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The Effects of Weak Magnetic Field on the Germination of *Myrtus communis* L.

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Abstract

The biological effects of magnetic field (MF) on living organisms have been explored previously. MF is able to induce various effects on seeds germination that is dependent on its application style, intensity and environmental conditions. The aim of this study was to examine the different level of intensities from weak MF (20, 40, 60, 80 gauss) on percentage of seed germination and seedling growth of *Myrtus communis* L. In the same conditions (23ºC, 70% humidity and 16 h photoperiod) within germinator the percentage germination of treated seeds was compared to the non-treated seeds. Growth data were measured on the 15th day in which showed that the treated plants grew slower than the controls. In this setting, weak magnetic field application reduced seedling and speed of germination when compared to controls. The observation on the 15th day of the treated group (80 gauss) showed that the speed of germination was statistically lower than to control plants. Some general trends in the effects of weak MF and differences in the tolerance of plant seeds to its action were revealed previously. However, herein application of magnetic field reduced amount and speed of germination in treated samples of *Myrtus communis* L.

Keywords

Magnetic Field, Germination, *Myrtus communis L.*

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1. Introduction

Natural magnetic field (MF, about 50 µT) of Earth influences all living organisms (Dahawi et al., 2009). There has been increasing more evidence to support the effects of magnetic fields (MFs) on germination and growth properties of plants. It was shown that the MFs affect proliferation, cell differentiation and activities of biological organisms and accelerate or decelerate seeds germination, changing in flowering time and aging which are those plant growth phenomena (Ahmet, 2003; Xi G et al., 1994; Belyavskaya, 2004).

It is seems that any biological effects of the electromagnetic field (ELF) are because of the magnetic component only. In this context, it was found that the growth of plants was inhibited by the presence of ELF antenna at Michigan (Dahawi et al., 2009). It has been widely reported that external magnetic fields influence both the activation of ions and polarization of dipoles in living cells (Johnson and Guy, 1972), and the forces of magnetic fields are large enough to affect any process that can change the rate of movement of electrons significantly (Goodman and Blank, 2002). The transportation of calcium across cell walls applies via the ELF, and the using of MF and ELF provide a feasible non-chemical solution in agriculture (Dahawi et al., 2009).

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Myrtus communis L. is widely distributed in the Mediterranean area and is used as a culinary spice and folk medicine as well (Levesque and Lafont, 2000). *Myrtus* has some medicinal effects such as antihyperglycemic, anti-inflammatory (Rossi et al., 2009), antioxidant and antimutagenic (Mimica-Dukić et al., 2010), antibacterial (Bonjor, 2004) and analgesic (Husni et al., 1989). The aim of this study was to examine the effect of weak MFs (20, 40, 60 and 80 gauss) and different duration of exposure to MFs on the percentage of seed germination.

2. Materials and Methods

2.1. Plant Materials

Fresh ripened fruits of *Myrtus communis* L. were purchased from local herbal shops of Khorramabad, Iran during September month of 2010. Fruits were authenticated at the botany department of Lorestan University. The seeds were scarified by sandpaper then were placed in MF intensities of 20, 40, 60 and 80 gauss and for different duration i.e. 1, 5, 10 and 15 consecutive days. The seeds were disinfected with sodium hypochlorite (5%) for 10 min and they were washed with distilled water 3 times. The germination of seeds were studied in Petri dishes (9 cm in diameter) using 25 seeds per dish. The trial was planned with four replications for each treatment. All Petri dishes had contained one layer moist filter paper and were disinfected by autoclave for 20 min previously. The experiment was carried out under controlled conditions (temperature: 23ºc, humidity: 70% and photoperiod 16 hours daily) in germinator (DAIHAN LABTECHCO; LTD, Korea)

2.2. Magnetic Fields

The pre-germination magnetic treatments were applied by using two magnets. These bar magnets were placed against each other, and to achieve the required magnetic field intensities, we moved the magnets forward and backward. We used a telemeter (CHINA, Ltd.,) for evaluation of MF intensities, and seeds were placed in the gap between magnets only after achieving the adequate MFs.

2.3. Data Analysis

Mean ± SD of germinated seeds for different days were compared in the control and treated samples by using independent sample t-test via statistical package (SPSS 19) and $p < 0.05$ was considered statistically significant.

3. Results and Discussion

All results are presented in table 1. Our data indicated that the percentage of seed germination on the 5th day of the treatment by 80 gauss was near to the non-treated sample. While, there was significant difference for 20, 40 and 60 Gauss in treated samples when compared to the controls for the 5th of the treatment ($P< 0.05$). The present study showed that using of MFs has negative effects on the germination of seeds for *Myrtus communis* L. The percentage of germinated seeds and the time which required for germination were evaluated for each treatment. Although the obtained percents was not linearly related to MF strength, but the diminution in the percentage of germination occurred in all treated seeds. However, exposure to 60 gauss was more effective in reduction of germination percentage and exposure for 10 days showed significant decrease in germination characteristics. In contrast, a previous study reported an optimal external ELF could accelerate the activation of plant growth, especially seed germination (Dahawi et al., 2009).

The interaction between duration of treatment and MF are shown in Table 1. Percentage of germination was significantly lower than to controls in the 10th day of the treatment for 60 gauss. Therefore, it appeared that the exposure of weak MF (20, 40, 60 and 80 gauss) in different time periods (1, 5, 10 and 15 days), reduces the percentage of germination in seeds of *Myrtus communis*.

In spite of the reported harmful effects in which magnetic and electric fields offer for living organisms, there are some evidences that showing the beneficial effects of certain MF intensities on improvement rate and percentage of germination in seeds. On the other hand, previous studies showed that prolonged exposures of plants to weak MFs may cause different biological effects at the cellular, tissue and organ levels (Husni A et al., 1989**;** Makkizadeh et al., 2006), and nutrition value could be enhanced via MF treatment. In this setting, Sharaf El-Deen, (2003) reported that MF increased amino acids, Ca and K content in mushroom (*Agaricus bispours*) and MF pretreatment of seeds increased lipid oxidation and ascorbic acid contents in cucumber (*Cucumis sativus*), the sugar content in sugar beet roots (*Beta vulgaris*) and gluten in wheat (*Triticum aestivum*) (Pietrussewski, 1999; Pietrussewski, 2000).

In conclusion, the present data suggest that the exposure of *Myrtus communis* L. seeds to weak MFs (20, 40, 60 and 80 gauss) reduces germination of seeds, and exposure of 60 gauss for 10 consecutive days, showed a significant reduction in seed germination. In this regard, many general trends in the effects of weak MF and differences in the tolerance of plant seeds to its action were revealed previously. However, further study is needed to clarify different aspects of the effects of weak MF on plants.

Table 1. The percentage (Mean ± SD) of seedling from *Myrtus communis* L. in the different duration of the treatment.

Groups	Duration of the treatment (Day)			
	1	5	10	15
Control (Untreated)	70± 3	70± 3	70± 3	70± 3
Treated (20 gauss)	50 ± 7	59 ± 19 [a]	52 ± 9	57 ± 5
Treated (40 gauss)	45 ± 6	56 ± 16 [a]	49 ± 15	63 ± 7
Treated (60 gauss)	59 ± 6	52 ± 14 [a]	27± 7 [a]	61 ± 2
Treated (80 gauss)	65 ± 7	69 ± 7	49 ± 10	49 ± 4 [a]

[a] indicates statistically different versus the control group for same days ($P < 0.05$).

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