Sudan University of Science and Technology

College of Agricultural Studies

Department of Plant Protection

Effect of Maharab (Cymbopogon cymbopogon) aqueous extract on the fungus (Fusarium solani)

تاثير المستخلص المائي لنبات المحريب على فطر (فيوزيريوم سولاني)

By:

Hadeel Abd Alhafeeth Abd Altam

Supervisor:

Ekhlass Hussein Mohamed Ahmed

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الآية

بسم الله الرحمن الرحيم

وَآيَةٌ لَّهُمُ الْأَرْضُ الْمَيْتَةُ أَحْيَيْنَاهَا وَأَخْرَجْنَا مِنْهَا حَبًّا فَمِنْهُ يَأْكُلُونَ ﴿٣٣﴾

سورة يس الآية 33

DEDICATION

To my father and my mother that through their prayers, support and encouragement I reached , so mom, dad, my unte(Aida Altam) and my Husband (Mohamed Fadol) thank you very much.

To my brother s, Grandfather and sisters and to all my family.

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ABSTRACT

This study was carried out in the laboratory of plant pathology; plant protection Department, College of Agricultural Studies, Sudan University of Science and Technology in 2017. The objective of this study is to evaluate the efficacy of Maharab aqueous extracts and tilt fungicides against Fusarium solani in potato in potato dextrose agar (PDA).

Was prepared aqueous extract from the plant Maharab. Used three concentrations of aqueous extract of leaves Maharab (12.5%, 25%, 50%)

Results that have been obtained Show that the effect of the aqueous extracts of the Maharab in all concentrations was of significant effect in inhibiting the growth of fungus compared to the control Effect of inhibition increases with increasing concentrations 16.8, 21.5, 54%

As a result, this study shows that the Maharab containing materials with the effect of an anti-fungal growth.

ملخص الاطروحة

اجريت هزة الدراسة في مختبر امراض النبات, قسم وقاية النبات, كلية الدراسات الزراعية, جامعة السودان للعلوم والتكنولوجيا 2017 لتقييم تاثير المستخلص المائي لنبات المحريب على فطر فيوزيريوم سولاني في بيئة بطاطس دكستروز اجار مقارنة بمبيد التلت تحت ظروف المعمل.

تم تحضير المستخلص المائي من نبات المحريب . استخدمت ثلاثة تركيزات من المستخلص (%50 %25 %12.5)

النتائج التى تم الحصول عليها توضح ان تاثير المستخلصات لنبات المحريب في كل التركيزات لها تاثير معنوي في تثبيط نمو الفطر مقارنة بالكنترول تاثير التثبيط يزيد بزيادة التركيز (16.8 21.5 54)

النتيجة توضح ان نبات المحريب يحتوي على مواد لها تاثير مضاد لنمو الفطريات.

CHAPTER ONE

INTERODUCTION

Pesticides were considered indispensable for sustainable agriculture production, in addition to their role in the protection of human health especially in the tropics (Kieran, *et. al*., 2006). Mean while, the increasing and irrational use of synthetic pesticides has become a source of great concern because of their possible effect on human health and non-target components of the environment (Okigbo, 2004 and Carvalho, 2004). This concern is heightened by the non-specificity and high toxicity of some pesticides ones. The foregoing has initiated the exploration of safe alternate antimicrobial agents (Research Council Board of Agriculture, 1987).

Accordingly Increasing efforts have been primary directed towards minimizing pesticides risks and residues in the environment through ecologically sound innovative measures of diseases control (Guddewar., *et al* 1999).

Recently, the uses of nayural products for crop protection were greatly emphasized by scientists in everywhere. There are unlimited example les and studies confirmed that higher plants do contain a wide variety of compounds with very good potential for plant diseases control. An example of leaf extracts of Neem tree (*Azadirachta indica*) and chinaberry where reported by (Hassanein *et al.*, 2008) to inhibit *F. oxysporum f. sp*.Lycopersici, which is the causal agent of wilt disease of tomato plant.

Likewise, Mint (*Mentha spicata*), Ryhan (*Ocimum basilicum*), and Maharab (*Cymbopogon schoenanthus poximus*) were tested to control sooty canker pathogen.

Extract from garlic followed by Henna (*lowsoniai nermis*) leaf extract was reported to control minimum mycelia growth of pythium aphanidermatum (Shenoi, *et al*., 1998).

Elkorashy,(1997) reported that the plant extract of Menthe spicata (Mint) at concentration of 50 and 100% inhibited the growth of *Rhizoctnia solani*, *Fusarium solani*, and *Sclerotium rolfsii* , which cause damping_ off disease of peanut.

Jatropha carcass under Study is becoming a potential source of natural pesticides. The oil and aqueous extract from oil has potential use as an insecticide, for instance, it has been used in the control of pests of pulses, potato and corn (Kaushik and Kumar, 2004). Medicinal plants have become the focus of intense study in terms of validation of their traditional uses, and then it can use as a natural pesticides. These pesticides are generally more selective in their action, economically feasible and less harmful to the environment than synthetic chemicals (Zhonghua and Michailides, 2005).

Currently, control of plant pathogens requires employment of alternative techniques because traditional handling with synthetic chemicals has caused various problems such as toxicity to users and impairment of beneficial organisms (Anderson, *et al*., 2003). Another important aspect is that pathogenic organisms have generated resistance to the active ingredient of some synthetic fungicides in response to selection pressure due to high dose and continuous applications, causing great economic losers.

However, natural products proved to be economical and efficient alternative for disease control since it does not affect environment and their residues are easy to degrade (Wilson, *et al*., 1999).

Based on the foregoing the objectives of this study is (i) To isolate of the fungus from potato tuber (ii) to investigate the effect of Lemongrass (*Cymbopogon spp*.) aqueous leaves extracts against the growth of the fungi (*Fusarium solani*) *in vitro.*

CHAPTER TWO

LITEREATURE REVIEW

2.1 Potato plant

The potato is a starchy, tuberous crop from the Perennial Nightshade Solanum *tuberosum,* the word [potato] may refer either to the plant itself or to the edible tuber in the Andes, where the species is indigenous, and some other closely related species are cultivated. Potatoes were introduced to Europe in the second half of the 16th century by the Spanish.

Potato has become a staple food in many parts of the world and an integral part of much of the world's fourth-largest food crop, following maize, wheat, and rice. The green leaves and green skins of tubers exposed to the light are toxic.

Wild potato species can be found thought the Americas from the United States to southern Chile.

The potato was originally believed to have been domesticated independently in multiple location, but later genetic testing of the wide variety of cultivars and wild species proved a single origin for potatoes in the area of present-day southern peru and extreme northwestern Bolivia [from a species in the Solanum brevicaule complex], where they were domesticated approximately 7,000-10,000 years ago. Following millennia of selective breeding, there are now over a thousand different types of potatoes. Over 99% of the presently cultivated potatoes worldwide descended from varieties that originated in the lowlands of south-central Chile, which have displaced formerly popular varieties from the Andes.

However, the local importance of the potato is variable and changing rapidly. Lt Remains essential crop in Europe [especially eastern and central Europe], where per capita production is still the highest in the world, but the most rapid expansion over the past few decades has occurred in southern and eastern Asia. As of 2014, china led the world in potato production, and, together with India, produced 37% of the potatoes world, s.

2.1.1 Classification:

Kingdom: plantae

Phylum: asteroids

Order: solanales

Family: solanaceae

Genus: solanum

Species: tuberosum

Scientific name: solanum tuberosum

2.1.2 Uses

Potatoes are used to brew alcoholic beverages such vodka, potcheen, or akvavit. They are also used as food for domestic animals.

Potato starch is used in the food industry as, for example, thickeners and binders of soups and sauces and binders of soups and sauces, in the textile industry,

Economic importance:

In terms of global production, potato *Solanum tuberosum* () is the fourth most important food crop after corn, rice and wheat. This crop is grown throughout the world. Present world production is some 321 million tons fresh tubers from 19.5 million ha.

Asia and Europe are the world's major potato producing regions, accounting for more than 80% of world production. China is now the biggest potato producer, and almost a third of all potatoes are harvested in china and India. North America was the clear leader in productivity, at more than 40 tons per hectare. Asian consumption represents almost half of the world's potato supply, but its huge population means that yearly consumption per person was a modest 25 kg in 2005. The heartiest potato eaters are Europeans. In Latin America and Africa consumption per capita is lowest, but increasing. The potato plays a strong role in developing countries with its ability to provide nutritious food for the poor and hungry. The demand for potato is growing as both a fresh and processed food. The decreasing availability of land for area expansion means that yields will have to be improved.

Critical to achieving improved tuber yields will be access to an adequate water supply, including more efficient use of scarce water and costly fertilizer inputs. Potato is grown in about 100 countries under temperate, subtropical and tropical conditions. The potato is basically a crop of temperate climates. Yields are affected significantly by temperature and optimum mean daily temperatures are 18 to 20C^0. In general a night temperature of below 15C^0 is required for tuber initiation. Optimum soil temperature for normal tuber growth is 15 to 18 C^0. Tuber growth is sharply inhibited when below 10 $C^0$and above 30 C^0. Cool conditions at planting lead to slow emergence which may extend the growing period.

Tuber yield decreases with reduced sunshine hours per day. Potato varieties can be grouped into early (90 to 120 days), medium (120 to 150 days) and late varieties (150 to 180 days). Improved varieties include russet Burbank, Yukon goid and Nicola, among others.

Compacted soils affect root penetration, water and nutrient uptake and tuber enlargement. The crop is moderately sensitive to soil salinity with yield decrease at different levels of Ece (Ece is the electrical Conductivity of a saturated soil paste extract). The plant spacing is 0.75 m to 0.90 m between rows and 0.15 m to 0.3 m between plants under irrigated conditions, while sowing depth is generally 5 to 10 cm.

Cultivation during the growing period must avoid damage to roots and tubers, and in temperate climates ridges are earthed up to avoid greening of tubers. Adoption of drip irrigation and fustigation in potato has proved to be technically feasible and economically viable and beneficial in many ways both in developed and developing regions of the world. Drip irrigation in many diverse agro ecological situations registered higher yields (40 to 72 tons/ha) apart from saving in water (30 to 40%), fertilizer (20 to 25%) and improving quality of tubers (grade and composition) in comparison to conventional furrow, overhead and centre pivot sprinkler irrigation methods. Under turkey and Indian conditions drip irrigated potato registered 50 and 42 tons tubers/ha with a net present value (npv) of 2085 used/ha and 2692 used/ha respectively and a payback period of one year.

For high yields, the seasonal crop water requirements for a 70 to 150-day crop were estimated to be 150 to 750 mm under a range of climatic conditions and varying (70-180days) length of growing seasons with a daily evaporate transpiration rate of 4 to 5 mm/day. Irrigation scheduling

using densitometers' enabled an efficient use of water, fertilizer and energy inputs. Potato is a heavy feeder of nutrients. Is root system is shallow and fibrous, hence fustigation is recommended for higher nutrient availability and use efficiency. The aim of the fustigation program is to cover the difference between crop demand and supply. The nutrient requirements of drip irrigated potato are relatively high. Other best management practices include earthling up, protection of crop from pests and diseases, need based weed management, harvesting and post harvesting operations to minimize losses.

2.2 *Fusarium solani* the causal agent of potato plant

The genus *Fusarium comprises* a wide and heterogeneous group of fungi important for the food and drug industry, medicine and agriculture.

Fusarium solani (mart) is a phytopathogenic fungus and is an important causal agent of several crop diseases, such are root and fruit rot of cucurbit spp, root and stem rot of pea, sudden death syndrome of soybean, foot rot of bean and dry rot of potato.

The morphological species *Fusarium solani* (Mart.) was first described by Martins in 1842 as *Fusarium solani* from rotted tubers of potato, *Solanum tuberosum*. The species was transferred to the genus Fusarium by the Italian mycologist piers (Saccardo.1881). *F.solani* was emended by (Snyder and Hansen.1941) to comprise a complex group of species that are widely distributed in soils and cause tuber, root, and stem rots of plants worldwide. There are at least 50 subspecies lineages (Desjardins, 2006).

2.2.1Classification:

Kingdom: fungi

Phylum: acomycota

Subphylum: pezizomycotina

Class: sordariomycetes

Subclass: hypocreoycetidar

Order: hupocreales

Family: Nectriaceae

Genus: Fusarium

Host range and distribution:

The predominant host's *Fusarium solani* are potato, pea, bean, and members of the cucurbit family such as melon, cucumber, and pumpkin. Some strains may cause infections in humans.

Fusarium damping off, corn rot, fruit ROT, root rot, and surface rot are caused by *Fusarium solani* (Mart.) and are found in most states in the United States). *Fusarium virguliforme* sp.., formally known as *F. solani*, *F. glycines*, causes sudden death syndrome (ads) in soybean. The name "sudden death" refers to the early defoliation and death of the soybean plant (kenning, 2001). Sudden death syndrome has become a serious problem in the commercial production of soybeans in north and South America since the early 1990's (aoki, *et al,* 2003). *Fusarium solani F. sp*. Phaseoli (Snyder and Hans) causes Fusarium root rot in common beans such as dry bean.

2.2.2Isolate of the fungus:

To isolate the pathogen from the soli, samples are mixed with deionizer water and shaken. A series of dilutions are then made, and then 1 m1

aliquot from each dilution is spread over modified Nash and Snyder's medium (NSM) in Petri dishes (Cho, 2001). Plates can be incubated at room temperature and light. After 7 days, colonies that are thought to be *F.* solani can be transferred to potato dextrose agar (PDA).

2.2.3 Identification of the fungus:

On potato dextrose agar medium, *F.* solani produces sparse to abundant, white cream mycelium. Macro conidia have three to four septa on average, are slightly curved, are rather wide and thick walled, and may have a slightly blunted apical end. Micro conidia are abundant, oval to kidney shaped, and formed in false heads on very long mono phial ides. Chlamydia spores are abundant.

2.2.4 Symptoms:

The first symptoms of root rot in potato are narrow, long, red to brown lesions on the stems, and lengthwise cracks often develop. Lesions extend down the main taproot, which may shrivel, decay and die. The symptoms in some cases extend up the hypocotyls to the soil surface. Clusters of fibrous roots (lateral roots or adventitious roots) commonly develop above the shriveled taproot. Severe Fusarium root rot kills primary and secondary roots of beans, and most times only adventitious roots are visible. Note the typical red brown symptoms of Fusarium root rot on the taproot.

2.2.5 Ecology and life cycle:

Fusarium solani produces asexual spores (micro conidia and macro conidia). Its sexual state is nectria haematococca (acomycota). It produces Chlamydia spore and overwinters as mycelium or spores in infected or dead tissues or it can be spread by air, equipment, and water.

2.2.6 Controls:

The control of *Fusarium solani* of potato is important in maintaining plant vigor. Documented methods that are used in the control of the disease are cultural, biological, use of resistance, chemical and use of natural products however, each method has got its own strengths and limitations.

2.2.7Use of resistance:

The most cost-effective and environmentally safe method of is the use of resistant cultivars whenever they are available. The use of resistant varieties is the best strategy for disease control. According to (prates *et al*, 2011), identification and utilization of potato plant varieties resistant to the disease represents a valid alternative to the use of chemicals. However, breeding for resistance can be very difficult when no dominant gene is known. In addition, new races of pathogens overcoming host resistance can develop.

The advantages of this method include saving the cost of chemical for control of the disease and enhancing cultivation of previously infested fields.

2.2.8Chemical control:

Agricultural chemicals are commonly used for management of pests and diseases. However, the high frequency of chemical use, non-target effects, development of resistance to many chemicals, pathogens which remain viable for many years and risks to human health and the surrounding environment have stimulated development of alternative methods for disease management.

Moreover, pesticides are not available for some diseases, and pesticides generally are more effective against aerial plant pathogens than their soil-borne counterparts it is also technically difficult to treat large amount of soil, and the range of approved chemicals is declining as active compounds are withdrawn for toxicological and environmental reasons, for example, methyl bromide have phased out due to its extremely high ozone depleting potential.

The current trend to near zero-market tolerance for pesticide residues in fresh leafy vegetables provides an additional motivation to search for non-chemical means to control pests and diseases.

Fusarium solani is controlled by disinfecting the soil with methyl bromide, chloropicrin or metham sodium. Systemic fungicides such as *Fusarium solani* however, sustainable use of fungicides in *Fusarium solani* management is difficult due development of resistant isolates and damaging effects on the natural environment, the agro ecosystem and human beings. Excessive use of chemicals results into buildup of phytotoxicity in soil.

2.2.9Biological controls:

Biological control involves the use of one or more biological organism to control pathogens or diseases. The microbial inoculates as bio control agents are effective and attractive alternatives to prevent the deficiencies brought about the exclusive reliance on chemicals (Nakkeeran *et al*., 2002).

Trichoderma spp (*T. viride, T. harzianum, and T .hamatum*) are very promising against phytopathogenic fungi such as *F .oxysporium*, *pythium ultimum* and *Sclerotinia sclerotium* (Manczinger *et al*, 2002)

Different workers reported the antagonistic activity of different Trichoderma isolates against different phytopsthogenic fungi such as *R. solani*, *F .oxysporum* and *sclerotium rolfsii* (deshmukh and raut, 1992, xu *et al*, 1993, askew and Laing, 1994). Different mechanism are said to be involved i.e. competition, production of antibiotic inhibiting fungal growth by producing volatile and nonvolatile compounds as reported by michrina *et al*,(1995). Zote *et al*, (2007) reported that soil seed application of *T. viride* was found to be most effective recording lowest wilt incidence and maximum seed germination over untreated control.

2.3.1Maharab (lemongrass):

***(Cymbogone* spp.)**

2.3.1Classification:

Kingdom: plantae

(Unranked): angiosperms

(Unranked): monocots

(Unranked): commelinids

Order: poales

Family: poaceae

S.N: *Cymbopogon spp*.

Subfamily: panicoideae

Genus: cymbopogon

Some species (particularly cymbopogon citrates) are commonly cultivated culinary and medicinal herbs because of their scent, resembling

that of lemons (*Citrus limon*). Common names include lemon grass, lemongrass, barbed wire grass, silky heads, citronella grass, and cha de dartigalongue fever grass, and tan glad, herbal Louisa or gavati chahapati, amongst many others.

2.3.2Uses

Lemongrass is widely used as a culinary herb in Asian cuisines and also as medicinal herb in India it has a subtle citrus flavor and can be dried and powdered, or used fresh it is commonly used in teas, soups, and curries. Lt is also suitable for use with poultry, fish, beef, and seafood. Lt is often used as a tea in afro can countries such as Togo, south eastern Ghana Volta region and the Democratic Republic of the Congo and Latin American countries such as a Mexico. Lemongrass oil is used as a pesticide and a preservative. Research shows that lemongrass oil has antifungal properties. Despite, its ability to repel some Insects, such as a "lure" it attract honey bees.

Lemongrass works conveniently as well as the pheromone created by the honeybee's nasonov gland, also known as attractant pheromones. Because of this, lemongrass oil can be used as a lure when trapping swarms or attempting to draw the attention of hived bees.

CHAPTER THREE

MATRIAL AND METHOD

3.1 Site location

This study which conducted under laboratory conditions was carried out at plant pathology laboratory of plant Protection Department, College Of Agricultural Studies, Sudan University of Science and Technology. To evaluate the inhibitory effect of Lemongrass aqueous extracts against *Fusarium solani*

3.2 Isolation

Isolation of Fusarium solani

Isolation from Plant materials

Infected Potato (Tuber) Showing symptoms of the disease were obtained from sick blots from Shambat Research Station in July, 2017. The tuber were cut into small section (0.5-1.0 cm), washed thoroughly with tap water, surface sterilized with Clorox (Na OCL) for 5 minutes, rinsed three time in changes of sterilized distilled water and dried on sterilized filter paper. The sterilized roots sections were plated at the rate of five sections / plate on to Potato Dextrose Agar (PDA) medium. This was supplemented with chlorampheicol (0.05 g/l) in 9-cm Petri dishes. The Petri dishes were incubateted at 25C^{o}. After incubation for 7 days, isolated fungi were sub cultured on PDA. When free from contamination; Isolates were maintained on PDA slants and examined visually for their growth patterns and pigmentation on the adverse side of the agar. Further microscopic examinations were carried out for mycelia and conidia structure using pure culture of *F.solani* was obtained by using Hyphal Tip Technique. Pure culture of the isolated fungi was transferred to PDA

slants and kept in refrigerator at 40c for further use. Sample of the obtained colonies were sub cultured by transferring small mycelia from the colony margins. Pure cultures were obtained by sub-culturing three time s and slides ware prepared and examined microscopically to confirm identity (x: 40).

3.3. Identification of the pathogens

The identification of fungus was based on visual culture characteristics, mainly the growth patterns and pigmentation. Furthermore, microscopic examinations were carried out for mycelia and conidia structure based on the methods of Booth's key (1977).

3.4 Growth Rate of the pathogen

The Pure cultures of *F. solani* were prepared using 7 days old mycelia. The fungus was cultured on PDA then transferred, aseptically, to the centre of Petri dishes containing PDA medium and incubated at $25C^{o}$. The linear growth of the fungus was assessed in cm after 48h.

3.5 Collection and preparing of plant materials

Lemongrass were collected from Bahri area and brought to the laboratory where they were shade dried. After complete dryness plant samples were crushed separately to obtain fine powder for extraction.

3.6. Extraction process

The obtained fine powder from each plant was weighted (70gm.) and placed in a conical flask containing 70 ml distilled water and it was placed in a shaker for 4 hrs. The extracts were filtered overnight to obtain 12, 5% 25% and 50% concentrations.

3.7 Fungicide process

The chemical tested were Tilt fungicides 10ml dissolved in 100ml of sterilized distilled water to give 5, 10, 15 ppm respectively. For this solution 5, 10, 15, were completed to 100 ml by adding sterilized potato dextrose agar medium to give final concentration.

3.8 Procedures

Inhibition zone technique was used in this study to evaluate the inhibitory effect of both tested plants as well as fungicide tilt. Previously prepared concentration were add to PDA media at ratio of 10% and then 5mm in diameter of fungal mycelium disc from pure culture were placed in a center of treated PDA media in 9 cm in diameter Petri-dish.

3.9 Test procedure

Inhibition zone technique was used in this study (Rao and Seivastava, 1994).The fungus spores suspension was prepared from previously prepared pure culture by allowing the spores to grow on PDA media (Ramprasad, 2005) treated was a desired concentration of (Lemongrass) water extract.

The PDA media was amended with the required concentration (5ml, 2.50 and 1.25) before being solidified in a conical flask of 250ml, agitated before pouring it into sterilized Petri dishes. Three plates were assigned for each concentration and left to solidify. The other three plates with PDA medium were served as control.

The Petri dishes of each concentration were inoculated using sterilized filter paper disc dipped in a fresh culture suspension of corresponding

fungus and placed at the centre of the plate. In case of the control the disc was treated with sterilized distilled water and placed at 28C^{o} for 3 days. The growth of the fungus was calculated every day.

The effect of each extracts was evaluated as percentage of reduction in diameter of fungal growth.

$$R = \frac{dc - dt}{dc} \times 100$$

Where R=Percentage reduction of the growth, dc= diameter of controlled growth and DT= diameter of treated growth.

3.10 Experimental designs

Data generated was subjected to a Complete Randomized Design.

3.11 Statistical analysis

The data obtained was statistically according to analysis of variance (ANOVA), LSD test was used for means separation.

CHAPTER FOUR

RESULTS

4.1 Laboratory Experiments

This study was conducted at the laboratory of plant pathology, Department of plant protection, college of Agricultural studies, Sudan University of Science and Technology during July-September, 2017.The aim of this study is to investigate the antifungal activities of (*Cymbogone spp*) Maharab aqueous extract on the liner growth of Fusarium solani in culture media under laboratory condition where temperature around 27 ^{C0}

4.1.1Effect of Maharab aqueous extract on the liner growth of *Fusarium solani*

The effect of Maharab (lemongrass) aqueous extracts on the liner growth of the *Fusarium solani* compared to control. The three concentrations from the extract showed spectrum of fungicide activity. The results (table) showed that extracts of Maharab plant tested had negative effects on fungal growth. In general the antifungal activity increased with extract concentration. Among all doses the dose 50% extracts tested Maharab caused 16.8% redaction, the dose 25% extracts tested Maharab caused 21.5% redaction, followed in descending order by the dose 12.5% extracts tested Maharab caused 54% redaction.

Effect of Maharab aqueous extract on the liner growth of *Fusarium solani*

Treatments		Mean	Redaction growth (%)
Control (*Fusarium solani)*		3.12	0
Fungicide(Tilt)			
Maharab(*Cymbopogon spp*)	%50	.622	16.8
	%25	.755	21.0
	%12.5	1.81	54
SE		0242	7.7

R= A-R *100

A——

R=Percent reduction *Fusarium solani*

A=Fusarium solani growth control

B=Fusarium solani growth of treatment

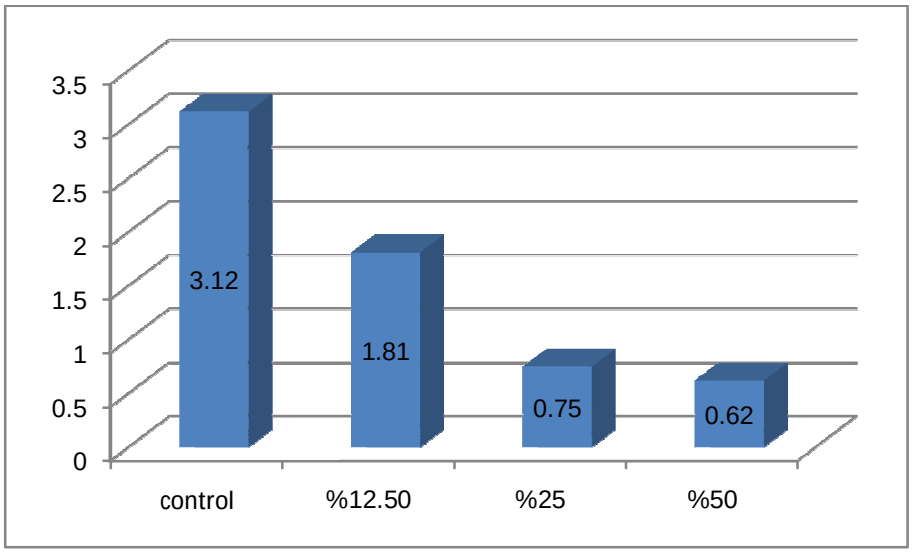

Figure1 The effect of Maharab (Lemongrass) on fungus (*Fusarium solani*)

CHAPTER FIVE

Discussion

The antifungal effect of crude medicinal plant extracts Maharab was determined by *in vitro* study using water as solvents. Three concentrations of Maharab plants extracts were used (12, 50, and 100%) as antifungal activity against *Fusarium solani*. The result of the experiment revealed that the Maharab extract was more effective. This finding corroborates the notion plant are one of the most important sources of medicine.

The present investigations revealed that *in vitro* growth of *F. solani* was significantly checked by aqueous extracts of Maharab at all concentration. Results showed that, Maharab had the highest antifungal activity against *F. solani* as it inhibited (.622%) the radial fungus growth (50%).

Through my experience in The laboratory of plant pathology, reduce the growth of *Fusarium solani* mushrooms using the water extracts of the Maharab plant on the image of three concentrations (50%, 25%, 12.5%) the result is that all these concentrations have bearing on the growth of the fungus of the *Fusarium solani* if the plant has effective in reducing mushroom growth, this is the beginning for the researchers to begin with.

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