

Allelopathic Effect of Aqueous Extracts of *Mentha longifolia* on Seed Germination of Two Cultivars of barley and a Weed

Iman Bajalan^{1*}, Masoumeh Zand² and Shahram Rezaee²

1. Young Researchers Club, Borujerd Branch, Islamic Azad University, Borujerd, Iran
2. Department of Agriculture, Islamic Azad University, Borujerd Branch, Borujerd, Iran

Corresponding author Email: Bajalan_Iman@yahoo.com

ABSTRACT: This research is an attempt to analyze the allelopathic effect of aqueous extracts of *Mentha longifolia* on germination of two cultivar of barley (Zarjo and Valfajr) and a weed (*Portulaca oleracea*) experimentally and in a quiet accidentally frame of 5 treatments and 4 replications. The treatments of the experiment included aqueous extract of *M. longifolia* (in concentrations of 6, 12, 25 and 50 percent) and distilled water (control). The results showed the strong allopathic effect of the extract of *M. longifolia* on germination of barley and *Portulaca oleracea* seeds in such a way that the statistical comparison indicates the reduction of germination percentage of seeds in treating the aqueous extracts in comparison with control in the level of 5 percent.

Keywords: Allelopathy, Aqueous extract, Barley, Germination, *Mentha longifolia*, *Portulaca oleracea*

INTRODUCTION

All aromatic plants emit volatile substances into the environment either during their life or during the decomposition process (Hassiotis, 2010). Secondary metabolites are present in all higher plants, usually in high structural diversity. In nature, many secondary metabolites play an important role in the protection of the plants as antibacterial, antiviral, antifungal, insecticides and also against herbivores by reducing their appetite for such plants. They also may attract some insects to favor the dispersion of pollens and seeds, or repel undesirable predators (Bakkali et al., 2008). Regarding the widespread and indiscriminate use of chemical poisons especially herbicides in the last decade taking use of allelopathic plants and also their remainders in the soil in order to control the plants and provide the suitable condition of growth has been considered (Inderjit and Keating., 1999).

Using the extracts of different Concentration of *Prosopis juliflora* leads to significant decreasing of germination and yield of Wheat (Siddiqui et al., 2009). *Mentha* is a genus of aromatic perennial herbs belonging to the family Lamiaceae, distributed mostly in temperate and subtemperate regions of the world (Lu Hui et al., 2010).

The aim of This research was compare and analyze the allelopathic effect of the aqueous extracts of *Mentha longifolia* in different concentrations on germination's characteristics of Zarjo and Valfajr barley (*Hordeum vulgare*) and purslane (*Portulaca oleracea*).

MATERIALS AND METHODS

In order to study the allelopathic effect of aqueous extracts of *M. longifolia* on germination of two cultivar of barley (Zarjo and Valfajr) and purslane an experiment was conducted in a completely accidental plan with 5 treatments and 4 replications in the laboratory of Department of Agriculture and Resources of I.A.U. of Broujerd. The experimented treatments contained concentrations of 0, 6, 12, 25 and 50 percent of the extract of *M. longifolia*.

Harvested aerial part (leaves, stems and flowers) were dried at room temperature for 1 week. (Hajlaoui *et al.*, 2009). Out of each plants ten percent strong weight extract – a mass (50g with 500ml water) was prepared by putting it on the Shaker for 24 hours (Ghorbani *et al.*, 2008).

Four layers of cotton fabric have been used to separate the plant's tissues and solid organs from the extract (Bajalan *et al.*, 2013). Then it was centrifuged with the speed of 2000 round per minute and for 15 minutes. In the next step, by adding distilled water to these strong extracts, aqueous extracts with the concentrations of zero (control) 6, 12, 25 and 50 percent were made. 30 barley and purslane seeds were placed in every Petri dish containing filter paper and for each treatment four replications were applied. According to the plan, 7ml from the prepared aqueous extract from every part with various concentrations was added to the Petri dishes containing seeds. The Petri dishes were placed inside the germinators and in temperature of 20 degrees. The first count of germinated seeds was done 48 hours later. The seeds which were germinated for 2ml were considered as grown seeds. At the end of the experiment, the percentage of germination, the length of the root, the stem and fresh and dry weight of the seedling were measured. In this experiment, the total weight of the seedling has been considered as the seedling weight. Finally, to measure the dry weight, the samples were kept in the oven for 24 hours in the temperature of 75 degrees.

The data analysis was done by a piece of software called MSTATC. Moreover, the average of the data was compared by use of Duncan technique and with the probability level of 5%.

RESULTS AND DISCUSSION

1. The percentage of germination

The Results of the percentage of germination of various cultivars of barley and weed shows the significant reduction of percentage of germination of all cultivars in extracts of *M. longifolia*. In total the extract of *M. longifolia* caused the more reduction of percentage of germination in all numbers, and all extracts. The most reduction of the percentage of germination among treatments of %25 belongs to treatment of *M. longifolia* on purslane (Figure 1).

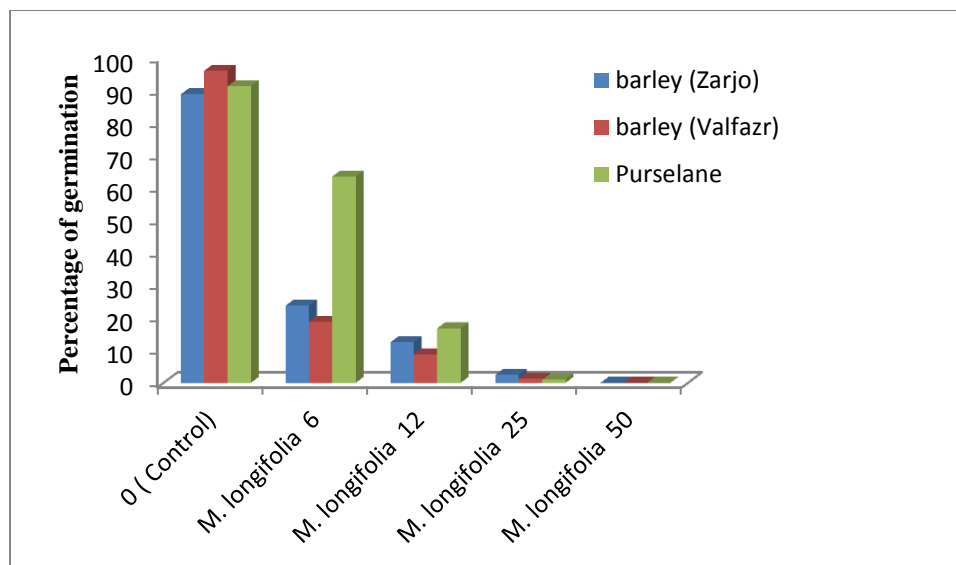


Figure 1. The percentage of germination of two cultivars of barley and Purslane in various concentrations of *M. longifolia*

2. The length of the root

The length of the root of all numbers was reduced as the percentage of the concentration of the extract was increased. All treatments had a significant difference with control. Germination of %50 was seen in none of the treatments. In concentration of %25valfajr showed more resistance compared with other numbers in comparison with control (Figure 2).

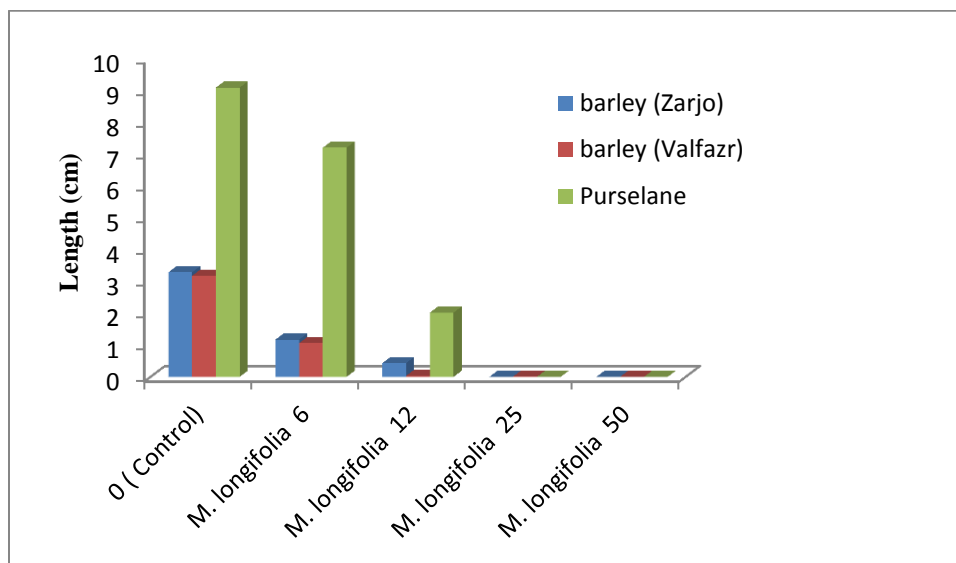


Figure 2. The length of the root of two cultivars of barley and Purselane in various concentrations of *M. longifolia*

3. The length of the shoot

The length of the shoot after the control treatment belongs to treatment of %6 of *M. longifolia* on purslane, but in none of the numbers in treatment of %50 germination happened. In treatment of %25, the length of the shoot was influenced less than that of barley. The least amount of germination in concentration of %25 belongs to Valfajr barley (Figure 3).

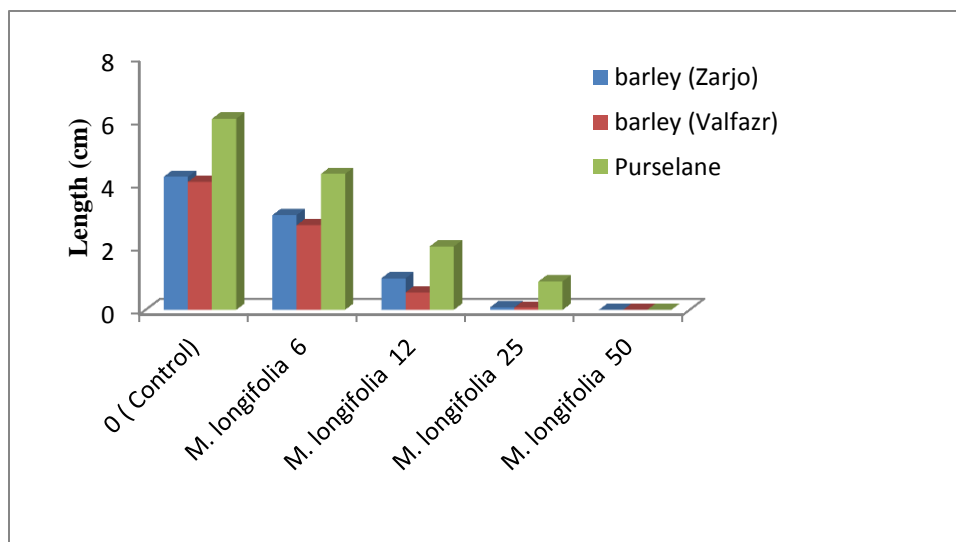
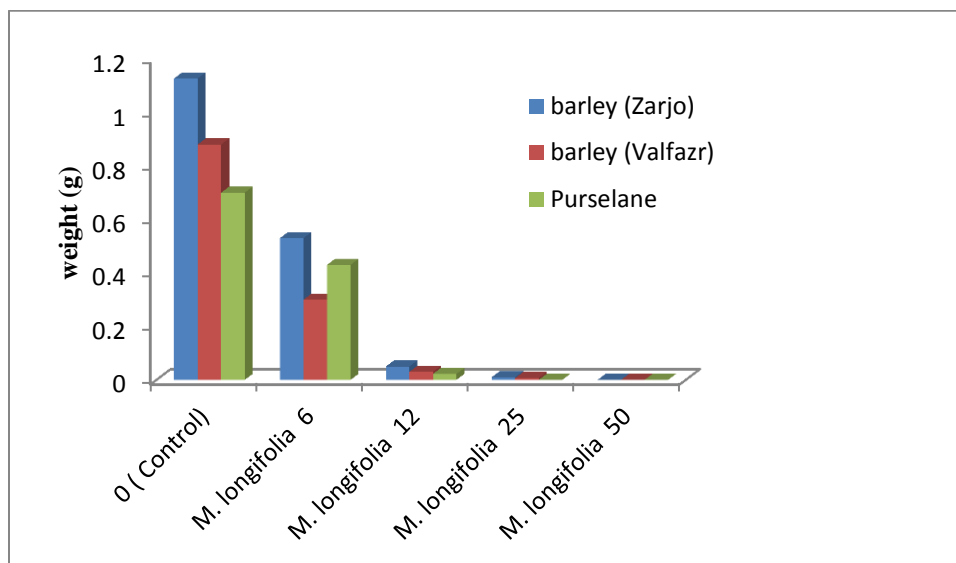


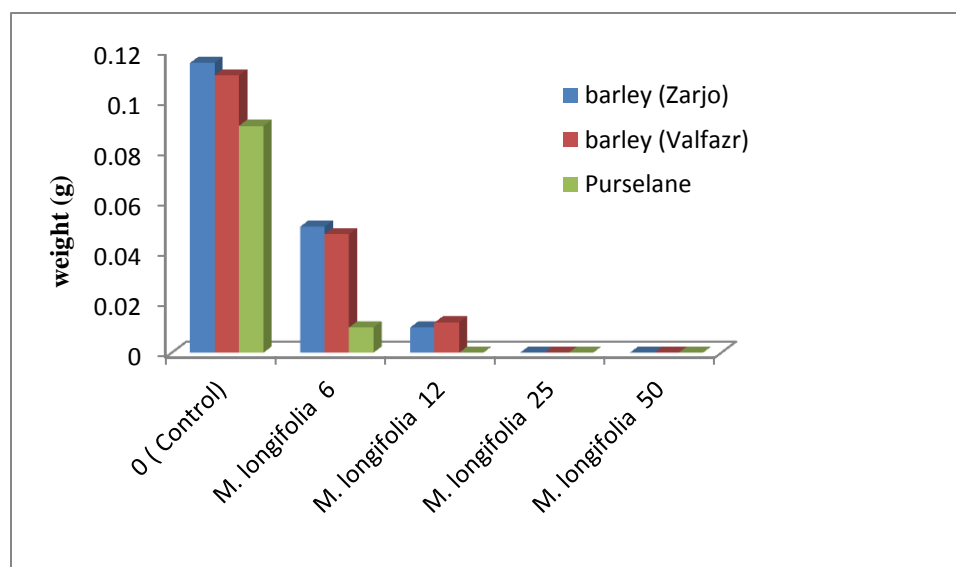
Figure 3. The length of the shoot of two cultivars of barley and Purselane in various concentrations of *M. longifolia*

4. Fresh and dry weight of plants

The least influence in extracts of %6 belonged to the influence of Zarjo barley (0.53gr), for Valfajr barley it was 0.3gr and for purslane it was .43gr (Figure 4). The dry weight of plant under the influence of various concentrations was reduced in a significant way (Figure 5). The amount of reduction in concentration of %25 *M. longifolia* on barley and purslane the amount of reduction were zero (Figure 5). IN this experiment the weights that are under .005gr, are considered as zero.



Figureure 4. The fresh weight of two cultivars of barley and Purselane in various concentrations of *M. longifolia*



Figureure 5. The dry weight of two cultivars of barley and Purselane in various concentrations of *M. longifolia*

The main constituents of *M. longifolia* are Polyphenol, Flavonoid, Tannin, piperitone oxide, piperitone, diosphenol, diosphenolene, menthol, menthyl acetate, menthine, limonene, pinene and caryophyllene (Hajlaoui *et al.*, 2009). *Mentha* spp. has been used as a folk remedy for treatment of nausea, bronchitis, flatulence, anorexia, and liver complaints due to its anti-inflammatory, carminative, antiemetic, diaphoretic, antispasmodic, analgesic, stimulant, emmenagogue, and anticatharrhal activities (Iskan *et al.*, 2002; Moreno *et al.*, 2002).

According to the Results of this research *M. longifolia* has strengthened allelopathic on germination of barley and purslane. Glume of barley in this experiment can be its reasons. Also different cultivars indicated different sensitivity. With studying different cultivars of barley and analyzing the degree of their sensitivity toward the effective combination of *M. longifolia* we can produce resistant cultivars for them. We can also use the characteristics of *M. longifolia* in producing natural herbicides and pesticides. We need more research about this subject to get more information.

ACKNOWLEDGEMENT

We must give our best thanks to Mr. Hossein Vosogh and Ms. Akram Khandani for their cooperation in different stages of this research.

REFERENCES

- Bajalan I, Zand M, Rezaee Sh. 2013. Allelopathic effects of aqueous extract from *Salvia officinalis* L. on seed germination of barley and purslane. International Journal of Agriculture and Crop Sciences 5(7): 802-805
- Bakkali F, Averbeck S, Averbeck D. 2008. Biological effects of essential oils- A review. Food Chem Toxicology 46: 446-475
- Ghorbanli M, Bakhshi Khaniki G, Shojaei A.A. 2008. Examination of the effects of Allelopathy of *Artemisia sieberi* Besser subsp. Siberia on seed germination and *Avena lodoviciana* and *Amaranthus retroflexus* seedling growth. Journal of Field Crops Research 21 (2 (79 In Natural Research)) 129-134
- Hajlaoui H, Trabelsi N, Noumi E, Snoussi M, Fallah H, Ksouri R, Bakhrouf A. 2009. Biological activities of the essential oils and methanol extract of two cultivated mint species (*Mentha longifolia* and *Mentha pulegium*) used in the Tunisian folkloric medicine. World J Microbial Biotechnol 25: 2227-2238
- Hassiotis C. 2010. Chemical compounds and essential oil release through decomposition process from *Lavandula stoechas* in Mediterranean region. Biochem. Syst. Ecol. doi:10.1016/j.bse.05.002.
- Hui L, He L, Huan L, XiaoLan L, AiGuo Z. 2010. Chemical composition of lavender essential oil and its antioxidant activity and inhibition against rhinitis related bacteria. African Journal of Microbiology Research 4 (4): 309-313
- Inderjit K, Keating L. 1999. Allelopathy: Principal and Practice. John Promises for Biological Control in: Advance in Agronomy, (eds). Sparks D.I., Academic Press 67: 141-231
- Iscan G, Kirimer N, Kurkcuoglu M, Baser K.H.C. 2002. Antimicrobial screening of *Mentha piperita* essential oils. J Agric Food Chem 50 (14): 3943-3946
- Moreno L, Bello R, Primo-Yufero E, 2002. Pharmacological properties of the methanol extract from *Mentha suaveolens* Ehrh. Phytother Res 16: 10-13
- Siddiqui S, Bhardwaj S, Saeed Khan S, Meghvanshi M. 2009. Allelopathic effect of different concentration of water extract of *Prosopis juliflora* leaf on seed germination and radicle length of wheat (*Triticum aestivum* Var-Lok-1). American-Eurasian Journal of Scientific Research 4 (2): 81-84