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Evaluation of the efficiency of some medicinal plant extracts on germination indicators and seedling vigor of some vegetable plants

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ABSTRACT

This research was carried out in the laboratories of Dept. of Horticulture and Landscape design/ College of Agriculture and Marie Fisker Institute for bioenergy, Thi Qar University to consider the effect of some medicinal plant extracts in improving germination and seedlings growth for some vegetable crops numbers from Solanaceae family. The experiment included soaking tomato (*Solanum lycopersicum* L.), pepper (*Capsicum annuum* L.), and eggplant (*Solanum melongena* L.) seeds in plant extracts prepared from cumin (*Cuminum cyminum* L.), citronella (*Hibiscus sabdariffa* L.), moringa (*Moringa oleifera* L.), and fenugreek (*Trigonella foenum-graecum* L.) at a concentration of 5% (w/v), in addition to a control treatment of soaking in distilled water.

The experiment was laid out in CRD with three replicates per crop. The results indicated that immersion with plant extracts had a positive effect on the physiological traits of germination, resulting in significant increase in percentage and rate of germination, root length and shoot length compared to the control treatment. The potential utility of the moringa and cumin extracts as natural stimulants to enhance seed viability and vegetable seedling growth was evidenced by their superiority in most of the traits investigated.

Keywords: Plant extracts, moringa, cumin, fenugreek, vegetables, eggplant.

Introduction

Germination is a critical phase in the life cycle of plants. This is likewise affected by a number of environmental and biological factors that can slow or prevent germination. The uniform and rapid germination is the key of good field growth, which promotes neatness in subsequent management of maintenance. So, the introduction of methods by which growing and germination of seeds would be enhanced may contribute directly in increasing the production of these crops especially Solanaceae family beside to eggplant, pepper and tomato as world-wide food most valuable crop (Zeinab 2013).

History of medicinal plants is significant in our society, and their contribution to nutrition and healthy living has been displaced over many genes from the ancestral generation. Print Although tremendous developments have taken place in the field of biochemistry and modern medicine, medicinal herbs and plants continue to be in demand since more and more people are using these due to their safety (or toxicity)

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towards humans when compared with pharmaceuticals. The importance of research directed toward the assessment and development of medicinal plants for safe use is emphasized in a number of reports published by the World Health Organization (WHO), United Nations Children's Fund (UNICEF) and Food and Agriculture Organization (FAO) (Al-Nadawi, 2006).

Cumin (*Cuminum cyminum* L.) is one of these plant species and it is an annual herbaceous plant belonging to the family Apiaceae. It is a good source of antioxidants, vitamins and bioactive substances that may sufficient to improve the germination characters (Al-Kaisy *et al*., 2010). Hibiscus sabdariffa L. is a medicinal plant that is a member of the Malvaceae family. Its flowers are rich in various bioactive substances, including vitamins minerals, organic acids antioxidants and phenolic compounds (Naeem, 2006).

Moringa (*Moringa oleifera* L.) is a multipurpose tree with tender leaves and pods that are commonly used for cooking as leafy vegetable, while its various parts have been also used as good source of nutrition and medicine due to their high protein, mineral and bioactive compound contents (Sodamade *et al*., 2017; Jahan *et al*., 2018). (*fenugreek Trigonella foenum-graecum* L.) is an annual medicinal plant, with anti-inflammatory, antispasmodic and carminative properties. The seeds have antioxidants and they are rich in active compounds (Foster, 2001; Al-Khuwailidi, 2024).

Some studies have demonstrated that the application of plant extracts on seeds has promoted germination and increased growth parameters and yield. They are also known to trigger physiological responses like awakening of dormancy and initiation of cell division/growth (Prabnu *et al*., 2010; Abdulhussein, 2010). These effects are attributed to the phytochemicals present in the plant extracts which have bioactive compounds like antioxidants (vitamins, carotenoids, polyphenols) and biologically active compounds such as alkaloids tannins saponins as well organic and aromatic acids glycosides flavonoids and steroids with known medical importance (Oladeji *et al*., 2017; Yadav *et al*., 2017).

Materials and Methods

The experiment was conducted in the labs of field crop department at Faculty of agriculture and marshes, University of Thi-Qar to investigate the effect soaking with some medicinal plant extracts on some germination characteristics for seeds tomato, Eggplant and Sweet Pepper. Materials and Methods The laboratory experiment was done based on Completely Randomized Design (CRD) with three replications, as a simple experimental design by five fertilizers separately for each crop.

Aqueous extracts of medicinal plants were prepared (cumin seeds *Cuminum cyminum* L., fenugreek seeds *Trigonella foenum-graecum* L., moringa seeds *Moringa oleifera* L., and roselle flowers Hibiscus *sabdariffa* L.) at a concentration of 5%. After cleaning and grinding, 5 g of each plant sample was taken and dissolved in a quantity of distilled water, and the volume was completed to 100 ml. The mixture was shaken for two hours and then left for 24 hours. It was first filtered through layers of gauze to separate large particles, and then filtered again using filter paper and a glass funnel. Each extract was placed in a special bottle labeled with a code.

Seeds of Tomatoes, Eggplant and Sweet Peppers seeds were thrashed and sound good seeds were extracted. For each crop, 30 seeds were placed in Petri dishes (d = 10 cm) on filter paper. The seeds were soaked with each extract for 12 h and ultimately plates were incubated in the lab at a constant room temperature of 18–25 °C. There are daily measurements in the Tendays study period and the following.

1- Germination percentage (%): The germination percentage was calculated according to the following equation: Germination percentage (%) = number of germinated seeds / total number of seeds × 100

2- Germination speed (seed·day^{-1}): The germination speed was calculated as follows: ermination speed (seed·day^{-1}) = number of germinated seeds / number of days since sowing

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3- Radicle length (cm): The radicle length was measured using a graduated ruler on the tenth day of the experiment.

4- Plumule length (cm): The plumule length was measured using a graduated ruler on the tenth day of the experiment.

The statistical analysis of the data was performed using the statistical software GenStat Discovery Edition 3 for analysis of variance (ANOVA). The Least Significant Difference (LSD) test was used to compare treatment means at the probability level of 0.05 (Al-Rawi and Khalaf Allah, 2000).

Results and Discussion

1. Germination Percentage (%)

Seed germination refers to the ability of the seed to produce a seedling and resume embryo growth after being dormant or temporarily inactive. The germination process includes natural, chemical, and physiological-biological events.

The results shown in Table (1) indicate that there were significant differences among the soaking treatments of vegetable plants seeds with plant extracts in terms of germination percentage. The highest germination percentages of 92.2%, 92.3%, and 90.7% were recorded for Tomatoes, Eggplant, and Sweet Peppers seeds, respectively, when soaked in moringa extract, followed by cumin extract, both of which differed significantly from the seeds soaked in distilled water.

This could be attributed to the function of extracts in decreasing water needs and stimulating hydrolytic enzymes like α-amylase and β-amylase which are vital for degradation of complex substances into simpler ones within the endosperm and transferring to embryo, leading to an increase in germination while decrease on inhibition effect of abscisic acid. (Atiyah and Judou, 1999; White *et al*., 2010).

Table 1. Effect of soaking with medicinal plant extracts on the germination percentage of some vegetable plants seeds (%)

Plant extracts	Tomatoes (%)	Eggplant (%)	Sweet Peppers (%)
Distilled water	86.3	85.9	80.8
Cumin	90.9	90.5	89.9
Moringa	92.7	92.3	90.7
Fenugreek	88.1	87.5	83.3
Roselle	87.2	88.2	82.6
L.S.D. 0.05	2.21	2.09	1.96

2. Germination Speed (seed·day^{-1})

The results presented in Table (2) indicate a significant effect of treatment with medicinal plant extracts on the germination speed of vegetable plants seeds. Significant differences were observed among the extracts, with soaking in moringa extract giving the highest germination speed values of 44.7, 42.7, and 41.4 seed·day^{-1} for Tomatoes, Eggplant, and Sweet Peppers, respectively. In contrast, the lowest values were recorded in seeds soaked in distilled water.

The increase in germination speed may be attributed to the role of plant extracts, through their antioxidant content and plant hormones, in breaking seed dormancy, as well as their role in reducing the mechanical resistance of the tissues surrounding the embryo and stimulating the latent growth potential of the embryo.

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Table 2. Effect of soaking with medicinal plant extracts on germination speed (seed·day^{-1}) of some vegetable plants seeds

Plant extracts	Tomatoes	Eggplant	Sweet Peppers
Distilled water	39.9	38.2	36.8
Cumin	42.7	41.8	39.6
Moringa	44.7	42.7	41.4
Fenugreek	41.2	39.2	37.6
Roselle	40.6	40.1	38.5
L.S.D. 0.05	1.86	1.32	1.49

3. Radicle Length (cm)

The results in Table (3) show the significant effect of treatment with medicinal on radicle length of vegetable plants seedlings rudiments cuts. Considerable differences were observed between the soaking treatments, and seed radicles in seeds soaked in moringa extract reached maximum lengths (7.1 cm for Tomatoes and 6.9 and 6.7 cm for Eggplant and Sweet Peppers, respectively), while the lowest value was recorded under control treatment.

Radicle emergence is the first sign of germination, which usually results from cell elongation rather than cell division. Typically, the radicle emerges from non-dormant seeds within a few hours or days after sowing, and its appearance marks the end of the initial imbibition phase of germination (Creelman et al., 1990).

Table 3. Effect of soaking with medicinal plant extracts on radicle length (cm) of some vegetable plants seeds

Plant extracts	Tomatoes	Eggplant	Sweet Peppers
Distilled water	5.7	5.2	5.0
Cumin	6.9	6.7	6.7
Moringa	7.1	6.9	6.7
Fenugreek	6.4	6.1	5.9
Roselle	5.9	5.8	5.5
L.S.D. 0.05	0.26	0.21	0.24

4. Plumule Length (cm)

The results in Table (4) indicate a significant effect of treatment with medicinal plant extracts on plumule length of vegetable plants seedlings. Significant differences were found among the soaking treatments, with cumin extract giving the highest plumule lengths of 4.9, 4.8, and 4.6 cm for Tomatoes, Eggplant, and Sweet Peppers, respectively, which did not differ significantly from the moringa extract treatment. The lowest values were recorded in the control treatment.

Table 4. Effect of soaking with medicinal plant extracts on plumule length (cm) of some vegetable plants seeds

Plant extracts	Barley	Eggplant	Sweet Peppers
Distilled water	3.8	3.6	3.6
Cumin	4.9	4.8	4.6
Moringa	4.9	4.7	4.5
Fenugreek	4.1	3.9	4.1
Roselle	4.2	3.9	3.8
L.S.D. 0.05	0.23	0.24	0.19

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Conclusions

It can be concluded from this study that stimulating the seeds of vegetable plants using medicinal plant extracts, especially moringa and cumin extracts, improved germination and its characteristics, thus producing seedlings with better morphological traits. This superiority in plumule and radicle length indicates stronger and more vigorous seedling growth.

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