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The Phenotype Characters Stability of Hybrid Watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) ♀ 'Maduri' and ♂ 'Putri Delima'

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ABSTRACT
Watermelon (Citrullus lanatus (Thunb.) Matsum. & Nakai) is one of the horticultural crops members of Cucurbitaceae family, which is known to have high economic value and public interest. Since the entry into Indonesia, the application of watermelon plant breeding has grown to produce new superior varieties, hence not only able to meet market demand, but also to have implications for the progress of the agribusiness sector and national food security. Watermelon ♀ 'Maduri' with ♂ 'Putri Delima' cultivar hybrid produce an oblong-shaped fruit, has a dark green skin tone with dark green streaks, orange flesh fruit, and sweet taste. However, to be certified and become a cultivar that can be cultivated extensively, the new varieties need to have an adaptive and stable character. This study aims to determine the phenotype character and stability of watermelon ♀ 'Maduri' with ♂ 'Putri Delima' cultivar hybrid which is cultivated in Jamusan Village, Prambanan Sub-district, Sleman, D.I.Yogyakarta fields. Furthermore, 1 randomly collected watermelon samples were taken. Then, the qualitative and quantitative characters of samples were observed. The quantitative data were analyzed using Microsoft Excel 2016 with ANOVA single factor test at 1% and 5% level. The result of ANOVA test at 5% significance level shows F value at 0,00055 and Fcrit value at 4,259677273, while at the l% significance level, F value obtained at 0,00055 and the Fcrit value obtained at 7,822871. F value is smaller than Fcrit value at 5% and 1% significance level so there is no significance difference. Thus, the phenotype character of F_2 watermelon is deemed stable.

Keywords*: Watermelon, 'Maduri', 'Putri Delima', Stability.*

1. INTRODUCTION

Watermelon was originated from Africa which became one of the most popular fruits in Indonesia. Almost all traded watermelon in Indonesia was imported. Several researchers in Indonesia conduct research to develop new watermelon varieties.

Watermelon has high water, fructose, vitamins, and minerals content but scare fibers (1,2). Watermelon also has electrolytes which ready to use chemicals for body. Antioxidants from watermelon has vital role to keep healthy state of body through preventing the formation of reactive oxygen species (ROS) and free radicals. This activity reduces the risk of having hypertension, diabetes, cancer, and some coronary heart diseases.

Laboratory of genetics and breeding, Faculty of Biology has success develop a hybrid watermelon (F_1) which has orange flesh from crossing the yellow fleshed Maduri to the red fleshed Putri Delima variety. In effort to get certificated from government, orange flesh watermelon needs to be tested its phenotype characters stability (5). This research aims to investigate the phenotype characters of inbreed (F_2) of hybrid watermelon (F_1) selfing.

2. MATERIALS AND METHODS

The materials that used in this research were F_1 and F_2 Watermelon plants and fruit, RHS colour chart, medline, camera, ruler, and scale. This research was conducted from August to November 2017. The watermelon was cultivated and harvested at Jamusan, Bokoharjo, Prambanan, Sleman, D.I.Yogyakarta while phenotype assessment was done at Laboratory of Genetics and Breeding, Faculty of Biology, Universitas Gadjah Mada. Acquired data was analyzed using ANOVA from MS Excel 2016 software.

3. RESULTS AND DISCUSSION

Based on Table 1, F_2 and F_1 (♀ 'Maduri' x ♂ 'Putri Delima') have oblong / inole fruit shape, crunchy flesh texture, and relatively long shelf life. However, several different characters were observed between F_2 and F_1 such as dark green fruit skin color with dark green hue on F2 (RHS 2015 133A; RHS 2015 139A) while dark green fruit skin color with dark green hues and patches yellow in the parent (RHS 2015 N137A; RHS 2015 189A; RHS 2015 N144A). This difference occur since F_2 has not reached a ripe age when examined, because one of the characteristics of the watermelon from crossing ♀ 'Maduri' with ♂ 'Putri Delima' is the color of the fruit skin that has yellowish spots.

The next different character is the color of the flesh with the code RHS 2015 21A (vivid orange yellow) on F_2 and RHS 2015 22A (light orange yellow) in the F_1. Although there are differences in the RHS code, both

have orange flesh, the only difference is that F_2 has a lighter orange flesh than its F_1 parent. This could be because the fruit from F_2 was harvested in immature conditions. A ripe watermelon is indicated by the color of aging flesh.

from the color of the flesh, there are also differences in the seed color of F_2 (RHS 2015 202A) and F_1 (RHS 2015 203 B). Although there are differences in the RHS code, they both have orange color. This difference caused by harvesting time of F_2 was not fully ripe. The last difference in qualitative characters is at the age of harvest. F_2 was harvested at the age of 67 days, while F_1 was harvested at the age of 58 days. Even though it has a longer harvest time, F_2 still cannot be fully harvested when it was ripe.

The difference in color index on the qualitative characters of watermelon phenotype can be caused by differences in the planting season and observations by researchers who tend to be subjective in the use of RHS color charts.

Table 1. The qualitative characters of inbreed orange flesh watermelon (F2) compared to its parent (F1)

Parameter	F_2	F_1
Fruit shape	oblong/inole	oblong/innole
Skin color	RHS 2015 133A; RHS 2015 139A	RHS 2015 N137A; RHS 2015 189A; RHS 2015 N144A
Flesh color	RHS 2015 21A	RHS 2015 22A
Flesh texture	crunchy	crunchy
Seed color	RHS 2015 202A	RHS 2015 203B
Harvest day	58 day	67 day
Storage	long	Long

Table 2. The quantitative characters of inbreed orange flesh watermelon (F_2) compared to its parent (F_1)

Number	Parameter	F_2	F_1
1	weight (kg)	1,99	1,68
2	Horizontal circumference (cm)	41	39,5
3	Vertikal circumference (cm)	58	51,27
4	Upper diameter (cm)	9,5	9,82
5	Lower diameter (cm)	10,5	9,91
6	Skin thickness (cm)	1	1,33
7	Flesh thickness (cm)	10	10,24
8	Horizontal Diameter (cm)	12	12,76
9	Vertikal Diameter (cm)	22,5	19,16
10	Sweetness Level (Brix)	6-10	8-12
11	Skin weight (gr)	0,85	0,83
12	Flesh weight (gr)	1,14	0,88
13	Seed number	244	264,55
14	Seed weight per 100 (gr)	2,79	2,59

F_1 cultivation and harvesting was conducted in the dry season (6), while F_2 was cultivated in the rainy season. Different planting seasons affect the formation of color pigments which affect the quality of plants and watermelons (4). Apart from affecting the formation of color pigments, seasonal differences also affect the length of harvest time. According to Kalie (3), ideally watermelon plants are grown in areas with relatively dry, calcareous climates, and have lots of nutrients (organic matter) such as phosphorus.

Based on Table 2, F_2 the fruit weight is 1.99 kg, the horizontal circumference is 41 cm, the vertical circumference is 58 cm, the top diameter is 9.5 cm, the bottom diameter is 10.5 cm, the skin thickness is 1 cm, the thickness meat of 10 cm, horizontal diameter of 12 cm, vertical diameter of 22.5 cm, sweetness level (brix) in the range of 6-10, skin weight of 1.14 grams, weight of pulp of 0.85 grams, number of seeds 244 seeds, and the weight of 100 seeds is 2.79 grams. The fruit weight in the research results is greater than the results of the Permadani (6) study (2017), so that this large fruit weight causes the vertical and horizontal circumference of the fruit, the weight of the seed cavity, the weight of the fruit skin and the weight of the fruit flesh to also increase. Apart from these characters, the quantitative character that most distinguishes F_2 from its parent is obtained in the sweetness level parameter (brix). Unlike F_2 which has a low brix range, F_1 has a high brix 8-12 (6). The difference in yield was influenced by the immature F_2 fruit. The condition of the immature fruit is influenced by the planting season which does not support the conditions for growing watermelon plants, namely the rainy season

4. CONCLUSION

The main character of F_2 watermelon is orange flesh (RHS 2015 22A) with dark green fruit skin (RHS 2015 133A; RHS 2015 139A) and the shape of the fruit is oblong / inole. Based on the statistical analysis, the phenotypic character of F_2 is classified as stable.

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