.

Specimen examined: The species has been detected in one occasion from durum wheat.

Dried and living cultures have been deposited at mycology bank, at Plant Protection Department, Faculty of Agriculture and Forestry, Duhok University.

This is the first report for the species on wheat grain in Iraq. However, the species was previously detected from wheat grain important to Iraq from Hungary and India (Juber and AL-Salahi , 2006).



Figure 2: *Bipolaris sorokiniana* conidia. Scale bar= 25 um.



Figure 3: *Bipolaris spicifera* conidia. Scale bar= 10 um.

Chaetomium elatum

Kunze, Mycol. Hefte. 1:16(1817). Figure 4 (A, B).

Colonies on PDA are white with pale aerial mycelium reaching 60 mm diam in 2 weeks at 25 °C and often with yellow exudates. Ascospores are spherical or ovate maturing within 2 weeks with brown wall, ostiolate 170-350µm size. Ascospores hairs are numerous, long, dichotomously branched mainly in the upper part, dark brown, regulose or warty, septate, 4-5µm thick at base . Asci are clavate, 8-spored, evanescent, 30-40×14-18 µm. Ascospores are limoniform, bilaterally flattened, brown at maturity 8-11×7-9 µm with an apical germ pore.

Specimen examined: The species is very common on both soft wheat and durum wheat

grains. Representative dried and living cultures have been deposited at mycology bank at Plant Protection Department, Faculty of Agriculture and Forestry, Duhok University. This is the first report for the species on wheat grains in Iraq. However, the fungus was previously reported from maize (*zea mays* L.) grains and sunflower (*Helianthus annuus*) seeds in Iraq (Abdullah and Al-Mousawi, 2006, 2010), from leaves of sugarcane (*Sacharum officinarum* L.) cultivars in Iraq (Abdullah and Saleh, 2010) and from soil at date palm plantations and from surface sediments of Shatt Al-Arab river and its creeks in Basrah, Iraq (Abdullah and Zora, 1993, Abdullah and Abbas, 2008).

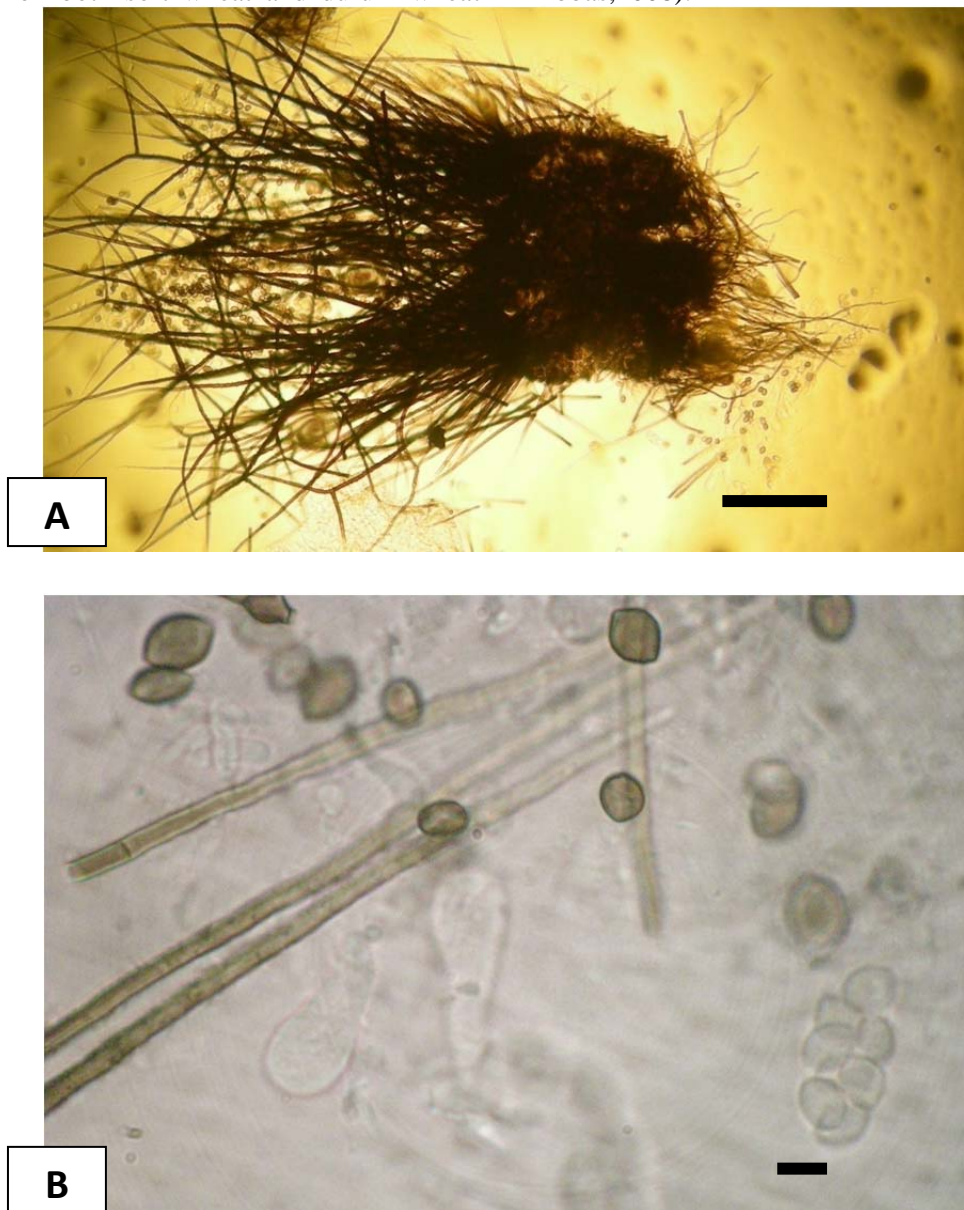


Figure 4: *Chaetomium elatum*. A: Ascomata with dichotomously branched hairs. Scale bar = 20µm. . B: Asci and ascospores. Scale bar = 10µm.

Emericella rugulosa (Thom&Raper) E.R.Beng. Mycologia 47:680 (1955). Figure 5 (A, B).

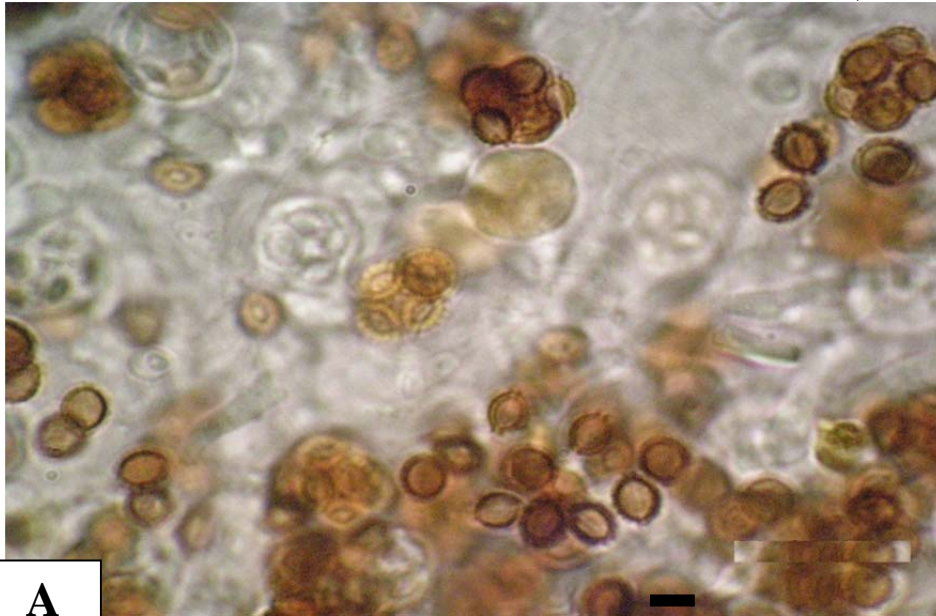
Anamorph :*Aspergillus rugulovavus* Samson&W.Gams. in Samson and Pitt (eds.) Advances in *Penicillium* and *Aspergillus* systematics ,New York .49.1984.

Colonies on MEA are green reaching 55 mm diam. in 2 weeks at 25°C with light yellow reverse. Cleistothecia are abundant developed within 2 weeks, 250-300 um diameter. Hule cells are globose, 18-20 um in diameter. Ascospores are grayish red, 3.5-4.5×3-3.5 um with rugulose convex wall and two equatorial crests. Conidial heads are short columnar. Conidiophores are smooth, 60-80×3-4 um. Vesicles are ovate to

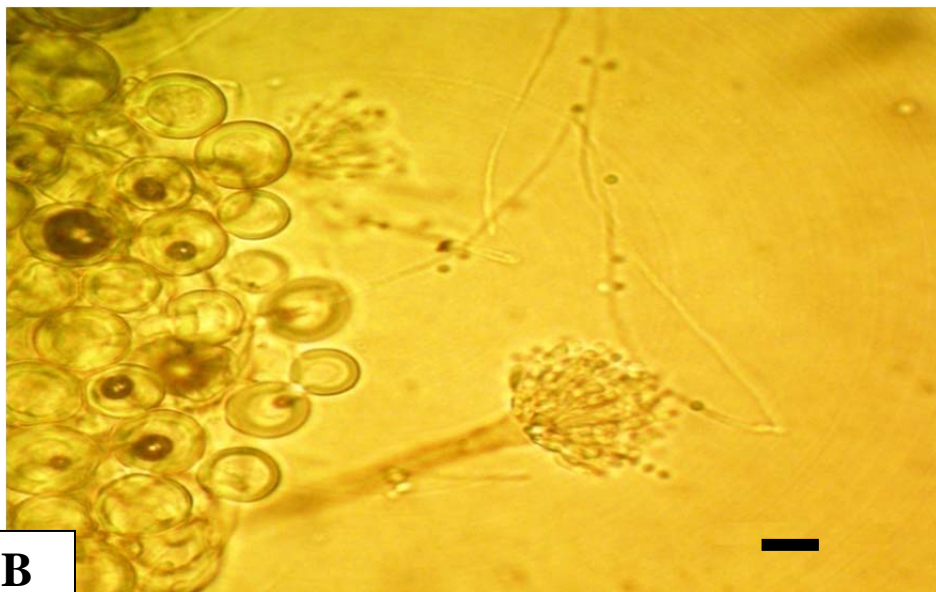
flask-shaped 8-12 um wide, biserriate, strigmata 4-7×3-3.5 um . philides are 6-7.5um long and 3-3.5um wide. Conidia are green in mass, spherical to subspherical 2.5-3.5 um diam.

Specimen examined: The species has been detected in one occasions for each of soft and durum wheat. Dried and living culture has been deposited at mycology bank, Department of Plant Protection, Faculty of Agriculture and Forestry, Duhok University.

This is the first report for the species on wheat grains. However, the species was previously reported from soil in Kurdistan region, Iraq (Abdullah and Abdullah, 2009; Abdullah and Saadullah, 2013).



A



B

Figure 5. *Emericella rugulosa*. A: Asci and ascospores. Scale bar =5um.

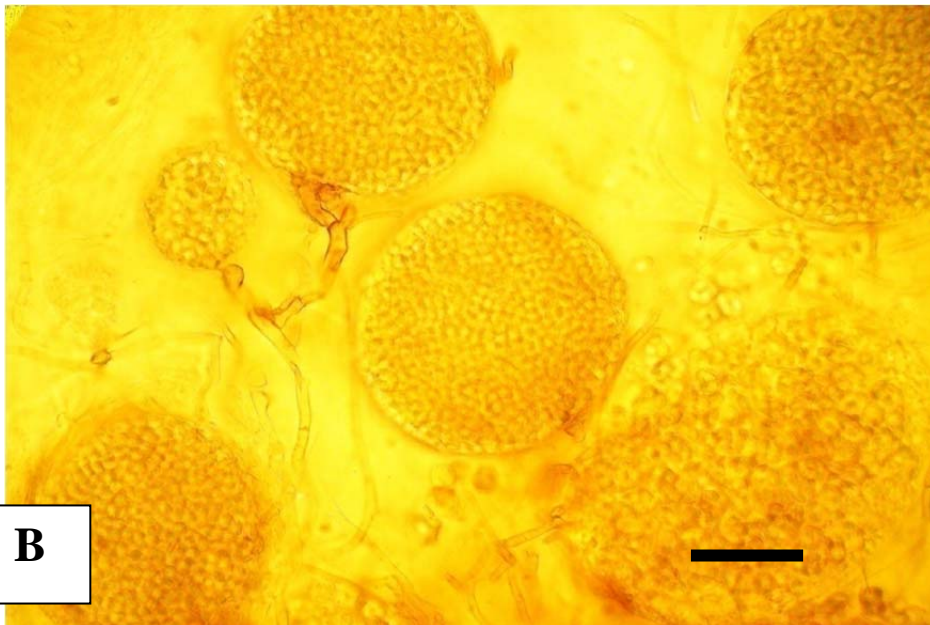
.B: Hule cells and *Aspergillus* anamorph. Scale bar = 10um.

Eurotium herbariorum (WH.Wigg.)
Link.Mag.Gesell.Naturf.Freunde,Berlin
3:31(1809). Figure 6 (A- C).

Anamorph: *Aspergillus glaucus* (L.)Link .Mag,
Gesell.Naturf.Frunde, Berlin 3:82(1809).

Colonies on MEA are cream to orange buff
reaching 50mm diam. in 2 weeks at 25°C
.Cleistothecia are abundant, 100-160um diam,
yellow to orange yellow encrusted with red
hyphae. Peridium composed of a single layer of
thin-walled pseudoparenchymatous cells of

texture angulrta. Asci are 8-spored, globose to
sub globose 11-14 um in diam. Ascospores are
white to yellow, 6-7×5-5.5um with pronounced
furrow and 2 equatorial crests with convex
surface finely roughened.Conidial heads sparse,
radiate to loosely columnar, pale blue green with
clavate to ellipsoidal uniseriate vesicle, 15-35um
in diameter.Conidia are globose to ellipsoidal,
dull green, thick walled, spinose to spinulose 5-
8mm in diameter.



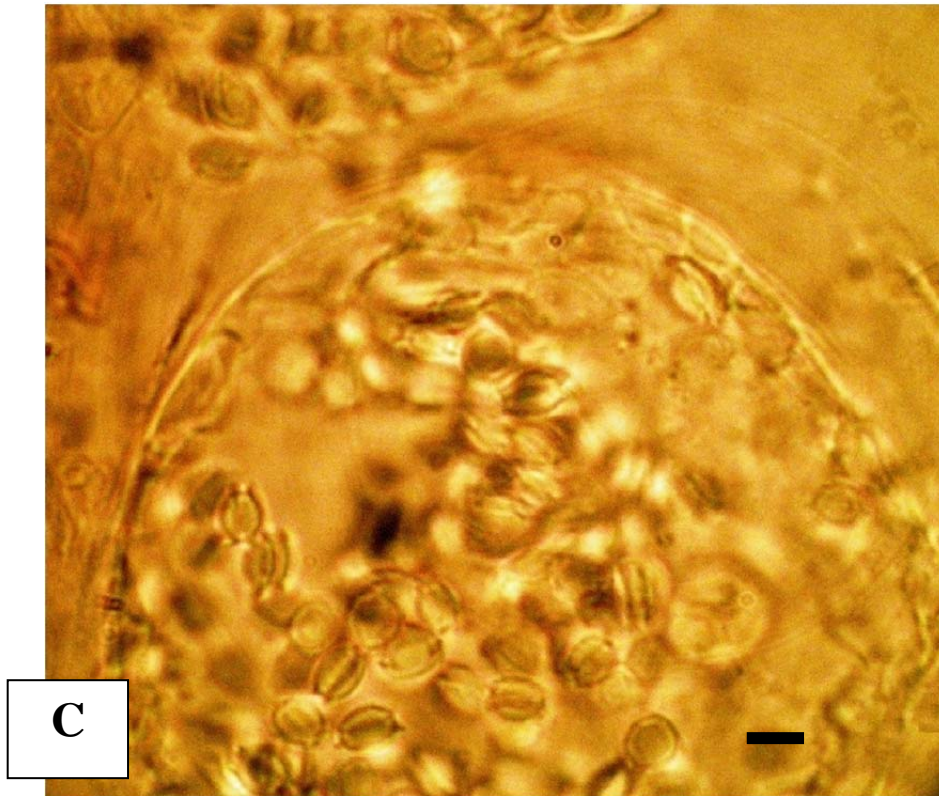


Figure 6: *Eurotium herbariorum*. A: *Aspergillus* anamorph. Scale bar =5um. B: Cleistothecia. Scale bar = 50 um. C: Asci and ascospores. Scale bar =5um.

This is the first report of the species from wheat grains in Iraq. However, the species has been recently isolated from soil at grapevine plantations in Duhok (Abdullah and Saadullah, 2013).

Nigrospora state of *Khuskia oryzae* Hudson. Trans.Br.mycol.Soc.46:355-360(1963). Figure 7. Anamorph : *Nigrospora oryzae* (Berk.&Br.) Petch, J.Indian Bot.Soc.4:24(1924).

Colonies on MEA are black reaching 40mm diam. in 2 weeks at 25°C. Aerial mycelium is wooly and hyphae are up to 9mm wide. Conidiophores are short pale brown, bearing

conidia singly and terminally. Conidia are black, globose in end view and ellipsoidal in side view, measuring 13-17 um diam.(mostly 12-14um).

Specimen examined: The fungus has been found in one occasion on durum wheat. Dried and living cultures have been deposited at mycology bank; plant protection Department, Faculty of Agriculture and Forestry, Duhok University.

This is the first record for the species on wheat grains in Iraq. However, Juber and Al-Salahi(2006) reported a *Nigrospora* sp. on wheat grains imported to Iraq.

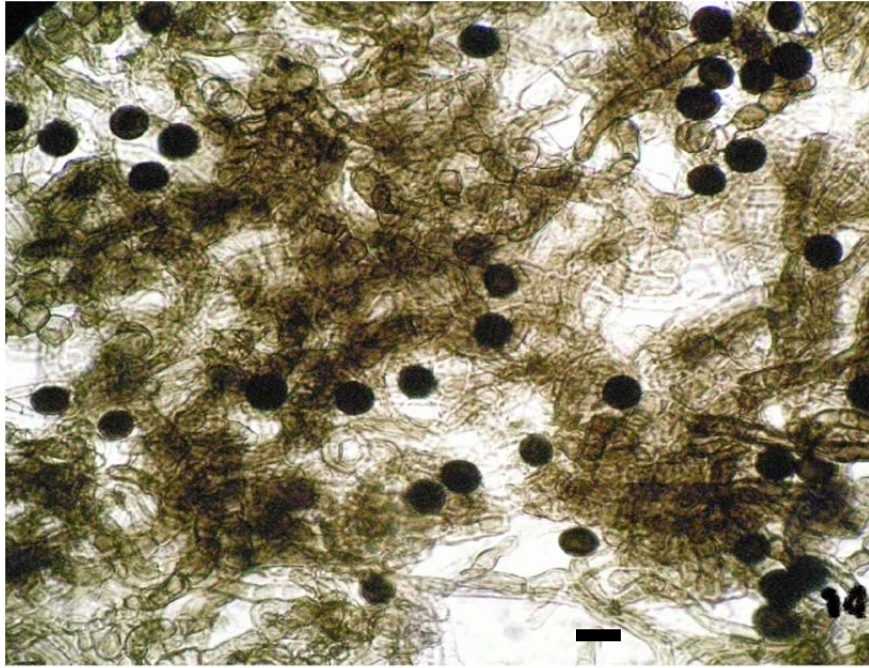


Figure 7: *Nigrospora* state of *Khuskia oryzae* conidia and hyphae. Scale bar = 10 μ m.

Ulocladium alternariae (Cooke) Simmons, Mycolgia 59:82-83(1967). Figure 8.

Colonies on PDA are reaching a diameter of 50 mm in 2 weeks at 25°C. Mycelium is pale brown, smooth 4-5 μ m. Conidiophores are golden brown up to 100 \times 4-7 μ m. Conidia are golden brown, smooth, obvoid to broadly ellipsoidal, 20-30 \times 12.5-18 μ m, with (1)-3-5 transverse septa and 1 or 2 longitudinal or oblique septa.

Specimen examined: The species has been isolated from both soft wheat and durum wheat grains during this study. Representative dried and living cultures have been deposited at mycology bank at Plant Protection Department, Faculty of Agriculture and Forestry, Duhok University.

This is the first record for the species in Iraq. However, the species has been reported on wheat grains collected from Kerman province, Iran (Gohari *et al.*.,2007).

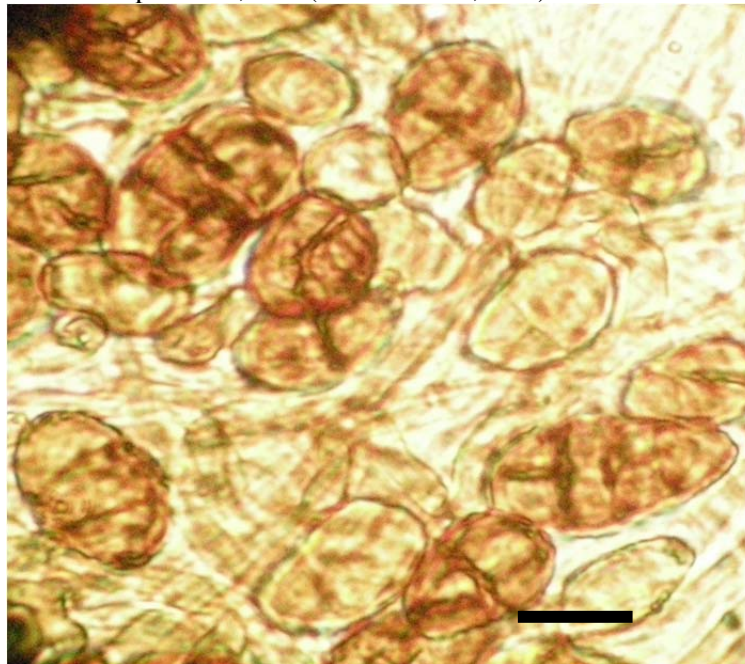


Figure 8. *Ulocladium alternariae* conidia. Scale bar =10 μ m.

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پوخته

نهؤ فه كولينه هاته كرن دا فه كولين لسهر هه بونا كومين كه رويلا لسهر توفى كه نى ل پارزگهها دهوكى. بدرىزيا نهقى فه كولينى (٨) جورين كه رويلا بو جارلا ئيكى ل عيراقى هاتينه تومار كرن ژوان

Arthrinium phaeospermum, Bipolaris sorkiniana, B.spicifera, Chaetomium elatum, Emericella rugulosa, Eurotium herbariorum, Nigrospora state of Khuskia oryzae , Ulocladium alternariae

ههمى جورين بو يكههم جارلا عيراقى هاتينه تومار كرن دگهل ديار كرنى بريكا وينين فوتوگرافى .

الخلاصة

أجريت هذه الدراسة لمعرفة واجراء المسح للفطريات المصاحبة لبذور الحنطة في محافظة دهوك. تم خلال هذه الدراسة تسجيل (٨) انواع من الفطريات لأول مرة في العراق مثل:

Arthrinium phaeospermum, Bipolaris sorkiniana, B.spicifera, Chaetomium elatum, Emericella rugulosa, Eurotium herbariorum, Nigrospora state of Khuskia oryzae , Ulocladium alternariae

تم وصف جميع هذه الأنواع التي سجلت لأول مرة في العراق مع التوضيح بالصور الفوتوغرافية.