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Study on Impact of different Levels of Indole-3-Butyric Acid (IBA), Rooting Media, and Correlation on Rooting and Survivability of Air Layered Water Apple (*Syzygium samarangense* L.)

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ABSTRACT: Water apple is one of the important fruit crops, but it remains uncultivated in many parts of the world due to less success in seed propagation and unavailability of quality planting material. Hence this study was undertaken to determine the impact of IBA, rooting media, and association between the different parameters on success of air layering in water apple at North Farm, Karunya Institute of Technology and Sciences, Coimbatore (2022–23), with 12 treatments replicated thrice. The experiment was set up using a FRCBD with four distinct concentrations of IBA, *viz.*, 1000 (I_1), 2000 (I_2), 3000 (I_3), and 4000 ppm (I_4), and three rooting media *i.e.* cocopeat (M_1), sphagnum moss (M_2), and garden soil (M_3). According to the analysis of variance, all treatments were found significant for all parameters. Among the treatment interactions, 4000 ppm IBA with sphagnum moss was earliest for the commencement of roots, time taken for layers to separate, root length, diameter and number of roots. Sphagnum moss was found superior for early rooting and root number. According to the results, using IBA and media together will be more effective at encouraging early rooting and getting more number of roots than using either IBA or media alone.

Keywords: Water apple, Air layering, Root initiation, IBA, Sphagnum moss, Interaction, Correlation.

INTRODUCTION

Water apple (*Syzygium samarangense* L.) is a non-climacteric tropical fruit tree that is a member of the Myrtaceae family (Zen-Hong *et al*., 2006). Wax apple is also known as Rose apple, Java apple, and Water apple (Pan and Shu 2007). Its chromosomal counts range, including 33, 42, 44, 66, and 88, and the species is thought to have originated in Malaysia and other South-east Asian nations. In Malaysia and its adjacent nations, including Thailand, Indonesia, and Taiwan, it is widely farmed and grown (Moneruzzaman *et al*., 2009). The most common species in South-East Asia is *S. samarangense*, one of three species. There are between 130-150 genera and around 5500 species in the family Myrtaceae. The flowering plant genus Syzygium is regarded as the largest in the family. The genus has 1100–1200 species, which have a great degree of diversity and are raised for a variety of reasons. It is a tiny tree with a dense, round, and symmetrical crown that can get up to 10 meter tall. The water apple has straightforward, opposite, oval leaves that are shiny, dark green, and has a leathery texture. Small white flowers are produced by the tree, which are followed by 3 to 5 centimeter-diameter round or pears-shaped fruits. The fruit's flesh is pink or red in colour and has a thin, smooth skin with white flesh (Sneha and Khare 2020), which are luscious and juicy with a sweet, somewhat acidic flavour. Water apples are technically deciduous trees that lose their leaves in the dry season. Due to its hardiness, this plant may grow in a variety of environments, including those with poor soil and tropical climates. The tree has a shallow root system and is vulnerable to water logging. It can grow well in both full sun and moderate shade, and it needs regular watering, especially during the dry season.

Water apple is also well known for its therapeutic benefits. The tree's leaves and bark have long been used in herbal medicine to treat conditions like fever, diarrhoea, and dysentery. Since it is a good source of vitamin C and other antioxidants, the fruit's juice is used as a natural cure for skin conditions including acne and eczema.

Sneha and Khare (2020) identified early bud and fruit drop as a significant issue with water apple output and quality. In especially for fruit tree species, air layering is a crucial asexual plant propagation approach (Tchoundjeu *et al*., 2010). The water apple is a significant tropical fruit tree that is mostly grown through air layering, a vegetative method. However, a number of variables, such as the usage of rooting media and the administration of plant growth regulators

like IBA, can affect the success of air layering in water apple. Exogenous IBA treatment accelerates photosynthate translocation to the shoot and encourages root growth and development (Shekhawat and Manokari 2016). According to research by Naithani (2018), the physiology of mother trees, the nutritional status of the tree and soil, wrapping materials, ringing or girdling, etiolation, exogenous rooting hormone, the timing of air layering, and the type of rooting medium employed can all have an impact on how air layers root. The results of this study will give essential new understanding into the variables that affect the success of air layering in water apples, which may be used to enhance propagation techniques for this significant fruit tree species. The outcomes can also aid in the creation of more successful and affordable propagation methods for several other fruit tree species. There has been little research especially on air layering water apples, despite numerous studies examining the impact of IBA and rooting material on air layering of diverse plants. Therefore, this study will offer useful insights into the best practices for air layering in water apples with the ideal combination of IBA and media for better rooting.

MATERIALS AND METHODS

A. Site and Location

The experiment was conducted at North farm of School of Agricultural Sciences, Karunya Institute of Technology and Sciences, Coimbatore, Tamil Nadu during 2022-23. The geographical coordinates of Coimbatore are Longitude - 76° 57' 58.03" East Latitude 11° 00' 19.98" North Coimbatore stands at 432 meters above sea level. Climatically in Coimbatore the wet season is oppressive and overcast, the dry season is humid and partly cloudy, and it is hot year round. Over the course of the year, the temperature typically varies from *20°C* to *36°C* and is rarely below *17°C* or above *38°C*. The maximum temperature rises up to 35.5℃ in the month of April (2022), minimum temperature recorded 18.3℃ in the month of January (2022). Monsoon starts from third week of July and last up to the second week of September (2022). Most of the rainfall is received from South West monsoon.

B. Plant Material

From the mini-orchard, which was healthy and active, and in its early stages, fifteen water apple trees were chosen for this study. In which five plants were selected for each replication. Following tree selection, branches aged one year and measuring approximately 30 cm in length and a pencil's thickness were chosen at random for air layering. The majority of the chosen twigs were appropriately tagged and ranged in diameter from 0.8 to 1 cm.

C. Preparation of IBA lanolin paste

For the preparation of 1000 ppm lanolin paste of IBA 1g of IBA powder was weighed on a chemical weighing balance and was transferred in to a beaker. After that, 5ml of ethyl alcohol of 95% was added to the powder and shake thoroughly to dissolve it properly. Then 200g lanolin paste was taken in beaker and heated. The dissolved growth regulator was transferred into the melted lanolin paste and stirred firmly or with the use of magnetic stirrer until the ethanol gets evaporated. In this method, Uniform mixture of IBA and lanolin paste was prepared.

D. Preparation of rooting media and treatment application on the twig

One kilogram of sphagnum moss and cocopeat was soaked in water until it was time to employ the wet materials. Before air stacking, each of the chosen twigs was correctly marked and had an average diameter of 0.8 to 1 cm. The leaves were separated from the ringing point of the chosen twigs, and a ring of bark (phloem) of around 2.7 to 3.0 cm in length was then removed by making two round cuts at either end of the ring with a budding knife. The ring was cut between 55 and 65 cm from the water apple trees' twig tips (Khandaker *et al.*, 2022). By carefully stroking the ringed area of the twig with a budding knife, the cambium layer was removed. The rooting media was positioned on the ringed area and wrapped in accordance with the treatment after the cambium layer had been removed. In order to observe the new roots, the ringed area of the treated branches was wrapped in white, translucent polythene sheets (15 cm ×15 cm) and then carefully fastened with plastic string. After ringing at the abaxial sides of the branches for approximately one month, treated and untreated branches both generated roots.

E. Detachment of air layers from the mother plant

When the roots were brown in colour and well-developed, the rooted air layers were separated from the mother trees. By cutting a cut with a sharp saw just below the lower end of the ringed surface, the twigs were separated from the trees. The air layers were carefully removed from the plastic wrap and transferred into ready-made polybags.

F. Observations recorded

1. Number of days taken for appearance of roots (no.) was done by manual calculation from the day of air layering to the day of detachment of layers
2. Days taken for detachment of layers (Days) was done by manual calculation from the day of air layering to the day of detachment of layers.
3. Number of roots per layer (no.) were counted manually
4. Length of longest root per air layer (cm) was measured by using measuring scale
5. Diameter of roots (mm) per layer was measured by using a digital vernier caliper

G. Experimental design

A Factorial Randomized Complete Block Design (FRCBD) with three (3) replicates was used to set up all of the treatments in this investigation. According to ANOVA, all data were evaluated. The mean was separated using Fisher's protected Least Significant Difference (LSD) test when the F test revealed significance at p 0.05.

Treatments Details:

Factor I: IBA (ppm) (I)	Factor II: Media (M)
I_1 - IBA @ 1000 ppm	M_1 - Cocopeat
I_2 - IBA @ 2000 ppm	M_2 - Sphagnum Moss
I_3 - IBA @ 3000 ppm	M_3 – Garden soil
I_4 - IBA @ 4000 ppm	

Treatment combination:

I_1M_1	IBA @ 1000 ppm + Cocopeat
I_1M_2	IBA @ 1000 ppm + Sphagnum Moss
I_1M_3	IBA @ 1000 ppm + Garden soil
I_2M_1	IBA @ 2000 ppm + Cocopeat
I_2M_2	IBA @ 2000 ppm + Sphagnum Moss
I_2M_3	IBA @ 2000 ppm + Garden soil
I_3M_1	IBA @ 3000 ppm + Cocopeat
I_3M_2	IBA @ 3000 ppm + Sphagnum Moss
I_3M_3	IBA @ 3000 ppm + Garden soil
I_4M_1	IBA @ 4000 ppm + Cocopeat
I_4M_2	IBA @ 4000 ppm + Sphagnum Moss
I_4M_3	IBA @ 4000 ppm + Garden soil

RESULT AND DISCUSSION

The result showed that the rooting was high using sphagnum moss compared to cocopeat and least from garden soil. The application of 4000 ppm IBA shown significantly higher values for rooting and survivability of air layered water apple than 3000 ppm, 2000 ppm and 1000 ppm respectively.

A. Number of days taken for appearance of roots (no.)

The results showed that the number of days taken for appearance of roots in air layer was significantly affected by rooting media and rooting hormone and their interactions effect were also significant in water apple (Table 1 and 2).

The main effect for IBA concentration has a significant difference between 1000 ppm (M = 28.48 days), 2000 ppm (M = 26.13 days), 3000 ppm (M = 24.18 days) and 4000 ppm (M = 22.76 days). The results indicate that the number of days taken for appearance of roots in air layer was decreased with the concentration of IBA solution. Among different concentrations of IBA, the least number of days taken for appearance of roots (22.76 days) was recorded when we used IBA @ 4000 ppm when compared to other concentrations of IBA.

The main effect for media on number of days taken for appearance of roots was significant. The least number of days taken for appearance of roots in air layers was recorded in sphagnum moss (18.80 days) followed by cocopeat (26.78 days). The highest number of days taken for appearance of roots was recorded in garden soil (30.58 days) (Table 1).

The interaction effect between IBA and rooting media was found significant in number of days taken for appearance of roots. The treatment combination I_4M_2 (Sphagnum moss with treatment of 4000 ppm IBA) gave the least number of days taken for appearance of roots (16.67 days) which was found to be significantly lower than the rest of the treatment combinations. Highest number of days taken for appearance of roots (35.50 days) was recorded under the treatment combination I_1M_3 (Garden soil with treatment of 1000 ppm IBA) (Table 2).

The disintegration of the cell wall's amyloplast was also shown to be accelerated by an optimal level of IBA, which also boosted cambium activity and drove the mobility of photosynthates to the places where roots develop in the air layers. In accordance with the findings of Singh *et al*. (2014), the exogenously applied IBA promoted the development of callus, increased interfascicular cambium dedifferentiation, and generated many cells that differentiated into root primordia and root cells. According to Yeboah *et al*. (2014), IBA likely improved the translocation of nutrients, plant growth regulators, and carbohydrates to the root formation zone for rooting and the creation of the air layers.

B. Days taken for detachment of layers (Days)

The results revealed that number of days taken for detachment of water apple air layered was significantly affected by rooting hormone and rooting media and their interactions effect were also significant (Table 1 and 2).

The main effect for IBA concentration has a significant difference between 1000 ppm (M = 85.33 days), 2000 ppm (M = 80.33 days), 3000 ppm (M = 75.33 days) and 4000 ppm (M = 70.33 days). The results indicate that the number of days taken for detachment of air layer was decreased with the concentration of IBA solution. Among different concentrations of IBA, the least number of days taken for detachment of air layers (70.33 days) was recorded in the case of 4000 ppm IBA treatment when compared to other concentrations of IBA.

The main effect for media on days taken for detachment of layers was significant. The least number of days taken for detachment of air layers (73.50 days) was recorded in sphagnum moss followed by cocopeat (78.75 days). The highest number of days taken for detachment of layers was recorded in garden soil (81.25 days) (Table 1).

The interaction effect between IBA and rooting media was found significant in number of days taken for detachment of layers. The treatment combination I_4M_2 (Sphagnum moss with treatment of 4000 ppm IBA) gave the least number of days taken for detachment of layers (16.67 days) which was found to be significantly higher than the rest of the treatment combinations. Highest number of days taken for detachment of layers (35.50 days) was recorded under the treatment combination I_1M_3 (Garden soil with treatment of 1000 ppm IBA) (Table 2).

This is as a result of exogenous IBA application, which may accelerate the translocation and transfer of carbohydrates from the leaf to the cutting area of the stem or air layering and enhance root formation and development of seedlings (Shekhawat and Manokari 2016).

C. Number of roots

Analysis of variance was calculated to determine the effects of rooting media and IBA hormone on the root

initiation of water apple air layers. Rooting media and hormone produced significant effects on root production; also their interaction effect was significant (Table 1and 2).

According to the findings (Table 1), all IBA concentrations considerably increased the number of air layer branch roots as the concentrations increased. The branch treated with 4000 ppm IBA had the most roots, while the branch treated with 1000 ppm IBA in air layers had the fewest roots (Table 1 and Figure 1). Additionally, it was discovered that IBA concentration boosted the root initiation of air layers.

The way that rooting material affected root development varied greatly as well. Garden soil had the fewest roots, while sphagnum moss produced the most roots when used as a rooting medium (Table 1 and Fig. 2). The interaction effect was also significant.

The root development of air layered branches was significantly influenced by the IBA and rooting media concentration. The treatment combination I_4M_2 (Sphagnum moss with treatment of 4000 ppm IBA) had the maximum number of roots counted (94.33), while the treatment combination I_1M_3 (Garden soil with treatment of 1000 ppm IBA) had the lowest number of roots recorded (56.20) (Table 2 and Figure 3).

The rooting of air layers was significantly impacted by several rooting media types. Sphagnum moss media had the most roots, compared to the garden soil and cocopeat used in this study. The growth of air-layered branches and the porosity and aeration characteristics of the growing medium may be impacted (Amri *et al*., 2009). In addition, Rymbai *et al*. (2012) discovered that coco peat and sphagnum moss improved the quantity of primary and secondary roots and the root initiation rate of guava air layer after 45 days after transplanting (DAT). Exogenous IBA hormone lengthens and increases the amount of air layer roots, which promotes seedling vegetative growth (Singh *et al*., 2014). The aeration and water holding capacity of the rooting media affect the formation of the roots. To promote maximal rooting, which can result in healthy seedlings, a balance between hormone and media must be maintained. It's possible that the use of exogenous IBA increased the natural levels of NO and H_2O_2 in the upper atmosphere. According to Barba-Espin *et al*. (2010); Ismail *et al*. (2015), an enhanced level of H_2O_2 activated protein is associated to cell division, cell elongation, plant signaling, and development. The number of roots in the air layers of the cape gooseberry increases with the best IBA and vermicompost combination, and the increased root system has a good impact on seedling length and shoot diameter (Gond *et al*., 2017).

D. Length of longest root per air layer (cm)

The findings revealed that rooting hormone, rooting media, and their interactions had a substantial impact on the root length of water apple air layers (Tables 1 and 2).

IBA concentrations of 1000 ppm (M = 6.01 cm), 2000 ppm (M = 7.40 cm), 3000 ppm (M = 9.05 cm), and 4000 ppm (M = 9.77 cm) all varied significantly in terms of the principal effect. The outcomes showed that the concentration of IBA solution increased the root length of the air layer. When compared to other IBA concentrations, the 4000 ppm IBA treatment resulted in the longest roots (9.77 cm) of all the IBA concentrations.

On root length, the media had a substantial major effect. Sphagnum moss had the longest root length (8.07 cm), while cocopeat had the longest root length (9.34 cm). Garden soil (6.76 cm) has the shortest root length ever observed (Table 1).

In terms of root length, the interaction effect between IBA and rooting media was discovered to be considerable. The longest length of roots (11.09 cm), which was found to be much longer than the other treatment combinations, was produced by the treatment combination I_4M_2 (Sphagnum moss with treatment of 4000 ppm IBA). Under the treatment combination I_1M_3 (Garden soil with treatment of 1000 ppm IBA), the smallest length of roots (4.24 cm) was observed (Table 2).

The root length of water apple air layers was greatly increased by the treatment regimen of sphagnum moss and 4000 ppm IBA. According to Atiyeh *et al*. (2001), sphagnum moss has a sizable number of potential nutrients and minerals that can aid in the growth and development of plants. According to a study by Sinha *et al*. (2010), adding sphagnum moss to rooting media reduces bulk and particle density while increasing water holding capacity. In order to faster the growth and development of stem cuttings or air layering, this procedure is helpful. A combination of genetic, chemical, and environmental factors can achieve the balance of hormones and other important components. The findings demonstrated that IBA treatment lengthened the roots of treated air layers, with IBA treatment at 1000 ppm producing the shortest roots. The IBA protein increases cell wall loosening and lengthens the root cells by dissolving the hydrogen bonds that hold the cellulose microfibrils together (Kumar *et al*., 2015; OuYang *et al*., 2015). At an appropriate concentration of IBA hormone, the rate of cambium cell differentiation, hydrolytic activity, and callus production are increased, which lengthens roots and creates a root system (Gilani, 2018). Exogenous plant growth regulators' hormone function and benefit are reliant on the proper concentration and application method (Nasir *et al*., 2021).

E. Diameter of roots (mm) per layer

Rooting hormone, rooting media and their interactions all had a substantial impact on the diameter of water apple air layers (Tables 1 and 2).

When the IBA concentration is 1000 ppm (M = 1.89 mm), 2000 ppm (M = 1.94 mm), 3000 ppm (M = 2.18 mm), or 4000 ppm (M = 2.55 mm), there is a substantial difference in the major effect. The findings show that the diameter of the air layer increased as IBA solution concentration increased. In contrast to previous IBA treatments, the 4000 ppm IBA treatment resulted in the largest root diameter (2.55 mm) measured among the various IBA concentrations. The main effect for media on diameter was significant. The maximum root diameter of air layers (2.48 mm) was recorded in

sphagnum moss media followed by cocopeat with a diameter (2.04 mm). The lowest diameter was recorded in garden soil (1.89 mm) (Table 1).

In terms of root diameter, it was discovered that IBA and rooting media had a substantial interaction effect. The greatest diameter of roots (3.32 mm) produced by the treatment combination I_4M_2 (Sphagnum moss with treatment of 4000 ppm IBA) was found to be significantly higher than that of the other treatment combinations. Under the treatment combination I_1M_3 (Garden soil with treatment of 1000 ppm IBA), the smallest diameter of roots (1.75 mm) was observed (Table 2).

Findings indicated that IBA treatment lengthened air layer branches and increased their width. According to Gond *et al*. (2017), the IBA considerably lengthened the branches compared to the control. Additionally, they claimed that sphagnum moss, which performed much better than cocopeat, and rooting media had a major impact on the shoot length of air layers. IBA and rooting media resulted in the increasing of length of air layered branches of cape gooseberry (Gond *et al*., 2017), similar result were obtained in our study for the interaction effect of rooting hormone and media on the length of air layers. The quantity and length of roots in water apple air layers increased at the optimal concentration of IBA, as was previously mentioned. Thus, a superior root system affects branch length and air layer diameter by increasing the surface area of nutrient and water absorption from the rooting environment (Gilani, 2018). According to Akwatulira *et al*. (2011), exogenous administration of IBA at the growing sites of cuttings improves the transfer of mineral nutrients and encourages the growth of the cuttings. According to Chalapathi *et al*. (2001), exogenous IBA treatment increased fresh and dry biomass of stem cuttings of stevia plants as well as root initiation, quantity, length, and thickness of roots. Plant growth regulators applied exogenously have an impact on the vegetative growth of plant organs or portions (Pessarakli, 2002).

F. Correlation

According to the above study the results suggested that the number of root parameters showed positive and significantly correlation to parameters such as length of longest root per layer (0.89**) and diameter of roots per layer (0.97**) and negatively correlated with number of days taken for appearance of roots (-0.80**) and days taken for detachment of layers (-0.90**).

Beside this, Number of days taken for appearance of roots had positive correlation with days taken for detachment of layers (0.73**), while negatively correlated with length of longest root per air layer (-0.84**) and diameter of roots per layer (-0.77**). Days taken for detachment of layers had negative correlation with length of longest root per air layer (-0.91**) and diameter of roots per layer (-0.83**). Length of longest root per air layer has positive correlation with diameter of roots per layer (0.81**).

Table 1: Effect of IBA and media on rooting and root parameters of air layered water apple.

Treatment	Days taken for Appearance of roots (Days)	Days taken for detachment of layers (Days)	Number of Roots per layer (no.)	Length of longest root per air layer (cm)	Diameter of roots per layer (mm)
IBA Concentration (C)					
I_1 -IBA@ 1000 ppm	28.48	85.33	61.09	6.01	1.89
I_2- IBA@ 2000 ppm	26.13	80.33	64.73	7.40	1.94
I_3- IBA@ 3000 ppm	24.18	75.33	71.07	9.05	2.18
I_4- IBA@ 4000 ppm	22.76	70.33	80.31	9.77	2.55
Mean	25.39	77.83	69.30	8.06	2.14
S.Em±	0.37	NS	1.03	0.12	0.04
C.D @ 5%	1.25	NS	3.47	0.41	0.14
Media (M)					
M_1- Cocopeat	26.78	78.75	68.55	8.07	2.04
M_2-Spagnum moss	18.80	73.50	76.63	9.34	2.48
M_3-Garden soil	30.58	81.25	62.72	6.76	1.89
Mean	25.39	77.83	69.30	8.06	2.14
S.Em±	0.65	NS	1.19	0.14	0.05
C.D @ 5%	1.25	NS	3.47	0.41	0.14
Interaction (I×M)					
S.Em±	0.74	NS	2.05	0.24	0.09
C.D @ 5%	2.16	NS	6.02	0.71	0.25

Table 2: Interaction effect of IBA and media on rooting and root parameters of air layered water apple.

Treatment combination	Days taken for Appearance of roots (Days)	Days taken for detachment of layers (Days)	Number of Roots per layer (no.)	Length of longest root per air layer (cm)	Diameter of roots per layer (mm)
I_1M_1	28.40	90.00	61.13	6.10	1.82
I_1M_2	21.53	81.00	65.93	7.70	2.10
I_1M_3	35.50	85.00	56.20	4.24	1.75
I_2M_1	27.33	80.00	65.87	7.27	1.89
I_2M_2	19.53	76.00	69.40	8.54	2.12
I_2M_3	31.53	85.00	58.93	6.38	1.82
I_3M_1	26.47	75.00	69.60	9.51	2.17
I_3M_2	17.47	71.00	76.87	10.04	2.39
I_3M_3	28.60	80.00	66.73	7.61	1.97
I_4M_1	24.90	70.00	77.60	9.41	2.30
I_4M_2	16.67	66.00	94.33	11.09	3.32
I_4M_3	26.70	75.00	69.00	8.80	2.03
Mean	25.39	77.83	69.30	8.06	2.14
S.Em±	0.74	NS	2.05	0.24	0.09
C.D @ 5%	2.16	NS	6.02	0.71	0.25

Table 3: Coefficient of correlation among different parameters of air layering in water apple.

Characters	DAR	DDL	LPR	DPR	NR
DAR	1	0.73**	-0.84**	-0.77**	**-0.80****
DDL		1	-0.91**	-0.83**	**-0.90****
LPR			1	0.81**	**0.90****
DPR				1	**0.97****

Note: DAR- Days taken for Appearance of roots (Days), DDL- Days taken for detachment of layers (Days), LPR- Length of longest root per air layer (cm), DPR- Diameter of roots per layer (mm), NR - Number of Roots per layer (no.).

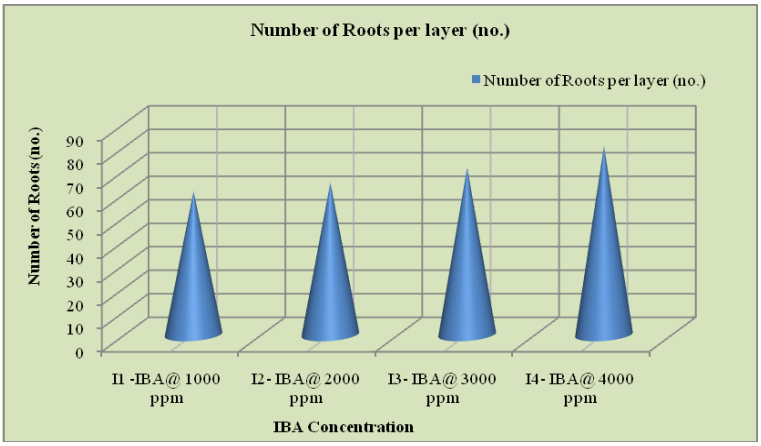

Fig. 1. Effect of different concentrations of IBA on number of roots.

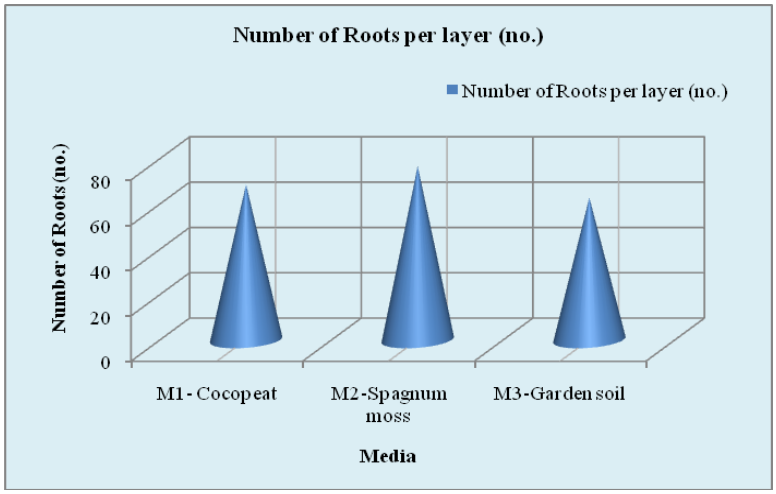

Fig. 2. Effect of different rooting media on number of roots.

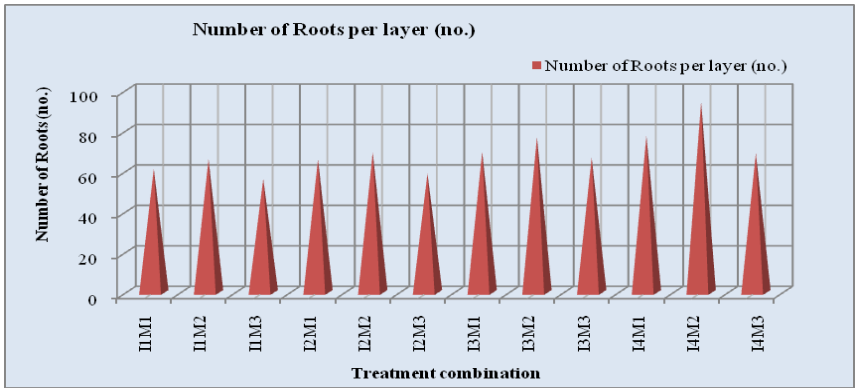

Fig. 3. Interaction effect of IBA and media on number of roots.

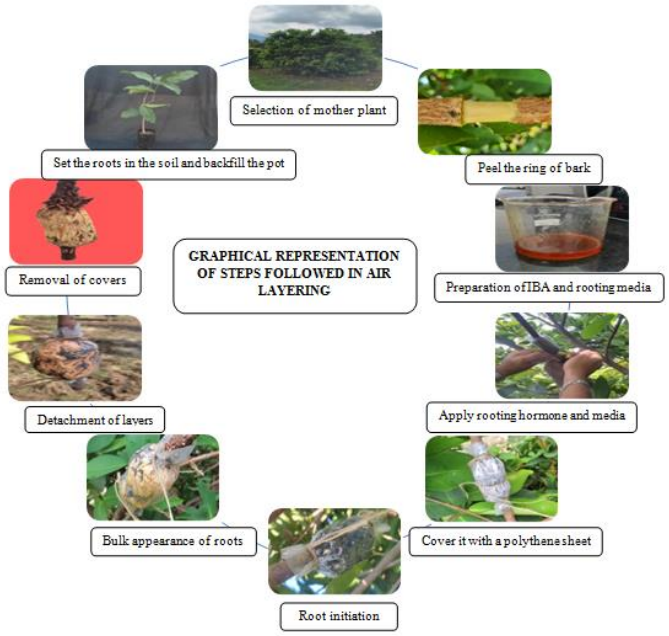

Fig. 4. Graphical representation of steps followed in air layering.

CONCLUSIONS

From the above investigation it can be concluded that the rooting and vegetative growth of air layers were all improved by the exogenous application of IBA with rooting media, particularly IBA at 4000 ppm. Sphagnum moss was the most effective rooting media for fastening the rooting in air layers. The treatment combination of 4000 ppm IBA and sphagnum moss was resulted in the best root initiation (100%) of water apple air layers. With this, we can determine the optimum dose and combination (4000 ppm IBA with sphagnum moss) for air layering in water apple to produce high-quality planting materials.

FUTURE SCOPE

Water apple is a rare fruit crop, but with the advances in agricultural technology and research, cultivation has become more feasible. It is known for its high nutritional value and health benefits, which contains high levels of antioxidants and vitamins, making it a valuable addition to any diet. It remains uncultivated in many parts of the world due to less success in seed propagation and unavailability of quality planting material. Technology like air layering will help in producing true to type quality planting material. With increased cultivation and availability, it could become a popular and sought-after ingredient in the global market. Since it is susceptible to climate, it is not suitable to grow in Coimbatore region with *36°C* but in this study some positive result were obtained with increase in concentration of growth hormone and proper care. The data generated in this study may help the interested farmers and researchers to select best propagation method and hormonal treatments for successful cultivation of water apple.

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Conflict of Interest. None.

REFERENCES

Akwatulira, F., Gwali, S., Okullo, J. B. L., Segawa, P., Tumwebaze, S. B., Mbwambo, J. R. and Muchugi, A. (2011). Influence of rooting media and Indole-3-Butyric Acid (IBA) concentration on rooting and shoot formation of *Warburgia ugandensis* stem cuttings. *African journal of plant science*, *5*(8), 421-429.

Amri, E., Lyarun, H. V. M., Nyomora, A. S. and Kanyek, Z. L. (2009). Evaluation of provenances and rooting media for rooting ability of African Blackwood (*Dalbergia melanoxylon* Guill. and Perr.) stem cuttings. *Research Journal of Agriculture and Biological Science*, *5*(4), 524-532.

Atiyeh, R. M., Edwards, C. A., Subler, S. and Metzger, J. D. (2001). Pig manure vermicompost as a component of a horticultural bedding plant medium: Effects on physicochemical properties and plant growth. *Bioresource Technology*, *78*(1), 11-20.

Barba-Espin, G., Diaz-Vivancos, P., Clemente-Moreno, M. J., Albacete, A., Faize, L., Perez-Alfocea, F. and Hernandez, J. A. (2010). Interaction between hydrogen peroxide and plant hormones during germination and the early growth of pea seedlings. *Plant Cell and Environment*, *33*, 981-994.

Chalapathi, M. V., Thimmegowda, N. D., Kumar, S., Gangadhar, G., Rao, E. and Mallikarjun, K. (2001). Influence of length of cutting and growth regulators on vegetative propagation of stevia (*Stevia rebaudiana* Bert.). *Crop Research*, *21*, 53-56.

Gilani, S. A. Q. (2018). Influence of Indole Butyric Acid (IBA) concentrations on air layerage in guava (*Psidium guajava* L.) *cv.* Sufeda. Pure and Applied Biology, *7*(4), 1-10.

Gond, M., Dwivedi, D. H. and Singh, N. (2017). Performance of cape gooseberry (*Physalis peruviana* L.) under different spacing and organic manures. *The Bioscan*, *12*(1), 377-380.

Ismail, S. Z., Khandaker, M. M., Mat, N. and Boyce, A. N. (2015). Effects of hydrogen peroxide on growth, development and quality of fruits: A review. *Journal of Agronomy*, *26*(1), 11-20.

Khandaker, M. M., Saidi, A., Badaluddin, N. A., Yusoff, N., Majrashi, A., Alenazi, M. M. and Mohd, K. S. (2022). Effects of Indole-3-Butyric Acid (IBA) and rooting media on rooting and survival of air layered water apple (*Syzygium samarangense* L.) *Cv* Jambu Madu. *Brazilian Journal of Biology*, *82*(1).

Kumar, V., Singh, M. K., Kumar, M., Prakash, S., Kumar, A., Rao, S. and Malik, S. (2015). Effect of different doses of IBA and Rooting Media on Rooting of Stem Cutting of Lemon (*Citrus limon* Burm) cv. Pant Lemon. *Journal of Plant Development Sciences*, *7*(7), 587-591.

Moneruzzaman, K. M., Hossain, A. B. M. S., Sani, W., Saifuddin, M. and Alenazi, M. (2009). Effect of harvesting and storage conditions on the post harvest quality of tomato (*Lycopersicon esculentum* Mill) *cv.* Roma VF. *Australian Journal of Crop Science*, *3*(2), 113-121.

Naithani, D. C. (2018). Effect of Time of Air Layering, IBA Concentrations, Growing Media and their Interaction on the Rooting Behaviour of Pant Prabhat Guava (*Psidium guajava* L.) under Sub-Tropical Condition of Garhwal Himalaya. *International Journal of Pure and Applied Bioscience*, *6*(3), 169-180.

Nasir, N. M. N. N., Khandaker, M. M., Mohd, K. S., Badaluddin, N. A., Osman, N. and Mat, N. (2021). Effect of Hydrogen Peroxide on Plant Growth, Photosynthesis, Leaf Histology and Rubisco Gene Expression of the *Ficus deltoidea* Jack *Var.* deltoidea Jack. *Journal of Plant Growth Regulation*, *40*(5), 1950-1971.

OuYang, F., Wang, J. and Li, Y. (2015). Effects of cutting size and exogenous hormone treatment on rooting of shoot cuttings in Norway spruce [(*Picea abies* L.) Karst.]. *New Forests*, *46*(1), 91-105.

Pan, H. H. and Shu, Z. (2007). Temperature affects color and quality characteristics of 'Pink' wax apple fruit discs. *Scientia Horticulturae*, *112*(3), 290-296.

Pessarakli, M. (2002). Handbook of plant and crop stress. *Boca Raton, FL: CRC Press*.

Rymbai, H., Sathyanarayana, R. G. and Reddy, K. C. S. (2012). Effect of cocopeat and sphagnum moss on guava air layers and plantlets survival under open and polyhouse nursery. *Agricultural Science Digest*, *32*, 241-243.

Shekhawat, M. and Manokari, M. (2016). Impact of auxins on vegetative propagation through stem cuttings of *Couroupita guianensis* Aub: a conservation approach. *Scientifica*, *2016*.

Singh, K. K., Choudhary, T., Prabhat, K. and Rawat, J. M. S. (2014). Effect of IBA for inducing rooting in stem cuttings of Duranta golden. *HortFlora Research Spectrum*, *3*(1), 77-80.

Sinha, R. K., Agarwal, S., Chauhan, K. and Valani, D. (2010). The wonders of earthworms and its vermicompost in farm production: charles Darwin's 'friends of farmers', with potential to replace destructive chemical fertilizers from agriculture. *Agricultural Sciences*, *1*(2), 76-94.

Sneha and Khare, V. K. (2020). Study on dropping behaviour of water apple (*Syzygium aqueum* L.) fruit. *Journal of pharmacognosy and phytochemistry*, *10*(1), 1700-1702.

Tchoundjeu, Z., Tsobeng, A. C., Asaah, E. and Anegbeh, P. (2010). Domestication of *Irvingia gabonensis* (Aubry Lecomte) by air layering. *Journal of Horticultural Science and Biotechnology*, *2*(7), 171-179.

Yeboah, J., Branoh Banful, B. K., Boateng, P. Y., Amoah, F. M., Maalekuu, B. K. and Lowor, S. T. (2014). Rooting response of air-layered shea (*Vitellaria paradoxa*) trees to media and hormonal application under two different climatic conditions. *American Journal of Plant Sciences*, *5*(9), 1212-1219.

Zen-Hong, S., Meon, Z., Tirtawinata, R. and Thanarut, C. (2006). Wax apple production in selected tropical Asian countries. *Acta Horticulturae*, *773*(1), 161-164.

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