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Ploidy Levels Based on the Cromosomal Counts of Banana Germplasm In Bandar Lampung, Indonesia

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Abstract: *Along with other South East Asian countries Indonesia is one of the homeland of bananas and is considered as a center of diversity of the genus Musa plants.However, given the vastness of Indonesia, the diversity of banana germplasm, especially in Lampung—oneof Indonesia's provinces on the island of Sumatra, has not been fully known.This study aimed to determine ploidy levels of banana germ plasm in the City of Bandar Lampung, based on the number of chromosomes. Banana plant sampleswere taken randomly from the back yard in 12 districts out of 20 districts in Bandar Lampung. The banana collectionswere then grown in soil media in polybagsand the secondary roots grown were taken for chromosomal preparationusing a modified squash method. The microcospic slide imageswere scanned and computerize analyzed to determine the ploidy level of banana germ plasmaby assessing the number of chromosome.The result showed there are 27accessions of the banana from two genera sections of Musa, 26 accessions belong to the Eumus section and 1 accession allegedly belongs to the section of Rhodhoclamys. Amongthe 27 accessions of bananas,6 accessions showed chromosome number2n = 22, 19 accessions have chromosome number2n = 33, and the last 2accessions have chromosome number 2n = 44.Itcan be concluded that the banana germplasm accessions in the city of Bandar Lampunginclude 3 ploidy levels, namely diploid (2n = 2x), triploid (2n = 3x) andtetraploid (2n = 4x).*

***Keywords*:** *Ploidy, banana germplasm, chromosome number, banana accessions*

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I. Introduction

Banana can be categorized as the 4th staple crop in the world after rice,wheat and corn.Bananasare commonly consumed as fresh fruit or processed foods (Megia, 2005). Bananas have complete nutritional content. In each 100 g of banana cooking there are more than 120 kcal, 74% water, 23% carbohydrate, 1% protein, 0.5% fat and 2.5% fiber.(UNCST, 2007).Megia (2005) notes that all bananas, whether species, varieties or hybrids are classified in the genus of Musa family Musaceae, and the order of Zingberales. The center of diversity of Musa (wild and cultivated/consumed) is in Asia and the Pacific region, including Indonesia. Furthermore, the ancestors of edible banana are Musa acuminateColla and Musa balbisianaColla.Indonesia ranks 4th as a world banana provider after India, China and Brazil with 5.6 million tonnes per year or 7.9% of the world's total banana production (BuletinKonsumsiPangan, 2013).BPS RI (2015) data shows in the period of 2010 -2014 that national banana production increase by 8.5%, reaching 6,862,558 tons at the end of 2014.Java still dominates national banana production and Lampung is the largest banana producing area outside Java with production reaching 1,481,692 tons with a growth rate of 36.68% far above national growth.The high diversity of banana genotypes in Indonesia has not been matched by adequate their characterization. Lampung is acenterof the banana production in Indonesia, therefore the collection of banana germplasms is worth considering.To prevent the duplication of names, it needs the study of identification and characterization of the collection (Rozyandra, 2004; Sobiret al, 2005).Identification based on morphological markers is relatively simple and easy to do but has limitations. The reason is that the expression is easily influenced by the environment, besidethe information of vegetative and new generative organ characters may be observed completely after the plants mature (Rao, 2004, Jumari&Pudjoarianto, 2000 in Wahyuningtyaset al, 2009). Cytological markers such as the number of chromosomes are considered relatively better although it is not as accurate as molecular markers. The objective of the study is to obtain information of the diversity of banana plasma ploidy level present in Bandar Lampung based on the number of chromosomes.

II. Materials and Methods

Collection of banana germplasms was obtained from traditional backyard plantain in 12 sub-districts out of 20 districts of Bandar Lampung.Characterization of chromosome number wasperformed in Botany Laboratory, Department of Biology, Faculty of Mathematics and Sciences, the University of Lampung

Chromosome preparation was performed using squash method (Gunarso, 1996).Banana seedlings of 15 - 40 cm were grown until secondary roots grow. Root cutting was done at 08.00 a.m. at the root end of the secondary root along the 3-5 mm from the bottom root of the root branch. The roots were then soaked in an 8-hydroxyquinolin solution of 0.03% for 3-5 hours at 18 ° -20 ° C. The roots were washed with distilled water 3 times and fixed in 45% acetic acid for 10 minutes. The next root tip was macerated in HCl 1 N solution for 3-5 min at 30 ° C.Then the roots were soaked in 2% acetic-orcein dye solution for 15 minutes. Root tips were put on top of object glass, closed and heated briefly. The roots were pressed gently until the preparation well spread. The slides were observed under a microscope with a gradual magnification until a representative chromosome object obtained. Observations were made of ten cells in the prometaphase stage of different roots. The best preparations were photographed using digital cameras, scanned and enlarged using computer to determine the number of chromosomes as a basis for determining the ploidy levels of banana germplasms.

III. Result and Discussion

The result shows there are 27 banana accessions from the two genera sections of Musa, 26 accessions including the Eumus section and 1 accession possibly included the section of Rhodhoclamys. Observation of chromosome on the 27 accessions of bananas indicated the chromosome number 2n = 22 number as many 6 accessions, 2n = 33 as many 19 accessions and 2n = 44 as many 2 accessions. It concludes that the diversity of accession of bananas at Bandar Lampung consists 3 ploidy levels, namely diploid (2n = 2x), triploid (2n = 3x) andtetraploid (2n = 4x).The full results can be seen in the following table1

Table 1. Number of Chromosome and ploidy level of banana germ plasm of Banda Lampung, Indonesia

No	Banana Accession	Number of Chromosomes	Ploidy
1	Lilin (Janten)	22	2n=2x
2	Mas	22	2n=2x
3	Mas Kuning	22	2n=2x
4	Mulih (Lampung)	22	2n=2x
5	Rejang	22	2n=2x
6	Musa ornate *	22	2n=2x
7	Ambon Kuning	33	2n=3x
8	Ambon Lumut	33	2n=3x
9	Cavendish	33	2n=3x
10	Papan	33	2n=3x
11	PisangSeribu	33	2n=3x
12	Morosebo	33	2n=3x
13	Tanduk	33	2n=3x
14	Raja Nangka	33	2n=3x
15	Raja Sajen	33	2n=3x
16	Raja Sereh	33	2n=3x
17	Raja Bakar	33	2n=3x
18	Rabig/Rabeg	33	2n=3x
19	Kepok Abu	33	2n=3x
20	KepokBatu	33	2n=3x
21	KepokKapas	33	2n=3x
22	KepokKuning	33	2n=3x
23	KepokLibanon	33	2n=3x
24	KepokMenado	33	2n=3x
25	Kidang	33	2n=3x
26	Batu	44	2n=4x
27	Ambon Australi	44	2n=4x

Keterangan: *Didugatermasuk genus Rhodhoclamys

Banana germalasm in Bandar Lampung is mostly tripoid (2n = 3x). The same result wereobtained by Siddiqah (2002) showing that banana janten, mas, rejang, and mulih is diploid. While banana abu, ambon, ambonlumut, papan, rabeg, raja abu, raja sereh, kapas,and tanduk is tripoid. Another sudy by Yuliantyet al (2006) declared thatMauli banana from Southern Kalimantan has 22 chromosome numbers (2n = 2x). Rinaldiet al (2014) stated banana nangka, Lilin Jambi, papan is triploid. Likewise, Banana raja nangka from the collection garden of Polytechnic Banjarnegara has 33 chromosome number (Hanayanti and Pramudya, 2014). This result is similar to that of Ploetzet al (2007) and Daniellset al (2001) that stated the genus Eusmusa and Rhodoclamys have basic chromosome 11 (x = 11).Megia (2005) stated that generally the bananas consumed are usually tripoid, in addition there is some of them are diploid. While tetraploid bananas are usually the result of a cross. It is also explained that compared to diploid bananas, triploid bananas generally have larger stems and fruits. Daniellset al (2001) stated that changing in the number of chromosomes from their dipoid can occur spontaneously or as recombination results. The consequent is that this causes a natural reproduction barrier within the species.

IV. Conclusion

1. Among the 27 accessions of banana studied, 6 accessions showed chromosome number 2n = 22, 19 accessions have chromosome number 2n = 33, and the last 2 accessions have chromosome number 2n = 44.
2. The banana germplasm accessions in the city of Bandar Lampung include 3 ploidy levels, namely diploid (2n = 2x), triploid (2n = 3x) andtetraploid (2n = 4x).

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