Study of allelopathic effects of sesame (*Sesamum indicum*) on canola (*Brassica napus*) growth and germination

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ABSTRACT: In the course of a laboratorial study that accomplished on the basis on a factorial layout within completely randomized design with four replications in 2008. Treatments include leaf, root, stem and flower extract. Each extract includes 4 levels 0%, 25%, 50% and 100%. The effects of sesame extract density on germination rate, germination percent, coleoptile weight, radicle length and coleoptile length were significant. The effects of plant organ on germination rate, radicle weight, radicle length and coleoptile length were significant. The interaction between sesame extract densities and plant organ was significant effect on germination rate, coleoptile weight, radicle weight, radicle length and coleoptile length. The conclusions demonstrated that Brassica napus sensitized to exuding allelochemical materials form sesame and the rate of germination and percentage of germination, seedling weight, coleoptile length, radicle length and brassica napus decreased by increasing density of extracts.

Key words: Brassica napus, Sesame, Allelopathy, Germination.

INTRODUCTION

The term of Allelopathy means each kind of direct or indirect effect, useful or harmful effect of chemical compounds of a plant on products of other plants or allelochemical are materials from allelopathy act in growth natural environment of a plant (Truc et al, 2002; Soltanipour et al., 2007). Allelopathy, the interference of one plant species by another, occurs in several crops that are grown in rotation (Panwaret et al. 2004). The production of allelochemicals by plants is kind of tension that effect the growth of plants. Allelopathy in sesame refers to chemicals that effect the growth of other plants by exuding secondary metabolites like phenolic and hydroxamic acids (Kadioglu et al. 2004; Panwar et al. 2004; Shamsher et al. 2004) into surrounding environment during its life cycle and the subsequent decomposition of their residues (Zhang et al. 2004; Iman et al. 2006). The materials from allelochemicals by plants is kind of tension that effect the growth of plants. Siemens et al. (2002) argued that production of secondary plant metabolites would lead to physiological cost and energy consumption. Allelopathy has been described as a dark grey system (Zhou et al. 2005). The effects of prevention decrease by diluting the soil extract. Expansive researches were accomplished to prove the presence of soil. The effects of many of them on plants growth were studied. Makizadeh et al. (2009) concluded that extract of rue contain numerous growth inhibitors that affect seed germination of three weeds. Rashid Mohasel et al. (2009) reported that, the leaves and corms extract of saffron reduced plant height, leaf weight and stem weight of redroot pigweed and lambsquarter. Hamidi et al. (2008) showed that root exudates that release from wild barley seedlings into the soil, did not affect wheat seedling height, whereas, those released from tillers significantly decreased seedlings and mature plants height and yield of wheat. Rice (1974) in their experiments found that the potential of fox tail remains indicum caused the decrease of root growth and coleoptil of maize. The remains of these compounds prevented from height growth, new weight and germination of both maize and soya in the soil. The interference of this weed has sensible effects on products outputs including: maize, soya and grain sorghum (Rice, 1974). Few studies were accomplished about the allelopathic effects of sesame on the germination and growth of the cultivated plant next itself yet. Song et al. (2004) demonstrated significant differences in the type of allelochemical produced by rice, depending on the growth stage. Efforts must be undertaken to balance the improvement of allelopathic potential in wheat along with other
agronomic characters in order to achieve high yield and strong resistance to environmental pressure. Sesame is the most important oily grain product of Khuzestan province in Iran and for many years, it has been cultivated. The reason of this product in the province, the fluency of cultivation, the effect of this product on traditional foods of people who live in this province, and also, it is economical for cultivators. But the observation demonstrate that, this plant in Khuzestan province and the other areas of the country causes the decrease of amount and quality of cultivated plant product that has settled in next alternation with it. But it has been defined yet that this decrease of operation is form which character of sesame. In this research, it has been tried to answer to this question: Dose this decrease, to some extent, result allelopathic effect of sesame.

MATERIAL AND METHODS

This research accomplished in seed technology laboratory of agriculture university of Ramin located in Molasani in 2008. All samples of sesame were gathered from research farm of Ramin Agriculture University that was located in 35 kilometers of Ahwaz. A factorial layout within completely randomized design with four replications was used. Treatments include leaf, root, stem and flower extract. Each extract includes 4 levels 0%, 25%, 50% and 100%. Aerial sections of the plant were separated from collar by scissiors and the roots were separated from the humid soil. Aerial sections and roots were dried and grined. The achieved 5 grams powder has been poured in 100 millililter water and has been put during 24 hours on shaker machine. Then, it was put in centrifuge machine during 15 minutes with 3000 rotations. The result mixture was filtered by watman filter paper (number 1). At first, the seeds of Brassica napus were put in sodium hypocoloid 5% during 5 minutes and then they were washed by distilled water. For germination test, 50 seeds were put in 12 centimeters petridishes on two layers of filter paper and 5 milliliters of distilled water for control and 5 milliliters from levels of expected extract were added to it. The lids of containers with the temperature 18-20 centigrade were prepared (12 hours in the day and 12 hours in the night). Every day, the germinated seeds were numbered in the certain hour. The criterion of radicle exit germination has been considered 1 millimeter. At the end of germination test, the length of radicle and coleoptile were measured. Also, at the end, the extreme percent of germination and the rate of germination were accounted. For counting the length of radicle and coleoptile, 10 germinated seeds were sent out from petridishes and measured by culis. The length of coleoptile was considered from collar to extreme bud and the length of radicle was considered from collar to the head of main root. For accounting the germination rate, from the second day, unit when the seeds did not germination, the germinated seeds were counted per 24 hours and on time. The germination rate was defined by using Maigor equation such as following (Equation 1):

\[ D_i = \frac{GR}{Si} \]

1) \( n \)

\( GR: \) Germination Rate (the number of germinated seed in the day)
\( Si: \) The number of germinated seeds in each counting.
\( Di: \) n- number of counting times.

Analysis of variance (ANOVA) was used to determine the significant differences. The Multiple Range Test of Duncan performed the separation means. Correlation coefficients were calculated for the relationship between parameters. All statistics was performed with MSTAT-C program (version 2.10).

RESULTS AND DISCUSSION

The effect of sesame extracts on germination rate and germination percentage was significant (P<0.01). The highest germination rate was obtained by control treatment, and the lowest one was related to sesame extract of 100%. The germination rate was significantly decreased from 0% to 100% of sesame extract. There were significant differences between 0% and densities of sesame extract. The maximum percent of germination was related to 0% of sesame extract (91.42%) (Table 2). The effect of organ on germination rate was significant (P<0.01) (Table 1). The highest germination rate was related to stem and the lowest one was obtained by root. There was no significant difference in germination rate between flower and stem, but the difference between root and leaf was significant. These results also demonstrate that canola is sensitive to exuding allelochemical materials from sesame. The interaction between sesame extract and plant organ also had significant influence on germination rate (P<0.01). The highest germination rate was related to 0% of sesame extract and flower, and the minimum one was obtained by 100% of sesame extract and leaf (Table 2). Aghajani et al. (2001) reported that root residues of sunflower showed the least effect and the combination of root-stem-leaf had the most effect on
The highest coleoptile length was related to 0% of sesame extract (0.03488 mg), and the lowest one was obtained by 100% of sesame extract (0.02213 mg). The highest radicle weight was related to 0% of sesame extract (0.01564 mg). Naseripour et al. (2008), also reported that maize radicle weight was significantly decreased with increasing concentration of barley water extract. Coleoptile weight was not significantly influenced by plant organ, but Radicle extract was significantly influenced by plant organ (P<0.05). Mansouri et al. (2005) concluded that, the effects of flower extract of mustard on length of radicle and coleoptile were more than of other organs on seedling growth of canola whereas the least effect belonged to root extract. The maximum and minimum radicle weight was obtained by stem (0.008750 mg), and flower (0.005750 mg), respectively. Interaction between sesame extract and different parts of plant organ also had significant effect on coleoptile weight (P<0.01) and radicle weight (P<0.05) (Table 1). The correlations between coleoptile weight and germination rate and germination percentage was \( r=0.870^{*} \), \( r=0.540^{*} \), respectively. These correlations showed the positive and significant effect of germination rate and germination percentage on coleoptile weight. The correlation between radicle weight and germination rate was positive and significant (\( r=0.330^{*} \)). Sesame extract had significant effect on radicle weight (P<0.05) and coleoptile length (P<0.01). The highest radicle length and lowest radicle length was related to 25% of sesame extract (5.428
mm), and 100% of sesame extract (5.322 mm). There was no significant difference between 0% and 50% of sesame extract (Table 2). Hosseinabadi et al. (2008), also concluded that allelopathic extract of wheat had significant effect on radicle length of binweed and rye in comparison with control. The highest coleoptile length was related to 0% of sesame extract (4.510 mm). Radicle length and coleoptile length also significantly influenced by plant organ (P<0.05) (Table 1). The maximum radicle length was related to stem (5.428 mm). The highest coleoptile length was related to flower extract (3.621 mm), and the minimum one was obtained by leaf extract (3.184 mm). Interaction between sesame extract and plant organ also had significant effect on radicle length and coleoptile length (Table 1). 25% of sesame extract and stem was obtained the maximum radicle length (6.102 mm), and the minimum one was related to 100% and flower extract. Germination rate and germination percentage also had significant and positive effect on radicle length, because the correlations between radicle length and germination rate and germination percentage was $r=0.893$, and $r=0.534$, respectively. The correlation between radicle length and coleoptile length was also positive and significant ($r=0.906$).

**CONCLUSION**

Generally, by averaging of the effects of sesame indicum on different organs of Brassica napus according to different factors from densities related to that factor can be concluded that the effects of sesame extract on Brassica napus have been decreasing and have caused the delay in the growth and germination of this plant. The results of this research correspond to the result of Ahn et al. (1997) and the research of Qasem and Hill (1989). It is possible that there are numerous organic compounds like terpenes, esterols, hydrocarbons, fattyacids, phenicolic acid, alkaloids and nitrogen compounds in sesame extract and preventive effects of these materials influence the growth of Brassica napus’s seedling. According to the results of this test, it can be concluded that one of the reasons of the decrease of cultivated plants operation that they are after sesame in the alternation, is the presence of allelopathic materials in herbaceous remains of this plant. One of the methods to confront this decrease is use of the plants that are resistant to sesame allelopathic materials. This operation involves the researches by which we can use the most resistant plant in the alternation with sesame. Therefore, it is important to consider the multiple effects of ecology, chemistry and physiology in assessing allelopathic effects.

**REFERENCES**


