زانکۆی سەلاحەدین - هەولێر
Salahaddin University-Erbil

Exploring the Rooting Potential of ZZ Plant (*Zamioculcas zamiifolia*) Leaflet Cuttings through Aloe Vera Gel (ALG)

Research Project

Submitted to the department of Horticulture in partial fulfillment of the requirements for the degree of BSc. in Horticultural plants

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SUPERVISOR CERTIFICATE

This research project entitled: "**Exploring the Rooting Potential of ZZ Plant (*Zamioculcas zamiifolia*) Leaflet Cuttings through Aloe Vera Gel (ALG)"** has been written under my supervision and has been submitted for the award of the degree of Bachelor of Science of Horticultural plants with my approval as a supervisor.

Signature 

Supervisor**: Dr. Media Ezzaddin MohammedAmin**

Date: 03/30/2024

I confirm that all the requirements have been fulfilled.

Abstract

This study was conducted in the green house of Naz-naz Nursery, to look into the impact of ALG extract concentrations and duration of immersion the leaflet cuttings on the root growth of Zambia plant, from October 15th, 2023, until March 19th, 2024. Two experiments were done for discovering the optimum concentration of ALG and four time of duration of immersion in ALG (0, 2,4 and 6 minutes) were tested for each experiment to select the proper one for the root growth. Results demonstrated that there was an increase in root growth parameters when lower concentration of ALG was used at the lower times duration of immersion in ALG.

1. Introduction:

ZZ plant or Zambia *Zamioculcas zamiifolia*, is a plant in the Araceae family or Arum family, a recent addition to the ecosystem of indoor plants and has become extremely popular for its attractive foliage and low maintenance requirements. Leaflet cuttings can be utilized to grow ZZ plants, which makes it an effective and inexpensive method for growers to expand their collections and meet market demands. However, Understanding the physiological mechanisms involved in rooting leaf cuttings and using the right strategies to encourage root growth are essential for effective propagation (Costa *et al*., 2017).

In horticulture, cutting-based plant propagation is a commonly used method that provides an effective way to multiply desired plant species. An interesting study option is to increase the success rate of ZZ plant leaflet cuttings by using natural rooting agents (Jung *et al*., 2015). According to

Lopez *et al*. (2009), *Z. zamiifolia* is grown via leaf cuttings, and the ideal medium is often a well-drained, friable combination (Wong, 2009).

Studies conducted on plant physiology have revealed how endogenous hormones control root architecture (Liu *et al*., 2017). Developing efficient propagation systems requires an understanding of these physiological reactions.

Certainly, because ALG has so many beneficial properties, including stimulating root development and feeding the plants, it is frequently used as a natural rooting hormone to improve the rooting of cuttings. The numerous biological properties of ALG, which is made from the plant's leaves, have long been known. Auxins, gibberellins, and polysaccharides (bioactive chemicals found in the gel) have been linked to Aloe vera's capacity to promote root formation in previous research (Kulkarni & Street, 2019). Additionally, Aloe vera has been shown to be useful in a variety of applications (Grace *et al*., 2009), which highlights its potential as a helpful supplement in horticulture techniques. A thorough investigation of the interactions between ZZ plant cuttings and Aloe vera gel extract is made possible by the coupling of these findings with the theories and methods of plant propagation (Hartmann *et al*., 2011).

In order to provide a solid scientific foundation for enhancing horticultural propagation methods, this study intends to expand on current knowledge by examining the synergistic effects of Zambia leaflet cuttings and ALG extract.

2. Materials and Methods:

2.1. Materials:

Sterilized sharp blade, sterilized sharp scissor, Spoon, electric blender, cylinder, conical flasks, petri dishes, ethanol 70%, 30 plastic pots (15 cm in diameter), two healthy ZZ plants (*Zamioculcas zamiifolia*), two mature Aloe vera (*Aloe barbadensis* miller) leaves, Peat moss and Perlite.

2.2. Methods:

The study was conducted in the green house of Naz-naz Nursery, located behind Rashad Mufti Mosque on Kirkuk Road- Erbil, Iraq, from October 15th, 2023, until March 19th, 2024.

To prepare leaflet cuttings, two robust *Zamioculcas zamiifolia* plants were chosen. ZZ plant leaflets are clipped at the base using sterile sharp scissors. Make careful to sanitize the scissors with 70% ethanol in between cuts.

To extract ALG, two mature Aloe vera leaves (*Aloe barbadensis* miller) were collected. After mature Aloe vera leaves were picked, they were cleaned with tap water to eliminate any impurities. A sharp, sterile blade was then used to cut off the outer covering of the leaves, extracting the gel and storing it in a sterile container.

Twenty-four (24) plastic pots were employed as experimental units and were filled with a 3:1 ratio of peat moss to perlite. According the two experiments which was based on the ALG concentrations (25 and 50%), the plastic pots were then divided into two groups each group contain (12 experimental units) with three replications in each group, four treatments were present in every replication concerning the duration of immersion of three

leaflet cuttings per pot in ALG for (0, 2, 4, and 6 minutes). After that ALG and tap water were combined to reach the desired concentrations, the nine leaflets of each time of duration of immersion were soaked in ALG for the two concentrations of it, and then, the leaflets were taken out of the solutions at the end of each treatment duration. The ZZ plant leaflets that had been treated were then placed in the pots. Accordingly, the pots were labeled.

2.3. Experimental Measurements

The following parameters were recorded for each treatment in the study:

- Pup diameter (mm): measured by Vernier
- The period required for “pup” formation (weeks).
- The number of roots per cutting (roots. Cutting^{-1}).
- Rooting percentage%:

The rooting percentage was computed using the following formula:

Rooting Percentage = (Number of Rooted Cuttings / Total Number of Cuttings Attempted) x 100

2.4. Data Collections

The data of rooting growth for the studied parameters were collected from nine leaflet cuttings for each treatment in each experiment.

2.5. Statistical Analysis

The Complete Randomized Design (CRD) was utilized for the statistical analysis of all data collected, and Duncan's Multiple Range Test was employed at 0.05 probability to compare the means of immersion duration in ALG (Al-Rawi and Khalafalla, 2000), However, using "Levene's Test for Equality of Variances," the means for the two experiments of ALG

concentrations were compared using a T-test at a 0.05 probability level. Version 18.0 of the statistical program for social sciences (SPSS) was used to analyze the data.

3. Results and Discussion

3.1. Results

3.1.1. The impact of ALG concentrations on the rooting parameters of leaflet cuttings of *Zamioculcas zamiifolia*

Results in table (1) shows the effect of ALG concentrations on the rooting parameters of leaflet cuttings of *Zamioculcas zamiifolia*. The analysis of variance indicated that only pup diameter showed significant difference between the three parameters presence in the table (1).

Table 1: The impact of ALG concentrations on the rooting parameters of leaflet cuttings of *Zamioculcas zamiifolia*

ALG concentrations (%)	Rooting Parameters		
	Pup diameter (mm)	The period required for Pup formation (weeks)	No. of roots per cutting (Roots. Cutting^{-1})
25%	4.13	6.17	1.50
50%	4.49	5.81	1.53
p-value	**0.035**	**0.312**	**0.938**

* Means statistically significant difference of P<0.05 according to "Levene's Test for Equality of variances"

3.1.2. The impact of ALG concentrations on the rooting percentage of leaflet cuttings of *Zamioculcas zamiifolia*

Figure (1) displays the impact of ALG concentrations on the rooting percentage of leaflet cuttings of *Zamioculcas zamiifolia*. It was demonstrated that the first experiment when (25%) ALG was used for immersion, had recorded the highest rooting percentage (56%).

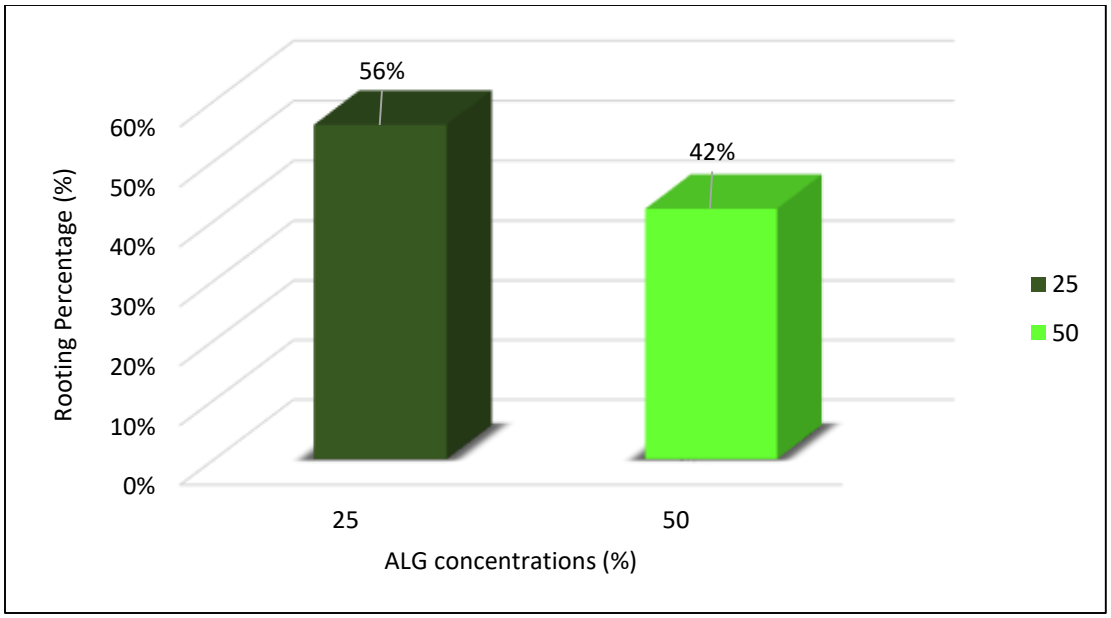

Figure 1. The impact of ALG concentrations on the rooting percentage of leaflet cuttings of *Zamioculcas zamiifolia*

3.1.3. The impact of duration of immersion the leaflet cuttings in ALG on the rooting parameters of *Zamioculcas zamiifolia*

It was observed that the highest pup diameter (4.63 mm) was obtained when the leaflet cuttings of Zambia plant treated with ALG for (0 and 2 minutes) and there were no significant differences between them and the other treatments. The period required for pup formation was significantly affected with the duration of immersion the leaflet cuttings in ALG which the shortest period that required for pup formation (4.22 weeks) was recorded by control treatment. For the number of roots per cutting significant variation was noted with the duration of immersion the cuttings in ALG. The maximum number of roots per cutting (2.94 roots. cutting^{-1}) was gained when there was no immersion in ALG (Table 2).

Table 2: The impact of duration of immersion the leaflet cutting s in ALG on the rooting parameters of *Zamioculcas zamiifolia*

Duration of immersion the leaflet cuttings in ALG (mins.)	Rooting Parameters		
	Pup diameter (mm)	The period required for Pup formation (weeks)	No. of roots per cutting (Roots. Cutting^{-1})
0	4.63 a	4.22 d	2.94 a
2	4.63 a	5.78 c	1.67 b
4	4.36 b	6.56 b	0.89 c
6	4.58 ab	7.39 a	0.56 cd

*The values followed with the same letters are not significantly different from each other according to Duncan's Multiple Range Test at the (0.05) level.

3.1.4. The impact of duration of immersion the leaflet cuttings in ALG on the rooting percentage of *Zamioculcas zamiifolia*

It is obvious from the (Figure 2) that the control treatment of both concentrations of ALG (25% and 50%) recorded the highest rooting percentage (100% and 96%) comparing with the other treatments in both groups. Though, the rooting percentages for all (25%) treatments are higher than the (50%) treatment.

3.1.2. The impact of ALG concentrations and duration of immersion the leaflet cuttings in ALG on the rooting parameters of *Zamioculcas zamiifolia*

It is clear from (Table 3) that significant variation was noticed between the values of rooting parameters when ALG concentrations combined with the duration of immersion the leaflet cuttings in ALG.

The highest pup diameter (5.10 mm) was obtained from the control and there were no significant differences between it and the (25% ALG for 6 mins.) treatment also with (50% ALG for 4 mins) and (50% ALG for 6 mins.)

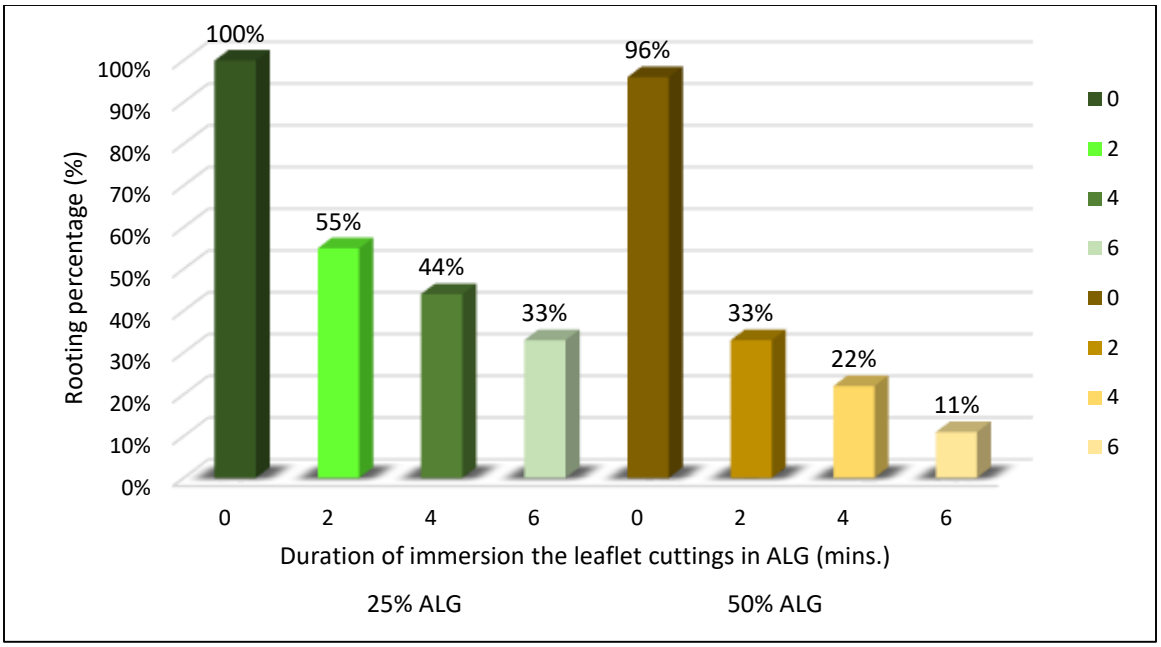

Figure 2: The impact of ALG concentrations and duration of immersion the leaflet cutting s in ALG on the rooting percentage of *Zamioculcas zamiifolia*

treatments. The shortest period required for pup formation (4.00 and 4.44 weeks) was observed from the control treatments. Also, the highest number of roots per cutting (3.22 roots. cutting^{-1}) was recorded with the control.

3.1.3. The impact of ALG concentrations and duration of immersion the leaflet cuttings in ALG on the rooting parameters of *Zamioculcas zamiifolia*

It is clear from (Table 3) that significant variation was noticed between the values of rooting parameters when ALG concentrations combined with the duration of immersion the leaflet cuttings in ALG.

The highest pup diameter (5.10 mm) was obtained from the control and there were no significant differences between it and the (25% ALG for 6 mins.) treatment also with (50% ALG for 4 mins) and (50% ALG for 6 mins.) treatments. The shortest period required for pup formation (4.00 and 4.44

weeks) was observed from the control treatments. Also, the highest number of roots per cutting (3.22 roots. cutting^{-1}) was recorded with the control (Figure 3).

Table 3: The impact of ALG concentrations and duration of immersion the leaflet cutting s in ALG on the rooting parameters of *Zamioculcas zamiifolia*

ALG concentrations (%)	Duration of immersion the leaflet cuttings in ALG (mins.)	Rooting Parameters		
		Pup diameter (mm)	The period required for Pup formation (weeks)	No. of roots per cutting (Roots. Cutting^{-1})
25%	0	4.16 b	4.44 bc	2.67 ab
	2	3.78 c	5.88 b	1.56 b
	4	4.07 b	6.78 ab	1.11 b
	6	4.51 ab	7.56 a	0.67 c
50%	0	5.10 a	4.00 c	3.22 a
	2	3.56 c	5.67 b	1.78 b
	4	4.64 ab	6.33 ab	0.67 c
	6	4.66 ab	7.22 a	0.44 c

*The interaction values within the column followed with the same letters are not significantly different from each other according to Duncan's Multiple Range Test at the (0.05) level.

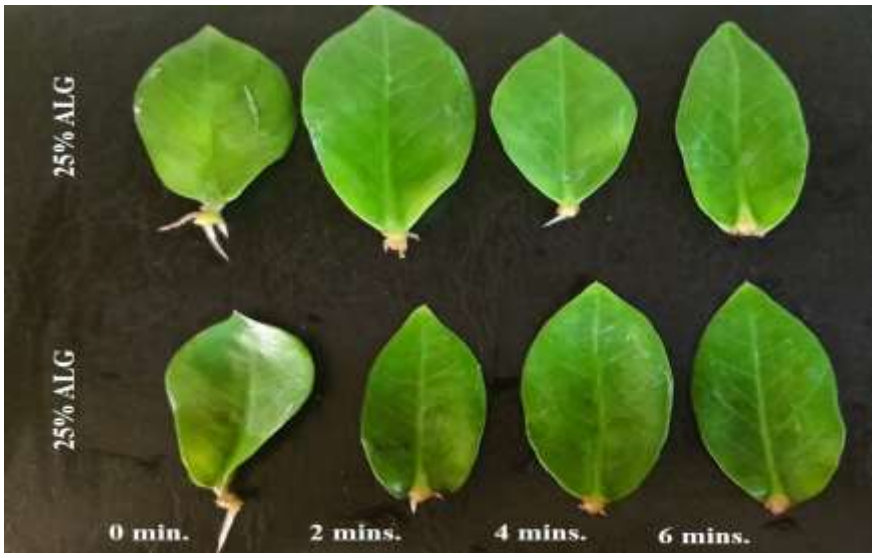

Figure 3. The leaflet cuttings of *Zamioculcas zamiifolia* rootings at the end of the study

3.2. Discussion

Many investigators indicated that using natural rooting substances as ALG had impact the rooting parameters of leaf cuttings of Zambia plant. The beneficial influence of ALG might be due to its offering of moisture, nutrition, pathogen defense, and hormonal stimulation, it could be considered as an alternative auxin-enriched in vitro rooting medium at rooting stage (El Sherif, 2017) and it can induce root growth in place of synthetic PGRs (Mirihagalla and Fernando, 2020). ALG can also increase the success rate of leaf cuttings while also encouraging root formation and general plant growth (Malla *et al*., 2023). The results are in accordance with those reported by (Ashrafuzzaman *et al*., 2015; Patel and Chauhan, 2015; Mohammadi and Azadbakht, 2018; Kanwar and Kaur, 2019 and Mirihagalla and Fernando, 2020).

4. Conclusion

It can be concluded that from the results that using of the lower concentration of ALG was superior for root growth enhancement of Zambia leaflet cuttings, in the study season (Fall), in which the leaflet cuttings were taken, this may be due to that ZZ plants tend to slow down throughout the fall and require less water and upkeep when compared to the spring and summer growing seasons.

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