Evaluation of Anthurium variability (*Anthurium andreanum*) in the F1 population

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Abstract. *Anthurium andreanum* is one of the popular flowers in the floriculture industries and the biggest cluster in the *Araceae* group. Genetic variabilities of *Anthurium andreanum* were obtained through hybridization and conventional breeding program. The study's objective was to evaluate the morphological character variation of anthurium in the F1 population. The F1 population of anthurium crossing was used for observation and evaluation in this research. The parameter observations were the morphological character of spadix and spathe, quantitative characters comprised of spathe width and length, spadix length, and the total number of flowers per plant in the first flowering stadia. There were 77 plants in the F1 population of crossing between anthurium cv. Sempre x Alvin. The longest spadix was 4.8 cm (SA.18), the longest spathe was 8 cm (SA.19), and the widest spathe was 8.7 cm (SA.19). Average of flowers per plant in the first blooming stadia was about 2-4 flowers. Variation of morphological characteristics was obtained in F1 population evaluation in some parameters. The evaluation showed that most offspring in the F1 population were dominantly inherited from A. Sempre.

1 Introduction

Anthurium is an important ornamental plant for floriculture industries. Anthurium is also the biggest group in *Aracea* [1]. There were many species in anthuriums and endemic in several countries. *A. clarinerviu* was endemic in Mexico, *A. crystallium, A. magnificium, A. veitchii, A. warocqueanum and A. andreanum* were endemic in Colombia, *A. hookeri* endemic in Guyana, and *A. Bakeri* was endemic in Costa Rica [2] The specific characteristics of anthurium andreanum were spadix and spathe [1]. Most anthurium propagation used tissue culture, vegetative propagation dan seed [3], stem cutting and suckers [4].

Anthurium is a commercially ornamental plant and has nine ranks in international floriculture industries [5]. Colombia, Israel, Italia, Kenya, Thailand, and Sri Lanka were exporter countries for cutting anthurium [6]. In Indonesia, anthurium was the tenth rank in the floriculture industries [7]. The ornamental market was dynamic and needed new varieties to supply as consumer preference demanded. One strategy to supply market demand was increasing genetic variability. Genetic variabilities of anthurium were enhanced through hybridization. Most anthurium hybridization focused for create new varieties, novelty, and improvement of flower size, flower colour, and shape of spathe it was also vase life and

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disease-resistant [8]. Previous research on anthurium was a quality improvement, such as big size, colour, and shape of the spathe [8], vase life (14- 28 days) [9], and resistance to blight disease caused by Xanthomonas *camprestris* [10]. The most important for anthurium hybridization was to create a new anthurium based on consumer preference and market demand [11]. Consumers are based on age, knowledge level, economic motivation, education, and income [12].

Germplasm was important for successful breeding to create new varieties [13]. Successfully anthurium hybridization was affected by genetic variability, gene segregation and selection methods [14]. Interspecific hybridization compatibility was also important to obtain new clones or varieties [15].

2 Material and methods

The research was conducted at Indonesian Ornamental Crops Research Institute - Cianjur, West Java, Indonesia. Commercial Anthurium cv. Sempre (A. Sempre) and Alvin (A. Alvin) were used as materials crossing. Anthurium cv. Sempre was a female parent, while Anthurium cv. Alvin was a male parent.

There were some steps in Anthurium conventional breeding. The steps were characters selection of parents crossing, anthurium crossing, seed formation, harvesting and seed sowing. F1 population of crossing A. Sempre x A. Alvin used as evaluation quantitative and morphological characteristics. Evaluation of quantitative characteristics consisted of the length of the spathe, the width of the spathe and the length of the spadix. While evaluation of morphological characteristics comprised of spathe colour, spathe's tip sinus's shape between lobus in spathe's base, and spadix tip's shape.

2.1 Hybridization of anthurium cv. Sempre x anthurium cv. Alvin

Anthurium hybridization was conducted in some stages, there were.

2.1.1 Characters selection of parents crossing

Characters' selection of parents crossing related to breeding objectives. Some objectives were disease resistance, biotic and abiotic stress, and improved quality and productivity. This research focused to create a new potted anthurium with colour as a consumer's preference. This selection was important to determine the best clones for creating new varieties.

2.1.2 Anthurium crossing

Anthurium crossing was conducted in the morning (7- 9 a.m.). It was a favourable time for crossing. At this time, the pistil was receptive, and the stamen produced enough mature pollen. The pistil was sticky and mature pollen of stamen was obtained. The Anthurium reproduction organ was spadix. The spadix contains pistil and stamen. The pollen was mature at separate times. Pistil was mature first than stamen. Mature pollen was smeared on the receptive pistil. It was about 3-4 times to smear in the spadix area to ensure that pollination was worked.

2.1.3 Seed formation

Seed formation was dependent on the parent's genetics of every cultivar. The earlier seed formation was 4 months after crossing. Usually, they need 8-9 months for seed formation.

The formation of anthurium seeds also depended on pollination time, humidity, temperature, and compatibility of their crossing parents [16].

2.1.4 Seed harvesting

Anthurium seed was harvested about 4- 9 months after hybridization. The mature seed was indicated yellow seed and swelling the spadix. Seed harvesting each hybridization was different, depending on the parent's genetic, compatibility and environmental factors such as humidity, temperature, and light intensity.

2.1.5 Seed sowing

Anthurium seed was mucus, it was because of some steps to manage the seed. The seed must be soaked overnight in the water, then the seed coat was peeled off. The seeds were sowed in sterile media such as husk charcoal or rice husk. It was also sowed through tissue culture in an MS medium.

2.2 Evaluation of quantitative and morphological characteristics in the F1 population

The evaluation of the F1 population was divided into quantitative characteristics and morphological characteristics. Quantitative characteristics consisted of the length of the spathe, the width of the spathe and the length of the spadix. The length of the spathe was measured from the base spathe to the top of the spathe. The width of the spathe was measured from the widest spathe, while the length of the spadix was measured from the base to the top spadix. Evaluation of morphological characteristics comprised of spathe colour, spathe's tip sinus's shape between lobus in spathe's base, and spadix tip's shape. All parameters were observed based on the Anthurium characterization guide [17].

3 Result and discussion

The anthurium breeding objectives focused to create potted anthurium and improving the performance of flowers. Based on flower performance, the observation focused on spathe and spadix quantitative's data and their morphological characters.

3.1 Quantitative characters of the F1 population Anthurium

The variation of quantitative characteristics of flowers was the length and width of the spathe. There were five scoring categories of anthurium size of spathe characterization. Clone SA.19 was the biggest size in length of the spathe (8 cm) and width of the spathe (8.7 cm). Overall, most anthurium offspring in the F1 population was very small categorized. Evaluation of the width of the spathe obtained that clone SA.19 was the widest spathe. Most clones of SA were ridiculously small categories. The F1 population anthurium, crossing between A. Sempre x A. Alvin was categorized into 3 groups based on the spathe's size. There were 1) very small (70 plants), 2) small (6 plants) and 3) big (1 plant).

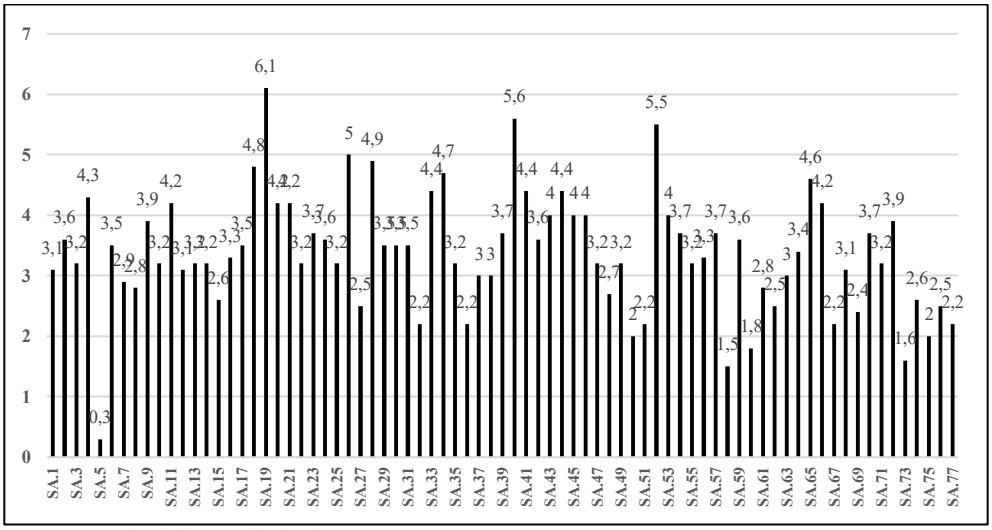

Fig. 1. Length of the spadix (cm).

The longest spadix was clone SA.19 (Fig. 1). Most of the spadix was categorized as a short spadix. The length of the spadix was usually balanced with spathe size. Based on the result of quantitative characters, anthurium crossing A. Sempre x A. Alvin was obtained from potted anthurium clones.

3.2 Morphological characters of F1 population Anthurium

Morphological variations of Anthurium were obtained in F1 Population, crossing between A. Sempre x A. Alvin. There were variations in spadix and spathe's colour, spathe and spadix's shape, spathe's tip sinus's shape between lobus in spathe's base, and spadix tip's shape (Fig. 2).

Fig. 2. Variations of colour shape and size in the F1 population, crossing A. Sempre x A. Alvin.

Based on spathe colour, there were categorized into 3 types of spathe colour in the F1 population crossing between anthurium varieties. Characterization of spathe's colour was using an RHS colour chart. The colour groups were red group (46A), pink (56C) and peach (38B). According to the anthurium characterization guide [17], classification of Spathe's shape was categorized into five types. Those were a) ellipse, b) big ellipse c). almost round, d) ellipsoid, e) big ellipsoid. Based on the spathe's shape, there were 3 types in the F1 population crossing A. Sempre x A. Alvin. The shapes were a) big ellipse (2), b) almost round (3), and c) big ellipsoid (5) (Fig. 3). The characterization was used by Anthurium characterization's guide [17].

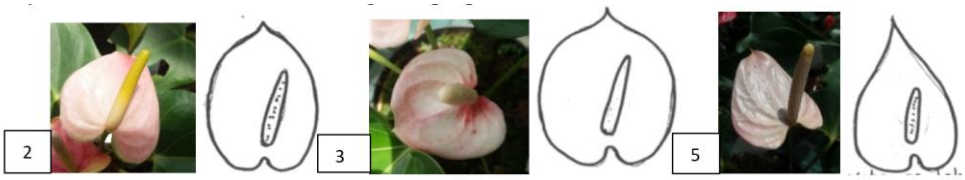

Fig. 3. Variation of spathe's shape in the F1 population based on Anthurium characterization's guide.

There were 5 types of characterization of lotus position in spathe, a) inside and no touch each other, b) free, c) touch each other, d) overlapping, and e) thrust. According to this characterization, there were 2 types in the F1 -SA population. The types were a) inside and not touching each other and b) free

Both lobus positions in spathe types were inherited from the parents. Even though most of the type was inherited from female parents (A. Sempre).

Characterization of spathe base's shape is divided into 3 shapes, there was a) spiky, b) rounded, and c) curl up [17]. Based on these categories, the spathe base's shape comprised 3 types of categories in the F1 population A. Sempre x A. Alvin (Fig. 4).

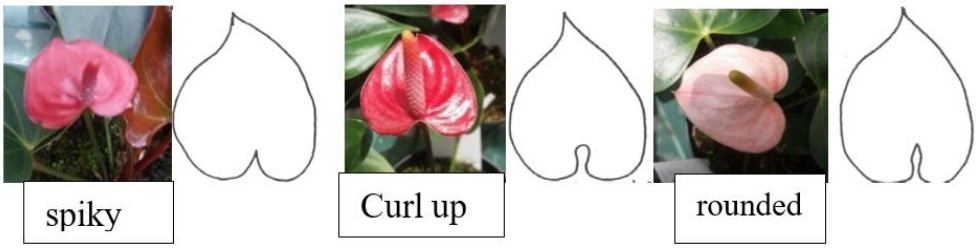

Fig. 4. Characterization of spathe base's shape in F1 population A. Sempre x A. Alvin.

These results indicated that most offspring were inherited from A. Sempre as a female parent. It means that A. Sempre was dominant to bequeath for shape character. Characterization spathe's tip is divided into 6 shapes, there were a) narrow spiky, b) pointed, c) wide pointed, d) narrow tapered, d) tapered, and e) tapered wide. According to these categories, there were 2 types of spathe's tip from the hybridization of A. Sempre x A. Alvin has obtained. The result showed that these characters were inherited from female parents (A. Sempre). Most offspring of spathe's tip in the F1 population A. Sempre x A. Alvin was bequeathed from the combination of their parents.

There were 9 types of morphological characterization of the sinus's shape between the lobus in the spathe's base. They were arcuate with bald decurrent on the petiole, parabolic, hippocrepiform, spathulate, obovate, rhombic, mitered, and triangular [17].

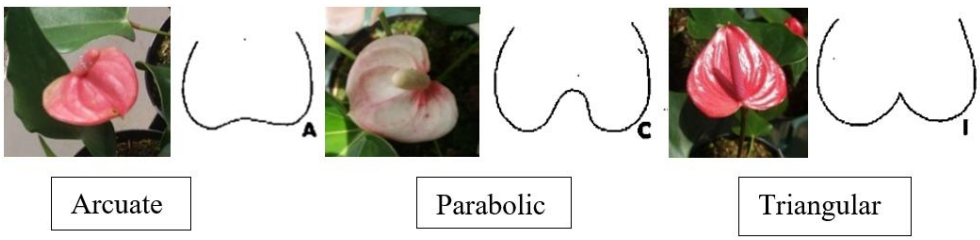

Fig. 5. Characterization of sinus's shape between lobus in spathe's base in the F1 population A. Sempre x A. Alvin.

Based on these characteristics, there were categorized 3 types of sinus shapes in the F1 population (Figure 4). Overall, anthurium cv. Sempre was dominant to bequeath in spathe characters.

There were 5 types of characterization of the spadix tip's shape. They were very weak, medium, strong, and very strong [17]. According to this characterization, there was one type of spadix shape, it was a very weak type. Most of the spadix tip's shape was inherited from A. Alvin as male parents.

Another morphological characteristic was the production of flowers per plant. The average flower production in the first blooming was almost non-significant for all individual plants in the F1 population. The average was about 2-3 flowers per plant. It was usual that the first blooming was not optimal to produce flowers.

4 Conclusion

Evaluation of the morphological character in the F1 population of anthurium obtained some variation in quantitative and morphological spathe and spadix. The variations of quantitative characters were the length of the spathe, the width of the spathe, and the length of the spadix. There were also variations in morphological characters. They were spathe colour, spathe's tip sinus's shape between lobus in spathe's base, and spadix tip's shape. No significantly different in flower production per plant. The evaluation showed that most offspring in the F1 population were dominantly inherited from A. Sempre.

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