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Characterization Of morfology structure flower from variation cultivars of pisang kepok (*Musa paradisiaca* L.)

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Abstract. *Banana is a fruit that is very popular in the community because it is easy to find and available in various types, besides is the price is very affordable, bananas also have a fairly complete nutritional value. One type of banana that is widely used by the community is pisang kepok. Pisang kepok has more diverse cultivars than other types of bananas. These cultivars have different morphological structures, one of which is the flower. Flowers have a role in the breeding of a plant. This study aims to determine the differences in the morphological structure of flowers among the pisang kepok cultivars with each other. The research was carried out in two stages. Frst, field sampling in residential area of Bandar Lampung City, Pesawaran Regency and South Lampung Regency. Second, morphological characterization based on the parameters determined conducted in the Biology Department of the FMIPA Unila Laboratory. The results obtained were cultivar of pisang kepok which had been observed to have almost the same morphological structure except in kepok batu. The specific character of pisang kepok batu can be seen in the character of the color of pollen sacs, compound tepal pigmentation, free tepal color, free tepal apex shape and pistil shape.*

Keyword: *Flower, Morphological structure, Pisang kepok.*

1. INTRODUCTION

Indonesia as a developing country is known to be one of the centers of diversity and the distribution of bananas. At present, more than 230 types of bananas are spread throughout Indonesia (Prabawati *et al.*, 2008). One type of banana that is very well known today is kepok Banana (*Musa paradisiaca* L.) which is the result of a cross between *Musa acuminata* and *Musa balbisiana* [1]. Kepok banana (*M. paradisiaca* L.) is a type of banana that is most often processed to other foods, such as fried bananas, chips, fruit flavor in syrup, various traditional foods and flour. Kepok bananas can grow well at an optimum temperature of 27°C and a maximum temperature of 38°C, have a rather flat and square shape with a small fruit size, 10-12cm in length while weighing around 80-120 grams and have white and yellow flesh [2].

The kepok banana has several cultivars, but the cultivars of the kepok banana have different genomes [3]. The differences in the genomes indicates that there are differences in morphological characteristics between one cultivar with another. One of the morphological features that distinguishes the cultivar is the flower organ. Flowers are generative breeding tools on banana plants where pollination and fertilization occur which will produce fruit [4]

The study was conducted to provide information on the morphology of banana flowers that play an important role in plant breeding, especially the crossing activities related to the expected superior character to improve the quality and production of banana kepok in the future.



2. MATERIAL AND METHODS

The research has been carried out in two places, first, the area of residents around Bandar Lampung City, Pesawaran Regency and South Lampung Regency, Lampung Province for banana flower sampling while the second, is in the Botany Laboratory of the Biology Department, Faculty of Mathematics and Natural Sciences, University of Lampung to characterize the morphological structure of flowers.

The process of sampling in the field uses the exploration method. Information about the name of the kepok banana cultivar was obtained through direct interviews with residents who own the yard. The flower of each cultivar was taken from three banana hearts of three different trees. Sampling is carried out in two stages, at each stage interspersed with the observation of morphological structure in the laboratory. This method is done so that plant material is not damaged.

Observation of the morphological structure of banana flowers is done in the laboratory by taking the flowers contained in the heart of a banana, then observed based on parameters determined. Parameters observed using the Manual description by IPGRI [5] in the form of qualitative and quantitative characters including flower's length, dominant color of the flower, compound tepal base color, compound tepal pigmentation, compound tepal lobe color, free tepal color, free tepal shape, free apex tepal shape, the color of the stalk, the color of the anthers, the color of the pollen sac, the base color of the pistil, the pigmentation of the pistil, the shape of the pistil, the color of the pistil's head, the position of the pistil, the shape of the ovary, the basic color of the ovary and the pigmentation in the ovary.

3. Results and Discussion

Based on observations of the morphological structure of the kepok banana cultivars in general, it is almost the same except for kepok batu, because the flowers in kepok batu bananas do not bloom before developing into fruit like other Kepok banana cultivars (Figure 1). The observations can be seen in the following Table 1.

Table 1. Morphological structure of flowers from 5 (five) kepok banana cultivars

Parameter	Yellow Kepok	Manado Kepok	Batu Kepok	Grey Kepok	Cotton Kepok
Average Flower's Length	7,3 cm	6,5 cm	7,2 cm	6,5 cm	6,9 cm
The dominant color in flowers	Yellow	Yellow	Beige	Yellow	Beige
Basic color of tepal compound	Beige	Yellow	Beige	Yellow	Beige
Tepal pigmentation compound	Pink color exists	Rust-colored spots	Rust-colored spots and there is pink color	Rust-colored spots	Rust-colored spots
Tepal lobe color compound	Yellow	Orange	Orange	Orange	Orange
Free tepal color	Opaque white and colored with yellow	Opaque white and colored with yellow	Translucent white and colored with yellow	Opaque white and colored with yellow	Opaque white and colored with yellow
Free tepal shape	Fan-shaped	Oval	Oval	Round	Fan-shaped
Free apex tepal shape	Blunt	Blunt	Triangle	Blunt	Blunt
The color of the stalk	White	White	White	White	White
The color of the anthers	Beige	Yellow	Yellow	Yellow	Yellow
Color of the pollen bag	Rusty chocolate	Rusty chocolate	Pink	Rusty chocolate	Rusty chocolate
Basic color of the pistil	White	White	White	White	White
Pigmentation of the pistil	There are black spots	There are black spots	There are black spots	Without pigmentation	Without pigmentation
Pistil shape	Curved twice	Curved at the base	Straight	Curved at the base	Curved at the base
Pistil head color	Beige	Yellow dominated by black	Bright yellow	Beige	Beige
Pistil position	Higher than anthers	Higher than anthers	Higher than anthers	Higher than anthers	Higher than anthers
Ovary shape	Slightly curved	Curved	Straight	Straight	Slightly curved
Basic color of the ovary	Yellow	Yellow	White	Yellow	Beige
Pigmentation of the ovaries	There is no visible pigmentation	There is no visible pigmentation	There is no visible pigmentation	There is no visible pigmentation	There is no visible pigmentation

Based on Table 1, the five cultivars have a higher pistil position than the stamens. The pollen bags have the color of rusty chocolate, except for the kepok batu whose pollen bags is colored pink. Tepal compound kepok banana cultivars generally have only one color pigmentation such as pink or rust spots, but on the kepok batu, they have pink pigmentation with rust spots. In the free tepal character,

yellow kepok, kepok manado, grey kepok and cotton kepok are opaque white colored, while the free tepal of kepok batu is translucent white. The free apex tepal on kepok batu is shaped triangle, while the other cultivars are shaped blunt. The shape of the pistil from the yellow kepok has two curves, the kepok batu has straight pistil, while the other cultivars are curved at the base (Figure 1).



Figure 1. Morphology of Kepok Banana Cultivar Flowers (A) Yello Kepok (B) Manado Kepok (C) Batu Kepok (D) Grey Kepok (E) Cotton Kepok.
 (1) Compound Tepal (2) Compound Tepal Lobe (3) Pistil
 (4) Anthers (5) Free Tepal (6) Ovary

Based on observational data, it is known that there are flower morphological variations between cultivars and within the same cultivar. The difference in morphological characters found in each banana cultivar is influenced by genetic and environmental factors [6]. [7] states that the differences in the character peculiarities between banana cultivars can be stated as unique categories. Morphological differences of flowers in yellow kepok can be categorized in 3 characters, which are tepal compound pigmentation, pistil shape and pistil head color. It is suspected that the morphological differences are caused by several factors. In pigmentation differences due to different pigment content, the pigmentation in yellow kepok 1 and 2 which are pink colored may be caused by a higher anthocyanin pigment content. Anthocyanin pigments are pigments that are water-soluble, stable at acidic pH, which is around 1-4, and display the color orange, pink, red, purple to blue [8]. The pistil from yellow kepok 3 is shaped straight, while yellow kepok 1 and 2 are curved at the base.

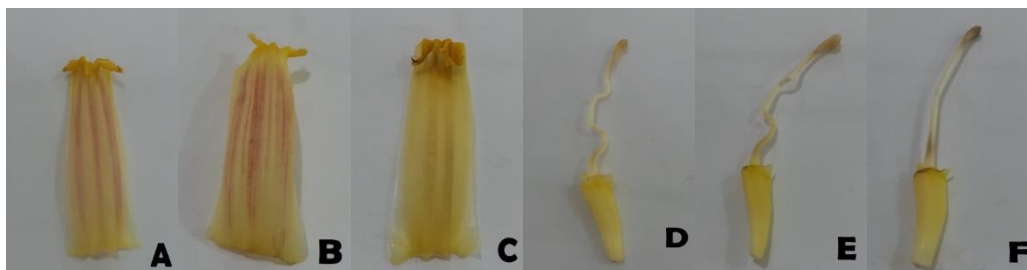


Figure 2. Morphological Differences in the Yellow Kepok Banana Cultivar
 (A) Tepal Compound Yellow Kepok 1 (B) Tepal Compound Yellow Kepok 2 (C)
 Tepal Compound Yellow Kepok 3 (D) Pistil Yellow Kepok 1 (E) Pistil Yellow
 Kepok 2 (F) Pistil Yellow Kepok 3

The morphological differences of the manado kepok can be seen in the character of the free tepal apex shape and the color of the pistil. Manado kepok 1 and 3 have yellow pistil heads which are dominated

by black, but the heads of the manado kepok 2 are colored yellow. The free tepal apex in manado kepok 1 and 2 is blunt shaped while in Manado Kepok 3 is the shape of a triangle.

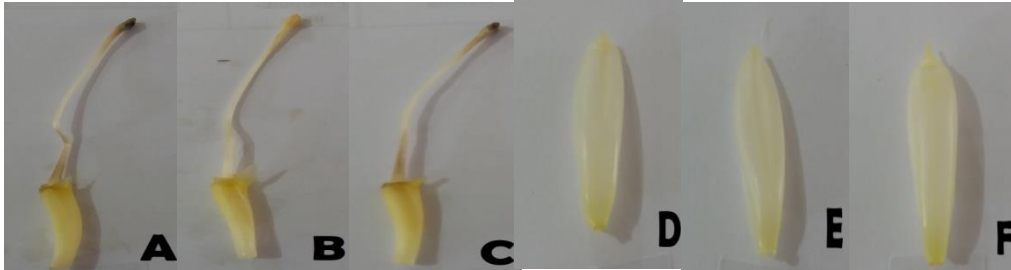


Figure 3. Morphological Differences in Manado Kepok Banana Cultivars. (A) Manado Kepok's Pistil 1 (B) Manado Kepok's Pistil 2 (C) Manado Kepok's Pistil 3 (D) Manado Kepok's Free Tepal 1 (E) Manado Kepok's Free Tepal 2 (F) Manado Kepok's Free Tepal 3

On the batu kepok 3 there is a striking difference from the batu kepok 1 and batu kepok 2, because the anther on batu kepok 3 has a small size and there is no pollen bag. This is thought to be possible due to genetic abnormalities or abnormal growths in batu kepok 3 in the form of shrinkage on the stalk so pollen cannot form normally.



Figure 4. Morphological Differences in Kepok Batu Banana Cultivars (A) Batu Kepok's Anthers 1 (B) Batu Kepok's Anthers 2 (C) Batu Kepok's Anthers 3

The differences in morphological variations of the kepok abu banana cultivar can be found in the shape of the pistil, the color of the pistil, the color of the ovary base and the dominant color of the flower. The base color of ovary and the dominant color on the grey kepok 1 and 3 is colored yellow, and the grey kepok 2 is white colored. Color degradation is suspected to have occurred on the pistil and ovary due to differences in the intensity of the light received, causing a difference in color. As explained by [9] that the formation of pigments in plants can be influenced by environmental factors such as temperature, light intensity and soil pH.



Figure 5. Morphological Differences in the Grey Kepok Banana Cultivar (A) Grey Kepok's flowers 1 (B) Grey Kepok's flowers 2 (C) Grey Kepok's flowers 3 (D) Grey Kepok's Pistil and Ovary 1 (E) Grey Kepok's Pistil and Ovary 2 (F) Grey Kepok's Pistil and Ovary 3

Morphological differences in cotton kepok banana are found in the character of compound tepal pigmentation, color of compound tepal lobe and pistil shape. Color difference in compound tepal lobe may be due to the carotenoid content in cotton kepok 1 and cotton kepok 2 which is higher than the carotenoid content in cotton kepok 3 (Figure 6). According to [10] β -carotene is a yellow-orange pigment, in which the more concentrated the color, the carotenoid pigment contained will be higher.

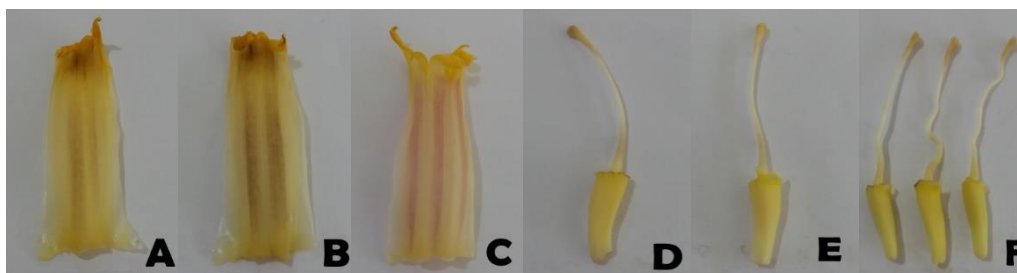


Figure 6. Morphological Differences in the Cotton Kepok Banana Cultivar (A) Cotton Kepok's compound Tepal 1 (B) Cotton Kepok's compound Tepal 2 (C) Cotton Kepok's compound Tepal 3 (D) Cotton Kepok's Pistil 1 (E) Cotton Kepok's Pistil 2 (F) Cotton Kepok's Pistil 3

Conclusion

Observed kepok banana cultivars have almost the same morphological structure of flowers except batu kepok, which has different traits of the color of the pollen bag, pigmented compound tepal, free tepal color, free tepal apex shape and pistil shape.

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