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Effect of some Plant Extracts and Media Culture on Seed Germination and Seedling Growth of *Moringa oleifera*

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ABSTRACT

This research was carried out at the College of Agricultural Engineering Sciences, University of Sulaimani. This study was applied to determine the effect of some extracts of *Glycyrrhiza glabra* and *Ammi majus* and different types of soil on seed germination, seedling growth and phytochemical contents as well as fresh and dry weights of *Moringa olefera*. The significant effects of some extracts were observed on the studied parameters of the moringa plant. The highest germination percentage of moringa recorded by the seeds treated with 10 g/L of *Ammi majus* extract. The greatest germination rate of moringa seeds (81.3) exhibited at control treatments of both extracts. The highest stem elongation was demonstrated by 5 g/L *G. glabra* and pet moss media. The maximum score of stem length of moringa (107.33 and 97.33 cm) was achieved from the combination 10 g/L *G. glabra* and *A. majus* with peat moss media, whereas the lowest value (44.33 cm) was stated by the interaction of control and peat moss. In addition, the greatest value of stem diameter (5.75 cm) was noticed by the interaction pet moss and 10 g/L *A. majus*. The number of leaf in moringa showed the maximum score when the seeds treated by 5 g/l *G. glabra*, peat moss and their combination. Whereas, the root number characteristic of moringa revealed the maximum values when the seeds treated by 5g/l *G.glabra* (23.44), pet moss (25.67) and its combination (32). The best results of dry biomass weight including shoots and leave were achieved in 5,10 g/L *G. glabra* and *A. majus* with peat moss combination, High value of the TPC, TFC and antioxidant – DPPH (3.955, 0.171 and 86.197, respectively) recorded by the interaction of 10 g/L *A. majus* with loam and significantly superior on other treatment. These results confirm the effectiveness of aqueous extracts of different plant and media cultures on seed germination, plant growth and phytochemical content of *M. olefera*.

Keywords: Seed germination, Seedling growth, Plant extracts, Media culure, Phytochemical analysis

INTRODUCTION

Moringa (*Moringa olifera*) belongs to family Moringaceae. It is the only genius are grown mainly in the semi-arid, the tropical and subtropical regions (Mubvuma, 2013, Tahir *et al*., 2020). The economic importance of *Moringa oleifera* which has many benefits and recognized by the community as a medicinal plant by utilizing almost all parts of the plant, ranging from leaves, seeds, berries and roots (Anwar *et al*., 2007, Tahir *et al*., 2018). It is adapted to a wide range of soil types, but grows best in well-drained loam to clay loam, neutral to slightly acidic soils, but cannot withstand prolonged waterlogging (Adebayo, 2011 and Padilla, 2012). Moringa is propagated sexually through seeds and vegetatively through stem cuttings, however, the spread of Moringa is also rare for seed germination and viability or survival are low, and there is the lack of vegetative propagation method (Devendra, 2012) but at abundance number of plant production has required propagation through seeds planted in the nursery using a light media (3/1 proportion) mixture of soil and sand, respectively also to get the plants in large quantities and quickly is using biotechnological approaches such as synthetic seed technology through micropropagation (Mubvuma, 2013). Seed germination is initiated through rapid water uptake, followed by the activation of metabolic mechanisms leading to the first visual signs of germination known as the protrusion of the radical (Muhl, 2010). WAC (2002) suggested that the sowing of seeds in topsoil leads to a germination percentage above 70% after three weeks. Germination occur within 5-30 days, depending on the media type and pretreatment method used, as soaking seeds for 24 hours, then putting in a plastic bag (Quintin, 2009). Some authors indicated the necessity of soaking or priming the seeds for 24 hours before sowing (Padilla, 2012, Pamo, 2004 and Nouman, 2012). The crop was distress directly or indirectly by the allelochemicals and lead to either stimulation or inhibition of growth. Same plant extraction from leaves, stem, roots, fruit which reported to interfere with the growth of other plants (Asgharipour and Armin, 2010). These chemical products mainly affect plants at seed emergence and seedling seeds levels(Alam and Islam, 2002). Shibata, (2000) showed that the liquorice root extract contains some compounds, which have a similar effect to those growth promoters such as minerals, phenolic compounds, flavonoids, amino acid, vitamins and also contains mevalonic acid used in gibberellins synthesis. Using Bio-fertilizers and spraying the fennel plant with cold water extract of Licorice to produce the fennel plant under sandy soil conditions (Abd El-Azim *et al*., 2017). Germination percentage of *Sorghum bicolor* cultivar Fatarita consistently increased when Ammi majust seed extract was added to the plastic Petri dish on paper tissues

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and the mean days to germination of *Sorghum bicolor* (L.) Moench, viz. Fataritaand Hybrid was relatively decreased by botanical application compared to control (Hassan *et al*., 2012). Mohammed *et al*., (2012) studied that allelopathic potential of aqueous extracts and powder of Ammi majus. In Iraqi Kurdistan, there is little technical information on the production of quality seedlings of the *Moringa olefera* plant. The goals of this investigation are the effect of three substrate compositions and plant extracts on enhancing the seeds germination, production of healthy seedlings, vigour growth of *Moringa oleifera* using plant extracts as an alternative that is safer than chemically growth regulators with taking a practical step toward meeting the increased local demand for such economically important medicinal plant.

MATERIALS AND METHODS

The experiment was conducted, by soaking the seed in different concentration of plant extracts for germination tests, on 1 July, the seed of *Moringa olifera* soaked in different concentration (0 and 5,10 g/L) for both aqueous root and seed extracts of *Glycyrrhiza glabra*(Licorice) and *Ammi majus* plant, respectively, for 24 hours and sowing in plastic bags above paper tissue with three replication in each replication 10 seeds are sowing and then place in the incubator at 25± 2°C. Finally, seeds are treated with different concentrations, then planted in polyethene pot are prepared by three soil types (100sandy, 50 sandy +50% peat moss and 100% peat moss) with three replications and then place in a lath house. The following parameters are measures:

1.Germination percentage and Germination rate index
2.Length, the diameter of the stem
3.Number of leafs
4.Length of Tuberous roots and the number of roots
5.Total biomass
6.Phytochemical contents

Total phenolic content (TPC), total flavonoid content (TFC) and antioxidant potential were determined as described by Tahir *et al*. (2019)

Measurement of traits

To assess the final germination percentage (G %) and rate of germination were calculated using the formulas:

$$G\% = (a/b)\ 100$$

Where, (a) is the proportion of germinant and(b) the total number of seeds. The higher the FGP value, the greater the germination of a seed population. Scott *et al.* (1984).

Germination Rate Index GRI (%/day) GRI=G1/1 + G2/2 +· · ·+ Gx/x

G1=Germination percentage × 100 on the first day after sowing,

G2=Germination percentage × 100 on the second day after sowing

The GRI reflects the percentage of germination on each day of the germination period. Higher GRI values indicate higher and faster germination. Esechi (1994) after modification.

RESULTS AND DISCUSSION

Effect of different concentrations of Licorice and Ammi majus extracts on germination parameters of moringa.

Figure 1 shows that germination percentage of Moringa gave higher value (86.6%) when they were treated with 10 g/L of seed extracts of *Ammi majus* as compared with the other treatments. On the other hand, the least value of germination percentage (80%) was recorded at control. As well as, for root extracts of Licorice highest germination percentage was 80% at control treatment as compared with the rest of treatments. The least value (60%) was obtained when seed *Moringa olefera* treated with 10 g/L root extracts of Licorice.

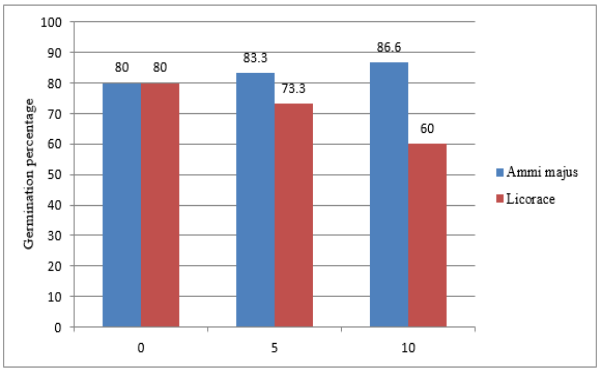

Figure 1. Germination percentage of seed Moringa Moringa as responded to different Licorice and *Ammi majus* extract concentrations.

The highest germination rate of seed Moringa (81.3) recorded at control treatment as compared with the other treatments and germination rate with 10 g/L for Ammi majus gave the least value (65.11) (Figure 2). On the other hand, the highest germination rate for seed Moringa (81.3) was observed at control. Whereas, the least germination rate (58.48)were recorded with those seed Moringa treated with 10mg/l root extract of Licorice.

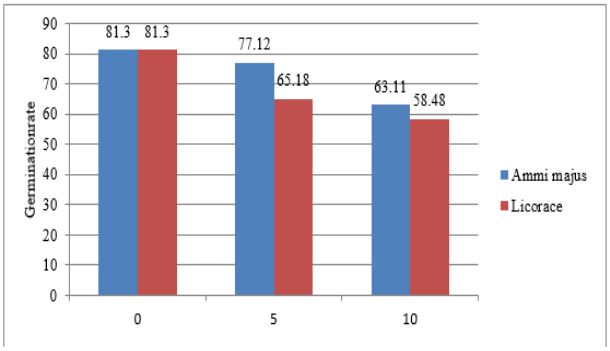

Figure 2. Germination rate of Moringa seeds as responded to different concentrations of seed extracts of Ammi majus and Licorice

Seedling growth

The data on *Moringa olifera* seedling growth indicated considerable differences due to different concentrations of extracts Licorice, Ammi majus, and different media culture with their interactions, as shown in Table 1. The longest stem length was recorded with the treatment 5 g/L of Licorice extract (84.56 cm) which was significantly showed superiority compared to other concentration. Peat moss media demonstrated the maximum stem length. Also, the effect of various concentrations of plant extracts combined with different media culture exhibited the highest stem length (107.33 cm) from the combination between Licorice and peat moss, which was superior upon the control with peat moss and 10 g/L liquorice with the mixture. On the other hand, concerning the effect of Ammi majus extract and culture media each alone did not have a significant effect on the stem length, while the highest stem length (97.33 cm) were recorded

from the combination between 10 g/L Ammi magus and peat moss which were superior on the control (44.33 cm).

The results in Table 2 explain that there were no significant differences in case the stem diameter at the different concentration of plant extract and types of soil alone, while, in combination different concentration of plant extract and types of soil were significantly different, the highest (5.170 and 5.753 cm) stem diameter was obtained in 5 and 10g/l Licorice and *Ammi majus* with peat moss, and the lowest (2.707 cm) was obtained in control with peat moss.

Table 1. Effect different concentrations of Licorice, *Ammi majus* and different media culture and their interactions on stem length (cm) of *M. olifera*

Plant extracts	Media cultures			Plant extract effects
	Peat moss	Loam	Mixture	
Control	44.333e	66.333cd	83bc	64.556b
5g licorice/L	89.333ab	64.333cd	100ab	84.556a
10g licorice/L	107.333a	65.333cd	61de	77.889a
Media culture effects	80.333a	65.333b	81.333a	
Control	44.333d	66.333bcd	83ab	64.556a
5g ammi majus	77abc	49.333cd	66.333bcd	64.222a
10g ammi majus	97.333a	73.667abcd	57.667bcd	76.222a
Media culture effects	72.889a	69.0a	64.111a	

The values connected by the same letters in each column, do not differ significantly ($P \leq 0.05$) according to Duncan's Multiple Range Test.

Table 2. Effect different concentrations of Licorice, *Ammi majus* and different media culture and their interactions on stem diameter (cm) of *Moringa olifera*

Plant extracts	Media cultures			Plant extract effects
	Peat moss	Loam	Mixture	
Control	2.707b	5.127a	4.743a	4.192a
5g licorice/L	3.923ab	5.170a	5.380a	4.878a
10g licorice/L	5.17a	4.183ab	4.227ab	4.527a
Media culture effects	4.399a	4.411a	4.783a	
Control	2.707c	5.127ab	4.743ab	4.192a
5g ammi majus	5.383ab	4.02bc	5.023ab	4.809a
10g ammi majus	5.753a	4.590ab	4.227ab	4.857a
Media culture effects	4.614a	4.579a	4.664a	

The values connected by the same letters in each column, do not differ significantly ($P \leq 0.05$) according to Duncan's Multiple Range Test

Table 3 showed the effect of different concentrations of plant extract and types of soil on the number of leaves per plant. The seeds soaking in 5 g/L Licorice was recorded the best result (14.778) compared to other treatments. Also, the highest number of leaf produced by plant growth in peat moss was significantly different as compared with loam. The same table showed that effect of the interaction of the plant extracts and types of soil on the number of leaves and 5 g/L Licorice extract with peat moss was given the highest number (18.33) which was significantly superior on the control with peat moss. Besides, the result illustrated that the greatest number of the number of leaves (18.333) were achieved when seeds of moringa were treated with 5 g/L liquorice and peat moss which was significantly superior on the control with peat moss. On the other hand, the results indicated that the highest number (13.00 and 13.111) of leaves per plant was obtained when treated with 5 g/L *Ammi majus* and peat moss alone.

The effect of different plant extract concentration and types of soil on roots number alone was evaluated and it showed that the highest roots number (23.44) were achieved when the seeds treated with 5 g/L liquorice, also peat moss alone, which was significantly different from the other treatments (Table 4). Liquorice with 5 g/L with peat moss (30.00) and control with loam (21.000) which were significantly different from the other treatments except for 5 g/L liquorice with loam. Whereas, there was no significant difference between mixture with all various concentration of liquorice extracts. At the same table, the effect of different concentrations of Ammi majus extract on roots number was displayed and 5 g and 10 g/L *Ammi majus* were significantly superior to the control. Furthermore, the result showed that the highest roots number (26.667) were recorded by peat moss, which were significantly different from the loam and mixture. Effect of interaction of the two factors on root number demonstrated that (5 and 10 g/L) with peat moss for *Ammi majus* gave the maximum (32.00) root number, also control with loam and 5 g/L *Ammi majus* with mixture gave the best result which was significantly different from the other treatments.

Table 3. Number leaves per plant of moringa affected by different concentrations of Licorice, *Ammi majus* and different media cultures.

Plant extracts	Media cultures			Plant extract effects
	Peat moss	Loam	Mixture	
Control	6.333c	9.667bc	12.333b	9.444c
5g licorice/L	18.333a	9.333b	16.667a	14.778a
10g licorice/L	17.667a	9.667bc	10.333b	12.556b
Media culture effects	14.111a	9.556b	13.111a	
Control	6.333d	9.667bcd	12.333bc	9.444b
5g ammi majus	18.333a	8cd	12.667bc	13a
10g ammi majus	14.667ab	11bcd	11bcd	12.222ab
Media culture effects	13.111a	9.556b	12ab	

The values in each column with the same letter do not differ significantly ($P \leq 0.05$) according to Duncan's Multiple Range Test.

Table 4. Roots number affected by different concentrations of Licorice, *Ammi majus* and different media culture.

Plant extracts	Media cultures			Plant extract effects
	Peat moss	Loam	Mixture	
Control	16.000bc	21.000b	19.333bc	18.778b
5g licorice/L	30.000a	20.333b	20.000bc	23.444a
10g licorice/L	18.000bc	10.333d	14.333cd	14.222c
Media culture effects	21.333a	17.222b	17.889b	
Control	16.000cd	21.000bc	19.333bcd	18.778b
5g ammi majus	32.000a	15.000cd	22.333b	23.111a
10g ammi majus	32.000a	13.667d	14.000d	19.889a
Media culture effects	26.667a	16.556b	18.556b	

The values in each column with the same letter do not differ significantly ($P \leq 0.05$) according to Duncan's Multiple Range Test.

Effect of various plant extracts on the shoot fresh weight of moringa studied and showed significant variation among different treatments (Table 5). The highest fresh weight (42.79 g) was noticed when the seeds treated with 5 g liquorice/L, whereas the types of soil did not significantly affect the shoot fresh weight. Interaction effects different concentration of plant extracts and types of soil. In the same table, the best value (46.613 g) of fresh weight for shoots was achieved in 10g/L Licorice and peat moss combination also 5g/L Licorice with loam (40.467 g) and mixture (41.960 g), respectively which was significantly higher than control. Concerning the effects of the two factors on fresh weight, 5g/L of *Ammi majus* was superior upon the control which had the least value (13.916g) and (10g/L) of *Ammi*

majus (28.663g) by producing the highest fresh weight reached to (30.460g). In addition, the highest value (26.930 g) for these traits were found in the peat moss, whereas, the lowest (19.213 g) recorded in loam media. Interaction effects of the two factors on shoots fresh weight showed that 5 g/L of Ammi majus with peat moss gave the highest (39.610 g), while the least values (7.40 g) (16.95 g) and (17.40 g) were recorded at peat moss, loam and mixture, respectively.

Table 5. Effect of different liquorice and *Ammi majus* concentrations on fresh weight of moringa

Plant extracts	Media cultures			Plant extract effects
	Peat moss	Loam	Mixture	
Control	7.400 d	16.950 c	17.397 c	13.916 b
5g licorice/L	45.943 a	40.467b	41.960 b	42.7.90 a
10g licorice/L	46.613 a	40.200 b	40.960 b	42.591 a
Media culture effects	33.319 a	32.539 a	33.439 a	
Control	7.400 g	16.950 f	17.397 f	13.916 c
5g Ammi majus	39.610 a	21.650 d	30.120 c	30.460 a
10g Ammi majus	33.780 b	19.040 e	33.170 b	28.663 b
Media culture effects	26.930 a	19.213 b	26.896 a	

The values in each column with the same letter do not differ significantly ($P \leq 0.05$) according to Duncan's Multiple Range Test

Also, the character shoot dry weight as shown in table 6 showed that the treatment of 5 g liquorice/L (15.733g) was highly and significantly affect shoot dry weight compared to the other treatments which were recorded lowest values. Fathe more The same Table revealed that peat moss alone recorded the highest dry weight for shoots(12.097 g) which was significantly superior on the mixture which recorded the least value (6.770 g). The dry weight for shoots supplemented with different concentrations of Licorice, Ammi majus and types of soil combinations at the same table illustrates that the highest weight (20.660 g) and (18.610g)were achieved when treated in 5g liquorice/L with peat moss and loam, respectively which was significantly superior on the rest of treatments. On the other hand, but did not reach the significant difference between all concentration for the extract of Licorice and mixture. concerning the effect of *Ammi majus* extract and types of soil each alone, seed extract of Ammi majus did not have a significant effect on the parameter, but in types of soil, mixture gave the highest (7.610 g) dry weight for shoots and the lowest (5.263 g) was recorded loam .in addition effect of the interaction of the *Ammi majus* and types of soil on dry weight for shoots which were the highest value (12.289g) and (9.100g) dry weight for shoots achieved in control with the mixture and 5g/l Ammi majus with peat moss respectively. while there was no significant difference between all concentration of seed extract Ammi majus and loam. The least values (2.070g) were recorded at the control and peat moss.

Table 7 showed that total phenolic content (TPC), total flavonoid content (TFC) and antioxidant potential (Antioxidant-DPPH). contents were significantly affected by the different of plant extract concentrations and types of soil, alone and the interactions between them. High values of TPC, TPC and Antioxidant – DPPH (3.955 mg gallic acid equivalent/g dry extract, 0.171mg quercetin equivalent/g dry extract and 86.197%), respectively recorded by 10 g/L *Ammi majus* extract with loamy combination and significantly superior on other treatments, whereas the lowest value (1.05 mg gallic acid equivalent/g dry extract and 66.446%) successively for TPC and Antioxidant-DPPH contents gave by control and loam. Furthermore, the lowest value (0.661171mg quercetin equivalent/g dry extract) is recorded by 5g/L Licorice and loam for TFC.

Table 6. Effect of different liquorice and *Ammi majus* concentrations and types of soil on dry weight for shoots of Moringa.

Plant extracts	Media cultures			Plant extract effects
	Peat moss	Loam	Mixture	
Control	2.070 e	7.950 cde	9.100 cde	6.373 b
5g licorice/L	20.660 a	18.610 ab	7.930 cde	15.733 a
10g licorice/L	13.560 bc	6.200 dc	3.280 e	7.680 b
Media culture effects	12.097 a	10.920 a	6.770 b	
Control	2.070 e	7.950 bc	9.100 ab	6.373 a
5g Ammi majus	11.289 a	3.830 dc	6.120 dc	7.077 a
10g Ammi majus	8.660 abc	4.010 bc	7.610 bc	6.760 a
Media culture effects	7.337 a	5.263 b	7.610 a	

The values in each column with the same letter do not differ significantly ($P \leq 0.05$) according to Duncan's Multiple Range Test.

Table 7. Effect of different liquorice and *Ammi majus* concentrations and types of soil on phytochemical composition

Treatment	TPC (mg gallic acid equivalent/g dry extract)	TFC (mg quercetin equivalent/g dry extract)	Antioxidant-DPPH (%)
Control -Mix	2.726 f	0.113 f	84.361 b
Control -P	3.375 b	0.104 g	84.141 b
Control-Loam	1.051 o	0.090 jk	66.446 f
T1-Loam	1.732 n	0.066 l	69.457 e
T1-Mix	2.077 m	0.145 c	75.404 c
T1-P	2.262 l	0.093 j	69.897 e
T2-Loam	2.603 i	0.088 k	71.959 d
T2-Mix	2.654 h	0.116 e	52.129 g
T2-P	2.955 d	0.101 h	85.022 b
T3-Loam	2.681 g	0.097 i	75.257 c
T3-Mix	2.450 k	0.097 i	72.026 d
T3-P	3.166 c	0.096 i	84.875 b
T4-Loam	3.955 a	0.171 a	86.197 a
T4-Mix	2.524 j	0.125 d	70.132 e
T4-P	2.854 e	0.166 b	71.439 d

The values in each column with the same letter do not differ significantly ($P \leq 0.05$) according to Duncan's Multiple Range Test.

These results confirm the effectiveness of plant extracts for seed germination, seedling growth and phytochemical. Furthermore, normal seed germination is usually occurred for these plants but gave the normal germination. Therefore, the plant extract is necessary to record the best results. Seed extracts of Ammi majus at the high concentration were very effective in increasing for seed germination percentage in other hand led to decreasing in germination rate these results were in agreements with Hassan *et al*., (2012) Showed that germination percentage of Fatarita consistently increased when seed extract of Ammi majusn was added to the culture medium. In contrast, *Khaya senegalensis* and *Albizia lebek* leaf aqueous extracts found to have no significant effects on seed germination of sorghum (Mubarak *et al*., 2009; Phiri, 2010).

As well as that when the concentration of root extract of Glycyrrhiza glabra increased the germination percentage decreased, while germination rate index increased These results were following these by Mustafa *et al*. (2017), Hassan., *et al*., (2012) and Navaey., *et al*., (2013) which

reported that the percentage seed germination of some weed species decreased with increasing concentration of aqueous extract of Glycyrrhiza glabra and showed plant that extracts stimulated some growth parameters and reserve others. This result may be due to the effect of Licorice root extract in increasing of endogenous hormones like GA3 in treated plants which increased the metabolic processes role and its effect in element content in tissue (Thanaa *et al*. 2016) and this might be because liquorice, release allelochemical compounds like tannins, wax, flavonoids, glycyrrhizic acid and phenolic acids into the environment(Mustafa *et al*, 2017).

And could be due to the selective permeability of the seed coat to the inhibitory substances (Mubarak *et al*., 2009). The promoting effect of soil types and soaking the seeds on growth characters and Some chemical constituents of *Moringa oleifera*, Lam. has been well established in several reports (Hegazi (2015).; Pahla *et al*. (2013); and Padilla *et al*.,(2012). Soil texture is an important factor where clays generally compromise the majority of cation exchange sites in soils. This is because clays by their small particle size have the most surface area and therefore the most exchange sites. Consequently, clay soils have the greatest risk for excess sodium binding and dispersion(Leal *et al*., 2009). The reduction of biomass was correlated with seedling height growth. This reduction may be due to stunted and reduced seedlings growth (Garcı´a *et al*., 2002).

CONCLUSION

The G.glabra and Ammi majus plant extracts were rich in minerals, phenolic compounds, flavonoids, amino acid, vitamins and also contains mevalonic acid used in gibberellins synthesis These extracts and media cultures inhibited and stimulated the germination and seedling growth *Moringa olefera*.The root extract of G. glabra at 5 g/l with peat moss increase in the number of leaf and root Moringa,while the10g/L Ammi majus with peat moss proved stimulated other characteristics.The plant extracts was a perfect raw material for inhibitory and stimulatory components that could be developed as plant growth regulator.

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تأثير بعض المستخلصات النباتية و وسط الزراعة على أنبات البذور و النمو شتلات النبات المورينكا *Moringa oleifera*

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تم تنفيذ هذه التجربة في كلية هندسة العلوم الزراعية تابع لجامعة السليمانية، بهدف اظهار تأثير مستخلص المائي لجزور كل من عرق السوس و خلة و وسط الزراعة المختلفة على نسبة انبات البذور، نمو الشتلات، محتوى الكيمياوي و الوزن الطري و الجاف لشتلات المورينكا.ظهر في النتائج تأثيرات المعنوية لمستخلصات النباتية في جميع صفات المدروسة ، وسجلت اعلى نسبة المئوية الأنبات عند معاملة البذور بالمستخلص المائي 10 غم/ لتر من خلة (*Ammi majus*)، واعلى نسبة أنبات البذور (81.3) ظهرت في معاملة المقارنة لكل من المستخلص النباتي عرق السوس و الخلة. أطول تطويل الساق انتجت في معاملة التداخل بين 5غم/لتر من عرق السوس و ووسط البيتموس، و أعلى درجة طول الساق لشتلات المورينكا (107.33 و 97.33) سم انجزت في معاملة التداخل 10 غم/ لتر كل من عرق السوس و الخلة مع الوسط الزراعة البيتموس. بينما ادنى القيمة (44.33 سم) انتجت في معاملة التداخل المعاملة المقارنة و البيتموس، اضافة الى ذلك اعلى القيمة من قطر الساق الشتلات (5.75 سم) اظهرت في معاملة التداخل بين الوسط البيتموس و 10 غم /لتر من الخلة. أكبر عدد الأوراق للشتلات سجلت عند معاملة 5 غم /لتر من مستخلص المائي لعرق السوس و وسط الزراعة البيتموس و التداخل بينهم. من الناحية الأخرى اكبر العدد من الجذور(23.44) انتجت عند معاملة البذور مورينكا بالمستخلص المائي 5 غم/لتر عرق السوس، و (25.67) في الوسط الزراعي البيتموس, (32) في معاملة التداخل بينهم. أما أفضل النتائج للوزن الجاف لكل من الأوراق و الأفرع أنجزت في معاملتين 5و10 غم/لتر لكل من عرق السوس و الخلة والتداخل مع الوسط البيتموس. أما أعلى القيمة من TPC،TFC و مضاد الأكسدة-DPPH (3.955، 0.171 و 86.197 على التوالي) سجلت عند معاملة التداخل 10 غم/لتر من الخلة مع وسط الزراعة الطم ولها معنوية التأثير على معاملات الأخرى.