AS- Proceedings

2nd International Conference on Frontiers in Academic Research

December 4-5, 2023 : Konya, Turkey

ICFAR

AS-Proceedings
https://alls-academy.com/index.php

https://www.icfarconf.com/

Allelopathic Effects of Ginger and Turmeric on the Germination of *Ipomoea triloba* and *Avena sterilis*

İpek ECE [1] and Yasin Emre KİTİŞ [1*]

[1]*Plant Protection Department, Agricultural Faculty, Akdeniz University, Antalya, Türkiye*

[*]*(emrekitis@akdeniz.edu.tr) Email of the corresponding author*

Abstract – Ginger and turmeric are two important cultivated plants that are widely used as spices and for medicinal purposes. In this study, the effects of the juice and water extract obtained from the fresh stems and leaves of these two species after their rhizomes were harvested were investigated on the germination of two important weed species (*Ipomoea triloba* and *Avena sterilis*). The study was conducted in laboratory conditions in petri dish experiments. The findings showed that ginger and turmeric extracts reduced the germination of both species in the trial, but I. triloba was more affected and plant juices were more effective than water extract.

Keywords – Ginger, Turmeric, Extract, Weed, Allelopathy

I. INTRODUCTION

Ginger (*Zingiber officinale* Roscoe) and turmeric (*Curcuma longa* L.) are widely used as spice in many countries of the world, especially in Asia, and are also widely used for medicinal purposes. Both species are herbaceous, rhizomatous perennial plants belonging to the Zingiberaceae family [1]. Ginger is an upright plant, 60 to 120 cm tall, with dark green leaves. It forms an annual stem (pseudo-stem) [2] (Fig 1). 4 million 895 thousand tons of ginger are produced in approximately 450 thousand hectares of land in the world. Although most of the production is in India, it is grown in many countries including Nigeria, China, Nepal, Thailand, Philippines, Australia, Malaysia, Brazil and Mexico [4]. A wide variety of biologically active compounds have been isolated from ginger, including essential oil, gingerol analogues, diarylheptanoids, phenyl alkaloids, sulfonates and others. Furthermore, volatile oil and gingerols are considered as the main components and are mostly responsible for the unique organoleptic properties of flavor and pungency produced by ginger [5].

Fig 1. Ginger (*Zingiber officinale* Rosc.)[3]

Turmeric is an upright plant, 70-140 cm high with a short stem tufted leaf. The leaves of turmeric are quite wide and long compared to ginger (Fig 2).

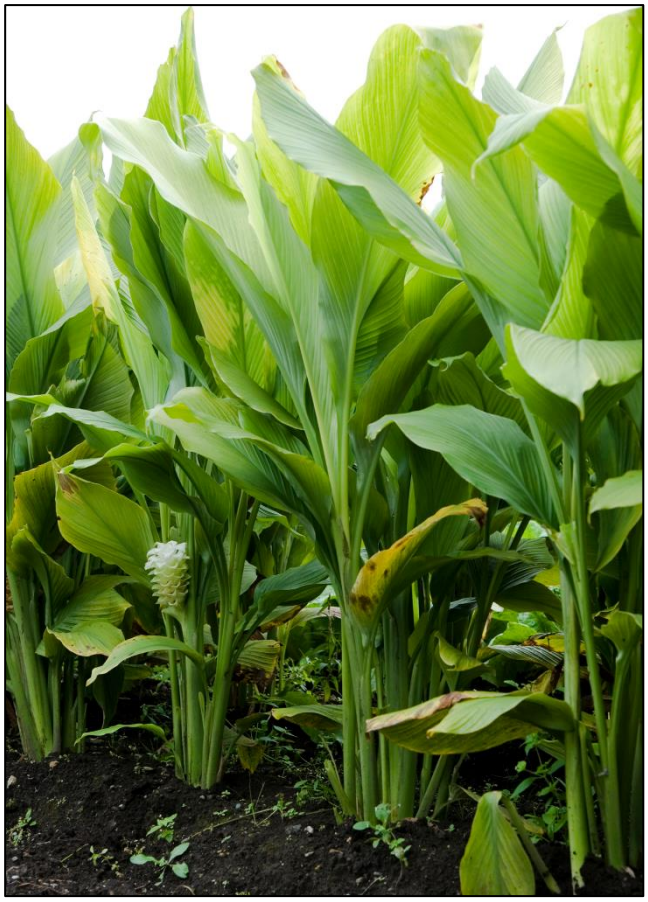

Fig 2. Turmeric (*Curcuma longa* L.)

Its flowers are yellow, between 10-15 cm in length. Turmeric grows in tropical and subtropical regions of Asia, especially in India, China, Indonesia, Jamaica, Peru and Pakistan [6]. The main component of the plant is curcumin. Curcumin is a low-weight, hydrophobic polyphenolic flavonoid. The plant, which is also used as a yellow-orange coloring agent, contains polyphenolic compounds called curcuminoids [7].

In this study, the allelopathic effects of two medicinal and spice plants, which contain a large number of bioactive compounds, on the germination of two important weed species, three lobe morning-glory (*Ipomoea triloba* L.) and sterile oat (*Avena sterilis* L.) seeds, were investigated.

Ipomoea triloba is an important ivy species that is a problem in tropical and subtropical regions, especially in summer crops. It is named after its three-lobed leaves. Its flowers are pink funnel-shaped (Fig 3). The species, belonging to the Convolvulaceae family, reproduces by seed. Under favorable conditions, it can emerge successively throughout the season and wrap itself around crop plants, causing significant yield losses, as well as

Fig 3. Three lobe morning-glory (*Ipomoea triloba* L.)

making harvesting operations difficult. It is subject to quarantine in some countries and shows an invasive character in new entry areas [8,9].

Avena sterilis is also an important weed species especially in cereals and some winter crops. *A. sterilis* is an annual grass weed. Stem to 1.5 m height, tufted, erect, rarely geniculate, not branching, nodes sometimes hairy. Leaf blades 60 cm long, 6-14 mm wide, 30-40 times as long as wide, linear, not hairy. Ligule 2 mm long, membranous, truncate, sheath often on lower leaves. Inflorescence an equilateral or slightly one-sided panicle, 15-45 cm long, 8-25 cm wide (Fig 4). Spikelets with 2-5 florets of which only the

lowest has a basal scar, pedicelled, disarticulating above the glumes, but not between the florets [10].

Fig 4. Sterile oat (*Avena sterilis* L.)

II. Materials and Method

In this study conducted to investigate the allelopathic effect of ginger and turmeric plants, fresh stems and leaves of the plants were used after rhizomes were harvested. These plant parts were washed first in tap water and then in pure water and filtered. Water extracts and concentrate extracts were obtained from ginger and turmeric. For the water extract, the stem and leaves were cut into small pieces and kept in pure water at room temperature for 44 hours. 1 kg of plant material was placed in 3 Liters of pure water (1/3 ratio). At the end of the period, it was filtered through cheesecloth and applied to the weed seeds without dilution or waiting.

Plant sap (concentrate extract) was obtained with the help of a blender from the plant material that was cleaned and passed through pure water. Similarly, the concentrate extract was applied to the weed seeds without diluting or waiting.

The study was carried out in petri dishes under laboratory conditions. For this purpose, 25 seeds of *I. triloba* and *A. sterilis* were counted and placed in 90 mm petri dishes with double-layer filter paper placed on the bottom (Fig. 5). *I. triloba* seeds were sanded to break dormancy before placing them in petri dishes. 10 ml of both extracts were applied to each petri dish without diluting. The same amount of pure water was given to the petri dishes in the control group. Petri dishes were wrapped with parafilm and placed in incubators set at 30 °C for *I. triloba* and 20 °C for *A. sterilis*. After seven days, the petri dishes were opened and the germinated seeds were counted. Seeds that formed radicles of 5 mm or more were considered germinated. The germination rate was calculated with following formula.

Germination Rate = (*ng* /*nt*) × 100

ng: The number of germinated seeds

nt: Total number of seeds

The trial was established in December 2021 in a randomized plots factorial experimental design with three replications.

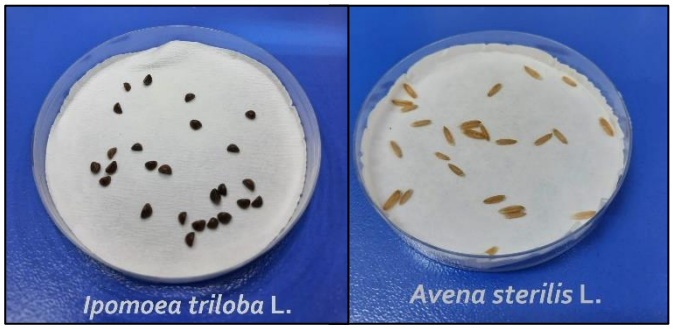

Fig 5. The weed seeds in petri dishes

III. Results and Discussion

According to the obtained results, the juice extracts (concentrated essences) of ginger and turmeric have reduced the germination of both *I. triloba* (IT) and *A. sterilis* (AS) seeds. This reduction was more pronounced in IT. In the control group, seeds of both species germinated at a rate of 100%, while ginger juice reduced the germination of IT seeds by 97.3%, and this reduction was 40% for AS. The water extract of ginger reduced the germination rate of IT seeds by 24%, while the reduction for AS was only 8% (Figure 6).

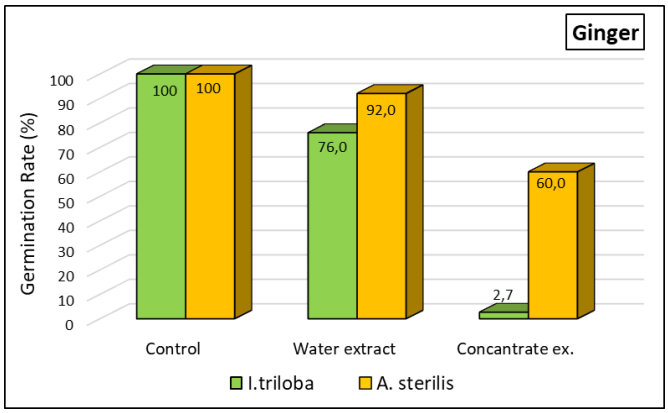

Fig 6. Effect of ginger extracts on the germination of the weed species

Turmeric juice, on the other hand, reduced the germination rate of IT by 90.7% and AS by 37.3%.

In contrast, turmeric water extract could only reduce the germination rate of IT by 18.7% and AS by 12% (Figure 7).

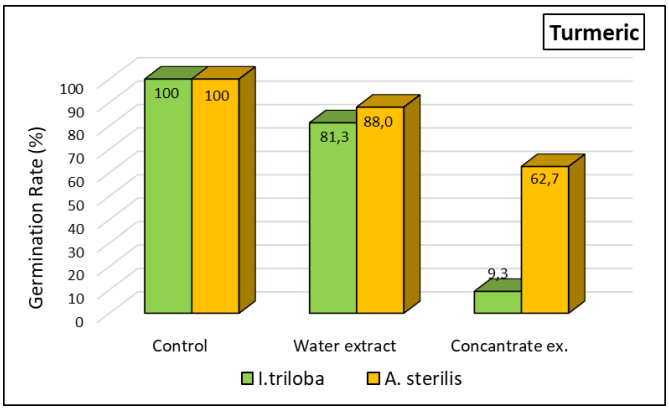

Fig 7. Effect of turmeric extracts on the germination of the weed species

It is evident that both ginger and turmeric juices were found to be more effective compared to water extracts. In terms of species sensitivity, IT was more affected by both water extracts and plant juices than AS, leading to a greater reduction in germination rate. In other words, IT was found to be more sensitive. When comparing the effectiveness of ginger and turmeric, it can be stated that there is not a significant difference between them; however, ginger appears to be slightly more effective.

IV. CONCLUSION

This study suggests that extracts obtained from the stems and leaves discarded after harvesting ginger and turmeric, commonly used for both culinary and medicinal purposes, could be utilized in weed control. Further research, including different weed species and field studies, is needed to support these findings.

REFERENCES

[1] Nair, K.P. Prabhakaran (2013). The Agronomy and Economy of Turmeric and Ginger: The Invaluable Medicinal Spice Crops. Newnes. pp. 7–10. ISBN 9780123948243.

[2] Nybe, E.V. (2016), "Ginger Production in India and Other South Asian Countries", Ginger, CRC Press, pp. 224–253, doi:10.1201/9781420023367-9, ISBN 9781420023367.

[3] Anonymous, (2023). https://www.pixiesgardens.com

[4] Anonymous, (2021). FAO (Food and Agriculture Organization) Available: https://www.fao.org/faostat/

[5] Zhang, M, Zhao, R, Wang, D, et al. Ginger (Zingiber officinale Rosc.) and its bioactive components are potential resources for health beneficial agents. Phytotherapy Research. 2021; 35: 711–742. https://doi.org/10.1002/ptr.6858.

[6] Lal, J. (2012). Turmeric, Curcumin and Our Life: A Review. Bull. Environ. Pharmacol. Life Sci.; Volume 1(7): 11-17.

[7] Delikanlı Akbay, G., Pekcan, A.G. 2016. Turmeric: Evaluation in Terms of Health and Nutrition. Bes Diy Derg 2016:44(1):68-72.

[8] Arslan, E., Kitiş, Y.E. 2021. Weeds and Population Situations in Cotton (*Gossypium hirsutum* L.) Cultivation Areas in Antalya Province. Turkish Journal of Weed Science, 24(2):141-149.

[9] Doğru, A.S. & Y.E. Kitiş, 2023. The weed species in corn fields in Antalya province of Türkiye. Ege Univ. Ziraat Fak. Derg., 60 (3): 429-436,https://doi.org/10.20289/zfdergi.1297576.

[10] Stace C, 1997. New Flora of the British Isles. 2nd edition. Cambridge, UK: Cambridge University Press.