Sudan University of Science and Technology

College of Agricultural Studies

Department of Plant Protection

Effect of Mesquite Leaves aqueous extract on fungal growth *Fusarium solani*

تاثير المستخلص المائي لاوراق المسكيت علي نمو الفطر(فيوزيزيم سولاني)

A Thesis Submitted in partial of the Requirements for the

B.Sc Honors in Plant Protection

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الآية

(وَهُوَ الَّذِي أَنشَأَ جَنَّاتٍ مَّعْرُوشَاتٍ وَغَيْرَ مَعْرُوشَاتٍ وَالنَّخْلَ وَالزَّرْعَ مُخْتَلِفًا أُكُلُهُ وَالزَّيْتُونَ وَالرُّمَّانَ مُتَشَابِهًا وَغَيْرَ مُتَشَابِهٍ كُلُوا مِن ثَمَرِهِ إِذَا أَثْمَرَ وَآتُوا حَقَّهُ يَوْمَ حَصَادِهِ وَلَا تُسْرِفُوا إِنَّهُ لَا يُحِبُّ الْمُسْرِفِينَ)

سورة الأنعام الآية(141)

Dedication

To *my father and mother, to my brothers, sister To all my teachers in plant protection, Sudan University of sciences and Technology, college of Agricultural Studies.*

To my class mate. To all member which help me to produce this work.

Acknowledgement

Firstly, thanks to god for giving me health and kept me well to finish this work.

For Grateful thanks are due to my supervisor ***Dr.Mawahib Ahmed*** to help me and participation throughout the study, thanks are due to teacher Moda Ibrahim

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And thankful are due to staff member of Plant Protection, Department, and College of Agricultural studies.

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 effect of Mesquite leaves aqueous extracts against Fusarium solani in potato.

The aqueous extract prepared of Mesquite leaves, used three concentrations (25%, 50%, and 100%).

Results that have been obtained show that the effect of the aqueous extracts of the leaves Mesquite in all concentrations was of significant effect in inhibiting the growth of fungus compared to the control.

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

ملخص البحث

اجريت هذه الدراسه في مختبر علم امراض النبات ، قسم وقاية النبات ، كلية الدراسات الزراعية ، جامعة السودان للعلوم و التكنولوجيا 2017 لتقييم تأثير المستخلص المائي لأوراق نبات المسكيت علي فطر الفيوزيريم سولاني في بيئة بطاطس دكستروز أجار تحت ظروف المعمل . تم تحضير المستخلص المائي من أوراق المسكيت .استخدمت ثلاثة تركيزات من المستخلص المائي لأوراق المسكيت(25%،50%،100%)النتائج التي تم الحصول عليها توضح أن تأثير المستخلصات المائية في أوراق المسكيت في كل التركيزات كانت ذات تأثير معنوي في تثبيط نمو الفطر مقارنه بالكنترول.

نتيجة لذلك توضح الدراسة أن نبات المسكيت يحتوي علي مواد ذات تأثير مضاد لنمو الفطر.

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CHAPTER ONE

Introduction

CHAPTER ONE

Introduction

Potato Plant (*Solanum tuberosum* L.) is member of the family solanaceae. the crop which was originally believed to be domesticated independently in multiple locations is an important crop worldwide and ranks fourth in production among food crops after maize (*Sea Mays* L.), rice (*Oryzae sativa* L.), and wheat |(*Tritium aesitvum* L.) (FAO STAT, 2006).the importance of potatoes is increasing due to the rising world population. The potatoes can grow well in diverse conditions, with high nutritional value with an annule production of 3.6 x108 tons (Hamilton, 2005 and Anonymous, 2012).

In Sudan, although potato cultivation depends mainly on exotic advanced cultivars but an old introduced material is still produced in Jebel Marra in the far west and it is locally known as Zalingei potato. The crop is cultivated in small area around large cities along the Nile and on seasonally flooded plains (FAO, 1999). However, the area around Khartoum accounts over 70 percent of the country's potato production (Geneif, 1986)

The losses caused by diseases and insects constitute the major constraints that facing the production of potato worldwide and among these, the most important wide spread and important are pathogenic fungi, affecting tubers and vegetative parts. One of the main fungal pathogenic that attack potato is Fusarium, which is a worldwide economic problem. There are many species of Fusarium reported to cause dry rot of potato worldwide (Nielson, 1981) of which *Fusarium solani* has been reported as the most pathogenic Fusarium species causing potato dry rot (sharifi *et al*.,2009 Soheili-Moghadam and Hosseinzadeh,2013).

The disease affects tubers in storage and seed potato pieces after planting.

Hanson *et al*., (1996) reported that Fusarium dry rot of feed tubers can cause crop losses up to 25%, while more than 60% of tubers can be infected in storage. Indiscriminate use of chemical pesticides to control various pests and pathogenic microorganism of crops plants is causing health hazard both in terrestrial and aquatic lives through their residual toxicity (Viana *et al*, 1996; Nikan and Morowati, 2013). Much attention is being focused on the alternative methods of pest control (Ali, 1996).

Natural plant extracts have been recommended as suitable alternative choices to synthetic chemicals (Suhr & Nielsen, 2003; Babu *et al*., 2008; Ownagh *et al*.,2010; Bahraminejad *et al*., 2010; Man gang and Chetry, 2012;Jafarpour *et al*.,2013) to control diseases and pests of crops . In Sudan the bioactivity of many cultivates and wild plants are demonstrated by many researchers (El-kamali 2001; Al-Doghairi *et al*., 2004; and sidahmed *et al*., 2009).

Based on the foredoing and considering the adverse and alarming effects of synthetic pesticide on environment and natural habitats, this study was under taken to find out a later native and nontoxic biological control agentes to control the dry rot of Fusarium in potatoes. It's aimed at investigating the antifungal activity of some higher plant extracts and fungicide (Fulldazin) aginst Fusarium dry rot of potatoes.

CHAPTER TWO

Literature Review

CHAPTER TWO

Literature Review

2.1Potato Solanum tuberosum

The potato plant which belongs to the family solanaceae, it was first domesticated in the region of modern –day southern Peru and extreme northwestern Bolivia between 8000 and 5000 BC. It has since spread around the world and become staple crop in many countries (Spooner, et al, 2005).

2.1.1 Scientific Classification

Kingdom : Plantae

Order : Solanales

Family : Solanaceae

Genus : Solanum

Species : S.tuberosum (Spooner, et al, 2005).

2.1.2 Uses:

Potatoes are used to brew alcoholic beverages such as 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, in the textile industry, as adhesives, and for the manufacturing of papers and boards.

Maine companies are exploring the possibilities of using waste potatoes to obtain for use in plastic products; other research projects seek ways to use the starch as a base for biodegradable packaging.

Potato skins, also with honey, are a folk remedy for burns in India. Burn centers in India have experimented with the use of the thin outer skin, layer to protect burns while healing potatoes (mainly Russets) are commonly used in plant research. The consistent parenchyma tissue, the clonal nature of the plant and the low metabolic activity (Orzolek et *a*, 2010)

2.1.3 Disease in potato:

Late Blight causal organism Phytophthora infestans

Early Blight causal organism Alternaria solani

Verticillium wilt causal organism Verticillium dahlia kleba

Black scurf causal organism Rhizoctonia solani

Dry rot causal organism Fusarium solani

Silver scurf causal organism Helminthosporium solani

Pythium leg causal organism Pythium ultimum

Pink rot causal organism hPytophthora erythroseeptica

Powdery scab causal organism Subterranean (Agar's, 2005).

2.2. Dry rot in potato:

Caused by Fusarium solani, distributed in soil and in association with plants. Most saprophyta and are relative abundant members of the soil some species produce

mycotoxin in cereal crops than animal health if they enter the food chain .The main Fusarium toxin are fumonisins and ,Trichothecene and Zearalenon(Orzolek et al,2010).

2.2.1 Classification by (Desjardins, 2006):

Kingdom: Fungi

Sub kingdom: Dikarya

Phylum: Ascomycota

Sub phylum: Pezizomycotin

Order: Hypocrites

Family: Nectriaceae

Genus: Fusarium

Species: Solani (Desjardins, 2006)

2.2.2 Morphology:

On potato dextrose agar medium, F.solani produces sparse to abundant white cream mycelium. Marcocoidia have three to four septa on average are slightly curved are rather wide and thick walled , and may have slightly blunted apical oval to kidney shaped , and formed in false heads on very long monophialides .(Orzolek, 2010)

2.2.3 Symptoms:

The discased plant generally, produces symptoms such as wilting, chlorosis necrosis, premature leaf drop, browning of the vascular system, stunting, and damping –off. The most important of these is vascular wilt (Ramsamg et al, 1996)

Fusarium dry rot stats out looking like vein clc aring on the younger leaves and drooping of the older lower leaves , followed by stunting of the plant , yellowing of the lower leaves , defoliation, marginal necrosis and death of the plant .On older plants symptoms are more distinct between the blossoming and fruit maturities stages . Fusarium dry rot characterized by an internal light to brown or black rot of the potato tuber-and it is usually dry. The rot may develop at an injury as a bruise or cut. The pathogen penetrates the tuber, often rotting out the extensive rotting causes the tissue to shrink and collapse usually leaving a sunken area on the outside of the tuber and internal cavities. Yellow, white or mold may be present (Zaccardelli et al, 2008).

2.2.4 Hosts Range:

The fungal pathogen F.solani affects a wide variety of hosts at any age. Tomato, tobacco, legumes, cucurbits, sweet potatoes and banana are a few of the most susceptible plants (Koenning, 2001)

2.2.5 Disease:

Fusarium wilts affect and cause severe losses on most vegetable and flowers, several filed crops such as cotton vegetable and flowers , and tobacco , plantation crops such as banana .Planting .coffee and sugar cane , and a few shade trees , Fusarium wilts are most severe under warm soil conditions and in green houses .

Most Fusarium wilts have disease cycles and develop symptoms (Koenning, 2001)

2.2.6 Environment:

As previously stated F.solani is a common soil saprophyte that infection a wide host range of plant species around the world .It has the a ability to survival most soil –aretic ,tropical desert, cultivated and non-cultivated .Though Fusarium spp. May be found in many places and environments . Development of the disease is favored by high temperatures and warm moist soils.

The optimum temperature for growth on artificial media is between 25-30c, and the optimum soil temperature for root infection is 30c or above (Koenning, 2001)

2.2.7 Management:

There are many ways to manage dry rot. Application of thiabendazole, also known as mertect, was a common and efficacious method used from 1970-1985.

Eventually, however, the pathogen developed resistance to the chemical treatment, and while some people still use thiabendazole, it is no longer an effective treatment .Effective chemical control of dry rot can be achieved with chemical like tope MZ, and Moneoat MZ. These chemical protect not only against dry rot, but also against other potato disease like Rhizoctonia, Silver scurf and black dot. These chemical treatments can delay emergence of the young plant but this doesn’t mean these chemicals shouldn’t be used many fungicide including thiabendazole, work best when they are applied to tubers before they cut into seed pieces (Schwartz, 2005).

2.3 Mesquite

2.3.1 Description:

Common mesquite (*Prosopis juliflora)* belongs to family a Fabaceae ,it is an evergreen muiti-purpose tree or shrub .Depending on water a availability the plant grows up to 12m high or in to a shrub . Mesquite growth is not limited by soil type, PH, salinity and /or soil fertility. The tree is a nitrogen fixer, endowed with an extensive root system. It tap root grows down to 53m and its lateral root may extend beyond the crown (Choge and ckikamai, 2003). The tree is competitive and allopathic. It is also a prolific seed produce. The seed s, mainly distributed by animals and water, are persistent and a high seed bank often build up in soil (Fowler, 1995)

2.3.2 Economic and other uses

Various Prosopis species have been introduced to Africa over the past 190 years for their beneficial qualities which include erosion control , shade , fuel wood, building materials , and pods for animal and human consumption in arid and there is clear economic use to this species but severe negative consequences of P.juliflora invasion makes this conflict of interesting species sacrificed (Ahmed ,2004).

2.3.3 Mesquite in Sudan

Mesquite (P.juliflora) was introduced in to Sudan from Egypt and South Africa in 1917 and established in a limited area in Shambat arboretum in Khartoum North (Broun and Massy, 1992, Babiker, 2006). In 1937the plant was introduced in to the grazing area in the White Nile province as aerial for evaluation of efficacy as a shelterbelt for curtailment of sand encroachment. A mesquite plantation was

established at Elshagera, Kilo 5, in 1938 and subsequently mesquite was planted on eroded slopes near Sonar, Elfoung, and Elgalabat and on sandy soil with high salt contents near Port Sudan with good results (Rizvi, 1999).

2.3.4 Methods of Mesquite Control:

2.3.4.1 Grubbing:

It is digging of large portion of the root system sufficient to prevent sprouting and regrowth, commonly used tool are hand axe, hoe and mattock. Reynolds and Martin (1968) found mattock to be the most effective mean of removing mesquite of small diameter (<1).Grubbing is generally more suitable for controlling light stands of young mesquite (Herbal, et al.,1958).

2.3.4.2. Cutting:

Cutting is normally carried out using different tools such as axes, chain saw out wheel-mounted and circular power saws. Cutting has the advantage of high selectivity, with little damage to desirable species and it can be done at any time (Rechenthin, et al., 1964).However, it is very expensive in term of labour and time (Miller, 1971)

2.3.4.3. Girdling:

Girdling is the removing of the barks and xylem. It is very effective in large trees .However, not all woody species are readily killed by this method. Girdling is carried out by hand axe, saw or power girdler. Girdling is more effective compared to clear cutting since it stops translocation of carbohydrates to the roots .Girdling permits greater exhaustion of root reserves than dose cutting (Vallentine, 1980)

2.3.4.4. Mechanical Control:

The use of mechanization for the control of mesquite is applied in many different ways: choosing the best mechanical method to use in controlling mesquite depends on several factors like characteristics of the species, size of the stem, topography and soil kind (Braun, 1991).

2.3.4.5. Biological Control:

Mesquite seal (Taumeyella mirabilis) was found to attack mesquite trees in Howe garden. However, it is ineffective on trees on the open desert (Wene, 1969). Also the mesquite twig girdle Oncideres rhodosticta showed a considerable damage to mesquite (Ueckert, et al., 1971)

2.3.4.6Chemical Control:

Herbicides are chemical compounds used to kill or inhibit growth of undesirable plants (Quantick, 1985)

Herbicide can be divided into two types (i) organic (ii) inorganic, with in the organic group, kerosene and inter diesel oil are used...Oils like kerosene and diesel oil are distinguished noxious plants even without adding herbicide (Vallentine, 1980)

CHAPTER THREE

Materials and Methods

Chapter Three

Materials and Methods

This study which conducted in Plant pathology laboratory, plant protection department, college of Agricultural studies, Sudan University of Science and Technology to evaluate the inhibitory effect of Mesquite aqueous extracts against *Fusarium solani*.

3.1 Collected Samples

The infected sample showing typical dry rot in potato tuber collected from central market for vegetables/bahry randomly and brought to the laboratory plant pathology for isolation.

3.2 Isolation of Fusarium solani:

The infected potato (tubers) showing symptoms of the disease were cut into small sections(0 .4-1.0 cm),washed thoroughly with tap water, Surface sterilized with Clorox(NaOCI) for 5 minutes rinsed three time in changes of sterilized distilled water and dried on sterilized filter papers. The sterilized roots sections were plated at the rate of five sections/plate on potato dextrose agar (PDA) medium supplemented with chloramphenicol (0.05g / L) in 9-cm Petri dishes .The Petri dishes were incubated at 25^{Co}.After incubation for 5 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 5^{o} C 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 times and slides were prepared and examined microscopically to confirm identity(x: 40).

3.4 Identification of the pathogen

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

3.5 Growth Rate of the pathogen

The pure cultures of *F.solani* were prepared using 5days old mycelia.

The fungus was cultured on PDA then transferred, aseptically, to the centre of petri dishes containing PDA medium and incubated at 25^{oC}.

The linear growth of the fungus was assessed in cm after 48h.

3-6 Collection preparing of plant materials

Mesquite were collected from Shambat 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 (100 gm.) and placed in conical flask containing 100 ml distilled water and it was placed in a shaker for 24hrs. The extracts were filtered overnight to obtain 25% 50% and 100% concentrations.

3-7 Fungicide process

The chemical tested were Fulldazin fungicides 10ml dissolved in 100ml of sterilized distilled water to give 5, ppm respectively. For this solution 5, 10, 15 were completed to 100ml 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 plant as well as fungicide Fulldazin previously prepared Concentrations 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 9cm in diameter petri-dishes.

CHAPTER FOURE

Results and Discussion

CHAPTER FOURE

Results and Discussion

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 September 2017.

The aim of this study is to investigate the antifungal activities of, Mesquite (Prosopis juliflora) leaves aqueous extract on the liner growth of *Fusarium solani* in cultural media under laboratory conditions, the temperature room around 27 ^{0}c

Table 1show the effect of Mesquite leaves aqueous extracts on the linear growth of *the Fusarium solani* compared to control. The extracts of Mesquite plant tested had significant effects on fungal growth. The concentration 100% of the extracts tested caused 77 % reduction in linear growth, followed by the 25% concentration extracts tested recorded 81 % redaction, and finally the 50% concentration extracts tested recorded 71 % redaction.

The present in vestigations revealed that in growth of *F.solani* was significantly checked by aqueous extracts of Mesquite at all concentration results showed that , mesquite had the highest antifungal activity against F.solani as it inhibited 77 % the radial fungus growth (100%).

Mesquite leaves extracts was determined by study using water as solvents three concentration of Mesquite plants extracts were used (25,50and 100%) as antifungal activity against *Fusarium solani* . The results of the experiment revealed that the mesquite extract was more effective .These finding corroborates the notion plants are one of the most important sources of medicine. Plants-derived compounds

(Phytochemicals) have been attracting much interest as natural alternatives to synthetic compounds.

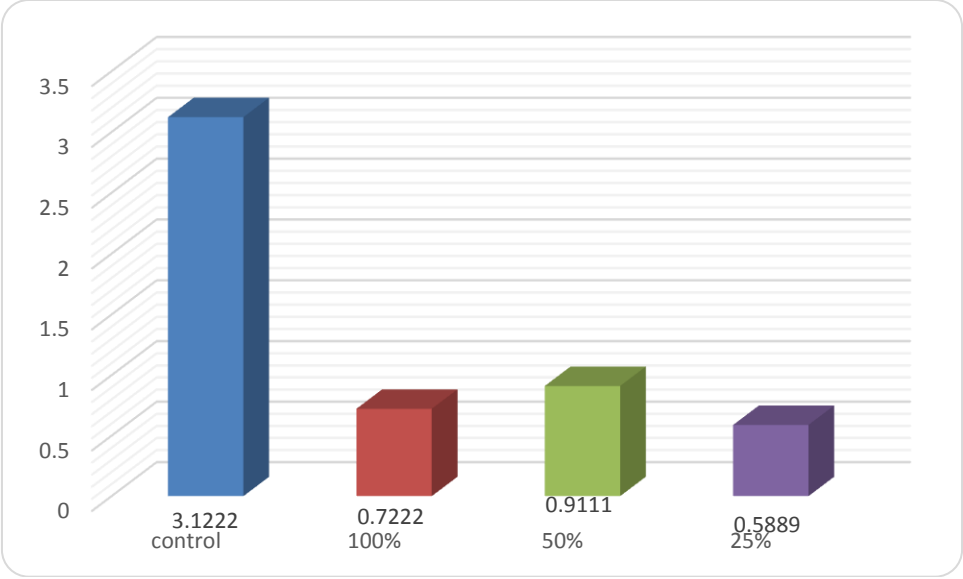
Table (1).The effect mesquite leaves aqueous extracts on the linear growth of the *Fusarium solani*

CV	Treatment (concentration)	% Reduction in growth(R)
23.16	25%	81%
73.92	50%	71%
54.41	100%	77%
17.08	Control	100%
00000	Fungicide	

$$R = \frac{C - T}{C} * 100$$

C= control

T= treatment


3.5
3
2.5
2
1.5
1
0.5
0
3.1222
control
0.7222
100%
0.9111
50%
0.5889
25%
Treatment

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