Morphological Diversity of Ipomea batatas (L.) Lamb. Leaves Crossed Between Antin 2 and Beta 2

Sulistiono[1*], Ida Rahmawati[1], Poppy Rahmatika Primandiri[1,3], Budhi Utami[1], Mumun Nurmilawati[2] and Agus Muji Santoso[1,3]

[1] Biology Education, Universitas Nusantara PGRI Kediri, Kediri, Indonesia
[2] Primary teacher education, Universitas Nusantara PGRI Kediri, Kediri, Indonesia
[3] Research Centre of Biodiversity, Universitas Nusantara PGRI Kediri, Kediri, Indonesia
sulistiono@unpkediri.ac.id

Abstract. Sweet potato has high genetic diversity. Analysis of genetic diversity based on phenotypic traits plays an important role in plant breeding. This study aims to describe the diversity of morphological structure of sweet potato leaves resulting from crosses between Antin 2 and Beta 2 accessions. The study was conducted in an observational, non-experimental manner on 40 individual plants resulting from crosses of sweet potatoes from the two accessions. The characters observed were young leaf color, leaf shape, leaf edge, number of angles of leaf edge incisions, leaf vein color, and number of primary leaf veins. The results of the study revealed that there were varia-tions in the morphological characters of the leaves on the sweet potato crosses of Antin 2 and Beta 2. The color of the young leaves varied, namely light green and green to purple, respectively 31 and 9 individuals- The second variation is the shape of the leaves, namely round and triangular, respective-ly 16 and 24 individuals. Other characters are flat leaf edges, finger grooved, finger-sharp and pointed respectively are 12, 11, 4 and 13 individuals- The number of angles varies, namely 6, 5, 4, 3 and 0, respectively 2, 14, 2, 4 and 18. The color of the veins is also different, namely green and purple, respec-tively 26 and 14. As well as variations in the number of primary veins, num-bering 5, 6, 7 and 9 respectively 1, 6, 20 and 13.

Keywords: Ipomoea Batatas, Morphology, Plant Breeding.

1 Introduction

Sweet potato (Ipomoea batatas (L.) Lamb.) has high genetic and phenotypic diversity as a result of self-incompatibility [1,2,3]. Every time crossbreeding occurs, it has the potential to produce very varied offspring and has the opportunity to produce new accessions. As of 2020, 331 superior accessions have been collected from various regions in Indonesia [4]. Examples of superior accessions that have been released by the Indonesian Legumes and Tuber Crops Research Institute (ILETRI) are Antin 2, characterized by purple root vegetable flesh, high anthocyanin content and moderate productivity, and the Beta 2 accession, characterized by orange leaf root flesh, high in beta carotene. and high productivity. The purple color is caused by anthocyanins,

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namely bioactive components of the purple flavonoid group which can prevent colon cancer [5], liver cancer [6] as well as being anti-diabetic [7] and an antioxidant [8]. Meanwhile, the orange color is caused by beta carotene, which is a tetraterpene compound which is composed of 8 isoprene units and has condensation at both ends [9]. Apart from being provitamin A, beta carotene also acts as an antioxidant to ward off free radicals [8]. Vitamin A plays an important role in immune function, growth and development of children, adolescent girls and women of childbearing age and prevents blindness in children [10].

Considering the importance of anthocyanins and beta-carotene as described above, it is necessary to breed sweet potatoes that have high anthocyanin and beta-carotene content and high productivity, namely by hybridizing the accessions antin 2 with beta 2. According to Koryati et al. [11], the release and distribution of breeding plants must begin with a selection, testing, and evaluation process. The initial stage of the selection process carried out in this research was to describe the diversity of leaf morphological structures of all individuals resulting from crosses.The morphological structural characteristics of leaves are important to describe because they will directly influence plant physiological and chemical processes, such as photosynthesis and respiration rates [12, 13], transpiration [14], CO2 consumption [13], O2 production, and productivity [12]. Apart from that, adjusting the morphological structure of leaves is also an effective way for plants to respond to environmental changes such as water availability, temperature, air humidity, nutrition, and climate change [15, 16, 17].Apart from that, it is hoped that the data on the morphological characteristics of the leaves from the cross will support the data on the inheritance patterns of the superior characters of the two parents. Based on the description above, this study aims to describe the morphological structure of sweet potato leaves resulting from crossing accessions Antin 2 with Beta 2. The characters described are: young leaf color, leaf structure, leaf margins, number of leaf edge angles, leaf vein color, and number of primary leaf veins.

2 Method

The research was carried out in an observational, non-experimental manner with the following tools, materials, and work procedures: The tools and materials used include black plastic pots with a diameter of 30 cm, agricultural tools, paddy soil, sand, manure, and 40 sweet potato sprouts resulting from a cross between the Antin 2 and Beta 2 asses.

The planting medium consists of a mixture of paddy soil, sand and manure in a ratio of 3:2:1 put into a plastic pot at 75% by volume. Next, the sprouts are transferred from the nursery medium to the prepared planting medium, one plant per pot, then coded C1 – C40. Treatment is carried out by cleaning weeds and watering when the planting medium starts to dry out. Observation of the morphological structure of the leaves, including: young leaf color, leaf structure, leaf edges, number of angles of leaf margins, color of leaf veins and number of primary leaf veins, was carried out when the plants were 2 months after planting.

3 Results and Discussion

From the results of crossing the sweet potato Asesi Antin 2 (code A) with Beta 2 (code B), 40 sprouts were obtained, which could grow into adult plants. The individuals resulting from the cross (F1) are coded from the 1st to the 40th individual, respectively, C1 to C40, whose leaf morphology structure can be seen in Table 1.In terms of leaf color characters, 31 plants (77.5%) were identical to the Antin 1 parent (light green) and 9 plants (22.5%) were identical to the Beta 2 parent (purple green), while 24 plants (60%) had leaf shape characters. identical to the parent Antin 2 (bagun triangularis), and as many as 16 plants (40%) were identical to the parent Beta2. In terms of leaf edge notch characters, 11 plants (27.5%) were identical to their two parents (palmati lobes), while 29 other plants (72.5%) were not identical to their two parents, namely 12 plants had no nicks, 4 plants had fingered tips, and 13 plants shared fingers.

Table 1. Morphological structure of sweet potato leaves

Code	Morphological Characters					
	Young leaf color	Leaf shape	Notch the edge of the leaf	Number of angles	Leaf vein color	Number of primary leaf veins
A	Light green	Trian-gularis	Palmati lobus	5	Purple	9
B	Purple green	Orbic-ularis	Palmati lobus	5	Green	9
C1	Light green	Orbic-ularis	Palmati lobus	4	Green	9
C2	Light green	Trian-gularis	Integer	0	Green	9
C3	Purple green	Orbic-ularis	Palmati fi-dus	6	Purple	7
C4	Light green	Trian-gularis	Integer	0	Green	6
C5	Light green	Trian-gularis	Palmati lobus	3	Green	9
C6	Purple green	Orbic-ularis	Palmati partitus	5	Green	9
C7	Light green	Orbic-ularis	Palmati partitus	5	Green	7
C8	Purple green	Orbic-ularis	Palmati partitus	5	Purple	5
C9	Purple green	Orbic-ularis	Palmati partitus	5	Purple	7
C10	Purple green	Trian-gularis	Palmati lobus	3	Green	9

Code	Morphological Characters					
	Young leaf color	Leaf shape	Notch the edge of the leaf	Number of angles	Leaf vein color	Number of primary leaf veins
C11	Purple green	Orbic-ularis	Palmati lobus	3	Purple	9
C12	Light green	Trian-gularis	Palmati lobus	3	Green	7
C13	Purple green	Trian-gularis	Palmati lobus	3	Green	7
C14	Light green	Orbic-ularis	Palmati lobus	5	Purple	9
C15	Purple green	Trian-gularis	Palmati lobus	4	Green	9
C16	Light green	Trian-gularis	Palmati partitus	5	Purple	7
C17	Light green	Trian-gularis	Palmati lobus	3	Purple	9
C18	Light green	Trian-gularis	Integer	0	Green	7
C19	Light green	Trian-gularis	Integer	0	Green	9
C20	Light green	Orbic-ularis	Palmati partitus	5	Green	7
C21	Purple green	Orbic-ularis	Palmati lobus	5	Green	9
C22	Light green	Orbic-ularis	Palmati lobus	5	Purple	9
C23	Light green	Orbic-ularis	Palmati partitus	5	Purple	7
C24	Light green	Trian-gularis	Integer	0	Green	9
C25	Light green	Trian-gularis	Palmati lobus	3	Purple	9
C26	Light green	Trian-gularis	Integer	0	Purple	7
C27	Light green	Trian-gularis	Integer	0	Purple	7
C28	Light green	Trian-gularis	Integer	0	Green	7
C29	Light green	Trian-gularis	Palmati fi-dus	4	Green	7
C30	Light green	Orbic-ularis	Palmati partitus	5	Purple	7

Code	Morphological Characters					
	Young leaf color	Leaf shape	Notch the edge of the leaf	Number of angles	Leaf vein color	Number of primary leaf veins
C31	Light green	Trian-gularis	Integer	0	Green	7
C32	Light green	Trian-gularis	Palmati partitus	6	Green	7
C33	Light green	Orbic-ularis	Palmati partitus	5	Green	6
C34	Light green	Trian-gularis	Integer	0	Green	7
C35	Light green	Orbic-ularis	Palmati partitus	5	Green	6
C36	Light green	Trian-gularis	Integer	0	Green	7
C37	Light green	Trian-gularis	Palmati partitus	3	Green	6
C38	Light green	Trian-gularis	Palmati fi-dus	4	Green	7
C39	Light green	Orbic-ularis	Palmati fi-dus	5	Purple	7
C40	Light green	Trian-gularis	Integer	0	Green	6
Similarity to Antin 2	77.5%	60%	27.5%	35%	65%	32.5%
Similarity to Betha 2	22.5.%	40%	27.5%	35%	35%	32.5%
Similarity to Both of Antin 2 and Betha 2	0%	0%	72.5%	65%	0%	67.5%

For the number of angulus characters, as many as 14 plants (35%) were identical to their two parents (5 angulus), and as many as 26 other plants (65%) were not identical to their two parents, namely with angulus totaling 6, 4, 3, and 0, respectively. 2, 4, 8, and 12 plants. Like the color and structure of the leaves, the color of the leaf veins is all identical to the two parents, namely, 26 plants (65%) are identical to the Antin 2 parent (green) and 14 plants (35%) are identical to the Beta 2 parent. The primary leaf veins of 13 plants (32.5%) are identical to their two parents (9 primary leaf veins), while the other 27 plants (67.5%) are not identical to their two parents, namely with primary leaf veins totaling 5, 6, and 7, respectively. 1, 6, and 20 plants.Based on the results of observations of the six leaf characters as described above, in the F1 generation there has been high phenotypic variation.

The very high variation in leaf morphology from crossing Antin 2 with Beta 2 can be explained below. According to Mendel's law of inheritance, it is explained that there is phenotypic uniformity in the first generation (F1). The high diversity in the F1 generation of sweet potato crosses is caused by the high heterozygous nature of the parents [18]. The characteristics of the parents who are heterozygous have a big influence on the wider variation in the characters of the offspring produced. The second possibility is the self-incompatibility factor [1]. The abundance of heterozygous sweet potato plants in nature is closely related to hexaploid chromosomes [14]. Plants with hexaploid chromosome types have a greater opportunity to produce variations in characters in their offspring. This happens because in the crossing-over process, a random recombination process occurs. This research provides recommendations for further analysis to be carried out to determine the morphological characteristics of the leaves that differentiate the results of crossing Antin 2 with Beta 2.

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