Application of bamboo shoot extract as natural plant growth regulator on the growth binahong (Anredera cordifolia (Ten.) Steenis.) in Tanah Karo

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Abstract. The application of bamboo shoot extract as natural plant growth regulator can affect plant growth of binahong. The objective of the research is to evaluate the growth response of binahong on the application of bamboo shoot extract. The research was conducted in Balai Penelitian Sayuran (Balitsa) in Tongkoh Village, Dolat Rakyat, Tanah Karo, Sumatera Utara on April to August 2019. The experimental design was a factorial Randomized Block Design with two factors. The first factor is the plant of origin from Tanah Karo (accession 1; accession 2; accession 3). The second factor is the dose of bamboo shoot extract (without treatment; 20%, 40%, 60% of bamboo shoot extract). The parameter observed were plant length, shoot dry weight and root dry weight. The results showed that the application of bamboo shoot extract significantly increased the plant length at 5-10 week after planted, whereas the application of bamboo shoot extract did not significantly effect on shoot dry weight and root dry weight.

1. Introduction
The use of plants as medicine has already exist along human’s civilization. Plants are a storehouse of chemicals that have many advantages, including drugs for various diseases. One of the plants which commonly used for herbal medicine is binahong (Anredera cordifolia (Ten.) Steenis). Binahong has the potential as a medicinal plant, because some ingredients there play a role in herbal medicine. However, binahong plants are not well known by the community and still considered as wild plants [1]. The results of previous studies have proven that binahong is beneficial in improving kidney function, as an antifungal, anti-bacterial, anti-virus, protease inhibitor, anti-hypertensive, anti-diabetic, vasodilator, xanthine oxidase inhibitor, diuretic, anti-obesity, antioxidant, gastroprotective, hypolipidemic, hepatoprotective anti-inflammatory, analgesic and wound recovery. Binahong leaves can be consumed safely and are proven to be developed as medicinal plants [2].

Binahong has some benefits, high economic value and allows it to be cultivated intensively. Binahong is currently used as a base material for the phytopharmaca industry. According to Balai Penelitian Tanaman Obat, Rempah dan Aromatik (2006), only about 20% of the industry's basic material is obtained from cultivation, while the others are obtained from the forest. That is because there are no cultivation techniques that support the plant’s growth [3].
The use of natural growth regulators is an easy alternative to be obtained, relatively inexpensive and safe to use, especially for phytopharmaca materials. There are various types of plant material that can be used as sources of growth regulators which is needed for plant’s growth, one of them is bamboo shoot as a source of gibberellins [4].

Manoi [5] states that Binahong belongs to the Basellaceae family which has a great potential to be developed and meticulous. Binahong originally come from China and disperse to Southeast Asia. Almost all parts of binahong, such as roots, stems, flowers, leaves and tubers found in the armpit of the leaf can be used for medication.

The application of bamboo shoot extract 4.5 ml/l water on green bean plants significantly affected the plant’s height, harvest age and number of pods, while on the dry’s weight parameters 100 seeds the great bamboo shoot extract was in 1.5 ml / l [6]. The natural ingredients from bamboo shoot which is used in this research were auxin (IAA) 0.0084%, gibberellin (GA3) 0.0058%, and cytokinin 0.0045%.

Maspary [7] says that bamboo shoot extract contains the hormone gibberellin, which has a function in cell division and elongation. Increasing nutrient availability through compost followed by supplying growth’s hormones contained in betung bamboo shoot extract can encourage the growth and development of palm’s seedlings better. 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 [8, 9, 10, 11]. Research on natural plant growth regulator 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 extract on the growth of binahong in Tanah Karo.

2. Materials and methods
The research was conducted in Balai Penelitian Sayuran (Balitsa) in Tongkoh Village, Dolat Rakyat, Tanah Karo, Sumatera Utara (N: 03°12’6” E: 98°31’24”) with a height of ± 1380 meters above sea level. The research conducted on April to August 2019.

The material was binahong tubers that used as planting material got from several places in Tanah Karo, topsoil which used as a mixture of planting media got from Tongkoh Village, compost chicken was used as a mixture of growing media got from Sei Sirim, river’s sand was used as a mixture of growing media, bamboo is used as a buffer pole, wire is used as a bamboo bond, seed banks and polybags in size 12 cm x 30 cm are used as planting media containers, bamboo shoots rope are used as a natural source obtained from Tanjung Selamat, aquades are used as solvents, envelopes are used as a place for harvesting.

The tools used in this study is analytical scales are used for dry weight of binahong plant, a bucket is used as a container of water, a ruler is used to measure the length of the plant, a blender to smooth bamboo sprouts’ extract, filters are used to separate the extracts and pulp in bamboo shoot extracts, knives are used to cut bamboo shoots, machetes are used to cut bamboo, sprayers are used to apply bamboo shoot’s extracts, bland is used to water plants, black paranets are used for 25% reduction in light intensity, the camera is used for documentation, the oven is used to remove the moisture content of plants and stationery is used to record the results of research.

This research used a factorial randomized block design with two factors. The first factor is the plant of origin from Tanah Karo (Ruran Area accession; Barus Jahe accession; Berastagi accession). The second factor is the dose of bamboo shoot extract (without treatment; 20% (mixing 200 g bamboo shoots with 1000 ml aquades), 40% (mixing 400 g bamboo shoots with 1000 ml aquades), 60% (mixing 600 g bamboo shoots with 1000 ml aquades) of bamboo shoot extract) Data were analysed using Analysis of Variance (ANOVA) and continued by the Duncan’s Multiple Range Test (DMRT) at \( \alpha = 5\% \).
3. Results and discussion

3.1. The length of plants

The data observation and length variation of binahong can be seen in Table 1. The results of variance indicate that at 5, 6, 7, 8, 9, and 10 weeks after planting (WAP) the application of bamboo shoot extract significantly affected plant length of binahong. The application of bamboo shoot extract at 11, 12, and 13 WAP did not significantly affect the length of the binahong.

In observations of 5 to 10 WAP showed that obvious results this is due to the addition of bamboo shoot extract containing the gibberelin’s hormone which has a role in cell elongation. This is consistent with the statement of Ariani et al. [12] which states that gibberellins affect the increase of cell division and cell enlargement. The addition of gibberellins provides the best growth and results for Dewata cultivar wheat.

Table 1. The application of bamboo shoot extract on length of binahong at 5-14 WAP

| WAP | Plant origin from Tanah Karo | Natural plant growth regulator | Mean |       |
|-----|-----------------------------|--------------------------------|------|-------|
| 5   | Accession 1 (A₁)            | 27.9fe                         | 52.8de | 94.1a | 54.3b-e | 57.3 |
|     | Accession (A₂)              | 10.5f                          | 64.0bcd | 93.6a | 65.7a-d | 58.4 |
|     | Accession (A₃)              | 46.4de                         | 41.1de | 82.6a | 81.4abc | 62.9 |
| Mean|                             | 28.3c                          | 52.6b  | 90.1a | 67.1b   |      |
| 6   | Accession 1 (A₁)            | 67.8                           | 93.6   | 152.7 | 109.1   | 105.8|
|     | Accession (A₂)              | 41.3                           | 107.8  | 164.9 | 132.2   | 111.6|
|     | Accession (A₃)              | 104.8                          | 83.3   | 153.6 | 136.1   | 119.4|
| Mean|                             | 71.3d                          | 94.9c  | 157.1a| 125.8b  |      |
| 7   | Accession 1 (A₁)            | 126.8d                         | 144.8cd| 196.6b| 179.8abc| 162.0|
|     | Accession (A₂)              | 78.8e                          | 161.6bcd| 212.1a| 192.6ab | 161.3|
|     | Accession (A₃)              | 164.0bcd                       | 143.5cd| 212.6a| 189.4ab | 177.4|
| Mean|                             | 123.2c                         | 150.0b | 207.1a| 187.3a  |      |
| 8   | Accession 1 (A₁)            | 177.3b                         | 219.1ab| 233.6a| 223.2ab | 213.3|
|     | Accession (A₂)              | 119.6c                         | 203.9ab| 249.3a| 238.7a  | 202.9|
|     | Accession (A₃)              | 212.2ab                        | 195.2ab| 247.6a| 228.9ab | 220.9|
| Mean|                             | 169.7c                         | 206.0b | 243.5a| 230.2ab |      |
| 9   | Accession 1 (A₁)            | 209.6                          | 248.7  | 246.3 | 245.4   | 237.5|
|     | Accession (A₂)              | 165.9                          | 228.7  | 264.5 | 262.2   | 230.3|
|     | Accession (A₃)              | 237.0                          | 220.0  | 265.3 | 244.0   | 241.6|
| Mean|                             | 204.2b                         | 232.5a | 258.7a| 250.5a  |      |
| 10  | Accession 1 (A₁)            | 229.3                          | 284.8  | 258.5 | 266.7   | 259.8|
|     | Accession (A₂)              | 199.1                          | 237.3  | 283.2 | 281.3   | 250.2|
|     | Accession (A₃)              | 265.6                          | 248.9  | 284.5 | 261.7   | 265.2|
| Mean|                             | 231.3b                         | 257.0ab| 275.4a| 269.9a  |      |
| 11  | Accession 1 (A₁)            | 259.0                          | 290.4  | 273.1 | 283.3   | 276.4|
|     | Accession (A₂)              | 245.9                          | 275.7  | 298.8 | 299.0   | 279.8|
|     | Accession (A₃)              | 284.1                          | 270.4  | 285.0 | 275.4   | 278.7|
| Mean|                             | 263.0                          | 278.8  | 285.6 | 285.9   |      |
| 12  | Accession 1 (A₁)            | 276.5                          | 299.6  | 286.7 | 294.6   | 289.3|
### Table 2. Shoot dry weight of several plant origins from Tanah Karo on application of bamboo shoot extract as natural plant growth regulators

| Plant origin from Tanah Karo | Accession 1 (A₁) | Accession 2 (A₂) | Accession 3 (A₃) | Mean    |
|-----------------------------|------------------|------------------|------------------|---------|
|                             | P₀               | P₁               | P₂               | P₃      |
| Accession 1 (A₁)            | 5.75             | 4.97             | 8.01             | 6.20    | 6.23    |
| Accession 2 (A₂)            | 4.91             | 6.71             | 6.90             | 8.26    | 6.69    |
| Accession 3 (A₃)            | 5.78             | 5.72             | 6.46             | 5.50    | 5.87    |
| Mean                        | 5.48             | 5.80             | 7.12             | 6.65    | 6.26    |

Note: P₀: No bamboo extract treatment, P₁: Giving 20% of bamboo shoot extract, P₂: Giving 40% of bamboo shoot extract, P₃: Giving 60% of bamboo shoot extract.
3.3. Root dry weight
The data and variability of root dry weight can be seen in Table 3 which states the shoot dry weight did not significantly affect the shoot dry weight of binahong on application of bamboo shoot extract. The response of root dry weight showed that the application of bamboo shoot extract did not significantly results because the needs of nutrient water, air and sunlight were not enough, caused the decreasing of carbohydrates. Harjadi [15] stated that carbohydrates also play a role in increasing the rate of cell division of meristem system in cambium. the point of growth of stems and root tips.

| Plant origin from Tanah Karo | Natural plant growth regulator | Mean |  |
|-----------------------------|--------------------------------|------|---|
|                             | \( P_0 \)                      | \( P_1 \) | \( P_2 \) | \( P_3 \) |
| Accession 1 (A1)            | 1.23                           | 0.52  | 0.77  | 0.70  | 0.81 |
| Accession 2 (A2)            | 0.88                           | 0.75  | 0.89  | 1.27  | 0.95 |
| Accession 3 (A3)            | 0.82                           | 1.32  | 0.70  | 0.69  | 0.88 |
| Mean                        | 0.98                           | 0.86  | 0.79  | 0.89  | 0.88 |

Note: P0: No bamboo extract treatment, P1: Giving 20% of bamboo shoot extract, P2: Giving 40% of bamboo shoot extract, P3: Giving 60% of bamboo shoot extract.

The ability of root absorption depends on the surface area of the root absorption which is influenced by the number and length of the roots. Increasing the number and length of roots will increase the nutrient uptake and plant's water. and plant's photosynthetic activity to produce plant's component. which will accumulate into the plant dry's weight.

4. Conclusion
The application of bamboo shoot extract as natural plant growth regulators significantly increased the plant’s length at the age of 5-10 WAP and did not support significantly at the age of 11-14 WAP, and the application of bamboo shoot extract did not significantly increase shoot dry weight and root dry weight.

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