

# STUDY OF ALLELOPATHIC EFFECTS OF EUCALYPTUS TERETICORNIS, AND TRACHYSPERMUM AMMI AND ITS FUTURE PROSPECT

## Abstract

In order to determine whether essential oils from *Citrus limon*, *Eucalyptus tereticornis*, and *Trachyspermum ammi* have any allelopathic effects, a study was done to determine these effects. The study's goal was to see whether these essential oils may potentially be used in the future to manage weeds. These three essential oils were tested for their impact on the germination of weed species. The weed species' germination rate was significantly reduced by the essential oils, which also had the potential to be allelopathic. The findings showed that, at various doses, all essential oils significantly hindered the weed species' ability to germinate. The use of essential oils as pre-emergent weed seed germination inhibitors and as a substitute for chemical herbicides was found to be effective in the biological control of weeds. We talk about the potential application of essential oils as herbicides.

**Keywords:** Essential Oils, Herbicides, Weeds, Germination, Chemical Herbicides.

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## I. INTRODUCTION

Weeds are a significant biological limitation that compete with crops for natural resources and inputs, limiting the output and productivity of agricultural products such as grains, fruits, and vegetables ( Yaduraju et al., 2015). India has a wide range of agroclimatic and soil types, and weeds cause 10-80% crop yield losses, impairing product quality and causing health and environmental hazards (Rao et al., 2015). Weeds account for approximately one-third of the losses caused by agricultural pests, and initiatives to boost agricultural productivity in India should include reducing weed losses. Weeds negatively impact cropped and uncultivated lands, substantially affecting agricultural production systems (Rao et al., 2020). Weeds have more adaptation characteristics to our agro-ecosystems than crop plants, absorbing nutrients faster than crop plants and accumulating them in their tissues (Gharde et al., 2018).

Weed competition has a significant negative impact on agricultural yields, with research showing that weed interference globally decreased crop production by 12-35% ( Oerke ,2006). In modern industrial herbicide research, the initial stage is to analyse and specify the study objectives. This is greatly influenced by the identification of economically significant weeds in important arable crops (Kraehmer et al., 2014). The use of chemical-based weedicides to control weed growth has created a serious negative impact on the environment (Mahmood et al., 2016). To address this issue, there is a growing interest in finding alternatives to weedicides, such as biodegradable substances like essential oils (Dudai, 1999). Essential oils are volatile, natural, complex compounds characterized by a strong odour and formed by aromatic plants as secondary metabolites (Bakali et al., 2007). They are extracted from various plant parts and are composed of various chemical compositions in different parts of plants (Moghaddam et al., 2017).

Essential oils are crucial for the conservation of plants in nature. Additionally, they could draw some insects to help pollen and seed dispersal or deter other unwelcome insects. EOs can therefore operate as a mediator between plants and their surroundings ( Zambori, 2020). The intricate makeup of essential oils is made up of a few dozen to several hundred components, primarily hydrocarbons and oxygenated molecules. Both hydrocarbons and oxygenated materials are responsible for the characteristic odour and flavour (Pourmortazavi and Hajimirsadegi, 2007).

Essential oils are highly concentrated compounds taken from leaves, stems, flowers, seeds, roots, resins, fruit, or bark (Hanif et al.,2019). They are insoluble in water but soluble in alcohol and ether (Dhifi et al., 2016), and are used in embalment, preservation of foods, as antimicrobial, analgesic, sedative, anti-inflammatory, spasmolytic, and locally aesthetic remedies (Bakali et al., 2007).

Some research suggest that mixing essential oils with other organic compounds might boost the potency of the chemicals' weed-suppressing effects. a research on the effectiveness of vinegar and essential oils in weed control. Their collective impact improved their capacity to manage weeds (Vaughn et al., 2007). Herbal weedicides effectively eliminate weeds while minimizing plant damage. Essential oils from specific plant species show selective herbicidal effects, with cinnamon and clove essential oils potentially susceptible to certain weed species (Khanh, 2007). Natural essential oils have lower toxicity profiles and are less likely to have a

negative impact on health than synthetic herbicides (Isman et al., 2004). Weedicides are the only way to completely eradicate weeds from crops, which can enhance output by up to 38% (Hussain et al., 2021).

## II. REVIEW OF THE ARTICLE

Eos are secondary metabolites that are present in plants. They are crucial to the defence mechanisms of plants against microbes, insects, herbivores, and allelopathic interactions (Mossa, 2016).

- 1. Biological Activities of Essential Oils:** Aromatic herbs have been utilised in food as flavouring agents, cures, and preservatives. Due to their synergistic combination of active ingredients, essential oils (EOs) are well-known for both their wide range of aroma and their therapeutic properties (Mohamed et al., 2022).
- 2. Essential Oils as Antioxidants:** Contrary to synthetic antioxidants like BHA and BHT, essential oils (EOs) have powerful antioxidant benefits on human health. Free radicals are destroyed by natural antioxidants like Eos, which also makes them safer and more stable. Antioxidants protect biological organs from oxidative deterioration (Mohamed et al., 2022).
- 3. Essential Oils as Antibacterial Agent:** Antibiotic resistance presents problems for antimicrobial chemotherapy, resulting in ineffective treatment. Essential oils (EOs), which are plant bioactives, have potent antibacterial capabilities that are effective against a variety of Gram-positive and Gram-negative bacteria. These substances have grown in popularity as helpful additions that increase food product shelf life and guarantee consumer microbiological safety (Mohamed et al., 2022).
- 4. Essential Oils as Antifungal Agent:** Due to their eukaryotic origin, immunological state, and resilience, fungi are more difficult to identify and cure than other illnesses. Essential oils (EOs) are promising organic substances that can stop the growth of fungi. EOs derived from plants or herbs have strong antifungal properties because of their low molecular weight and lipophilic makeup. One of the active ingredients in EOs, terpenes/terpenoids, has the potential to have antimicrobial or antifungal actions by damaging cell membranes, killing cells, or preventing the sporulation and germination of fungus. When consumed separately from the essential oil, terpenes and terpenoids may not function as potent antibacterial agents, according to in vitro research (Nazzaro et al., 2017).
- 5. Anticancer Properties:** Essential oils have been used to regulate cancer in cells and tissues by promoting cell survival, growth, and reducing inflammation. These oils have been discovered for the first time in treating inflammatory and oxidative disorders and may also possess anticancer properties (Bhalla et al., 2013).

## III. MATERIAL AND METHODS

The weed species taken for the experiment is *Amaranthus caudatus*.

The plant is a substantial, upright annual herb. The entire plant is coloured crimson or purple. The leaves are ovate-oblong to rhomboid-ovate, 3-15 x 2-7 cm, with an obtuse to subacute apex and a mucronate base. The petiole measures 7 cm. Axillary and terminal flowers with panicles up to 20 cm long in red or green are also available. The spikes are covered with both male and female flowers. Oval, caudate-acuminate, and aristate bract. Flowers have one gender. Five perianth, measuring 2-3.5 mm in length. They are aristate, oblong-elliptic. Males have five stamens. The stigma is trilobed. Utricle is ovoid-globose, 2 mm long, and circumscissile. One to 1.5 mm wide, compressed, lenticular, black, and shiny seeds.

**1. Essential Oils:** The different Eos taken for the experiment are *Citrus limon*, *Eucalyptus tereticornis* and *Trachyspermum ammi*.

- **Citrus Limon:** Lemons are small, spiny shrubs or trees with evergreen leaves, shiny leathery, and oil glands. They have winged stems with a spine on the twig attachment. The leaves are ovate, oblong, and taper to a point on the non-stem end. They have a glossy finish on the green topside and a matte finish on the lighter green underside. When young, they are red, but as they mature, they turn to a deep green colour. Lemon leaves are slightly oily with an aromatic, bright, green citrus taste. Lemon essential oil, also known as "Liquid Sunshine," is extracted from the skin of the lemon and is known for its vibrant yellow colour, refreshing scent, purifying properties, and burst of energy. It can also be used as an herbicide, pesticide, or weedicide (Adinee et al., 2008).
- **Eucalyptus Tereticornis:** Eucalyptus plants, native to Australia, are known for their smooth, fibrous, hard, or stringy bark, oil glands on their leaves, and sepals and petals that fuse to form a cap or operculum over the stamens. The fruit is a woody capsule called a gumnut, with leathery leaves and glands containing fragrant volatile oil. Eucalyptus trees are quick growers and yield valuable timber, oils, and essential oils. Eucalyptus oil, a distilled oil from the leaves of Eucalyptus species, is a commercially significant source of oil used in medicine, fragrance, and industry (Boland et al., 2006). Eucalyptus oil is categorized into three broad types based on their composition and main end-use: medicinal, perfumery, and industrial.
- **Trachyspermum ammi:** *Trachyspermum ammi* is a small, oval-shaped, seed-like herb with pale brown schizocarps. It has a bitter and pungent taste, similar to anise and oregano. Growing up to 60-90 cm tall, it has white flowers and pinnate leaves. *Trachyspermum ammi's* oil, made from crushed ajwain seeds, has a pale golden hue and a potent scent. It is used for aromatherapy, therapeutic purposes, and as a herbicide, pesticide, and weedicide (Mohsenzadeh et al., 2012).

**2. Preparation of Solutions:** By combining methanol and distilled water, a stock solution of several Eos was created. Then, 100 ppm, 200 ppm, 300 ppm, and 400 ppm concentrations were created.

**3. Seed Germination Experiment:** The petri plates were taken and washed properly. Then the filter papers were cut according to the size of the petri plates. The two layers of filter paper were added to the petri plates.

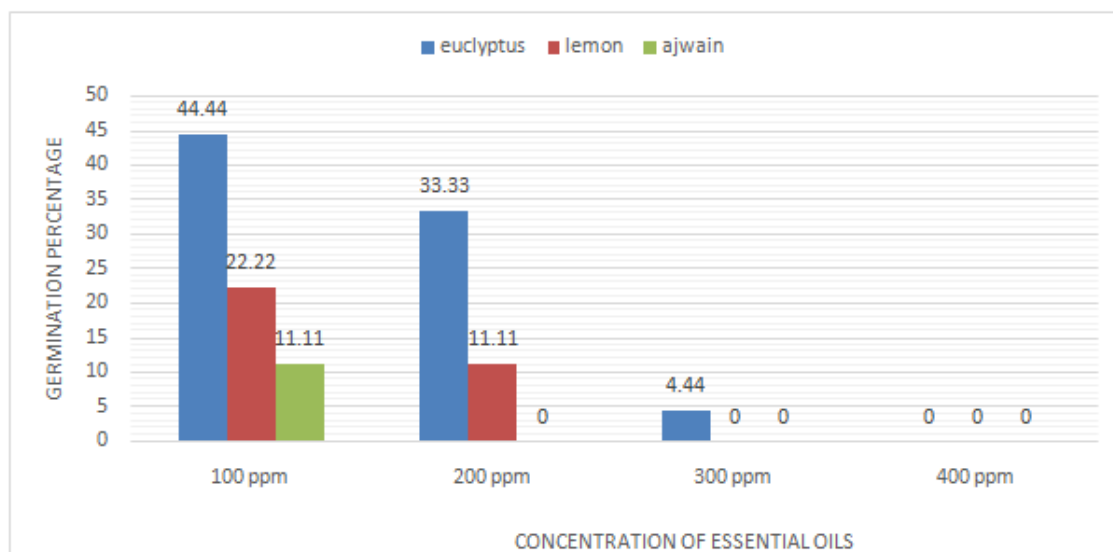
A total of 24 petri plates were taken for the experiment with two kinds of seeds. Then a set of three petri plates was taken for each concentration, and in each petri plate, 15 seeds were added.

After the preparation of petri plates these were kept in Seed Germinator for 10 days in dark at 27 °C. The experiment was performed three times for different Eos.

#### IV. RESULTS

The effect of EO from different plants *Citrus limon*, *Eucalyptus tereticornis* and *Trachyspermum ammi* was studied. The effects of these EO were seen on the germination percentage of weed species *Amaranthus caudatus*.

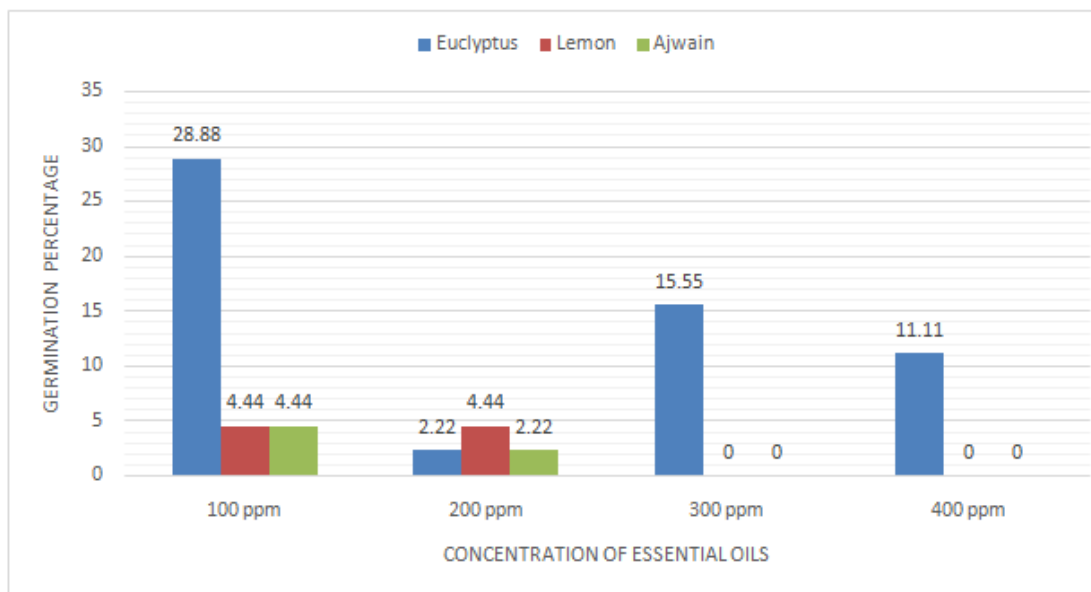
The effect of these EO was also seen on *Lettuce* and the germination percentage is shown in Figure 1



**Figure 1:** Effect of EO on Germination of *Lettuce*

This result showed us the effect of different Eos on *Lettuce*. The 300-ppm concentration of Eos of *Citrus limon*, *Eucalyptus tereticornis* and *Trachyspermum ammi* showed very less or no germination as compared to other plants. The control treatment shows 81.11% of germination percentage.

The result of Eos was also seen on weed *Amaranthus caudatus*. The results varies in different concentrations for different Eos. The control treatment on weeds seeds shows germination percentage of 83.33%.



**Figure 2:** Effect of Eos on Germination of Weed *Amaranthus Caudatus*

According to results, the 200ppm concentration of *Eucalyptus* EO has showed a decreased germination rate as compared to other concentrations. There is a very less difference in germination percentage with the treatment of 300ppm and 400ppm concentrations of Eos.

The 300ppm and 400ppm concentration of *Citrus limon* EO showed no germination and 100ppm and 200ppm concentration showed very less germination and both the concentrations showed the same result.

The 300 ppm and 400 ppm concentration of *Trachyspermum ammi* EO showed no germination in weed and 100 ppm and 200 ppm concentrations showed very less germination.

## V. CONCLUSION

The findings lead us to the conclusion that we can limit the undesirable productivity of weeds using 200 ppm concentrations of *Eucalyptus* EO, 300 ppm and 400 ppm concentrations of *Citrus limon* EO, and 300 ppm and 400 ppm concentrations of *Trachyspermum ammi* EO. These EO shows a significant difference in the germination of weeds.

However, we further need to develop some other techniques to ensure that the use of EOs doesn't negatively impact the primary crop.

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