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PREFACE

Dear colleagues,

It is with great pleasure that I introduce the *Book of Proceedings* for the 15th International Scientific Agricultural Symposium "AGROSYM 2024." I trust that you will find it a valuable resource in your work. This year, around 800 contributions have been accepted for inclusion in the *Book of Abstracts*. The themes of AGROSYM 2024 span the full spectrum of agricultural sciences, divided into seven key sessions: 1) Plant Production, 2) Plant Protection and Food Safety, 3) Organic Agriculture, 4) Environmental Protection and Natural Resource Management, 5) Animal Husbandry, 6) Rural Development and Agro-Economy, and 7) Forestry and Agroforestry.

There is growing consensus among scholars and practitioners that technological innovations have the potential to boost agricultural production, enhance supply stability, and reduce the environmental impact of farming. Technology has been especially pivotal in increasing the productivity of annual crops such as maize, rice, soybeans, wheat, and cotton. However, with trees having longer growth cycles, breeding programs for these crops require more time. New plant breeding techniques promise improvements in productivity, but they have sparked an ongoing academic debate regarding their advantages and drawbacks.

While much of the focus in the past has been on the production side of agriculture (e.g., productivity and efficiency), there is an increasing emphasis today on the consumption side and the intermediate stages of the food chain, such as processing and distribution. This shift is driving the transition toward a "farm-to-fork" approach. Globally, consumers are sending clearer signals about their preferences for higher quality, healthier, safer, and more flavorful products. In response, many agri-food companies are exploring innovative ways to gain greater control over production processes and ensure the quality and safety of final products. Furthermore, changes in investment strategies hold the potential to reduce the environmental and social costs of agriculture. It has become increasingly clear to investors that companies that prioritize sustainability and social responsibility tend to yield better long-term returns.

Agri-food systems are at the heart of global discussions surrounding sustainable development and the achievement of the United Nations Sustainable Development Goals (SDGs) by 2030. These systems are deeply connected to numerous global challenges, including climate change, poverty, food insecurity, biodiversity loss, resource depletion, and ecosystem degradation. A key goal of the sustainable agriculture movement is to create farming systems that mitigate or eliminate the environmental harms associated with industrial agriculture. Additionally, it is critical to improve the resilience of food systems to crises, shocks, and pandemics.

I would like to extend my heartfelt thanks to all the authors, reviewers, and colleagues who contributed to the editing of the *Book of Abstracts*. Special thanks are due to our co-organizers and partners for their unwavering collaboration and comprehensive support throughout this endeavor.

Dušan Kovačević

East Sarajevo, 10 October 2024
Prof. Dušan Kovačević, PhD
Editor in Chief, President of the Scientific Committee of AGROSYM 2024

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USE OF ESSENTIAL OIL FOR WEED CONTROL IN ORGANIC FARMING

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Abstract

Consumers demand for organic foods is increasing all over the world due to heavily used synthetic pesticides in conventional agriculture that severally treats human and environment health. Organic farming is the way of producing good quality crops in harmony with biodiversity and ecosystems. Weeds remain one of the most important problems associated with organic crop production since organic farming excludes the use of synthetic herbicides. Essential oils have a great potential to be used as bio-herbicide to control problem weeds in organic farming. A study was conducted to determine the bio-herbicidal potential of organically grown oregano (*Origanum onites*), rosemary (*Rosmarinus officinalis*), thyme (*Thymus vulgaris*) and sage (*Salvia officinalis*) essential oils. The experimental design was a completely randomized design with three replications. Different concertation of essential oil (2, 4, 8, 16 and 32 ml/L) alone and vinegar mixed were applied on the four leaf stage pigweed (*Amaranthus retroflexus*). The major essential oil components of oregano, rosemary, thyme and sage essential oils were carvacrol, thimol, 1,8 cineole and b-thujone, respectively. The highest herbicidal effects on pigweed were obtained from vinegar + 32 ml/l essential oil mixed treatments. Herbicidal effects of essential oil increased with the increasing concentration of essential oils. Among the tested plant species, oregano and rosemary essential oils were found the most effective when used as herbicide. Vinegar alone had low herbicidal effect on pigweed seedlings. However, the vinegar and essential oil mix had the highest herbicidal effects on pigweed seedlings. Essential oil and vinegar mixtures have potential to be used in organic farming to control problem with weeds in organic farming.

Keywords: *Essential oil, Bio-herbicide, Organic farming weed control.*

Introduction

Weed control is one of the most troublesome practices in organic crop production areas, since there are a few organically approved herbicides available for weed control. Organic agriculture is Anon (1997) defined organic farming as a production system that sustains health of soil, eco-system and people, by relying on ecological process, bio diversity and natural cycles and adapted to local conditions than use of inputs with adverse effects. Successful weed management is crucial for a successful organic crop production. In conventional crop production, weed control is an important part of applied practices to increase crop yield and quality. Conventionally chemical pesticides are applied to minimize or completely eliminate the damage of weeds. Today, many conventional producers quickly accepted the use of herbicides due to ease application. Like conventional farming, weeds are one of the worst problems in organic farming. Weed control in organic farming is one of the most important obstacles for traditional farmers to switch to organic farming.

During the production process in the organic farming areas, studies are widely carried out on different methods and machines other than chemical pesticides. Environmentally friendly and new control methods such as allelopathy, organic herbicides, solarization, robotics, freezing,

microwave, UHF rays, laser rays, ultraviolet rays, infrared rays, electricity, steam and pressurized water applications are the weed control practices applied in organic crop production areas (Quarles, 2013; Pacanoski, 2015). Many natural herbicides that are not organic licensed yet can be approved to use in organic farming by certification companies. One of the main disadvantages of organically approved herbicides are high costs, higher quantities, non-selectivity, effective only in the early growth stages of the weeds (Young, 2004; Lanini, 2010; Webber *et al.,* 2012; Bari and Kato-Noguchi, 2017).

Essential oils extracted from plants can suppress weeds and they can be used as bio-herbicide for weed control (Campiglia *et al*., 2007; Frabboni *et al*., 2009; Synowiec and Nowicka-Połeć, 2016; Werrie *et al*. 2020). It has already emphasized by many researchers that essential oils can inhibit seed germination of weed species (Dudai *et al.* (1999).

The aim of this study was to determine the contact herbicidal potential of oregano, lavender, thyme and sage essential oil on problem weeds.

Materials and Methods

The dried aerial parts of oregano (*Origanum onites*), rosemary (*Rosmarinus officinalis* L.), thyme (*Thymus vulgaris*) and sage (*Salvia officinalis*) plants were collected in the organically grown medicinal and organic plant production areas of Erciyes University, Kayseri, Turkey. The dry herbage of plant parts were subjected to hydro-distillation for 3 h using a Clevenger-type apparatus, to extract essential oil. The extracted essential oils were dried over anhydrous sodium sulphate and stored in low temperature until use.

The herbicidal effect of the essential oils was tested under field condition. Pigweed seeds were planted in the experimental farm of Erciyes University. To applied as herbicide, 2, 4, 8, 16 and 32 ml/L of oregano, rosemary, thyme and sage essential oil were mixed with 1 ml tween 20 and 1 L distilled water and shaken for 30 minutes in a shaker at 700 rpm. In the case of vinegar and essential oil mixture, 2, 4, 8, 16 and 32 ml/L of essential oil oregano, rosemary, thyme and sage essential oil were mixed with 1 L commercial vinegar and 1 ml tween 20. When the pigweed seedlings were in the four leaf stages the prepared essential oil were sprayed on the weed seedlings. The application doses of essential oil were 2, 4, 8, 16 and 32 ml in the prepared mix of bio-herbicide. One week after application growth injury of treatments were recorded by using 1-5 scale.

GC-MS analysis

Analysis of the tested essential oil were carried out by using Thermo Scientific Focus Gas Choromatograph equipped with MS, auto sampler and Rtx®-5 capillary columns (60 m x 0.32mm, 0.25µm film thickness). Helium (99.9%) was the carrier gas at a flow rate of 1 mL/min. MS transfer line temperature was 250°C, MS Ionization source temperature was 220^{o}C, the injection port temperature was 220°C. The samples were injected with 250 split ratio. The injection volume was 1µL. Oven temperature was programmed to 50°C to 220°C at 3°C /min (Kaya *et al*., 2003). The structure of each compound was identified by comparison of their mass spectrum (Wiley) using the Xcalibur software program.

Results and Discussion

Chemical composition of oregano, rosemary, thyme and sage essential oil were given in Table 1. Only major essential oil components are shown. The major components of oregano oil were carvacrol (60.03%), p-cymene (8.81%) and a-terpinene (2.79%). The 1,8 cineole (22.25%) and thymol (20.21%) were the major components of rosemary oil. Thymole /37.13%), p-

cymene 18.46%) and a-terpinene (4.14%) were the major components of thyme oil. The major components of sage oil were b- thujone (20.38) and L-camphor (19.41%).

Table 1. Chemical composition of essential oils used in experiment (major components in %)

Essential oil components	Oregano	Rosemary	Thyme	Sage
1,8 cineole	-	22.25	2.6	24.51
a-terpinene	2.79	1.04	4.14	0.85
p-cymene	8.81	3.04	18.46	-
Thymol	0.95	20.21	37.13	-
Carvacrol	60.03	-	4.12	-
b- thujone	-	-	-	20.38
L-camphor	-	-	-	19.41
b-pinene	0.5	-	0.4	7.62

Herbicidal effects of essential oils alone and their mixture with vinegar was given in Table 2. Essential oils have long been recognized for their anti-microbial activities. The lowest herbicidal rate was obtained from 4 ml essential oil treatments, while the highest was obtained from 32 ml/l essential oil treatments mixed with vinegar for all tested essential oils (Table 2). The herbicidal effects of oregano, rosemary, thyme and sage essential oil increased with the increasing essential oil concentrations. Maximum herbicidal effects were obtained when essential oil was mixed with vinegar. Vinegar alone has equal herbicidal effect on pigweed seedling regardless of the applied dose, but it has not enough potential to kill pigweed seedlings.

Table 2. Bio-herbicidal effect of oregano, rosemary, thyme and sage essential oil on pig weed seedlings

	Dose of applied essential oil (ml/L)/ Bioherbicidal effect				
Treatments	*2*	*4*	*8*	*16*	*32*
Vinegar only*	3	3	3	3	3
Oregano	1	2	2	3	4
Rosemary	1	2	2	3	4
Thyme	1	2	2	3	4
Sage	1	2	2	3	4
Vinegar+Oregano	1	2	3	4	5
Vinegar+Rosemary	1	2	3	4	5
Vinegar+Thyme	1	2	2	3	5
Vinegar+Sage	1	2	2	3	5

1: weeds are not injured, 2: weeds are slightly injured; 3: weeds are injured but not death; 4: most of the weeds are severely injured; 5: All weeds are death.

* Vinegar was not diluted. Pure vinegar was applied and no water or any other ingredients was not added.

The herbicidal effects of tested essential oils can be attributed to their major components (Table 1). The given compounds were found to be the most active components of tested essential oils (Frabboni *et al*., 2009; Synowiec and Nowicka-Połeć, 2016; Werrie *et al*., 2020). In most cases, the inhibitory effect of essential oils has been attributed to its major components (Farag *et al.* 1989). These essential oil components were reported as strong biocidal (phytotoxic, antifungal, and insecticidal) compounds (Arslan *et al*. 2010; Bendre *et al*., 2018; Liu et al., 2019; Muñoz *et al*., 2020).

Conclusion

Oregano, rosemary, thyme and sage essential oils had the similar herbicidal effects on pigweed seedlings. Herbicidal effects of tested essential oil on pigweed seedlings increased with the increasing essential oil concentrations. Vinegar alone had moderate herbicidal effect on pigweed seedlings. The bio-herbicidal effects of tested essential oils were increased when vinegar was used instead of water for delivering the essential oil on pigweed seedlings. This study showed that Oregano, rosemary, thyme and sage essential oils and their vinegar mixtures have potential to be used as bio-herbicide in organic farming.

References

Arslan, M. and Dervis, S. 2010. Antifungal activity of essential oils against three vegetative-compatibility groups of *Verticillium dahlia*. World J Microbiol Biotechnol, vol. 26, pp.1813-1821

Bari, I. N., and Kato-Noguchi, H. 2017. Phytotoxic effects of *Cerbera manghas* L. leaf extracts on seedling elongation of four monocot and four dicot test species. Acta Agrobotanica, vol. 70(3), Article 1720.

Bendre, R., Bagul, S., and Rajput, J. 2018. Carvacrol: An excellent natural pest control agent. Natural Products Chemistry & Research, vol. 6(6), Article 349

Campiglia, E., Mancinelli, R., Cavalieri, A., Caporali, F. 2007. Use of essential oils of cinnamon, lavender and peppermint for weed control. Italian Journal of Agronomy, vol. 2(2), pp.171–178.

Dudai N., Poljakoff-Mayber A., Mayber A.M., PutievskyE., Lerner H.R. 1999. Essential oils as allelochemicals and their potential use as bioherbicides. Journal of Chemical Ecology, vol. 25, pp. 1079-1089.

Farag R.S., Daw Z.Y., Abo-Raya S.H. 1989. Influence of some spice essential oils on Aspergillus parasiticus growth and productionof aflatoxins in a synthetic medium. J Food Sci vol. 54 pp.74–76

Frabboni, L., Tarantino, A., Petruzzi, F., & Disciglio, G. (2019). Bio-herbicidal effects of oregano and rosemary essential oils on chamomile (*Matricaria chamomilla* L.) crop in organic farming system. Agronomy, vol. 9(9), Article 475.

Kaya, D.A., Arslan, M. Rusu, L. (2013). Effects of harvesting hour on essential oil content and composition of *Thymus vulgaris*. Farmacia, vol. 61, pp. 1194-1203.

Lanini, W.T., 2010. Organic herbicides - do they work? California Weed Science Society Journal, vol. 6: pp.1-3.

Liu, Q., Qiao, K., & Zhang, S. (2019). Potential of a small molecule carvacrol in management of vegetable diseases. Molecules, vol. 24(10), Article 1932.

Muñoz, M., Torres-Pagán, N., Peiró, R., Guijarro, R., Sánchez-Moreiras, A. M., and Verdeguer, M. (2020). Phytotoxic effects of three natural compounds: Pelargonic acid, carvacrol, and cinnamic aldehyde, against problematic weeds in Mediterranean crops. Agronomy, vol. 10(6), Article 791.

Pacanoski, Z., (2015). Bioherbicides. Herbicides, physiology of action, and safety. In Tech, Chapter 11. http://dx.doi.org/10.5772/61528. pp. 253-274.

Quarles, W., (2013). New biopesticides for IPM and organic production. The IPM Practitioner Monitoring the Field of pest Management. Vol. XXXIII, 7/8 July/August 2011. pp. 1-9.

Synowiec, A., and Nowicka-Połeć, A. 2016. Effect of aqueous extracts of selected medicinal plants on germination of windgrass [*Apera spica-venti* (L.) *P. Beauv*.] and lambsquarters (*Chenopodium album* L.) seeds. Acta Agrobotanica, vol. 69, Article 1668

Webber, C.L. III., Shrefler, J.W., Brandenberger, L.P., 2012. Organic weed control. In Tech. pp, 185-198.

Werrie, P.-Y., Durenne, B., Delaplace, P., & Fauconnier, M. L. 2020. Phytotoxicity of essential oils: Opportunities and constraints for the development of biopesticides. A review. Foods, vol. 9, Article 1291

Young, S.L., 2004. Natural product herbicides for control of annual vegetation along roadsides. Weed Technology, vol 18, pp.580-587.