



Effects of decomposed sider (*Ziziphus Spina*) and B.O citrus (*Citrus aurantium*) leaves on seed germination, seedling growth and rooting of stem cuttings

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Abstract

The aim of this study is to determine the effect of fallen leaves from the bitter orange and jujube trees on seed germination and rooting of stem cuttings before and after the decomposition process. The results indicated the allelopathic effect of these leaves (orange and jujube leaves) on the percentage of seed germination, seedling growth, compared to the control treatment, and after a two-month from decomposition process, the treatment with decomposed sider leaves had a positive effect on the percentage of tomato seed germination, reaching 95%, compared to 70% in the control treatment, while bitter orange stay had allelopathic effects on seed germination and stem cutting rooting after two months of decomposing.

Keywords: bitter orange, sider, decomposition process, seeds germination, stem cutting roots.

Introduction

The chemical relationships between plants vary, which including symbiotic relationships, or stimulating the growth of neighboring plants, in other relationships inhibit the growth of the neighboring plant due to the secretion of toxic compounds to the neighbor plant, through various methods, such as root exudate, volatile oils, leaching and the decomposition of plant parts like leaves and other plant tissues in the environment. The stimulating or inhibiting relationship is scientifically termed allelopathy, The release of these chemical compounds are called (allelochemicals).(1,2)

Citrus aurantium (Rutaceae), commonly known as a bitter orange tree, The *Citrus* genus marks its presence in daily life in the fields of traditional medicine, cosmetics, food and perfumery industry. in medicinal is used to treatment of various diseases (3,4,5).

Ziziphus spina-christi L tree, known locally as "sider," is an important tree in industrially and medicinally. It has been used in traditional medicine as a, purifier, stomach tonic, astringent, and mouthwash (6).

It is a rich source of natural antioxidants and antimicrobials, which can be used to prevent of many chronic diseases. It contains a variety of physiologically important active compounds such as vitamin C, amino acids, triterpene, polysaccharides, polyphenols, flavonoids, saponins, alkaloids, indole derivatives, and fatty acids (7,8).

Z. spina-christi leaf extracts in medicinal and pharmaceutical industries. Due to their richness of phenolic contents, these extracts may be used as antioxidant, insecticidal, and allelopathic agents. *Z. spina-christi* leaves may be a good candidate for food and pharmaceutical supplement formulations, as well as industrial uses (9,10). Bitter orange and sider are considered deciduous trees, so this experiment was designed to test the fallen leaves after grinding and mixing with the soil before and after their decomposition and their effect on the germination of barley and stem cutting of oleander rooting in winter, in spring season we study the effect of decomposing of citrus and sider leaves on tomato seeds germination and rosemary stem cutting.



sider



Bitter orang

Material and methods

Sidr and citrus fallen leaves were collected in the fall of 2023 from the Dora area south of Baghdad. The leaves were washed from the soil and dried in an electric oven at 50°C for 3 days. The leaves were ground with an electric grinder, then weighed and mixed with soil, to prepare the following treatments:

- 1- 5 g of ground leaves of sidr per 1½ kg of soil.
- 2- 10 g of ground leaves of sidr per 1½ kg of soil.
- 3- 5 g of ground leaves of citrus per 1½ kg of soil.
- 4- 10 g of ground leaves of citrus per 1½ kg of soil.
- 5- Soil only as control.

The same treatments were repeated to test the decomposition process after 3 months of these treatments (where water is added to moisten the soil) to facilitate the work of microorganisms in the decomposition process.

The treatments after **three** months were:

- 1-5 g of ground leaves of sidr per 1½ kg of soil.
- 2-10 g of ground leaves of sidr per 1½ kg of soil.
- 3-5 g of ground leaves of citrus per 1½ kg of soil.
- 4-10 g of ground leaves of citrus per 1½ kg of soil.
- 5- Soil only as control

The research were conducted in the botany laboratory and green house in Al-Farabi University. in two seasons during winter and spring. start from (November, 2023 to January, 2024). The spring season starts from (February, 2024 to March, 2024) .

The initial experiments to test the effect of grinded sidr and orange bitter (O.B) leaves on seed germination and seedling growth of garden cress indicated that there was an clear inhibition in the germination process and seedling growth of garden and the inhibition was very clear.



Control

sidr

O.B

Effect of bitter orange and sidr leaves treatments on the seed germination and growth of garden cress. (From the initial testing trials).

Secondly, to study the effect of the treatments on the rooting process of stem cuttings. The following treatments were used.

1- The effect of different concentrations of bitter orange and sidr leaves treatments on barley seed germination.

Ten barley seeds were selected and sterilized with a 10% Clorox solution. Then washed several times until the Clorox effect was removed. These seeds were planted in 9 cm diameter pots filled with the aforementioned treatments, with three replicates for each treatment, After 10 days, took the following data: 1-percentage of germination seeds, 2- root length, 3- stem length of seedling.

2- Effect of different concentrations of bitter orange and sidr leaves treatments on the growth of oleander stem cuttings in winter season.

Oleander cuttings measuring (12-15) cm in length were selected from Al-Farabi University in the Al-Dora area and planted in pots with a diameter of 9 cm filled with sidr treatments and bitter orange treatments, with three replicates of each treatment. They were placed in a greenhouse and watered as needed. After two months, measurements were taken of the cuttings.

Spring season results

In this season, used after three months the decomposition of bitter orange and sidr leaves in the soil to study the effect of the decomposition processes on seed germination and seedling growth, in addition we study the effect of these treatments on rooting of rosemary stem cutting.

1- Seeds germination and Seedling growth of tomato seeds

Ten tomato seeds were selected and sterilized with a 10% clorax solution and washing several times. These seeds were planted in pots where the decomposition process was carried out for all treatments. After a week, tomato seedlings began to appear in the treatments, and after two weeks, the measurements taken:

1- percentage of germination seeds, 2- root length, 3- stem length of seedling, 4- number of leaves.

2-Effect of different concentrations of bitter orange and sidr leaves treatments on the growth of rosemary stem cuttings.

Rosemary cuttings measuring (10-12) cm in length were selected from Al-Farabi University , and planted in 9 cm diameter pots filled with treatments of decaying leaves of bitter orange and sidr leaves, with three replicates of each treatment. They were placed in a greenhouse and watered as needed. After 45 days, measurements were taken of the cuttings. The data were: 1-roots number, 2- roots length, 3-leaves number, 4- leaves length, 5- number of branches.

Results and Discussion

1-The effect of different concentrations of bitter orange and sidr leaves mixed with soil on barley seed germination in winter season.

Table 1 shows that the higher concentration of the treatments, the greater inhibition. In general, the inhibitory effect of bitter orange leaves is greater than sidr leaves. Where it appears from the table .1. the inhibition in seed germination in bitter orange in concentration 10gm give 50% compare with control which give 100%, While sidr treatment with the same concentration gave 95% seed germination. The number of roots (2cm), root length (4.5cm), and stem length were (4.5cm) respectively, while sidr treatment in concentration (10gm) gave (3) number of roots,(7.5, 6.5 cm) length of root and length of stem respectively compare with control treatment which gave (4) number of roots, and (11,10) length of root, and length of stem respectively.

Table 1. Effect of different concentrations of bitter orange and sidr leaves mixed with soil on barley seed germination in winter season.

Treatments	control	5 gm Bitter. orange (B.O)	10 gm Bitter. orange. (B.O)	5 gm sidr	10gm sidr
Seed germination%	100	88	50	97	95
Number of roots	4	2	2	3	3
Length of roots	11	5	4.5	8	7.5
Length of stem	10	6	4.5	7.5	6.5
L.S.D	1.2				



10gm Con B.O 5gm Con B. O control



10gm Con. sidr 5gmCon sidr control

Fig 2. Effect of different concentrations of bitter orange and sidr leaves mixed with soil on barley seed germination in winter season

The results of the experiment on rooting the stem cuttings of the oleander plant indicated that none of the treatments resulted in any rooting of the oleander stem cuttings. even the control treatment, after two months of planting, however, we notice that the stem cuttings have green leaves, which indicates that the rooting process is hindered by the cold weather, despite being in the green house. still the growth of leaves in control treatment better in growth and number of leaves as is clear in Figure .2, We find that the vegetative growth of cuttings grown in soil containing sidr leaves is better than that of cuttings grown in soil containing bitter orange leaves, as shown in Figure 2.

this is due to many reasons many studies indicate that the leaves of bitter orange bear an allelopathic character due to the presence of allelochemical cause anatomical and physiological changes in plant seedlings leading to

lack of adventitious root formation (11). In another study showed that the essential oil in bitter orange cause significant inhibition of the seed germination and seedling growth of many plants, *Heliantus annus*, *Portulaca oleracea*, *Lupinus albus* and *Malva parviflora*. The allelopathic property of the essential oils studied represent a promising source for the developing of biodegradable and non-toxic natural herbicides. (12).



Figure.3

In many study indicated that sidr leaves contain many phenolic such as chlorogenic acid, ferulic acid, Ellagic acid, caffeic acid, Coumaric acid, and many others of phenolic acids (13). These compounds in sidr leaf had allelopathic effect which cause a negative effect on the growth of plants. in another study showed that both (water and methanolic) extracts of sidr leaves in elevated concentration can suppress germination as well as seedling development (14).

It appears from the table. 2 (spring season), the treatments with sidr at different concentrations gave the higher percentage of seed germination than the control treatment, but in (B.O) still the seeds germination lower than control treatment, as shown in table 2. The table indicated that increasing the concentration also increased the percentage of germination for the sider treatments, Where it gave (90, 95%) seed germination in (5 and 10gm) concentration respectively, in compare with control treatment gave 70%, the same concentrations of sidr gave (8,11) cm in root lengths, compare with control (3) cm root lengths, and gave (3,4) cm in stem length compare with (2) cm in control treatment, table (2) indicated that sidr treatments after decaying stimulate seed germination and seedling growth than (B.O) and control treatments, the results showed that The greater concentration, in sidr treatments the greater stimulation of seeds germination and seedling growth. While the (B.O) treatments in the two concentrations still had the negative effect in seeds germination and seedling growth compare to control treatment in all study data.

Table 2. Effects of different decomposed leaves on germination and seedling growth of tomato seeds in (spring season).

Treatments	Control	5 gm (B.O)	10 gm (B.O).	5 gm sidr	10gm sidr
Seed germination%	70	60	60	90	95
Number of roots	3	2	2	3	3
Length of roots	5	4	3	8	9
Stem length	3	2	2	3	4
Number of leaves	2	2	1	2	2
L.S.D 2.73					

It appears from Table 3 that the process of decomposition in sidr leaves has led to stimulation of the rooting process and such as the number and length of roots and the number and length of leaves and number of branches for the stem cuttings of the rosemary stem cuttings.

Table 3 indicated that the allelopathic effect of decomposed of (B.O) leaves has decreased in toxicity , possibly due to the breakdown of toxic compounds and their decomposition into simple compounds which didn't inhibit the rooting processes and the growth of the stem rosemary cuttings.

Sidr treatments gave higher results than the control in all study data, especially in concentration of (10 gm) which gave (14), in roots number and (11) cm, leaves length, and gave (26,4) number of leaves and (6) number of branches while the control treatment gave (7) roots number, (9) cm leaves length, (18,3) number of leaves and

(4) number of branches. The lowest value data relatively given by (10 gm) (B.O), may be the allelochemicals still present after decomposition, in study show the allelopathic of (*Sorghum bicolor*) after different time of leaves decomposing showed that the allelochemical and allelopathic effects still present in its negative effect on seeds germination and seedling growth (15). In another study showed that the litter of *E. grandis*, after decomposition for 20–30 days, exerted stronger phytotoxicity on the growth and biochemical characteristics of *E. fetida*, and the toxicity was weakened by decomposition. *E. fetida* individuals exhibited significant inhibition of weight and activities under litter treatment after 20–30 days of decomposition (16).

While the study of decomposing litter over various time intervals (0, 30, 60, 120, and 180 days). Subsequently, a soil–plant feedback experiment was carried out to further evaluate the effects of decomposing litter on soil biochemistry and plant dynamics. The study revealed that the litter decomposed exhibited greater nitrogen (N) remaining mass which stimulate the growth of the plant present in that soil (17). plant litter decayed at a rate of between 54 and 36% with slight changes in nutrient composition (C, N, C:N, and P content) at the end of the assay (18). methanolic leaf extract of sidr leaf and bark powders are rich in essential nutrients and phytochemicals, and could serve as natural sources of essential organic, macro and micro minerals. sidr leaf its higher proximate and mineral contents, (19).

Table 3. effects of different decomposed leaves treatments on rosemary stem cutting rooting (spring season).

Treatments	Control	5 gm (B.O)	10 gm (B.O)	5 gm sidr	10gm sidr
Root length	7	6	5	8	14
Root number	9	5	5	10	11
Leaves number	18	18	18	20	26
Leaves length	3	3	2.5	3	4
Number of branches	4	4	2	6	6
L.S.D	3.28				

Some of these compound as antioxidant which stimulate growth, in addition, it contains essential organic, macro and micro minerals, which play important role in stimulating and growth in stem cuttings. The chemical component of sidr leave, revealed that sidr leaf is a good source of protein, calcium, potassium, and magnesium. and contain a high amount of Menadione (Vit. K), Ascorbic acid (Vit. C), and Pyridoxine (Vit.B6). Also, it is considered a good source of total phenols and flavonoid, which act as antioxidant and stimulating growth (21). For these reasons the decomposing leaves of sidr, which have been decaying for at least three months, can be considered a plant growth stimulant and act as a natural fertilizer due to their content of substances essential for plant growth and seed germination (22,23).



Fig .4. Effect of different concentrations of (B.O) leaves mixed with soil after three months of decomposition on rooting of rosemary stem cuttings



5 gm Con. Sidr



10gm Con .sider

Fig.5. Effect of different concentrations of sidr leaves mixed with soil after three months of decomposition on rosemary stem cuttings

Conclusions

It is possible to benefit from the fallen leaves of the sidr plant after the decomposition process for 3 months, as they act as good fertilizer to the plants because of it contain nutritious and many other organic compounds. and even to benefit from the leaves of the bitter orange plant after decomposition process for longer period than 3 months.

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