Sudan University of Science and Technology

College of Graduate Studies and Scientific Research

Seed Health Testing For Nine Cultivars of Sorghum bioclor L. in Gadarif Area

فحص بذور تسعة أصناف من الذرة الرفيعة بمنطقة القضارف

A thesis submitted in partial fulfillment of the requirements for the M. Sc. degree in plant protection

By:

Hana Abdalhameed Mohamed Abdalla

Supervisor:

Associate/Prof. Eltigani Ahmed Abuelgasim

April2013

Sudan University of Science and Technology

College of Graduate Studies and Scientific Research

Seed Health Testing For Nine Cultivars of Sorghum bioclor L. in Gadarif Area

فحص بذور تسعة أصناف من الذرة الرفيعة بمنطقة القضارف

A thesis submitted in partial fulfillment of the requirements for the M. Sc. degree in plant protection

By:

Hana Abdalhameed Mohamed Abdalla

B.Sc. Agric. (Honors), May2001

College of Agricultural Science

Gezira University

Supervisor:

Associate/Prof. Eltigani Ahmed Abuelgasim

April 2013

الآيـــة

قَالَ تَعَالَىٰ:

﴿ فَقُلْتُ ٱسْتَغْفِرُوا۟ رَبَّكُمْ إِنَّهُۥ كَانَ غَفَّارًا ﴿١٠﴾ يُرْسِلِ ٱلسَّمَآءَ عَلَيْكُم مِّدْرَارًا ﴿١١﴾ وَيُمْدِدْكُم بِأَمْوَٰلٍ وَبَنِينَ وَيَجْعَل لَّكُمْ جَنَّٰتٍ وَيَجْعَل لَّكُمْ أَنْهَٰرًا ﴿١٢﴾ ﴾

صدق الله العظيم

سورة نوح: الآيات ﴿١٠-١٢﴾

DEDICATION

To the soul of my brother Amin

To my members family: Fathers& Mother

Brothers& Sisters

To my dear hasbund and

To my lovely son Mohund

To my friends and colleagues

With end lessloves&respect

Hana

Acknowledgments

I am indebted to Allah the almighty who gave me the mind, health, strength and patience to accomplish this work.

I am deeply indebted to my supervisor Prof.Eltigani Ahmed Abuoelgasim for his guidance,help and support revising the text and giving valuble adrvices and close attention and patience throughout this study and had never preserved has efforts to help, I am so grate full to him.

All of all I would like to express my aptitude thanks to Dr; Ibrahim Saeed the head department of crop protection who had supported me with advice and who had gradually escalated with me till was able to produce this study.

I must also express my deep sincer thanks to my sister Dr: Suaad Ibrahim for her logistical,support,affectionate,advice and guidance.

I would like to express special gratitude to my friend Hagar Bushra for helping me to over come all the difficulties and problems giving me special solicitude.

Thanks extend to Dr Tajelser Ahmed and Us Fatma Diab and Us Mouda Ibrahim in tissaeIcultur and plant patholo labs. I am honord to express my deep gratitude and special thanks to my beloved Hasbund who had encouraged me to achirve success and prospect and had also helped me to clinb the ladder of knowledge and cognition.

Thanks are due to Mr: Ahmed Awad Miss Um khalthum Hamid in plant protection department Gadarif for their kind help

Finally thanks full ness for my family and thanks full ness for all who helped me and were not mentioned individually.

Hana

Contents

List of Tables

List of Figures

List of Plates

Abstract

This study was conducted in both laboratories of plant pathology and tissue culture in College of Agricultural Studies, Sudan University Science and Technology

Nine cultivars of *Sorghum bicolor collected* from Gadarif area were tested for the presence of seed borne fungi.

The cultivars were Mugudahmer, Wadahmed, Wadakar. Arfaagadamac, Hageen, Tetron, Dabar, Fatarita and Tabet.

Seed health testing included dry inspection in which the seeds were divided into healthy, broken and infected.

Seeds were germinated on moistened medical cotton in sterilized plastic petridishes and as well seeds were plated on moistened filter paper and incubated at 25^{o} C . Seven fungi were isulated,purified and identified .

These were; *Drechslera spicifer*, *Macrophomina phaseolina, Fusarum oxysporum, Penicillum digitatum, Spergillus flavus,Aspergillus niger, Rhizopus nigricans.*

Pathogenicity test was carried out for four fungi these were *Drechslera spicifer, Macrophomina phaseolina, Fusarum oxysporum, Penicillum digitatum.*

The results revealed that the symptoms produced from artificial inculcations were seed rot bre-and post- emergence damping off as well leaf spots.

The fungi *Macrophomina phaseolina,* recorded the highest incidence 26.6% in cultivars Wad ahmed and the least incidence 6.6% in cultivars

Hageen. Wad ahmed and Arfaagamac the highest bos- emergence damping off was 40% in cultivar Daber and the least incidence 20% in cultivars Wad ahmed. Wad akar and Arfaa gadamac.

For symptoms development the highest Arfaa gadamac 26.6% and the least incidence was 6.6% in cultivars Daber and Fatarita.

For *Drechslera spicifer*, the highest incidence for seed rot and pre-emergence damping off was 33.3% for Wad akar arfaaga gadmac and the least incidence in cultivars Daber

For symptoms development the highest incidence was 20% in Wad ahmed, Arfaagadamac Fatarata, Tabet and the least incidence was 6.6% in cultivar Daber.

For *Fusarum oxysporum* the highest pre emergence damping off was33.3% in cultivars Tabet, Tetron, Hageen, Wadahmed and Arfaa gadamac

And the least was 13.3% in cultivar Daber The highest post emergence damping off was 40 in Daber and the least incdence13.3% in cultivars Mugud ahmer, Hageenand Daber. For symptoms development the highest in cultivars Wad Ahmed 33.3% and the least mdence was 13.3% in cultivars Daber Hageen and Nugud ahmer.

For *Penicillum digitatum* the highest of seed rot 40 in cultivars Arfaa gadmac, Tetron and the least incidence was 20% in Hageen Wad Ahmed Fatarita the percentage of post emergence damping off was 26.6% in Wad Ahmed Fatarita Hageen and the least 6.6% in Arfaa gadamac and Tetron.

For symptoms development the gighest in Tetron 33.3% and the lest incidence was 6.6% in cultivars Fatarita.

ملخص البحث

أجريت دراسة معملية بمعمل الأنسجة ومعمل أمراض النبات بكلية الدراسات الزراعية جامعة السودان للعلوم والتكنولوجيا شمبات فى فحص بذور أصناف مختلفة من الذرة الرفيعة المزروعة بمنطقة القضارف للتأكد من صحتها وفقاً لقوانين المنظمة الدولية لإختبارات البذور (ISTA) للعام (1966) و معرفة مدى إصابتها بالفطريات .

اجريت هذه الدراسة على تسعة أصناف من الذرة الرفيعة شملت: مقد أحمر، ود أحمد، ود عكر، ارفع قدمك ، هجين، تترون، دبر، فتريته و طابت.

أجريت عليها عدة إختبارات

طريقة الفحص الجاف: اظهر الفحص الجاف للبذور وجود بذور سليمة وبذور مصابه، مكسورة، ملونه بألوان مختلفة و هي مؤشرات علي إصابة البذور بالفطريات.

طريقة الزراعة والتحضين علي أوساط غذائية و ورق ترشيح وقطن طبي علي أطباق بتري قطر 9 سم بواقع 15 بذرة لكل طبق حضنت في درجة حرارة 25 درجة مئوية لحين ظهور النموءات الفطريه إذ أخذ العزل الفطري من محيط المزارع الفطرية النامية بإستخدام إبره معقمه ***needle*** و نقلت الي شريحة زجاجيه للتعرف علي نوع الفطريات النامية علي بذور الأصناف المختلفة حيث تم التعرف علي سبعه انواع من الفطريات شملت :

Derchslera spicifer , Penicillum digitatum , Macrophomina phaseolina, Rhizopus nigricanus , Asperigllus nigur, Fusarum oxyporum & Asperigllus flavus

أجريت بعض الدراسات مثل اختبارات العدوى الاصطناعية Phathogenicity لأربعة من هذه الفطريات و هي :

Derchslera spicifer, Penicillum digitatum, Macrophomina phaseolina& Fusarum oxyporum .

تمت تنمية الفطريات علي بيئة الأجار المحضرة معمليا ومصبوبه في أطباق بتري لمدة 15 يوم لحين الوصول للنمو التام للفطر، ومن ثم تم حقن الفطريات و تنميتها علي بيئة القمح بعد تعقيمه.

بعد الوصول للنمو التام للفطريات موضوع الدراسة تم حقنها في تربة معقمه موضوعه في كأسات تزريع وتم ريها كل يومين لمدة أسبوع و بعد الوصول للنمو التام

للفطر تمت زراعة البذور المعقمة مقارنة بالكنترول لكل صنف لمعرفة الأثر الضار لهذه الفطريات.

أظهرت العدوى الصناعية مقدرة هذه الفطريات علي قتل البذرة قبل أو بعد الإنبات و كذلك ظهور بعض الأعراض علي البادرات مثل تبقع الأوراق بنسب مئوية متفاوتة بين كل فطر وآخر. دونت النتائج في جداول و قورنت أعلى نسبه و اقل نسبه للضرر لكل عرض.

الفطر: *Macrophomina phaseolina*

أعلى نسبه لموت البذور قبل الإنبات كانت 26.6% في الأصناف ود احمد ، ود عكر و ارفع قدمك و اقل نسبة 6.6% في الصنف هجين.

أعلى نسبه لموت البذور بعد الإنبات بلغت 40% في الصنف دبر و اقل نسبه 20% في الأصناف ود احمد، ود عكر و ارفع قدمك.

أعراض الإصابة سجلت أعلى نسبه 26.6% في الصنف ارفع قدمك و أقل نسبه 6.6% في الصنفين دبر و فتريته.

الفطر : *Derchslera spicifer*

أعلى نسبه لموت البذور قبل الإنبات بلغت 33.3% في الأصناف فتريته، ارفع قدمك و عكر و أقله 6.6% في الصنف دبر.

أعلى نسبه لموت البذور بعد الإنبات بلغت 40% في الصنف دبر و اقلها 13.3% في الأصناف ود عكر، ارفع قدمك و فتريته.

سجلت أعراض الإصابة أعلى نسبه 20% في الأصناف ود عكر، طابت، ارفع قدمك و فتريته واقلها 6.6% في الصنف دبر.

الفطر : *Penicillum digitatum*

أعلى نسبه لموت البذور قبل الإنبات 40% في الصنفين تيترون و ارفع قدمك وأقلها 20% في الأصناف هجين، ود احمد و فتريته .

أعلى نسبه لموت البذور بعد الإنبات بلغت 26.6% في الأصناف هجين، فتريته، ارفع قدمك و ودعكر. و اقلها 6.6% في الصنف تيترون .

أعراض الإصابة سجلت أعلى نسبه لها 33.3% في الصنف وداحمد و اقلها 13.3% في الأصناف مقد احمر، هجين و دبر.

الفطر : ***Fusarum oxyporum***

أعلي نسبه للموت قبل الإنبات بلغت 33.3% في الأصناف طابت، تيترون، هجين، وداحمد و ارفع قدمك و أقلها 13.3% في الصنف دبر.

أعلى نسبه للموت بعد الإنبات بلغت 40% في الصنف دبر و اقلها 13.3% في الاصناف مقد احمر، وداحمد، ودعكر، هجين و طابت.

أعراض الإصابة سجلت أعلى نسبه لها 33.3% في الصنف وداحمد واقلها 13.3% في الأصناف مقد احمر، هجين و دبر.

CHAPTER ONE
INTRODUCTION

1.1Defination:-

Sorghum bicolor L., is a cereal crop that belongs to the family Poaceae, previously known as Graminae. Cereal crop represent half the total area cultivated all over the world. They are sources of carbohydrates important for both humans and animals.

The indigenous home of Sorghum is the Sudan and Ethiopia. Sorghum is the oldest crop for feeding humans and animals and the centers of cultivation are Africa and Asia. But, in the United States of America it is sown as a fodder for animal feeding (Skerman and Riveros, 1990).

The total area cultivated by sorghum all over the world is 106 million feddans. The five top countries wise area are India, Sudan, USA, Nigeria and China. The areas under cultivation in these countries represent 66% of the total world areas cultivated by sorghum. Sorghum comes in the fifth rank of cereal crops area and production wise after wheat, rice, maize and barley (Simmond, 1979).

In the Sudan sorghum is produced mainly in rain – fed agriculture. Vast acreage are cultivated in mechanized crop production Schemes is Gadarif, 6302 ton/feddan , Damazin 1945 ton /feddan (Blue Nile State) and both Kordofan 1548 ton/feddan and Darfur States 650 ton/feddan. The crop is also grown in irrigated schemes of Gezira 483.649 ton/feddan and Rahad 109.419 ton/feddan as an important crop in rotation.

In the traditional rainfed Smalls, Sorghum is cultivated in Kordofan, Darfur 800 ton/feddan, White Nile 120.408 ton/feddan, Butana and Blue Nile. It is produced mechanically by rains in Gadarif areas 6302 ton/feddan,

Rosairis 1945 ton/feddan, Hbeela, Kosti 120.408 ton/feddan, Daleng2000 ton and upper Nile. (Ministry of agriculture and forestry, MAF, 2012)

In Sudan the common name of sorghum is Aish which means life. It represents the most important food for most of the population. It also represents the biggest crop contribuebing in the national gross production. There are several cultivars of the crop. These are Feterita, Mayo, Daber, Hageen and Tabet. The crop is considered as one of the pillars of food security politically and socially. (Khatab et al 2000).

Sorghum is grown in all types of soils except sandy and high saline soils. Yet , the crop is tolerant to moderate salinity.

1.2 Chemical composition of grain:-

There are noticeable differences in the chemical composition of the different types of grain sorghum and this normal table shows the average analysis of these grains moisture soluble 9.5 , carbohydrate 17.0 , protein 31.0 , fat 3.3 , fiber or 1.5, ore similar to grain sorghum in grain chemical composition not that grain sorghum contain a slightly higher proportion of protein and less fat compared pills.

1.3 Uses of sorghum:-

Most important of these uses:-

- Food for human being directly used as many third world countries as grain sources in human nutrition.

- Feed for the animals in the form of green or dry fodder takes different forms: pills, silage, pasture.

- Industrial uses include the extraction of many products such as starch, oil, alcohol, sugar and sugary juices. (Khatab et al 2000).

1.4 Objectives of this study:-

1/ To determine seed borne pathogens and contaminants in the seeds of nine cultivars of Sorghum. These are Mugud ahmer, Wad ahmed, Akar, Arfaa gadamic, Hageen, Tetron, Daber, Feterita, Tabet in Gadarif area.

2/ To determine the pathogenic propensities of the most prevalent pathogens isolated from seeds.

CHAPTER TOW

LITERATURE REVIEW

2.1 Distribution

Sorghum bicolor (L) crop is subject to attack by several insects mainly stem borers, Antad and desert locust. Birds may cause drastic damage on the crop when out breaks occur. The parasitic flowering plant, striga (Buda). Is now gaining more importance as the damage is increasing annually. (Khatab et al 2000).

As far as diseases are concerned smuts are the most dominant.other diseases are leaf spotting agents. Among these are *Drechslera* species such as *Drechslera hawaiiensis*, *D. spacifer*, *D. tostrata*, *D. tetramera* etc... And *colletotrichum spp*. Such as *C. lindemuthianum*, *C. Dematium C. graminicola*. As well as *Alternaria tenuis*, *A. allernata*, Root rot fungi such as *Macrophomina phaseolina*, *Fusarium moniliforme*, *F. solani* and *F.semitectum*. (Richardson 1979).

The origin of the crop is Ethiopia and has spreaded to other parts of Africa, south East Asia, India, Australia and United states (Skerman and Riveros, 1990).The crop is cultivated to varying extent in almost all tropical and sub – tropical areas of the world (Tarr, 1962).Sorghum has spread over much of the old sorghum growing world, being found in India and china (Mann et al., 1983).

2.2 Botany description:-

Sorghum is a coarse grass. The stems are erect and solid and grow in height from 2 – 15 feet. There is a lateral bud at each node on alternate arrangement. There is a tendency in some varieties, for the lateral buds at the lower most nodes to develop into tillers. If plants are dense, these tillers are

suppressed or never begin develope. The length of the internodes determines the height of the plant. Sorghum leaves are shaped and leaves insroll during periods of drought, contributes to the drought resistance of the species. The inflorescence of sorghum is a panicle, usually called the head. The head is compact except in Sudan grass. Broomcorn and few sorgos. There are many primary branches that bear paired ellipsoidal spikelets. There are two florets in the sessile or fertile spikelet, the lower is sterile and the upper is fertile. Sorghum is generally self – pollinated, but there is no barrier to cross fertilization, when varieties are grown adjacent to one another. Cross fertilization, of about 6% is common by atmospheric condition. pollination cross is higher in Sudan grass than in grain sorghum. Sorgo fodder usually contains less than 20% by weight Average yield of green fodder of sorgo varieties, vary from 6 – 25 tons per acre, and the lower yield being made by early maturing varieties. (Quinby and Karper, 1981).

2.3 Importance of sorghum in the Sudan:-

Sorghum and food security:

The most definition of food security is access by all people of all times to enough and appropriate food to provide the energy and nutrients needed to maintain active and healthy life (Barret, 1999). According to the definition and by many virtues, sorghum has been the main pillar of food security in the Sudan. Sorghum is a strategic crop as it is the staple food for the majority of the population. It is consumed in almost all regions by almost all income groups and all population segments.

It is complemented by millet in Western Sudan, cassava in Southern Sudan, and wheat in Central, Eastern and Northern Sudan. Sorghum account to 65 percent of the total cereals for consumption followed by wheat and millet, In1995 it constituted about 72 percent (Ministry of agriculture and forestry, MAF, 1996).

The annual national sorghum consumption is about 3 million ton. It is mainly consumed in the form of porridge and kisra, a pancake which is dipped into a highly flavored meat or vegetables stew as well. It is featured in some of the traditional dishes of the Sudan and used in making some drinks including sorghum beer . (Brandt, et al., 1987), estimated its rural and urban annual per capita consumption as 124 – 141 kilograms.

According to Hassan (1988), sorghum consumption has been increasing during 1980 since the drought of 1984 /1985 due to the sharp decrease in production of millet, the close substitute of Sorghum , the drought displaced population settled in their new home and shifted to consume sorghum at the expense of millet . Sorghum consumption was still stimulated by the in flux of refugees from neighboring countries.

2.4 The significance of sorghum in the Sudan:-

Sorghum serves as a staple, food security, import substitute, cash and export crop as well as livestock forage and grain feed. With the exception of the drought period (1984_ 1985), Sudan is a sorghum surplus country. Sudan ranks the first in the world in area and grain consumption but number five after China, India, USA and Nigeria in sorghum production. This is despite the fact of the very low average sorghum yield in Sudan of 218 kg/ feddan compared with the range of 1211 to 1661 kg/ feddan in world leading producing countries and the world average of 578 Kg/ feddan by the end of the 1980 (Mahmoud 1994).

Sorghum is the most important cereal world wide crop used as a stock feed in the developed world while in developing countries, such as the Sudan, it is the nutritional back borne of the country. In the Sudan, there is no stronger indictor of Sorghums importance than its popular name aish, which means life. This upward trend continued through the 1990ś. Sudan had a bumper harvest of 3.6 million metric tons in 1994/95 which considerably

improved the food security in the country. In 1995/96 the production was 32 percent more than the past season , which decreaced level of food aid and increased self sufficiency (FAO WFP, 1995).

In 1995/96, the total sorghum production declined to 2.5 million metric tons compared to season 1994/95 whereas the area decreased from 15.3 to 12 million feddans due to weak preparatory measures at the beginning of the season. In 1996/97 the area increased to 15.6 million and the production jumped to 4.2 million metric tones. However, in 1997/98 the area decreased to 12.6 million feddan and the production to 2.9 million tones (Ministry of Agriculture and Forestry, 1996: IMF 1999).

After bummer harvest of 4.8 million tones in 1998/99 with an area of 15 million feddan, sorghum production fell below average in 1999/2000 to 2.3 million tones out of an area of 11 million feddans (FAO WFP, 2000).

This is mainly due to farmer's response to the prevailing low pieces and their shifting to more lucrative cash crops like sesame in addition to high incidence of pests mainly birds which reduced yields tangibly (FAO WFP, 2000). The situation worsend to 10.8 million feddans producing about 2.7 million tones, due to late rains, prolonged dry spells and localized droughts.

2.5 Adaptation:-

Since sorghum is quite resistant to drought, the species grown mostly in areas where rain fall is insufficient for corn production, sorghum responds well to irrigation and the crop is well adapted to regions of limited rain fall with an average of 17 – 25 inches per annum. The most favorable mean temperature for growth is about 80 of the minimum temperature is 60f.

Sorghum is a short – day plant but most of our forage varieties are relatively insensitive to photo – period. Sorghum is produced successfully on all types of soil, growth being dependent upon relative fertility and soil moisture

supply. It is more tolerant to alkaline soils than most cultivated crops (Quinby and Karper, 1981).

Sorghum is often grown in areas with relatively low rainfall, high temperatures and saline soils (Netondo *et al.* 2004). Tolerance to salinity is variable among crops (Sanogo 2004). Plant responses to salinity stress depend upon various factors, such as the duration and degree of the stress and growth stage (Triky-Dotan *et al*. 2005). Most agronomical crops do not function well at a salinity level of 5 dS m-1 or higher (Mass 1986). Sorghum's ability to be productive in comparison with other cereals in saline and drought-prone environments has been attributed to several different morphological and physiological traits (Smirnoff, 1998).

2.6 Seed – borne fungi of *Sorghum bicolor***:-**

The following micro – organisms were reported to be seed borne on sorghum bicolor. These are *Alternaria spp*., *Curvularia lunata*, C. *spicifer*, *Drechlera spp*., *D. longirotrata, Fusarium moniliforme*,

Sphacelotheca curenta, S. reliana, Aspergillus niger, Penicillium spp., Phoma sorghina, (Richardson 1979). Abd Allah and Alhag (1974) isolated the following fungi from sorghum grain, *Curvularia spp.*, *Aspergillus spp* and *Aspergillus niger*.

In a survey 43 species of seed borne fungi were isolated of which 9 are new host records and 18 new records for the Sudan (EL- shafei, and Webster1982).

Fahim et al, (1984 - 86) reported that the Blotter methods proved to be the best substrate for isolating internally and extermally seed – borne fungi . On other hand four sorghum cultivars yielded 20 fungal species most of these reduced germination and the most frequent were, *Fusarium oxysporium, Curvularia geniculata, Alternaria alternate, Aspergillus spp,* were the most

inhibitory to seed germination Kkhairmar and Gambhir (1984). Bhale and Khare (1984), reported that among 26 fungi are associated with sorghum seed *Curvularia lunata* and *Fusarium moniliforme were dominat*.

Abdullah and Kadhum(1987) reported that nine sorghum cultivars were associated with 38 species of fungi belonging to 22 genera. *Alternaria alternata*, *Curvularia lunata*, *Drechslera spicifer* and *F.moniliforme*, *Aspergillus niger* and *A. flavus* were detected using the blotter method.

From 29 – 92% of sorghum seed infected with fungi germination percentage ranged from 12 – 85.6%. Singh et al (1990) reported that stored sorghum seed in India were infected by *Curvularia lunata* and *F.moniliforme.*

Bandyopadhyay et al (1990) reported that *Fusarium spp, Curvularia spp,* and *Alternaria spp* which cause sorghum grain mold were monitored over rainy season.

Chavan and Raut (1990) reported that from 5 sorghum cultivars inocubated on moist blotters the following fungi were identified. *Alternaria alternata*, *Claosporium spp*, *Drechslera halodes*, *F.moniliforme*, *Curvularia lunata* and *Phoma sorghina*, *A.altrnata*, and *Drechslera halodes* were more common on glumes than seeds.

Osman et al, (1990) reported the following fungi in 4 cultivars of srghum. *Fusarium spp*., *Drechslera spp*., *Alternaria spp*. and *Aspergillus spp.*

Adiver and Anahosur(1996 – 1998) reported that samples tested by the Blotter method revealed the presence of *Curvulria lunata.*

In India Rajni and Gupta (1996) reported the presence of *Fusarium spp*., *Curvularia spp., Alternaria spp*., *Cladosporium spp., Phoma spp*. and *Asperillus spp.*

Seed – borne fungi of 130 samples of rice, sorghum maize and cowpeas collected from different regions of Ghana were investigated using standard seed health testing methods.

A number of fungi were found associated with discoloration, spots and strips observed on the seeds. Zuwahu, and Akueshi (1992), recorded 14 fungi isolated from the seeds. *Aspergillus flavus* and *Pencillium citrinum* were the most frequent causals of seed discoloration and reduced germinability. They were associated with infection with other fungi in Nigeria. Somani et as(1993) from India reported *Curvularia lunata* and *F.moniliforme* as casuals of black and pink discoloration of seeds.

2.7 Aspergillus flavus:

Aspergillus flavus is acommon mold in the environment, and can cause storage problems in stored grains. It can also be a human pathogen, associated with *Aspergillosis* of the lungs and sometimes causing corneal, otomycotic, and nasoorbital infection. Many strain produce significant quantities of aflatoxin, a carcinogenic and a cutely toxic compound. *A.flavus* spores are allergenic Klich MA. (2007).

A flavus growth is a yellow – green mold in culture. Like other *Aspergillus* species, it produces a distinctive conidiophore composed of a long stalk supporting an inflated vesicle. Conidiogenous cells on the vesicle produce the conidia. Many strains of *A. flavus* exhibit agreenish fluorescence under Ulv light that is correlated with levels of aflatoxin production. Agrios 1997).

A flavus is particularly common on corn and peanuts and is one of several species of mold known to produce aflatoxin, which can cause acute hepatistis, immunosupperssion, and hepatocellular carcinoma. Despite rarely

occurring in indoor environments, it hass been isolated in water damaged carpets and other water – damaged building materials.

The absence of any regulation of screening for the fungs in countries that also have a high prevalence of viral hepatistis highly creasesin the risk of hepatocellular carcinoma.

To protect tree nuts and sorghum plants that are affected by *A. flavus* scientists of the Agricultural research service found that treating these plant with the yeast pichia anomala reduced the growth of A. flavus. The study showed that treating pistachio trees with p. anomala inhibited the growth of *A. flavus* up to 97% when compared to untreated trees. The yeast successfully competes with *A. flavus* for space and nutrients, ultimately limiting the growth of *A. flavus*. Agrios 1997).

2.8 Drechslera spicifer:

Conidiaphores of *Drechsler spicifer are* solitary or in small group straightly or flexuous sometimes geniculate, pale to mid brown or oliraceous brown, up boom long, 4- 8μ thick.

Conidia usually curyed, naricular fusiformes or oblclavate, Occasionally almost cylindrical pale to mid golden brown, smooth, 16-14 pseudosedtate, 63-153 (109) × 14-22 (17)μ, hilum minute often protruding slightly, papillate. Conidia formed on glumes and in culture on wheat straw under near. N. u. v. light are as arule larger and darker than those formed on leaf spots.

On leaves, leaf sheaths and glumes of sorghum D spicifer is cause of brown spot disease, cosmopolitan, leaf spots, when small brown or purplish brown, later plate in the center with to dark brown margin. (Richardson, 1997).

2.9Fusarium oxysporum:

The species develops, reddish brown to beige discoloration on potato sucrose agar with a relatively flat, hairy (stranded) aerial mycelium, with formation of micro conidia it becomes powdery micro conidia, from phialides either lateral or on short branches, are oval to cylindrical, pointed at one end, occasionally slightly curved, 7- 14 × 3- 2-44. Booth (1971).

Macro Conidia resemble the martiella type and are formed from aslimy piomotal layer or from small scattered sporodochia. They are generally 3-5 septate falcate, pedicellate and broader in the upper third, 20-55 × 4.5μ chlamudospores are terminal and intercalary, spherical to oval; sclerotia formed sparsely, cream to pale brown. (Booth (1971).

The Fusarium is one of the most important fungi that attack a wide host range nearly all crops. This fungus causes disease symptoms such as root rot, damping- off, crownot and seedling blight. Richadson 1979).

2.10 Asperillus niger:

Asperillus niger is one of the most common species of the genus *Aspergillus*. It causes a disease called black mold on certain fruits and seeds and is a common contaminant of food.

It is ubiquitous in soil and black colonies can be fused with those of Sachybotrys species of which have also been called black mould.

Some strain of A. niger have been reported to produce potent mycotoxins called ochratoxins. Commonly foud as saprophyte growing on dead leaves stored grain, compost piles, and other decaying vegetation. Agrios (1997).

2.11 Pathogenicity:

Aspergillus niger causes black mold, infection of seedlings by A. niger can become systemic, manifesting only when conditions are conducive.

A. niger causes a common post harvest disease of stored grains, in which the black conidia can be observed between the scales the scales of the bulb in onions. Agrios 1997).

***2.12 Rhizopus nigricans*:**

The mycelium of the fungus produces long, aerial sporangiophores at the tips of which black spherical sporangia develop .The sporangia contain thousands of spherical sporangiospores.When the mycelium grows on a surface, it produces stolons, i.e., hyphae that arch over the surface and at the next point of contact with the surface produce both root-like hyphae, called rhizoids, which grow toward the surface, and aerial sporangiophores bearing sporangia. From each point of contact more stolons are produced in all directions. Adjacent hyphae produce short branches called progametangia, which grow towards one another. When they come in contact, the tip of each hypha is separated from the progamentangium by a cross wall. The terminal cells are gametangia. This fuse and their nuclei pair. The cell formed by the fusion enlarges and develops a thick, black, and warty cell wall.

This sexually produced spore is called a zygospore and it is the overwintering or resting stage of the fungus. When it germinates it produces a sporangiophore bearing a sporangium full of sporangiospores. Agrios 1997).

2.13 Penicillium digitatum:

The various species of *Penicillium* cause the blue mold rots and the green mold rots, also known as *Penicillium* rots. They are the most common and usually the most destructive of all are postharvest diseases, affecting most

kinds of fruits and vegetables (Figs. 11-125B and 11-125E). On some fruits, such as citrus, some infections may take place in the field, but blue molds or green molds are essentially postharvest diseases and often account for up to 90% of decay in transit, in storage, and in the market. *Penicilliumsp* enters tissues through wounds. However, it can spread from infected fruit in contact with healthy ones through the uninjured skin.

Penicillium rots at first appear as soft, watery, slightly discolored spots of varying sizes and on any part of the fruit. The spots are rather shallow at first but quickly become deeper. At room temperature most or all of the fruit decays in just few days. Soon a white mold begins to grow on the surface of the fruit, near the center of the spot, and starts producing spores. The sporulating area has a bluish-green, or olive-green color and is usually surrounded by white mycelium and a band of water-soaked tissue. The fungus develops spots of any size as long as the air is moist and warm. In cool, dry air, surface mold is rare, even when the fruits are totally decayed. Decaying fruit has a musty odor. Under dry conditions it may shrink and become mummified. Under moist conditions, secondary fungi and yeasts also enter the fruit, which is then reduced to a wet, soft mass.

In addition to the losses caused by the rotting of fruits and vegetables by *Penicillium*, the fungus also produces several mycotoxins, such as patulin, in the affected products, which contaminate juices and sauces made from healthy and partly rotten fruits. Agrios 1997).

2.14 Macrophomina phaseolina

(Tassi) Goid. Causes charcoal rot disease on more than 500 plant species throughout the world (Srivastava *et al*., 2001). The disease has caused economically important losses on oilseed plants, especially on bean (*Phaseolus vulgaris* L.), corn (*Zea mays* L.), cotton (*Gossypium herbaceum* L.), sesame (*Sesamum indicum* L.), and sorghum (Sorghum bicolor L.]

Moench), soybean (*Glycine max* L.), and sunflower (*Helianthus annuus* L.). *Macrophomina phaseolina* is the main fungal pathogen affecting sunflower in Egypt (Purkayastha *et al*., 2006). Estimates of yield reduction due to charcoal rot in the USA were 1.98, 0.28, and 0.49 million metric tones in 2003, 2004, and 2005, respectively. Differences in soybean yield suppression due to charcoal rot among years are due to differences in the environment with yield suppression due to this disease increasing with drought (Wrather and Koenning, 2006). Although only one species is recognized within the genus *Macrophomina*, great variability in morphology and pathogenicity was recognized among isolates from different hosts (Fernandez *et al*., 2006). Subdivisions of this mono specific genus are often based on virulence to a particular set of differential host cultivars that vary in disease resistance. Although useful in phytopathology, these tests bear inherent problems including dependence on different host cultivars, influence of numerous variables such as cropping systems, tillage practices, temperature, irrigation, and drought stress (Kendig *etal*., 2000; Mayek-Pérez *et al*., 2002; Amusa *et al*., 2007; Wrather *et al*., 2008).

Charcoal rot is a major disease problem under drought and saline conditions (Diourt *et al*. 1995). The effects of salt on plant disease may result from its effect on one or more of biotic components involved in the disease namely the pathogen, the host, microbial activity in soils, or abiotic components of soil (Triky-Dotan *et al*. 2005). Water potentials from -1.2 to -1.5 MPa have been shown to increase predisposition to root rot pathogens.

Edmunds (1964) found that charcoal rot was severe in sorghums plants when inoculated near maturity at temperatures of 35-40°C and 25% available soil moisture. Water stress can predispose the plant to *M. phaseolina* whenever the defense mechanism of the plant is impaired (Waller 1986).

CHAPTER THREE

MATERIAL AND METHODS

3.1 Collection of the sample:

Nine seed samples of Sorghum bicolor L., were obtained from the Gadarif area.These were Mugud ahmer, Wad ahmed, Akar, Arfagdmic, Hageen, Tetron, Daber, Feterita and Tabet.

Seed samples were drawn according to international standards for seed testing association (ISTA, 1966). They were collected in paper bags and transferred to the laboratory for further investions, and stored at $5C^{o}$ in the refrigerator.

3.2 Dry seed inspection:

Two hundred (200) seeds of each seed sample were examined under stereoscopicbinocular microscope (25-40 x) and by magnified lens according to the international seed testing association (ISTA Rules, 1966). The samples were examined for impurities, plant debris, sclerotia, and galls and also for discoloration and malformation.

3.3 Incubation procedures:

The seed samples were tested by the standard blotter and agar plant method for detection of seed borne fungi as described by ISTA . Normal and discolored seeds were tested separately for seed borne Fungi.

3.4The Blotter and cotton Method: Non-pertreated seed.

The seed were tested by the standard blotter method according to ISTA Roles.

Two hundred unt reated seeds from each sample were plated in sterilized glass petri dishes (9 cm diameter) 15 seeds in each dish on the top of three layers of sterilized moistened filter paper and cotton .

Seeds were plated at equidistant distances. The plates were then incubated at 28 C^{o} for 7 days under alternating cycles of NUV and darkness (12/12 hrs).

On the 8th day.the plates were examined under the stereoscopic and compound microscope.

3.5 Pretreated Seeds:

Two hundred seed from each sample were surface sterilized with sodium hypochlorite (1% available) chlorine for 3 minutes and then washed3 times in sterilized Petri- dishes containing sterilized distilled water. Each(15) seeds were kept between three layers of sterilized filter paper to dry. Fifteen seeds were plated on moistened filter paper and cotton in glass Petri dishes and incubated a 28 C^o for 7 days under alternating cycle NUV and darkness (12/12 hrs). On the 8 day the seed were examined and the incidence of seeds borne fungi was recorded.

3.6Agar Test:

Sorghum seeds sample were first pretreated by 5% sodium hypochlorite for 5 minutes, washed 5 times with sterilized distilled water and dried between 2 filter papers.Each10 seeds were plated in glass tube containing potato dextrose Agar medium

(PDA) the plates were then incubated at 28C^o for 7 days on the 8 days the seeds were examined under stereoscopic binocular and compound microscope.

3.7Soil Inoculation:

The soil was autoclaved at 70 C^o for 20 minutes and pressure of 15 pars /$inch^3$ and left to be aerated. The inoculum was thoroughly mixed with the soil and left to multiply for three days. The seeds of sorghum bicolor treated by sodium hypochlorite (1% available chlorine) for five minutes and then washed five time in sterilized distilled water and sown at the rate of 7 seeds/ plastic bag. The plastic bags were irrigated at intervals . Three replicates were made for each variety . Plastic bags containing ste. The plastic bags were irrigated at intervals rilized soil only were sown with treated seed as served as control.

The plastic bags were kept in the glass house for a period of 2 weeks. Observations were recorded daily on weekly starting from seed germination to mature seed lings.

3.8Grown on test:

This test was carried out in the laboratory in plastic cups diameter (5 inch) on mixed soil and 75% and Gurar 25%.The seeds were irrigated at intervals of two days. The sown seeds of sorghum cultivars were surface sterilized by sodium hypochlorite for five minutes and then washed five times in sterilized distilled water and seven seeds were sown in each cup. Seeds and seedlings were observed every day to detect seed born fungi. After a 3 week blotter tests of leaves and roote was carried out. This test was reported after 21 days. The isolated fungi were maintained on (PDA) medium in pure culture to be identified.

CHAPTER FOUR

RESULTS

4.1Detection and isolation of seed-borne fungi dry seed inspection:

Nine cultivars of sorghum of season 2010-2011 were examined. The results showed the percentage of pure healthy and unhealthy, discolored and damaged as shown in T able(1).

4.2The Blotter & Cotton test:

Each of the two hundred seed cultivars tested were treated by Sodium hypochorite (1%) this treatment exuded all the saprophytic fungi carried on the surfaces of seeds.

In this test the following fungi were detected *Fusarium oxysporum*, *Drechslera spicifera*, *Aspergillus flavus*, *Aspergillus niger*, *Rhizopus nigricans, Penicilium digitatum* and *Macrophomina phaseolina*. (Plate No (3))

4.3The Agar test:

Sorghum seed cultivars (Mugud ahmer, Wad ahmed, Akar, Arfaa Gadamic, Hageen, Tetron, Feterita and Tabet) she in using the agar plate method,in this test the following fungi were detected (*Fusarium oxysporum*, *Drechslera spicifera*, *Aspergillus flavus*, *Aspergillus niger*, *Rhizopus nigricans, Penicillum digitatum* and *Macrophomina phaseolina*.

4.4 Single spore culture:(M&M)

In the single spore culture technique after isolation, the fungus was kept in slant culture on PDA medium in Mc cartney bottle for preservation for further Studies. (Plate No (5&6))

4.5The grown on test :(M&M)

Growing on test was accomplished according to seed health test rules.

The seed were sown in plastic bottle successively every 7 days.

The results revealed that the symptoms produced from artificial inculcations were seed rot bre-and post- emergence damping off as well leaf spots. (Plate No (4)).

4.6 PhathogenicityTests

The infected seedling, Dead Seedling and seed every three days to trace the symptoms developed on these infected seedlings, dead seedling and dead seed as shown in diffract percentage in Plate No(7-15)

The fungi *Macrophomina phaseolina*, recorded the highest incidence 26.6% in cultivars Wad ahmed and the least incidence 6.6% in cultivars Hageen. Wad ahmed and Arfaagamac the highest bos- emergence damping off was 40% in cultivar Daber and the least incidence 20% in cultivars Wad ahmed. Wad akar and Arfaa gadamac.

For symptoms development the highest Arfaa gadamac 26.6% and the least incidence was 6.6% in cultivars Daber and Fatarita.

For *Drechslera spicifer*, the highest incidence for seed rot and pre-emergence damping off was 33.3% for Wad akar arfaaga gadmac and the least incidence in cultivars Daber

For symptoms development the highest incidence was 20% in Wad ahmed, Arfaagadamac Fatarata, Tabet and the least incidence was 6.6% in cultivar Daber.

Table (1):Numbers & Per`centage of Different categories of the cultivars tested (Dry inspection: (200 seeds for each cultivar tested)

Cultivars	Healthy		Unhealthy			
	Normal seeds	%	Discolored seeds	%	Damaged seeds	%
Mugudahmer	153	76.5%	35	17.5%	12	6%
Wad ahmed	165	82.5%	18	9%	17	8.5%
Wad akar	184	92%	10	5%	13	6.5%
Arfaa Gadamic	176	88%	24	12%	0	0%
Hageen	165	82.5%	35	17.5%	0	0%
Tetron	199	99.5%	1	0.5%	0	0%
daber	177	88.5%	9	4.5%	14	7%
feterita	177	88.5%	5	2.5%	18	9%
Tabet	163	81.5%	35	17.5%	2	1%

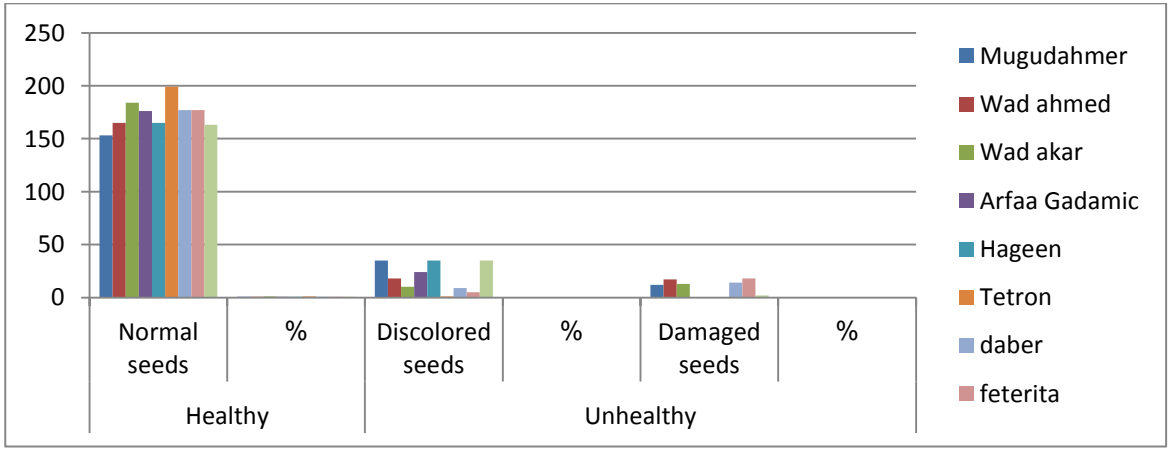


Figure (1): Categries of Dry inspection test

Table (2). Degree &percentage of infection compared to control in Mugud ahmer sample

symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	4	26.6%	3	20%	2	13.3%	0	0	0
Macrophomina phaseolina	4	26.6%	3	20%	3	20%	0	0	0
Penicillium.digitatum	5	33.3%	2	13.3%	4	26.6%	0	0	0
Fusariumoxysporum	5	33.3%	2	13.3%	5	33.3%	0	0	0

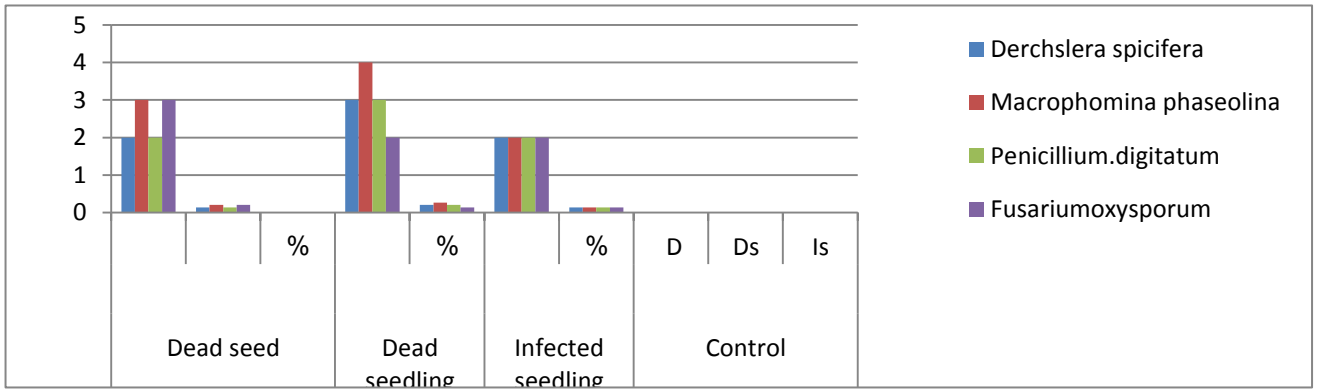


Figure (2). Degree &percentage of infection compared to control in Mugud ahmer sample

Table (3): Degree &percentage of infection compared to control in Wad ahmed sample

Symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	2	13.3%	3	20%	2	13.3%	0	0	0
Macrophomina phaseolina	3	20%	4	26.6%	2	13.3%	0	0	0
Penicillium.digitatum	2	13.3%	3	20%	2	13.3%	0	0	0
Fusariumoxysporum	3	20%	2	13.3%	2	13.3%	0	0	0

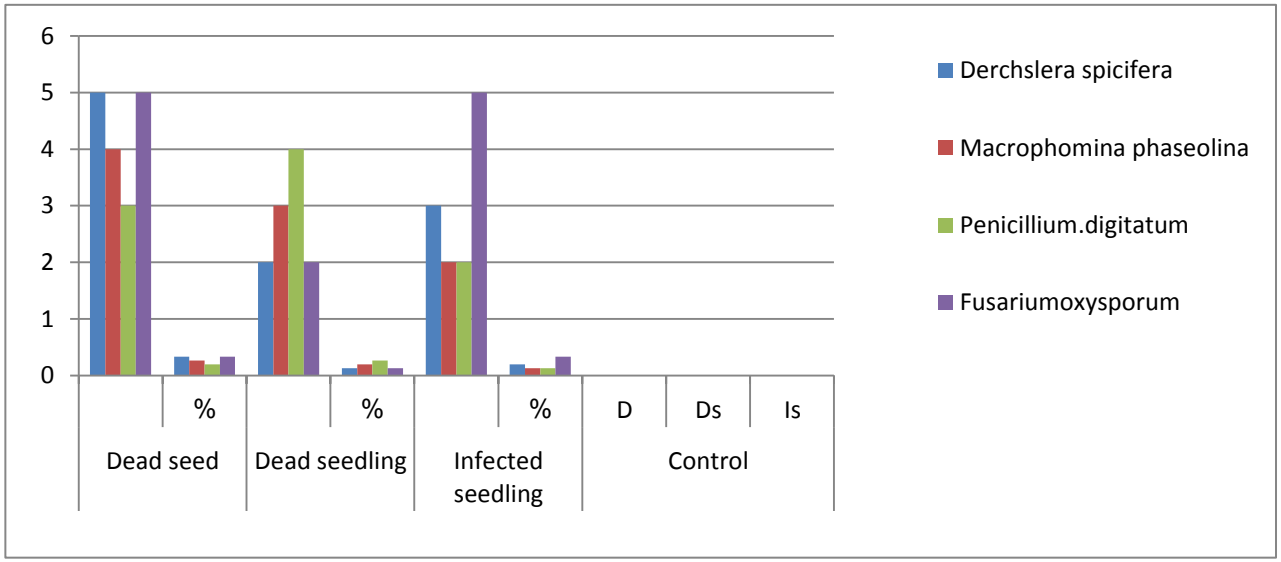


Figure (3). Degree &percentage of infection compared to control in Wad ahmed sample

Table(4): Degree &percentage of infection compared to control in Wad aKar sample:

symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	5	33.3%	2	13.3%	3	20%	0	0	0
Macrophomina phaseolina	4	26.6%	3	20%	2	13.3%	0	0	0
Penicillium.digitatum	3	20%	4	26.6%	2	13.3%	0	0	0
Fusariumoxysporum	5	33.3%	2	13.3%	5	33.3%	0	0	0

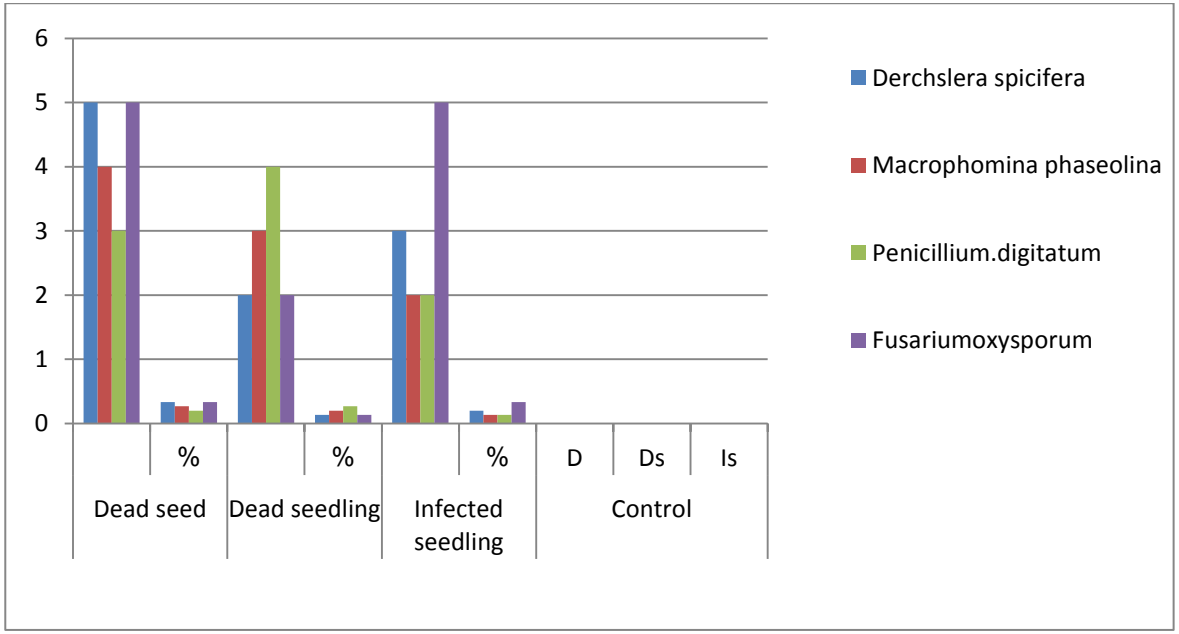
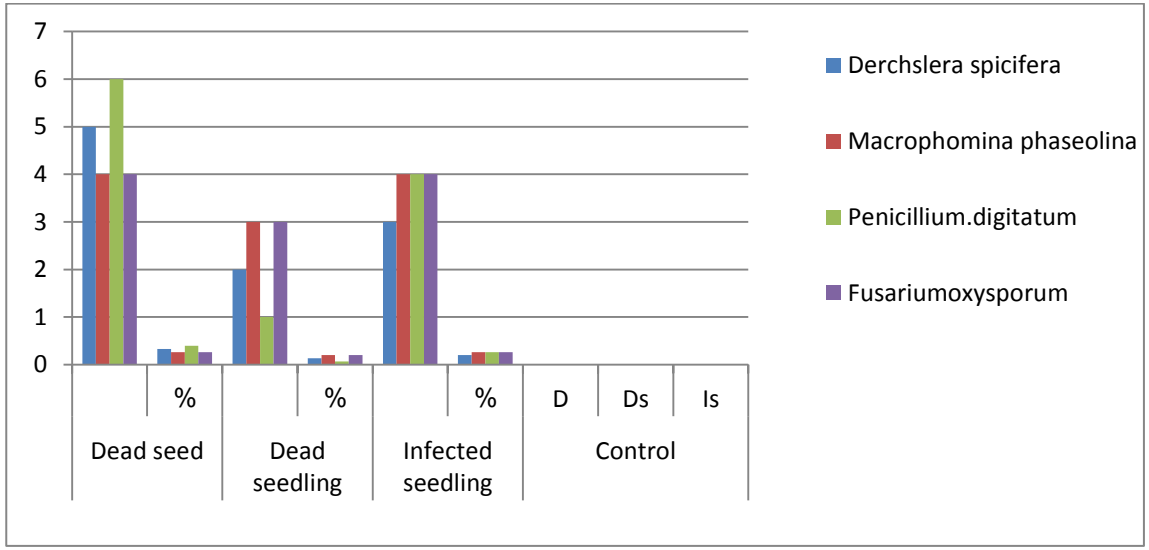


Figure 4. Degree &percentage of infection compared to control in aKar sample

Table 5: Degree &percentage of infection compare to control in Arfaa Gadamic sample:

symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	5	33.3%	2	13.3%	3	20%	0	0	0
Macrophomina phaseolina	4	26.6%	3	20%	4	26.6%	0	0	0
Penicillium.digitatum	6	40%	1	6.6%	4	26.6%	0	0	0
Fusariumoxysporum	4	26.6%	3	20%	4	26.6%	0	0	0



Figure(5): . Degree &percentage of infection compare to control in Arfaa Gadamic sample

Table 6: Degree &percentage of infection compared to control in Hageen sample:

symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	4	26.6%	3	20%	2	13.3%	0	0	0
Macrophomina phaseolina	1	6.6%	5	33.3%	1	6.6%	0	0	0
Penicillium.digitatum	3	20%	4	26.6%	2	13.3%	0	0	0
Fusariumoxysporum	5	33.3%	2	13.3%	4	26.6%	0	0	0

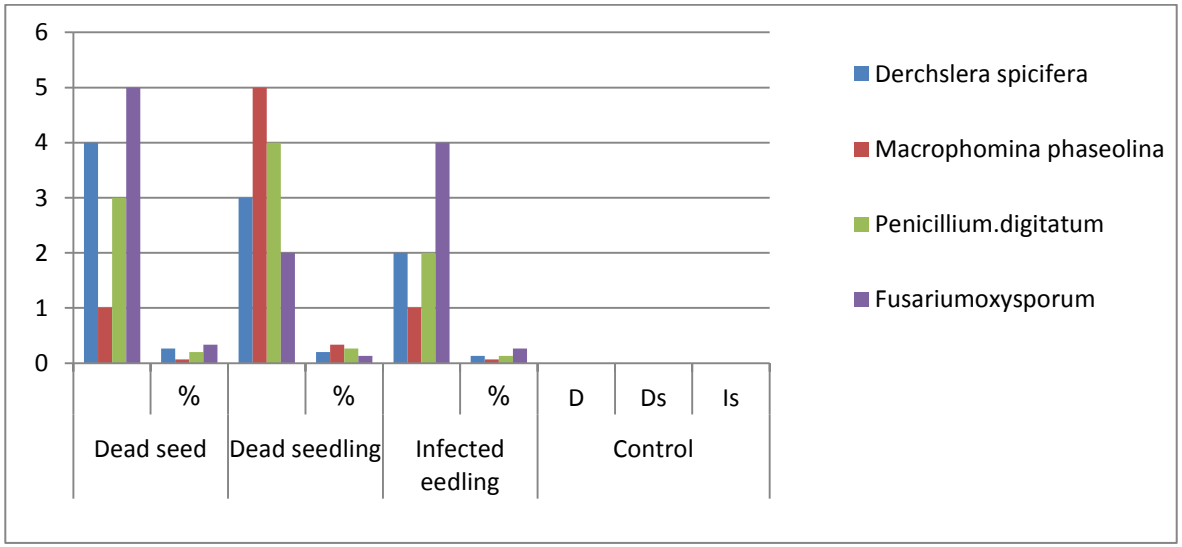


Figure 6: Degree &percentage of infection compared to control in Hageen sample

Table 7: Degree &percentage of infection compared to control in Tetron sample:

symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	3	20%	4	26.6%	2	13.3%	0	0	0
Macrophomina phaseolina	3	20%	4	26.6%	2	13.3%	0	0	0
Penicillium.digitatum	6	40%	1	6.6%	5	33.3%	0	0	0
Fusariumoxysporum	5	33.3%	2	13.3%	4	26.6%	0	0	0

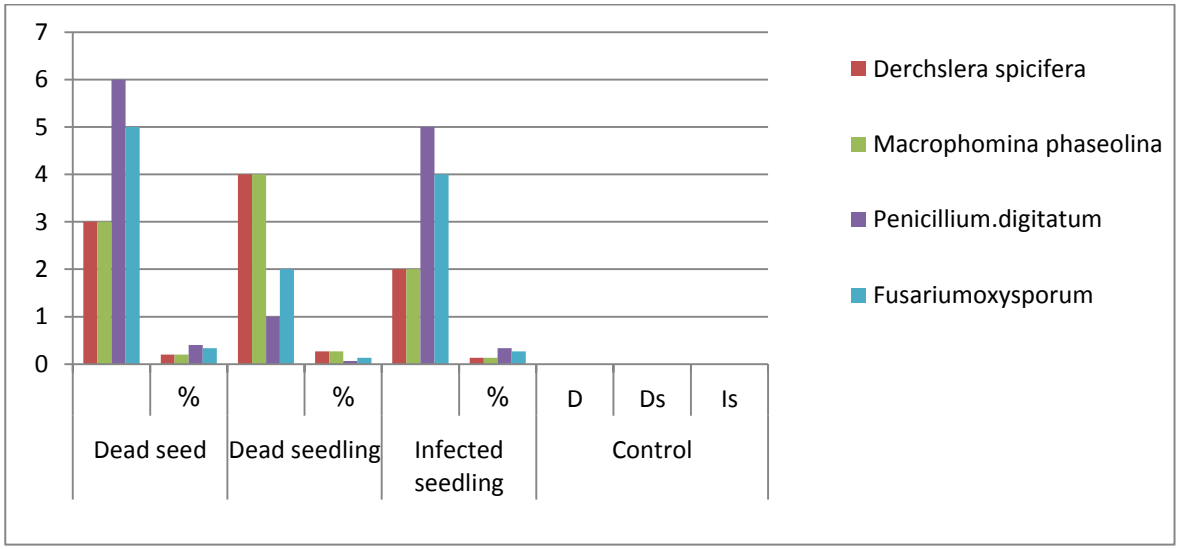


Figure 7: Degree &percentage of infection compared to control in Tetron sample

Table 8: Degree &percentage of infection compared to control in daber sample:

symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	1	6.6%	6	40%	1	6.6%	0	0	0
Macrophomina phaseolina	2	13.3%	6	40%	2	13.3%	0	0	0
Penicillium.digitatum	0	0%	0	0%	0	0%	0	0	0
Fusariumoxysporum	4	26.6%	3	20%	4	26.6%	0	0	0

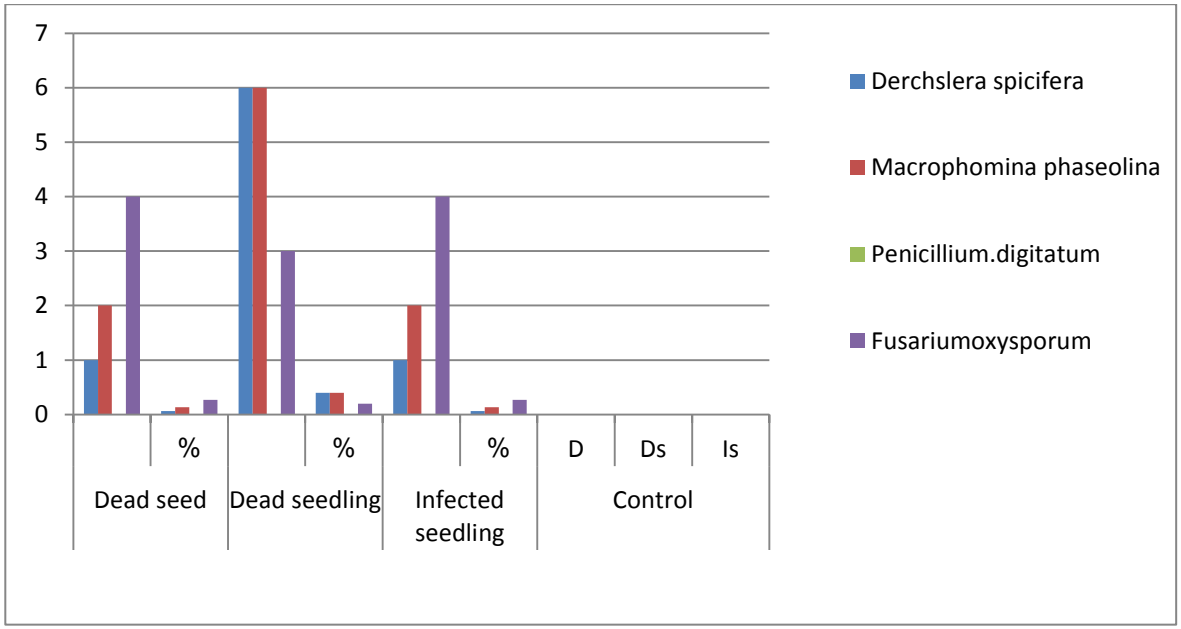


Fig ure 8. Degree &percentage of infection compared to control in daber sample

Table 9: Degree &percentage of infection compared to control in feterita sample:

symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	5	33.3%	2	13.3%	3	20%	0	0	0
Macrophomina phaseolina	2	13.3%	5	33.3%	2	13.3%	0	0	0
Penicillium.digitatum	3	20%	4	26.6%	1	6.6%	0	0	0
Fusariumoxysporum	4	26.6%	3	20%	4	26.6%	0	0	0

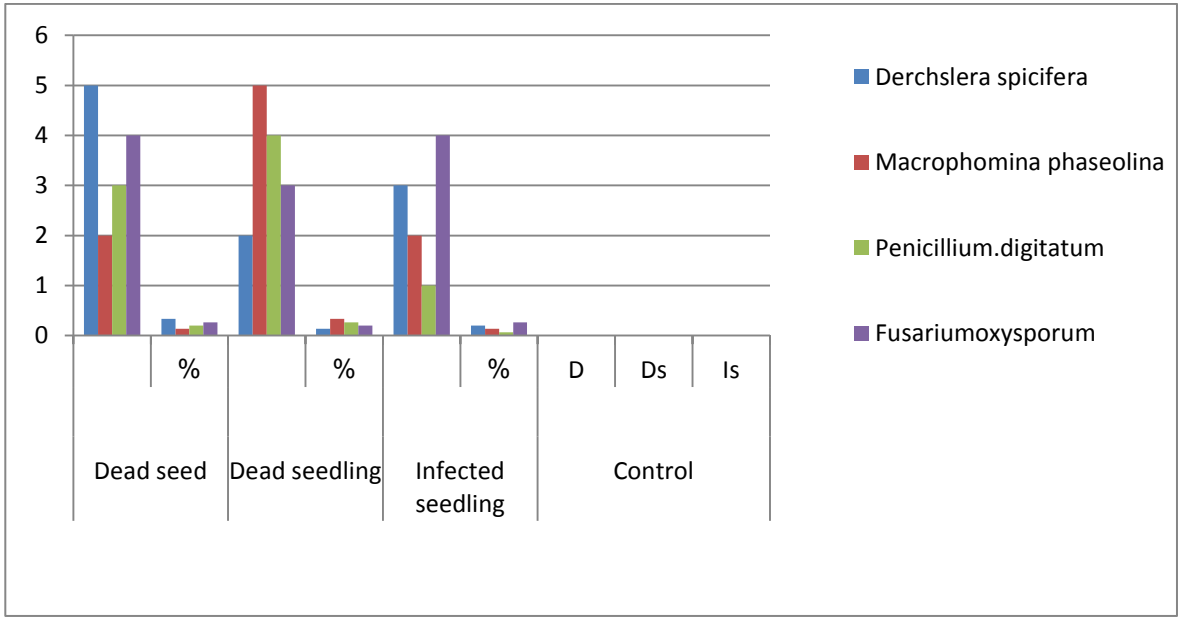


Figure 9: Degree &percentage of infection compared to control in feterita sample

Table 1: Degree &percentage of infection compare to control in Tabet sample:

Symptoms / Fungi	Dead seed		Dead seedling		Infected seedling		Control		
		%		%		%	D	Ds	Is
Derchslera spicifera	4	26.6%	3	20%	3	20%	0	0	0
Macrophomina phaseolina	3	20%	4	26.6%	1	6.6%	0	0	0
Penicillium.digitatum	5	33.3%	2	13.3%	3	20%	0	0	0
Fusariumoxysporum	5	33.3%	2	13.3%	4	26.6%	0	0	0

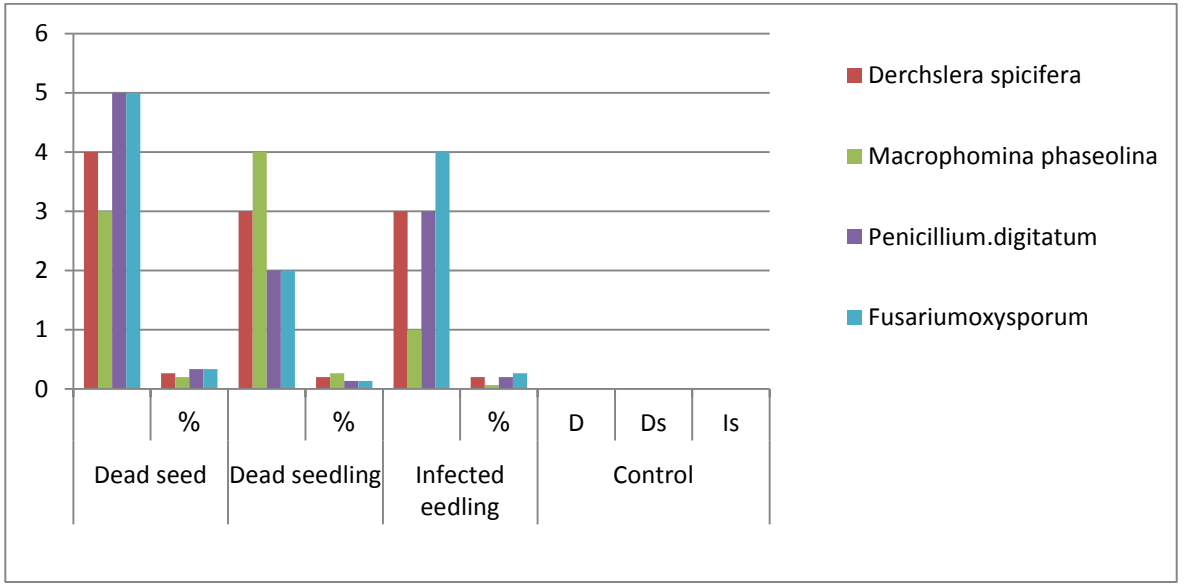


Figure 1: Degree &percentage of infection compare to control in Tabet samp

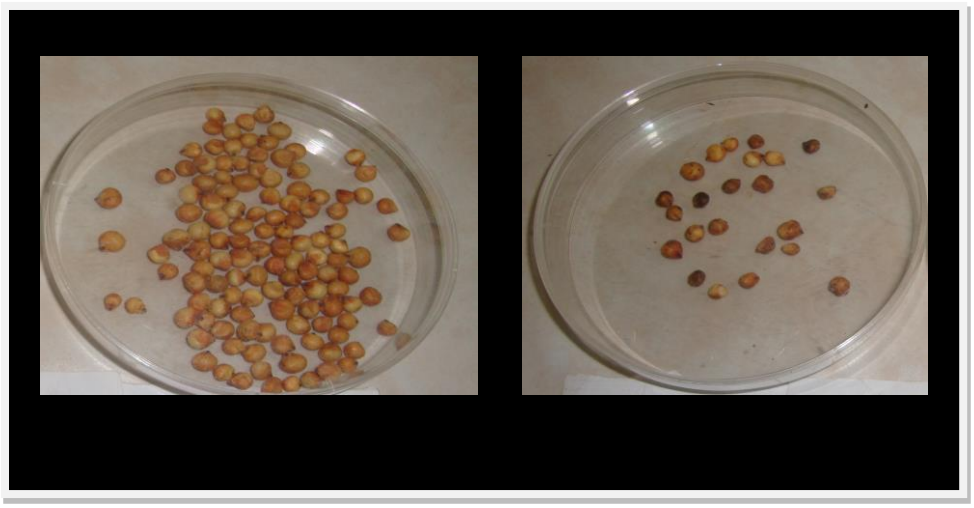
For *Fusarum oxysporum* the highest pre emergence damping off was33.3% in cultivars Tabet, Tetron, Hageen, Wadahmed and Arfaa gadamac

And the least was 13.3% in cultivar Daber The highest post emergence damping off was 40 in Daber and the least incdence13.3% in cultivars Mugud ahmer, Hageenand Daber. For symptoms development the highest in cultivars Wad Ahmed 33.3% and the least mdence was 13.3% in cultivars Daber Hageen& Nugud ahmer.

For *Penicillum digitatum* the highest of seed rot 40 in cultivars Arfaa gadmac, Tetron and the least incidence was 20% in Hageen Wad Ahmed Fatarita the percentage of post emergence damping off was 26.6% in Wad Ahmed Fatarita Hageen and the least 6.6% in Arfaa gadamac and Tetron.

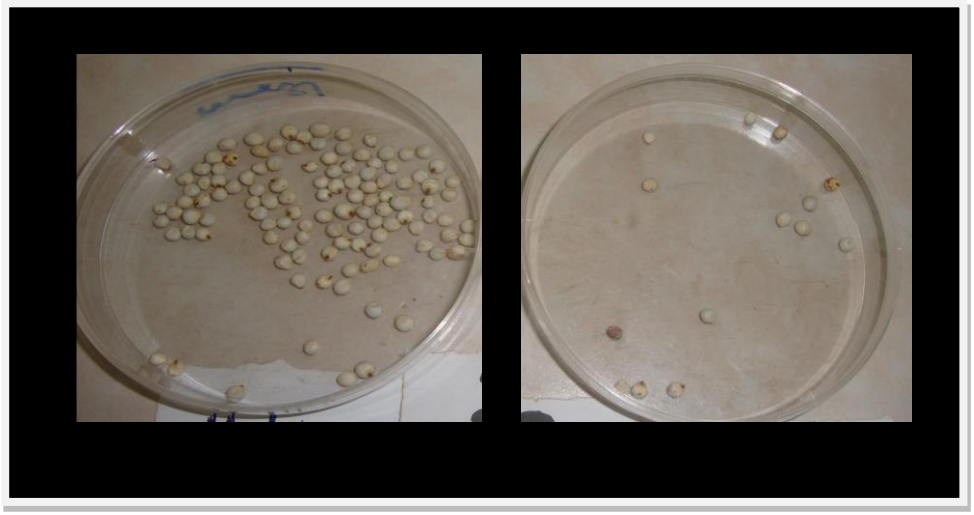
For symptoms development the gighest in Tetron 33.3% and the lest incidence was 6.6% in cultivars Fatarita.

Plate No: (1) Showing Dry Seeds Inspection



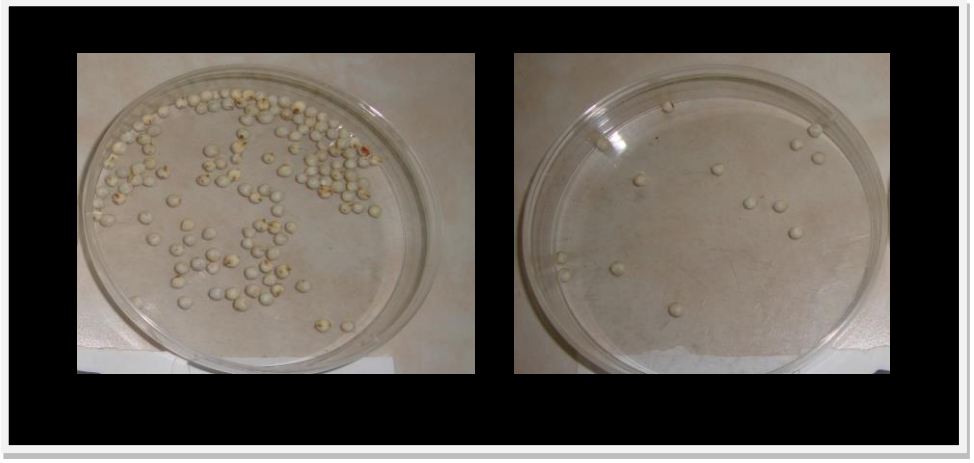
Healthy Seeds **Unhealthy Seeds**

Mugud Ahmar



Healthy Seeds **Unhealthy Seeds**

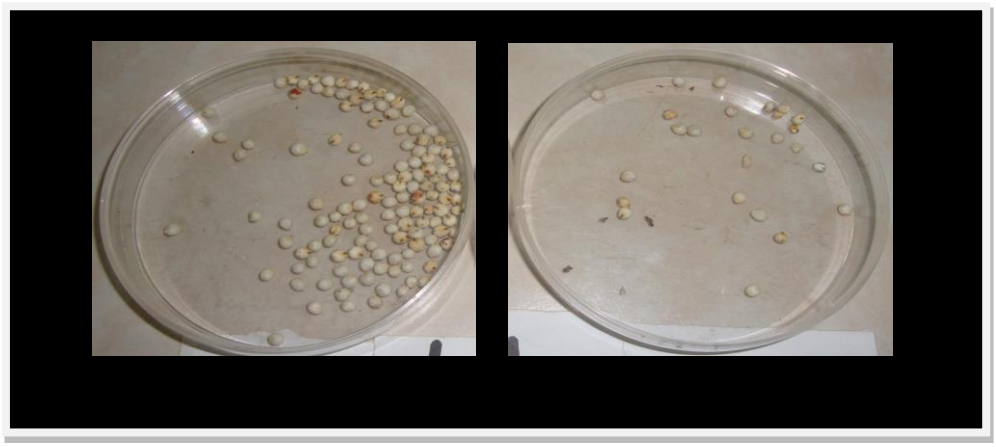
Wad Ahmed



Healthy Seeds **Unhealthy Seeds**

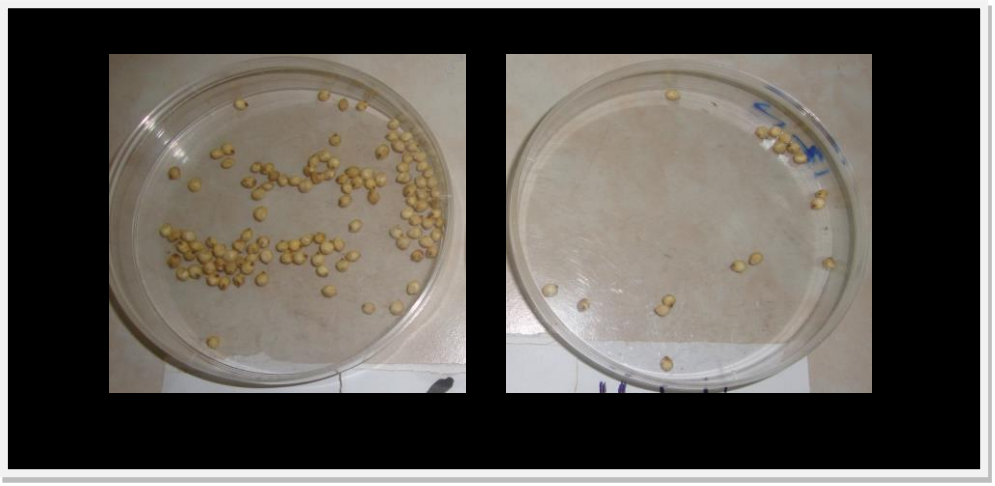
Wad akar

Plate No: (1) Showing Dry Seeds Inspection



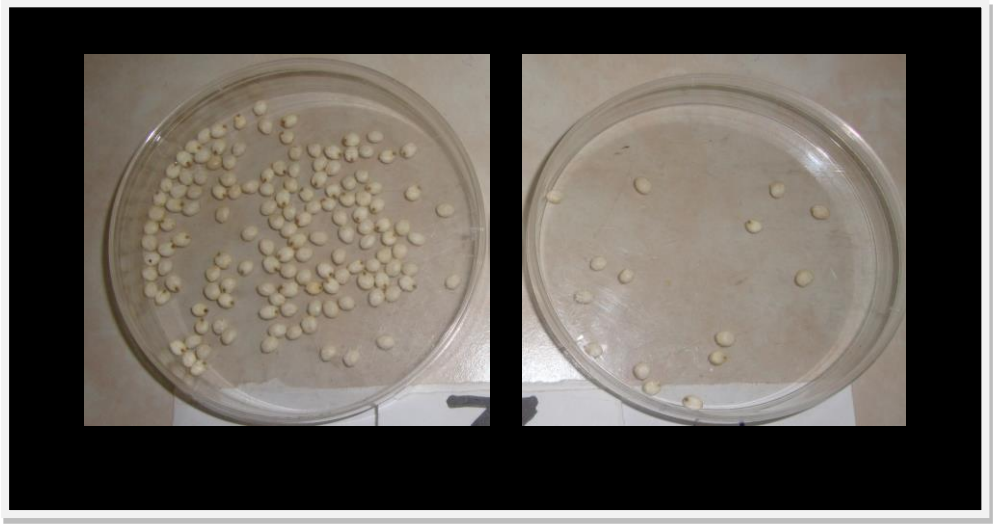
Healthy Seeds **Unhealthy Seeds**

Arfaa Gadamak



Healthy Seeds **Unhealthy Seeds**

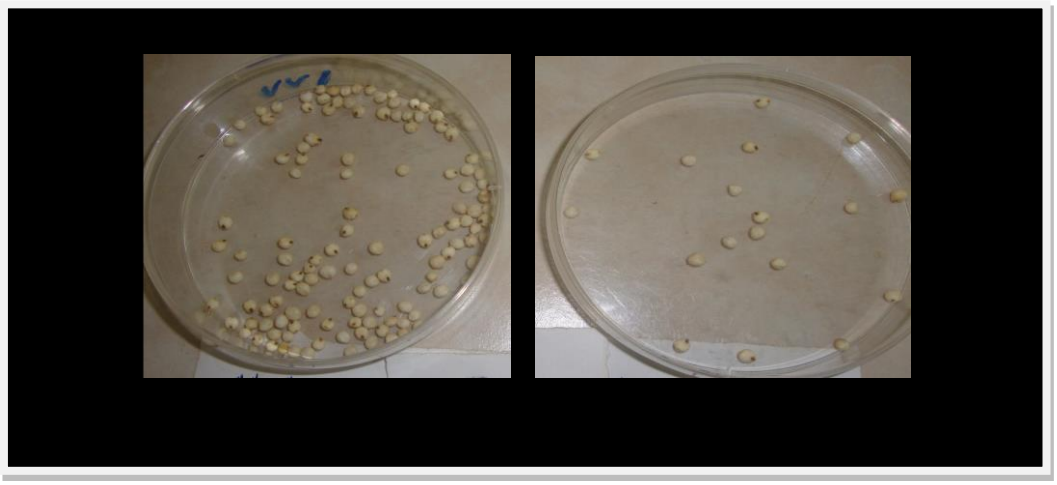
Hageen



Healthy Seeds **Unhealthy Seeds**

Tetroon

Plate No: (1) Showing Dry Seeds Inspection

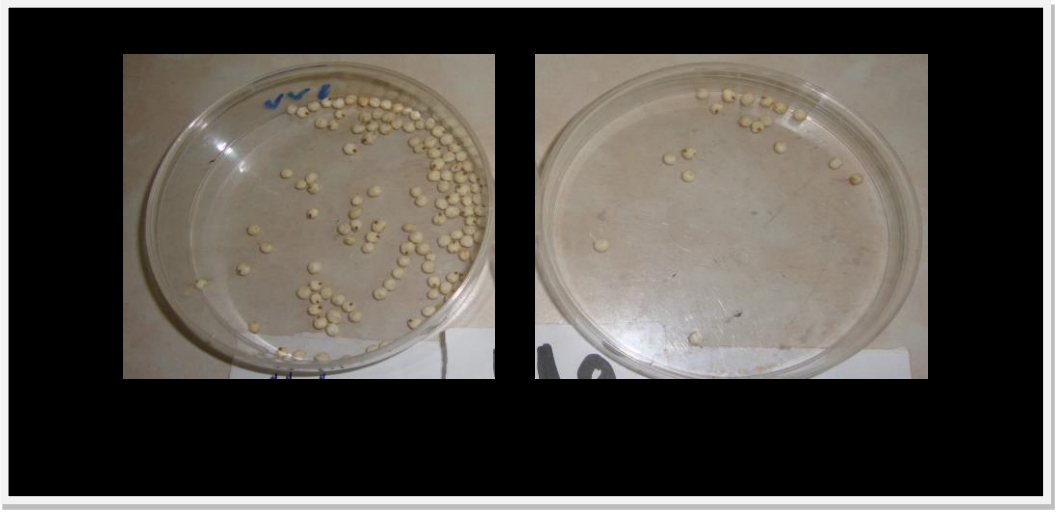


Healthy Seeds **Unhealthy Seeds**

Dabar

Healthy Seeds **Unhealthy Seeds**

Fatareta



Healthy Seeds **Unhealthy Seeds**

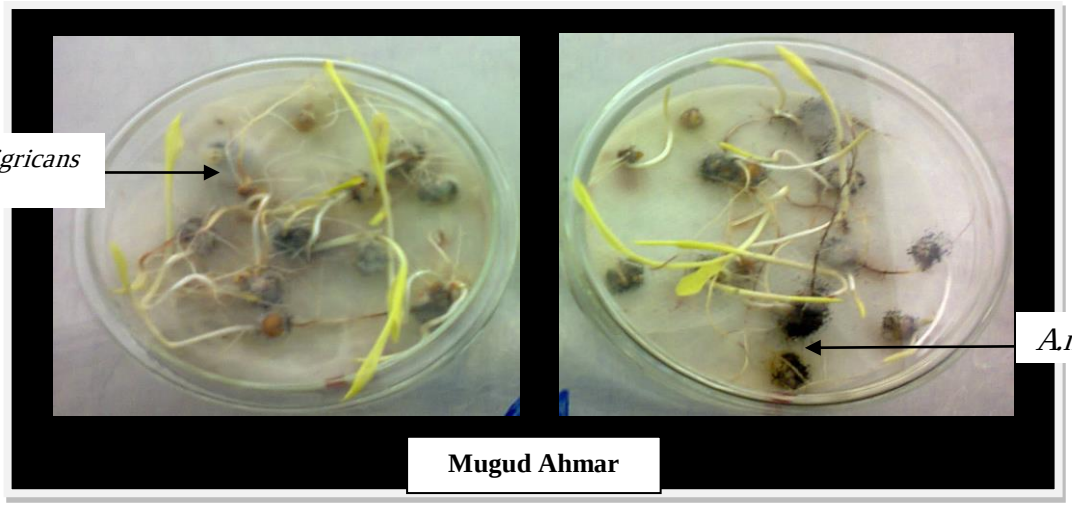
Tabet

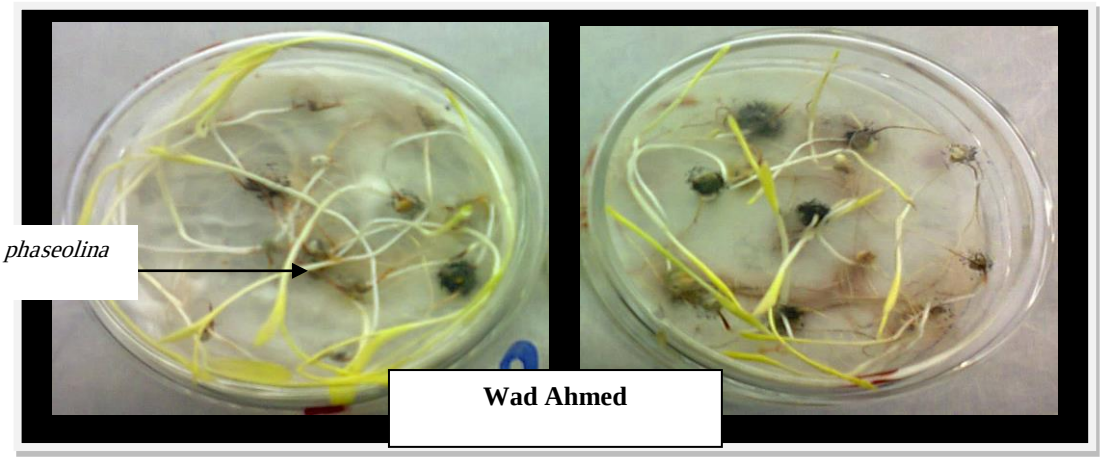
Plate (2): Showing Stages of Germination

Post-emergence Damping off

Control

Plate No (3) Showing Cotton & Plotter Metho





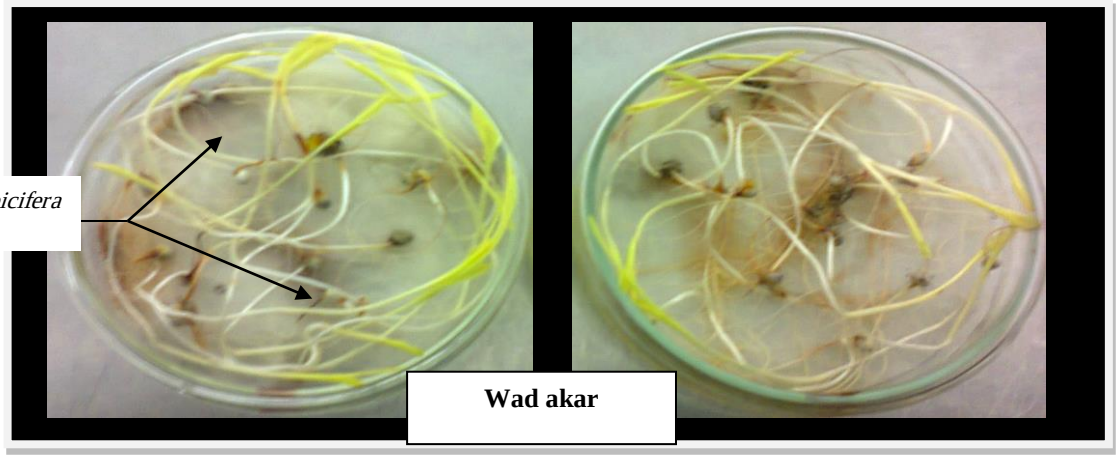
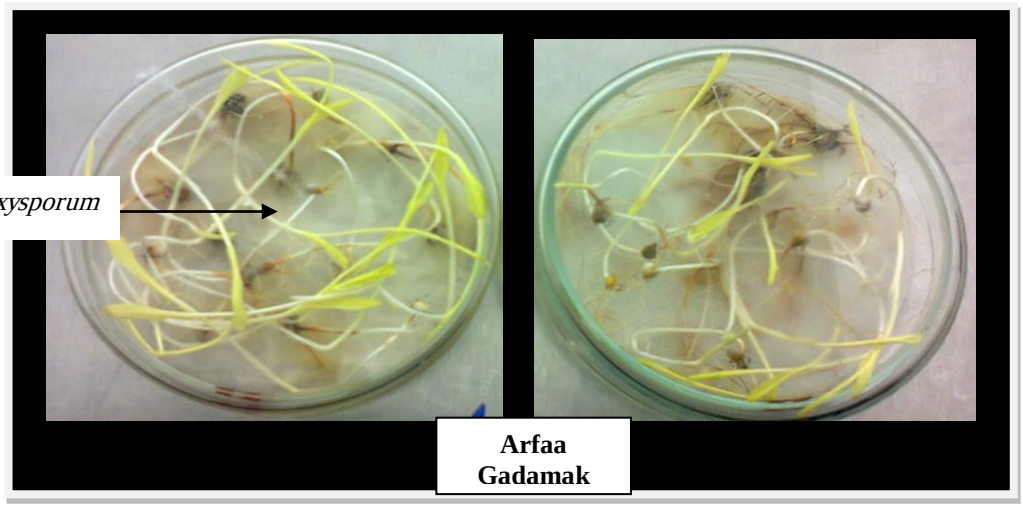
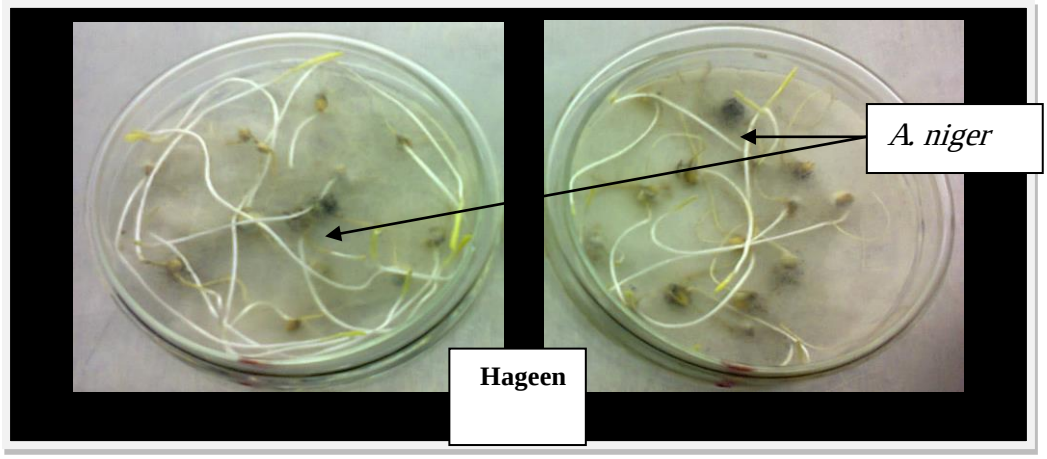


Plate No (4) Showing Cotton & Plotter Methods





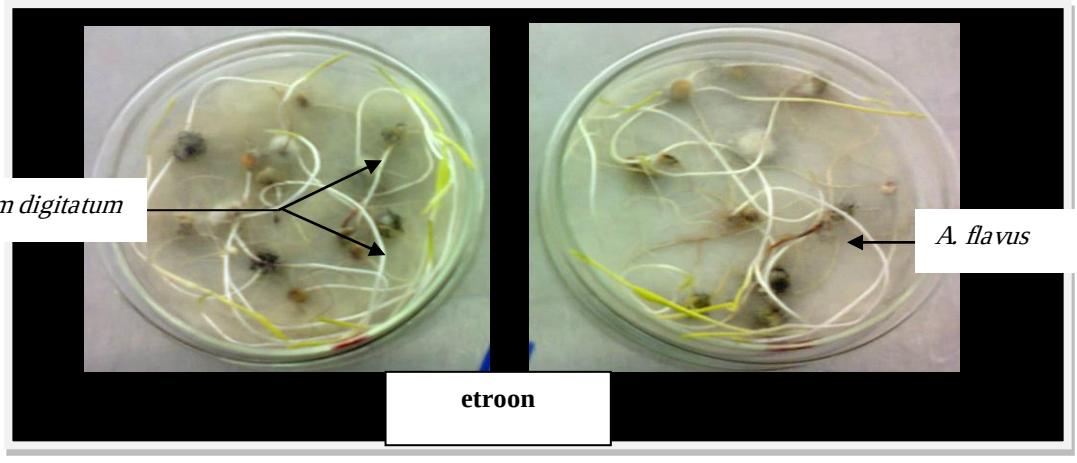
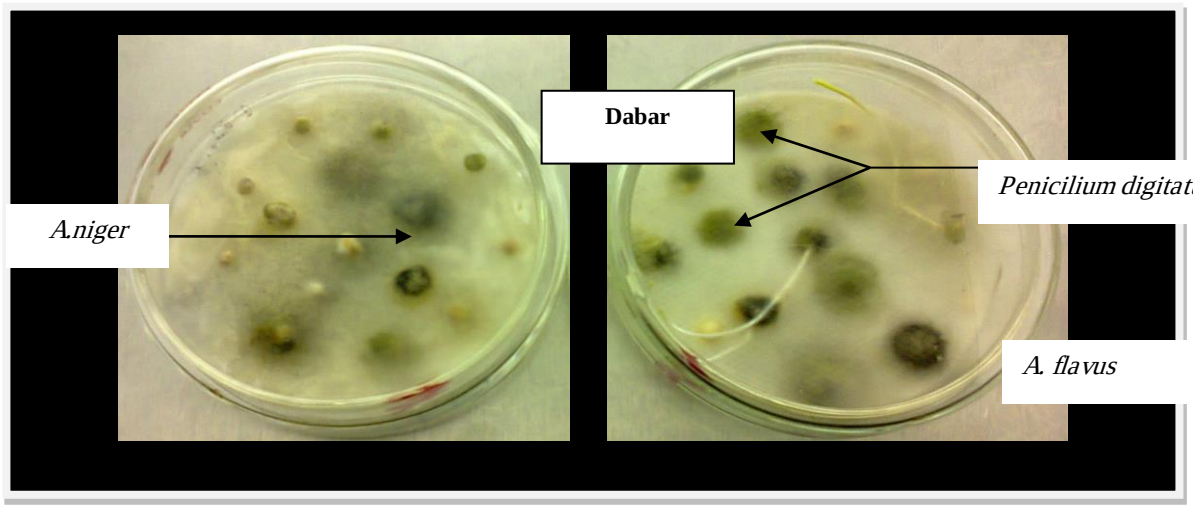


Plate No (5) Showing Cotton & Plotter Methods



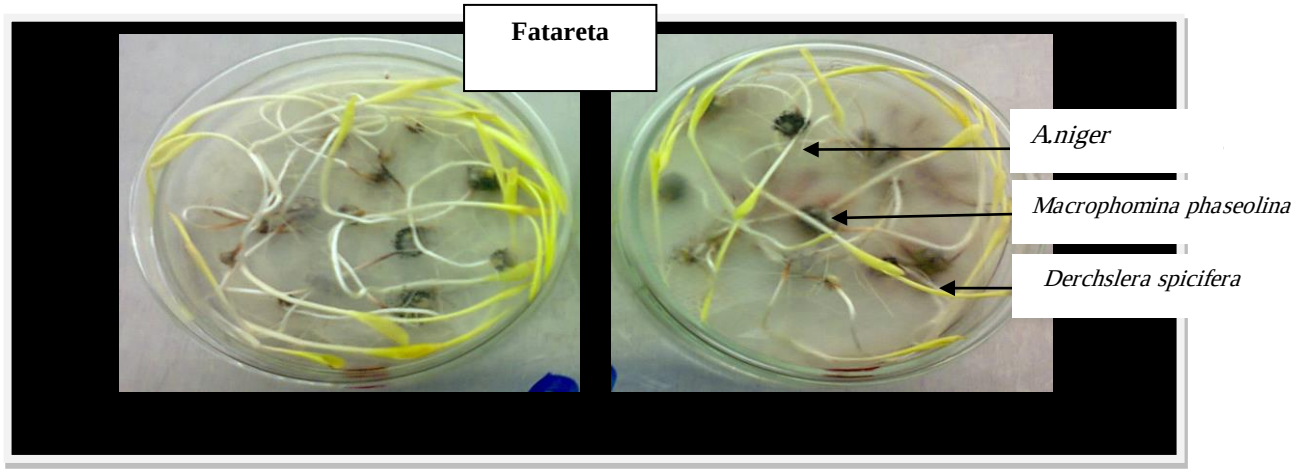
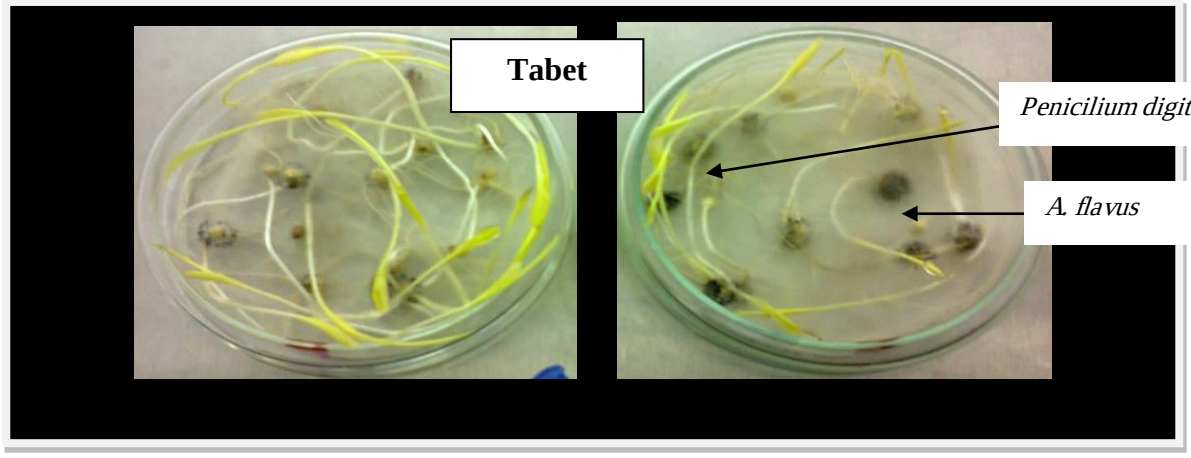
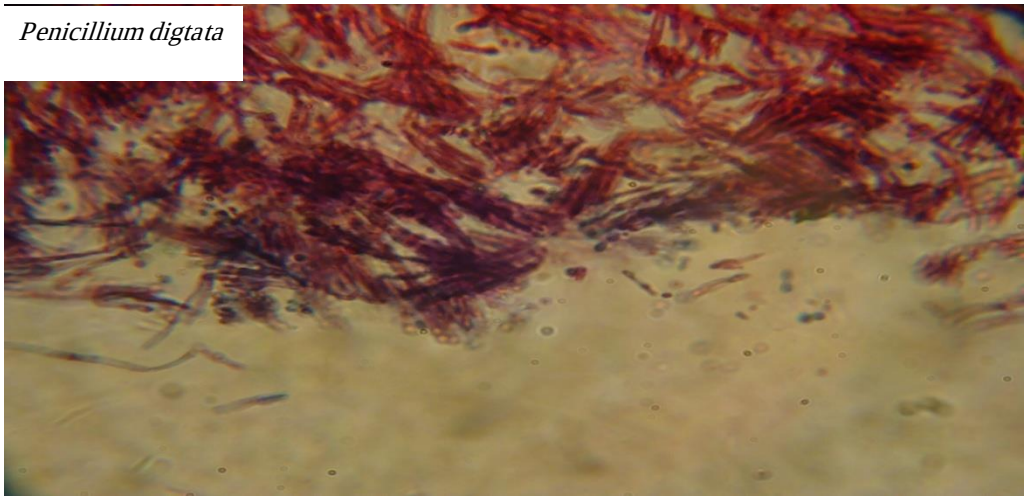


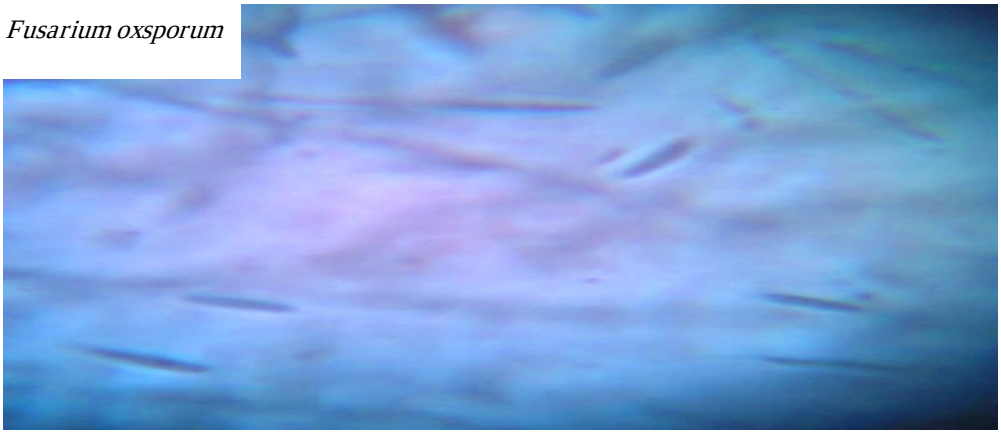
Plate (6): Showing Conidia & Conidiophores of different fungi



Penicillium digtata



Fusarium oxsporum



Rhizopus nigricans

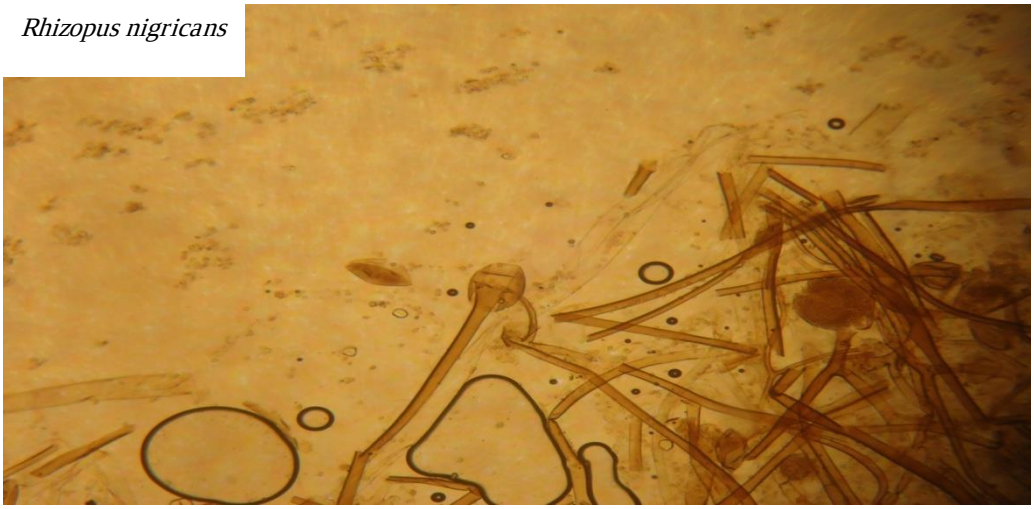
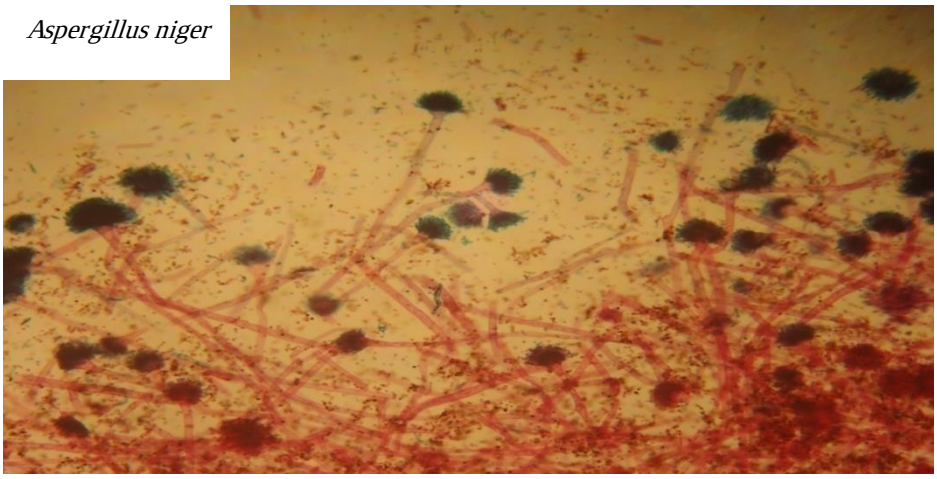


Plate (7): Showing Conidia & Conidiophores of different fungi

Aspergillus niger



Aspergillus flavus

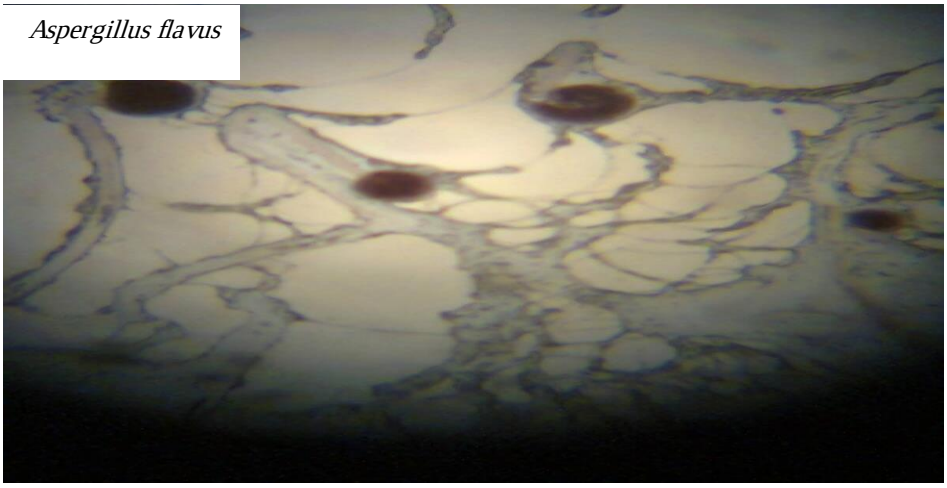
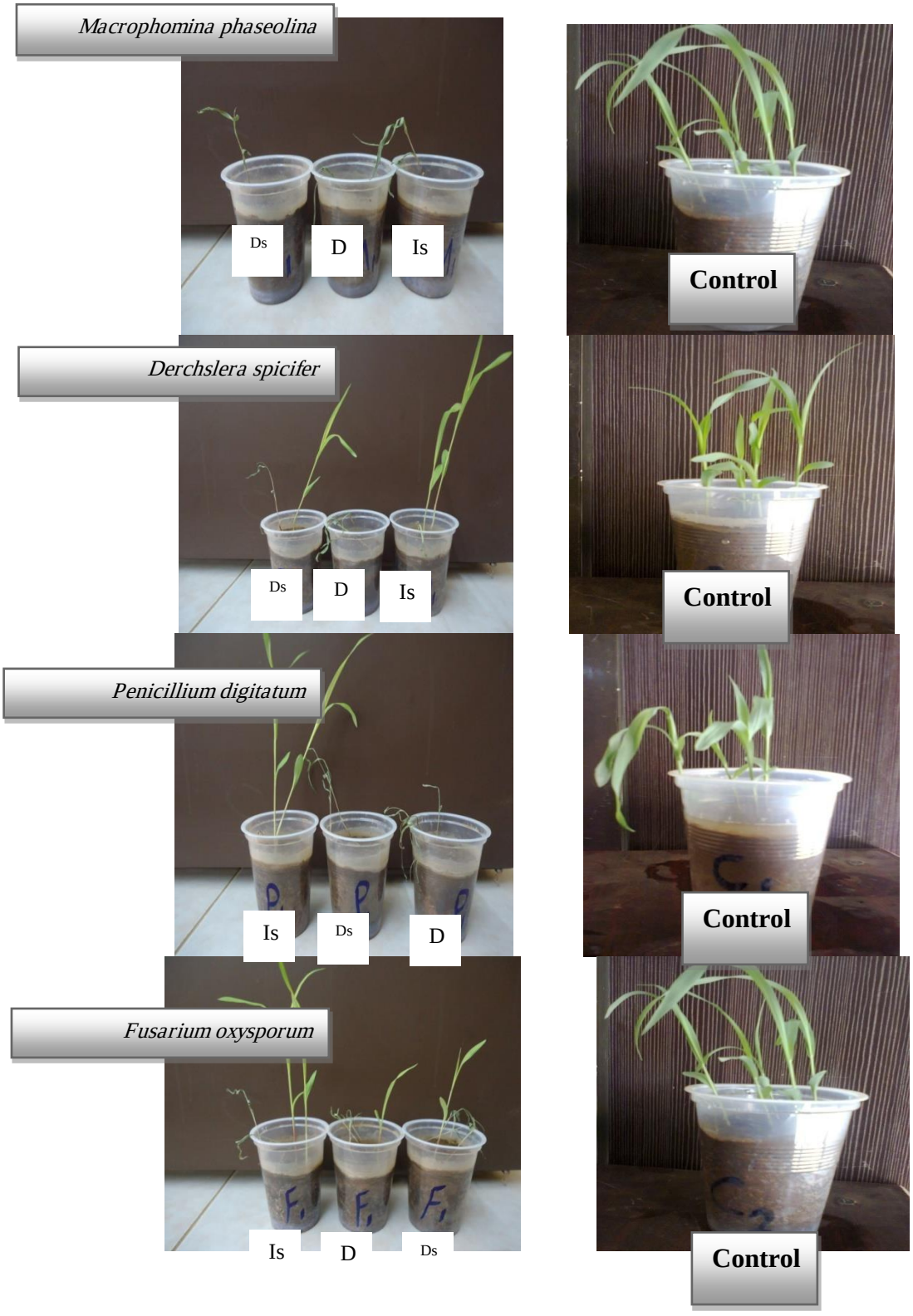


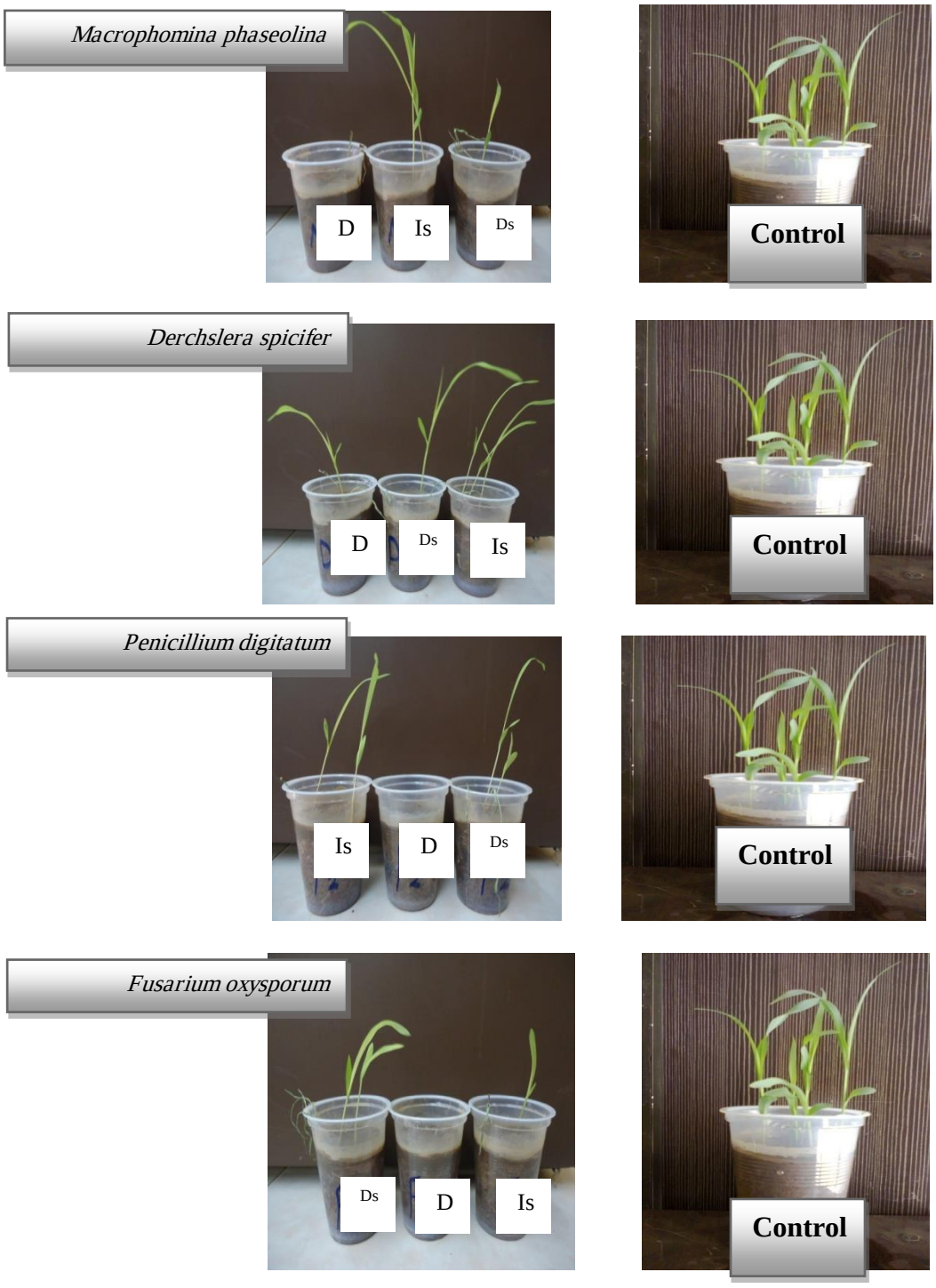
Plate No (8): Showing Incupation Fungi in Wheat media

Plate (9): Showing degrees of infection compared to control in Mugud ahmer sample:



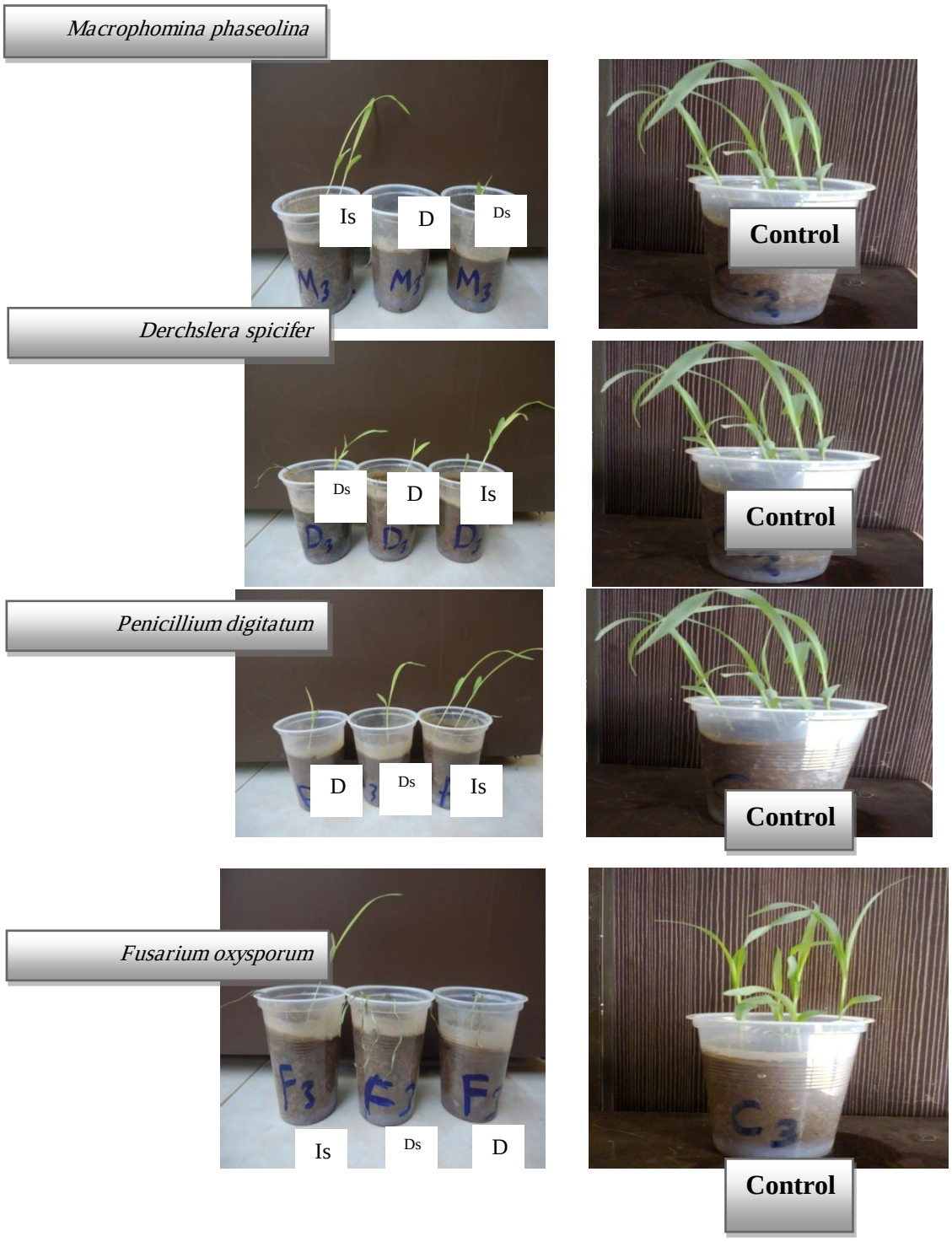
D= Dead Seed- D.s= Dead Seedling- I.s= Infected

Plate (10): Showing degrees of infection compared to control in Wad ahmed sample:



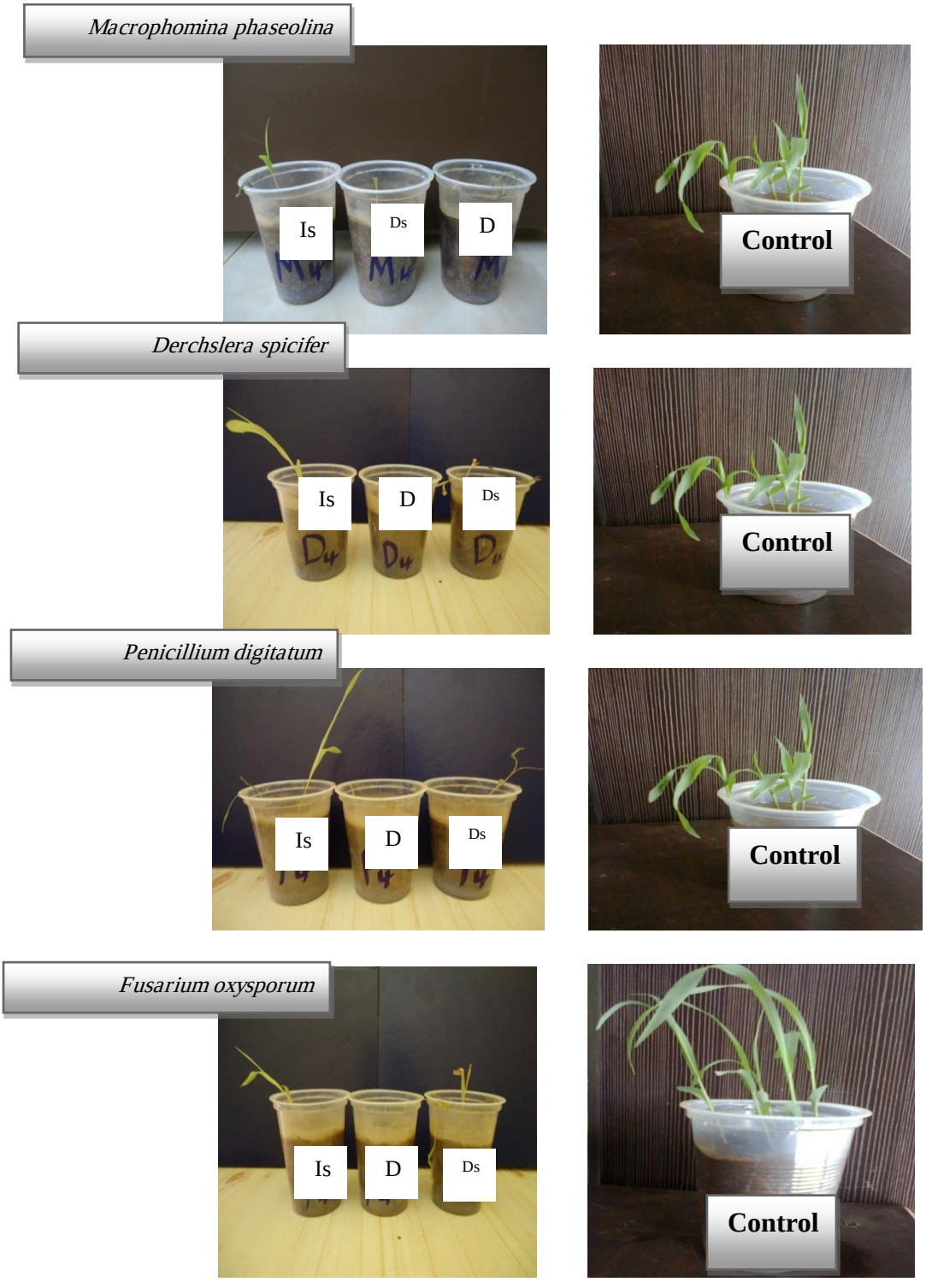
D= Dead Seed- D.s= Dead Seedling- I.s= Infected

Plate (11): Showing degrees of infection compared to control in Wad aKar sample:



D= Dead Seed- D.s= Dead Seedling- I.s= Infected

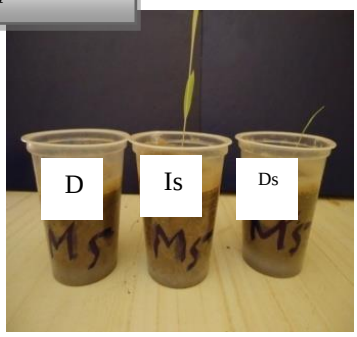
Plate (12): Showing degrees of infection compare to control in Arfaa Gadamic sample:



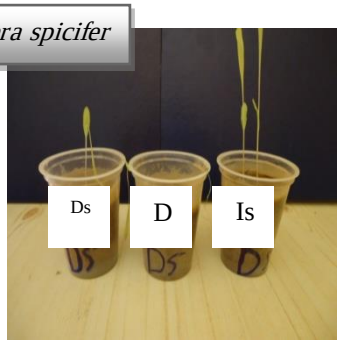
D= Dead Seed- D.s= Dead Seedling- I.s= Infected

Plate (13): Showing degrees of infection compared to control in Hageen

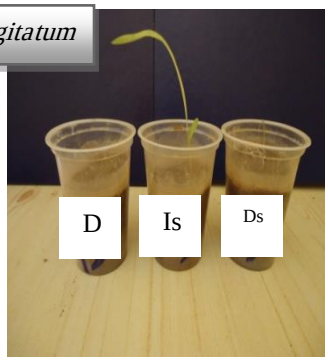
Macrophomina phaseolina



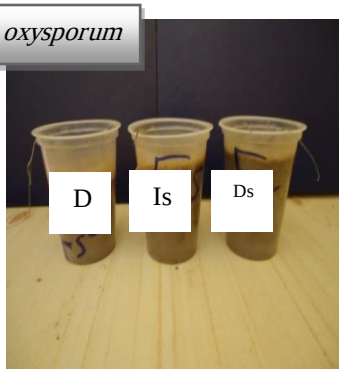
Derchslera spicifer



Penicillium digitatum

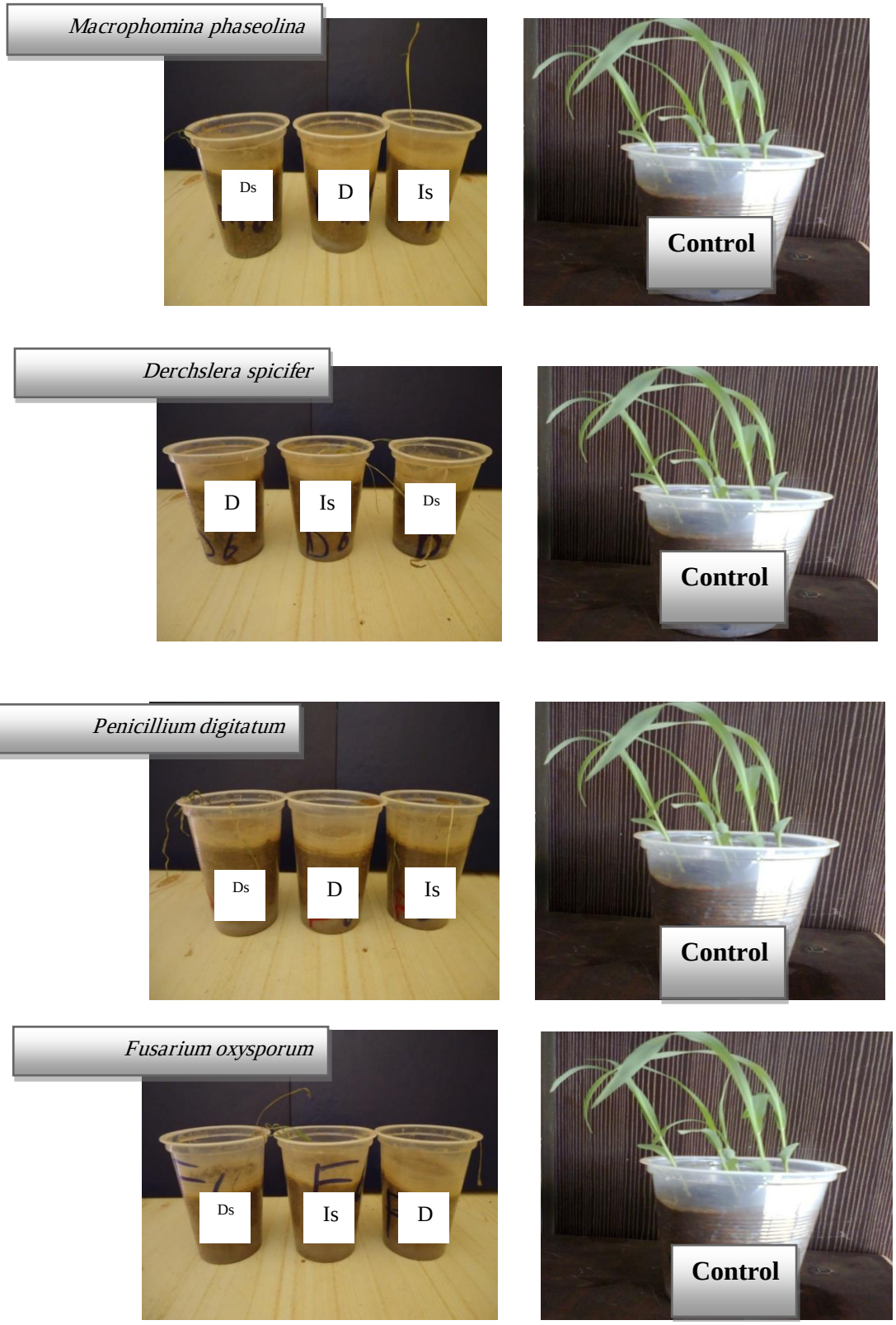


Fusarium oxysporum



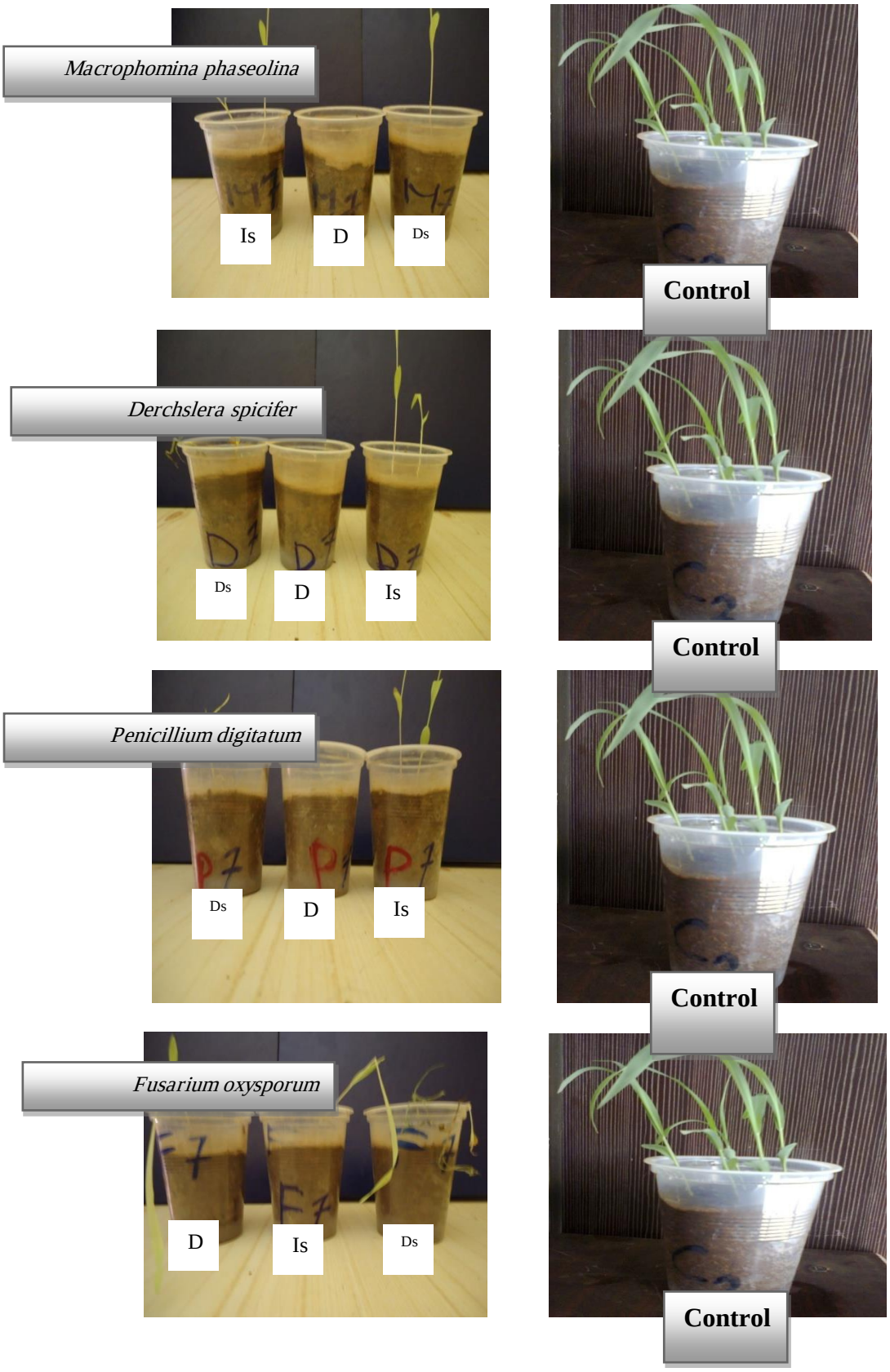
D= Dead Seed- D.s= Dead Seedling- I.s= Infected

Plate (14): Showing degrees of infection compared to control in Tetron sample:



D= Dead Seed- D.s= Dead Seedling- I.s= Infected

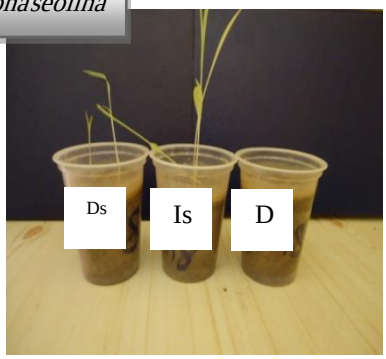
Plate (15): Showing degrees of infection compared to control in daber sample:



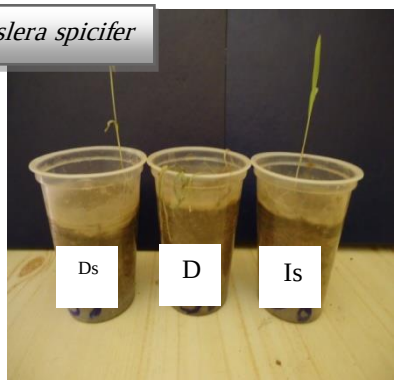
D= Dead Seed- D.s= Dead Seedling- I.s= Infected

Plate (16): Showing degrees of infection compared to control in feterita sample:

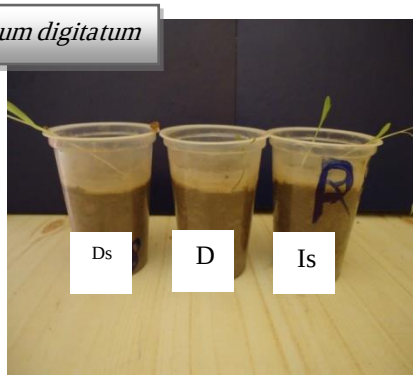
Macrophomina phaseolina



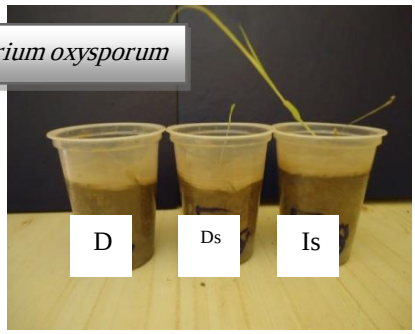
Derchslera spicifer



Penicillium digitatum

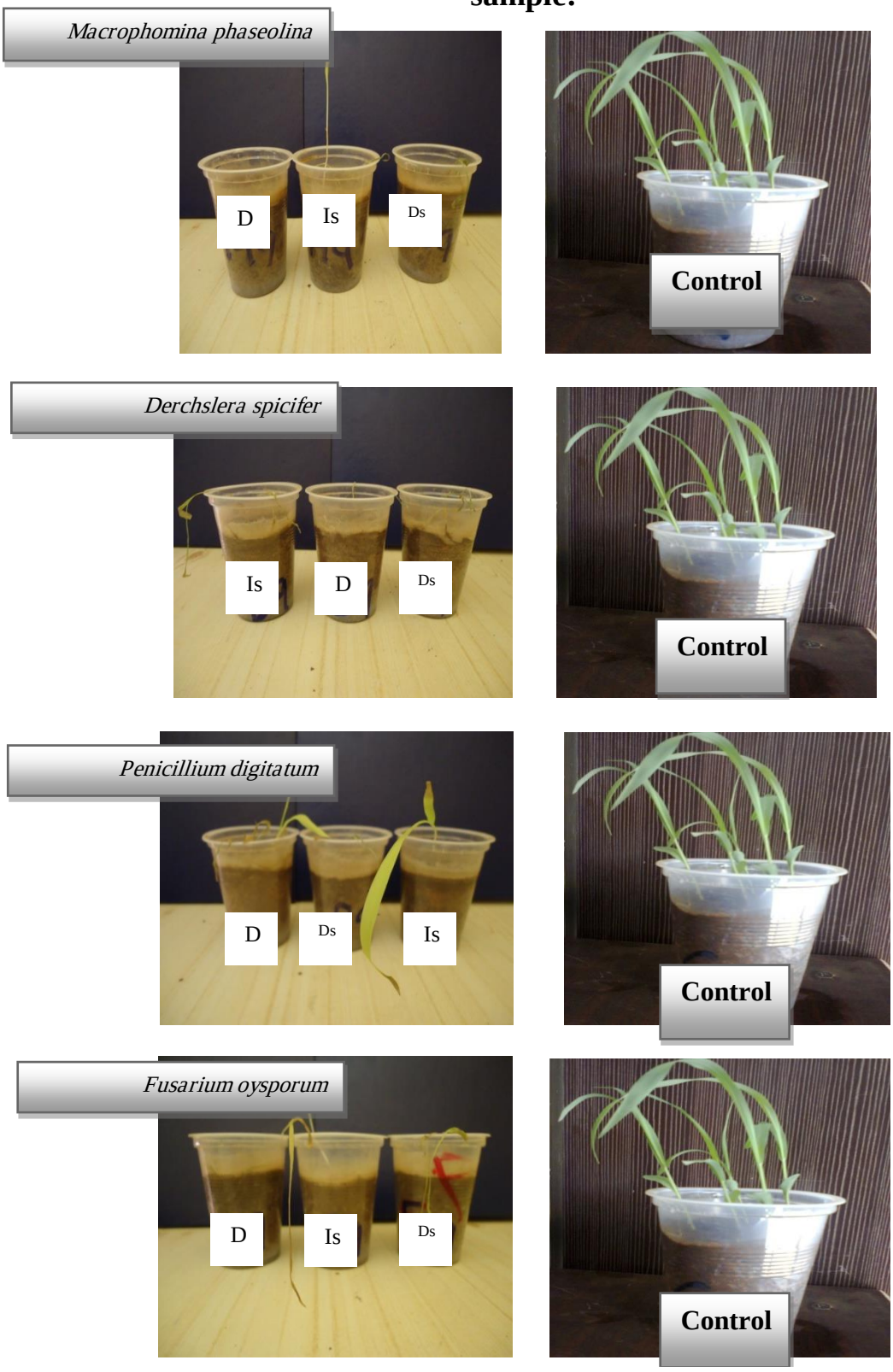


Fusarium oxysporum



D= Dead Seed- D.s= Dead Seedling- I.s= Infected

Plate (17): Showing degrees of infection compare to control in Tabet sample:



D= Dead Seed- D.s= Dead Seedling- I.s= Infected

Chapter Five

Discussion:

In the percent investigation seed health testing for nine cultivars of Sorghum bicolor L. was carried out according to ISTA rules (1966). The fungi isolated were *Penicillium digitatum*, *Fusarium oxysporum*, *Aspergillus niger*, A. *flavus*, *Rhizopus nigricans*, *Drechslera specifer* and *Macrophomina phasiolina*. This finding agree with Richardson (1979), Abdalla and Alhag (1974) and Elshafie and Webster (1982).

The blotter incubation method proved to be the best substrate for isolation of internally and extremely seed-borne fungi. This finding coincides with those reported by Fahim et.al. (1984) whom results yielded isolates of twenty fungal species most of which reduced germination of seeds. *Aspergillus spp*. were reported to be the most inhibitory to seed germination, (Kairman and Gambhim (1984), Btale & khare (1984). Also Abdalla and Kadhum (1987) reported that nine sorghum cultivars were associated with 38 species of fungi; Among which *Aspergillus niger and Aspergillus flavas* were detected by the blotter method. The present investigation is in line with those reports.

The results tabulated in table 6, 7,8 and 9 for the nine tested cultivars of sorghum revealed that the percentage of dead seeds was in the range of 26.6-40%. This result agree with Abdalla & Kadhum (1987), singh *et. al*. (1990) and Chavan and Raut (1990).

The dry inspection test for the samples of the nine tested cultivars revealed discoloration of sorghum grains at varying degrees. Zuwahu and Akaeshi (1992) recorded 14 fungi isolated from seeds. *Aspergillus flavus* and

Penicillium citrinum were the most frequent casuals of seed discoloration and reduced germination inability. Soman et. al (1993).

Future Recommendations

1- To eliminate seed borne diseases seed treatment is a must prior to sowing.

2- Seed Certification should be seed considered essential in production schemes.

3- Growing on test on small or large scale reffects seed health.

References:

Abd allah, M. H. and Elhag, A. D. (1974). Studies on irrigated rhizospher and non rhizophere myciflora. Sudan Agric. Journal.

Abdullah, S. K. and Kadhum, (1987). Seed mycoflora of Sorghum bicolor in Iraq. Arab Gulf Journal of Scientific Research, Bull Agricultural and Biological Sciences. 5 (3): 401-410.

Adiver, S. S., Anahosur, K. H., (1996). Association of curvularia and Exserohilum species as Sorghum moulds and their effect on seed germination and seedling growth. Current- Research- University of Agricultural Science- Bangalora, 23 (3-4): 38-40.

Agrios, G. N. (1997). Plant Pathology, 4 Ed. Academic Press, New York.

Amusa, N.A., R.U. Okechukwu, and B. Akinfenwa. 2007. Reactions of cowpea to infection by *Macrophomina phaseolina* isolates from leguminous plants in Nigeria. African Journal of Agricultural Research 3:73-75.

Bandyopadhyay, R., Mughogho, L. K. and Satyanarayana, M. V., (1990). Occurrence of airborne spores of fungi causing rain Mould over ashorghum crop. Mycological Research, 95 (11): 1215-1320.

Barret, C. (1999). Food Security and Food Assistance programmes. In: Gardner, BL. And Rausser, G. C. (ed): Hand book of Agricultural Economics. Amsterdam: 1-156.

Brandt, H. et al (1987). Potential Contribution of Irrigated Agriculture to Food Security in the Sudan: The Cast of the Gazira Irrigation Scheme. Berlin.

Charan, S. M. and Raut, J. G., (1990). Fungi of glumes and seed at various stages of grain development in Sorghum. PKV- ResearchJournal, 11 (2): 187-188.

Diourt, m., starr, j.l., jeger m.j., stack, J.P. and rosenow, D.T. (1995). Charcoal rot (*Macrophomina phaseolina*) resistance and the effects of

water stress on disease development in sorghum. **Plant Pathol**. 44: 196-202.

Edmunds, L.K. (1964). Combined relation of plant maturity, temperature, and soil moisture to charcoal stalk rot development in grain Sorghum. **Phytopathology** 54: 514-517.

El- Shafie, A. E., Webster, J., (19982). A surrvey of seed borne fungi of sorghum bicolor from Sudan Transactions of the British Mycological Society. 77 (2): 339-342.

Fatim, M. M., Bankat, F. M., Attia. M. F and Aly, Hy., (1984). Fungi associated with stored sorghum grains and their role in grain deterioration Egyptian Journal of phytopathology. 14 (1-2): 39-49.

Fajni- Gupta, Gupta-., (19960. Seed borne fungi in Sorghum- Plant- Genetic-News letter. 106 (13) 39-40.

FAO WFP (1995-2000). Special Report on Sudan, 1995, 1996, 1997, 2000-Rome.

Fernandez, R.B., A. De Santiago, S.H. Delgado, and N.M. Perez. (200). Characterization of Mexican and non-Mexican isolates of *Macrophomina phaseolina* based on morphological characteristics, pathogenicity on bean seeds and endoglucanase gene. Journal of Plant Pathology 88:1-8.

F.S and KRIEG, D.R.1992. Osmotic adjustment in sorghum.II. Relationship to gas exchange rates. **Plant Physiol**. 99: 583-588.

Hassan, H. A. (1988). Instability of Sorghum prices in the Sudan with Special Reference to Gedare Area. Diploma rbeit, Thecnische University Berlin.

http://amlorg.yoo7.com/t22-topic.

IMF (1999). Sudan Recent Economic Developments IMF staff country Report 99/53. Washing, D. C.

Kendig, S.R., J.C. Rupe, and H.D. Scott. (2000). Effect of irrigation and soil water stress on densities of *Macrophomina phaseolina* in soil and roots of two soybean cultivars. Plant Disease 84:895-900.

Khairmar-D. N.and Gambhir- SP, (1984). Studies on seed mycoflora of some Gaur varieties from Walik area (maharashtrg)- India- Botanical-Reporter 4 (1): 68-70.

S.N. 2007. *Macrophomina phaseolina* as causal agent for charcoal rot of sunflower. **Mycopathologia** 5: 111-118

Hassan (2000). Agricultural and Animal Production in the Sudan. Arabic text. 150 pp.

Klich MA. (2007). *Aspergillus flarus*: the major producer of aflatoxin. Molecular Plant Pathology 8 (6): 713-22.

Mahmoud, F. B. (1994). The Sudanese Bourgeoisie: Vanguard of Development. London.

Mann, J. A. Kimber, C. T. and Miller, F. R. (1983). The origin and early Cultivation of Sorghum in Africa. Texas Agriculture Experiment Station, Collage Station TX, USA. Bulletin 1454.

E.V. 1986. Salt tolerance of plants. **Appl. Agric. Res**. 1: 12-26.

Mayek-Pérez, N., C. López-Castañeda, M. González-Chavira, R. Garcia-Espinosa, J.A. Acosta-Gallegos, D.I. Martínez, .(2002). Variability of Mexican isolates of *Macrophomina phaseolina*, based on the pathogenesis and AFLP genotype. Physiological and Molecular Plant Pathology 59:257-263.

J.K. 1986.Whole-plant carbon balance during osmotic adjustment to drought and salt stress. **Aust. J. Plant Physiol**. 13: 33–43.

Ministry of Agriculture and Forestry, MAF (1996). Time Series of Cereals and oil Crops (1970/71- 1995/96). Khartoum.

Ministry, of Agriculture and forestry, MAF (2o12). Time series of Cereals and oil. Khartoum.

Netondo, G.W., ONYANGO, J.C. and BECK, E. (2004). Sorghum and salt: I. Response of Growth, water relations, and ion accumulation to NaCl salt. **Crop Sci**. 44: 797-805.

Osman, A. R, Mikhail- M. S, Aly, Soleman- NK, (1990). Sorghum grain-borne fungi and their effect on grain viability under different storage conditions. Egyptian – Journal- of- phytopathology, 20 (1): 47-61.

Purkayastha, S., B. Kaur, N. Dilbaghi, and A. Chaudthury. (2006). Characterization of *Macrophomina phaseolina*, the charcoal rot pathogen of cluster bean, using conventional techniques and PCRRAPD based molecular markers. Plant Pathology 55:106-116.

Quinby, J. R. and Karper, R. E. (1981). Sorghum forage in: Forages. 2nd Edition p. 345. The Lowa State University press. Low USA.

Richardson, M. J. (1979). An annotated list of see borne fungi 3rded C. A, 318 pp.

Richardson, M. J. (1979). An annotated list of seed- borne fungi 3 reded C. A. P, 318 pp.

Richardson, M. J. (1997). An annotated list of seed borne disease. C. A. B. 31 pp.

RIKY-DOTANo, S., YERMIYAHU, U., KATAN, J. and GAMLIEL, A. 2005. Development of crown and root rot disease of tomato under irrigation with saline water. **Phytopathology** 95: 1438-1444.

SANOGO, S.(2004). Response of chile pepper to *Phytophthora capsici* in relation to soil salt. **Plant Dis**. 88: 205-209.

Singh- DP., Agarwal- V. K., Khetarpal- R. K., (1990). Etiology and host-pathogen relation ship of grain mould of Sorghum. India-phytopathology, 41 (3): 389-397.

Skerman, P. J. and Riveros, F. (1990). Tropical Grasses FAO plant production and protection Series No 023.

SMIRNOFF, N. 1998. Plant resistance to environmental stress. **Curr. Opin. Biotech.** 9: 214-219.

Somani, R. B., Pandrangi- R. B., Wan Khade- S. G., Paul- D. B., (1993). Amineo acid spectra of healthy and mouldy grains of Sorghum hybrid SpH 388- Indian- phytopathology, 46 (3): 249-250.

Srivastava, A.K., T. Singh, T.K. Jana, and D.K. Arora. 2001. Microbial colonization of *Macrophomina phaseolina* and suppression of charcoal rot of chickpea. p. 269-319. *In* Sinha, A. (ed.) Microbes and Plants. Vedam eBooks, New Delhi, India.

Tarr, S. A. (1962). Diseases of Sorghum, Sudan grass and Broom Corn pp. 380.

WALLER, J.M. 1986. Drought, irrigation and fungal diseases of tropical crops. Pp. 175-187 *In*: Ayres PG and L. Boddy. (Eds.), **Water, Fungi and Plants**. Cambridge University Press, Cambridge.

Wrather, J.A., and S.R. Koenning. 2006. Estimates of disease effects on soybean yields in the United States 2003-2005. Journal of Nematology 38:173-180.

Wrather, J.A., J.G. Shannon, T.E. Carter, P.J. Bond, J.C. Rupe, and A.M.R. Almeida. 2008. Reaction of drought-tolerant soybean genotypes to *Macrophomina phaseolina*. Online, Plant Health Progress doi:10.1094/PHP-2008-0618-01-RS.

Zuwahu, S. D., Akueshi- C. O., (1992). Seed borne mycoflora of Sorghum used for malting at JOS International Brewary, Nigerian- Journal of Botany (2): 103-108.