The Study on Allelopathic Effects of Mentha longifolia on Seed Germination of Velvet Flower and Two Cultivars of Wheat

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ABSTRACT: The allelopathic activity of Mentha longifolia against 2 cultivars of wheat (Azar and Alvand) and velvet flower was investigated. The aqueous extracts of this plant was diluted to 6, 12, 25, 50 and 100 strength. The effect of these extracts on germination and seedling growth of wheat and velvet flower were studied. The data showed that the allelopathic activity of aqueous extracts of Mentha longifolia had differed significantly against wheat cultivars and velvet flower. In concentrations of 25 percent there were reduction of germination in all of them but it prevents the growth so that in the concentration of 50 percent, reduction of 100 was observed.

Keywords: Allelopathy, Aqueous Extracts, Mentha longifolia, Velvet Flower, Wheat.

INTRODUCTION

Allelopathy is the suppression of growth of a neighboring plant by another species through the release of chemical compounds into the environment (Lambers et al., 1998). For allelopathy to be an ecologically relevant mechanism in influencing growth of plants in field situations, allelochemicals must accumulate and persist at phytotoxic levels and come in contact with the target plant (Choesin and Boerner, 1991). However, after entering soil, processes like retention (sorption), transport and transformation determine persistence and fate of allelochemicals. The type of allelochemical, microflora and substrate conditions each play an important role in determining the persistence of allelochemicals in soils. After isolation and identification of allelochemicals, it becomes necessary to study their behavior in soil. Mere presence of chemicals in the donor plant and its phytotoxic activities in artificial medium (e.g., agar) does not demonstrate its allelopathic activity in natural situations. Allelopathy methodology has been criticised due to neglect of soil (Inderjit, 2005).

In recent years a great deal of importance has been attached, by more and more scholars at home and abroad, to allelopathy, an interaction between plants which exists widely in nature. It plays a more important role in agriculture attributable to such regimes as a reasonable pattern of cropping systems, weed and pest control, and a reduction in the endangerment of continuous cropping obstacles. Allelopathy also plays an important part in forest ecosystems because it can severely affect not only the structure, functions and benefits of the forest community, but also the development and stability of the forest ecosystem itself. It is of theoretical and practical importance to study allelopathy in forest ecosystems to solve the problems in afforestation and management of mixed forests and plantations, such as inhibiting regeneration, continuous fostering of obstacles, a gradual reduction in productivity of forestland, as well as biological control of forest pests and sustainable forest management (Guang-de et al., 2007). 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). Broad and extensive researches have been done on this issue. The researches show the significant reduction of the parameters which are relevant to germination of various numbers of wheat in reaction to the allelopathic activity of aqueous extract of some weeds (Kiarostami, 2004).

Mentha is a genus of aromatic perennial herbs belonging to the family Lamiaceae, distributed mostly in temperate and subtemperate regions of the world (Hui et al., 2010). This research was done in order to compare
and analyze the allelopathic effect of the aqueous extracts of Mentha longifolia in different concentrations on germination's characteristics of Alvand and Azar wheat and velvet flower (Amaranthus retroflexus).

MATERIALS AND METHODS

In order to study the allelopathic effect of aqueous extracts of M. longifolia on germination of two cultivar of wheat (Azar and Alvand) and velvet flower 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 (Shahrokhi et al., 2011). 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 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 (Bajalan et al., 2013).

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. 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. The average of the data was compared by use of Duncan technique and with the probability level of 5%.

RESULTS

The percentage of germination

The Results of the percentage of germination of various cultivars of wheat and barley and weeds shows the significant reduction of percentage of germination of all cultivars in extracts of M. longifolia the most percentage of germination after control treatment belonged to Alvand and in treatment of 6%. In total the extract of M. longifolia caused the more reduction of percentage of germination in all numbers, and all extracts. Also, among the numbers various sensitivities toward the applied extracts were seen (Fig. 1).

![Figure 1. The percentage of germination of two cultivars of Wheat and velvet flower in various concentrations of M. longifolia.](image-url)
The length of the root and the stem

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. After control treatment the longest root belonged velvet flower with concentration of %6. Germination of %50 was seen in none of the treatments. The length of the stem after the control treatment belongs to treatment of %6 of M. longifolia on velvet flower but in none of the numbers in treatment of %50 germination happened.

Fresh and dry weight of plants

The least influence in extracts of %6 belonged to the influence of Alvand (0.91gr). For Azar it was 0.73gr and for velvet flower it was 0.5gr (Fig. 4). The dry weight of plant under the influence of various concentrations was reduced in a significant way (Fig. 5). In this experiment the weights that are under 0.005gr, are considered as zero.
The Results of this research indicates the allelopathic effects not only lead the reduction of the percentage of germination but also it causes a delay in germination reduction in length of root and stem and also reduction of the plant weight. Delay in germination can have negative effects in competition with other plants and this can exacerbate the allelopathic effects and weaken the plant. A plant with weak roots in bad environmental condition like low dampness of the soil or nutritional tensions with other plants will be overcome. Also allelopathic constituents can influence the roots and other roots of the plant and it the reduction of water absorption in the plant (Chon et al., 2005).

According to the Results of this research M. longifolia has strengthened allelopathic on germination of wheat and velvet flower. Also different cultivars indicated different sensitivity. With studying different cultivars of wheat and velvet flower 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. To get more information about this subject we need more research.
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