The Effect of Sieve Mesh Size for Trema(*Trema orientalis* Linn. Blume) Seed Selection to Its Seed Viability and Seedling Growth

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Abstract. Trema (*Trema orientalis* Linn. Blume) is a potential multipurpose tree species belongs to Cannabaceae, that can be used for producing biomass energy, light construction, charcoal and herbal medicine. In relation to the seed procurement, the objective of this research is to find out the effect of sieve mesh size for seed selection of trema to seed viability and seedling growth. The research design used completely random design with treatments of (1) control (without using sieve mesh), (2) 1.18 mm in size of sieve mesh, (3) and 1.70 mm in size of sieve mesh. Every treatment contains 4 replications. The observed parameters were of Germination Percentage (GP), Germination Rate (GR), seedling height and seedling diameter. The results of this research indicated : (1) the sieve mesh size has been significantly influence the GP, GR, seedling height and seedling diameter, (2)1.70 mm in size of sieve mesh was the best method for seed selection of trema, with the average of 83% in GP, 4.2391 %/etmal in SG, 13.6 cm for seedling height and 2.1 mm in seedling diameter.

1. Introduction
Trema (*Trema orientalis* Linn. Blume) is a multipurpose tree species as an alternative tree species for producing biomass wood energy. Trema is belongs to the Cannabaceae family. This species is cathegorized as versatile plants because all of parts of the tree can be used. Its wood contains heat of 4576 cal / g [1] and it can be used as tools, roof frame building materials, paper industry, plywood, matches and charcoal, and also the leaves and stems can be used as herbal remedies, and the bark for coloring [2]. That is way, this species is very potential to be developed.

Trema seed is a small seed, which has an average seed length of 2.103 ± 0.0496 mm, an average seed width of 1.812 ± 0.0588 mm [3]. One of the problems that arise in the small seed procurement is to determine the proper seed selection method to improve the viability of seeds and the seedlings growth. According to [4] seeds of forest plants have variations in seed size which generally affect the quality of the seeds. Seed size affects seed quality and seed vigor, although not always the effect is seen significantly. To support the success of planting, it is necessary to supply the best quality seeds. One method for providing good quality seeds is by selecting seeds based on seed weight or size.

According to [5], seed size sometimes correlates with seed viability and vigor, where the heavier seeds tend to have better vigor. The more size of the seeds in the form of weight and dimension is more widely chosen because it generally relates to better seed germination and seedlings growth, but this will remove smaller seeds that may have better genetic makeup. Variation in seed weight and size
is influenced by heredity (genetic) and environmental factors. The prediction of bigger-sized seeds provide physiological advantages because food reserves that are more sufficient for seed germination need to be studied for several species of forest plants.

Figure 1. Tree, fruit and seed of Trema

One of the methods in good quality seeds procurement is by selecting seeds based on seed weight or size [4]. This method can be used to improve seed viability [6]. The seed selection method can be conducted by using a sieve (mesh) [7], based on morphological or physiological characteristics of seeds, for example dimensions (small, medium and large) or seed weight ([8] ; [9]). It is hoped that this seed size classification will improve the physiological quality of seed lots of Trema that can guarantee better germination and seedling growth. Therefore these efforts will increase the success of nurseries in order to provide good quality seeds for planting [4].

The small seed selection techniques can be done using a sieve (mesh). The size of the sieve varies depending on the size and shape of the seed. The purpose of this study was to determine the effect of sieve size in seed selection on seed viability and seedling growth of trema.

2. Materials and Methods

2.1. Place and Time of Research
The seed collection of the trema was conducted in Badung District, Bali Province. Seed testing was carried out in the laboratory and greenhouse of the Tree Seed Technology Research and Development Institute in Bogor. Nursery testing was carried out at Nagrak Research Station, Bogor. The study was conducted for four months, from February to May 2015.

2.2. Materials and Methods
2.2.1. Materials
The materials that used in this study were 1.18 mm and 1.70 mm sieve size, sterilized the mixture medium of soil and sand, compost, polybags in size of 10 cm x 15 cm, and shadding net with 70% shade intensity.

2.2.2. Methods
The seed collection of Trema was conducted by climbing the trees using hooked pole tools for collecting only its ripe fruit which have black colour that can be categorized as
physiologically ripe fruit. The seed extraction for removing seeds from the other parts of fruit was done by rubbing the fruit and pulverizing it together with coarse sand, then washing with water until the seedcoat in cleaned condition. The seeds were then air dried in a sheltered place. Seed selection of trema was done by using a sieve size of 1.18 mm and 1.70 mm (Figure 2 and Figure 3).

![Figure 2. Sieve size of 1.18 mm](image)

![Figure 3. Sieve size of 1.70 mm](image)

The seeds of the trema which were selected by using sieve size of 1.18 mm and 1.70 mm, were then sown (germinated) in a sprout tub. The number of seed for each sieve treatment were 4 replications @ 100 seeds for germination testing with the parameters to be observed were germination percentage (GP) and germination rate (GR). The next stage is transplanting the seedling in the nursery, using a polybag of 10 cm x 15 cm in size and the medium of a mixture of soil and compost (3: 1 / v / v). After transplanting for 1 month the height and diameter of the seedlings were then measured.

2.2.3. Experimental design
This study used a Completely Randomized Design (CRD) with treatment of sieve size (mm). The observed parameters were of seed germination, germination rate, seedling height and seedling diameter.
2.2.4. Data Analysis
The results of the research data were analyzed by analysis of variance (ANOVA). If it has a significant, will then be continued by Duncan test to find out the difference further.

3. Results and Discussion

3.1. Research Result

3.1.1. Germination Percentage (GP)
Based on the results of the analysis of variance showed that the treatments of seed selection based on sieve size significantly affected the GP of trema (Table 1).

Table 1. Analysis of variance in the effect of seed selection treatments on the germination percentage of trema

| Source of variation | Degree of freedom | Sum of square | Mean of square | F calc. | F table (5 %) |
|---------------------|-------------------|---------------|----------------|----------|---------------|
| Treatments          | 2                 | 4180,67       | 2090,33        | 30,59*   | 4,26          |
| Residue             | 9                 | 615,00        | 68,33          |          |               |
| Total               | 11                | 4795,67       |                |          |               |

Remarks : * = Significant at 95 % confident level

Figure 4. The average of germination percentage based on seed selection of trema (Duncan Test)

3.1.2. Germination Rate (GR)
The treatment of seed selection based on sieve size significantly affected on the GR of trema (Table 2).
Table 2. Analysis of variance of the effect of seed selection on the seed germination rate of trema

| Source of variation | Degree of freedom | Sum of square | Mean of square | F calc. | F table (5%) |
|---------------------|-------------------|---------------|----------------|---------|--------------|
| Treatments          | 2                 | 11.22         | 5.61           | 29.20*  | 4.26         |
| Residue             | 9                 | 1.73          | 0.19           |         |              |
| Total               | 11                | 12.94         |                |         |              |

Remarks: * = Significant at 95 % confident level

Figure 5. The Average of GR of trema based on the seed selection treatment (Duncan Test)

3.1.3. Seedling Height

The results of analysis of variance showed that the treatment of seed selection based on sieve size significantly affected the seedlings height (Table 3).

Table 3. Analysis of variance of the effect of seed selection treatments on seedling height of trema

| Source of variation | Degree of freedom | Sum of square | Mean of square | F calc. | F table (5%) |
|---------------------|-------------------|---------------|----------------|---------|--------------|
| Treatments          | 2                 | 25.84         | 25.84          | 27.19*  | 7.71         |
| Residue             | 9                 | 3.80          | 0.95           |         |              |
| Total               | 11                | 29.64         |                |         |              |

Remarks: * = Significant at 95 % confident level
Figure 6. The average of seedling height of trema (at the age of 1 month) from seed selection treatments based on sieve size (Duncan Test)

3.1.4. Seedling Diameter

The results of variance analysis showed that the treatment of seed sorting based on sieve size significantly affected the seedling diameter (Table 4).

Table 4. Analysis of variance in the effect of seed selection on seedling diameter

| Source of variation | Degree of freedom | Sum of square | Mean of square | F calc.  | F table (5%) |
|---------------------|-------------------|--------------|----------------|----------|--------------|
| Treatments          | 2                 | 0,35         | 0,35           | 22,84*   | 7,71         |
| Residue             | 9                 | 0,06         | 0,02           |          |              |
| Total               | 11                | 0,42         |                |          |              |

Remarks: * = Significant at 95 % confident level

Figure 7. The average of seedling diameter of trema (at the age of 1 month) from seed selection treatments based on sieve size (Duncan Test)
3.2. Discussion

The treatment of seed selection based on sieve size significantly affected the GP, GR, seedling height, and seedling diameter of trema. Seed selection of trema by using sieve size of 1.70 mm resulted in GP (83%), GR (4.24% / etmal), seedling height (13.59 cm), and seedling diameter (2.11 mm). The use of sieve size of 1.70 mm has resulted in better seed viability and the growth of trema seedling compared to sieve size of 1.18 mm. The larger in seed size the better seed germination and seedling growth with the minimum seed size of 1.70 mm for producing high seed quality of trema. Seed size tend to have good correlation with vigor. Larger in seed size have a tendency faster to germinate and grow better. For example, the large tanjung seeds have higher germination percentage and germination faster, so that they are more vigorous and able to grow into normal plants in the field [10]. Likewise on mindi seeds, and kemenyan ([11]; [12]).

According to [5], the size of seeds correlates with viability and vigor of seeds, where larger seeds tend to have better vigor. The germination rate is a picture of the seed vigor. Seeds that have high vigor can germinate faster than seeds that have low vigor. Vigor is the nature of seeds which determines the potential for rapid and uniform of becoming normal seedling under relatively wide field conditions.

It is assumed that large seeds have more food reserves as a source of energy for the seed germination process. The main function of food reserves in seeds is to feed young embryos and plants before they are able to produce food, hormones, and proteins [13]. Large seeds contain more food reserves and larger embryos compared to small seeds [14]. Thus if the reserves of food are available in small amount, then plant growth tends to be weaker. [9] also reported that large seeds of Acacia crassicarpa had a higher GP compared to small seeds.

According to [15] large seeds provide physiological benefits because food reserves are more sufficient for seed germination. This shows that heavier seeds have better growth, that reflected in the speed of germination of larger and higher sizes of seeds compared to the light seeds, so that the growth energy is still going on in growing seedling.

Large seeds tend to germinate more uniformly and produce larger seedlings and high vigor than small seeds of the same plant species. Seed size plays an important role in generating energy during the germination process. Seeds that are relatively large and heavy indicate the amount of food that is abundant from the parent tree [4]. With these abundant food reserves, it can guarantee a longer growth period of tillers in a new environment before the plants are able to utilize the results of their assimilation. Therefore, the size of the seed is usually related to the size of the seedling [5].

The description of the growth of seedlings of trema has shown that the trema seeds that were selected using a 1.70 mm sieve size can produce higher seedling height and seedling diameter compared to the seeds selected by using a 1.18 mm sieve size. This is an indication that the larger seeds have better seedling growth. The results of the study [16] stated that the size of the seed gave a significant effect on seed germination of gmelina. Large and medium seed sizes provide better seedling growth compared to small seed sizes. [17] also reported that the larger size of Shorea leprosula seed produced higher GP and seedling growth. According to [15], the larger seeds have greater potential to support the development of seedlings ready for planting, with high parameters of morphological criteria of seedling, in addition to diameter, appearance of leaves, stems and shoots, shape and root volume, and root growth potential.

4. Conclusion

The use of sieve size for seed selection has effected the GP, GR, seedling height, and seedling diameter of trema. The sieve size of 1.70 mm produce the better seed viability and seedling growth of trema with the average of GP is 83%, the average of GR is 4.2391% / Etmal, the average of seedling height is 13.5851 cm and the average of seedling diameter is 2,1144 mm. The minimum in size of 1.70 mm for trema seed can be stated as guidance for producing high seed quality.
5. References

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