International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Early Development of Root and Shoot in Ficus pseudopalma Blanco Stem Cuttings Using Different Propagation Media

Wella Babe O. Sitoy

Institute of Biological Sciences, College of Arts and Sciences, Central Mindanao University, Musuan, Maramag, Bukidnon, 8714

Abstract

Ficus pseudopalma, commonly known as Philippine fig, Dracaena fig, or palm-leaf fig, is an indigenous species in the Moraceae family. Locally referred to as Lubi-lubi or Niyog-niyogan due to its palm-like appearance, it holds significant ethnobotanical value as an ornamental plant, food source, and medicinal resource. Given its endemic status, propagating F. pseudopalma is vital for conservation, biodiversity preservation, and maintaining ecosystem health. This study aimed to determine the most effective propagation medium for cultivating stem cuttings of F. pseudopalma to support these efforts. A completely randomized design (CRD) with 10 replicates per treatment was employed. Stem cuttings measuring 10 cm were collected from healthy mother plants, with over 40 cuttings used as planting materials. Three propagation media were prepared: M1 (topsoil, peat, sawdust in a 1:1:1 ratio), M2 (topsoil and sand in a 1:3 ratio), and M3 (topsoil and parboiled rice hulls in a 1:1 ratio). The cuttings were cultivated for 50 days, during and after which data on root and shoot development were collected. Statistical analyses, including ANOVA and Bonferroni-adjusted post hoc tests at a significance level of $P<0.05$, were conducted to evaluate the results. Findings revealed that the combination of topsoil, peat, and sawdust (M1) was the most effective propagation medium, significantly enhancing both root and shoot growth compared to the control medium (M0). Although media with topsoil and sand (M2) and topsoil with parboiled rice hulls (M3) supported plant growth, their performance was less remarkable than M1. Interestingly, while M1 showed notable differences from the control, there were no significant differences among the other media combinations in most growth parameters. In conclusion, M1 emerged as the optimal propagation medium for F. pseudopalma stem cuttings, offering a practical approach to improving propagation success rates. This study contributes to conservation strategies for native Philippine flora by identifying effective cultivation techniques that support the growth and sustainability of this endemic species.

Keywords: Figs, Cultivation, Parameters, Optimal Medium, Growth

1. Introduction

Ficus pseudopalma is a species of fig in Moraceae which is also known as Philippine fig, Draceana fig (Bailey & Bailey 1976), and palm-leaf fig, locally known as Lubi-lubi and Niyog-niyogan as it resembles a palm tree. It is a Philippine endemic plant, usually found in the island of Luzon and cultivated in the rest of the Philippine regions for different purposes (Neal, 1948; Starr et al., 2003). This is an erect shrub with a bare, unbranched mesocaul stem capped with a cluster of leaves that resembles a palm. Indeed, pseudopalma means "false palm" in Latin (Amoroso et al., 2022). The leaves can reach 30 to 36 inches (75 to 90 cm) in length, have a yellow midrib, and are edged with dull teeth. The fruit is a dark green fig that grows in pairs, each measuring slightly over an inch long (Bailey & Bailey, 1976).

Ficus pseudopalma is an indigenous medicinal plant that has numerous ethnobotanical uses. Aside from being an ornamental plant, it is also used for food and medicinal purposes (Santiago et al., 2014). The plant harbors a range of bioactive compounds such as flavonoids, unsaturated sterols, triterpenes, steroid glycosides, saponins, tannins, and phenols (Ragasa et al., 2009). These constituents contribute to its antibacterial properties, primarily attributed to flavonoids and terpenoids found in the crude ethanolic extract (De Las Llagas et al., 2014). Additionally, the leaves are utilized in decoction form for treating conditions like diabetes and kidney stones (Deepa et al., 2018; Acosta et al., 2013). Furthermore, its young shoots can be consumed raw or cooked, serving as a delectable side dish or incorporated into salads and various culinary preparations as a potherb (Santiago et al., 2014).

The propagation of the Philippine endemic Ficus pseudopalma is critical for conservation efforts for native trees, biodiversity preservation, and ecosystem health. Ficus pseudopalma is commonly propagated through stem cuttings or air layering techniques (Starr et al, 2003). This study will focus on the utilization of stem cutting technique in propagating this plant of interest. Stem cutting is a conventional technique of vegetative propagation for most woody species that is both economical and easy (Ooyama and Toyoshima, 1965). Propagation of this plant not only aids in conservation but also unlocks its potential for medicinal and culinary purposes. By increasing its availability through propagation, locals can utilize it for its medicinal properties, potentially treating various ailments. Additionally, the plant can be incorporated into local cuisine, offering a new food source that adds to the diversity of their diet. This dual utility enhances the value of propagating Ficus pseudopalma, benefiting both human health and local livelihoods.

Thus, this study is crafted that aims to identify the most effective propagation medium for cultivating stem cuttings of Ficus pseudopalma. By determining the optimal medium, we can enhance the success rate of propagation efforts, ultimately facilitating the conservation and utilization of this valuable species for medicinal and culinary purposes.

2. Methodology

Preparation of potting media

The methodology outlined by Shamsuddin et al. (2021) was followed with slight modification, three soil mixtures were prepared for propagation experiments. M1 consists of topsoil, peat, and sawdust in a 1:1:1 ratio, M2 comprises sand and topsoil in a 1:3 ratio, and M3 consists of topsoil and parboiled rice hulls (used as an alternative to perlite) in a 1:1 ratio.

Potting Media:

M1- topsoil+peat+sawdust (1:1:1 ratio)

M2- sand+topsoil (1:3 ratio)

M3-topsoil+parboiled rice hulls (1:1 ratio)

M0-garden soil (control)

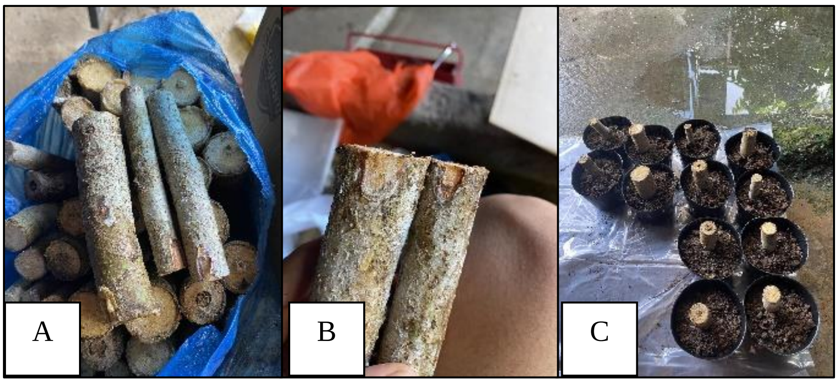
Figure 1. Propagation media used and the experimental set-up with 10 replicates for each medium.

Additionally, garden soil, serving as a control medium, was prepared separately to prevent contamination from other media and placed in a medium-sized pot. Each mixed potting medium has 10 replicates each and placed in medium-sized pots and was labeled accordingly with the medium number and the replicate number (Fig. 1).

Collection and preparation of stem cuttings

Stems from a healthy mother plant of Ficus pseudopalma was gathered obtaining 40 stem cuttings and more, each measuring 10 cm in length, to be used as planting materials (Fig. 2A). Stem cuttings were marked on one side of the tip to indicate the burying side for planting (Fig. 2B). The cuttings were planted in the potting media by burying half of the stem cutting in it (Fig. 2C). After planting, the potted cuttings were placed in a transparent cover chamber. They were regularly monitored to prevent drying out and the weed growth was managed. Watering the plants was minimized since the water accumulated in the plastic chambers kept the moisture, even in hot weather. Additionally, the plants also were kept from directly sunlight to maintain optimal growing conditions.

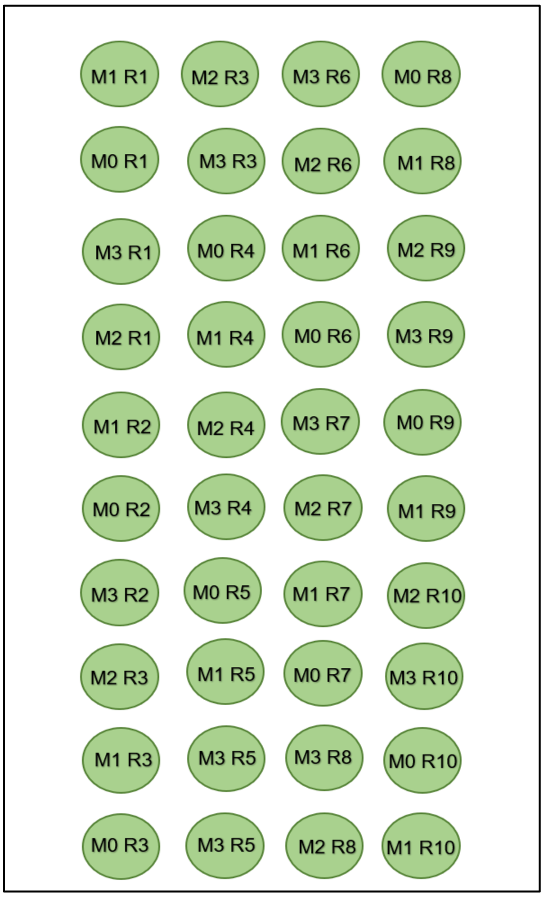
Figure 2. Stem cuttings obtained from *Lubi-Lubi* mother plant used as the planting material.



Experimental design and data analysis

In this experiment, a completely randomized design (CRD) was employed, with 10 replicates in each treatment group.

Figure 3. Experimental layout of *ex-situ* stem cuttings.



After a cultivation period of 50 days, the plants were harvested, and data was collected for various parameters including number of shoots emerged, number of branches, number of well-developed leaves, number of small emerging leaves, shoot length (longest) (cm), shoot width (cm), leaf length (longest) (cm), leaf blade length (cm), leaf blade width (widest part) (cm), petiole length (cm), petiole width (cm), number of roots emerged, number of primary roots, number of secondary roots, number of tertiary roots and length of well-developed root (cm).

Data analysis was done using the Microsoft Excel and its available Data Analysis features. Analysis of variance (ANOVA) was performed to assess statistical significance among treatments, followed by a Post Hoc Test to make multiple comparisons of means using at $P<0.05$ to determine the best treatment by employing the t-Test: Two-Sample Assuming Equal Variances along with Bonferroni Adjustments. Bonferroni Adjustment is a Post Hoc test that suggests that the p-value for each test must be equal to its alpha divided by the number of tests performed. In this study the researcher made six multiple tests to manually compare the means of each medium per parameter, thus, the alpha level was adjusted to 0.00833.

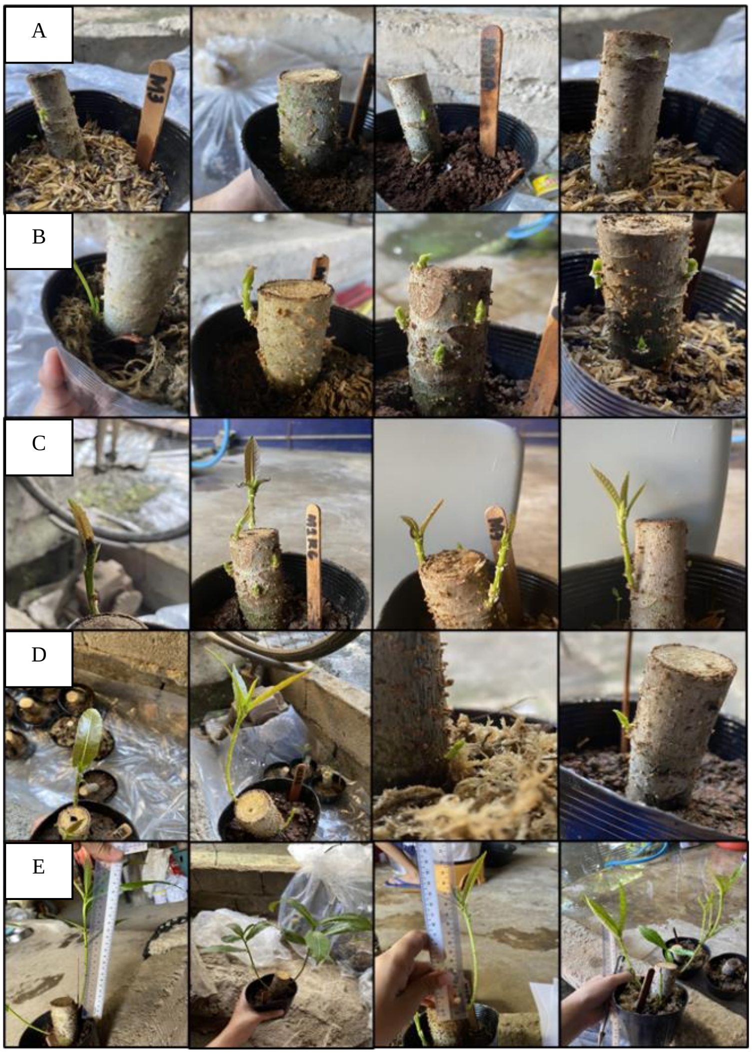
Documentation

The study area and specimens utilized was observed and recorded using a phone camera. Furthermore, all stages of the experiment, such as collection, processing, preparation of potting media, plant monitoring, and other activities, were meticulously documented. This extensive photographic documentation serves to create a comprehensive record of the entire experimental process, facilitating analysis, reporting, and future reference.

3. Results and Discussions

The cultivation period took 50 days, with five observations conducted regularly. In the first week of observation, buds began to appear on some of the stem cuttings (Fig. 4A). By the second week, shoots lengthened, and the first leaves emerged, with additional buds developing on certain stem cuttings in some pots (Fig. 4B). By the third observation, leaves were fully formed and shoots showed significant increases in both width and length especially in Medium 1 (Fig. 4C).

Figure 4. Shoot growth and development observations for 50 days.



Subsequently, during the fourth observation, leaves matured, turning greener, while new leaves continued to emerge alongside an increase in bud formation (Fig. 4D). Finally, just before harvest in the sixth week, primary shoots began branching, showing further maturity as both leaves and shoots increased in width and length, with continued emergence of new leaves (Fig. 4E).
During the harvest, the stem cuttings were gently uprooted to assess root development. Upon checking, it was observed that some stem cuttings lacked roots entirely, while others were in the early stages of root formation. However, certain well-developed stem cuttings did exhibit root growth including the presence of secondary and tertiary roots (Fig. 5).

Figure 5. Root growth and development observed upon harvest after 50 days.

The result of this study shows that there is a significant influence of the propagation medium in some of the parameters measured in the root and shoot development. Specifically, the significant differences observed in shoot development is recorded in the number of shoots that emerged, number of small emerging leaves, shoot length, leaf length, leaf blade length, and petiole length (Table 1). Meanwhile in root development, the significant differences are observed in the number of roots that emerged, number of primary roots, and length of well-developed roots (Table 2).
Table 1 shows the means of shoot growth and development with corresponding superscripts that indicates the significant differences among the four (4) propagation medium with respect to the different parameters. Means followed by the same alphabetical letter in the same column are not significantly different at a significance level of $p \leq 0.05$. The statistical analysis revealed that Medium 1 which is made up of topsoil, peat, and sawdust in 1:1:1 ratio, has highest total means across all measured parameters. There are no significant differences among the media used in terms of their shoot development.
However, Medium 1 significantly outperformed the control medium (M0) showing the lowest total average across parameters in terms of the number of shoots that emerged, number of small emerging leaves, shoot length, leaf length, leaf blade length, and petiole length. According to the study of Shamsuddin et al. (2021), the combination of peat and perlite showed significantly enhanced shoot growth because the more organic material present in the propagation medium the greater the shoot growth which can be associated to the nutrient uptake of the plants. Peat provides aeration that properly assess plant growth and yield (Olle et al., 2012) while sawdust mixtures triggered early sprouting and taller seedlings

(Ahmed et al., 2023). This study highlights the significant impact of using organic materials such as peat and sawdust based on the gathered results.

Furthermore, both M2 and M3 demonstrated slight improvements in their shoot growth and development. While not as effective as the performance of Medium 1, these media still have positive effect to the overall growth and development of the shoots.

Table 1. Mean of shoot growth and development of *Ficus pseudopalma* stem cuttings affected by propagation medium.

Parameters	No. of shoots emerged	No. of branches	No. of well-developed leaves	No. of small emerging leaves	Shoot length (longest) (cm)	Shoot width (cm)
Medium 0	1^{b}	0^{a}	1.1^{a}	1^{b}	2.44^{c}	0.09^{a}
Medium 1	2.4^{a}	0.3^{a}	4.9^{a}	3.5^{a}	17.17^{a}	0.25^{a}
Medium 2	1.3^{ab}	0.3^{a}	2^{a}	1.6^{ab}	4.98^{b}	0.17^{a}
Medium 3	1.7^{ab}	0.1^{a}	2.1^{a}	2.4^{ab}	7.62^{abc}	0.18^{a}

Parameters	Leaf length (longest) (cm)	Leaf blade length (cm)	Leaf blade width (widest part) (cm)	Petiole length (cm)	Petiole width (cm)
Medium 0	1.62^{b}	1.52^{b}	0.59^{a}	0.1^{b}	0.05^{a}
Medium 1	7.64^{a}	7.64^{a}	1.92^{a}	0.3^{a}	0.13^{a}
Medium 2	2.81^{ab}	2.66^{ab}	0.69^{a}	0.15^{ab}	0.06^{a}
Medium 3	2.65^{ab}	2.52^{ab}	0.71^{a}	0.13^{ab}	0.04^{a}

In table 2, it presents the means of the various parameters related to root growth and development, along with corresponding superscripts denoting the significant differences found through multiple comparisons of the means. Likewise, means sharing the same alphabetical letter in the same column indicate no significant different at a significance level of $p \leq 0.05$ when compared with each other. The result of the statistical analysis revealed that Medium 1 which is a combination of topsoil, peat, and sawdust shows higher values of means in three parameters: number of roots that emerged, number of primary roots, and length of well-developed roots, this medium has significant difference with that of the control medium which has the lowest values in all parameters. When compared to other two media; Medium 2 and Medium 3, there is no significant difference found. This is an indication that Medium 1 has provided optimum condition for rooting formation among all treatments. This result is attributed to the ability of peat and sawdust to hold enough moisture and nutrient and porosity to keep the soil aerated as organic matters (Waseem et al., 2013).

Table 2. Mean of root growth and development of *Ficus pseudopalma* stem cuttings affected by propagation medium.

Parameters	No. of roots emerged	No. of primary roots	No. of secondary roots	No. of tertiary roots	Length of well-developed root (cm)
Medium 0	0.4^{b}	0.2^{b}	0.2^{a}	0^{a}	0.31^{b}
Medium 1	1.8^{a}	1.5^{a}	2.6^{a}	1.5^{a}	1.9^{a}
Medium 2	0.8^{ab}	0.6^{ab}	1^{a}	0.6^{a}	0.74^{ab}
Medium 3	1.1^{ab}	0.9^{ab}	1^{a}	0.4^{a}	0.96^{ab}

The parallel findings from both shoot and root growth and development indicated that the optimum propagation medium for growing the stem cuttings of Ficus pseudopalma is the combination of peat, sawdust, and topsoil. Overall, there were no significant differences among the means of the parameters, except for the notable difference between the control medium (M0) and the optimal Medium 1. While media containing mixtures of topsoil and sand (M2), and topsoil and rice hulls (M3) also supported growth, however, their performance was not as remarkable as that of the medium composed of topsoil, peat, and sawdust.
In addition to the propagation medium used, several factors influence the growth and development of both shoot and root systems in this study. The maturity of the planting materials used can significantly impact the emergence rate of shoots and roots. Furthermore, contamination by fungi in some replicates hindered their development, leading to eventual decline and mortality in these stem cuttings.

4. Conclusion

This study revealed that the most effective propagation medium for cultivating stem cuttings of Ficus pseudopalma is the mixture of topsoil, peat, and sawdust. Medium 1 emerged as the optimal medium for the early development of both shoots and roots of Ficus pseudopalma, with significantly higher mean values across all parameters compared to other media. The findings of this study suggest the importance for experimenting various propagation media to ensure sustainable and effective utilization when propagating stem cuttings of this plant species.

5. References

1. Acosta, C. J., Macabeo, A. P., & Santiago, L. A. (2013). Assessment of the antiurolithiatic and antioxidant properties of Ficus pseudopalma Blanco leaves (Moraceae). Current Research in Biological and Pharmaceutical Sciences 2013; 2: 22, 30.
2. Ahmed, M. S., Yasin, M., Zia, M. U., Nadeem, M. A., Muhammad, S., & Mahmood, A. (2023). Composted Melia azedarach L. (Chinaberry tree) sawdust mixtures regulate the sprouting and growth of single bud node seedlings of sugarcane. Journal of Soil Science and Plant Nutrition, 23(2), 2465-2475.
3. Amoroso, V. B., Aser, C. M. A., Villalobos, A. P., Mendez, R. A., Lodevico, D. P., & Barbosa, G. B. (2022). New Insights on the Morphology of the Philippine Endemic Ficus pseudopalma Blanco. Journal of Tropical Life Science, 12(1).
4. Bailey, L. H. and E. Z. Bailey. 1976. Hortus. 3rd ed. Macmillan General Reference, NY.
5. De Las Llagas, M. C., Santiago, L., & Ramos, J. D. (2014). Antibacterial activity of crude ethanolic extract and solvent fractions of Ficus pseudopalma Blanco leaves. Asian Pacific Journal of Tropical Disease, 4(5), 367-371.
6. Deepa, P., Sowndhararajan, K., Kim, S., & Park, S. J. (2018). A role of Ficus species in the management of diabetes mellitus: A review. Journal of Ethnopharmacology, 215, 210-232.
7. Neal, M.C. (1948). In Gardens of Hawai'i. Bernice P. Bishop Museum, Special Publication 40, Honolulu, HI.
8. Olle, M., Ngouajio, M., & Siomos, A. (2012). Vegetable quality and productivity as influenced by growing medium: a review.
9. Ooyama, N., & Toyoshima, A. (1965). Rooting ability of Pine cuttings and its promotion.

10. Ragasa, C. Y., Tsai, P. W., & Shen, C. C. (2009). Terpenoids and sterols from the endemic and endangered Philippine trees, Ficus pseudopalma and Ficus ulmifolia. Philipp J Sci, 138(2), 205-209.
11. Santiago, L. A., Mayor, A. B. R., & Arimado, J. B. (2014). Ethnobotanical survey and nutritional composition of Ficus pseudopalma Blanco (Moraceae). Philippine Sci Lett, 7(2), 401-405.
12. Shamsuddin, M. S., Shahari, R., Amri, C. N. A. C., Tajudin, N. S., Mispan, M. R., & Salleh, M. S. (2021). Early development of fig (Ficus carica L.) root and shoot using different propagation medium and cutting types. Tropical life sciences research, 32(1), 83.
13. Starr, F., Starr, K., & Loope, L. (2003). Ficus pseudopalma.
14. Waseem K, Hameed A, Jilani M S, Kiran M, Javeria S and Jilani T A. (2013). Effect of different growing media on the growth and flowering of stock (Matthiola incana) under the agro- climatic condition of Dera Ismail Khan. Pakistan Journal of Agricultural Sciences 50(3): 523–527.