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

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Abstract. The effect of bamboo shoots and shallots extract combination as natural plant growth regulator on the growth of binahong (Anredera cordifolia (Ten.) Steenis.). This research aim was to determine the effect of bamboo shoots and shallots extract combination as natural plant growth regulator on the growth of binahong. This research was conducted at the Universitas Sumatera Utara, Faculty of Agriculture Screen House from June to August 2019. The results of this research indicated that the selection of planting material from Aswad Medan Johor tends to increase plant length, shoot dry weight and root dry weight of binahong plants. The application of 40% bamboo shoot extract tends to increase the shoot dry weight of binahong plant and the application of 40% bamboo shoot extract + 40% shallot extract increased the root dry weight of the binahong plant.

1. Introduction

Binahong (Anredera cordifolia (Ten.) Steenis) in Indonesia is known as a "gendola" which is commonly used as a hedgerow as well as a medicinal plant. This plant is easy to grow in the highlands and lowlands. According to Sundari [1], differences in the environment where binahong plants grow will affect the quality differences of secondary metabolites produced. Besides, the limited variety of binahong plants makes it difficult to get good quality binahong.

Binahong can function as a traditional medicinal plant. Binahong plant parts such as root, leaf, stem, and flower, are very useful for humans and animals [2]. Some researchers have reported that binahong acts as an antioxidant [3], antihypercholesterolemia [4], anti-bacterial [5], antihyperlipidemia [6], antihypertensive [7], anti-inflammatory [8], anti-obesity [9], anti-diabetes [10], and wound healing [11].

One technology for increasing productivity in binahong cultivation is to use plant growth regulators (PGR). According to Nurlaeni and Imam [12], plant growth regulators are usually active in small concentrations and can be produced in plants themselves (endogenous). However, plant growth regulators which are naturally present in plants are often below optimal, hence external sources are needed to produce a maximum response and optimal growth. Then exogenous PGR can be applied as a treatment, especially in germination.

One of the plants that can be used as a natural exogenous plant growth regulator is shallot (Allium ascalonicum L.). Because it has growth hormone content in the form of auxin and gibberellins, hence it can spur the growth of seeds [13]. While the results of Masitoh's [14] research reported that
the application of shallot extract with a concentration of 400 g/L could potentially be a plant natural growth regulator in the process of supplying red dragon fruit plant cuttings if the number of cuttings for cultivation was limited because it produced the highest shoot length and shoot weight.

The use of bamboo shoots as PGR has been carried out on several types of plants. Fitohormon which contained in bamboo shoots is gibberellins. According to Maretza [15], bamboo shoots are an important food in Indonesia and China which in the process must be boiled and produce bamboo shoot wastewater that may contain PGR.

Plant growth regulators can be mixed to stimulate plant growth and development, for example; an auxin contained in shallot mixed with gibberellins contained in bamboo shoots can stimulate and influence cell division. According to Rusmin [16], there is cooperation between auxin and gibberellins which stimulates the development of vessel tissue and encourages cell division thus encouraging stem enlargement.

Previous research about binahong mostly reported that binahong was used as a raw material for phytopharmaca, the effect of binahong for medicinal or vegetative growth of binahong [17, 18, 19, 20]. Research on natural PGR has been widely carried out, but the effect of natural PGR on the growth of binahong plants has not been done much. Based on this background, this research aim was to evaluate the effect of bamboo shoots and shallots extracts combination on the growth of binahong.

2. Materials and methods
The research was conducted from June to August 2019. The research was conducted at the screen house of the Faculty of Agriculture, Universitas Sumatera Utara with an altitude of ± 25 meters above sea level. This research used factorial Randomized Block Design (RBD) with the following treatments; First factor: Plant Origin (A), A1: Accession 1 (Aswad Medan Johor Street), A2: Accession 2 (Marelan VII Pasar 1 Tengah Street), A3: Accession 3 (Ampera No.24 B Setia Budi Street) and second factor: application of plant growth regulators (P), P0: Without application of Natural PGR, P1: Extracts of Bamboo Shoots 40%, P2: Extract of Shallots 40%, P3: Bamboo Shoots Extract 40% + Shallot Extract 40%.

This research started from land preparation, shade making, planting media preparation, planting material preparation, seed preparation, planting, making natural PGR extract, natural PGR application, taking care of the plants: watering, staking, weeding, pest and disease control.

The making of natural growth regulator extract is done by way of the Shallot tubers that have round tuber shape characteristics, pink and brownish-red tuber colour were blended every 400 g. Then, added with 1000 ml of distilled water and the results of the blender are filtered to get the onion tuber extract, then fermented for 1 week. Bamboo shoots used have the characteristics of light-brown midrib, white and soft shoots. Then, the bamboo shoot was blended every 400 g and added with 1000 ml of distilled water and the results of the blender were filtered to get bamboo shoot extract, then fermented for 1 week.

The natural plant growth regulator (PGR) was applied three times, that is 3 WAP, 4 WAP and 5 WAP, namely: Bamboo shoot extract: was taken 40% of bamboo shoot extract which has been fermented and sprayed to all parts of the plant using a sprayer. Shallot Extract: was taken as much as 40% of Shallot extract which has been fermented and sprayed to all parts of the plant using a sprayer. Bamboo shoot extract + Shallot extract: bamboo shoot extract + shallot extract (40% + 40%) which has been fermented and sprayed to all parts of the plant using a sprayer.

Observation parameters included: plant length (cm), shoot dry weight (g), and root dry weight (g). Data were analysed statistically by the analysis of variance and continued by the Duncan’s Multiple Range Test (DMRT) at α = 5%.
3. Results and discussion

3.1. Plant length
Based on Table 1, it can be seen that there is no interaction in the origin of planting material with natural PGR to the length of binahong plants aged 6-14 weeks after planting (WAP). The data presented in Table 1 also indicated that the treatment of planting material origin and the application of natural PGR were not significantly different on the length of the binahong plant at 6, 7, 9, 10, 11, 12, 13, and 14 WAP. This was because the success of a plant in growth is influenced by genetic and environmental factors. Genetic factors are related to the inheritance of plant traits derived from the parent plant while environmental factors are related to the environmental conditions in which the plants grow [21].

Based on the analysis of variance results in Table 1 indicated that the length of the binahong plant at the origin of planting material which differed in age 8 WAP, namely planting material accession 1 and accession 2 were significantly different from the origin of planting material accession 3. This was presumably due to the morphology of the binahong leaves from accession 1 and accession 2 are longer and wider than the origin of accession 3, hence the number and size of chloroplast and chlorophyll contained in palisade tissue and parenchymal sponges are higher. With the longer and wider of the leaves, the plant will be able to streamline the photosynthesis process which will produce assimilates and then distributed through phloem transport network to other plant parts [22]. Baskoro and Purwoko [23] added that several factors from the planting material included the age of the cuttings, types of plants, the presence of shoots and leaves on the cuttings, food supply and growth regulators which influenced the vegetative propagation.

3.2. Shoot dry weight
The treatment of the origin of planting material and the application of natural PGR did not significantly affect the shoot dry weight of the binahong plant at the age of 6-14 MST. The treatment of accession 2 planting material origin tended to be higher with 7.76 g of shoot dry weight compared to accession 1 planting material origin with 6.69 g of shoot dry weight and accession 3 origin with 6.77 g of shoot dry weight. This was because the length and width of the leaves can increase the efficiency of photosynthesis in producing photosynthates and translating into all plant organs hence higher shoot plants are also formed. Different treatments of various natural PGR that was 40% bamboo shoot extract tended to be higher with 7.80 g shoot dry weight compared to natural PGR from 40% shallot extract and natural PGR combination of 40% bamboo shoot extract + 40% shallot extract. It was suspected that only the application of bamboo shoot extract 40% has been able to increase the growth and development of high shoot in binahong plants (Table 2).

3.3. Root dry weight
Based on the research results, the origin of planting material with natural PGR application did not significantly affect the root dry weight of binahong plant aged 6-14 MST. Root dry weight indicated the power of plants to absorb water and nutrients in the soil. The treatment of Accession 1 planting material origin tended to be higher with 1.16 g of root dry weight compared to Accession 2 and Accession 3 planting material origin with 1.10 g of root dry weight. This was presumably because the number of leaves and length of plants formed was higher hence it was in line with the rate of root formation of binahong plants. The process of forming plant roots from propagation by cuttings is different from that from seeding. Roots in cuttings formed adventitiously from cambium and parts of nodes formed by injury and formed in parenchymal tissue. A large number of roots will lead to optimal absorption of nutrients and water hence the physiological process will proceed well to balance the growth and development of cuttings in forming a perfect plant [24].

The different treatments of natural PGR that were 40% bamboo shoot extract + 40% shallot extract tended to be higher with 1.15 g of root dry weight compared to natural PGR of 40% bamboo shoot extract and natural PGR of 40% shallot extract (Table 3).
Table 1. Plant lengths at different plant origins and application of different natural plant growth regulator combination at 6-14 WAP

| WAP | Plant origin from Medan | Natural plant growth regulator | Mean |
|-----|-------------------------|--------------------------------|------|
|     |                         | P0              | P1   | P2   | P3   |      |
| 6   | Accession 1 (A1)        | 9.74            | 11.00| 9.51 | 10.66| 10.23|
|     | Accession 2 (A2)        | 10.22           | 9.04 | 6.46 | 9.02 | 8.68 |
|     | Accession 3 (A3)        | 8.65            | 9.15 | 9.30 | 9.19 | 9.07 |
|     | Mean                    | 9.54            | 9.73 | 8.42 | 9.62 |      |
| 7   | Accession 1 (A1)        | 11.52           | 13.01| 11.14| 12.43| 12.02|
|     | Accession 2 (A2)        | 10.71           | 11.51| 8.37 | 11.04| 10.41|
|     | Accession 3 (A3)        | 10.85           | 11.20| 11.01| 11.10| 11.04|
|     | Mean                    | 11.03           | 11.91| 10.17| 11.52|      |
| 8   | Accession 1 (A1)        | 194.55          | 239.13| 192.67| 207.03| 208.35 a|
|     | Accession 2 (A2)        | 201.12          | 193.48| 123.63| 184.67| 175.73 a|
|     | Accession 3 (A3)        | 81.00           | 86.05 | 93.37 | 92.00 | 88.10 b|
|     | Mean                    | 158.89          | 172.89| 136.56| 161.23|      |
| 9   | Accession 1 (A1)        | 253.00          | 306.55| 248.83| 289.87| 274.56|
|     | Accession 2 (A2)        | 271.95          | 256.38| 181.42| 273.95| 245.93|
|     | Accession 3 (A3)        | 211.05          | 269.88| 263.27| 262.03| 251.56|
|     | Mean                    | 245.33          | 277.61| 231.17| 275.28|      |
| 10  | Accession 1 (A1)        | 280.12          | 323.92| 289.22| 314.90| 302.04|
|     | Accession 2 (A2)        | 301.60          | 291.98| 255.67| 309.67| 289.73|
|     | Accession 3 (A3)        | 316.38          | 305.28| 326.18| 336.72| 311.62|
|     | Mean                    | 299.60          | 307.85| 278.51| 306.06|      |
| 11  | Accession 1 (A1)        | 296.50          | 328.85| 312.10| 322.88| 315.08|
|     | Accession 2 (A2)        | 316.38          | 305.28| 296.70| 328.12| 311.62|
|     | Accession 3 (A3)        | 308.92          | 321.58| 300.42| 306.83| 303.69|
|     | Mean                    | 299.60          | 318.57| 303.07| 319.28|      |
| 12  | Accession 1 (A1)        | 316.82          | 330.78| 331.65| 331.80| 327.76|
|     | Accession 2 (A2)        | 323.53          | 311.02| 326.18| 336.72| 324.36|
|     | Accession 3 (A3)        | 290.82          | 331.10| 298.38| 313.12| 308.35|
|     | Mean                    | 310.39          | 324.30| 318.74| 327.21|      |
| 13  | Accession 1 (A1)        | 328.52          | 332.52| 335.45| 320.30| 329.20|
|     | Accession 2 (A2)        | 323.78          | 320.53| 340.27| 331.52| 329.03|
|     | Accession 3 (A3)        | 308.52          | 332.35| 317.32| 336.27| 323.61|
|     | Mean                    | 320.27          | 328.47| 331.01| 329.56|      |
| 14  | Accession 1 (A1)        | 317.53          | 324.55| 334.48| 328.83| 326.35|
|     | Accession 2 (A2)        | 316.42          | 311.78| 345.80| 324.77| 324.69|
|     | Accession 3 (A3)        | 298.62          | 322.92| 311.27| 326.52| 314.83|
|     | Mean                    | 310.86          | 319.75| 330.52| 326.71|      |

Note: P0: Without application of Natural PGR, P1: Extrait of Bamboo Shoots 40%, P2: Extract of Shallots 40%, P3: Bamboo Shoots Extract 40% + Shallot Extract 40%. The same letter behind the numbers indicated not significantly different according to Duncan’s Multiple Range Test at the level of α=5%.
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  |
|------------------------|-------------------------------|-------|
|                        | P₀                            | P₁    | P₂    | P₃    |
| Accession 1 (A₁)       | 9.28                          | 7.01  | 7.02  | 7.72  | 7.76  |
| Accession 2 (A₂)       | 6.75                          | 7.85  | 5.74  | 6.40  | 6.69  |
| Accession 3 (A₃)       | 4.90                          | 8.54  | 6.03  | 7.63  | 6.77  |
| Mean                   | 6.97                          | 7.80  | 6.26  | 7.25  |       |

Note: P₀: Without application of Natural PGR, P₁: Extracts of Bamboo Shoots 40%, P₂: Extract of Shallots 40%, P₃: Bamboo Shoots Extract 40% + Shallot Extract 40%.

Based on the results of the natural PGR analysis by the Balai Penelitian Tanaman Rempah dan Obat (2018), it indicated that bamboo shoot extract contained Auxin (IAA) 0.0084%, Gibberalgin (GA3) 0.058% and Cytokinin 0.045% while shallot extract contained Auxin (IAA) 0.0027%, Gibberalgin (GA3) 0.0021% and Cytokinin 0.0022%. Generally, the auxin hormone is in the form of indole-3-acetic acid (IAA). Auxin hormone has the benefit to stimulate shoot growth and bud growth because it functions as a regulator of cell enlargement. In low conditions, IAA can stimulate root lengthening [25]. Gibberellin (GA3) is useful for stimulating root growth and cytokinin functions in stimulating cell division (cytokinesis) which have a lot of influence on root and shoot growth [25]. The combination of 40% shoot extract + 40% shallot extract will increase the availability of auxin, gibberellin, and cytokinin hormones which will affect the absorption and performance of roots to support root growth in binahong plants.

Table 3. Root dry root weights on plant origin and application of different natural growth regulators

| Plant origin from Medan | Natural plant growth regulator | Mean |
|------------------------|-------------------------------|------|
|                        | P₀                            | P₁   | P₂   | P₃   |
| Accession 1 (A₁)       | 1.25                          | 1.09 | 1.02 | 1.28 | 1.16 |
| Accession 2 (A₂)       | 1.12                          | 1.13 | 1.12 | 1.04 | 1.10 |
| Accession 3 (A₃)       | 1.09                          | 1.10 | 1.08 | 1.12 | 1.10 |
| Mean                   | 1.15                          | 1.11 | 1.08 | 1.15 |     |

Note: P₀: Without application of Natural PGR, P₁: Extracts of Bamboo Shoots 40%, P₂: Extract of Shallots 40%, P₃: Bamboo Shoots Extract 40% + Shallot Extract 40%.

4. Conclusion

Planting material from accession 1 origin tends to increase plant length, shoot dry weight and root dry weight of binahong plants. The application of 40% bamboo shoot extract tends to increase the shoot dry weight of the binahong plant. Application of 40% bamboo shoot extract + 40% shallot extract increased the root dry weight of the binahong plant.

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Acknowledgment
The authors gratefully 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.