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Germination Test And Growth Kind Of Invasive Alien Bellucia Pentamera Naudin On Different Light Intensity

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Abstract – The research about germination and growth of the invasive alien species *Bellucia pentamera* Naudin with different light intensities was conducted from December to March 2022 at Plant Ecology Laboratory and Plant Physiology Laboratory, Biology Department, Faculty of Mathematics and Natural Science, Universitas Andalas, Padang. The research objectives were to find out the effect of different light intensity and the germination of *B. Pentamera* with differences in the growth of *B. pentamera*. The research used a completely Randomized Design (CRD) with 3 treatments 9 replications and light intensity <25%, ±50%, and >75%. The parameters of the research were time of germination, percentage of germination, number of leaves, number of seedlings, seedling height, and dry weight and wet weight. Based on the research, it was found that on the parameter of seed germination, the average germination appeared from 18 to 25 day. The percentage of seed germination ranges from 1,14% -1,78%. The parameter of the average number of leaves in each treatment ranges from 3-4 leaves, then the parameter of the number of seedlings is 1-2 seedlings. The seedling height ranged from 1-2 cm, the wet weight ranged from 0.01-0.12 gram, and the dry weight ranged from 0.002-0.03 gram. Statistical test results showed that the treatment was not significantly between treatments

Keywords – *Bellucia pentamera*, germination, growth, invasive plant, light intensity

I. INTRODUCTION

An invasive plant is a type of plant that is introduced into other ecosystems quickly causing environmental damage and can even replace native plant species [1]. PERMENLH 2016 mention that one of the invasive species that needs to be controlled is Bellucia pentamera [2]. B. pentamera is an invasive plant that has spread from Mexico to Tropical America, and is now invading several areas in Indonesia including the tropical forests of Sumatra, but the effects of this invasion on vegetation and abiotic environments are not well understood [3].

One of the areas that have been invaded by the *Bellucia* plant is the conservation forest area of the oil palm plantation of PT. Kencana Sawit Indonesia (KSI) in South Solok Regency, West Sumatra Province [4]. Solfiyeni's research (part b) was conducted in the high conservation value forest of PT. KSI states that the distribution of *B. pentamera* grows at a certain distance from non-*Bellucia* trees with large and dense canopies and leaves canopy gaps between them, and *Bellucia* trees with smaller diameters are usually found in gaps between large trees, both between non- *Bellucia* and between *Bellucia* and non-*Bellucia* trees [5]. In Gunung Palung National Park (TNGP) the weed *Bellucia* also grows a lot. A large number of *Bellucia* in this area is due to selective logging activities so there are several canopy gaps. Through the canopy gap light can enter which causes the *Bellucia* species to germinate quickly [6].

The invasive plant species *Bellucia* has a very large number of seeds, approximately around 3000 seeds per fruit, a large number of seeds is one of the reasons this species quickly invades several places. In addition to the number of seeds, the potential for weeds is influenced by the number of fruits, and how the potential for these plants to germinate and grow into saplings [7].

Germination is a process in which the initial stage of the process of growing an embryo in a plant [8]. while growth is the increase in size in plant organs which are irreversible in nature [9]. Germination in plants is influenced by two factors, namely internal factors, and external factors. Internal factors consist of genes and hormones, while external factors consist of water, temperature, soil, and light [10]. Light is one of the important external factors for the germination process, generally, plants are very dependent on sunlight for metabolic energy. The intensity of light required is not always the same for each growth, some require full light and some require little light for the germination process [11].

Devi's research [12] regarding the germination test of invasive foreign plants *B. pentamera* at different light intensities and soil sources, stated that at a light intensity of ±50% the seeds from *B. pentamera* germinated earlier than those treated with a light intensity of >75%. This study is different from Devi's research, where in this study the effect of differences in light intensity was observed not only until germination but continued until *B. pentamera* puppies became. The purpose of this study was to determine the effect of differences in light intensity on the germination and growth of *B. pentamera* germination.

II. RESEARCH METHODS

This research was conducted using an experimental method with a completely randomized design (CRD) consisting of 3 treatments and 9 replications so that a total of 27 experimental units were obtained with different treatments of light intensity. The work procedure in this study was to make a shade which was made with a wooden frame measuring 150 cm x 150 cm x 150 cm covered with a paranet with 3 levels of light intensity, namely light intensity <25%, light intensity ±50%, and light intensity >75%.

Light intensity was measured using a lux meter. Light intensity measurements were carried out at 10.00-14.00 noon. Next, prepare the planting media where the planting media uses garden soil and then sifts it and puts it into a 25x25 cm polybag. Next is the preparation of seeds, seeds that come from perfectly ripe fruit (pale yellow), which fall around the tree. The fruit is then collected, selected, and dried in a greenhouse for ± 10 days [13].

After the fruit is dry, the process of separating the seeds from the fruit flesh is carried out by placing it in the water while the seeds are separated from the fruit flesh. Furthermore, the seeds are spread in all the planting media that have been prepared and watered every morning and evening according to field capacity. Observation parameters were divided into germination and growth parameters. Germination parameters were observed during 6 weeks of planting. The observed were the time of emergence of germination (days) and the percentage of germination (%). Growth parameters were observed during 6 weeks of planting, which were observed were the number of leaves (strands), seedlings height (cm), number of germination becoming seedlings, fresh weight (g), dry weight (g), and environmental factors measured, namely soil moisture and soil temperature. .

III. RESULT AND DISCUSSION

A. Time of germination appearance and Percentage of germination(%)

The results of observations regarding the time of emergence and the percentage of germination of *B. pentamera* with different treatments of light intensity and statistical tests have been carried out, indicating that between treatments did not have a significantly different effect on the time of emergence of germination and the percentage of germination of *B. pentamera*. Data on the time of emergence of germination and the percentage of germination can be seen in table 1.

Table 1. Average time of emergence and average germination percentage of *B. pentamera* Naudin with different light intensities

Treatment light intensity (%)	Time of emergence of germination (days)	Percentage of germination (%)
<25	18,66 a	1,14 a
±50	25,11 a	1,83 a
>75	19,88 a	1,78 a

Treatment of different light intensities did not have a significantly different effect on the time of emergence of germination. This proves that *B. pentamera* is capable of germinating under various light intensity conditions, thus causing this species to become an invasive plant. *B. pentamera* germination first appeared on day 10 in the light intensity treatment of ±50%,

then on day 13 in the light intensity treatment >75%, and then on day 17 germination appeared in the light intensity treatment <25%. In accordance with Devi's research (2020) regarding the germination test of invasive foreign plants *B. pentamera* at different light intensities and soil sources, the earliest germination appeared in the ±50% light intensity treatment, followed by the <25% and >75% light intensity.

In Table 1 it can also be seen that the ±50% light treatment tends to be higher on average when the germination appears than the other light intensity treatments, namely 25,11. This was caused by the germination still appearing on the last days of observation such as days 37, 41, and 43 where the observation time for germination appeared ended on day 45, so that the average final yield of germination appearing in the light treatment ± 50% tended to be higher than on other light intensity treatments. However, the results of statistical tests showed that the time of emergence of germination was not significantly different between treatments. Invasive plants have the character of being able to live with any light intensity, and also have the speed of responding to environmental damage both in structure and composition of the original environment, and there is no resistance so that nothing hinders their growth rate [14].

The average percentage of germination after being tested statistically showed that between treatments did not have a significant different effect on the percentage of germination. The percentage of germination in *B. pentamera* was quite low, ranging from 1,14% - 1,78%. In a study by Zanzibar stated that the germination percentage of tembesu seeds (*Fragraea fragrans* Roxb.), which is one of the pioneer plants, germinated directly without treatment to obtain a germination percentage of 26% [15]. This shows a higher percentage of germination than the percentage of *B. pentamera* germination. The low germination rate of *B. pentamera* in this species is in accordance with Renner's research which stated that in one *B. pentamera* fruit there are about 3000 seeds in it, and only 1% germinate [16].

B. Number of Leaves

Observations on the number of leaves can be seen in Table 2. The results of the statistical analysis showed that different light intensity treatments had no significant effect on the number of leaves. There was no real difference in the number of leaves between treatments thought to be due to the different light intensities which did not affect the emergence of germination, so the age of the germination was almost the same for each treatment. Research by Susilawati's also stated that the light intensity treatment used in her research parameters regarding the number of cempaka leaves, showed results of variance that were not significantly different during the 3 months of the study [17].

Table 2. Average number of leaves (strands) of *B. pentamera* with different light intensities

Treatment light intensity (%)	Average number of leaves
<25	3,38 a
±50	4,36 a
>75	3,49 a

Research by Adesokan's also stated that different light intensities did not affect the number of Anona muricata leaves during 3 months of observation [18]. Ferry's also showed that the number of leaves of *Curcuma xanrhorriza* was not significantly different in the different light intensity treatments observed for 4 months [19]. In Table 2 it can be seen that the light intensity does not have a significantly different effect on the number of leaves, however, having seen from the research documentation, different light intensity treatments have more effect on leaf area (Figure 1).

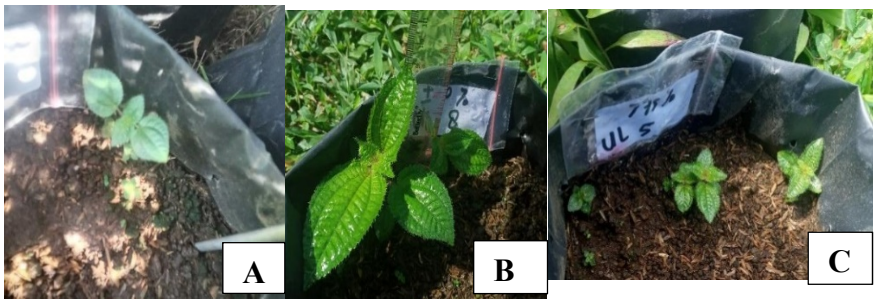

Figure 1. Images of *B. pentamera* leaves in several light intensity treatments (A). Leaves in treatment <25% (B). Leaves in ±50% treatment (C). Leaves in treatment >75%

In Figure 1. If you look at Figures (A), (B), (C) have leaf areas that tend to vary. Figure (B) with light intensity treatment of ±50% shows that *Bellucia* leaves are wider. This is because in the ±50% light intensity treatment there were germinations that appeared earlier, so when seen from the research documentation the leaf area in the ±50% light intensity treatment was wider than other light intensity treatments.

C. Number of seedlings and height of seedlings

Observations on the number of seedlings and seedling height can be seen in Table 3. The results of the statistical analysis showed that different light intensity treatments had no significant effect on the number of seedlings and seedlings height of *Bellucia*.

Table 3. Average number of seedlings and seedling height of *B. pentamera* with different light intensities

Treatment light intensity (%)	Average number of seedlings (cm)	Seedlings height (cm)
<25	0,22 a	0,30 a
±50	1,88 a	2,02 a
>75	1,00 a	0,62 a

Based on Table 3, different light intensity treatments did not have a significantly different effect on the number of seedlings and seedling height. This is because the number of seedling in the percentage of germination from the statistical test results was also not significantly different after counting all the germination that appeared, associated with the germination that became seedlings only a few could be measured, so the results were also not significantly different. In Table 3, the average number of seedlings tends to be more in the light intensity treatment of ±50%, namely 1,88 seedlings. The highest number of germination that became seedlings were in the ±50% light intensity treatment with 17 seedlings, 9 seedlings with >75% light intensity and the least in the <25% treatment with 2 seedlings.

Based on the data in Table 3, it can also be seen that the light intensity treatment did not have a significant effect on the height of the seedlings. It has no real effect on the treatment of light intensity on plant height, presumably because the germination that appear and will become seedlings are still relatively few. The saplings referred to here are germination whose height can be measured. This is thought to be a factor in the treatment of different light intensities which did not have a significant effect on the height of the seedlings.

4. Wet weight and dry weight

Observations on wet weight and dry weight can be seen in Table 4. The results of statistical analysis showed that different light intensity treatments had no significant effect on the wet weight and dry weight of *Bellucia*.

Table 4. Average wet weight and dry weight of *B. pentamera* with different light intensities

Treatment light intensity (%)	Average wet weight (grams)	Average wet weight (grams)
<25	0,01 a	0,002 a
±50	0,12 a	0,03 a
>75	0,06 a	0,02 a

Based on Table 4. The treatment of different light intensities did not have a significant effect on the wet weight and dry weight, this was because there were only a few germination that grew into seedlings. In the ±50% light intensity treatment, the germination grew more seedlings than the other light intensity treatments, namely 17 seedlings, so that if seen from the table above, the light intensity treatment of ±50% wet weight and dry weight tended to be higher.

Based on Table 4. The treatment of different light intensities did not have a significant effect on the wet weight and dry weight, this was because there were only a few sprouts that grew into tillers. In the ±50% light intensity treatment, the sprouts grew more tillers than the other light intensity treatments, namely 17 tillers, so that if seen from the table above, the light intensity treatment of ±50% wet weight and dry weight tended to be higher. Wet weight is the plant's ability to absorb water and nutrients during the growth process[19]. According to Alfandi and Dukat wet weight is the amount of water content and photosynthetic results in the plant body, barriers to water absorption and photosynthetic processes cause the total water content and photosynthetic yields to decrease in plants [20]. Meanwhile, dry weight is the result of plant metabolism such as photosynthesis and respiration [21].

The value of plant's wet weight can be affected by the number of leaves and plant height, the taller the plant and the more the number of leaves, the wet weight will also increase [22]. In this study it can be seen that the value of plant wet weight can be affected by the number of leaves and plant height. The taller the plant and the greater the number of leaves, the wet weight will also increase. In this study, it can be seen that the highest number of leaves and the highest plant height were produced in the light intensity treatment of ±50% (Table 2 and Table 3). In Table 4 it can be seen that the average dry weight tends to be small. According to Sunarpi et al., (2010) each treatment showed a dry weight which tended to be small in value compared to the wet weight. In the treatment of light intensity ± 50% dry weight of plants higher, namely 0.03 grams. Dry weight shows the biomass stored by plants, this biomass is influenced by the amount of food reserves contained in these plants [23].

IV. Conclusion

Based on the research that has been done, it can be concluded that differences in light intensity did not significantly affect the time of emergence of germinations and the percentage of *B. pentamera* germination and differences in light intensity did not significantly affect the growth of *B. pentamera* shoots (number of leaves, seedling height, number of seedlings).

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