Influence of seedlings height and planting media on Eha growth (*Castanopsis buruana* Miq.) from the extract of natural saplings

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**Abstract.** Eha is one of the important plants in Indonesia's tropical forests that has important ecological and economic value. During this time Eha is cultivated generatively through seeds, but because of the often constrained seasons and availability of seeds, therefore, we need an alternative cultivation technology with vegetative propagation. This study aims to examine the influence of seedlings height and planting media on the growth of Eha from the extraction of natural saplings. This study was compiled based on a Complete Randomized Design of factorial patterns consisting of two factors. The first factor is the height of seedlings consisting of 3 levels of treatment, namely height 10 cm, 20 cm and 30 cm. The second factor is the type of media consisting of 3 levels of treatment, namely soil, 1:1 sand soil and 1:1:1:1 husk charcoal sand soil. The results show that a seedling height of 20 cm can increase the percentage of life, the percentage of buds and the number of leaves of Eha from the extract of natural saplings. The composition of the best planting medium is a mixture of soil and sand (1:1) because it tends to give the best results against the percentage of sprouts and the percentage of life Eha from the extraction of natural saplings.

1. **Introduction**

Eha (*Castanopsis buruana* Miq.) is one of the 120 species of the genus Castanopsis family Fagaceae in the Asian Tropics [1]. This species grows naturally in primary and secondary lowland forests up to an altitude of 1000 meters above sea level [2], spread across Maluku, Sulawesi and Kalimantan [3, 4]. Eha has a height of 20-30 m with a diameter of 10-30 cm [2], is a strong grade II-III wood and durable class III [4]. Based on the durable and strong class of wood of this species can be used for beams on residential buildings and bridges, boards, poles, ribs and good to be used as shingles [2].

In addition to wood, Eha fruit produces edible nuts, high nutritional value and gluten-free, the bark produces tannins and as a source of natural dyes [5]. Locally, Eha fruit is roasted and eaten like peanut flavor by wawonii people, Konawe Islands Regency, Southeast Sulawesi [6]. The results reported that Eha seeds (chestnut) contained 2.46% protein, 0.34 fat, and 66.75% carbohydrates [7]. Based on the content, Eha seeds have the potential as a nutritious and healthy alternative food. Thus, this plant has economic potential so that it is feasible to be developed in the Sulawesi region.
To support the development of Eha forest in Sulawesi, it is necessary to master the silviculture techniques. Until now, Eha plants can be reproduced with seeds [7, 8]. But the obstacle faced in generative multiplication is that the seeds are easily damaged and have a hard and thick seed skin that takes a long time to germinate. In addition, the fruiting season is erratic and the fruiting period interval is very long [9]. The problem becomes a reason to look for alternative cultivation technology, namely by multiplication through the extraction of natural saplings.

The source of seedlings from the extract of natural saplings must have criteria based on their morphological classification. This is due to the morphological measurement of seedlings easier, faster and easier [10]. The most widely used morphological characteristics assess the quality of seedlings is the high seed [11]. The height of seedlings correlates with the number of leaves that can provide an estimate of photosynthesis capacity and transpiration area [10]. The results showed that good quality pinus taeda seedlings are characterized by height 20-25 cm [12], Pinus merkusii 6.1-10 cm [13], Sterculia foetida and Calophyllum inophyllum ≥ 30 cm [14, 15] and Shorea parvifolia 60-65 cm [16]. While in Eha there has been no research on morphological criteria, especially high seedlings against Eha growth.

In addition to the quality of seedlings, planting media also plays an important role in influencing plant growth. Physically, the media must have high porosity, drainage and good aeration. It can support metabolism and good root growth chemically, the medium is able to provide the main nutrients macro nutrients such as N, P, K, Ca and Mg needed for plant growth and development [17]. This study aims to examine the high influence of seedlings and planting media on the growth of Eha from the extraction of natural saplings.

2. Research methods

2.1. Preparation of materials
The materials used are soil samples, sand, charcoal husks, compost, hoods and Eha seeds. The tools used are GPS, digital cameras, crowbars, cutting scissors, buckets, polybags, stars, label papers and stationery.

2.2. Research design
This study was compiled based on a Complete Randomized Design in a factorial pattern consisting of two factors. The first factor is the height of seedlings consisting of 3 levels of treatment, namely height 10 cm, 20 cm and 30 cm). The second factor is the type of media consisting of 3 levels of treatment, namely soil, 1:1 sand soil and 1:1:1:1 husk charcoal sand soil. Each treatment was repeated 3 times, so there are 27 experimental units.

2.3. Research procedures
The seeds used in this study are natural saplings taken by extraction. Criteria for healthy saplings with a high size of seedlings 10-30 cm with 2-3 pairs of leaves. The planting media used is soil, sand and husk charcoal. All media to be used are sterilized using autoclaves for 2 hours, with a pressure of 1.5 atm and a temperature of 120°C. Extracts of Eha natural saplings obtained from the field were planted in polybags that have been filled with planting media. Maintenance includes watering, pest and disease control.

2.4. Data analysis
The observation data of each variable was analyzed using F Test. If the treatment has a significant effect then it will be continued with Duncan's multiple distance test to analyze significant differences with a real level of 5% using SAS software version 94.
3. Results
The treatment of seedlings height and planting media had no significant effect on all the parameters observed. The interaction between the seedlings height and planting media exerts an unreal influence on all observational variables, except for the variable of percentage of life of Eha that showed a significant effect (table 1).

| Treatment                          | Percentage of life (%) | Percentage of buds (%) | Number of buds | Shoots Height (cm) | Number of leaves (helai) | Shoots dry weight (g) |
|------------------------------------|------------------------|------------------------|----------------|--------------------|--------------------------|------------------------|
| Height of seedlings                | 0.20 ns                 | 0.18 ns                 | 0.27 ns        | 0.06 ns            | 0.73 ns                  | 0.96 ns                |
| Planting media                     | 0.20 ns                 | 0.57 ns                 | 0.80 ns        | 0.08 ns            | 0.33 ns                  | 0.87 ns                |
| Interaction of seedlings height and planting media | 0.05 *                 | 0.96 ns                 | 0.73 ns        | 0.44 *             | 0.23 ns                  | 0.74 ns                |

Information: ns= not significant; *= significant

3.1. Seedling height
Test results are real difference (α = 5%) based on Duncan multiple range test. Results show that the treatment of seedlings height gave an unreal difference to the growth of Eha plants. However, the trend of growth suggests that the height of seedlings of 20 cm resulted in a higher increase in the percentage of life, the percentage of buds and the number of leaves of Eha compared to the seedlings height of 10 cm and 30 cm (figure 1).

![Figure 1. Effect of seedlings height on Eha growth](image-url)
3.2. Planting media
Test results are real difference ($\alpha = 5\%$) based on Duncan multiple range test. Treatment of planting media gave an unreal difference to the growth of Eha plants. However, the growth trend shows that sand soil (1:1) there is a higher increase in the percentage of life and percentage of shoots compared to soil media and charcoal husk sand soil (1:1:1) (figure 2).

![Figure 2. The influence of planting media on the growth of Eha](image)

3.3. Interaction of seedlings height x planting media
Test results are real difference ($\alpha = 5\%$) based on Duncan's multiple range test. The interaction of treatments height of seedlings and planting media presented in figure 3. The height of seedlings 10 cm, 20, and 30 cm with soil media, sand soil (1:1) and ground charcoal husks (1:1:1) produced a percentage of life Eha 100% and differed markedly only from the seedlings height treatment of 10 cm on soil media, sand soil (1:1) and charcoal husks (1:1:1) (figure 3).

![Figure 3. Effect of interaction of seedlings height and planting media on the percentage of life of Eha.](image)
4. Discussion

Propagation of Eha plants using natural extracting methods can be one of the alternatives in the cultivation of Eha plants in the future. The results showed that the height of seedlings extracting Eha from natural saplings significantly increased the growth of Eha plants on the seedling scale. The height of the seedlings 20 cm produces an average percentage of life, the percentage of buds and the number of leaves Eha higher compared to the height of seedlings 10 cm and 30 cm. This is thought to be related to the quality of seedlings to grow and adapt to their environment. One of the morphological characteristics that are widely used in assessing the quality of seedlings is the height of seedlings [11]. The minimum high standard of seedlings varies greatly for each type, seed zone and age class [10].

The height of seedlings is related to the number of leaves that can provide photosynthesis capacity and transpiration areas. Higher seedlings have the ability to compete with weeds and indicate superior genetic traits. Large transpiration areas in higher seedlings cause stress when planted mainly when the roots have not yet formed [10].

In addition to the quality of seedlings, planting media also plays an important role in spurring plant growth on the nursery scale. The results showed that soil media as well as a mixture of soil media with sand and charcoal husks significantly increased the percentage of life extracted from natural saplings. The high percentage of Eha growth from the extraction of natural saplings on the soil media is suspected because the land is a medium overgrown by Eha on its natural distribution in Kendari and its surroundings. In addition, the rooting of Eha extract is thought to have been colonized by ectomycorrhiza fungi so as to support the growth of Eha. According to Basrudin et al. [18, 19] that Eha formed colonization with ectomycorrhiza fungi. As a result of this colonization the growth of plants became better [20]. This is because ectomycorrhiza fungi help absorb nutrients, increase the resistance of plants to drought, produce substances that plants can use, and can protect the rooting of plants from pathogenic attacks.

Proper media composition will result in high porosity, drainage and good aeration, as a result of which it can support for the better metabolic processes and root growth [17]. The results showed that a mixture of soil media, manure and sand (1:1:1) can increase the growth of diameter, height and number of manglid seed leaves, while the percentage of life of manglid seedlings is best produced in a mixture of soil media, manure and rice husks (1:1:1). Nonetheless, each type of plant has different media needs. A mixture of topsoil media, sand and compost (3:3:1) and top soil, compost (6:1) is the best medium for the increase in height and diameter of the extract of bitter charm (*Eurycoma longifolia* Jack.) [21]. A mixture of top soil, compost (1:1) and top soil media, compost (1:2) is the best medium for the increase in height and diameter of *Shorea leprosula* Miq. saple extract [22].

5. Conclusion

Eha can be reproduced generatively through seedlings from the extract of natural saplings. The height of seedlings 20 cm can increase the percentage of life, the percentage of buds and the number of leaves Eha from the extract of natural saplings. The composition of the best planting medium is a mixture of soil and sand (1:1) because it tends to give the best results against the percentage of sprouts and the percentage of life Eha from the extraction of natural saplings.

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