

## **Ploidy Levels Based on the Chromosomal 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—one of 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 samples were taken randomly from the back yard in 12 districts out of 20 districts in Bandar Lampung. The banana collections were then grown in soil media in polybags and the secondary roots grown were taken for chromosomal preparation using a modified squash method. The microscopic slide images were scanned and computerized analyzed to determine the ploidy level of banana germ plasm by assessing the number of chromosome. The result showed there are 27 accessions 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*. Among the 27 accessions of bananas, 6 accessions showed chromosome number  $2n = 22$ , 19 accessions have chromosome number  $2n = 33$ , and the last 2 accessions have chromosome number  $2n = 44$ . It can be concluded that the banana germplasm accessions in the city of Bandar Lampung include 3 ploidy levels, namely diploid ( $2n = 2x$ ), triploid ( $2n = 3x$ ) and tetraploid ( $2n = 4x$ ).

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

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Date of Submission: 20 -02-2018

Date of acceptance: 05-02-2018

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### **I. Introduction**

Banana can be categorized as the 4th staple crop in the world after rice, wheat and corn. Bananas are 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 Zingiberales. 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 acuminata* Colla and *Musa balbisiana* Colla. 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 (Buletin Konsumsi Pangan, 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 a center of 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, besides the 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 was performed 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 ( $2n = 3x$ ) and tetraploid ( $2n = 4x$ ). The full results can be seen in the following table 1

**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 germplasm in Bandar Lampung is mostly triploid ( $2n = 3x$ ). The same result were obtained 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 triploid. Another study by Yulianty et al (2006) declared that Mauli banana from Southern Kalimantan has 22 chromosome numbers ( $2n = 2x$ ). Rinaldi et 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 Ploetz et al (2007) and Daniell et al (2001) that stated the genus *Eumus* and *Rhodhoclamys* have basic chromosome 11 ( $x = 11$ ). Megia (2005) stated that generally the bananas consumed are usually triploid, 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. Daniell et al (2001) stated that changing in the number of chromosomes from their diploid 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 ( $2n = 3x$ ) and tetraploid ( $2n = 4x$ ).

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Etiernawiati " Ploidy Levels Based on the Chromosomal Counts of Banana Germplasm In Bandar Lampung, Indonesia" *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)* 11.2 (2018): 81-83.