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Allelopathic Effect of Eucalyptus (*Eucalyptus camaldulensis* Dehnh) on the Growth of Pumpkin Crop Plants

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ABSTRACT
Allelopathy is the process whereby a certain plant species secretes a particular biochemical into the environment, which might have a favorable or negative effect on another plant. Allelochemicals are substances that are expelled from plant components. The current experiment was conducted at Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala (Haryana), India during February to May, 2020. The present study revealed that the Eucalyptus camaldulensis infested soil significantly reduced growth of pumpkin plants. The result showed that the soil significantly decreased vine length, number of leaves and root length of crop. The maximum vine length 37 cm, leaves 11, root length 17.7cm and maximum size of leave 35x30cm were observed in without Eucalyptus infested soil; whereas with the Eucalyptus infested soil the maximum vine length 10 cm leaves 4, root length 4cm and maximum size of leave 10x8cm were observed. The numbers of leaves also reduced per plants in Eucalyptus infested soil. Thus the allelochemicals released from the Eucalyptus reduces the growth and productivity of pumpkin plants than, those cultivated in soil without Eucalyptus infestation. It is a pioneer report of Eucalyptus allelopathic potential on the growth of pumpkin which is one of the important vegetable crops and because of the nutritional and medicinal values, it is considered as important vegetable crop nowadays.

KEYWORDS: *Allelopathy, Allelochemicals, Pumpkin, Eucalyptus camaldulensis.*

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INTRODUCTION

Allelopathy is a chemical interaction between higher plants in which the allelochemicals produced by donor plants significantly changed and, in some situations, impeded the development of receiver plants (Zhang *et al*., 2024). Allelopathy, in which one plant influences the growth, survival, and reproduction of nearby plants, is thought to be a significant contributing cause to their quick spread (de Almeida *et al*., 2024). Plants produce biologically active molecules during this process, and the residue they leave behind may transform into various

forms and influence the growth of similar or dissimilar plants. True alleopathy, autoalleopathy, and functional alleopathy are the three primary categories of allelopathy. When a plant releases chemicals that impact another plant of a different species, this is known as interspecific chemical co-action, or true alleopathy. When a plant emits chemicals that can affect the growth, development, or survival of other plants in the same species, this is known as autoalleopathy, or intraspecific chemical co-action. One kind of allelopathy known as functional allelopathy occurs when the released molecules change from their initial state (Shan *et al*., 2023).

One genus in the Myrtaceae family, Eucalyptus (*Eucalyptus camaldulensis* Dehnh), is huge and grows quickly, reaching heights of 125–160 meters (Sani *et al*., 2014; Shayoub *et al*., 2015). It is brought to other nations from Australia to meet demand as a raw material for the plywood and paper industries (Cossalter and Pye-Smith, 2003). Eucalyptus may have detrimental effects on crops and native plant species. Eucalyptus competition causes crops to receive less light, water, and nutrients (Pérez-Bidegain *et al*., 2001; Dafaallah and El-Twom, 2017). By altering the pH of the soil, it also impacts the growth of other plants (Mubarak *et al*., 2011). Allelochemicals that it releases hinder the growth and productivity of species found in the understory (Moradshahi *et al*., 2003).

The pumpkin is one of the most significant vegetable crops. It is currently regarded as a significant vegetable crop due to its nutritional and therapeutic qualities (Abd EI-Aziz and EI-Kalek). The pumpkin, which is a member of the genus *Cucurbita* and family Cucurbitaceae, is also referred to as "Sitaphal," "Kashiphal," or "kaddu" in India. According to Jeffrey's most recent taxonomic taxonomy (1990), the Cucurbitaceae family comprises approximately 118 genera and 825 species. It includes *C. moschata, C. Pepo, C. Maxima, C. Mixta, C. Ficifolia* and *Telfairia occidentalis* as vegetable crops. Three of these, like *C. pepo* L., *C. maxima Duch.* and *C. moschata Duch*. are economically important species, have high production and cultivated worldwide (Whitaker and Davis, 1962; Taylor and Brant, 2002). *C. moschata* has a Central American origin, domesticated in Mexico at least c. 5000 B.C. and in Peru c. 3000 B.C., now widely distributed throughout the world.

Nutritional values

Around the world, pumpkin is grown for food and animal feed in regions with hot climates. In addition to them, the ripe fruits, young stems, and blossoms are eaten as vegetables and later utilized to make a variety of desserts. The protein, fat, and carbohydrate content of pumpkin seeds varies by region, ranging from 28–40%, 44–53%, and 7–10%. They are a notable source of both protein and oil (Achu, 2005). In addition to being eaten directly by people as a snack food, the seeds are also roasted or toasted and mashed into various stews (Al-Khalifa, 1996). According to Nwofia *et al*., (2012), pumpkins are a good source of iron, magnesium, phosphorus, potassium, copper, manganese, and other minerals. They contain high levels of thiamin, niacin, vitamin B6, have even higher levels of vitamin C and vitamin E and are also dominant fatty acids present in the oil like oleic acid of 29% and linoleic acid of 47% (Younis *et al*., 2000).

The present study explore the allelopathic of effects Eucalyptus on the growth and development of pumpkin. The authors conducted a field trial to examine the potential allelopathic effects of Eucalyptus infested soil with leaf litter and living roots on seedling survivorship of pumpkin.

MATERIALS AND METHODS

The experiment was conducted at the field of Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala (Haryana), India during June to August, 2021. Haryana is a landlocked state in North India and situated between Lat 27°39'–30°35' N; Lon 74°28'–77°36' E and Alt 200–1200 m MSL. The climate of experimental site ranged from arid to semi-arid with mean rainfall of 354.5mm. However, 29% of precipitation is received during rainy season, while remaining rainfall recorded during the winter period. The pumpkin is normally propagated through vegetative mode which is easy and convenient in cultivation. Therefore, well drained high land was selected for

cultivation, under the shade of 10 years old *Eucalyptus camaldulensis* plantations having proper sun light from south direction. A spacing of 1x1.5ft² between plants and 1x2 ft² among rows of plantation was followed along the control experimentation without Eucalyptus infested soil. The recorded data was enumerated through statistical tools.

RESULTS

The observation during the investigation was summarized in Table 1. The present study revealed that the *Eucalyptus camaldulensis* infested soil significantly reduced growth of pumpkin plants. The result showed that the soil significantly decreased vine length, number of leaves and root length of crop. The maximum vine length 37±2.3cm, number of leaves 11, root length 17.7±2.2 cm and maximum size of leave 35x30cm were reported in without Eucalyptus infested soil (Fig. 1); whereas with the Eucalyptus infested soil the maximum vine length 10±1.2cm, number of leaves 4, root length 9.0±1.2 and maximum size of leave 15 × 10cm were observed. The numbers of leaves also reduced per plants in Eucalyptus infested soil (Fig. 2). The numbers, length and width of leaves were also reduced per plants of pumpkin grown under the Eucalyptus shaded infested soil.

Table 1: Morphometry (Shoot Length, root Length and Number of leaves) of Pumpkin plant growing with and without Eucalyptus infested soil after 45 days.

S. No	without Eucalyptus infested soil				With Eucalyptus infested soil			
	Shoot Length (cm)	**No of leaves**	Root Length (cm)	Size of Leaves (cm)	Shoot Length (cm)	**No of leaves**	Root Length (cm)	Size of Leaves (cm)
1	33.6±2.2	10	16.5±2.3	30 × 25	10±1.2	5	6.5±0.6	15 × 10
2	25.5±1.5	8	12.6±1.6	25 × 20	15±1.6	4	5.0±0.8	12 × 8
3	28.6±1.7	9	13.3±1.3	30 × 25	12±1.3	5	7.8±1.1	17 × 12
4	37.7±2.3	11	15.5±1.8	35 × 30	17±1.7	4	4.0±0.5	10 × 8
5	35.5±1.5	10	17.7±2.2	32 × 25	14±1.4	4	9.0±1.2	14 × 9

Figure 1: Pumpkin plant growing without Eucalyptus infested soil.

Figure 2: Pumpkin plant growing with Eucalyptus infested soil.

DISCUSSION

This study revealed that the Eucalyptus infested soil significantly reduced growth of pumpkin plantations, in length, width and numbers of leaves (Fig.1). These findings were corroborated to the findings of Patil who reported the allelopathic effect of Eucalyptus on the germination and growth of maize, wheat and sorghum using greenhouse experiment (Patil *et al.,* 2002). Dafaallah and El-Twom, (2017) have also reported that, the integration of Eucalyptus leaf powder into soil significantly declined plant height, number of leaves and root length of seedlings. They concluded that Eucalyptus has allelopathic potential on seed germination and seedling growth. The phenolic acids and volatile oils of Eucalyptus leaves, bark and roots have injurious properties on other plant species (Sasikumar *et al.,* 2002; Florentine and Fox, 2003; Malik, 2004). More studies are required for extraction, purification and characterization of allelochemicals compounds from Eucalyptus plant to evaluate the targeted interaction with the pumpkin plants *in vitro* for the better propagation and cultivation of these economically important crops.

CONCLUSIONS

Allelopathy is a chemical interaction between higher plants in which the development of recipient (test) plants dramatically altered, and in certain cases, inhibited, by the allelochemicals produced by donor plants. The present study revealed that the *Eucalyptus camaldulensis* infested soil significantly decreased vine length, number of leaves and root length of pumpkin crop. Hence this type of soil not found suitable for farmers to cultivate the pumpkins.

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