Plant Archives Vol. 21, Supplement 1, 2021 pp. 1481-1484 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
doi link : https://doi.org/10.51470/PLANTARCHIVES.2021.v21.S1.233

EFFECT OF ELECTRIC SHOCK AND GAMMA RAYS ON STIMULATION OF SEED GERMINATION AND GROWTH OF SEEDLING IN THYME (*THYMUS VULGARIS*)

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ABSTRACT

A experiment was conducted in the plastic house of Aromatic and Medicinal Plants Research Unit/ Horticulture Department/ College of Agriculture/ Baghdad University, during spring season 2019 to test the impact of four Gamma doses Radiation (0, 10, 20, 30 Gray), and two levels of electric current severity AC (0, 6, Ampere) on seed germination and growth of (*Thymus vulgaris*). This study was designed according to Complete Randomized Design (CRD) in three replicates and the results was analyzed using L.S.D at 5% level of significant. Observations have identified a number of traits of seed germination percentage (FGP), germination speed(GS) and growth traits such as seedling height, wet weight of root and shoots, dry weight of root and shoots, number of leaves and root length. The results obtained: The top Improvement of germination speed when the seeds are irradiated at a dose of 30 Gray (2.40 % day^{-1}), while the highest level of dry weight of shoot (0.01490 g) and Leaf number(19.40 leaf\plant) at a dose of 20 Gray while the control gave less results of this studied characteristics. Electric shock (6A) exceeded control treatment in wet and dry weight of shoot (0.0580, 0.01560 g), Wet weight of root (0.0350 g), Leaf number (17.10 leaf/plant) and Root length (10.10 c.m).

Keywords: Thyme, electric shock, gama rays, germination.

Introduction

Medicinal and aromatic plants since long time ago played very important positions to treatment diseases all around the world (Fallah-Hoseini *et al*., 2006), the application of medicinal and aromatic plants is speeding up worldwide, due to a growing interest in herbal treatments and the tremendous expansion of traditional medicine. Plants are being used in pharmacy to improve and health, mental and cultural those and to cure some ailments and conditions It was known that African countries, Latin America and Asia use conventional medicine to assist meet a lot of thir primary fitness care requirements (Idu *et al*., 2009). Thyme (*Thymus vulgaris*) is a one of medicinal and aromatic plants that follow the Lamiaceae family and has recommended huge attention as both a medication and pharmaceutical agent where over the world. Studies and articles specify that the major pharmacological impacts of thyme are caused carvacrol and thymol, which are the much of important bio-active compounds that thyme includes (Aeschbach *et al*., 1994; Grigore *et al*., 2010). The antioxidative assets of Bio-active compounds in the structure of thyme was diagnosed in the laboratory testing (Grosso *et al*., 2010). Carvacrol and thymol are well-known not just to have antioxidative effects but likewise antiviral, antimicrobial activity and aroma controlling effects (Aeschbach *et al*., 1994; Grosso*et al*., 2010).

Propagation of M. champaca still has some problems due to poor seed storage and seedling viability. The seed propagation is time consuming (slow germination: 5 weeks to 4 months to germinate) and generally low percentage of germination and quick loss of viability Propagation of M. champaca still has some problems due to poor seed storage and seedling viability. The seed propagation is time consuming (slow germination: 5 weeks to 4 months to germinate) and generally low percentage of germination and quick loss of viability

Propagation of *Thymus vulgaris* still has a few challenges due to viability of seedling and misstorage of seed. Propagation of seed is generally speaking low germination percentage also It takes some time and fast survival failure. Gamma irradiation and electric shock are considered among the joint practices to stimulate genetic variation in several species of plants. (De Micco, Arena, Pignalosa, & Durante, 2011; Moussa, 2011) . Because of these techniques (gamma irradiation and electric shock) their power of penetration and easy availability so these have proved to be more effective and economical compared to other ionizing radiations. **(** Moussa *et al*., 2006).

Materials and Methods

A pot experiment was conducted in the unheated plastic house in Aromatic and Medicinal Plants Research Unit/ Horticulture Department/ College of Agriculture/ Baghdad University, during spring season 2019.

Source of seeds: Seeds of (*Thymus vulgaris*) were obtained from Germany/Chrestensen company to gamma treatment and electric current.

Radiation of gamma: Using a Cobalt(60) / 1 Gy=100 rad For the purpose of Irradiation of (*Thymus vulgaris*) seeds was performed (Piri *et al*., 2011). In special circumstances at the University of Baghdad College of Physics. The exposure dosage was 0, 10, 20 and 30 Gray .

Electric shock: The selected seeds were splited into groups with 100 seeds each group. They were saturated in NaCl1% for 2 h to allow the solution to permeate the seed in order to increase electric conductivity during later treatment. The seeds were placed in cloth bags to avert mixing. The system was used as qualified by Elsahookie and Alsubahi (2001). An electric shock system with a patent number(3112) dated 2002/6/20 owned by Elsahookie and Alsubahi (2001) was released from the central unit for standardization and quality control in Iraq (Figure 1).

Various treatments were carried out by set seeds in the system under different electricity intensities 0 and 6 A for 5 min with a stable voltage (220 V). The seeds have then been washed with running water for only one hour and for two times to get rid of the remaining salt solution.

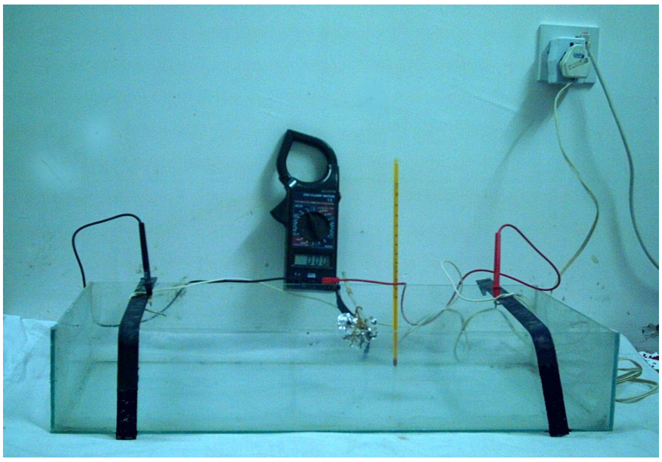

Fig. 1 : Electric shock system

Laboratory and field operations: For test of germination, all treated seeds were sown over the planting media in a germination dish and placed inside. Was replicated each treatment three times with use(100) seeds in each treatment. The number of seeds germinated each day was counted. The final time for germination was defined as that day when there is no further germination**.**

Final Germination percentage: The final germination percentage (FGP) was based on the calculation (Anjum & Bajwa, 2005)

as like:

$$FGP = \frac{(N_T.100)}{(N)}$$

Where(N_T) = It means the percentage of germinated seeds in each of the final measurement treatments;

(N) = seeds number used for bioassay.

The index of germination is a quantitative definition of germination that relates the maximum germination valueto the daily germination rate.

Germination Speed: it has been computed by according to the formula presented by the researcher (Czabator., 1962)

Germination speed = (n1/d1+n2/d2+n3/d3+----------)

Where (n) mean number of germinated seeds.

(d) mean number of days.

Statistical analysis: This study was designed according to Complete Randomized Design (CRD) in three replicates and the results was analysed using L.S.D at (5%) level of significant.

Study indicators: After seven weeks of planting, the following parameters of seed germination and seedling growth were measured regarding germination percentage(%), germination speed, wet weight of shoot (g), dry weight of shoot (g), wet weight of root (g), dry weight of root (g), leaf number, root length (cm) and plant height (cm).

The length of the vegetative group for seedling was measured from the top of the seedlings to surface of the soil. after separating the vegetative group from the root at the soil surface, was washed with water to remove the soil, after that dry it by a special cloth to absorb the moisture of the wash water, then was measured the fresh and dry weight by using a sensitive scales. Then put the vegetative group and root for seedling in the oven at (50 ºC) for the purpose of drying it.

Results and Discussion

Effect of electric current and gamma irradiation on speed and percentage of germination

Obviously, the test for seed germination after gamma irradiation (0, 10, 20, 30 Gy) and electric current (A0, A6) revealed that the maximum of percentage and speed of germination was with 30 Gy (38.0% and 2.40% day^{-1}) Compared with the Control (31.3% and 4.83% day^{-1}) respectively. Germination percentage was negatively influenced by electric current treatment (22.3%) compared with the control (31.3%), while recorded a large increase in germination speed with A6 treatment (3.70% day^{-1}) as compared with the control (4.38% day^{-1}) (with no shock). As seen in Fig. 2 and 3.

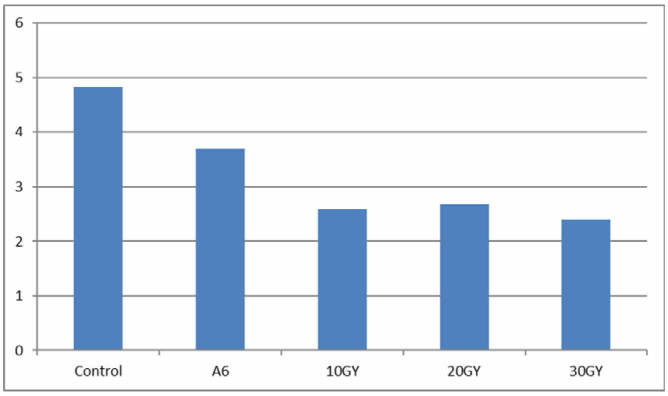

Fig. 2 : Gamma irradiation effect and electric current on speed germination day^{-1}

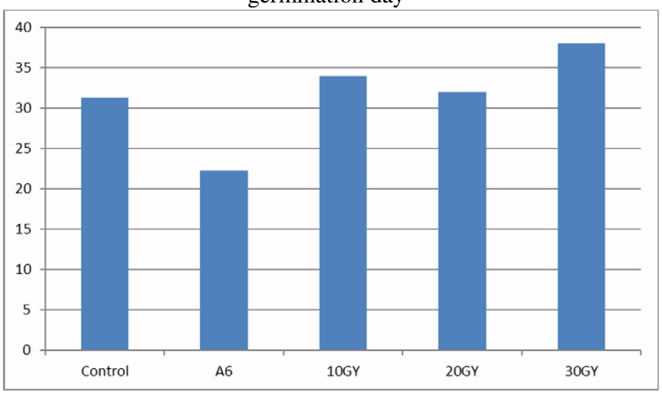

Fig. 3 : Gamma irradiation effect and electric current on percentage germination %

Damage to cell components at the molecular level or altered enzyme activity due to mutagenic treatments may be the cause of decreased seed germination (Khan & Goyal, 2009). Yusuf and Nair (1974) They came to the conclusion that the electric current and gamma rays accelerate the degradation of existing enzymes as well as interfere with the formation of enzymes at the same time by participating in the formation of growth regulators such as auxins and thus all this reduces seed germination. The components of plant cells can be destroyed by free radicals or modified by them. It is indicated and based on the percentage of irradiation Its effect on anatomy, morphology, physical and chemical properties, and germination of plant seeds has been reported, (Maamoun, El-Mahrouk, Dewir & Omran, 2014). Kumar and Mishra (2004). Kumar and Mishra (2004) showed that increased doses of gamma rays caused a decrease in the germination rate of okra (*Abelmoschus esculentus*) in general. Decreased germination rate has also been reported with increased doses of gamma rays in *pines* (Thapa, 2004) and *Cicer arietinum* (Khan, Qureshi, Hussain, & Ibrahim, 2005). Electric shock treatments of seeds caused an raise in speed of germination. This shows the tonic effect of electric shocking. This result was confirmed by Robert (2007) who stated that seeds patronize with electric currents had higher germination speeds.

Gamma irradiation effect and electric current on growth of seedling

The results in table 1 shows a significant effect for gamma irradiation with 20Gy on dry weight of shoots and leaf number (0.01490 and 19.40 g) as Compared with the control (0.00960 and 11.30 g) sequentially. the maximum increase of wet weight of shoot (0.0585 g) was recorded at 10 Gy, superiority significant the control was registered at 0.0320g.

It is very clear that the statistical analysis strongly reported the influence of electric current on most of the growth characteristics, except for dry weight of root, and seedling height, table 1 explained significant differences in the wet weight of shoot (0.0580g), dry weight of shoot (0.01560g), wet weight of root (0.0350g), leaf number (17.10 leaf/plant) and root length (10.10cm), as all growth traits were superior to the control treatment which gave the least average for this attributes (0.0320g, 0.00960g, 0.0130g, 11.30leaf/plant and 6.50 cm) sequentially.

This study agreed with Sharif, Khattab, Ghanamah, Salem, and Radwan (2011) on *Hibiscus sabdriffa*, who noted that low doses of gamma rays caused a significant increase in the dry weight of the plant. Sakin (2002). The researcher stated that the increase in the average plant height compared to the controls was due to gamma irradiation treatment. In fact, many researchers reported that different species are affected by ionizing radiation and this effect is on morphology and growth. (De Micco *et al*., 2011; Piri *et al*., 2011; Iglesias-Andreu *et al*., 2012). These results are in agreement with the report of Sidaway (1966) on *Avena sativa* seeds that an increase in germination speed, a later increase in growth, and dry weight were as a result of exposure to electricity.

The similarity between wet and dry weight parameter results affected by the studied factors is as a result of the difference between them, that is, moisture content excluding the dry weight which is mostly stable and can be dried using a heat drying process. The increase in wet and dry weights affected by electric current treatments can be ascribed to its role in stimulating metabolic cell activities, such as carbon fixation and alteration of cell pH inside and outside the cell which allows transport across cellular membranes resulting in osmotic equilibrium by induction or electric tension. Thus the cells react by accumulating secondary metabolites which play a role in biological synthesis (Zhang *et al*., 2004).

The increase in leaves number of henbane was significantly different until six weeks of age, reaching 6.7 leaves in average (Nassar *et al*., 2016).

This finding was supported by Lynikiene *et al*. (2006) who treated different crops seeds with electric shock, causing physiological, chemical, and biological changes, which in turn, resulted in an increase in water absorption, increase in respiration levels, and carbon fixation in seedlings of these different plant types.

L.S.D (0.05)	GY30	GY20	GY10	A6	Control	Treatment Attributes
0.01230	0.0430	0.0540	0.0585	0.0580	0.0320	Wet weight of shoot (g)
0.003743	0.01320	0.01490	0.01390	0.01560	0.00960	Dry weight of shoot (g)
0.01312	0.0077	0.0230	0.0213	0.0350	0.0130	wet weight of root (g)
0.00823	0.0066	0.0054	0.0065	0.0140	0.0075	Dry weight of root (g)
5.329	16.52	19.40	12.66	17.10	11.30	Leaf number
3.472	8.30	9.40	9.73	10.10	6.50	Root length (cm)
1.145	2.90	3.15	3.36	3.23	2.37	Seedling Height (cm)

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