

PAPER • OPEN ACCESS

Effect of coconut water and banana hump extract on the growth of binahong (*Anredera cordifolia* (Ten.) Steenis) accessions from lowland

To cite this article: Y Hasanah *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **591** 012004

View the [article online](#) for updates and enhancements.

You may also like

- [Growth response of binahong \(*Anredera cordifolia* \(L.\) Steenis\) accessions from lowland and highland as affected by technological packet](#)
L Mawarni, Y Hasanah, F E Sitepu *et al.*
- [Total Lactic Acid Bacteria \(LAB\), Antioxidant Activity, and Acceptance of Synbiotic Yoghurt with Binahong Leaf Extract \(*Anredera cordifolia* \(Ten.\) Steenis\)](#)
R P Lestari, C Nissa, D N Afifah *et al.*
- [Preparation Smallest PVA/Binahong Leaf Nanofiber for Wound Dressing Applications by Varying Electrospinning Variable using Taguchi Method](#)
F Ridwan and A A Ananta

Effect of coconut water and banana hump extract on the growth of binahong (*Anredera cordifolia* (Ten.) Steenis) accessions from lowland

Y Hasanah¹, L Mawarni¹, C Hanum¹ and Nurhaida¹

¹Faculty of Agriculture, Universitas Sumatera Utara, Prof. A. Sofyan No. 3 Kampus USU, Medan, 20155, Indonesia

E-mail: yaya@usu.ac.id

Abstract. The application of natural plant growth regulators (PGR) influences the growth of binahong (*Anredera cordifolia* (Ten.) Steenis). The objective of the current research is to evaluate the growth component of lowland binahong accessions due to the application of natural PGR of coconut water and banana hump extract. The research used factorial randomized block design with 2 factors and 3 replications. The first factor was different accessions of binahong from lowlands (Marelan; Ampera Timur; Helvetia) in the city of Medan, North Sumatera, Indonesia. The second factor was natural PGR, in which we conducted experiments without the application of PGR; 40% coconut water application, banana hump extract 40%; coconut water 40% + banana hump extract 40%. The results showed that the accessions from Ampera Timur had root dry weight that were higher than the other accessions. The treatment of 40% coconut water + banana hump extract 40% increased plant length, and root dry-weight. Interaction of Ampera Timur binahong accession and 40% coconut water + banana hump extract 40% increased shoot dry-weight and root dry-weight.

1. Introduction

Binahong is one of the plants that can be developed as a raw material for phytopharmaca. Previous studies have reported that binahong contains phytochemical compounds such as flavonoids, alkaloids, terpenoids, saponins, anthocyanins, glucans, carotenes, organic acids, mucopolysaccharides such as L-arabinose, D-galactose, L-rhamnose, aldonic acid, also can contain saponins, vitamins A, B and C [1, 2].

Phytochemical compounds contained in binahong plants are very useful as raw materials for phytopharmaca. Previous studies have reported that this plant is able to expedite and normalize blood circulation and blood pressure, increase endurance, cure ulcer disease, intestinal inflammation, typhus, rheumatism, gout, and hemorrhoid, postoperative wounds, overcome swelling and blood clotting, restore weak conditions after illness, prevents stroke and can improve damaged kidney function [3–6].

Until now, only about 20% of known binahong accessions have been cultivated, while the rest is obtained from the forest. Limited knowledge of good agricultural practices as standard operating procedures for biomass production and phytochemical content in binahong plants as quality raw materials for phytopharmaca is still a problem, because there are limited literature available on this issue. Therefore, research that examines good agricultural practices is needed to obtain binahong biomass production as a source of phytopharmaca based on local resources.

One way to elucidate higher/better binahong biomass production is by assessing the biomass production of different binahong accessions. In addition, treatments that can increase binahong biomass by applying natural plant growth regulators (PGR) should also be done. Coconut water and banana hump are natural sources of PGR because they contain indole-3-acetic acid (IAA), gibberellins and cytokines. Previous studies [7] have reported that banana hump contains as much as 0.0025% IAA; GA3 as much as 0.0019% and Cytokinins 0.0020%. While coconut water contains IAA as much as 0.0022%; GA3 as much as 0.0016% and Cytokinin 0.0021%.

Auxin has been shown to play an important role in plant growth and development, such as controlling cell division by regulation of meristem formation that gives rise to new organs such as lateral and adventitious roots, cell elongation by changing cell wall plasticity, apical dominance and tropic response to sunlight and gravity, response to pathogenic and abiotic stress [8–12]. Gibberellins play a role in stimulating the growth of most organs through increased cell division and cell elongation, and stimulates the transition of developmental phases, including those between seed dormancy and germination, juvenile and adult phases, and vegetative and reproductive growth. Gibberellins also play a role in increasing resistance to abiotic stresses such as cold temperatures, salinity and osmotic stress [13, 14]. Cytokines play an important role in regulating the proliferation and differentiation of plant cells, and also control various processes in plant growth and development, including the promotion of shoot growth, inhibition of root growth, fruit and seed development, delay in aging, and role in responding to abiotic and biotic stress. Cytokinin homeostasis is maintained through biosynthesis, activation, degradation, and conjugation of bioactive molecules [15].

Researches on binahong have been carried out, including morphological characteristics binahong accessions in lowlands and highlands [16], physiological characteristics of binahong [7], the content of chlorophyll, stomata and cuticle thickness of binahong [17], and the effect of natural PGR of bamboo shoot and shallot extract [18,19]. However, the effect of natural PGR of banana hump and coconut water not widely reported.

Based on this background, this present study aims to examine the role of natural growth regulators found in coconut water and banana hump extract on the growth of binahong accessions obtained from lowlands.

2. Materials and methods

2.1. Research site and time

The study was conducted at the screen house of the Faculty of Agriculture, Universitas Sumatera Utara, Medan, in June-August 2019, an area of $\pm$ 25 meters above sea level.

2.2. Procedure

This research used a factorial randomized block design with the following treatments. Factor 1: Plant Origin (A), A1: Accession 1 (Medan Marelan district), A2: Accession 2 (Ampera Timur, Medan Sunggal district), A3: Accession 3 (Medan Helvetia district). As a second factor, the application of natural PGR (P), consisting of P0: Without the application of Natural PGR, P1: 40% coconut water, P2: 40% banana hump extract, P3: 40% coconut water + 40% banana hump extract. This research started from land preparation, planting material preparation in the form of leaf axillary tubers of binahong, 25% shade making, filling the planting media into polybags, with the composition of top soil : chicken manure : sand = 1: 1: 1, as much as 2 kg/polybag, making binahong nursery, planting, making natural PGR extract, PGR application, plant maintenance includes watering, weeding, controlling pest and disease. The extract of natural PGR is done by blending 400 g of banana hump followed by the adding 1000 ml of distilled water, then the results of the blender were filtered to get banana hump extract, and then fermented for one week. As much as 400 ml of coconut water were added 1000 ml of distilled water was used to get a concentration of 40% coconut water, then fermented for one week. The natural PGR application based on the treatment was carried out 3 times, i.e., 3, 4 and 5 weeks after planting (WAP) by spraying to all parts of the plant using a hand sprayer. Observation parameters including plant length (cm), shoot dry-weight (g), and root dry-weight (g).

2.3. Data analysis

Data were statistically analyzed by analysis of variance and continued by Duncan's Multiple Range Test (DMRT) at $\alpha = 5\%$.

3. Results and discussion

3.1. Plant length

Based on the results of the study, it can be seen that the accession of binahong, natural PGR and the interaction between the two have no significant effect on plant length (Table 1). The length of the Helvetia accession plant tends to be longer than that of the Marelan and Ampera Timur accessions. The combination treatment of 40% coconut water and 40% banana hump extract produced the longest plant length compared to other treatments (Figure 1).

This is presumably because coconut water and banana hump extract contain auxiliary ZPT, gibberellins and cytokinins which are very instrumental in the regulation of meristem formation that gives rise to new organs, increases cell division and elongation, and regulates the proliferation and differentiation of plant cells, and also controls various processes in plant growth and development [20,21]. Therefore, the synergy between auxin, gibberellins and cytokinins found in coconut water and banana hump extract plays a major role in increasing plant length. Continuous cell division in a plant can result in an increase in plant length.

Table 1. The length of several plants accession binahong 6-10 week after planting (WAP) with the treatment of natural growth regulators coconut water and banana hump extract.

WAP	Plant origin from Medan	Natural plant growth regulator				Mean
		P0	P1	P2	P3	
.....cm.....						
6	Marelan (A ₁)	51.33	49.50	54.33	58.33	53.38
	Ampera Timur (A ₂)	59.17	47.17	55.67	60.17	55.54
	Helvetia (A ₃)	48.00	59.17	54.50	58.00	54.92
	Mean	52.83	51.94	54.83	58.83	54.61
7	Marelan (A ₁)	160.42	150.80	115.28	217.77	161.07
	Ampera Timur (A ₂)	147.78	139.77	169.48	127.22	146.06
	Helvetia (A ₃)	164.45	160.70	149.08	211.33	171.39
	Mean	157.55	150.42	144.62	185.44	159.51
8	Marelan (A ₁)	217.53	222.22	191.77	184.53	204.01
	Ampera Timur (A ₂)	217.47	187.78	230.45	212.08	211.95
	Helvetia (A ₃)	234.55	223.43	206.38	277.51	235.47
	Mean	223.18	211.14	209.53	224.71	217.14
9	Marelan (A ₁)	288.88	277.50	244.57	275.05	271.50
	Ampera Timur (A ₂)	276.83	254.00	293.60	259.08	270.88
	Helvetia (A ₃)	308.58	293.92	294.98	337.37	308.71
	Mean	291.43	275.14	277.72	290.50	283.70
10	Marelan (A ₁)	324.85	323.27	283.38	307.02	309.63
	Ampera Timur (A ₂)	301.53	283.98	331.62	293.42	302.64
	Helvetia (A ₃)	338.67	337.85	315.45	385.90	344.47
	Mean	321.68	315.03	310.15	328.78	318.91

Note: P0: Without application of Natural PGR, P1: Coconut water 40%, P2: Extract of banana hump 40%, P3: Coconut water 40% + Extract of banana hump 40%.

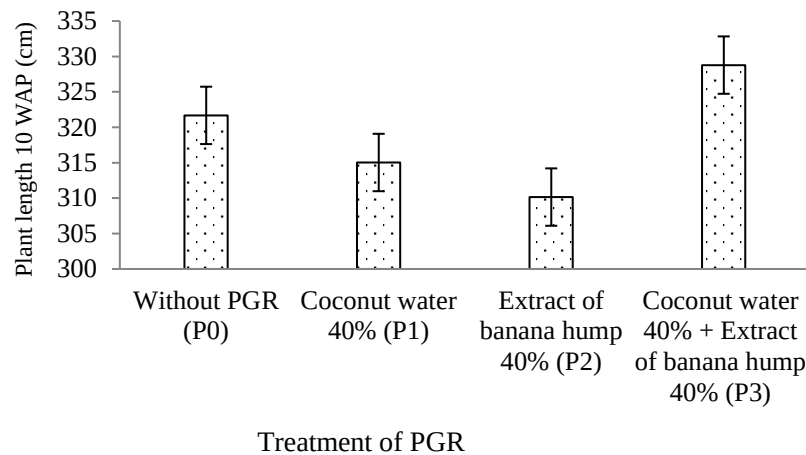


Figure 1. Plant length of binahong 10 WAP with PGR application

3.2. Shoot dry weight

Based on the results of the study, it can be seen that the accession of binahong, natural PGR and the interaction between the two have no significant effect on the dry weight of the binahong crown (Table 2). The dry weight of the binahong canopy accessions Marelán (7.76 g) tends to be higher than that of Helvetia (6.69 g) and Ampera Timur (6.77 g). The 40% coconut water treatment produced the highest canopy dry weight (7.80 g) compared to other treatments. The combination of 40% coconut water treatment + 40% banana hump extract on the Ampera Timur accession resulted in the highest canopy dry weight (8.35 g) compared to other treatment combinations.

This is presumably because coconut water and banana hump extract contain auxiliary PGR, gibberellins and cytokinins which are very instrumental in the proliferation and differentiation of plant cells, and also control various processes in plant growth and development [20, 21]. Auxin has the function of accelerating root growth, encouraging cell extension and development, phototropism, and accelerating germination, and apical dominance. Therefore, the synergy between auxin, gibberellins and cytokinins found in coconut water and banana hump extract plays a major role in increasing the shoot dry weight of binahong.

Table 2. Shoot dry weights on several plant origins and application of different natural plant growth regulators.

Plant origin from Medan	Natural plant growth regulator				Mean
	P ₀	P ₁	P ₂	P ₃	
	g				
Marelán (A ₁)	6.07	6.65	4.16	5.34	5.63
Ampera Timur (A ₂)	5.82	3.46	4.59	8.35	4.62
Helvetia (A ₃)	4.54	5.41	4.45	4.57	4.80
Mean	5.48	5.17	4.40	6.09	

Note: P₀: Without application of Natural PGR, P₁: Coconut water 40%, P₂: Extract of banana hump 40%, P₃: Coconut water 40% + Extract of banana hump 40%.

3.3. Root dry weight

Based on the results of the study, it can be seen that the accession of binahong, natural PGR and the interaction between the two have no significant effect on the dry weight of the binahong root (Table 3). The dry weight of the roots of the Ampera Timur accession (0.96 g) tends to be higher than the accessions of Marelán (0.31 g) and Helvetia (0.53 g). Treatment of 40% coconut water + 40% banana hump extract produced the highest root dry weight (1.07 g) compared to other treatments. The combination of 40% coconut water treatment + 40% banana hump extract on Ampera Timur accession resulted in the highest root dry weight (2.48 g) compared to other treatment combinations.

This is because coconut water and banana hump extract contain PGR of auxin which acts to accelerate root growth, encourage cell extension and development [22]. Whereas other PGR are gibberellins are plant growth hormones which promote cell division and regulate numerous physiological processes including seed germination, stem elongation, leaf, root and reproductive organs expansion [23].

Therefore, the synergy between auxin, gibberellins and cytokinins found in coconut water and banana hump extract plays a major role in increasing the dry weight of the roots of the binahong.

Table 3. Root dry weights on several plant origins and application of different natural plant growth regulator.

Plant origin from Medan	Natural plant growth regulator				Mean
	P ₀	P ₁	P ₂	P ₃	
	g.....				
Marelan (A ₁)	0.38	0.18	0.33	0.35	0.31
Ampera Timur (A ₂)	0.46	0.58	0.32	2.48	0.96
Helvetia (A ₃)	0.43	0.66	0.62	0.39	0.53
Mean	0.42	0.47	0.42	1.07	0.60

Note: P₀: Without application of Natural PGR, P₁: Coconut water 40%, P₂: Extract of banana hump 40%, P₃: Coconut water 40% + Extract of banana hump 40%.

4. Conclusion

The planting material from Helvetia district produced the highest plant length, while the planting material from Marelan district generated the highest canopy dry weight, and the planting material from Ampera Timur produced the highest root dry weight. Application of coconut water 40% and banana hump 40% increase plant length, shoot dry weight and root dry weight of binahong. Application of coconut water 40% and banana hump 40% on Ampera Timur accession has the highest of shoot dry-weight and root dry-weight.

Acknowledgement

The authors would like thank Directorate of Research and Community Service, Directorate General of Research Strengthening and Development, Ministry of Research, Technology and Higher Education, in accordance with Research Assignment Agreement, Fiscal Year 2019 Number: 11/E1/KP.PTNBH/2019, dated March 29, 2019.

5. References

- [1] Ozella E F, Stringheta P C and Chauca M C 2007 Stability of anthocyanin of spinach vine (*Basella rubra*) fruits *Cien. Inv. Agr.* **34** (2): 115-120
- [2] Rachmawati S 2008 *Macroscopic study and phytochemical screening of Anredera cordifolia (Ten) Steenis leaves* (in Indonesian) [Thesis] (Surabaya: Universitas Airlangga)
- [3] Shabella R 2012 Binahong Leaf Therapy (in Indonesian) (Klaten: Cable Book) pp 10-12
- [4] Rofida S 2010 Ethnobotany and ethnopharmacological studies of binahong (*Anredera cordifolia* (Ten) Steenis) (in Indonesian) *Farmasains* **1**(1): 1-7
- [5] Kaur G, Utami N V and Usman H A 2014 Effect of topical application of binahong [*Anredera cordifolia* (Ten.) Steenis] leaf paste in wound healing process in mice *Althea Med J* **1**(1): 6-11
- [6] Sukandar E Y, Sigit J I and Adiwibowo L F 2013 Study of kidney repair mechanisms of Corn Silk (*Zea mays* L. Hair)- Binahong (*Anredera cordifolia* (Ten.) Steenis) leaves combination in rat model of kidney failure *Int J of Pharmacol* **9**(1): 12-23
- [7] Hasanah Y, Mawarni L and Rusmarilin H 2019 Physiological characteristics of binahong (*Anredera cordifolia* (Ten.) Steenis) on application of natural plant growth regulator *Asian J Plant Sci* **18**(3): 117-112
- [8] Kazan K and Manners J M 2009 Linking development to defense: auxin in plant-pathogen interactions *Trends in Plant Sci* **14**(7): 373-382

- [9] Fu J and Wang S 2011 Insights into auxin signaling in plant–pathogen interactions *Frontiers in Plant Sci* **2**(74):1-7
- [10] Wang S, Bai Y, Shen C, Wu Y, Zhang S, Jiang D, Guilfoyle T J, Chen M and Qi Y 2010 Auxin-related gene families in abiotic stress response in *Sorghum bicolor* *Funct Integr Genomics* **10**(4): 533-546
- [11] Friml J, Vieten A, Sauer M, Weijers D and Schwarz H 2003 Efflux-dependent auxin gradients establish the apical-basal axis of *Arabidopsis* *Nature* **426**(6963): 147–153
- [12] Vanstraelen M and Benková E 2012 Hormonal interactions in the regulation of plant development *Annu Rev Cell Dev Biol* **28**: 463-487 doi:10.1146/annurev-cellbio-101011-155741
- [13] Colebrook E H, Thomas S G, Phillips A L, Hedden P 2014 The role of gibberellin signalling in plant responses to abiotic stress *J Exp Biol* **217**(Pt 1): 67-75 doi:10.1242/jeb.089938
- [14] Bailey-Serres J and Voesenek L A 2010 Life in the balance: a signaling network controlling survival of flooding *Curr Opin Plant Biol* **13**(5): 489-494 doi:10.1016/j.pbi.2010.08.002
- [15] Achard P, Renou J P, Berthomé R, Harberd N P and Genschik P 2008 Plant DELLAs restrain growth and promote survival of adversity by reducing the levels of reactive oxygen species *Curr Biol* **18**(9): 656-660 doi:10.1016/j.cub.2008.04.034
- [16] Hasanah Y and Mawarni L 2020 Exploration and identification of *Anredera cordifolia* morphological characters in the highlands and lowlands *Biodiversitas* **21**(6):2759-2766 doi: 10.13057/biodiv/d210652
- [17] Hasanah Y and Mawarni L 2020 The content of chlorophyll, stomatal density and cuticle thickness of binahong (*Anredera cordifolia* (Ten.) steenis) accessions from Medan *International Conference on Agriculture, Environment and Food Security (AEFS) 2019 IOP Conf. Series: Earth and Environmental Science* **454**(2020) 012152 doi:10.1088/1755-1315/454/1/012152
- [18] Manurung G C, Manurung T, Hasanah Y, Hanum C and Mawarni L 2020 The role of bamboo shoot and shallot extracts combination as natural plant growth regulator on the growth of binahong (*Anredera cordifolia* (Ten.) Steenis.) in Medan *International Conference on Agriculture, Environment and Food Security (AEFS) 2019 IOP Conf. Series: Earth and Environmental Science* **454**(2020) 012169 doi:10.1088/1755-1315/454/1/012169
- [19] Hasibuan A R, Mawarni L, Hasanah Y, Irsal and Fatiani 2020 Application of bamboo shoot extract as natural plant growth regulator on the growth binahong (*Anredera cordifolia* (Ten.) Steenis.) in Karo *International Conference on Agriculture, Environment and Food Security (AEFS) 2019. IOP Conf. Series: Earth and Environmental Science* **454** (2020) 012170 doi:10.1088/1755-1315/454/1/012170
- [20] Michael S, Stéphanie R and Jürgen Kleine-Vehn 2013 Auxin: simply complicated *J Exp Bot* **64**(9): 2565–2577
- [21] Jameson P E and Song J 2016 Cytokinin: a key driver of seed yield *J Exp Bot* **67**(3): 593–606
- [22] Vanneste S and Friml J 2009 Auxin: a trigger for change in plant development *Cell* **136**(6): 1005–1016
- [23] Achard P, Gusti A, Cheminant S, Alioua M, Dhondt S, Coppens F, Beemster G T and Genschik P 2009 Gibberellin signaling controls cell proliferation rate in *Arabidopsis* *Curr. Biol* **19**(14): 1188– 1193