Potential of aqueous extracts of medicinal plant seeds as rooting and growth stimulating hormones

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Abstract
This study high lights the aqueous extracts of the seeds of some medicinal plants, these seeds were coriander, cloves, hawthorn seeds and IBA. All treatments were compared to distilled water, and the concentrations used were 0.5 g/L and 1gm\L. The results were tested on stem cutting rooting. Four types of stem cuttings were test: Ficus, rosemary, Chrysanthos, and Morus. The results showed that the aqueous extract of coriander seeds, giving the highest results in rooting, number and length of roots , the number of new leaves and new branches. The chemical analysis of this extract showed that it contains the growth regulators indole acetic acid, gibberellins, and cytokinin, , anti-oxidant and many important phenolic acids.

Keywords: seeds extracts, stem cuttings, coriander, clove, hawthorn, IBA, chemical analysis.

Introduction
Medicinal plants are a rich source of active compounds that have played a major role in the medical field, as a therapeutic substance instead of expensive manufactured drugs that cause harm to the human body when they are deposited and cause damage to the liver and kidneys. In the last century, these plants were used in agricultural applications.For example plant extracts were used as pesticides , fungicides, and even used in biological control of field weeds and parasitic weeds. In the recent years, there has been a lot of research to use extracts as alternatives methodes instead of stimulating hormones for rooting stem cuttings [1 and 2] and seed germination [3 and 4]. In this study, some medicinal plant seeds that have been used in human health fields were used and tested in agricultural fields in terms of their effect on rooting stem cuttings.
The seeds used were: 1- Clove seeds (*Syzygium aromaticum*). 2-Hawthorn seeds (*Crataegus azarolus)*.3- Coriander seeds (*Coriandrum sativum*).4- IBA as chemical promoting roots processing hormon, 5- distald water as control.

Material and methods

The research experiments were conducted in the plastic house in Al-Farabi University, College of scince, Department of biology, in February 2025.
Healthy and uniform of cuttings were: 1-(Ficus, (*Ficus carica L)* ,2-Morus (Morus rubra).
3-Rosemary (*Rosmarinus officinalis*).4- Chrysanthos (*Chrysanthemum indicum*).
To increase the surface area of absorbing, these cuttings were slanted cut at the base, and to prepare the growth regulator IBA, one gram of IBA was dissolved in a small amount of 70% ethanol, shaken, and then the solution was diluted to a volume of one liter with distilled water. to from 1g/L IBA.
Preparation of seeds aqueous extracts: All the seeds were collected from the local markets of Baghdad. The seeds were washed with water, then dried in an electric oven at 60 degrees Celsius, then ground individually using an electric grinder, then, the seeds were weighed with an electric balance to prepare the following concentrations: 1\2 and 1 gram\liter. The seeds were placed in blender with 500 ml of distal water to begin the extraction process for ten minutes. After that the mixture left for an hour , then filtered with cheese cloth to obtain a solution free of fibers and pure, after that ,complet the volum of the extraction to liter, to obtain the required concentrations. The filtration was stored in drack container in the refrigerator until use.
Stem cutting treatments: The cutting were half-woody , and contained more than four nodes in each cutting, then they were immersed for 24 hour in seeds aquous extract.
All the extracts were at two concentrations 1 g/L and 1.2 g/L, 1 g/L IBA. Distilled water as control. After that, these cuttings were planted in 9 cm diameter pots containing soil mixed with pit mose in equal quantities, with three replicates for each treatment. and each replicate had two cuttings. The pots covered with plastic bags to keep the moisture of the cuttings. After two months of planting, the rooting percentage and numbers of the roots, numbers of new leaves and new branches were recorded, for all treatments.

Chemical analysis

1- **Detection of antioxidants** :A method used by [5] was used to detect the antioxidant using a device HPLC by added to 1 ml of DPPH to different dilutions of coriander extract.

2- **Detection of growth hormones (kinetin, Indole acetic acid, Gibberellic acid)**, Growth hormones were detected by HPLC according to a procedure reported by [6].

3- **Detection of phenols and flavonoids** :were detected by HPLC according to the method [7].

Results and Discussion

1- Rooting percentage:

Table 1. Effects of different treatments in concentration 1/2gm\L on numbers of roots.

Treatments	Ficus	chrysanths	Morus	rosemary	means
IBA gm/L	17	7	4	4	8
½ gm\L.clove	10	7	5	4	6.5
1\2gm/Lit.coriander	22	13	10	6	12.75
1\2gm/l. Howthorn	7	4	3	3	4.25
control	2	3	2	2	2.25
L.S.D for Treatments =3.8					

Table 2. Effects of different treatments in concentration 1gm\L on numbers of roots.

Treatments	Ficus	chrysanths	Morus	rosemary	means
IBA gm/L	17	7	4	4	8
1 gm\L. clove	17	8	6	4	8.75
1gm/Lit. coriander	23	15	11	9	14.5
1gm/l. Howthorn	8	4	3	3	4.5
control	2	3	2	2	2.25
L.S.D for Treatments= 4.7					

Table (1,2) showed roots numbers that the Coriander seeds aqueous extracts in 1and1\2 g\L concentration were gave the highest mean results in rooting numbers (12.75 ,14,5) , than other treatments such as IBA treatment. The lowest number of roots was observed in the distilled water control treatment (2.25). These results may be due to the active compounds in these extracts and also It was probably that coriander extract contains a high concentration of stimulating compounds for rooting, [8] indicated that has several medicinally valuable chemical components such as, Linalool, Geranyl acetate, Limonene, Camphor, Geraniol, and seeds of coriander.

Table 3. Effects of different treatments in concentration 1/2gm\L on longe of roots in cm.

Treatments	Ficus	chrysanths	Morus	rosemary	means
IBA gm/L	5	10	2	3	5
½ gm\L.clove	5	9	3	3	5
1\2gm/Lit.coriander	10	15	4	6	8.7
1\2gm/l. Howthorn	1	3	1	2	1.5
control	1	3	1	2	1.6
L.S.D for Treatments= 2.16					

Table 4. Effects of different treatments in concentration 1gm\L on long of roots in cm.

Treatments	Ficus	chrysanths	Morus	rosemary	means
IBA gm/L	5	10	2	3	5
1 gm\L.clove	8	10	3	4	6.2
1gm/Lit.coriander	13	16	6	7	10.5
1gm/l. Howthorn	2	4	2	3	3.25
control	1	3	1	2	1.75
L.S.D for Treatments=2.88					

The results in table (3-4) showed that Coriandrum seeds aqueous extracts gave the highest means values in roots long, respectively (8.7 ,10.5 cm) in 1\2 g/L and 1 g\L concentration respectively compared with IBA treatment (5 cm). the lowest values were given by
comparison treatment (distilled water) was (1.6 cm). Studies have shown that coriander seeds have an effect on increasing growth in research conducted on animals [9, 10 and 11].

Table 5. Effects of different treatments in concentration 1/2gm\L on No. of leaves

Treatments	Ficus	chrysanths	Morus	rosemary	means
IBA gm/L	1	1	1	1	1
½ gm\L.clove	1	2	1	2	1.25
1\2gm/Lit.coriander	3	5	2	4	3.5
1\2gm/l. Howthorn	1	2	1	1	1.25
control	1	1	1	1	1
L.S.D for Treatments=0.03					

Table 6. Effects of different treatments in concentration 1gm\L on No. of leaves

Treatments	Ficus	chrysanths	Morus	rosemary	Means
IBA gm/L	1	1	1	1	1
gm\L.clove	3	3	2	2	2. 5
1gm/Lit.coriander	4	4	3	5	4
1gm/l. Howthorn	2	2	1	1	1. 5
control	1	1	1	1	1
L.S.D for Treatments=0.8					

In Tables (5,6), we observe that the coriander seed extract treatments resulted in the highest percentage of leaf formation (3,4), higher than the hormone treatment IBA (1), followed by clove extract (1,3), with the lowest values for the control treatment(0.5).

Number of branches.

Table 6. Effects of different treatments in concentration 1/2gm\L on No. of branches.

Treatments	Ficus	chrysanths	Morus	rosemary	Means
IBA gm/L	2	2	2	3	2.5
gm\L.clove	1	2	1	2	1.5
1gm/Lit.coriander	3	4	3	3	3.25
1gm/l. Howthorn	1	1	1	1	1
control	1	1	1	1	1
L.S.D for Treatments=0.6					

Table 7. Effects of different treatments in concentration 1gm\L on No. of branches.

Treatments	Ficus	Chrysanthos	Morus	rosemary	Means
IBA gm/L	2	2	2	3	2.5
gm\L.clove	2	2	2	2	2
1gm/Lit.coriander	3	4	3	5	3.75
1gm/l. Howthorn	1	2	1	1	1.25
control	1	1	1	1	1
L.S.D for Treatments=0.84					

Tables (6,7) show also that coriander seed extract gaves the highest means values in number of branches (3.25, 3.75 means number of branches), compae with IBA treatment which gaves (2.5 mean number of branches) and the lowest means value gave by control treatment (0.75 mean number of branches).
We observe in all the tables that the higher the concentration, the greater effects and stimulation of roots growth and formation, and gaves the greater formation of new leaves and branches.
The plant extracts are natural products which are rich in active compounds such as vitamins, carbohydrates, nucleic acid, lipids, in addition to different minerals, amino acids. which are very important. It is involved in many important physiological processes. These compounds enhance the physiological metabolisms of the plant such as uptake of macro and microelements and their translocation within plants, also increase the root growth, for example, it is involved in the formation of important hormones in growth processes and stimulate root formation in plants [12 and

1]. The plant extracts components were vary between plants so any effect on the metabolism process is different from the extract to another depending on the active compounds in these extracts.[13]. Researchers have found that the coriander plant is characterized by being have very important of volatile essential oils which act as anti-oxidant, these compounds can stimulate and improve the rooting in the stem cutting [14]. Which agree with our results the highest values in rooting.

Rosmary treatments

Chrysanthos treatments

Ficus teatments

Morus treatments

Table (8) Antioxidant activity of coriander seeds.

	Dry weight in milligram							
	0.25	0.5	1	2	4	6	8	10
DPPH scavenging	34.3	51.6	64.4	77.2	82.8	87.9	Nd	ND

The table (8), shows the presence of antioxidants that protect vital plant functions, in the plant including protection from oxidation caused by external influences of environmental conditions. Antioxidant activity continuously increases before root formation to enhance the resistance of cuttings against stress. The activity of the antioxidant had ability to promotes lignin biosynthesis in addition to promotes the production of iso-2tyrosin [15 and 16]. But after adventitious root emergence the activity of these compounds start to decline, and the activity of antioxidant starts to decrease [17and 18]. The table (8) shows that when the concentration increases of the dry weight of the seeds, there is an increase in these compounds. These results explain that the high concentrations gave the highest growth.

Table (9). Analysis of growth hormones in coriander seeds.

	subjects	Retention time (min)	Area	Concentration 5 µg/ml = 1mg/L.
1	kinetin	2.275	92349	2.9411
2	Indole acetic acid	3.620	84178	24.5574
3	Gebberellic acid	4.698	78850	23.0032

Indole Acetic Acid (IAA) is one of the most important naturally occurring auxins, a class of plant hormones that play a crucial role in regulating plant growth and development. IAA is involved in various essential processes such as cell elongation, root development, and the response of plants to light and gravity. It is a key player in many agricultural practices, helping plants grow more efficiently [19 and20]. The endogenous hormones, (cytokinin and auxin) regulate and metabolism each other, IAA controls cytokinin content, by regulation of their biosynthesis, and positively effect on rooting number, length in addition to promoting cell division. [21 and 22]. Gibberellins could play a role in the initiation of shoot growth by dormant plants in the spring, and has an indirect promotion for causing bud activity and increased the endogenous auxin supply from the axillary buds as mentioned by [23 and 24].

In recent study, indicated the role of GA in bud germination and growth and the positive regulatory function of GA signaling in shoot branching processes. [25]. kinetin (Kn). A significant
increase was noticed in branch number, leaf number, leaf area, and seed mass [26 and 27].

Table (10). Analysis of Phenols and flavonoids in coriander seeds.

	Seq Subjects	Retention time (min)	Area	Concentration 5 µg/ml
1	Non-chlorogenic acid	2.41	108489	13.7462
2	Caffeic acid	3.155	121859	15.4403
3	Ferulic acid 4	4.227	114565	14.5162
4	Iso-orientin	5.313	119458	15.136
5	Quercetin-3-b-o glucoside	6.156	112354	14.2359
6	Kaempferol- 3-b-O rutioside	7.06	111564	14.1358
7	Quercetin-3—o glucuronides	7.798	100939	12.7896

Table (10) indicated that phenolic acids like Gallic acid,Ferulic acid and caffeic acid are natural compounds known for their antioxidant properties, protecting cells from damage and they also act as rooting promoters by influencing hormone (IAA) levels, scavenging radicals that degrade hormones, and supporing plant- microbe interactions, with ferulic acid notably boosting adventitious root formation, and prevent (IAA) from breakdown and enhancing root development (28, 29 and 30).

Conclusion

This research is one of the ideas that its aim to replace manufactured chemicals plant growth regulator with environmentally friendly alternatives plant extract, that do not have any negative effects on the environment. • The superiority of coriander seeds extracts by giving the highest results in rooting of stem cuttings than the IBA and other treatments.

Recommendations : Find readily available and inexpensive compounds that stimulate root growth and formation in plants, as alternatives to chemical compounds harmful to living organisms, including humans, and to the environment in general.

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