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Allelopathic Effect of *Eucalyptus camaldulensis* Aqueous Extract on the Growth Rate of *Arachis hypogaea*

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Abstract

Laboratory and nursery experiments were conducted to investigate the allelopathic effects of Eucalyptus camaldulensis on growth parameters (seedling height, girth and number of leaves) of Arachis hypogaea (groundnut). Aqueous leaf extracts of Eucalyptus (cold and hot water solutions) were used at different rates (0%, 25%, 50% and 100%) as treatment to determine their effects on seedling height, girth and number of leaves of groundnut plant in both outdoor (nursery) and indoor (laboratory) conditions. The aqueous extract was formed by dissolving leaf powder of dried Eucalyptus (0g, 25g, 50g and 100g) in 1 liter of cold and another been boiled to get hot water extract. The aqueous extract of different concentrations of cold and hot water mixture showed allelopathic effects on the growth parameters of Arachis hypogaea. The inhibitory effects were more pronounced in the indoor (laboratory) experiment than the outdoor (nursery experiment) experiment. Hot Eucalyptus aqueous extract inhibited the groundnut growth rate compared to the cold aqueous extract. The study concluded that Eucalyptus camaldulensis has allelopathic potential which can negatively impact groundnut production. Therefore, it is recommended that Arachis hypogea should not be planted in association with Eucalyptus camaldulensis trees due to its inhibitory effects (Allelopathy) on the growth of the plant species.

Keywords: *Eucalyptus camaldulensis*, Alllelopathy, *Arachis hypogaea*

Introduction: Allelopathy is a biological phenomenon where one plant affects another plants through the release of biochemical's (known as allelochemicals) through leachates, root exudation, volatilization and residue decomposition in both natural and agricultural systems (Gupta, Thakur & Das, 2007). These, allelopathic substances inhibit the growth and germination of neighbouring plant species and these allelochemicals can be found in various parts of a tree plant, in the flowers, roots, tree back, and also in the leaves (Kato-Noguchi, 2021). The phenomenon (Allelopathy) has both positive (beneficial) and negative (harmful) effects, negatively it causes auto toxicity, soil sickness, and it hinders or inhibits the growth and germination of receptor plants, positively it helps in the control of pests and diseases in plant (Bachheti, Sharma, Bacheti, Husen & Pandey, 2020; Nyong, *et al*.,2023). Furthermore, the negative impact of allelopathic trees on adjacent agricultural crops, resulting from the release of allelochemicals into the environment through leaching by dews or rain, litter decomposition, roots exudation or direct volatilization, has become a pressing concern in recent times, particularly with the growing recognition of agro forestry as a separate discipline (Oyun, 2006).

The issue of allelopathy on inhibiting the growth of plants or agricultural crops is alarming (Chu, Mortimer, Wang, Wang, Liu & Yu, 2014). Often, poor harvest performance is attributed to the soil or seed quality, but another significant factor is allelopathy. This can lead to decreased biodiversity (Chu et al., 2014). Unaware of this, farmers may intentionally or unintentionally plant harmful tree species, such as *Eucalyptus camaldulensis*, which contains allelochemicals that negatively impact nearby crops. As a result, these trees can harm agricultural productivity and biodiversity, Nyong, *et al*.,2023) . Similar studies have found that inhibitory effects of *Eucalyptus camaldulensis* depends on the

level of concentration of the extract and litter fall with higher concentration of materials having higher effects and vice versa (Ahmed, Hoque & Hossain, 2008; Nyong, *et al*.,2023). Now *Eucalyptus camaldulensis* being the target tree of this research is widely distributed in the study area, and the effect of the allelochemicals present in the tree is very high, but the rate of the effects are unknown. So the rate of these effects is investigated. The aim of this research is to investigate the allelopathic effects of *Eucalyptus camaldulensis* on the growth rate of *Arachis hypogaea* while the specific objectives of the study are; to investigate the rate of the inhibitory effects of aqueous extracts of *Eucalyptus camaldulensis* on groundnut at different levels of concentrations, to determine the effects of cold and hot *Eucalyptus camaldulensis* aqueous extracts preparation on the growth performance of *Arachis hypogaea* and to compare the effect of outdoor and indoor experiment on the growth rate of *Arachis hypogaea*. Nyong, and Nweze,, 2012.

Materials and methods: Description of the study area: The experiment was conducted at Aliko Dangote University of science and Technology Wudil. The area is located on Latitude $11^0$51'N and Longitude $9^0$20' E at an altitude of 430m above sea level. The mean annual rainfall is 800mm with relative humidity of 75% during the rainy season with a mean annual temperature of 26^0C (Olofin, Nabegu & Dambazau, 2008).

Experimental procedures: The leaves were dried under a shed, and then ground into a powder. Three different amounts of the powdered leaves (25g, 50g, and 100g) were dissolved in 1000ml (1 liter) of water, respectively. The extract was prepared in two ways. In the first method the extract was heated on a low heat and in the second method the leaf powder was soaked in water for two days. After preparation, the results were filtered using a cotton cloth, and the extract was stored for further use. The experiment consisted of two phases: an outdoor phase conducted at the Department of Forestry and Wildlife Management nursery, and the indoor phase conducted in the department's laboratory. In each phase, 70 polythene bags were used, with 30 bags allocated to each treatment (cold water and hot water) and 10 bags serving as controls (0%). Within each treatment (cold and hot), 10 bags were assigned to each concentration level (25%, 50%, and 100%). The polythene bags were filled with a mixture of soil and organic manure (cow dung) in a 3:1 ratio. The mixture was watered for seven days to allow it to stabilize. Seeds were planted at the same time and depth (5-7 cm). Treatments were applied starting from the next day, and readings were taken accordingly.

Experimental design and treatment: The experiment was conducted using a Randomized Complete Block Design (RCBD), with two treatment factors (cold water and boiled water) and four concentration levels of *Eucalyptus camaldulensis* aqueous solution (0%, 25%, 50%, and 100%). This design allowed for the evaluation of the effects of both treatment factors and concentration levels on the experimental outcomes.

Data collection: The growth rate was assessed by measuring shoot length (cm), girth (cm), and number of leaves for a period of five (5) weeks.

Statistical analysis: The analysis of variance (ANOVA) was conducted to determine the variability among the treatments. Statistical Analysis System (SAS) software (version 9) was used for the analysis. Means were compared using a Least Significant Difference (LSD) at 5% level of significance.

Results and discussion

Seedling height (outdoor experiment): Effects of *E. camaldulensis* on seedling height (Hot treatment): Table 1 presents the seedling height values of *Arachis hypogaea* in an outdoor (nursery) experiment, recorded over four weeks, treated with a hot water mixture of aqueous extract of *E. camaldulensis*. The results reveal a significant difference ($P<0.05$). In (WAS 2, 3,4 and 5) the highest plant height was observed in T1 (control) (5.44cm, 10.80cm, 16.32cm and 21.76cm) respectively, followed by T3 (4.12cm, 8.20cm, 12.34cmand 16.42cm), then T4 (3.75cm, 7.48cm, 11.10cm and 15.00cm) and the lowest height value was observed at T2 (3.03cm, 6.06cm, 8.99cm and 12.76cm) respectively. The findings are in line with the research of Wasihun (2012) that showed *E. camaldulensis* has inhibitory effect on the shoot length of some arable crops when compared to the control.

Effects of *E. camaldulensis* on seedling height (Cold treatment): According to Table 1 below, the outdoor experiment using cold *Eucalyptus* aqueous solution showed a significant difference (P<0.05) between the treatments. In (WAS 2, 3,4 and 5) the highest plant height was recorded in T1 (control) (5.44cm, 10.88cm, 16.32cm and 21.76cm) respectively, followed by T2 (3.97cm, 7.94cm, 11.91cm and 15.43cm), then T4 (3.95cm, 7.74cm, 11.54cm and 15.48cm) and the lowest height value was observed at T3 (3.86cm, 7.72cm, 11.58cm and 15.44cm) respectively. However, in week 4 cold treatment, T3 (11.58cm) happened to be higher than T4 (11.54cm) and in week 5, T4 (15.48cm) recorded higher than T3 (15.44cm) and T2 (cold) (15.43cm). From the results obtained, the irregularities recorded could be due to the interference of rainfall. Comparing between cold and hot water, there was no noticeable difference in terms of inhibitory effect as *E. camaldulensis* reduces the seedling height of *Arachis hypogaea* compared to controls which is in line with the findings of (Wasihun, 2012; Nyong, and Nweze,, 2012)

Table 1: Shows the seedlings height of the outdoor (Hot and Cold treatment) experimentation

	Hot treatment (WAS 2-5)				Cold treatment (WAS 2-5)			
Treatment	**WAS 2**	**WAS 3**	**WAS 4**	**WAS 5**	**WAS2**	**WAS 3**	**WAS 4**	**WAS 5**
T1 (0%)	5.440^{a}	10.890^{a}	16.320^{a}	21.760^{a}	5.440^{a}	10.880^{a}	16.320^{a}	21.760^{a}
T2 (25%)	3.030^{c}	6.060^{c}	8.990^{c}	12.120^{c}	3.970^{b}	7.940^{b}	11.910^{b}	15.430^{b}
T3 (50%)	4.120^{b}	8.200^{b}	12.340^{b}	16.420^{b}	3.860^{b}	7.720^{b}	11.580^{b}	15.440^{b}
T4 (100%)	3.750^{bc}	7.480^{bc}	11.110^{bc}	15.00^{bc}	3.950^{b}	7.740^{b}	11.540^{b}	15.480^{b}
LSD (5%)	0.0001	0.0001	<.0001	0.0001	<.0001	<.0001	<.0001	<.0001

Data with different superscripts are significantly different (p<0.05). Note: WAS means week after sowing.

Seedling girth: **Effects of *E. camaldulensis* on seedling girth (Hot treatment)**: The table 2 below shows the seedlings girth values of *A. hypogaea* in an outdoor (nursery) experiment recorded for four weeks using hot aqueous extract of *E. camaldulensis*. The result showed a significant (P<0.05) difference. In (WAS2, 3,4 and 5) the widest plant girth was observed in T1 (control) (1.81cm, 1.89cm, 2.03cm and 2.17cm) respectively, followed by T3 (1.50cm, 1.22cm, 1.54cm and 1.62cm), then T4 (1.25cm, 1.18cm, 1.37cm and 1.47cm) and the thinnest girth value was observed at T2 (1.10cm, 1.09cm, 1.13cm and 1.07cm) respectively. The reduction in plant girth in the treatments as compared to control is in line with the findings ;of Rao and Reddy (1984); Nyong, and Nweze,, 2012), which showed the inhibitory effect *E.* camaldulensis on growth rate of some legumes.

Effects of *E. camaldulensis* on seedling girth (Cold treatment): Table 2 below presents the outdoor experiment seedlings values of *Eucalyptus* girth under cold aqueous mixture, there was significant (P<0.05) difference the treatment values in the weeks. In (WAS 2, 3,4 and 5) the widest plant girth was observed in T1 (control) (1.81cm, 1.95cm, 2.20cm and 2.20cm) respectively, followed by T3 (1.62cm, 1.51cm, 1.54cm and 1.52cm), then T2 (1.35cm, 1.42cm, 2.60cm and 1.47cm) and the thinnest girth value was observed at T4 (1.28cm, 1.37cm, 1.37cm and 1.51cm) respectively. However, in week 4, T2 (2.60cm) happened to be wider than T1 (2.20cm) and T3 (1.54cm). Also, in week 5, T4 (1.51cm) is wider than T2 (1.47cm). From the results obtained, the irregularities recorded could be due to the interference of rainfall. Between the cold and hot water extract mixture, there was no noticeable difference. Similarly, the reduction in plant girth in the treatments as compared to control is in line with the findings of Rao and Reddy (1984); Nyong, and Nweze,, 2012) which showed the inhibitory effect *E. camaldulensis* on growth rate of some legumes.

Table 2: Shows the seedlings girth of the outdoor (Hot and Cold treatment) for four weeks

	Hot treatment (WAS 2-5)				Cold treatment (WAS 2-5)			
Treatment	**WAS 2**	**WAS3**	**WAS 4**	**WAS5**	**WAS2**	**WAS3**	**WAS4**	**WAS5**
T1 (0%)	1.810[a]	1.890[a]	2.030[a]	2.170[a]	1.810[a]	1.950[a]	2.200[a]	2.200[a]
T2 (25%)	1.100[c]	1.090[b]	1.130[c]	1.070[c]	1.350[b]	1.420[b]	2.600[a]	1.470[b]
T3 (50%)	1.500[ab]	1.220[b]	1.540[b]	1.620[b]	1.620[a]	1.510[b]	1.540[a]	1.510[b]
T4 (100%)	1.250[bc]	1.180[b]	1.370[bc]	1.470[b]	1.280[b]	1.370[b]	1.370[a]	1.510[b]
LSD (5%)	0.0006	0.0001	<.0001	<.0001	<.0001	<.0001	0.6323	<.0001

Data with different superscripts are significantly different (p<0.05). Note: WAS means week after sowing.

Number of leaves: Effects of *E. camaldulensis* on seedling number of leaves (Hot treatment): The table 3 below shows the outdoor values for the number of leaves of *Arachis hypogaea* recorded for four weeks using aqueous extract (hot) of *Eucalyptus camaldulensis*. Significant (P<0.05) difference was observed among the treatments. In (WAS 2, 3, 4 and 5) the highest number of leaves was observed in T1 (control) (20.80, 41.60, 62.42 and 83.20) respectively, followed by T3 (10.40, 20.80, 31.20 and 41.69), then least was observed in T2 and T4 (9.20, 18.40, 27.60 and 36.80) where both are the same. The reduction in number of leaves in the treatments as compared to the control is in agreement with the findings of Bhaskar, Arali and Shankar, (1992); Nyong, and Nweze,, 2012), that showed the inhibitory effect of *Eucalyptus* on number of leaves of legumes.

Effects of *E. camaldulensis* on seedling number of leaves (Cold treatment): Table 3 below presents the seedlings values under outdoor experiment for the number of leaves using cold *Eucalyptus* aqueous extract, the result showed a significant (P<0.05) difference in the number of leaves across all the treatment. In (WAS 2, 3, 4 and 5) the highest number of leaves was observed in T1 (control) (20.80, 41.40, 62.40 and 83.20) respectively, followed by T2 (19.60, 39.20, 58.80 and 78.40), then T3 (14.80, 29.60, 44.40, 59.20) and the least was observed in T4 (13.70, 27.80, 41.20 and 54.80). The finding is similar to that of Wasihun (2015), which stated that all the treatments levels of *Eucalyptus camaldulensis* significantly reduced the growth of maize and haricot beans except for that of 10g which is 10% extract. Similarly, the reduction in number of leaves in the treatments as compared to the control is in agreement with the findings of Bhaskar et al. (1992); Nyong, and Nweze,, 2012) that showed the inhibitory effect of *Eucalyptus* on some number of leaves of legumes.

Table 3: Shows the seedlings number of leaves outdoor (Hot and Cold treatment) for four weeks

	Hot treatment (WAS 2-5)				Cold treatment (WAS 2-5)			
Treatment	**WAS 2**	**WAS 3**	**WAS 4**	**WAS 5**	**WAS 2**	**WAS 3**	**WAS 4**	**WAS 5**
T1 (0%)	20.800[a]	41.600[a]	62.400[a]	83.200[a]	20.800[a]	41.400[a]	62.400[a]	83.200[a]
T2 (25%)	9.200[b]	18.400[b]	27.600[b]	36.800[b]	19.600[a]	39.200[a]	58.800[a]	78.400[a]
T3 (50%)	10.400[b]	20.800[b]	31.200[b]	41.600[b]	14.800[b]	29.600[b]	44.400[b]	59.200[b]
T4 (100%)	9.200[b]	18.400[b]	27.600[b]	36.800[b]	13.700[b]	27.800[b]	41.200[b]	54.800[b]
LSD (5%)	<.0001	<.0001	<.0001	<.0001	0.0089	0.0111	0.0093	0.0089

Data with different superscripts are significantly different (p<0.05).Note: WAS means week after sowing.

Seedling height (indoor experiment): Effects of *E. camaldulensis* on seedling height (Hot treatment): The table below shows the indoor seedlings height values of *Arachis hypogaea* recorded for four weeks using aqueous extract (hot). Significant ($p<0.05$) difference was recorded across the four weeks. In (WAS 2, 3, 4 and 5) the highest plant height was observed in T1 (control) (8.63cm, 19.06cm, 25.33cm and 30.04cm) respectively, followed by T2 (3.11cm, 5.31cm, 5.52cm and 9.45cm), then T3 (3.17cm, 4.33cm, 4.91cm and 7.98cm) and the lowest height value was observed at T4 (1.14cm, 2.74cm, 2.96cm and 5.56cm) respectively. However, in week 2, T3 (3.17cm) is higher than T1 (3.11cm) and this could be due to variation in measurement. The finding is similar to the research conducted by Faroz, Rao & Manta, (2013) ; Nyong, and Nweze,, 2012) that stated that 100% concentration of *Eucalyptus* extract had the most significant effect on plant growth compared to lower concentrations.

Effects of *Eucalyptus camaldulensis* on seedling height (Cold treatment): The data in the table 4 below illustrates the plant height values for the cold mixture treatment across four weeks. Statistical analysis revealed significant differences ($P<0.05$) in plant height between treatments across the weeks, indicating a clear effect of the treatments on plant growth. The control treatment (T1) consistently demonstrated the highest plant height at each week, with values of (8.63cm, 19.06cm, 25.33cm, and 30.03cm) followed by T2 (3.11cm, 5.31cm, 5.52cm and 9.45cm), then T3 (3.17cm, 4.33cm, 4.91cm and 7.98cm) and in contrast, T4 exhibited the lowest plant height values, with values of (1.75cm, 2.72cm, 5.40cm, and 8.46cm) for weeks 2, 3, 4 and 5, respectively. Notably, the control treatment (T1) showed the highest overall plant height, aligning with the findings of Faroz et al. (2013),;Nyong, *et al*.,2023) which demonstrated that a 100% concentration of Eucalyptus extract had the most significant effect on plant growth compared to lower concentrations.

Table 4: Shows the seedlings height of the indoor (Hot and Cold treatment) for four weeks

	Hot treatment (WAS2-5)				Cold treatment (WAS2-5)			
Treatment	**WAS2**	**WAS 3**	**WAS 4**	**WAS 5**	**WAS2**	**WAS 3**	**WAS 4**	**WAS 5**
T1 (0%)	8.630^{a}	19.060^{a}	25.330^{a}	30.040^{a}	8.630^{a}	19.060^{a}	25.330^{a}	30.030^{a}
T2 (25%)	3.110^{b}	5.310^{b}	5.520^{b}	9.450^{b}	4.260^{b}	6.190^{b}	7.470^{b}	10.230^{b}
T3 (50%)	3.170^{b}	4.330^{b}	4.910^{b}	7.980^{b}	2.620^{b}	4.130^{b}	5.450^{b}	8.480^{b}
T4 (100%)	1.140^{b}	2.740^{b}	2.960^{b}	5.560^{b}	1.750^{b}	2.720^{b}	5.400^{b}	8.460^{b}
LSD (5%)	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

Data with different superscripts are significantly different ($p<0.05$). Note: WAS means week after sowing.

Seedling girth: **Effects of *E. camaldulensis* on seedling girth (Hot treatment)**: Table 5 below presents the indoor seedlings girth values recorded for four weeks using hot *Eucalyptus* aqueous extract. The result showed significant ($P<0.05$) difference between the treatments except in (WAS 3) under hot treatment that shows no significant difference ($P\geq0.05$). The highest and lowest girth values were recorded in T1 (0.90cm, 1.31cm, 1.73cm and 1.80cm) and T4 (0.26cm, 0.67cm, 0.77cm, 0.86cm), (WAS 2, 3, 4 and 5) respectively. This result is similar to the findings of Lisanework and Michelson (1993); Nyong, *et al*.,2023), that noted a decrease in germination of maize due to applied *Eucalyptus globulus* and *Eucalyptus camaldulensis* extracts.

Effects of *E. camaldulensis* on seedling girth (Cold treatment): The table 5 below presents the indoor seedlings girth values of *Arachis hypogaea* as influenced by cold *Eucalyptus* aqueous extract. The result showed significant ($P<0.05$) difference between the treatments except in (WAS 2) under cold treatment

that shows no significant difference (P≥0.05). The highest girth value was recorded in T1 (control) (0.91cm, 1.27cm, 1.73cm and 1.80cm) the lowest girth value was recorded in T4 (0.53cm, 0.67cm 0.86cm and 0.94cm) in (WAS 2, 3, 4 and 5). Similarly, this research is in line with the findings of Lisanework and Michelson (1993 Nyong, *et al*.,2023), that noted a decrease in germination of maize due to applied *Eucalyptus globulus* and *Eucalyptus camaldulensis* extracts.

Table 5: Shows the seedlings girth of the indoor (hot and cold treatment) for four weeks

	Hot treatment (WAS2-5)				Cold treatment (WAS2-5)			
Treatment	**WAS2**	**WAS3**	**WAS4**	**WAS5**	**WAS2**	**WAS3**	**WAS4**	**WAS5**
T1 (0%)	0.900^{a}	1.310^{a}	1.730^{a}	1.800^{a}	0.910^{a}	1.270^{a}	1.730^{a}	1.800^{a}
T2 (25%)	0.810^{a}	1.310^{ab}	0.960^{b}	1.090^{b}	0.710^{a}	0.800^{b}	0.930^{b}	1.270^{b}
T3 (50%)	0.530^{ab}	1.050^{ab}	1.040^{b}	1.130^{b}	0.620^{a}	0.680^{b}	0.860^{b}	1.110^{b}
T4 (100%)	0.260^{b}	0.670^{b}	0.770^{b}	0.860^{b}	0.530^{a}	0.670^{b}	0.860^{b}	0.940^{b}
LSD (5%)	0.0107	0.0522	0.0001	0.0001	0.2811	0.0194	0.0009	0.0001

Data with different superscripts are significantly different (p<0.05). Note: WAS means week after sowing.

Number of leaves: **Effects *E. camaldulensis* on seedling number of leaves (Hot treatment)**: The table below shows the indoor seedlings number of leaves values recorded for four weeks with hot *Eucalyptus* aqueous extract. There was significant (p<0.05) difference in all the treatment values recorded across the four weeks, WAS (2, 3, 4and 5). The highest number of leaves was observed in T1 (control) across the four weeks as (11.2, 31.2, 44.8 and 60.4) respectively, while the least value was recorded in T4 (2.4, 11.2, 17.6 and 20) respectively. The results validate the findings of Ebrahim, Mohammad & Mustafa, (1999) and Khan, Hussain & Khan, (2007) ; Nyong, *et al*.,2023), that reported leaf extract of *Eucalyptus microthecia* delayed and inhibited the growth of some arable crops.

Effects *E. camaldulensis* on seedling number of leaves (Cold treatment): The table 6 below shows the indoor seedlings number of leaves of *Arachis hypogaea* as influenced by cold *Eucalyptus* aqueous extract. The result showed significant (p<0.05) difference between the treatments across the four weeks of the experimentation. In WAS 2, 3, 4 and 5, T1 (control) (11.2, 31.2, 42.0 and 60.4) recorded the highest value for number of leaves while T4 (3, 12.4, 20.0 and 20.8) recorded the least value for number of leaves across the four weeks. This is similar to the findings of Lisanework and Michelson (1993); Nyong, *et al*.,2023) who noted a decrease in germination of arable crops due to the effects of *Eucalyptus globulus* and *Eucalyptus camaldulensis* extracts.

Table 6: Shows the seedlings number of leaves for the indoor (Hot and Cold treatment) for four weeks

	Hot treatment (WAS 2-5)				Cold treatment (WAS 2-5)			
Treatment	**WAS 2**	**WAS 3**	**WAS 4**	**WAS 5**	**WAS 2**	**WAS3**	**WAS 4**	**WAS 5**
T1 (0%)	11.200^{a}	31.200^{a}	44.800^{a}	60.400^{a}	11.200^{a}	31.200^{a}	42.00^{a}	60.400^{a}
T2 (25%)	6.400^{b}	21.600^{b}	31.200^{b}	39.600^{b}	6.400^{b}	21.200^{ab}	25.200^{b}	36.000^{b}
T3 (50%)	6.800^{ab}	18.00^{bc}	23.200^{bc}	29.200^{c}	6.00^{b}	12.800^{b}	17.600^{b}	25.000^{c}
T4 (100%)	2.400^{b}	11.200^{c}	17.600^{c}	20.00^{c}	3.00^{b}	12.400^{b}	20.000^{b}	20.800^{c}
LSD (5%)	0.0038	0.0010	<.0001	<.0001	0.0045	0.0017	0.0011	<.0001

Data with different superscripts are significantly different (p<0.05). Note: WAS means week after sowing.

Correlation for outdoor experiment (Hot treatment): The table below shows the correlation coefficient for the outdoor experiment (hot). The correlation coefficient depicted that the height positively correlated with the number of leaves (0.92) and also positively correlated with the girth (0.120), which means that as the height increases the number of leaves and girth tends to increase also. The correlation coefficient for the number of leaves and the height shows a positive relationship as (0.972), and negatively correlated with the girth (-0.008), it means that as the leaves increase in number the girth decreases. The correlation coefficient between the girth and the height is positive (0.709) and also positive with the number of leaves meaning that as the girth increases the number of leaves and height also increases. Nyong, *et al*.,2023)

Table 7: Correlation analysis for outdoor (Hot treatment) experiment

	Height	No of leaves	Girth
Height	1	0.92	0.120
No of leaves	0.972	1	-0.008
Girth	0.709	0.980	1

Correlation for outdoor experiment (Cold treatment): The table below shows the correlation coefficient of the outdoor experiment (cold). The correlation coefficient of the heights positively correlated with the number of leaves (0.927), but negatively correlated with the girth (-0.266), meaning that as the height and the number of leaves were increasing the girth reduced. The number of leaves is positively related to the height (0.927) but negatively correlated with the girth (-0.422). The girth is negatively correlated with the height (-0.266) and also negatively correlated with the number of leaves (-0.422), meaning that as the girth reduces the height and the number of leaves also reduces. Nyong, *et al*.,2023)

Table 8: Correlation analysis for outdoor (Cold treatment) experiment

	Height	No of leaves	Girth
Height	**1**	**0.927**	**-0.266**
No of leaves	**0.927**	**1**	**-0.422**
Girth	**-0.266**	**-0.422**	**1**

Correlation for indoor experiment (Hot treatment): The correlation coefficient table for the indoor experiment (hot) reveals positive correlations between the plant height, number of leaves, and girth. The Height is positively correlated with the number of leaves (0.962) and girth (0.915), indicating that as height increases, both the number of leaves and girth also tend to increase. The number of leaves is strongly positively correlated with height (0.962) and girth (0.900), suggesting that an increase in the number of leaves is associated with increases in both height and girth. The Girth is positively correlated with height (0.915) and number of leaves (0.900), indicating that an increase in girth is associated with increases in both height and the number of leaves. Nyong, *et al*.,2023). Overall, these positive correlations suggest that all three parameters (height, number of leaves, and girth) tend to increase together, indicating a strong relationship between them

Table 9: Correlation analysis for the indoor (Hot treatment) experiment

Height	No of leaves	Girth
1	0.962	0.915
0.962	1	0.900
0.915	0.900	1

Correlation for indoor experiment (Cold treatment): The table below showed the correlation coefficient of the indoor experiment (cold). The correlation coefficient of the height is positively related to the number of leaves (0.964) and also positively correlated with the girth (0.885); this means that as the height increases the number of leaves and the girth tend to also increase. The correlation coefficient between the number of leaves and the height is positive (0.964) and is also positive with the girth which is (0.847). Same goes for the girth also, the correlation coefficient of the girth and the height is positive (0.885) and is also positive with the number of leaves (0.847), this means that as the girth increases the number of leaves and the height also increases. Nyong, *et al*.,2023)

Table 10: Correlation analysis for the indoor (Cold treatment) experiment

	Height	No of leaves	Girth
Height	1	0.964	0.885
No of leaves	0.964	1	0.847
Girth	0.885	0.847	1

Conclusion: *Eucalyptus* species is claimed that it is notorious for having allelopathic effect on the growth of agricultural crops in its vicinity. Generally, the indoor (laboratory) experiment inhibited the growth performance of the groundnut more compared to the outdoor (nursery experiment) experiment. Moreover, hot *Eucalyptus* aqueous extract inhibited the groundnut growth rate more compared to the cold aqueous solution. Conclusively, the allelochemicals present in the aqueous extract of *Eucalyptus camaldulensis* suppressed all the parameters measured (height, girth and number of leaves) in the crop specie studied and thereby increased inhibition with the increase of concentrations of the extract. This finding proves the alllelopathic effect of *Eucalyptus camaldulensis* on the growth performance of groundnut.

Recommendation: It is recommended that groundnut (*Arachis hypogaea*) should not be planted close to or in association with *Eucalyptus camaldulensis* trees due to the effects (Allelopathy) on the growth of the plant species. There is need to provide information to Farmers about the dangers of *Eucalyptus* species on their farms because of its allelopathic effects on agricultural crops.; Strategies should be developed so as to mitigate the negative impact of *Eucalyptus camaldulensis* alllelopathy of groundnut production.**;** and Further research should be conducted the potential uses of *Eucalyptus camaldulensis* allelochemicals in pest and disease management.

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