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Invitro selection resistant plantain of king bulu (*Musa Paradisiaca* L. Var Sapiantum) on droughts an animal

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Abstract. Plantain feathers (*Musa Paradisiaca* L. var sapiantum) is one of the tropical plants that can grow in the highlands with an altitude of 1600 meters above sea level (asl) and in the lowlands. Banana stem as a by-product obtained from banana cultivation (*Musa Paradisiaca* L. var sapiantum) has good potential to be developed as a feed source for energy sources in the supply system of ruminant livestock because the amount of biomass produced is quite large. Based on the results of chemical analysis, banana stems contain fairly good carbohydrate compounds, as seen from the crude fiber content of 21.61% and extract without nitrogen (BETN) of 59.03%. Inadequate water availability is a problem for the growth of banana trees. Drought almost occurs every year, the main limitation of plant growth Efforts to overcome the drought constraints need to be done to get the genotype of banana plants that are resistant to drought stress. This needs to be done as an increase in the growth of bananas as animal feed ingredients. The study was conducted in a completely randomized design with 5 treatments and 5 replications. The treatment is the addition of PEG 6000 into the MS medium (Murashige & Skoog) with a concentration of 0%, 5%, 10%, 15% and 20%. The experimental unit is plantain planted on MS medium. Variance analysis at 5% real level. If the interaction is real, then it will be followed by a BNT test at the 5% real level. The results showed an increase in the stomata index in the leaves of plantain plantlets. The response to the highest increase in the stomata index was seen at a concentration of 20%

1. Introduction

Banana species found in Indonesia are approximately 230 banana varieties. Plantain feathers (*Musa Paradisiaca* L. var Sapiantum) are one of the tropical plants that can grow in the highlands with an altitude of 1600 meters above sea level (asl) and in the lowlands [1]. Several types of animal feed can be given to livestock, such as legume grass, banana waste in the form of banana skin and banana trees, elephant grass, king grass and Chinese petai [2]. The problem that is often faced by farmers is the high price of animal feed, because of the availability of feed that is still dependent on the outside. In addition, animal feed needs are also high, reaching 70% -80% of production costs, therefore the provision of alternative animal feed materials needs special attention. One way that can be taken to overcome the problem of food availability is by utilizing local feed ingredients derived from agricultural and plantation waste [3]. Banana stem as a by-product obtained from the cultivation of banana plants (*Musa Paradisiaca* L. var sapiantum) has good potential to be developed as feed ingredients for energy sources in the supply system of ruminant livestock because the amount of



biomass produced is quite large. Based on the results of chemical analysis, banana stem contains quite good carbohydrate compounds, it can be seen from its crude fiber content of 21.61% and extract without nitrogen (BETN) material of 59.03% so it is good for animal feed ingredients [4].

So it is necessary to increase the cultivation of banana plants to help provide alternative animal feed. However, in the implementation, there were problems with the disruption of the disease and the lack of availability of water which caused the drought of banana plantations. Inadequate water availability is a problem for the growth of banana trees. Drought almost occurs every year, becoming the main limitation of plant growth caused by the level of drought. Drought stress on plants can result in slow leaf area increase and influence on the rate of photosynthesis so that it can reduce productivity and growth of plants [5]. Efforts to overcome drought constraints need to be done to obtain banana plant genotypes that are resistant to drought stress. This needs to be done as an increase in the growth of bananas as animal feed ingredients using Poly-ethylene-glycol (PEG) compounds which can reduce the osmotic potential of the solution with the activity of the ethylene oxide sub unit matrix so that it binds water molecules with hydrogen bonds. Giving PEG to plantlets aims to produce dry stress conditions and orchid of the ground resistant to fusarium oxysporum [6,7].

The use of PEG 6000 solution as an effort to repair plants resistant to drought stress has been carried out among them on Peanut plants, hybrid rice, and tomatoes, In vitro resistance of orchids has also been done [8–11]. So far there has never been a study of plantain feathers against drought stress using PEG 6000. So this research is interesting to do. The research was conducted to find the candidate for plantain plantlets (*Musa paradisiaca* L. var Sapiantum) that are tolerant to drought as livestock feed Plantain able to withstand drought hopefully will be able to be applied to enhance the growth of banana plants as animal feed

2. Methods

This was carried out in the Ruangan vitro Botanical Laboratory, Biology Department, Faculty of Mathematics and Natural Sciences, Lampung University. The study was conducted in a completely randomized design with 5 treatments and 5 replications. The treatment is the addition of PEG 6000 into the MS medium (Murashige & Skoog) with a concentration of 0%, 5%, 10%, 15% and 20%. The experimental unit is plantain planted on MS medium. Variance analysis at 5% real level. If the interaction is real, then it will be followed by a BNT test at the 5% real level.

2.1. The study of Planting

Medium and selection of medium used were Murashige & Skoog (MS) solid with the addition of Benzyl Amino Purin (BAP) 1 mg/ml. After the medium is thawed, then the medium is sterilized for 15 minutes. The sterilized MS medium was then added with PEG 6000 with concentrations of 5%, 10%, 15%, 20% and controls (0%).

2.2. Stomata Index

Making stomatal preparations using the method from [13] as follows. The leaves of the *Musaparadisiaca* plantlets are made of rectangular pieces with sides ± 5 mm and put in a tube containing a solution of chloral hydrate in water (5: 1). The tube is heated in a water bath for ± 10 -15 minutes until the leaf pieces are transparent. The leaf pieces are placed in a solution of khloralhidrat in the glass of the object. The surface of the stomata is placed on top, then covered with a glass cover. Preparations are observed in 10 different regions. epidermal cell (E) is marked with (x), each stoma (S) is marked with (O). The stomata index is calculated by the formula [12].

3. Results and discussion

3.1. Stomata index

Stomataplays a major role in controlling water loss in plants [13]. Plants will experience adaptation in the face of drought-stricken environments in an effort to restrain the rate of transpiration. Plants will

develop stomata resistance and the ability of leaves to hold water to prevent water loss due to excessive transpiration [14].

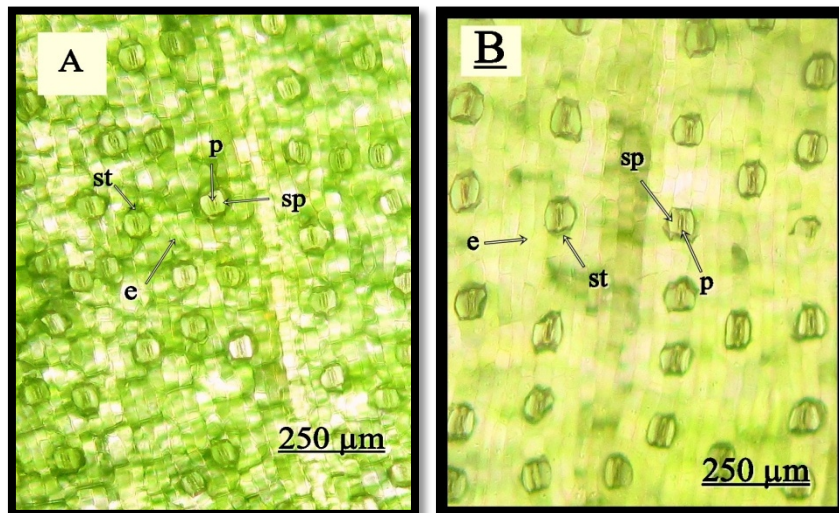


Figure 1. The bottom surface of the plantain feather plantlets leaves, showing PEG 6000 induced leaf stomata (A), (B) affected by PEG 6000. e = epidermis, st = neighboring cells, p = porous and sp = closing cells.

Based on observation 1 picture, the stomata shape looks like a kidney. The closing cell in the stomata is surrounded by four neighboring cells. Neighboring cells usually develop from protoderm cells that are compressed with stoma stem cells but can also develop from stoma stem cells [15]. Visible cover cells protrude higher than epidermal cells. The shape and arrangement of epidermal cell leaves of feather plantlets are diverse. The epidermal cells of the feather plantain plantlets look rectangular and irregularly shaped round. The epidermis is the network that is located at the outermost of each plant organ, namely the leaves, stems, and roots. The epidermis has a special function as a protection against water loss, mechanical damage, temperature changes and loss of food substances [16]

The stomata index is used as a comparison between leaf stomatal responses to the dynamics of environmental conditions that lack water content. The stomata index ANOVA results in a significant difference where F count is greater than F table ($8.106 > 3.478$), this shows that there is a significant effect of water content on the stomata index of plantain feather plantlets in drought stress. The analysis continued with the 5% BNT test presented in table 1.

Table 1. Stomata index on feather plantain leaf plantlets

Konsentrasi PEG 6000	Indeks stomata (%)
Kontrol	6.41 ± 0.67^a
5%	7.15 ± 0.21^{ab}
10%	8.6 ± 0.33^{bc}
15%	10.83 ± 0.43^d
20%	11.98 ± 0.20^d

Description:

Stomata index = $\bar{y} \pm SE$.

\bar{y} = average value of content Stomata index

SE = error standard

The number followed by the same letter is not significantly different at the level of 5%.

$$\text{BNT (0.05)} = 2.06$$

The results of the study in Table 1. Shows that there is an increase in the stomata index in the leaves of plantain plantlets. The response to the highest increase in the stomata index was seen at a concentration of 20% (11.98%) followed by a concentration of 15% (10.83%) and 10% (8.6%) in these three concentrations significantly different from the control. While the concentration of 5% (7.15%) experienced an increase in the stomata index but the increase was not significantly different from the control.

The results showed that there was an effect on the stomata index on feather plantain plantlets that experienced drought stress. The stomata index increased with increasing PEG 6000 concentration in the selection medium. This study is in line with [17] study of the stomata relationship to drought, indicating an increase in the stomata index in IR 64 rice varieties higher than the control. While the stomata index on towuti varieties varies, the stomata index increases and some decreases.

The stomata index on leaves that experience environmental stress the number of stomata will increase, but the increase is more due to the smaller size of epidermal cells so that the stomata distance will be closer [18]. Factors that have a strong influence on the stomata index, stomatal conductivity and transpiration rate include light intensity, air humidity, wind speed, water content and soil moisture [19].

4. Conclusion

shown that there was an increase in the stomata index in feather plantain leaf plantlets. The response to the highest increase in the stomata index was seen at a concentration of 20% (11.98%) followed by a concentration of 15% (10.83%) and 10% (8.6%) in these three concentrations significantly different from the control. While the concentration of 5% (7.15%) experienced an increase in the stomata index but the increase was not significantly different from the control.

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