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Investigation of Allelopathic Potential of *Acacia nilotica* L. Different Parts (Bark, Leaves and Pod) on Some Plants.

A thesis presented to the department of botany faculty of science Benghazi university for fulfillment of the requirement for the degree of master of science

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Gifting

To the seal of the prophets and messengers honest and custodian prophet

"Muhammad peace be upon him"

To the candle Which Lights my life and its light Such as sunlight

My mother

To than will remain a all lifetime In my memory

my father

To than she taught and lit my way of science and knowledge

Prof . Mohamed Adrawi Alaib

To than he taught and easy to me the difficulties

My brothers

To my brother and his family a decent

My friends

All friends help me my project

Acknowledgment

praise be to **Allah**, which helped me on the completion of this message.

I am very grateful to **prof .Mohamed Adrawi Alaib**, my advisor .I am thank my **family** and my **friends**. Special thanks for all staff members of botany department, faculty of science University of Benghazi .I would also like to thank all helped me for the completion of this thesis.

CONTENTS

Title **Page No**

LIST OF TABLES

LIST OF FIGURES

List of plates

Abstract

Set of experiments were conducted for evaluation of the allopathic effects of water extracts of different parts (Bark, leaves and pods) of *A. nilotica* as well as soil extracts under canopy on seed germination and seedling development of two receptor species (*Cucumus sativus* L. and *Rphanus sativus* L.*)* under different concentration. inhibitory effect of the different donor plant parts water extracts was ranked as follows: pod > leaf > bark. On the other hand, the germination percentage and seedling growth of investigated receptor species demonstrated a gradual decrease with applying higher concentration of the donor species as follows: *Rphanus sativus* > *Cucumis sativus* regardless of the different donor plant parts.

Soil extracts at different distances from trunk had stimulatory effect at 2m and 5 m distance while at the edge soil extract showed inhibitory effect on seed germination and seedling development m of both *Cucumus sativus* L. and *Raphanus sativus* L.

study of the effects of water extracts on seedling development through foliar spray were also investigated the results showed that both species responded negativity in different ways.

Finally the obtained result reported in this thesis suggests that *Acacia nilotca* can cause grate losses in crop yield through it is release of

allelochemicals that can inhibit seed germination and seedling development. On the other hand allelchemicals produced by that plant may be used as natural pre-emergence herbicides to control many weeds in crop fields.

Introduction

Allelopathy is a natural phenomenon in which plant interaction play an important role in the agroforestry system (Rice, 1984). defined allelopathy as the effects of one plant (including microorganisms) on anther plant via the release of chemicals into the environment (Kong *et al*., 2004). Plant allelochemicals are known to be secondary plant metabolite that may be released to the environment from plants by means of four processes: root exudation, volatilization, Leaching and decomposition of plant residues in soil (Chou, 1989). Many plant allelochemicals recoreded in plants such as phenolics , terpenoids, alkaloids, fatty acid, steroids, and polyacetylenes are known to play an important role in allelopathy, which includes positive and negative effects in the plants (Inderjit and Malik,2002). The multiple effects resulting from allelochemicals include decrease in plant growth, absorption of water, mineral nutrients, ion uptake , leaf water potential , shoot turgor pressure, osmotic potential, dry matter production, leaf area expansion, stomatal aperture size, stomata diffusive conductance, and phytosynthesis (Chou and Lin, 1996). Most researarch on allelopathy has focused on the effect of interaction among weed species, weed and crops and crops species (Singh *et al*., 2009).

Understanding allelopathic effects of forest trees on potential crops is vital for successful agroforestry systems (Kohli *et al*.,1998).

Acacia is multipurpose nitrogen fixing tree legume. It occurs from sea level to over 2000m and withstand at extreme temperature (>500 C) and air dryness but sensitive to frost when it is young.(Bargal *et al*., 2009).

Acacia species contains secondary metabolites including amines and alkaloids, cyanogenic glycosides, cyclitols, fatty acids and seed oils, fluoroacetate, gums, nonprotein amino acids, terpenes (including essential oils, diterpenes, phytosterol and triterpene genins and saponins), hydrolyzable tannins, flavonoids and condensed tannins (Seigler, 2003). The plant is richer source of cystine, methionine, threonine, lysine, tryptophan, Potassium, phosphorus, magnesium, iron and manganese (Singh *et al*., 2008)The plant chemical compounds like diester, pentacosane dioic acid dihexadecyl ester alcohol, heptacosane 1, 2, 3-triol (Banso, 2009). Seeds: contain high percentage of phenolic constituents consisting of m-digallic acid, gallic acid, protocatechuic and ellagic acids, leucocyanidin, m-digallic dimer 3,4,5,7-tetrahydroxy flavan-3-ol, oligomer 3,4,7- trihydroxy flavan 3,4-diol and 3,4,5,7-tetrahydroxy flavan-3-ol and (-) epicatechol. The mature seed also contains crude protein, crude fibre, crude fat, carbohydrates, potassium, phosphorus, magnesium, iron and manganese occurred in high concentrations and it is richer source of cystine, methionine, threonine, lysine and tryptophan. Fruit also contains mucilage and saponins(Pande, 1981 ;Siddhuraju *et al.*, 1996). Pods: contains gallic acid and it's Me-este-n-digallic acid and condensed tannins. Leaf: contain apigenin, 6-8-bis-D-glucoside, rutin, 8% digestive protein (12.4% crude protein). Relative levels of tannin in different parts of plant is, deseeded pods (50%), pods (5.4%), leaves (7.6%), bark (13.5%) and twigs (15.8%). (Wassel, 1990). Bark: contains tannin (12-20%), terpenoids, saponins and glycosides,Phlobetannin, gallic acid, protocatechuic acid pyrocatechol, (+) – catechin, (-) epigallocatechin-5,7-digallate. (Chaubal, 2006). Its extract contains total phenolic content ranging from 9.2 to 16.5 g/100 g (Bushra *et al*., 2007) Root: contains octaconsanol, betulin, B-amyrin and B-sitosterol. Gum: is composed of galactoaraban which gives on hydrolysis L-arabinose, D-galactose, L-rhamnose, D-glucuronic acid and 4-O-methyl- D-glucuronic acid.

A. nilotica is widely spread in subtropical and tropical of *Acacia nilotica* includes much of Africa and the Indian subcontinent (Cox, 1997). From the GRIN database (USDA, ARS, National Genetic Resources Program. 2001), the native distribution includes: Africa: Algeria, Angola, Botswana, Egypt, Ethiopia, Gambia, Ghana, Guinea-Bissau, Kenya, Libya, Malawi, Mali, Mozambique, Niger, Nigeria, Senegal, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe

Asia: Iran, Iraq, phalestain, Oman, Saudi Arabia, Syria, Yemen, India, Nepal, Pakistan.(Reichard *et al*., 2009).

Distribution of *A. nilotica* in Libya confined to sauterne part particularly in : Sokna, Sebha, Germa, Tajirhi, Wegh, Ghat El Birkit, Gebel Uweinat, Ghat and Kufra. (Jafri *et al*., 1978).

Acacias are established as very important economic plants since early times as source of tannins, gums, timber, fuel and fodder. They have significant pharmacological and toxicological effects In Africa and the Indian subcontinent; *A. nilotica* is extensively used as a browse, timber and firewood species (Gupta, 1970; Mahgoub, 1979; New, 1984).

It is a medicinally important plant. Its different parts are used for different purposes. *Acacia nilotica* is economically used as a source of tannins, gums, timber, fuel and fodder (Gupta,1970 ; Mahgoub, 1979). It is used as Anti-cancer, anti tumours, Antiscorbutic, Astringent, anti-oxidant, Natriuretic, Antispasmodial, Diuret ic, Intestinal pains and diarrhea, Nerve stimulant, Cold, Congestion, Coughs, Dysenter Fever, Hemorrhages, Leucorrhea, Ophthalmia and Sclerosis. (Saini, 2008). Seed: have antimalarial, antidiabetic, antihypertensive and antispasmodic activities. Leaves & Pod: The leaves and pods are an excellent fodder with antiinflammatory properties, rich in protein. The pods have molluscicidal and algicidal properties. Bark: It is used in the treatment of hemorrhages, cold, diarrhea, tuberculosis and leprosy. Root: is used as an aphrodisiac and the flowers for treating syphilis lesions. Gum: obtains from the tree is pharmaceutically used as suspending and emulsifying agent and in preparation of many formulations. Its resins repel insects and water (Duke, 1983).

The aims of the study

Evaluation of phytotoxicity of the extracts of different parts of *Acacia nilotica* L. (park, leaves and pods),through its effect on

1-Seed germination

2-Seedling growth and development of test plant .

Literature Review

2.1. Definition of allelopathy:

Allelopathy is an interference mechanism, in which live or dead plant materials release chemical substances, which inhibit or stimulate the associated plant growth (Harper, 1977 ; May and Ash, 1990).

Allelopathy is the term used to refer to certain biochemical interactions between all types of plants, including micro-organisms The chemical exudates or leachates which are released from leaves, stems or roots (living or dead) can have an inhibitory or a stimulatory effect on other species or on the same species. The word does *not* refer to *direct* competition for water, minerals, food or light (Molisch, 1937).

A rapidly growing body of data suggests that allelopathy is often important in the survival and growth of trees in both plantations and natural stands. An awareness this phenomenon, and its potential effects on regeneration and site productivity, is essential in the practice of intensive silviculture. (Fisher, 1980).

Phenomena previously attributed to competition for light, moisture, or minerals should be evaluated with a cognizance of possible allelopathic effects. (De Moral and Cates, 1971).

The evidence is obviously accumulating rapidly indicating that many important forest tree species exert allelopathic effects against either herbaceous species or woody species or both. Such effects can no longer be ignored in forestry. (Rice, 1979).

Allelopathy has been known for a long time. For example, Pliny the Elder reported the toxic relation of walnut to other plants (Plinius, first century B.C.). In addition, allelopathy is well known in folk lore. The nonspecialist would usually consider, however, that allelopathy is a minor phenomenon restricted to exceptional species. Black walnut *(Juglans nigra)* is' one of the best known (Massey, 1925; Schneiderhan, 1927; Brooks, 1951; Bode, 1958; Fisher, 1978; Funk *et al.*, 1979.)

2.2. Mode of action of allelopathy

The mechanisms of action of allelochemicals are not yet clear. Also, the mode of action of plant –produced toxins is still more unclear (fitter and hay,1995). Allelochemical production and toxicity were affected by multiple factors, like soil moisture and texture nutrient availability, temperature and solar radiation. Allelopathic ecosystem – level effects include changes in germination rates, inhibition of seedling growth, insect and bacterial growth, function of mycorrhizal, dieback of mature tree and inhibition of nitrification or litter fall decomposition (Blance, 2007).

Allelopathic interaction in development and growth is complex process that affects all development and growth aspects(El-khatib *et al*., 2004) e.g. protein, hormone and chlorophyll synthesis, cell division, cell wall structure, membrane permeability and function and active transmission of especially enzymes, anther and spore germination, organelle synthesis, photosynthesis, respiration, leg-hemoglobin biosynthesis, activity of nitrogen fixation bacteria and mycorhizal fungi, crop water up take rate are liable to disturbances by allelochemicals (De -Neergard and Porter ,2000).

2.3. Allelopathic activity of *Acacia nilotica*.

Tripathi *et al*., (1998) studied the allelopathic activity of *Acacia nilotica* on germination and growth of soybean, in which, the leaf extracts at lower concentrations there was stimulatory effect on germination, growth, chlorophyll, protein, carbohydrates and proline contents of soybean, but in higher concentrations, there was a decreasing trend of all the parameters in the soybean.

El-Khawas and Shehata, (2005) reported that the leaf leachates of *Acacia nilotica* inhibited The germination and growth of *Zea mays* and *phaseolus vulgaris*.

Khan *et al*., (2005) reported that allelopathic potential of aqueous extracts of bark of *Acacia nilotica* inhibited The germination and growth *Ipomoea sp. Asphodelus tenuifolius Barssica campestris* and *Triticum aestivum*.

Velu *et al* ., (1999) reported that the *Acacia* spp. Have phytotoxic effects on the tree crops of Legumes.

Duhhan and Lakshinarayana, (1995) found that the growth of *Cyamopsis tetragonoloba* and *Pennisetum* growing at distance of 1-2 and 7.5m from tree of *Acacia nilotica* was inhibited.

Fag and Stewart, (1994) suggested that the inhibitory effect of *Acacia nilotica* on seed germination and seedling growth is related to presence of allelochemicals including Tannins, flavonoids and phenolic acids.

Stratmann and Ryan, (1997) and El- Khawas, (2004) suggested that allelopathy of *Acacia* ssp. Induced the formation of stress proteins. These proteins are responsible for folding assembling,translocation and degradation in a broad array of normal cellular processes such as improvement of plant growth, physiological and molecular characteristics.

Li and Wang, (1998) Stated that allopathic ability of *Acacia nilotca* may have the potential as Herbicide and can be used in biological control of weeds.

Swaminatha *et al*., (1989) has studied the Allelopathic activities of *Acacia nilotica*. were tested for potential inhibitory effects on eight arable crops. Seed germination of the arables was significantly inhibited by the extracts. To a greater extent, radicle and plumule growth too were affected. The inhibition by bark extract was greater than by leaf extract. It is assumed that the effective substances are phytotoxins, mostly tannin, which are present in the extract. However, the response of the crops was disparate, tomato being the most susceptible and sunflower the least. The poor growth reported in some areas, of crops irrigated from tanks, the foreshores of which have been grown to stands of *A. nilotica* may be related to tannin leached mostly from bark of the tree in rain wash.

Mehmood *et al.,* (2011) has studied the Effect of aqueous and n-hexane bark extracts of allelopathic tree species viz., *Acacia nilotica* (L.) was studied on germination and seedling growth of *Parthenium hysterophorus* L. In laboratory trials, all the concentrations of aqueous extract of both the test plants increased seed germination of target weed while by employing n hexane concentrations of *A. nilotica* the number of germinated seeds remained the same as in control except 20%. There was a negative phytotoxic response on weed growth by aqueous extracts of both test plants. Conversely a pronounced effect on plant growth (shoot and root length) was exhibited by n-hexane extract of test plants. Similarly, the biomass was significantly reduced by both aqueous and n-hexane extracts of both test plants. In pot trials, all the n-hexane concentrations of test plants invariably suppressed the root and shoot growth of target weed. There was 30-35%, 20-27%, 50% and 50-55%, 80% and 80-82% reduction in shoot length, root length and fresh/dry biomass of parthenium by n-hexane extracts of *A. nilotica*.

Dhanai *et al.*, (2013) reported that the Aqueous extracts of fresh leaf, bark and pod of *Acacia nilotica* were tested for potential effects on Wheat (*Triticum aestivum*). The results on seed germination and shoot-root length indicated that the inhibitory effect was proportionate to the concentration of the extracts. Seed germination and shoot-root length of wheat was found to be significant and aqueous effect increased with increasing in the concentration of aqueous fresh leaf, pod and bark extract from 5 to 20 per cent. Inhibitory effect was much pronounced on shoot length rather than root length. The maximum inhibitory effect among the various parts of *Acacia nilotica* was observed for pod extract.

Al-Wakeel *et al*., (2007) indicated that A greenhouse pot experiment was conducted to assess the allelopathic effects of *Acacia nilotica* leaves on the growth and metabolic activities of 45-day-old pea (*Pisum sativum L.*) plants. Qualitative and quantitative HPLC analysis of water extract of *Acacia nilotica* leaves revealed that protocatechuic and caffeic acids were the principal phenolic compounds accompanied by major amounts of ferulic, cinnamic acids and apigenin; whereas, pyrogallic, p-coumaric, syringic acids and coumarin were found in trace amounts. The lower doses of *Acacia* leaf residue (0.25 and 0.5%, w/w) stimulated the growth of pea shoot and root, but the higher doses (0.75, 1.0, 1.5 and 2%, w/w) were inhibitory to seedling growth and the effect was concentration dependent. The total phenolic content of pea shoots (particularly phenolic glycosides), increased at lower doses of *Acacia* residue and decreased with higher ones While, the phenolic aglycones increased with higher doses than lower ones. Chlorophyll a, b and carotenoids accumulated in pea shoot at lower doses of *Acacia* leaf residues, accompanied by accumulation of total sugar, mainly the insoluble fraction. On the other hand, the inhibition in the contents of photosynthetic pigments at higher doses of *Acacia* residues was paralleled by significant reduction in all sugar fractions. The contents of total nitrogen and phosphorus (their insoluble forms), increased with lower *Acacia* residues (0.25 and 0.5%); whereas all nitrogen and phosphorus fractions declined by increasing *Acacia* doses up to 1%.

Shahidtd *et al*., (2007) has studied the Aqueous extracts of (*Acacia nilotica*) were evaluated for their herbicidal potential alone and in combination with herbicides againts weeds of wheat during 2005-2006 at Agricultural university peshauar- Pakistan. Dried and chopped parts of these plants were soaked in water. Boiled filtered and were solely applied twice as foliar spray 30 and 50 days after sowing (Das). Herbicides namely Buctril M40 EC (Bromoxynilt+ MCPA), puma super 75 EW (fenoxaprop-p-ethyl) and Affinity 50 WDG (carfentrazone ethyl ester)
Were solely sprayed once as recommended rates 30 DAS. In combinations, doses of herbicides were reduced to half and applied mixed with full dose of extract once 30 DAS. Percent increase/decrease in weed density, dry

weed biomass and wheat grain yield relative to control were significantly affected by all the treatments.

2.4. Effect of *A. nilotica* on soil Characteristics

It was reported that the tree of *A. nilotica* improves soil fertility under its canopy by reducing proportion of sand with simultaneous increase in clay particles, mainly due to protection of soil from the impact of raindrops. Higher nutrient concentration under canopy compared to canopy gap is mainly a consequence of increased above and belowground organic matter input , nutrient cycling through leaf litter and protection of soil from erosion (Pandey *et al*.,2000; Nair, 1993; Palm, 1995). The decrease in nutrient concentration towards the canopy edge compared to mid canopy position is mainly due to relatively low inputs of leaf litter as the canopy of *A. nilotica* is thin towards canopy edge(Pandey *et al*., 1999).

A. nilotica is reported to be well nodulated with *Rhizobium* species (Dreyfus and Dommergues,1981). This nodulation behaviour help in biological nitrogen fixation which help to meet the nitrogen requirement in nutrient-poor soils. In addition, this species form symbiotic associations with naturally occurring soil fungi called vesicular arbuscular mycorrhizae (VAM) (Kaushik and Mandal, 2005). This association assists the roots to exploit more soil volume and to gain improved access to available nutrients especially phosphorus under stress and also makes the unavailable forms of nutrients into utilizable (Bowen, 1973).

2.5. Effect of *A. nilotica* on crop yield

It was reported that *A. nilotica* generally reduced crop yield under its canopy and this reduction varies with distance from the tree trunk (Pandey *et al*., 1999; Bargali *et al*., 2004).

In an experiment (Bargali *et al*., 2004) reported that gram yield increased with increasing the distance from the tree trunk and decreased with increasing the age of the tree. In the Mitchell grasslands of northwest Queensland Australia, *A. nilotica* suppresses pasture production by 50% at 25-30% tree canopy cover or 2 m2 basal area per hectare. It dramatically alters the ecological balance of grasslands and thereby threatens biodiversity.

Materials and method

3.1. Plant material:

Seeds of *Raphanus sativus* L. (radish) and *Cucumis sativus* L.(cucumber).were obtained from the local market.

3.2. Experimental site:

The experiments were conducted in main research laboratory. Benghazi university, Faculty of Science, Botany Department.

3.3. Preparation of extracts:

Fresh barks, leaves pods of *Acacia nilotica* and soil were collected from El kufra area in south west part of Libya (Mimosaceae) family. during March 2013 The materials were thoroughly washed with tap water followed by washing with sterilized water and oven dried at 50°C. The dried material was crushed in pestle and mortar and soaked in distilled water The water extracts of different parts of plants were prepared as per method of Narwal, (1996). (1 , 5and 10%) g of powdered plant material was dissolved in 100ml water to prepared extract of (1,5and 10%)concentration. The mouth of flask containing the extract was covered by aluminum foil and kept for 24 hours. After shaking well the extract was first filtered through a muslin cloth and again filtered through Whatman filter paper No.1 for complete separation of suspended particles. The extracts of different concentration were stored in refrigerator during the experimental period as per requirement.

A total of 500g of soil sample collected from under the canopy of *Acacia nilotica* were soaked in 500 ml distilled water for 24 h and, after shaking in an electric shaker for 30 min, were passed through Whatman No. 1 filter paper. Noumi and Chaieb, (2012).

3.4. Germination test*:*

Seeds were purified and selected of similar size. They were sterilized with 3% sodium hypo chlorait (chlorox) and were thoroughly washed with distilled water many times. Petri dishes (9cm in diameter) were cleaned, lined with one layers of filter paper. Four replicates were used per treatment (concentration), each contains ten seed five ml of distilled water and tested concentrations (from Bark, , leaves, pods and soil) were added. All Petri dishes were incubated in (WTB bind) incubator at 20 ºC. Distilled water and tested solutions were added whenever were needed. Seeds were allowed to germinate for five days. Daily and final germination percentages of seeds under different extracts solutions.

Were counted using the following formula:

Germination percentages (%) = Number of germination seeds/Total number of seeds ×100.

3.5. Seedling test:

After five days the plant were harvested and measures of the total fresh and dry weight of root and shoot of each seedling were taken .

1- Length of shoots and roots(cm) by using a ruler
2- Fresh weight by using four decimals balance (AB54-SMettler Toledo)
3- Roots and shoots were cover with aluminum foil and then placed in an oven at 60-80 C for one days. Root and shoot dry mass were recorded separately.

3.6. Foliar spray bioassay:

Rphanus sativus L . and *Cucumis sativus* L. seeds were sown in pots of 7 cm diameter and 8 cm deep each containing 800 g of botmose soil. Initially 10 seeds were sown in each pot, which were thinned to 3 uniform seedlings one week after germination and were further thinned to one at the time of photography. Leaves bark and pods extracts was prepared as for foliar spray bioassays. Freshly prepared extracts were sprayed on the surface of 15 days old **:** *Raphanus sativus* L. and *Cucumis sativus* L. plants with a hand sprayer. Ten subsequent sprays were similarly carried out with 5 days intervals each. Control plants were similarly sprayed with water. Plants were harvested 5 days after last spray. Data regarding length and fresh biomass of both root and shoot were recorded.

3.7. Determination of pH:

The pH of the extracts was determined by the PH meter

3.8. Statistical analysis:

Two way ANOVA and One way ANOVA with Tukey pos- hoc test and T test wear conducted initial length and fresh ، dry weight of shoot and root. Repeated measures analysis was used to investigate the patterns of change in growth over time among treatment.

Results

4.1. Effects of water extract of *Acacia nilotica* L. parts on *Cucumis sativus* L. (Cucumber) :

4.1.1. Seed germination:

Daily germination percentages of Cucumber seeds were not affected with increasing the concentration of water extracts of *A. nilotica* bark, leaves and pods from the third day up to fifth day of germination period. Final germination percentages were varied from 96% under (1 g / 100 ml), 98% under (5, 10 g /100ml) bark extracts concentration to 100% under control condition (0.0 g / 100 ml). While Final germination percentages were varied from 96% under (1 g / 100 ml),94% under (5 g /100ml), 92% under (10g / 100ml) leaves extract concentration to 100% under control condition (0.0 g / 100 ml). Also Final germination percentages were varied from 98% under (1 g / 100 ml),76 % under (5 g /100ml)86% under (10 g /100ml) pod extracts concentration to 100% under control condition (0.0 g / 100 ml) shown in (fig1). Different concentration of water extracts of *A. nilotica* bark, leaves and pods 1.0 g /100 ml had enhanced seed germination of *C. sativus* seeds. Whereas the highest concentration of pod, bark and leaves extract (10 g/ 100ml) significantly inhibited germination of *C. sativus* seeds. Analysis of the data however; Showed the germination percentage of cucumber was significantly affected by various extracts shown (table 1 Fig 1).

Table. 1. Effect of different concentrations of water extracts of *Acacia nilotica* L. on seed germination percentages of *Cucumis sativus* L.

Extract concentration	Day 1	Day 2	Day 3	Day 4	Day 5
Control	94.0±2.45	100.0±0.0	100.0±0.0	100.0±0.0	100.0±0.0
Bark					
1	86.0±2.45	94.0±2.45	96.0±2.45	96.0±2.45	96.0±2.45
5	92.0±3.74	98.0±0.200	98.0±0.200	98.0±0.200	98.0±0.200
10	84.0±24.5	94.0±2.45	96.0±2.45	96.0±2.45	98.0±2.45
Leaves					
1	82.0±0.200	96.0±2.45	96.0±2.45	96.0±2.45	96.0±2.45
5	62.0±3.74	94.0±0.400	94.0±0.400	94.0±0.400	94.0±0.400
10	66.0±0.400	92.0±0.200	92.0±0.200	92.0±0.200	92.0±0.200
Pod					
1	90.0±0.0	96.0±0.245	98.0±0.200	98.0±0.200	98.0±0.200
5	50.0±0.632	68.0±0.548	76.0±0.678	76.0±0.678	76.0±0.678
10	42.0±0.374	80.0±0.632	86.0±0.400	86.0±0.400	86.0±0.400

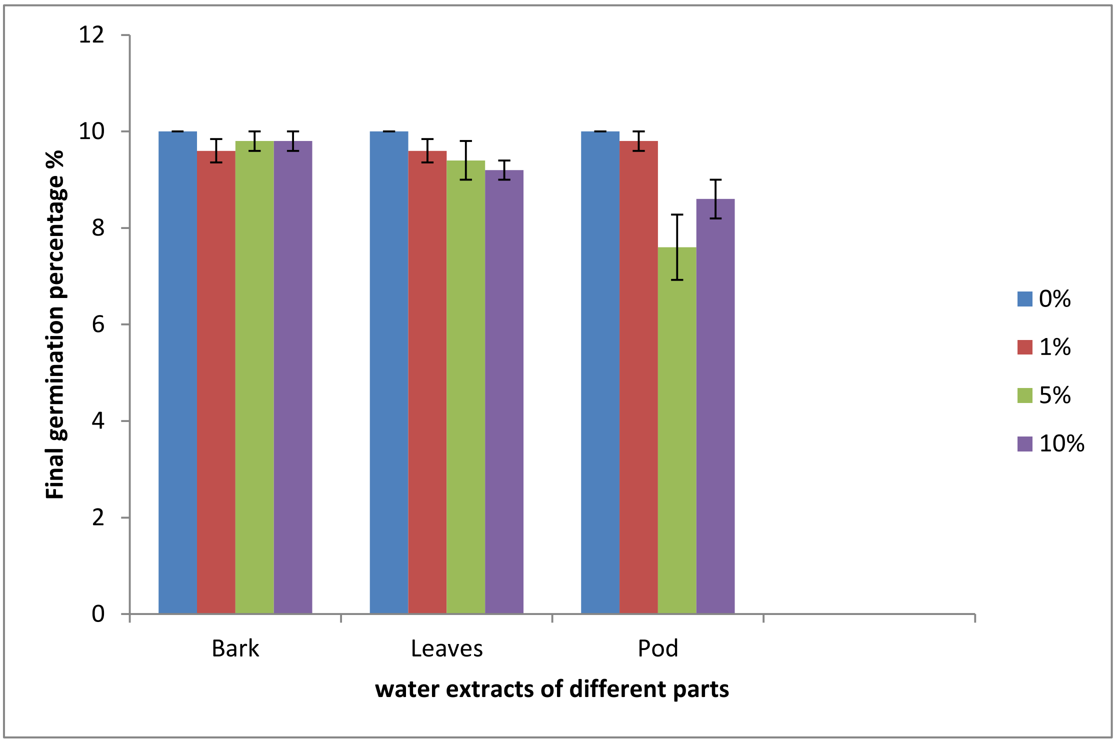


Figure. 1. Effect of different concentrations of water extracts of *Acacia nilotica* L. parts on final germination percentages of *Cucumis sativus* L. seeds five days after treatment.

4.1.2. Seedling growth

The test of allopathic potential of bark, leaves and pods water extracts on Cucumber seedling growth was carried out by measuring these parameters:

a. Shoot length(cm):

Statistical analysis showed that there were significant differences in the mean shoot lengths between treatments (bark, leaves and pods extracts) compared to control. Statistical analysis further revealed that for bark extract (F value = 2.896; $P<0.05$), for leaves extract (F value =26.145;$P<0.001$), and for pod extract (F value=17.850; $P<0.001$). Also there were significant differences within each treatment (table 2). It was observed that in most cases the inhibitory effect was found at (1,5and 10 g /100 ml) leaves, bark and pods extracts in comparison with control condition except 1% Bark extract which had stimulatory effect of *C. sativus* as shown in (Fig.2).

b. Root length(cm):

Statistical analysis showed that there were significant differences in the mean root lengths between treatments (bark and pods extracts) compared to control. Statistical analysis revealed that for(F value =55.233; $p<0.001$) for bark extract; and (F value =5.092; $p< 0.05$) for pods extract ,but leaves extract at (F value =0.124; $p>0.05$) were not significant differences . Also there were significant differences within each treatment (table 2) and(plate 1,3 and 5). was observed that in most cases the inhibitory effect was found at (1,5and 10 g /100 ml) leaves, bark and pods, in addition to that the colure of roots became dark brown compared with control condition ,while at 1% of bark extract stimulation of root system was evident (Fig. 3).

c. Biomass (g).

Fresh weight of shoots and roots of *Cucumus sativus* seedlings was reduced with increasing concentration of water extracts of different parts of the *A. nilotica* L. (bark, leaves and pods extracts) (table 2). The results of the study also showed that at the lowest concentration (1%) of bark extract of *A .nilotica* fresh weight of shoots and roots was increased . Whereas inhibitory effect was found at (1,5 and 10 /g 100 ml) of bark , leaves and pod extracts compared with control condition. Statistical analysis revealed that there were not significant differences between treatments and between different concentration within treatments (F value =0.148; $P>0.05$), for leaves extract, and (F=1.890; $P>0.05$) for pods extract but statistical analysis revealed that there were significant differences between treatments and between different concentration within treatments (F value =13.40; $P<0.05$) for bark extract of *C. sativus* (Fig.4).

For dry weight It was observed that the inhibitory effect was found at (1,5and 10 g /100 ml) leaves, bark and pods extracts compared with control condition except bark extract at 1% was increased in weight.

(table 2). Statistical analysis revealed that there were significant differences between treatments and between different concentration within treatments (F value = 8.401; $p<0.001$) for extract bark, (F value =0.990; $p<0.05$) for pods extract and (F value=11.203; $p<0.05$) for extract leaves concentration within treatments of *C. sativus* seedlings (Fig.5).

Table. 2. Effect of different concentrations of water extracts of *Acacia nilotica* L. on some growth parameters of *Cucumis sativus* L.(Cucumber) seedlings in Petri dish

Treatment	Conc.%	SL	RL	SFW	SDW
	control	3.100±0.2950	5.247±0.3263	0.64467±0.58012	0.11767±0.002333
Bark					
	1	2.853±0.5504	4.427±0.3398	0.67900±0.029000	0.11500±0.00493
	5	2.080±0.2680	1.813±0.3017	0.50967±0.44 281	0.10933±0.00233
	10	1.893±0.1067	0.713±0.1341	0.36067±0.009701	0.9800±0.00100
Leaves					
	1	1.913±0.0792	2.880±0.3410	0.46733±0.066195	0.07933±0.02333
	5	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0
	10	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0
Pod					
	1	1.413±0.1059	1.320±0.1964	0.43400±0.022030	0.04033±0.004096
	5	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0
	10	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0

SL: shoot length(cm) RL: Radical length (cm) SFW: Seedling fresh weight (g) SDW : Seedling dry weight (g)

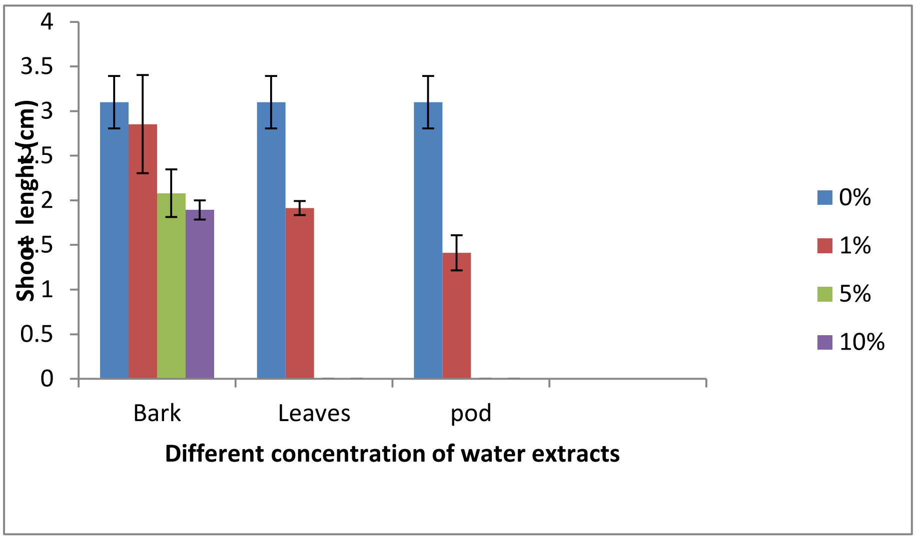


Figure. 2. Effect of different concentrations of water extracts of bark, leaves and pods of *Acacia nilotica* L. on shoot length of *Cucumis* sativus L. (Cucumber) seedlings in Petri dish .

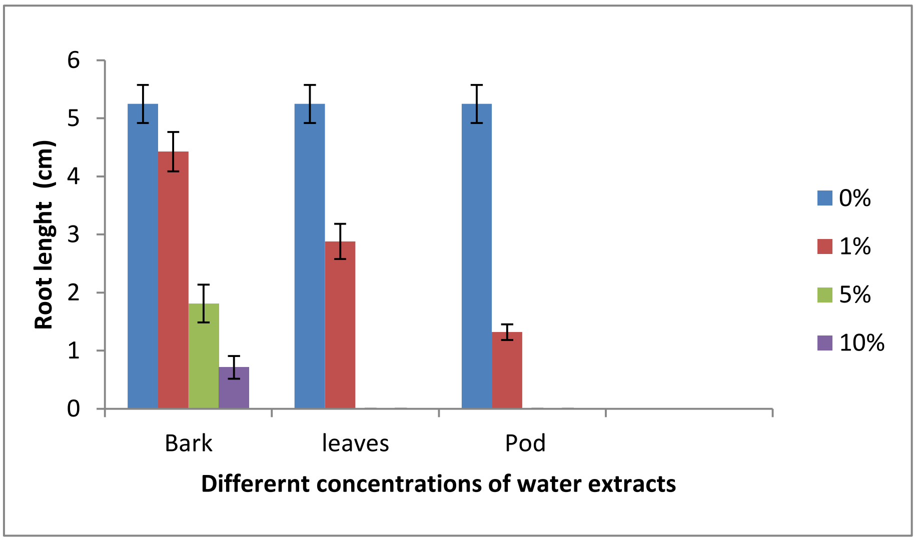


Figure. 3. Effect of different concentrations of water extracts of bark, leaves and pods of *Acacia nilotica* L. on root length of *Cucumis sativus* L. (Cucumber) seedlings in Petri dish .

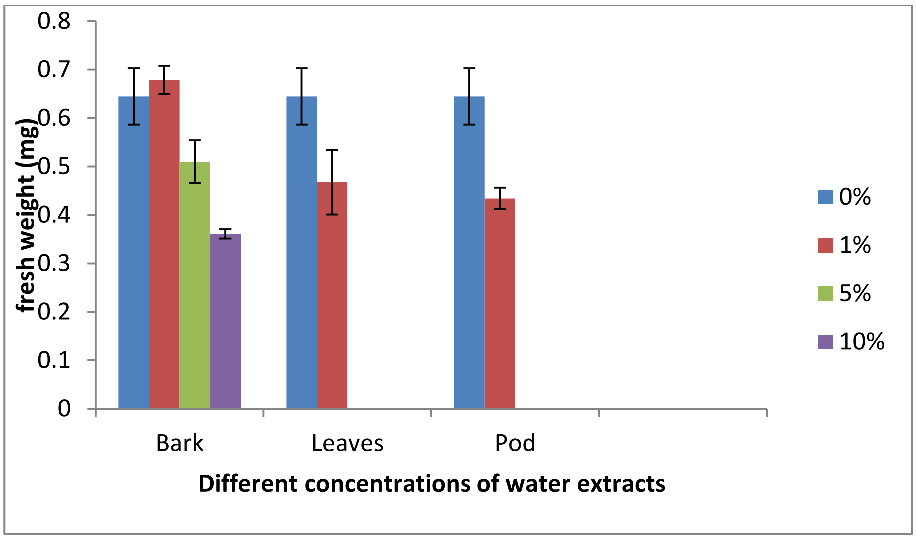


Figure. 4. Effect of different concentrations of water extracts of bark, leaves and pods of *Acacia nilotica* L. on Fresh weight of *Cucumis sativus* L. (Cucumber) seedling in Petri dish.

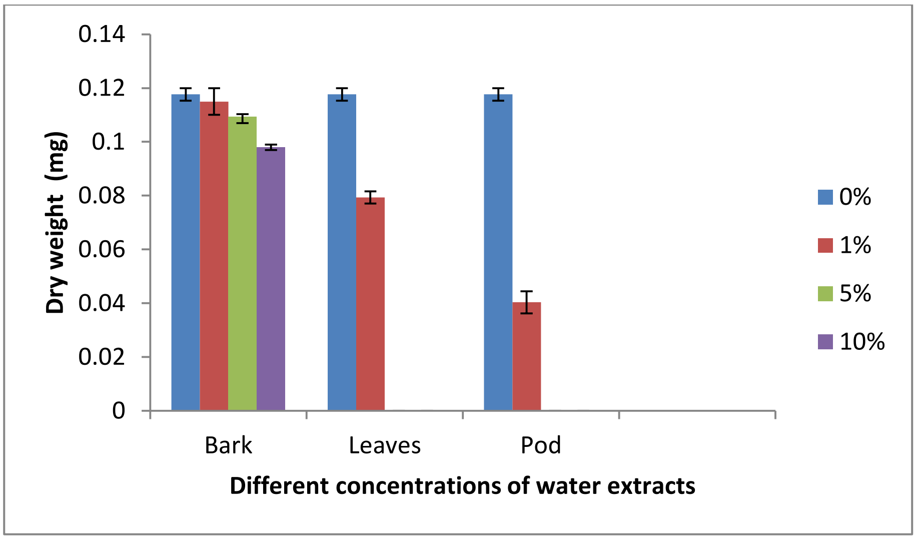


Figure. 5. Effect of different concentration of water extracts of bark, leaves and pod of *Acacia nilotica* L. on dry weight of *Cucumis sativus* L. (Cucumber) seedlings in Petri dish.

4.1.3. Foliar spray bioassay:

Data regarding the effect of foliar spray on cucumber seedlings showed that there were significant differences within treatment of the tree different concentrations (1, 5 and 10%) of the *A. nilotica* bark, leaves and pods extracts as shown in (table 3) plate (2,4 and 6). The pod and leaves extracts had more effect on shoot length at 10% compared 5% and 1% and control. While the bark extracts had less effect on shoot length at 10 ,5and 1% extracts (Fig.6). Statistical analysis showed that there were significant differences in shoot length between different treatments and controls in respect to. concentration used. (F value =8.011; $p< 0.001$) for bark extract,(F velum =20.527; $P<0.001$) for leaves extract, and (F velum =16.489: ; $p<0.001$) for pod extracts .

In respect to root length : pods extracts at all concentrations significantly suppressed root length of *Cucumis sativus* L. (Fig.7). On other hand bark and leaves extracts had the lest effect on root length at different concentrations compared to control. Statistical analysis showed that there were significant differences in root length between different treatments and controls in respect to concentration used (F value = 4.937; $P<0.01$) for bark extract,(F value =3.499; $P<0.05$) for leaves extract and(F value = 14.125 ; $P<0.001$) for pods extract root length of *Cucumis sativus* L.

Regarding the biomass all the extract types of *A. nilotica* at different concentrations significantly reduced the fresh and dry weight of shoots and roots of cucumber (Fig.8.). Statistical analysis showed that there were significant differences in fresh weight of cucumber which treated with different concentrations of *A. nilotica* parts compared to control. (F value=13.165; $P< 0.001$) for bark extract,(F value= 18.513; $P<0.001$) for leaves extract and (F value=34.452; $P<0.001$) for pods extract. Mean while statistical analysis showed that there were significant differences in shoot and root dry weight of cucumber which treated with different concentrations of *A. nilotica* parts compared to control (Fig.9.). (F value=6.574; $P< 0.001$) for bark extract,(F value =6.650; $P<0.001$) for leaves extract and(F value=7.088 ;$P<0.001$) for pods extract.

Table. 3. Effect of different concentrations of water extracts of *Acacia nilotica* L. on some growth parameters of *Cucumis sativus* L.(Cucumber) seedlings in pots .

Treatment	Conc.%	SL	RL	SFW	SDW
	control	20.07±0.441	12.87±1.144	2.187929±0.1852889	0.374980±0.1196134
Bark					
	1	17.03±0.701	10.53±0.496	1.220040±0.1025285	0.074247±0.0053191
	5	17.73±0.796	11.23±0.765	1.514133±0.0816575	0.067660±0.0058721
	10	15.73±0.573	8.13±0.599	1.204587±0.1132164	0.060633±0.0054092
Leaves					
	1	17.73±0.651	10.40±0.505	1.254009±0.0988636	0.07273±0.0050993
	5	18.00±0.602	12.13±1.068	1.428060±0.1202470	0.063500±0.0060742
	10	13.73±0.621	8.93±0.727	0.916307±0.629563	0.061627±0.0067084
Pod					
	1	13.60±0.600	8.47±0.631	920493±0.0781397	0.060073±0.0059195
	5	12.73±0.968	9.33±0.919	0.682080±0.0858710	0.052020±0.0050602
	10	10.67±1.582	4.53±0.654	0.674807±0.1138295	0.053107±0.0088086

SL: Shoot length(cm)   RL: Radical length (cm) SFW: Seedling fresh weight(g) SDW : Seedling dry weight(g)

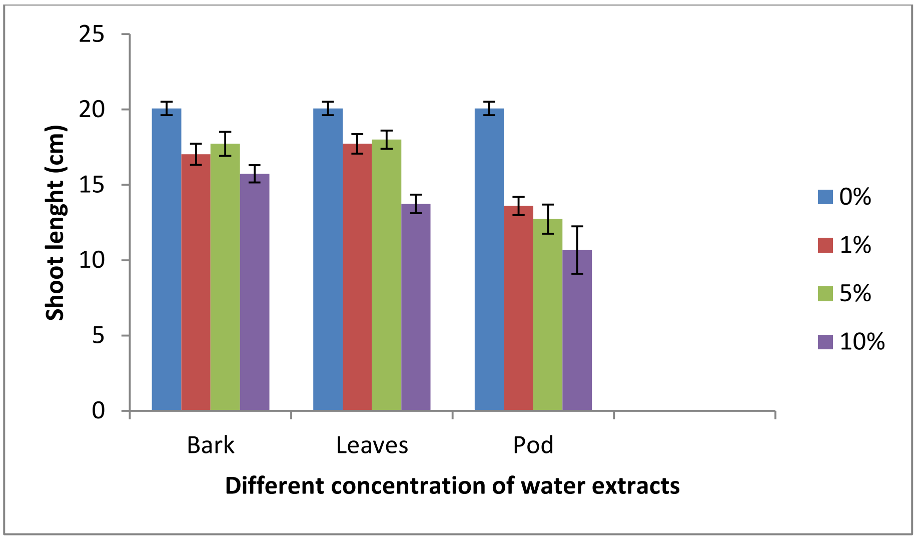


Figure. 6. Effect of different concentrations of water extracts of bark ,leaves and pods of *Acacia nilotica* L. on shoot length of *Cucumis sativus* L. in pots.

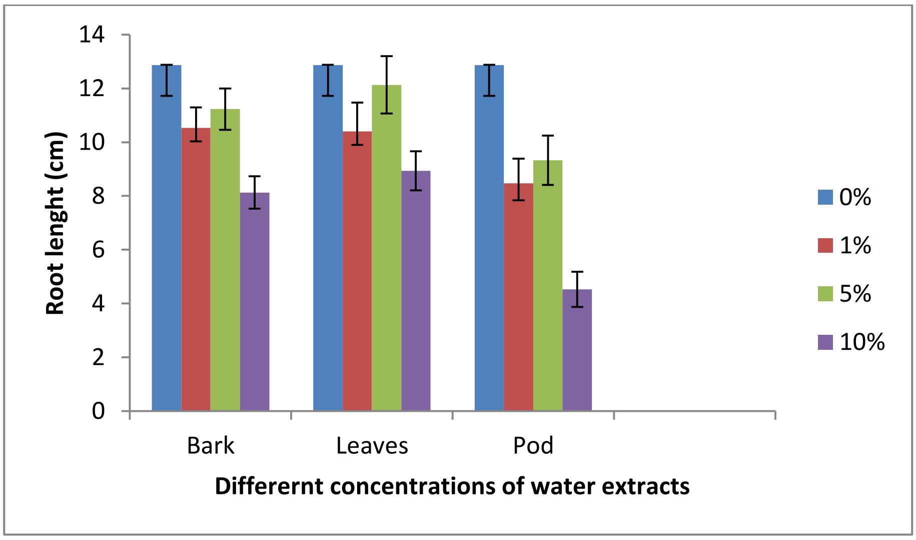


Figure. 7. Effect of different concentrations of water extracts of bark ,leaves and pod of *Acacia nilotica* L. on root length of *Cucumis sativus* L. in pots.

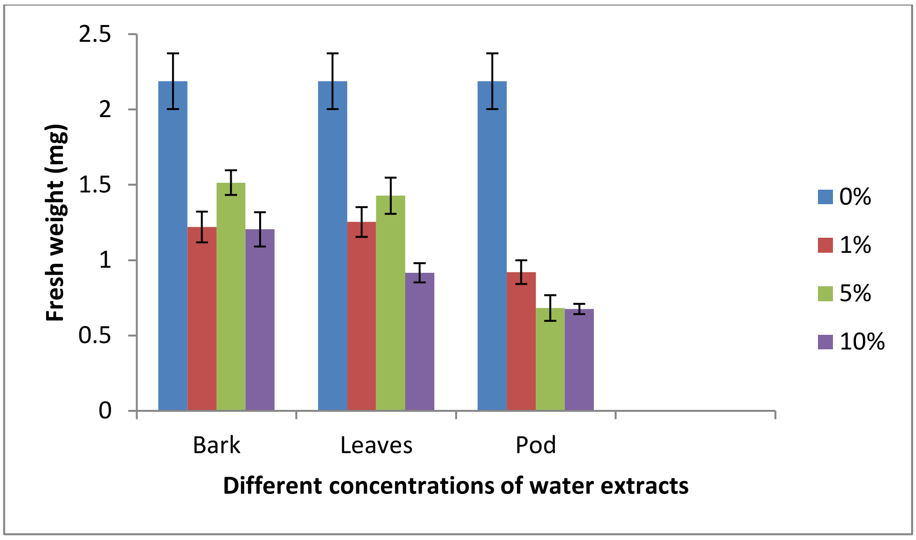


Figure. 8. Effect of different concentrations of water extracts of bark, leaves and pod of *Acacia nilotica* L. on fresh weight of *Cucumis sativus* L. in pots.

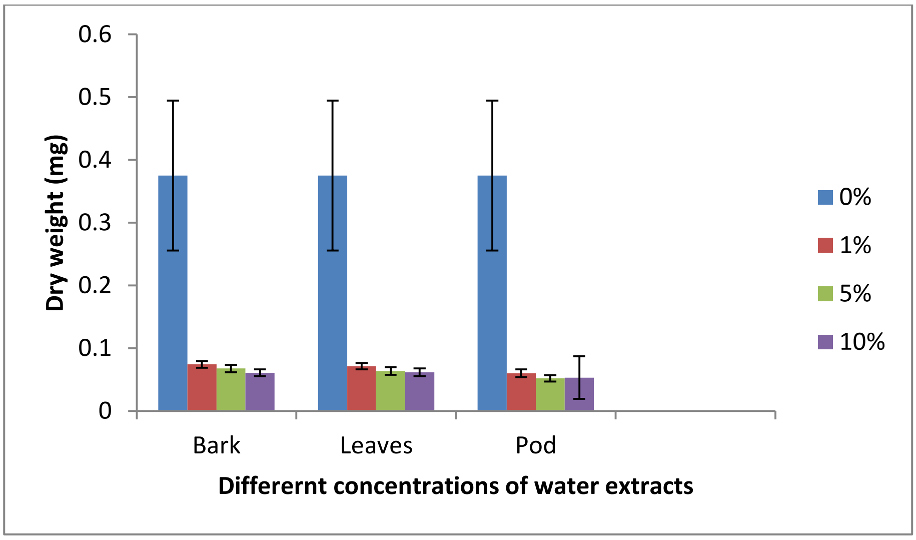


Figure. 9. Effect of different concentrations of water extracts of bark, leaves and pod of *Acacia nilotica* L. dry weight of *Cucumis sativus* L. in pots.

4.2. Effect of soil extracts under canopy of *Acacia nilotica* L. on seed germination and seedlings development of *Cucumis sativus* L.:

4.2.1. Seed germination :

Final percentage of seed germination showed that there were significant difference between the effect of soil extracts 2 and 5 (100% and 100%) mater distance from the trunk compared to control and tree edge soil (98% and 86%) (table 4). Extracts of soil of 2 and 5 m distance had stimulatory effect on germination of cucumber seed, while extracts edge soil had no effect compared to control. (Fig.10).

Table. 4. Effect of different concentrations of soil extracts of *Acacia nilotica* L. on seed germination percentages of *Cucumis sativus* L. five days after treatment

Soil extracts	Day1	Day2	Day3	Day4	Day5
control	70.0±0.316	84.0±0.245	98.0±0.200	98.0±0.200	98.0±0.200
2M	58.0±0.374	74.0±0.510	90.0±0.316	100.0±0.00	100.0±0.00
5M	62.0±0.374	84.0±0.245	94.0±0.00	100.0±0.00	100.0±0.00
EC	44.0±0.510	54.0±0.812	86.0±0.583	86.0±1.772	86.0±1.772

2M= 2Mater 5M=5Mater EC = Edge Canopy

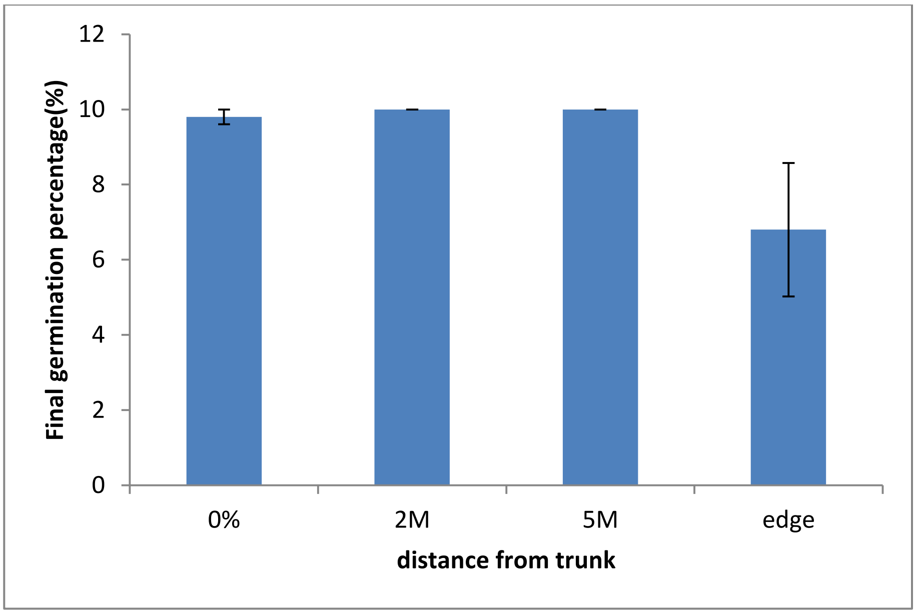


Figure.10. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances on final germination percentage five days after treatment. .

4.2.2. Seedling growth:

The test of allopathic potential of soil extracts 2M, 5M and edge from tree trunk *Acacia nilotica* on Cucumber seedling growth was carried out by measuring these parameters:

a. Shoot length(cm):

The effect of soil extracts at different distances from tree trunk on shoot length (table 5). It was observed that in most cases the stimulatory effect was found at (2m and 5m) compared with control condition but edge soil showed inhibitory effect of shoot length (Fig.11). Statistical analysis revealed that there were significant differences in effect of different soil extracts on shoot length of *C. sativus* (F value =10.011; $p<0.001$).

b. Root length(cm) :

The effect of soil extracts at different distances from tree trunk on root length (table 5). It was observed that in soil extracts at 2M and 5M from trunk had stimulatory effect on root which showed an increase in length and became more branched compared to control . But soil edge extract showed inhibitory effect of root length (Fig.12) (plate.7). Statistical analysis revealed there were significant differences in effect of different soil extracts on root length of *C. sativus* (F value =31.453; $P<0.001$)

c. Biomass (g):

The effect of soil extracts at different distances from tree trunk on fresh weight of cucumber are shown on (Fig.13.). It was observed that in soil extracts at 2M and 5M from trunk had stimulatory effect on biomass which showed an increase biomass compared to control whilst soil edge extract showed inhibitory effect of fresh weight. Statistical analysis revealed there were significant differences in effect of different soil extracts on fresh weight of *C. sativus* (F value=4.34; $p<0.05$). The effect of soil extracts at different distances from tree trunk on dry weight of cucumber are shown on (Fig.14.). It was observed that in soil extracts at 2m and 5m from trunk had stimulatory effect on biomass which showed an increase biomass compared to control whilst soil edge extract showed inhibitory effect of fresh weight . Statistical analysis revealed there were not significant differences in effect of different soil extracts on fresh weight of *C. sativus* (F value =2.121; $p>0.05$)

Table.5. Effect of soil extracts under canopy of *Acacia nilotica* L. on seedlings of *Cucumis sativus* L.

treatment	distances	SL	RL	SFW	SDW
	control	2.660±0.2968	4.800±0.05019	0.68533±0.068533	0.062733±0.0255524
soil					
	2M	3.933±0.4020	7.087±0.05520	1.051067±0.01472197	0.101400±0.0076166
	5M	4.900±0.03525	11.400±0.07007	1.072167±0.1122507	0.089433±0.0020464
	CE	2.793±0.02643	4.933±0.03990	0.900767±0.0663109	0.1017833±0.0058156

2M=2Mater 5M=5Mater CE= Canopy edge

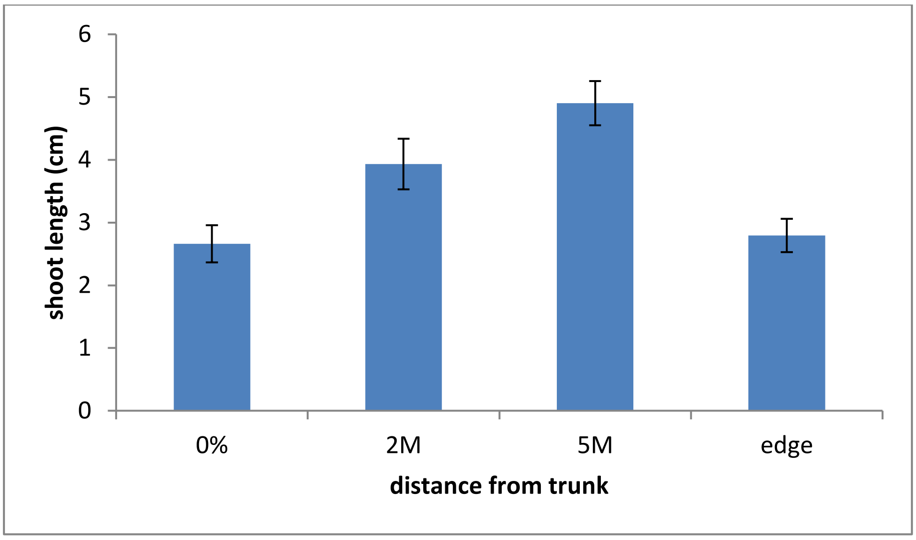


Figure .11. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances from trunk on shoot length of *Cucumis*. *Sati*vus L.

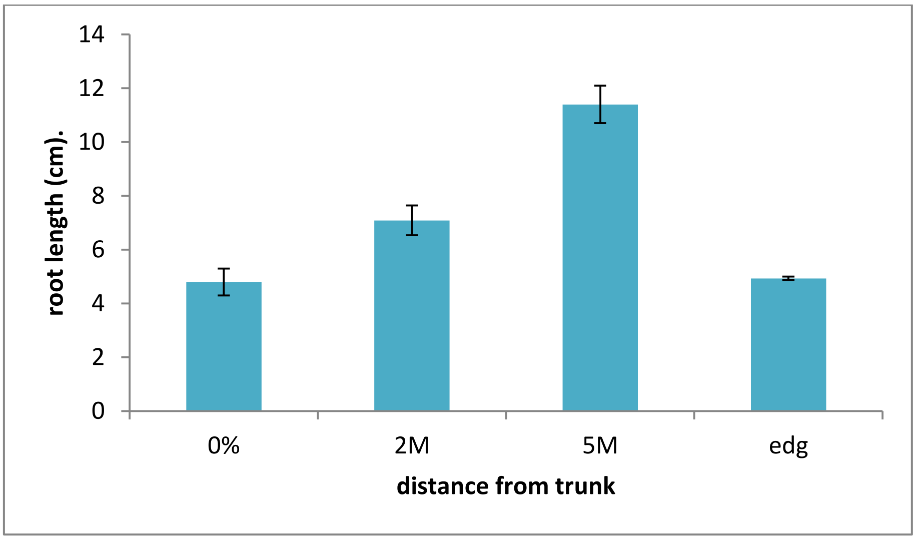


Figure.12. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances from trunk on root length of *Cucumis* *Sati*vus L.

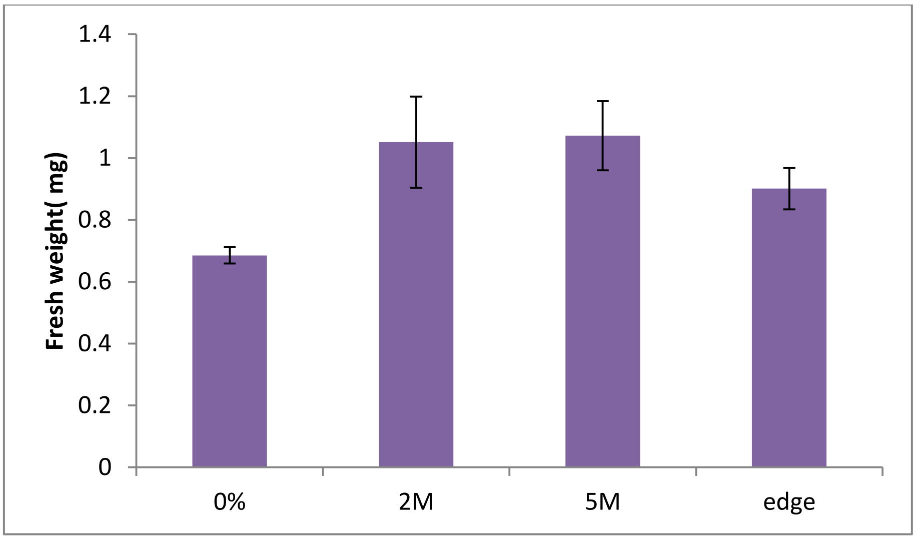


Figure. 13. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances from trunk on fresh weight of *Cucumis Sativ*us L.

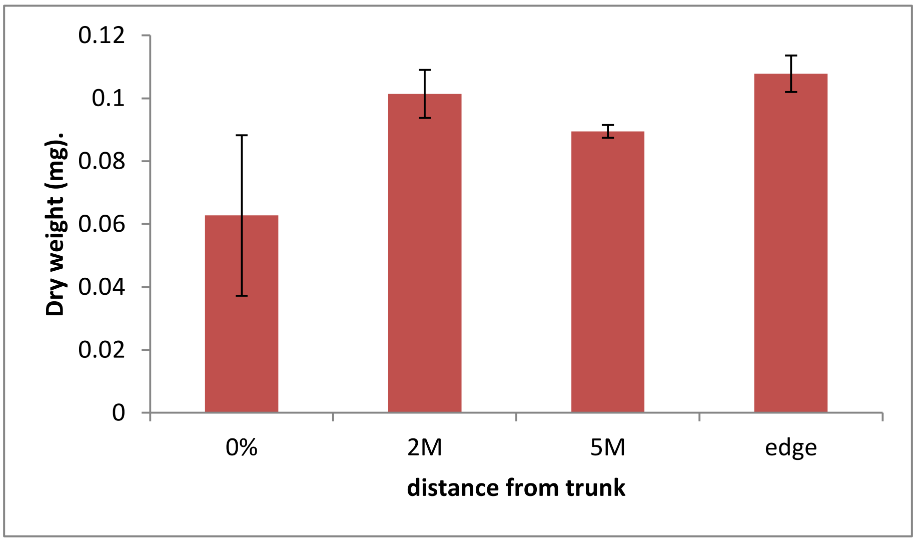


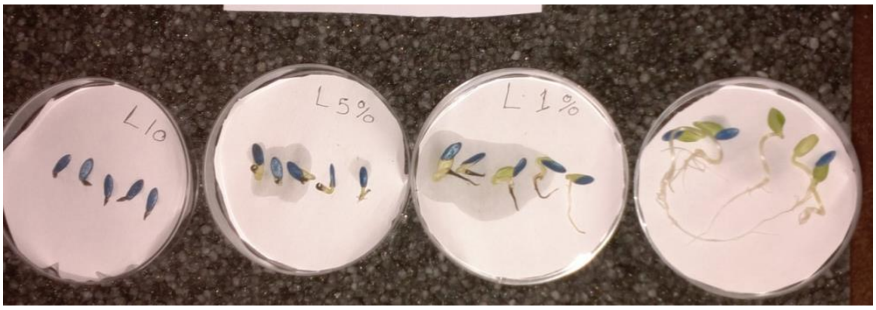
Figure. 14. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances from trunk on dry weight of *Cucumis Sativ*us L.

%10 %5 1% %0

Plate.1 . Effect of water extract of bark of *Acacia nilotica* on seed germination and seedlings development of *Cucumis sativus* L.

%0 %1 %5 %10

Plate.2. Effect of foliar spray of water extract of bark of *Acacia nilotica* on growth of *Cucumis sativus* L. seedlings .



10% 5% 1% 0%

. plate. 3. Effect of water extract of leaves of *Acacia nilotica* on seed germination and seedlings development of *Cucumis sativus* L.

%0 %1 %5 %10

Plat. 4. Effect of foliar spray of water extract of leaves of *Acacia nilotica* on growth of *Cucumis sativus* L. seedlings.

%10 %5 1% %0

Plate.5. Effect of water extract of Pod of *Acacia nilotica* on seed germination and seedlings development of *Cucumis sativus* L.

%0 %1 %5 %10

Plate. 6. Effect of foliar spray of water extract of Pod of *Acacia nilotica* on growth of *Cucumis sativus* L. seedlings.

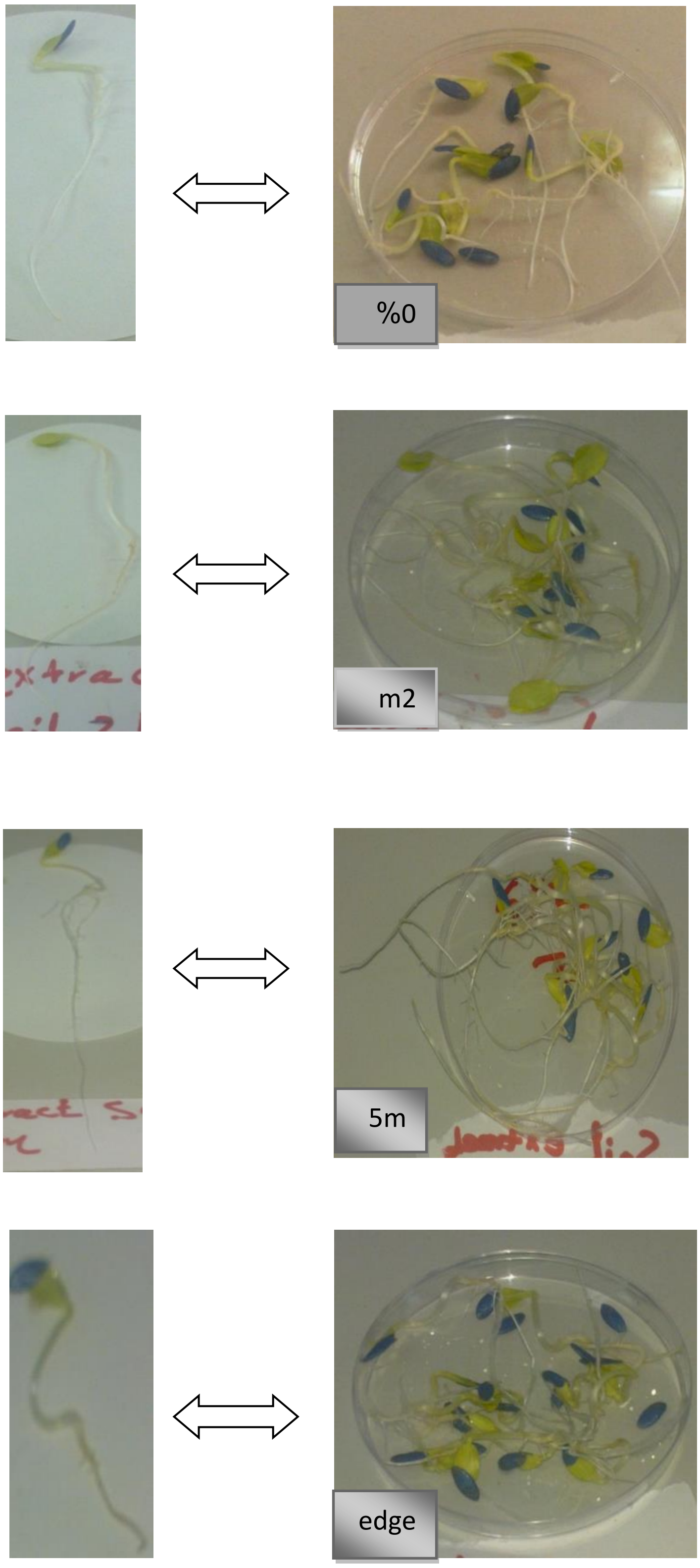


Plate.7. Effect of soil extracts at different at distance from trunk on seed germination and seedlings development of *Cucumis sativus* L.

4.3. Effect of water extracts of *Acacia nilotica* L. parts on *Raphanus sativus* L . (Radish):

4.3.1. Seed germination :

Daily germination percentages of radish seeds were not affected with increasing the concentration of water extracts of *A. nilotica* bark, leaves and pods had an effect with increasing concentration from the

third day up to fifth day of germination period. Final germination percentages were varied from 96% under (1,5 g / 100 ml),90% under (10 g /100ml) extract bark concentration to 96% under control condition (0.0 g / 100 ml). Final germination percentages however, were varied from 86% under (1 g / 100 ml) to 64 % under (10g / 100ml) of leaves extracts compared to 96% under control condition (0.0 g / 100 ml). For pods the percentage varied from 84% under (1 g / 100 ml),78 % to 26 % under (5g,10 g /100ml) of pods extracts compared to 96% under control condition (0.0 g / 100 ml). Different concentration of water extracts of *A. nilotica* bark 1.0 and 5.0 g /100 ml had enhanced seed germination of *R. sativus* seeds. Whereas the highest concentration of pod, bark and leaves extract (10 g/ 100ml) significantly inhibited germination of *R. sativus* seeds. Analysis of the data however; Showed the germination percentage of Radish was significantly affected by various extracts(Fig..15.).

Table. 6. Effect of different concentrations of water extracts of *Acacia nilotica* L. on seed germination percentage of *Raphanus sativus* L.

Extract concentration	Day 1	Day 2	Day 3	Day 4	Day 5
Control	90.0±5.48	92.0±0.374	96.0±0.248	96.0±0.248	96.0±0.248
Bark					
1	88.0±0.735	94.0±0.245	96.0±0.245	96.0±0.245	96.0±0.245
5	82.0±0.490	94.0±0.400	96.0±0.245	96.0±0.245	96.0±0.245
10	54.0±0.812	88.0±0.200	90.0±0.0	90.0±0.0	90.0±0.0
Leaves					
1	52,0±0.800	82.0±0.374	86.0±0.245	86.0±0.245	86.0±0.245
5	6±0.245	44.0±0.812	64.0±0.400	68.0±0.663	68.0±0.663
10	00.0±0.0	36.0±0.510	64.0±0.400	64.0±0.400	64.0±0.400
Pod					
1	42.0±0.583	80.0±0.548	84.0±0.748	84.0±7.48	84.0±0.748
5	4±0.245	28.0±0.490	78.0±0.800	78.0±0.800	78.0±0.800
10	00.0±0.0	22.0±0.583	26.0±0.748	26.0±0.748	26.0±0.748

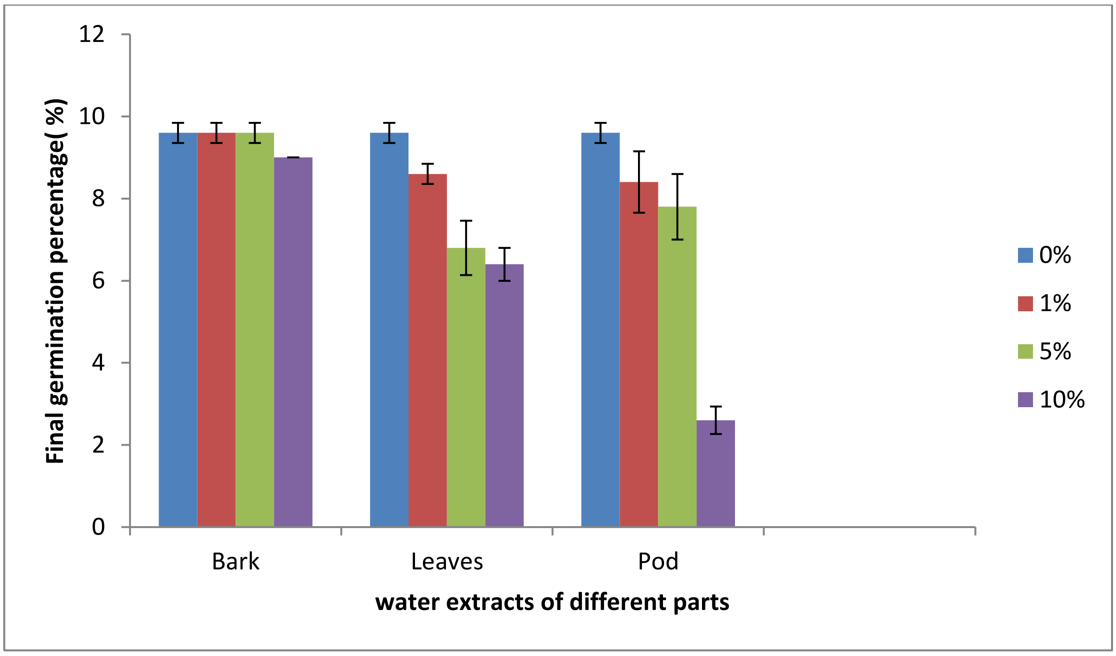


Figure. 15. Effect of different concentrations of water extracts of *Acacia nilotica* L. Bark, leaves and Pod on final germination percentage of *Raphanus sativus* L. five days after treatment..

4.3.2. Seedling growth:

The test of allopathic potential of bark, leaves and pods water extract on Radish seedling growth was carried out by measuring these parameters:

a. Shoot length(cm):

Statistical analysis showed that there were significant differences in the mean shoot lengths between treatments (bark, leaves and pods extracts) compared to control. Statistical analysis further revealed that for bark extract (F value = 42.203; P<0.001) for leaves extract (F value = 61.751;P<0.001), and for pod extract (F value= F15.066; p< 0.001). Also there were significant differences within each treatment (table 7). It was observed that in most cases the inhibitory effect was found at (1,5and 10 g /100 ml) leaves, bark and pods extracts in comparison with control condition except 1% Bark extract which had stimulatory effect of *R. sativus* as shown in (Fig.16).

b. Root length (cm).

Statistical analysis showed that there were significant differences in the mean root lengths between treatments (bark, leaves and pods extracts) compared to control. Statistical analysis revealed that for(F value = 67.062; p< 0.001) for bark extract; (F value =71.065; p<0.001) for leaves extract and F=45.418; p< 0.001)) for pods extract. Also there were significant differences within each treatment (table 7) and(plate8,10 and12). It was observed that in most cases the inhibitory effect was found at (1,5and 10 g /100 ml) leaves, bark and pods, in addition to that the colure of roots became dark brown compared with control condition ,while at 1% of bark extract stimulation of root system was evident (Fig.17).

c. Biomass (g).

Fresh weight of shoots and roots of *R. sativus* seedlings was reduced with increasing concentration of water extracts of different parts of the *A. nilotica* L. (bark, leaves and pods extracts) (table7). The results of the study also showed that at the lowest concentration (1%) of bark extract of *A .nilotica* fresh weight of shoots and roots was increased. Whereas inhibitory effect was found at (1,5 and 10 /g 100 ml) of bark , leaves and pod extracts compared with control condition. Statistical analysis revealed that there were not significant differences between treatments and between different concentration within treatments,($F=3.812; p>0.05$), for leaves extract, and($F=5.743; p>0.05$) for pods extract but statistical analysis revealed that there were significant differences between treatments and between different concentration within treatments (F value = 21.162; $p<0.001$) for bark extract of *R. sativus* (Fig.18).

For dry weight It was observed that the inhibitory effect was found at (1,5and 10 g /100 ml) leaves, bark and pods extracts compared with control condition except bark extract at (1%) was increased in weight. (table 7). Statistical analysis revealed that there were significant differences between treatments and between different concentration within treatments (F value =6.811;$p<0.05$) for extract leaves, and(F value =12.668; $p<0.05$) for pods extract, but extract bark at (F value =1.769; $p>0.05$) were not significant differences between treatments and between different concentration within treatments of *R. sativus* seedlings (Fig.19).

Table.7. Effect of different concentrations of water extracts of *Acacia nilotica* L. on some growth parameters of *Raphanus sativus* L. (Radish) seedlings in Petri dish

Treatment	Conc.%	SL	RL	SFW	SDW
	control	3.600±0.2378	7.133±0.2025	0.75400±0.101323	0.05133±0.006333
Bark					
	1	2.433±0.2025	2.367±0.1987	0.34500±0.009074	0.04500±0.002000
	5	1.307±0.0813	0.827±0.0777	0.25833±0.029180	0.04167±0.000882
	10	1.313±0.0965	0.453±0.0675	0.20167±0.024552	0.04033±0.002963
Leaves					
	1	1.913±0.2077	1.260±0.2227	0.27567±0.044916	0.04200±0.002000
	5	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0
	10	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0
Pod					
	1	1.053±0.0839	0.400±0.0697	0.27200±0.034429	0.03967±0.000667
	5	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0
	10	00.0±0.0	00.0±0.0	00.0±0.0	00.0±0.0

SL: shoot length(cm) RL: Root length (cm) SFW: Seedling fresh weight as g SDW: Seedling dry weight.

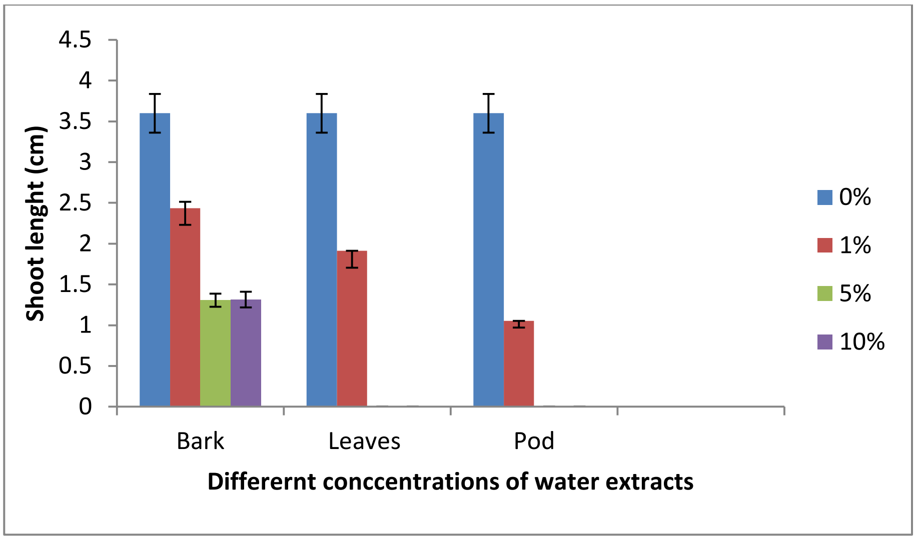


Figure.16. Effect of different concentrations of water extracts of bark, leaves and pod of *Acacia nilotica* L. on shoot length of *Raphanus sativus* L. (radish) seedlings in Petri dish.

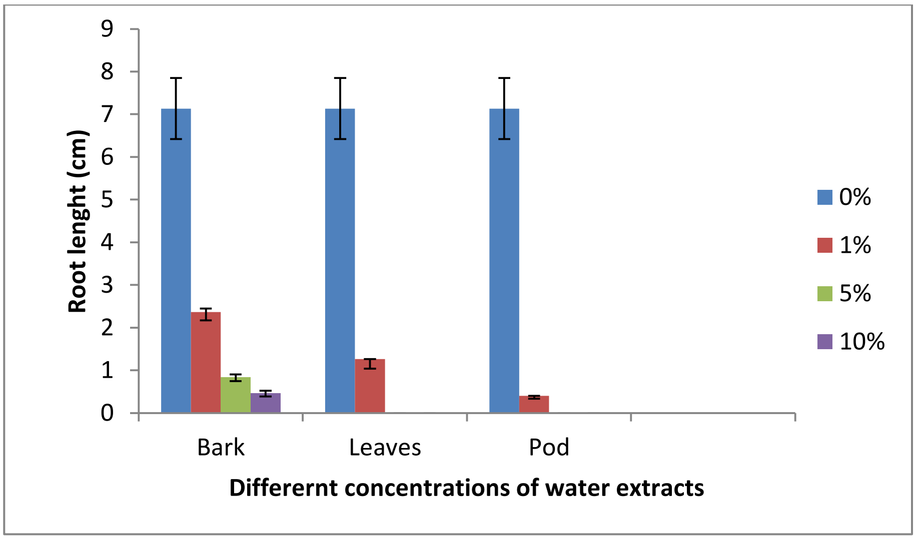


Figure. 17. Effect of different concentrations of water extracts of bark, leaves and pod of *Acacia nilotica* L. on root length of *Raphanus sativus* L. . (radish) seedlings in Petri dish.

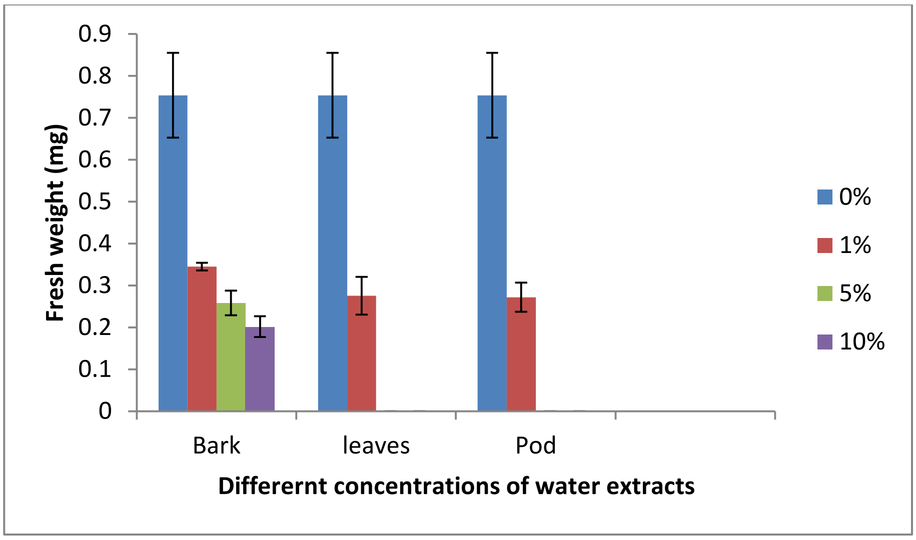


Figure.18. Effect of different concentration of water extracts of bark, leaves and pod of *Acacia nilotica* L. on fresh weight of *Raphanus sativus* L. (radish) seedlings in Petri dish.

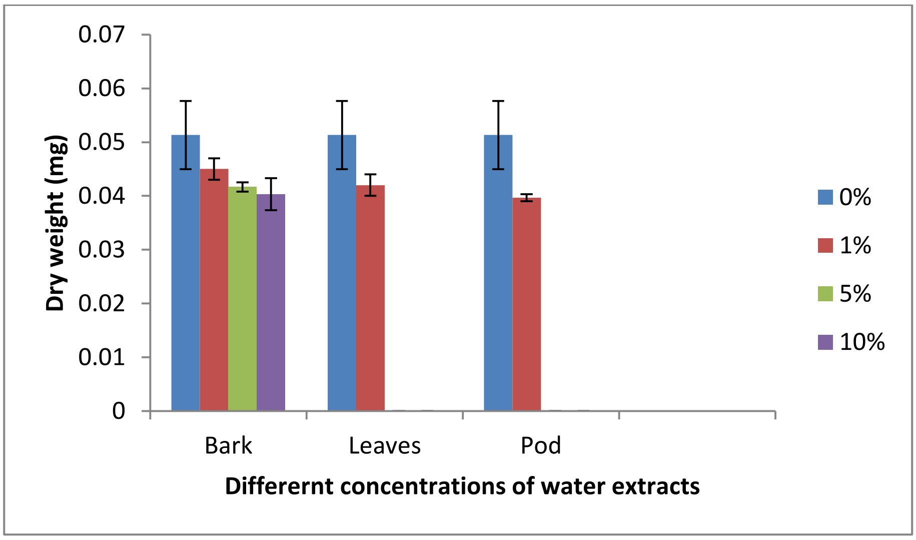


Figure. 19. Effect of different concentrations of water extracts of bark, leaves and pod of *Acacia nilotica* L. on dry weight of *Raphanus sativus* L. (radish) seedlings in Petri dish.

4.3.3. Foliar spray bioassay:

Data regarding the effect of foliar spray on Radish seedlings showed that there were significant differences within treatment of the tree different concentrations (1, 5 and 10%) of the *A. nilotica* bark, leaves and pods extracts as shown in (table 8) plate (9,11and 13). The bark extract had more effect on shoot length at 10% compared 5% and 1% and control. While the pod and leaves extracts had less effect on shoot length at 10 ,5and 1% extracts (Fig.20). Statistical analysis showed that there were significant differences in shoot length between different treatments and controls in respect to. concentration used. (F value -174;p<0.001) for bark extract, ,(F value =5.552;p<0.001) for leaves extract, and(F value= 10.102; p< 0.001) for pod extracts .

In respect to root length : bark extract at all concentrations significantly suppressed root length of *R. sativus* L. (Fig.21). On other hand pod and leaves extracts had the lest effect on root length at different concentrations compared to control. Statistical analysis showed that there were significant differences in root length between different treatments and controls in respect to concentration used (F16.466;p< 0.001) extract bark,(F value= 2.783 ;p<0.05) extract leaves but extract pods at (F value =2.478;p>0.05) were not significant differences root length of *R. sativus* L. (Fig.21.).

Regarding the biomass all the extract types of *A. nilotica* at different concentrations significantly reduced the fresh and dry weight of shoots and roots of radish (table 8.). Statistical analysis showed that there were significant differences in fresh weight of Radish which treated with different concentrations of *A. nilotica* parts compared to control (Fig .22). (F value=87.927; $P< 0.001$) extract bark,(F value = 29.502;$p<0.001$) extract leaves and(F value =11.851$P <0.001$) extract pods. Mean while statistical analysis showed that there were significant differences in shoot and root dry weight of Radish which treated with different concentrations of *A. nilotica* parts compared to control (Fig.23.). (F value =43.649; $P< 0.001$) extract bark and (F value= 3.614;$P <0.01$) extract pod, but extract leaves at (F value= 1.190;$P >0.05$) were not significant differences of *R. sativus* .

Table. 8. Effect of different concentrations of water extracts of *Acacia nilotica* L. o some growth parameters of *Raphanus sativus* L.(radish) seedlings in pots

Treatment	Conc.%	SL	RL	SFW	SDW
	control	13.90±0.371	8.35±0.978	0.451570±0.0304642	0.019930±0.0014495
Bark					
	1	10.10±0.277	7.40±0.364	0.220690±0.0221115	0.014150±0.0010638
	5	1.20±0.917	2.10±1. 703	0.31540±0.0234736	0.003230±0.0021691
	10	000±0.00	000±0.000	000±0.0	000±0.00
Leaves					
	1	10.75±1.099	6.45±0.383	0.270700±0.0319631	0.014810±0.0014533
	5	10.80±0.588	8.85±1.006	0.19343 ±0.0194652	0.016020±0.0013474
	10	9.20±1.052	6.30±0.569	0.072330±0.0331163	0.029390±0.0118608
Pod					
	1	11.08±0.314	7.60±0.618	0.26641 ±0.0167886	0.013440±0.0011627
	5	11.85±0.107	7.40±0.733	0.226440±0.023124	0.016190±0.0597
	10	10.80±0.727	10.20±0.869	0.243050±0.0439943	0.016830±0.0017488

SL: shoot length(cm). RL: Root length (Cm) SFW: Seedling fresh weight (g) SDW :Seedling Dry weight(g)

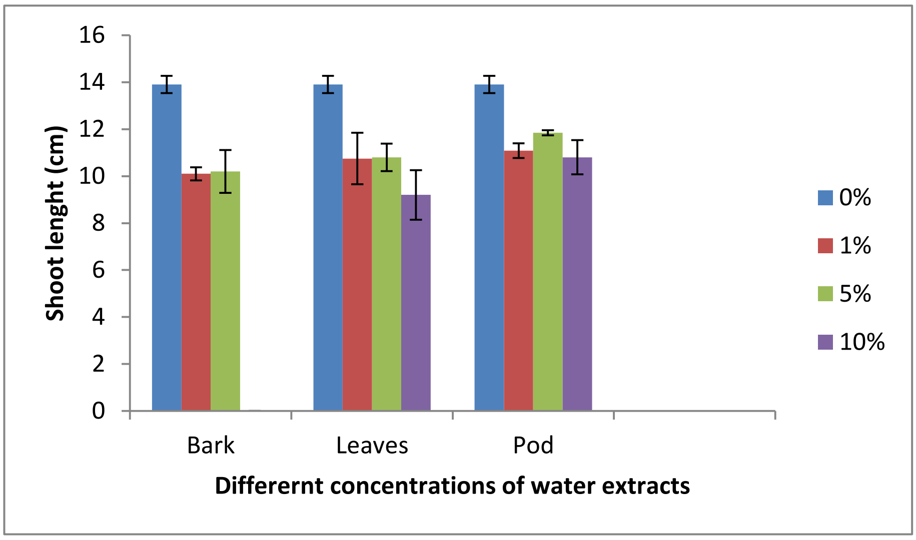


Figure. 20. Effect of different concentrations of water extracts of bark, leaves and pods of *Acacia nilotica* L. on shoot length of *Raphanus sativus* L. in pots.

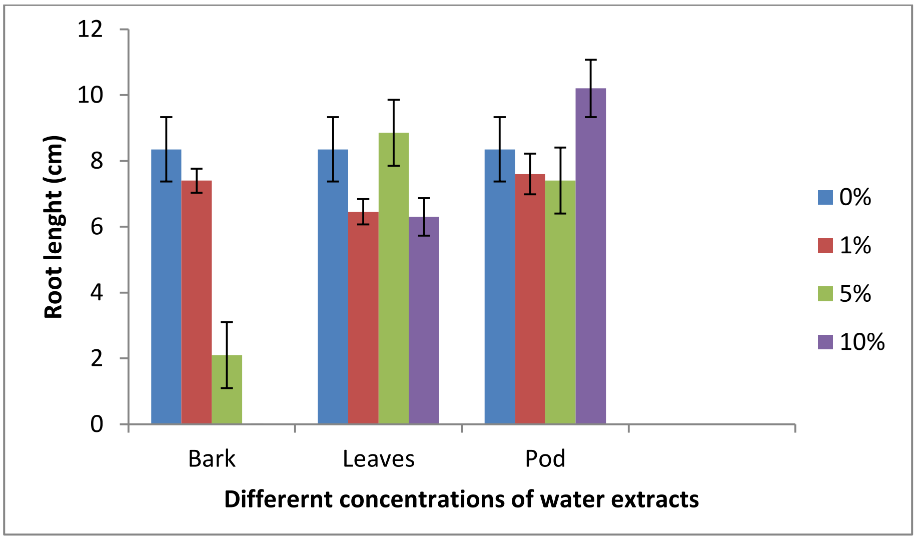


Figure. 21. Effect of different concentrations of water extracts of bark, leaves and pods of *Acacia nilotica* L. on root length of *Raphanus sativus* L. in pots.

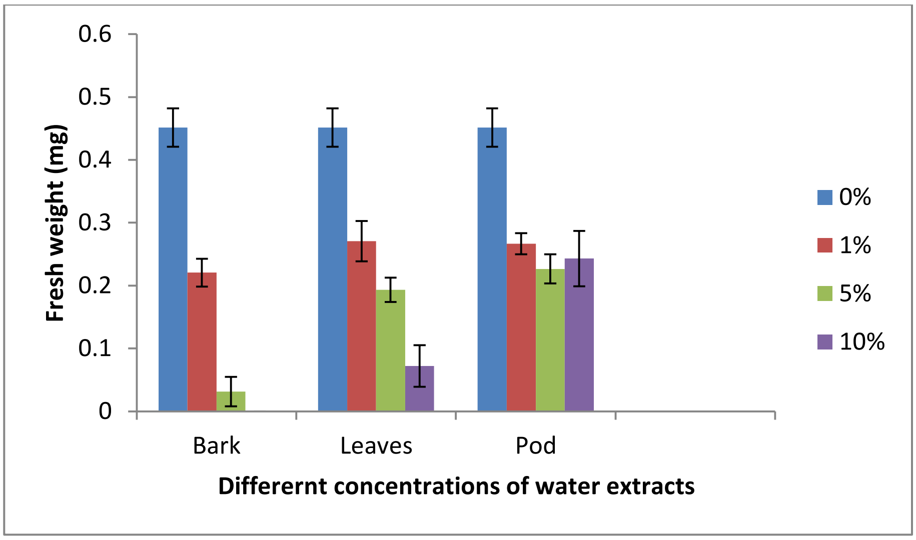


Figure. 22. Effect of different concentrations of water extract of bark, leaves and pod of *Acacia nilotica* L. on fresh weight of *Raphanus sativus* L. in pots.

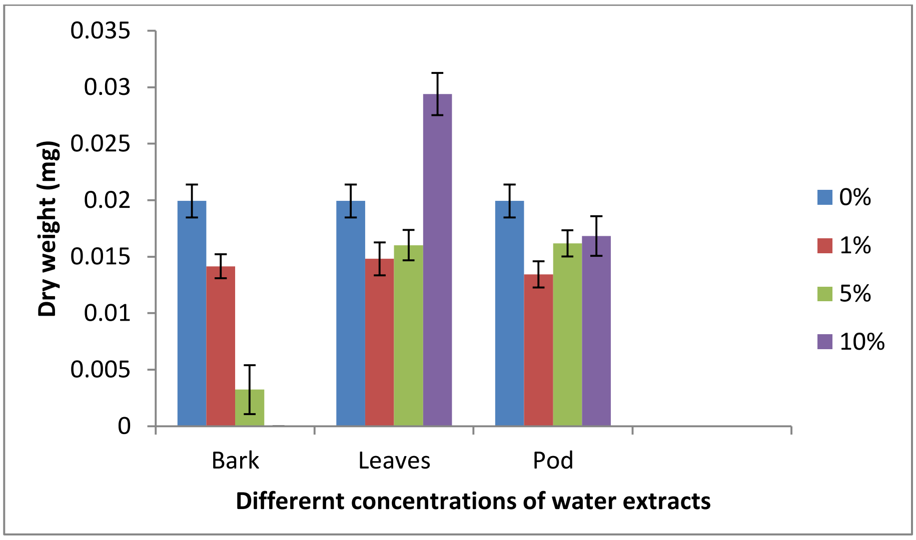


Figure. 23. Effect of different concentrations of water extracts of bark, leaves and pod of *Acacia nilotica* L. on dry weight of *Raphanus sativus* L. in pots.

4.4. Effect of soil extract under canopy of *Acacia nilotica* L. on seed germination and seedling development of *Raphanus sativus* L:

4.4.1. Seed germination:

Final percentage of seed germination showed that there were significant difference between the effect of soil extracts 2 and 5 (96% and 92%) mater distance from the trunk compared to control and tree edge soil (92% and 32%) (table 9). Extracts of soil of 2 and 5 m distance had stimulatory effect on germination of radish seed, while extracts edge soil had effect inhibitory compared to control. (Fig.24).

Table. 9. Effect of soil extracts under canopy of *Acacia nilotica* L . on seed Germination percentages of *Raphanus sativus* L. (Radish)

treatment	Day1	Day2	Day3	Day4	Day5
Control	58.0±0.583	76.0±0.400	92.0±0.200	92.0±0.200	92.0±0.200
Extract Soil					
2M	56.0±0.150	76.0±0.400	96.0±0.245	96.0±0.245	96.0±0.245
5M	60.0±0.77	76.0±0.510	92.0±0.200	92.0±0.200	92.0±0.200
CE	18.0±0.800	18.0±0.800	30.0±1.265	32.0±1.393	32.0±1.393

2M=2Mater. 5M= Mater. CE= Canopy edge

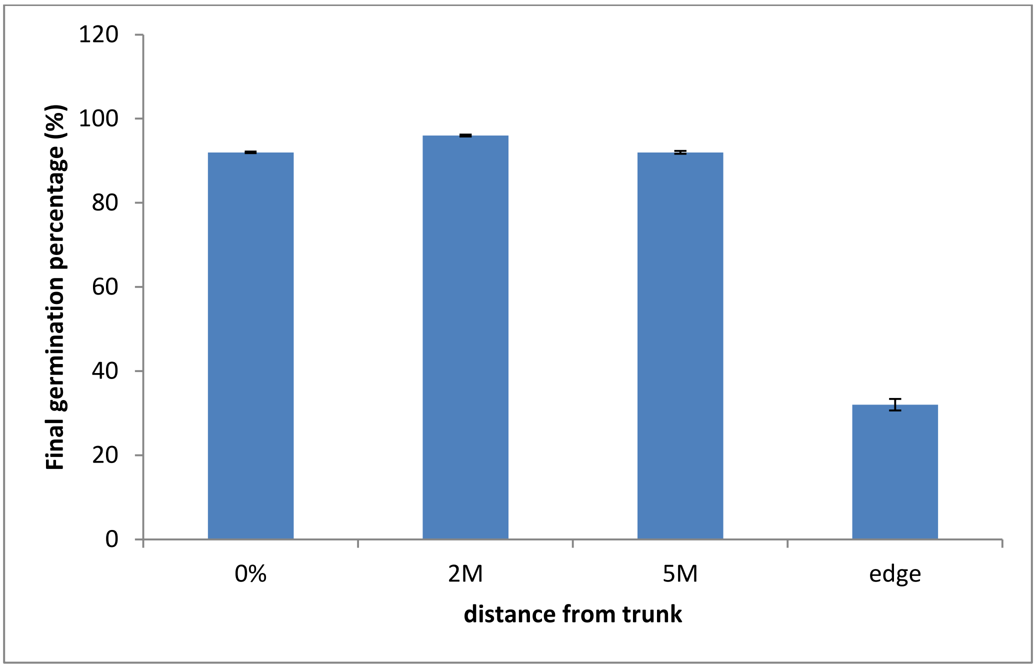


Figure .24. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances on final germination percentage five days after treatment.

4.4.2. Seedling growth:

The test of allopathic potential of soil extract 2m, 5m and edge from tree *Acacia nilotica* on Radish seedling growth was carried out by measuring these parameters:

a. Shoot length(cm):

The effect of soil extracts at different distances from tree trunk on shoot length (table 10). It was observed that in most cases the stimulatory effect was found at (2m and 5m) compared with control condition but edge soil showed inhibitory effect of shoot length (Fig.25). Statistical analysis revealed that there were significant differences in effect of different soil extracts on shoot length of *R. sativus* (F 49.063;$P<0.001$).

b. Root length :

The effect of soil extracts at different distances from tree trunk on root length (table 10) plate (14). It was observed that in soil extracts at 2M and 5M from trunk had stimulatory effect on root which showed an increase in length and became more branched compared to control . But soil edge extract showed inhibitory effect of root length (Fig.26). Statistical analysis revealed there were significant differences in effect of different soil extracts on root length of *R. sativus* (F value =16.268$p<0.001$) .

Biomass (g):

The effect of soil extracts at different distances from tree trunk on fresh weight of Radish are shown on (Fig.27.). It was observed that in soil extracts at 2M and 5M from trunk had stimulatory effect on biomass which showed an increase biomass compared to control whilst soil edge extract showed inhibitory effect of fresh weight . Statistical analysis revealed there were significant differences in effect of different soil extracts on fresh weight of *R. sativus*(F value=7.256;$P<0.01$).

The effect of soil extracts at different distances from tree trunk on dry weight of Radish are shown on (Fig.28.). It was observed that in soil extracts at 2M and 5M from trunk had stimulatory effect on biomass which showed an increase biomass compared to control whilst soil edge extract showed inhibitory effect of dry weight . Statistical analysis revealed there were not significant differences in effect of different soil extracts on fresh weight of *R .sativus* (F value=1.986;$P>0.05$).

Table. 10. Effect of soil extracts under canopy of *Acacia nilotica* L . on seedlings of *Raphanus sativus* L.

treatment	distances	SL	RL	FSW	DSW
	control	3.220±0.2825	5.433±0.7001	0.503400±0.0719469	0.038767±0.0028399
Soil extracts					
	2M	2.613±0.2843	4.480±0.7511	0.418833±0.0639361	0.049167±0.0014621
	5M	5.033±0.3026	5.967±0.6555	0.479864±0.0146262	0.042667±0.00101925
	CE	0.573±0.1529	0.0513±0.1162	0.146733±0.0734212	0.026367±0.0131925

2M=2Mater 5M= 5Mater CE= Canopy edge

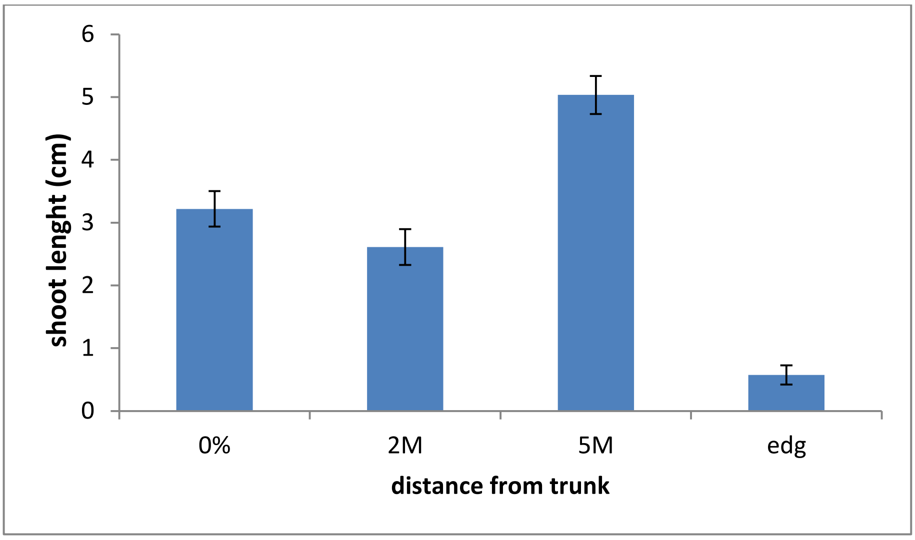


Figure.25. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances from trunk on shoot length of *Raphanus Sati*vus L.

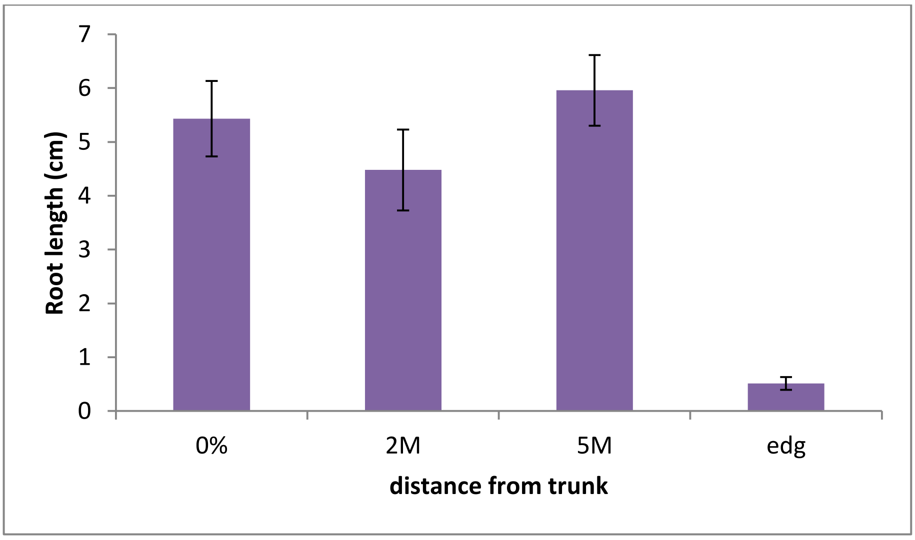


Figure. 26. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances from trunk on root length of *Raphanus Sati*vus L.

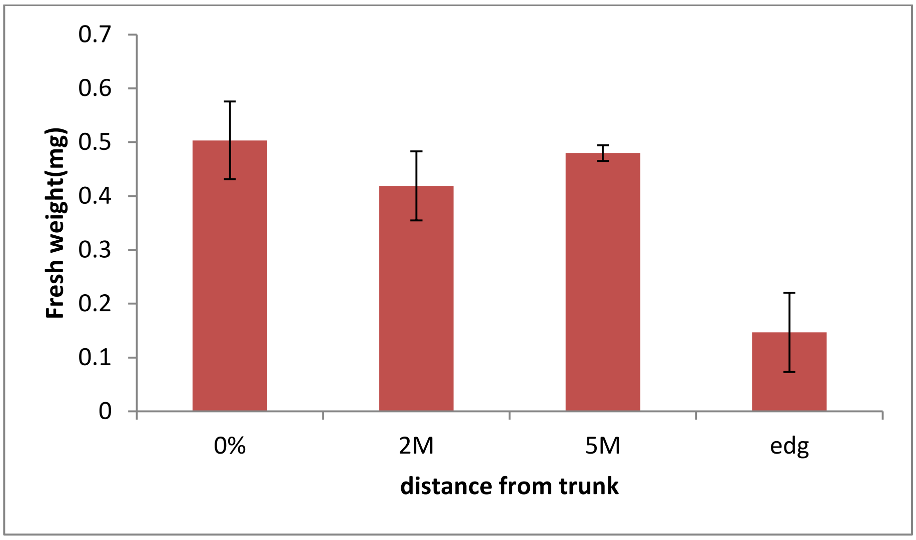


Figure. 27. Effect of soil extracts under canopy of *Acacia nilotica* L. at different distances from trunk on fresh weight of *Raphanus Sati*vus L.

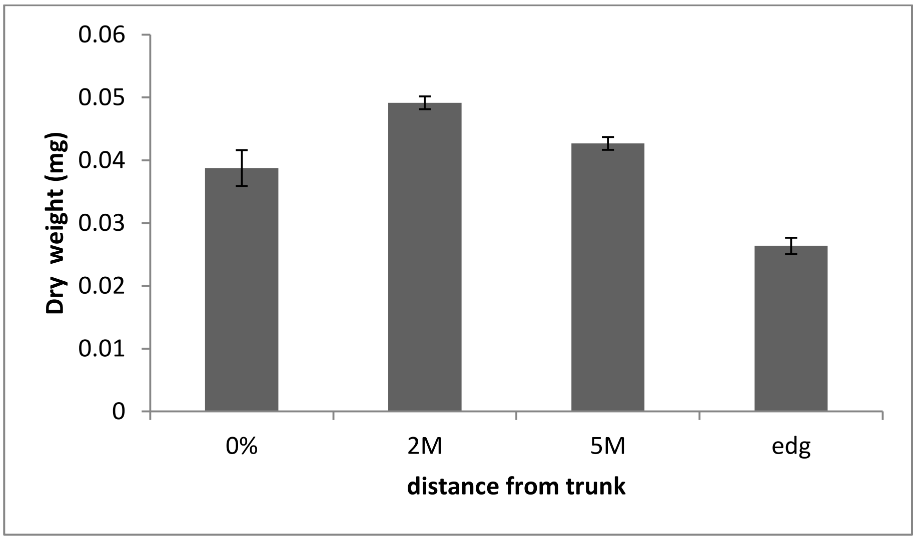
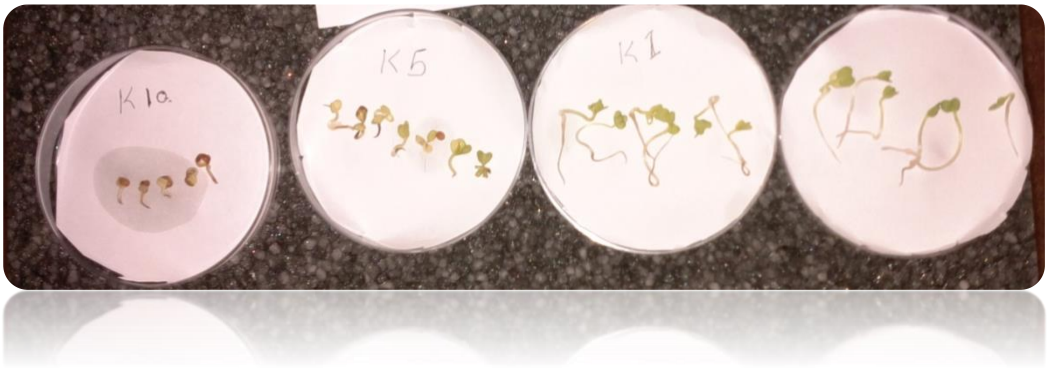
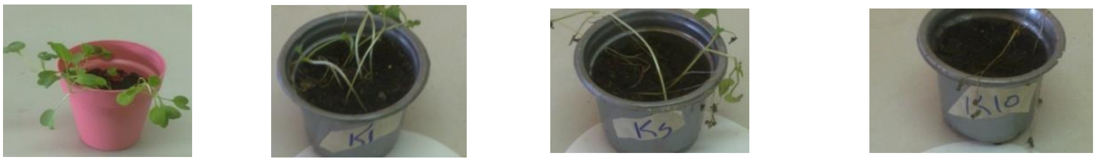


Figure. 28. Effect of soil extracts under canopy of *A. nilotica* L. at different distances from trunk on dry weight of *Raphanus Sati*vus L.



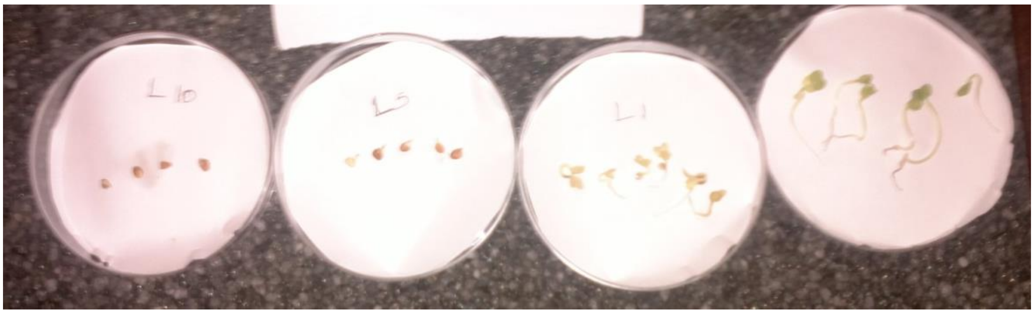
%10 %5 %1 %0

Plate.8. Effect of water extract of bark of *Acacia nilotica* on seed germination and seedlings development of *Raphanus sativus* L.



0% %1 %5 %10

Plate .9. Effect of foliar spray of water extract of bark of *Acacia nilotica* on growth of *Raphanus sativus* L. seedlings.

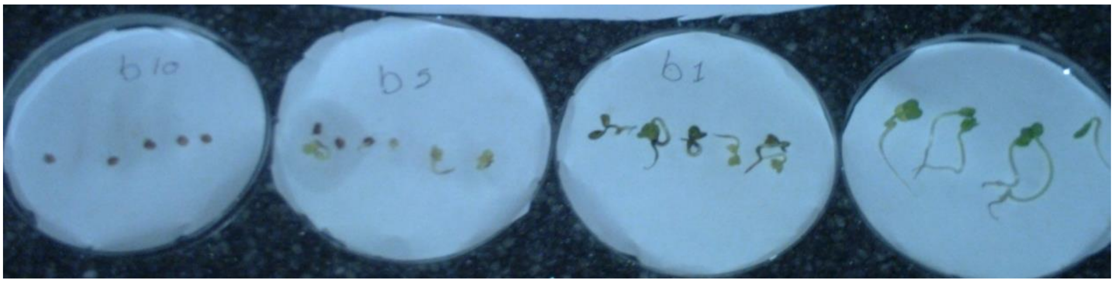


%10 %5 %1 %0

Plate. 10. Effect of water extract of Leaves of *Acacia nilotica* on seed germination and seedlings development of *Raphanus sativus* L.

%0 %1 %5 %10

Plate .11. Effect of foliar spray of water extract of leaves of *Acacia nilotica* on growth of *Raphanus sativus* L. seedlings.



%10 %5 %1 %0

. plate.12. Effect of water extract of pod of *Acacia nilotica* on seed germination and development seedlings of *Raphanus sativus* L.

%0 1% 5% 10%

Plate .13. Effect of foliar spray of water extract o f pod of *Acacia nilotica* on growth development of *Raphanus sativus* L. seedlings.

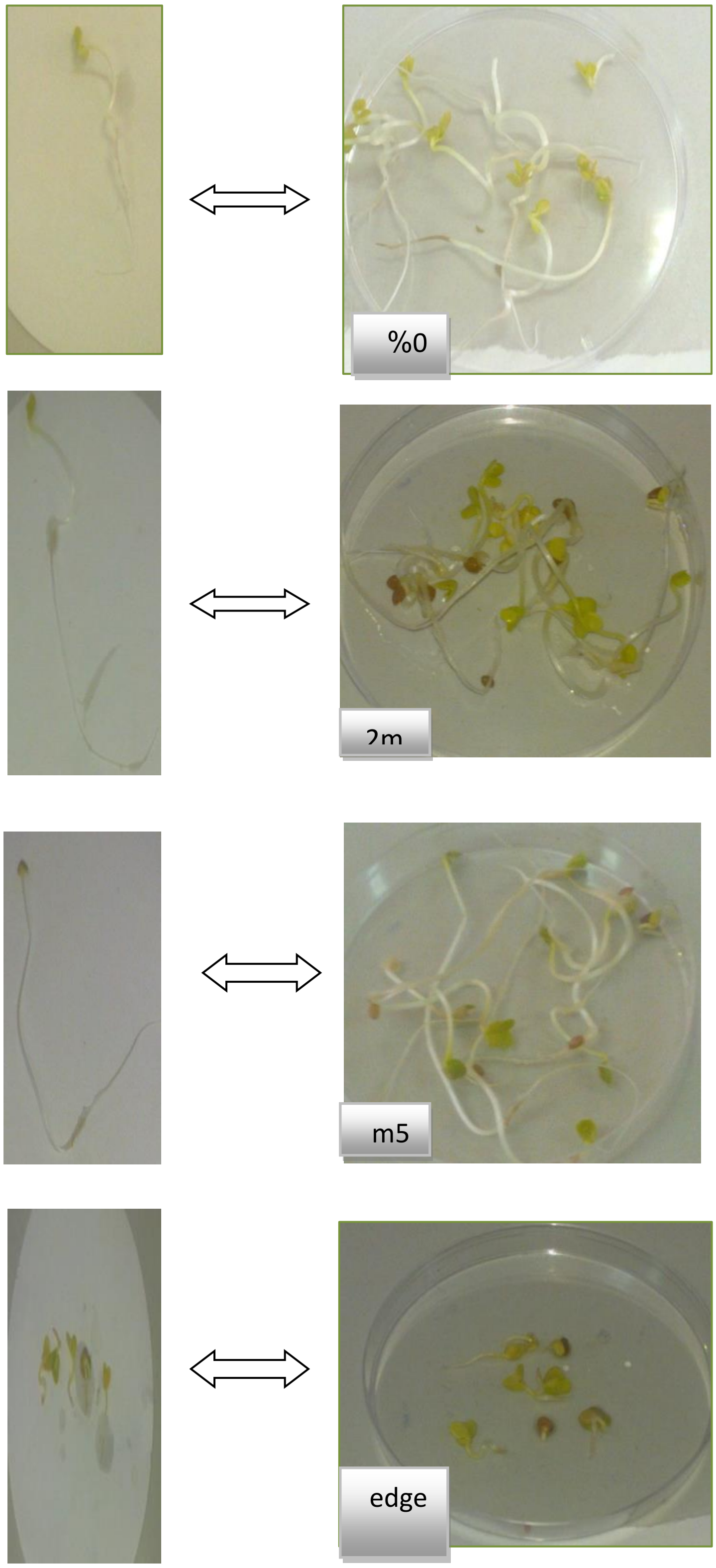


Plate.14. Effect of soil extracts at different distance from trunk on seedlings development of *Raphanus sativus* L.

4.5.1. Analysis of pH for extracts of different parts of *Acacia nilotica* L.

From table-11 it is clear that the pH for extracts of different parts of the tree was different from the control.

Table. 11. pH of different extracts parts of *Acacia nilotica* L.

Treatment	concentration	PH
	control	7.00
Bark		
	1%	7.96
	5%	5.80
	10%	6.48
Leaves		
	1%	7.19
	5%	6.00
	10%	5.95
Pod		
	1%	5.46
	5%	4.94
	10%	5.00

4.5.2. Soil analysis pH.

From table-12 it is clear that the pH for soil extracts of different distance from trunk tree was different from the control.

Table .12. pH at different distances from trunk of *Acacia nilotica* L.

distances	PH
control	9.33
2M	7.04
5M	8.18
edge	8.00

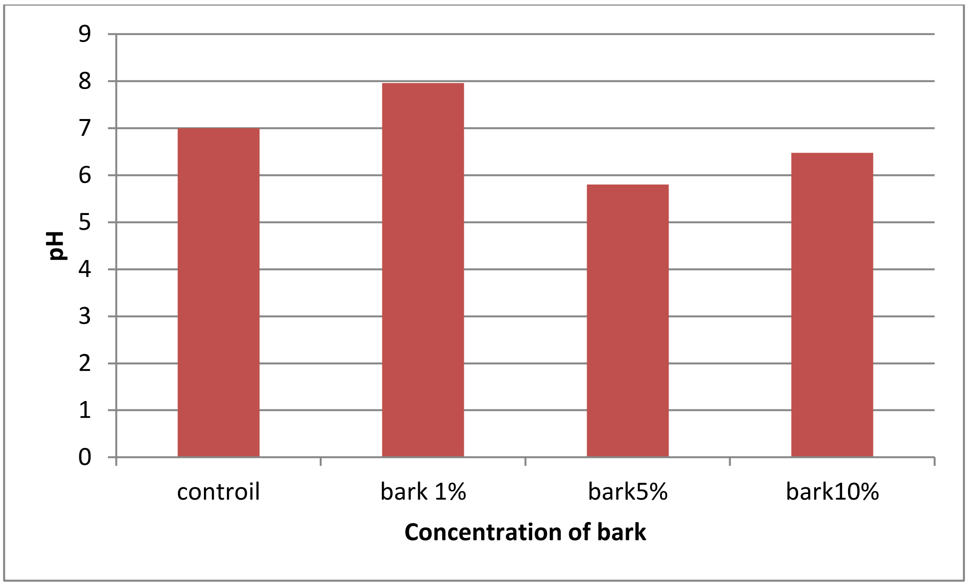


Figure. 29**. pH values of bark different concentrations.**

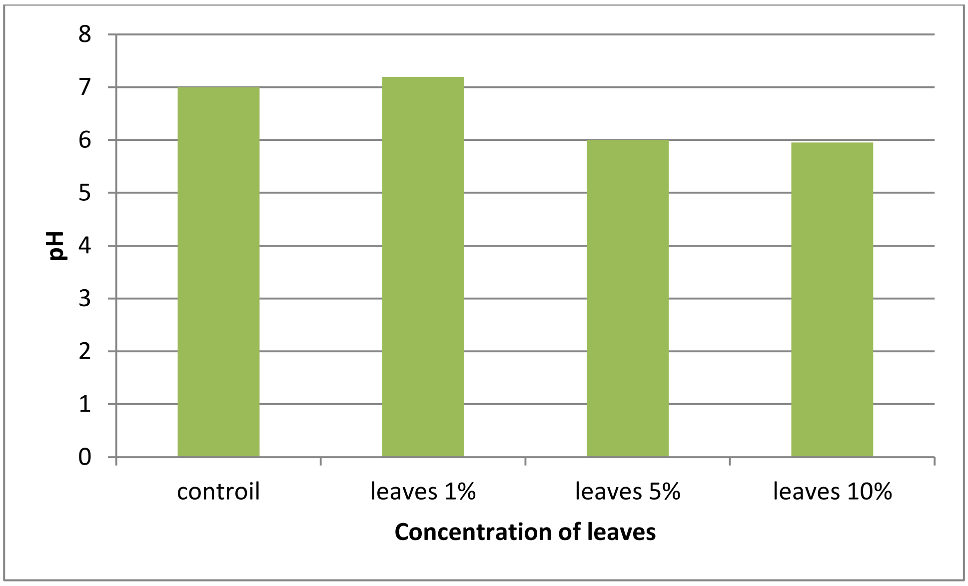


Figure. 30. pH values of leaves different concentrations .

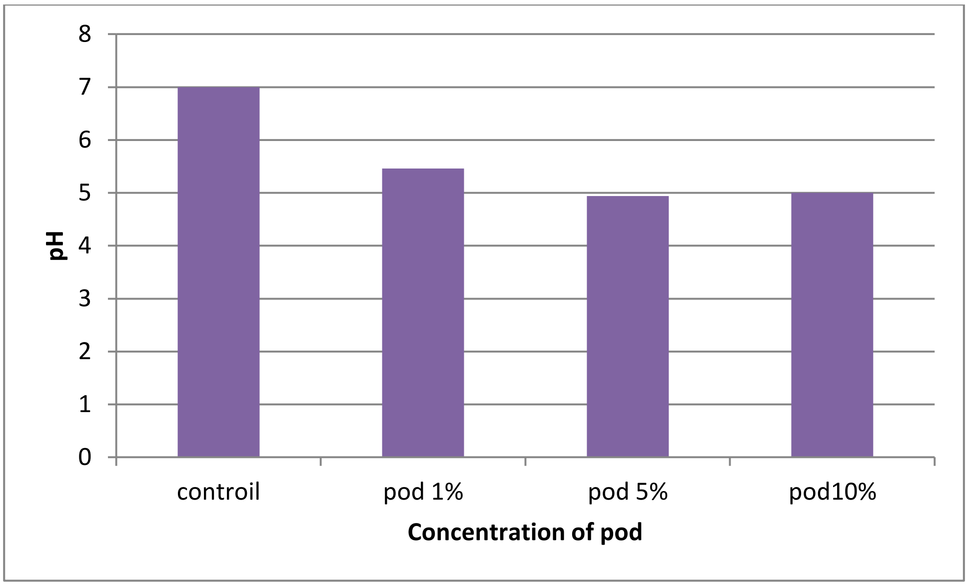


Figure. 31. pH values of pod different concentrations.

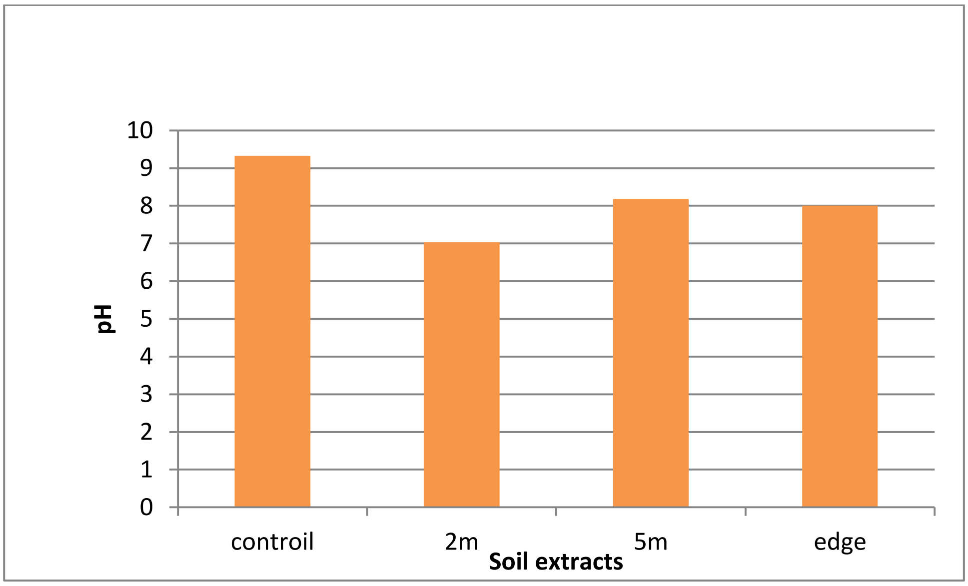


Figure. 32. pH values of soil extracts.

Discussion

Set of experiments were conducted for evaluation of the allopathic effects of water extracts of different parts (park, leaves and pods) of *A. nilotica* as well as soil extracts under canopy on seed germination, seedling development of two receptor species (*Cucumus sativus* L. and *Rphanus sativus* L.*)* under different concentration. inhibitory effect of the different donor plant parts water extracts was ranked as follows: pod > leaf > bark. On the other hand, the germination percentage, seedling growth and plant growth of investigated receptor species demonstrated a gradual decrease with applying higher concentration of the donor species as follows: *Rphanus sativus* > *Cucumis sativus* regardless of the different donor plant parts.

Soil extracts at different distances from trunk had stimulatory effect at 2 and 5 m distance while at the edge soil extract showed inhibitory effect on seed germination and seedling development m of both (*Cucumis sativus* L. and *Raphanus sativus* L.*)*

It is obvious that low concentration of water extract of *Acacia nilotica* bark (1%) stimulated the germination and seedling growth of *Cucumis sativus* and *Rphanus sativus*, but high extract concentration (5 and 10%) significantly reduced the germination and seedling growth of the species as compared with distilled water . Which suggests that the stimulatory or inhibitory effect is a function of the concentration (Saxena and Sharma, 1996). Similarly, Reigosa *et al*., (1999) concluded that certain allelochemicals have a stimulatory effect or no action on various plant species at lower concentrations. These results are in agreement with those obtains by Khan *et al*., (2005) who found that the bark extract had stimulatory effect on germination percentage of *Asphodelus tenuifolius*. In contrast These our results not in agreement with those obtains by Mehmood *et al*., (2009) who found Aqueous bark extract of *A. nilotica* at different concentrations significantly enhanced germination, shoot and root length except 20% concentration which significantly reduced shoot and root length.

The results regarding the effects of leaf extract of *Acacia nilotica at* 1,5 and 10% showed inhibition in germination and seedling growth of the test species . These result are in agreement with those obtains by El-Khawas and Shehata (2005) who reported that the leaf leachates of *Acacia nilotica* inhibited the germination and growth of *Zea mays* and *phaseolus vulgaris*. On the other hand these results are in agreement with those obtained by Duhhan and Lakshinarayana (1995) who found that the growth of *Cyamopsis tetragonoloba* and *Pennisetum* growing at distance of 1-2 and 7.5m from trunk of *Acacia nilotica* was inhibited. .mean while the obtained results are not in agreement with those obtained by Tripathi *et al*., (1998) who found that the allelopathic activity of the leaf extracts of *Acacia nilotica* at low concentrations had stimulatory effect on germination, growth, chlorophyll, protein, carbohydrates and proline contents of soybean ,but in the higher concentrations, there was a decreasing trend of all the parameters in the soybean. The aqueous extract of leaves was proved more inhibitory on seed germination and seedling growth of test plant than bark of *Acacia nilotica* These results are not in agreement with those obtains by Swaminatha *et al*., (1989) who found that the inhibition effect of bark extract was greater than leaf extract on eight arable crops.

Pod extracts had inhibitory effect at all concentration on both seed germination and seedling growth of *Cucumis sativus and Raphanus sativus* and effect was increased with increase in the concentration. The water extract of pod was proved more inhibitory on seed germination and seedling growth of test plant than any other part of *Acacia nilotica*. These result are in agreement with those obtains by Dhana *et al*., (2013) who was observed the maximum inhibitory effect among the various parts of *Acacia nilotica* for pod extract on wheat (*Triticum aestivum*)than bark leaves extract.

The data reported in this study revealed that bark ,leaves and pod had inhibitory effect at all used concentrations on both seed germination and seedling growth of *C .sativus* and *R. sativus*, the effect was increased with increase in the concentration, which is agreed with Singh *et al*., (2006) who reported that biological activities of receiver plants to allelochemicals are known to be concentration dependent on a response threshold is characteristically inhibition as the concentration increases.

The data also revealed that at all concentrations of different parts of *Acacia nilotica* root length was more sensitive to water extracts for both species than shoot length where all the employed extract concentrations significantly suppressed root length. The root system became brownish and formation of root hairs and death of cells was evident except for bark extract at 1% concentration had stimulatory effect on root growth and branching of roots. This result is in agreement with Al-Shahid *et al*., (2006) who reported that plant roots exposed to allelochemicals became brownish and root hairs formation. This might be due to the rapid inhibiting effect on the respiration of root tips which ultimately reduced elongation.

Also Bais *et al*., (2003) reported that catechin a putative phytotoxin inhibits plant growth due to sever oxidative burst in root tips, resulting in cell death.

Since roots are the first to absorb chemical compounds from the environment, so exhibit abnormal growth in response to chemicals present in the extracts, resulting in suppressive growth (Javaid and Shah, 2007). The extract of *A. nilotica* is known to contain gallic acid, m-digallic acid, catechin, chlorogenic acid, gallolyated flaven-3, 4-diol and rabidandiol (Malan, 1991). These compounds are allelopathic of *Acacia nilotica* present in the different parts extracts might be responsible for the retardation of germination and other growth parameters of *R.sativus* and *C.sativus*, in the present study. Further Phenolics are widely recognized for their allelopathic potential in plants and can be found in a variety of plant tissues (Djurdjevic *et al*., 2004). Many other species of genus *Acacia* (Mimosaceae), like *A. dealbata* Link (Carballeira & Reigosa 1999; Lorenzo *et al*., 2008), *Acacia confusa* Merr (Chou *et al*., 1998), *Acacia auriculiformis* A. Cunn. ex Benth (Rafiqul-Hoque *et al*., 2003; Oyun 2006), and *Acacia nilotica* (El-Khawas and Shehata 2005; Al-Wakeel *et al*., 2007), are known to exhibit allelopathic activity. The effects of allelochemicals have been studied mostly on seed germination and the suggested mechanisms for its inhibition are the disruption of mitochondrial respiration (Abrahim *et al*., 2000) through the influence of allelochemicals on glycolysis, the Krebs cycle, electron transport and oxidative phosphorylation (Muscolo *et al*., 1999), and the mitochondrial membrane .

The data concerning the assay of soil under canopy indicated that the water extract of soil at 2 and 5 m distance from tree trunk caused stimulatory effect in germination and seedling growth of the test plant. but soil extract at the edge had inhibitory effect. this result is not in agreement with Duhhan and Lakshinarayana (1995) who found that the growth of *Cyamopsis tetragonoloba* and *Pennisetum* growing at distance of 1-2 and 7.5m from tree trunk of *Acacia nilotica* was inhibited. This result is in agreement with (Pandey *et al*., 2000, Nair 1993 Palm 1995) who reported that the tree of *A. nilotica* improves soil fertility under its canopy by reducing proportion of sand with simultaneous increase in clay particles, mainly due to protection of soil from the impact of raindrops. Higher nutrient concentration under canopy compared to canopy gap is mainly a consequence of increased above and belowground organic matter input , nutrient cycling through leaf litter and protection of soil from erosion. The decrease in nutrient concentration towards the canopy edge compared to mid canopy position is mainly due to relatively low inputs of leaf litter as the canopy of *A. nilotica* is thin towards canopy edge (Pandey *et al*., 1999).

Also *A. nilotica* is reported to be well nodulated with *Rhizobium* species (Dreyfus and Dommergues,1981).This nodulation behaviour help in biological nitrogen fixation which help to meet the nitrogen requirement in nutrient-poor soils. In addition, this species form symbiotic associations with naturally occurring soil fungi called vesicular arbuscular mycorrhizae (VAM) (Kaushik and Mandal, 2005). This association assists the roots to exploit more soil volume and to gain improved access to available nutrients especially phosphorus under stress and also makes the unavailable forms of nutrients into utilizable forms (Bowen, 1973). On other hand allelopathic metabolites leached out from woody plants often suppress the undergrowth species sharing the same habitat (Chou and Lee, 1991). Many woody species are reported to have phytotoxins (Akram *et al.*, 1990; May and Ash, 1990; Kil and Yun, 1992). Chou and Lee, (1991) showed that bamboo, *Phyllostachys edulis* (*Poaceae*) contains significant amounts of allelopathic compounds that can inhibit the growth of undergrowth weeds. The presence of allelopathic substances in the soil is often determined by a number of important factors. These include the density at which the leaves fall, the rate at which this material decomposes, the distance from other plants, and, finally, the quantity and distribution of the annual rainfall (Mann, 1987; Escudero *et al.*, 2000; Nilsson *et al.*, 2000). The decomposition of plant material is then dependent on leaf tissue quality (C:N and C:P ratios), temperature, rainfall and the presence of certain micro-organisms (Friedman *et al.*, 1977; Newman and Miller, 1977; Ito *et al.*, 1998). Soil type and its pH are also important (Saxena and Sharma, 1996) in determining whether or not allelopathic substances are present in the soil and if they are in sufficiently high enough concentrations to affect other plants.

Allelopathic effects generally produce an inhibition of germination and early growth of seedlings (Akram *et al.*, 1990; Kil and Yun, 1992). While we did not investigate the specific mode of action, many other studies demonstrated inhibition occurring through limiting cell division, respiration, photosynthesis or by disrupting membrane regulation (Macias *et al.*, 1992).

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الملخص

تم في هذا البحث تقييم التأثير المضاد للمستخلصات المائية للأجزاء النباتية المختلفة (القلف ، الأوراق ،القرون). لنبات السنط النيلي (*Acacia nilotica* L.) وكذلك مستخلص التربة المجمعة من أسفل تاج النبات على الإنبات وتطور البادرات لنوعين من النبات هما الفجل والخيار *Raphanus sativus* L. and *Cucumis sativus* L. ، تحت التراكيز المختلفة، وكان التأثير المثبط للأجزاء النباتية المختلفة بترتيب التالي (القرون< الأوراق < القلف).

كما تمت دراسة تأثير مستخلصات التربة التي تم تحضيرها من ترب على مسافات مختلفة من جذع الشجرة (2 م، 5 م) , حيث بينت النتائج إن لهذه المستخلصات تأثيرا محفزا ، بينما مستخلص التربة عند حافة الشجرة سجل تأثيرا مثبط على نسبة الإنبات وتطور البادرات لكل من الفجل والخيار *Raphanus sativus* L. and *Cucumis sativus* L.

وأخيرا تم دراسة تأثير الأجزاء المختلفة للنبات(القرون, الأوراق , القلف) عند مختلف التركيز(1, 5, 10 %) في غرفة الإنبات باستخدام رش البادرات الفجل والخيار حيث أظهرت النتائج عند جميع التركيزات المستخدمة إن للمستخلصات المائية تأثيرا على النوعين المدروسين بدرجات متفاوتة.

وفي النهاية يمكن القول بأن النتائج المتحصل عليها المسجلة في هذه الدراسة بينت أن نبات السنط يمكن أن يسبب خسائر في المحاصيل الحقلية من خلال إطلاقه لمواد كيميائية يمكن أن تثبط إنبات البذور وتطور البادرات , من ناحية أخرى فأن المواد المنتجة بواسطة هذا النبات يمكن استخدامها كمبيدات حساسة طبيعة في عمليات مكافحة الحشاش في الحقول الزراعية.