ISPEC Tarım Bilimleri Dergisi
5(3): 750-756, 2021

Araştırma Makalesi

E-ISSN:2717-7238

www.ispecjournal.com

ISPEC Journal of Agr. Sciences
5(3): 750-756, 2021

Research Article

Belgin COŞGE ŞENKAL[1a*]

Tansu USKUTOĞLU[1b]

[1]Yozgat Bozok University, Faculty of Agriculture, Department of Field Crops, Yozgat

[1a]**ORCID**: 0000-0001-7330-8098

[1b]**ORCID**: 0000-0001-6631-1723

[*]Corresponding author:

belgin.senkal@yobu.edu.tr

DOI

https://doi.org/10.46291/ISPECJASvol5iss3pp750-756

Alınış (Received): 08/05/2021

Kabul Tarihi (Accepted): 10/06/2021

Keywords
Styrax officinalis, seed coat, fruit peel, extract, seedling height, emergence

Impacts of Extracts From *Styrax officinalis* L. on Seedling Growth of *Salvia sclarea* L.

Abstract

Many plant species synthesize different biochemical substances from their various organs (leaves, flowers, fruits and roots, etc.). While some of these biochemical substances which are known as allelochemicals have a stimulating effect on the growth and development of other plants, some of them have an inhibitory effect. In this study, the effect of extracts obtained from the *Styrax officinalis* L., which spreads naturally in the Mediterranean and Aegean regions, on the seedling growth of *Salvia sclarea* L. were investigated. In the study, the extracts prepared with water at 5% concentration from dry fruit peel and seed coat of *S. officinalis*, and tap water as control were used. According to the results of this study, it was determined that the fruit peel and seed coat extracts obtained from *S. officinalis* had a significant inhibitory effect on the emergence of *S. sclarea* seeds and its seedling growth. The inhibitory effect of fruit peel was higher than that of seed coat.

INTRODUCTION

There are many factors affecting yield and quality in crop production. One of these factors is the negative effects caused by weeds. 45% of losses in agricultural production worldwide are caused by weeds. For this reason, yield and quality increase in plant production depends on effective control of weeds (Pala and Mennan, 2019). Herbicides are used extensively in the fight against weeds all over the world. However, excessive and unconscious use of herbicides brings with it some health and environmental problems. In recent years, alternative methods of struggle that do not harm human health and the environment have gained importance. One of these alternative methods is the use of extracts from various plants in weed control (Talukder et al., 2015). There are a number of substances that prevent the growth and development of other plants in various organs (flowers, fruits, leaves, roots, etc.) of some plants. These chemicals can also prevent the growth of the same plant variety in some cases (Weston and Duke, 2003). The inhibitory effects on nearby plants or microorganisms with its chemical secretions of a plant are called allelopathic. Chemicals released by also plants are called allelochemicals. Allelochemicals can inhibit or promote seed germination and plant growth in plants (Serim et al., 2015; Uslu et al., 2018). Today, many natural compounds (phenolic acids, coumarins, terpenoids, flavonoids, alkaloids, glycosides, saponins and tannins, etc.) obtained from plants have allelopathic properties. These water-soluble compounds are responsible for direct or indirect allelopathic effects that occur under natural conditions (Ambika, 2002; Özbay, 2018). Plant extracts with allelopathic properties can be obtained from cultivated plants and weeds (*Sorghum halepense* (L.) Pers., *Helianthus annuus* L., *Azardirachta indica* A. Juss, *Eucalyptus camaldulensis* Dehnh., *Acacia nilotica* (L.) Willd., *Brassica napus* L., *Solanum lycopersiccum* L., *Raphanus sativus* L., and *Oryza sativa* L. etc.) (Uygur et al., 1991; Kim, 2001; Serim et al., 2015). The leaf, fruit, fruit peel, flower and seed of the *Styrax officinalis* plant contain many natural compounds (alkaloids, phenols, saponin glycoside, essential oils, tannins, steroids, flavonoids, and phenolic acids etc.) with various biological activities (Proestos et al., 2006; Dib et al., 2016; Jaradat et al., 2018). Most of the studies carried out focused on the pharmacological properties of the plant. There are no studies on the allelopathic effect of the plant (Jaradat, 2020). Allelopathic plant extracts can generally be prepared with water as well as dissolved in solvents such as ethanol, methanol and hexane.

In this study, it was aimed to investigate the allelopathic effect of aqueous extracts obtained from seeds and fruit peels of *S. officinalis* on seedling growth of clary sage (*Salvia sclarea* L.).

MATERIAL and METHODS

General information about the herbal materials used in the research is given below:

***Styrax officinalis* L.**

S. officinalis L. (Styracaceae) known as “Tesbi” or “Ayı Fındığı” is a perennial shrub-shaped plant with a distribution area up to 100 – 1000 m altitudes in the Southern Marmara, Central Black Sea, Main Aegean, Antalya, Adana and Middle Euphrates sections of Turkey (Güner, 2012; Cesur et al., 2018). It has spherical fruits with a diameter of 1.2-1.4 cm. These fruits contain brown seeds with an average weight of 38 g per 100 seeds. The shell forms approximately 72% of the seed's weight (Cesur et al., 2018). Its seeds contain eugenol and benzofuran derivatives (Jaradat, 2020).

***Salvia sclarea* L.**

S. sclarea L. (Lamiaceae) known as “Misk Adaçayı” or “Paskulak” is a biennial or perennial herb, 20-120 cm tall, branched at the top, with a thick, upright stem. It has lilac, white or pale blue flowers. Seeds are brown, rounded triangular in shape. *S. sclarea* is an economically important species that grows naturally in many countries around the world and is also cultivated. The general distribution area of this species is all of Turkey (Bizimbitkiler, 2021; Arslan et al., 2015).

Styrax officinalis fruits collected from their natural environment (Kahramanmaraş and Hatay) were kept in room conditions. Dry peels of fruits and seed coats were used as material in the preparation of extracts (Figure 1).

Figure 1. Natural area images of *S. officinalis* and prepared extracts, A: *S. officinalis* bush, B-C: Fruit, and D: Seed

Preparation of Extracts

Dry fruit peel and seed coat of *S. officinalis* plant were ground. 100 grams of ground samples were placed in 2 liters of water (5% concentration) and boiled. The boiling of the samples continued for 20 minutes starting from the moment they started to boil. After the boiling samples were cooled at room conditions, they were filtered with Whatman 1 filter paper and the extracts prepared during the experiment were stored in the refrigerator (+4^{o} C). Tap water was used as a control.

Figure 2. *Salvia sclarea* and seeds sown viols

The seeds from *S. sclarea* plants in the collection plots of Yozgat Bozok University, Gedikhasanlı Research and Application Area were sown in viols containing peat (08 March). Irrigation was done regularly with the prepared extracts and tap water. The experiment was set up with 3 replications according to the randomized plot design and the research was carried out under greenhouse conditions (Figure 2).

The appearance of cotyledons in the soil was considered as the main emergence criterion and the first count was made. The second count was made 20 days after the sowing (ISTA, 2017). The emergence percentage (%) was calculated using the following formula:

The emergence percentage (%): [Number of seedlings/Total number of seeds sown] x 100

After the second count, seedling height (mm) and root length (mm) values were measured in healthy growing seedlings (Figure 3).

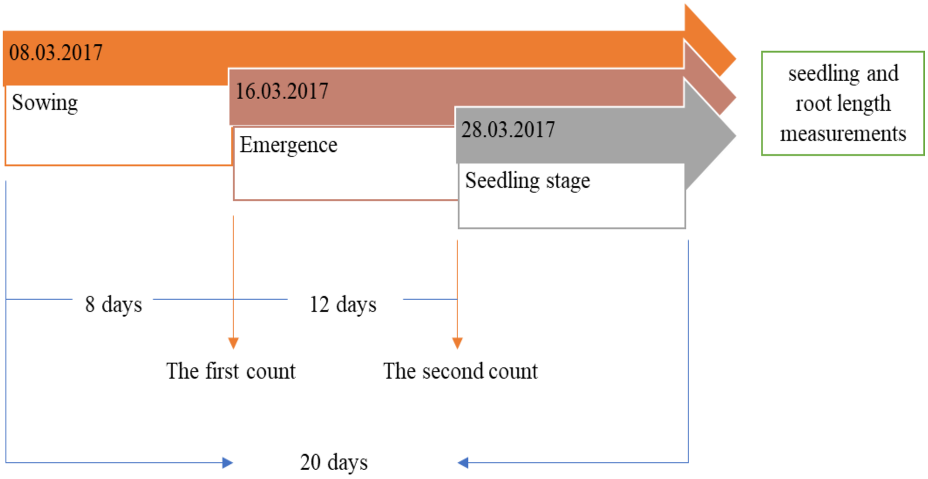

Figure 3. Schematic summary of the applications made

The data obtained from the study were analyzed according to the randomized plot design and the differences between the means were determined by the LSD (Least Significant Difference) test. The TARIST package program was used in the analysis (Açıkgöz et al., 2004).

RESULTS and DISCUSSION

The first count was made 8 days after sowing the *S. sclarea* seeds. In the first count, there was no emergence in viols irrigated with seed coat (SC), and 20% emergence was detected in those irrigated with fruit peel (FP). In the control (Ct) group, the emergence percentage was recorded as 40%. The second count was made 12 days after the first count. In this count, the emergence values were determined as 28.89% in SC, 26.67% in FP and 60% in Ct (Figure 4). In the second count, the height and root length of the seedlings were measured. Among the obtained values, it was found to be statistically significant at the 1% level. The highest values in terms of seedling height and root length were obtained from the control application, followed by SC and FP, respectively. Compared to the control treatment, the heights of the seedlings treated with SC and FP extracts were 31.35 cm and 71.51 cm shorter, respectively. Similarly, it was observed that the root lengths of the seedlings were 52.99 mm and 84.87 mm shorter in FP and SC treated respectively, compared to the control (Table 1 and Figure 5). It has been observed that the effect of allelopathic extracts on the development of different organs of plants is different (Yarina et al., 2009). In general, it has been reported that root development is inhibited more than shoot growth by allelopathic extracts (Talukder et al., 2015; Özkan et al., 2019; Yıldız et al., 2020). In studies on allelopathy have been evaluated the relationships between weeds and weeds, crops and crops, and crops and weeds (Kadıoğlu and Yanar, 2004). Many plants can show allelopathic effects at high doses (Fujii et al., 2003). Numerous studies have been conducted on the allelopathic effects of plant extracts (Chon et al., 2003). In a study conducted by Fritz et al. (2007), it was observed that extracts from *Hypericum myrinthum* and *Hypericum polyanthemum* significantly inhibited the germination and growth of lettuce. In another study, Uslu et al. (2018) reported that oleander (*Nerium oleander*) flower extracts suppressed the growth of Italian grass (*Lolium multiflorum*). Similarly, aqueous extracts of *Azardiracta indica* have been reported to inhibit grass and seedling growth of turnip (*Brassica rapa*) and ladies finger (*Hibiscus esculentus*) (Talukder et al., 2015). The effects of the plant parts we used in our study were different. This may be due to the presence of different allelochemicals in aqueous extracts. For example, in a study examining the effects of aqueous extracts from different parts (rhizome, root, leaf sheath and leaf lamina) of the banana plant on the germination and seedling growth of some vegetables, the inhibitory effect of the rhizome extract on germination and seedling growth was higher than that of other extracts (Roy et al., 2006). When evaluated in general, the findings of our study are in line with what the researchers reported.

Table 1. Difference grouping of recorded measurements in applications

Applications	Seedling height (mm)	Root length (mm)
Fruit Peel (FP)	39.89 c[1]	52.78 c
Seed Coat (SC)	80.05 b	84.75 b
Control (Ct)	111.40 a	137.74 a
LSD $_{(0.05)}$	22.05	25.43

[1]The difference between the means denoted by the same letter is statistically insignificant.

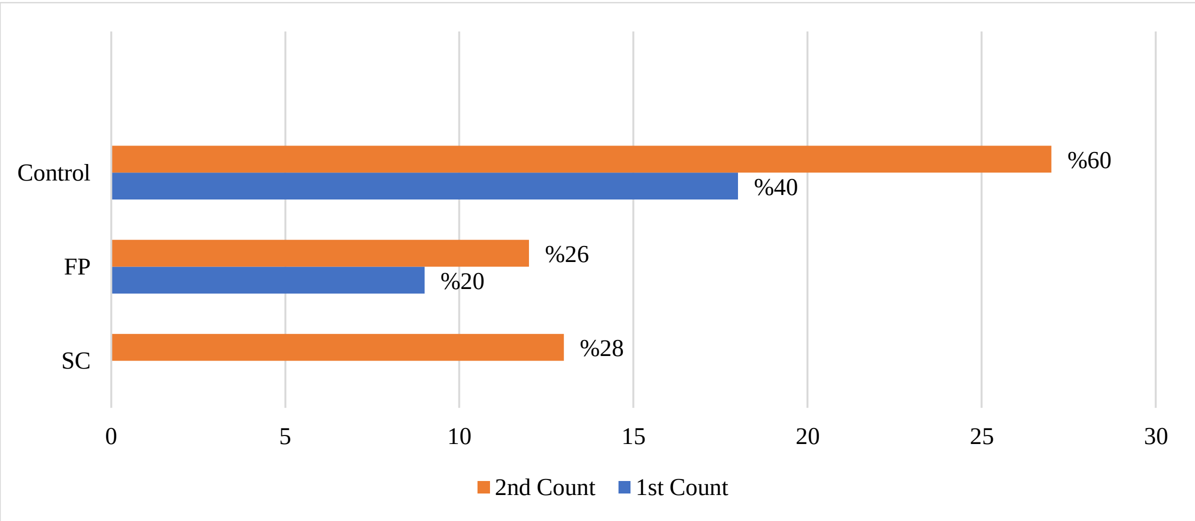

Figure 4. The variation in emergence percentage by applications

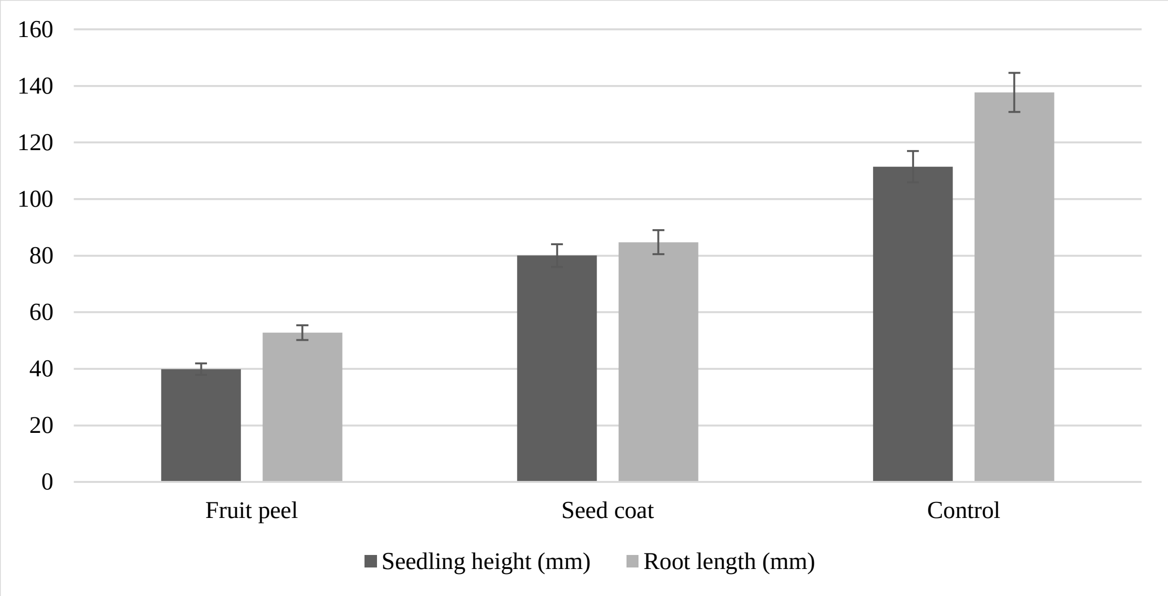

Figure 5. Effects of extracts on seedling growth

CONCLUSION

According to the findings obtained from this study, it was determined that the FP and SC extracts obtained from *S.officinalis* had a significant (*P*<0.01) inhibitory effect on the emergence of *S.sclarea* seeds and seedling growth. The inhibitory effect of FP was higher than that of SC. In this context, it would be beneficial both to analyze chemical content of the extracts and to conduct more extensive research in order to fully reveal the allelopathic potential of *S.officinalis*.

REFERENCES

Açıkgöz, N., İlker, E., Gökçöl, A. 2004. Computerized evaluation of biological research (Tarist). E. U. Seed Technology Research and Application Center Publication (in Turkish).

Ambika, S.R. 2002. Allelopathic plants. 5. *Chromolaena odorata* (L) King and Robinson. Allelopathy Journal, 9(1): 35-41.

Arslan, N., Gürbüz, B., Gümüşçü, A. 2015. Annotated Guide to Medicinal and Aromatic Plants, Ankara University, Faculty of Agriculture Publications, Ankara (in Turkish).

Güner, A. 2012. http://www.bizimbitkiler.org.tr/ [Internet]. 2012 [cited 2021 july 30] Available from:

Cesur, C., Coşge Şenkal, B., Uskutoğlu, T., Doğan, H., Kaya, A.R., Fidan, H. 2018. A New industrial plant within the scope of agricultural forestry: Tesbi (*Styrax officinalis* L.). EJONS International Journal on Mathematic, Engineering and Natural Sciences. 5: 83-90 (in Turkish).

Chon, S.U., Kim, Y.M., Lee, J.C. 2003. Herbicidal potential and quantification of causative allelochemicals from several composite weed. Weed Research, 43: 444-450.

Dib, R., Makhoul, K., Maalouf, R. 2016. Preliminary bioactivity investigation of *Styrax officinalis* fruit extract as potential biopesticide. Journal of Pharmacognosy and Phytotherapy, 8: 209-213.

Fritz, D., Bernardi, A.P., Haas, J.S., Ascoli, B.M., Bordignon, S.A.L., Poser, G. 2007. Germination and growth inhibitory effects of *Hypericum myrianthum* and *H. polyanthemum* extracts on *Lactuca sativa* L. Revista Brasileira de Farmacognosia, 17: 44-48.

Fujii, Y., Parvez, S.S., Parvez, M.M., Ohmae, Y., Iida, O. 2003. Screening of 239 medicinal plant species for allelopathic activity using the sandwich method. Weed Biology and Management, 3: 233-241.

ISTA, 2017. International Rules for Seed Testing, International Seed Testing Association, Bassersdorf, Switzerland.

Jaradat, N., Al-Masri, M., Zaid, A.N. 2018. Assessment of the antimicrobial and free radical scavenging activities of *Moluccella spinosa*, *Helichrysum sanguineum*, and *Styrax officinalis* folkloric medicinal plants from Palestina. Oriental Pharmacy and Experimental Medicine, 18: 107-114.

Jaradat, N. 2020. Phytochemistry, traditional uses and biological effects of the desert plant *Styrax officinalis* L. Journal of Arid Environments, 182: 104253.

Kadıoğlu, I., Yanar, Y. 2004. Allelopathic effects of plant extracts against seed germination of some weeds. Asian Journal of Plant sciences, 3(4): 472-475.

Kim, Y.S. 2001. Allelopathic effects of some volatile substances from the tomato plant. Journal of Crop Production, 4(2): 313-321.

Özbay, N. 2018. Allelopathic effects of some herbs and medicinal plants' extracts on seed germination and seedling growth of pepper. Turkish Journal of Agricultural and Natural Sciences, 5(1): 81-85 (in Turkish).

Özkan, T.G.I., Urusak, E.A., Appiah, K.S., Fujii, Y. 2019. First board screening of allelopathic potential of wild and cultivated plants in Turkey. Plants. 8: 532.

Pala, F., Mennan, H. 2019. Chemical weed control recommendations for wheat. ISPEC Journal of Agricultural Sciences, 3: 19-31.

Proestos, C., Boziaris, I., Nychas, G. J., Komaitis, M. 2006. Analysis of flavonoids and phenolicc acids in Greek aromatic plants: investigation of their antioxidant capacity and antimicrobial activity. Food Chemistry, 95: 664-671.

Roy, S., Asaduzzaman, M., Pramanik, M.H.R., Prodhan, A.K.M.A. 2006. Effect of banana plant extracts on germination and seedling growth of some vegetable crops. Bangladesh Journal of Crop Science, 17(1): 235-242.

Serim, A.T., Güzel, N.P., Türktemel, İ. 2015. Use of allelopathic plant extract with herbicide. Derim, 32(2): 225-236 (in Turkish).

Talukder, M.A.I., Rahaman, M., Roy, B., Saha, K.C. 2015. Effects of herbal plant extracts on germination and seedling growth of some vegetables. International Journal of Science and Nature, 6(3): 421-425.

Uslu, Ö.S., Gedik, O., Kaya, A.R., Erol, A., Khan, M.A., Taşsever, M.N., Türkkaya, E. 2018. Allelopathic effects of flower extract of oleander (*Nerium oleander*) on the germination of seed and seedlings growth of *Lolium multiflorum*. Iğdır University Journal of the Institute of Science and Technology, 8(1): 309-317.

Uygur, F.N., Köseli, F., Cesurer, L. 1991. The allelopathic effect of *Raphanus sativus* L. (Radish) on zea mays corn and weeds that is a problem in *Zea Mays* L. Journal of Turkish Weed Science, 6: 167-171 (in Turkish).

Weston, L.A. ve Duke, S.O. 2003. Weed and crop allelopathy. Critical Reviews in Plant Sciences, 22(3-4): 367-389.

Yarina, M., Khorshidi Benam, M.B., Farajzadeh Memari Tabrizi, E. 2009. Allelopathic effects of sorghum extracts on *Amaranthus retroflexus* seed germination and growth. Journal of Food, Agriculture and Environment, 7: 770-774.

Yıldız, E. 2020. Allelopathic effect of some medicinal plant extracts on seed germination and seedling growth of maize, soybean and sunflower. Turkish Journal of Agricultural and Natural Sciences, 7(4): 1218-1226 (in Turkish).