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Research Article

Cytogenetics of Pisang Awak (Kluai Namwa Tanao Sri) from Suan Phueng district, Thailand

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Abstract - This research aims to study karyotype of Pisang Awak (Kluai Namwa Tanao Sri, *Musa* × *paradisiaca* L.) from Suan Phueng district, Ratchaburi province. Chromosomes were obtained directly from the root tip and fixed roots; meristem cells were stained with acetocarmine dye which were then photographed under a light microscope for cells that were in the metaphase stage. Excel and the Adobe Photoshop CS5 application were used to analyze the data and display ideograms. The chromosome numbers of *Musa* × *paradisiaca* L. is $3n = 33$ ($x = 11$), metacentric, submetacentric and acrocentric chromosome are commonly observed. The chromosome range length was reported between 0.742-1.697 μm, karyotype comprising three large submetacentric, six large acrocentric, six medium metacentric, nine medium submetacentric, three medium acrocentric, three small metacentric and three small submetacentric chromosome, respectively. The karyotype formula of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.) as follows: 3n (33) = $L^{sm}_{3} + L^{a}_{6} + M^{m}_{6} + M^{sm}_{9} + M^{a}_{3} + S^{m}_{3} + S^{sm}_{3}$

Keywords: Kluai Namwa Tanao Sri, banana, chromosome, karyotype

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1. Introduction

Currently, the majority of the residents in Tanaosri Sub-district, Suan Phueng District, Ratchaburi Province, are farmers, and the majority of the bananas grown there are in Kluai Khai, Kluai Hom, and Kluai Namwa. Kluai Namwa Tanao Sri is a traditional breed in the area, they are angular, huge, bushy, and quite large. The ripe fruit has a yellowish white color, is firm, sweet tasting, and fragrant. Moreover, nutritious bananas of a protein diet compared to other common cultivars of Kluai Namwa.

Bananas are plants in the family Musaceae, genus *Musa*, which is divided into 4 sections: *Eumusa*, *Rhodochlamys*, *Australisa* and *Callimusa*, bananas in the first two categories have 2*n*=22, the latter two have 2*n*=20 (Chapman, 1970; Chessman & Larter, 1935); Hutchingson, 1966; Pursglove, 1978). The bananas from Section *Eumusa* are currently eaten and considered the most economically important. This group of bananas have a somewhat complicated genetic heritage. Examining the origins of each variety of banana. This can be accomplished by employing a scoring approach to categorize bananas according to their morphological traits among 15 characteristics of bananas (Simmonds & Shepherd, 1955). This approach was used to identify bananas as AA (2*n* = 22), AAA (2*n* = 33), AAB (2*n* = 33), ABB (2*n* = 33), ABBB (2*n* = 44), and BB (2*n* = 22), each group can indicate its origin from which parent. Bananas are generally edible. Their ancestors are *Musa acuminata* Colla (genome A) and *Musa balbisiana* Colla (genome B) (Hribova *et al*., 2008). However, the classification of bananas using this method is still up for debate. Therefore, cytogenetic research is necessary to make it clearer (Phengchang *et al*., 2009).

We studied on chromosome number of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.) from Suan Phueng district, Ratchaburi province. The purpose of this study was to investigate on chromosome number of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.) of Ratchaburi province which is an economically important species. The knowledge gathered from this study can be used to improve breeding. The identification of banana species is made more accurate by having a basic understanding of the traits of the breed and the precise number of chromosomes.

2. Materials and methods

2.1 Plant materials

Specimens were collected from natural habitats of Tanaosri Sub-district, Suan Phueng District, Ratchaburi Province and courtesy of a 6-month-old Tanaosri cultivar banana sample from the Tissue Culture Center, Muban Chom Bueng Rajabhat University. The plant samples were identified by Flora of China (2000).

2.2 Chromosome counts

The meristematic tissue of root was used for chromosome counts. Root was germinated in clean water on plastic glass at room temperature. Harvested the root tips of plants had grown 1-1.5 cm in length were stopped from the germinating by pretreating with 2% colchicine for twelve hours. Then, fix using Carnoy's fixative (methanol:acetic acid, 3:1) and store it at 2-4°C. The root

tips were then rinsed in water, hydrolyzed for 10-15 min at room temperature with 1 N HCl, and rinsed for at least 3-5 min under running water. The root tips were stained with acetocamine stain for 1-2 hours. Lastly, preparations for the squash were made. At least 20 metaphase spreads were analyzed to confirm the 2n, karyotype structure. Images were captured using a digital microscope Olympus CX31 with visualization device based on LCD screen and camera. Chromosomes were classified as metacentric (m), submetacentric (sm), acrocentric (a) or telocentric (t) according to their relative length (Chaiyasut, 1989).

3. Results and discussion

The Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.) share $3n = 33$ ($x = 11$), metacentric, submetacentric and acrocentric chromosome are commonly observed (Figure 1). The reported chromosomal range length ranged from 0.742 to 1.697 μm (Table 1), karyotype comprising three large submetacentric, six large acrocentric, six medium metacentric, nine medium submetacentric, three medium acrocentric, three small metacentric and three small submetacentric chromosome, respectively. The karyotype formula of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.) as follows: $3n\ (33) = L^{sm}_{3} + L^{a}_{6} + M^{m}_{6} + M^{sm}_{9} + M^{a}_{3} + S^{m}_{3} + S^{sm}_{3}$

Figures 1 and 2 depict the somatic metaphase, karyotypes, and ideograms of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.).

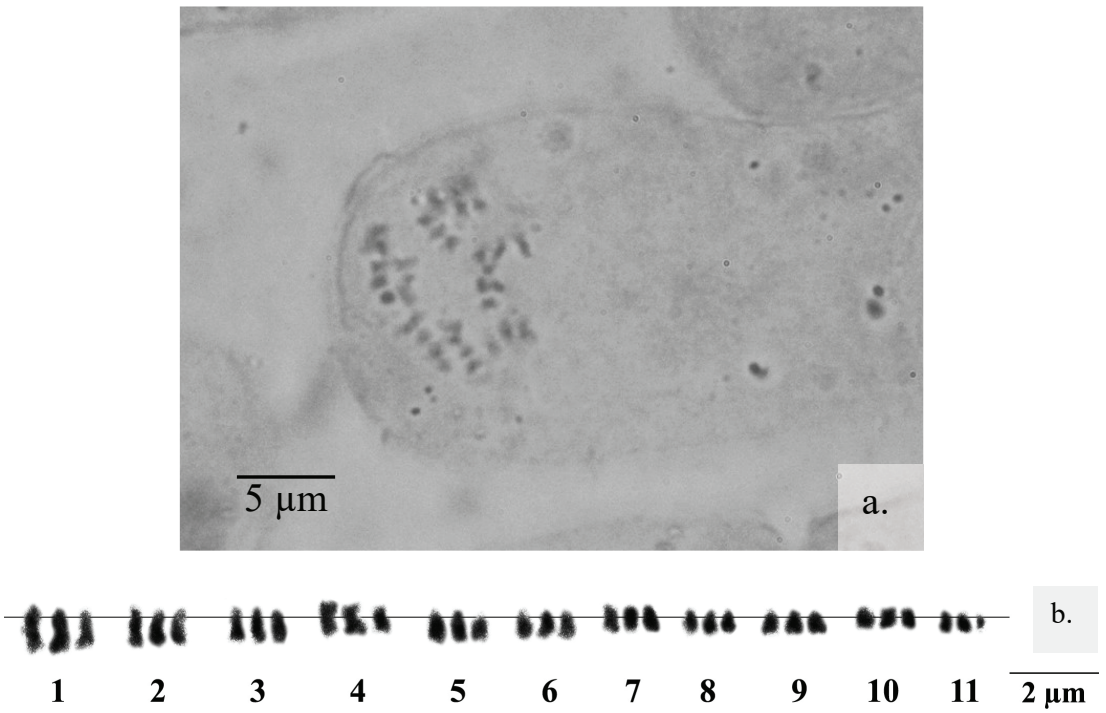

Figure 1. Metaphase (a.) and karyotypes (b.) of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.), arranged from conventionally acetocamine stained. Scale bar = 5 μm (a.) and 2 µm (b.).

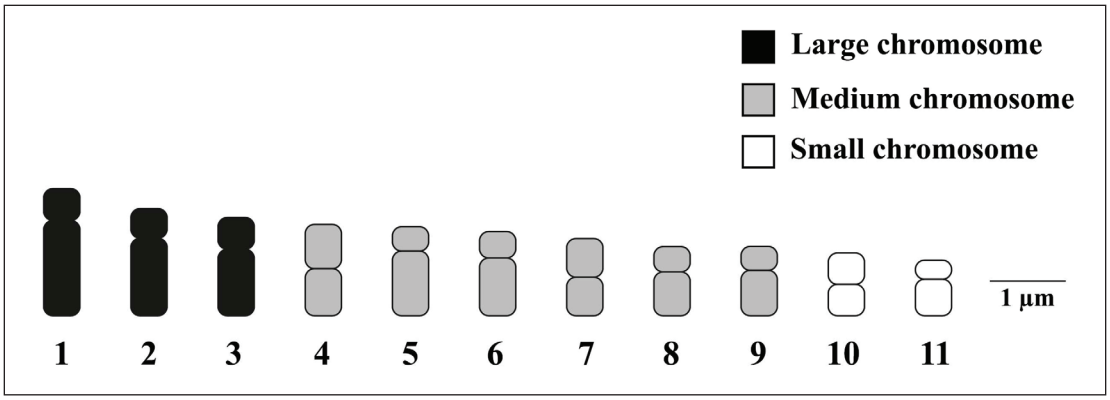

Figure 2. Standard ideograms of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.), arranged from conventionally acetocamine stained. Scale bar = 1 µm.

Table 1. Mean length of short arm chromosome (Ls), length of long arm chromosome (Ll), length of total arm chromosome (LT), relative length (RL), centromeric index (CI), and standard deviation (SD) of RL, CI from 20 metaphase cells of Kluai Namwa Tanao Sri (*Musa* × *paradisiaca* L.), 3*n*=33.

Chromosome pairs	Ls	Ll	LT	RL±SD	CI±SD	Chromosome type
1	0.426	1.272	1.697	0.137±0.003	0.750±0.017	acrocentric
2	0.394	1.036	1.430	0.115±0.004	0.725±0.017	acrocentric
3	0.425	0.887	1.312	0.106±0.001	0.676±0.022	submetacentric
4	0.591	0.629	1.219	0.098±0.001	0.515±0.023	metacentric
5	0.326	0.863	1.189	0.096±0.004	0.727±0.028	acrocentric
6	0.354	0.771	1.125	0.091±0.003	0.685±0.016	submetacentric
7	0.516	0.516	1.032	0.083±0.003	0.501±0.027	metacentric
8	0.336	0.586	0.922	0.074±0.003	0.637±0.050	submetacentric
9	0.318	0.607	0.926	0.074±0.002	0.656±0.018	submetacentric
10	0.417	0.421	0.838	0.067±0.003	0.502±0.026	metacentric
11	0.253	0.489	0.742	0.060±0.002	0.660±0.051	submetacentric

In Thailand, there are numerous banana types with chromosomal numbers starting at 2n = 22, 33, or 44, where x = 11 (Oselebe *et al*., 2006). As a result, cultivated bananas typically have 2X, 3X, and 4X sets of chromosomes. Bananas also have a wide range of genetic variations. There are several hybrids descended from these two parents, which are the wild banana species *Musa acuminata* Colla and *Musa balbisiana* Colla (Hribova *et al*., 2008; Ferreira *et al*., 2004; Harrison & Schwarzacher, 2007). It is challenging to distinguish between each banana species since there are multiple copies of the genome, which are as follows: AA, AAA, BB, BBB, AAB, ABB, and ABBB. Moreover, each local name is different even though it is the same type of banana. Additionally, while all belonging to the same banana type, each local name is

distinct. Or even various banana varieties with the same name could result in confusion. (Phengchang *et al*., 2009).

Tanaosri bananas are categorized as belonging to the Section *Eumusa*, with chromosome numbers 3*n* = 33, which include metacentric, submetacentric, and acrocentric chromosomes like Kluai Tip and Kluai Khom Nak, which have ABB and AAB genomes, respectively (Silayoi & Babpraserth, 1983). From the collection of relevant documents, it was found that the triploids (*2n* = 33) were Kluai Khrao, Kluai Neu Mu Nang, Kluai Nam Kap Dum, Kluai Kung Khieo, Kluai Nam, Kluai Tip, Kluai Leb Chang Kut, Kluai Tip Khum, Kluai Khom Bao, Kluai Khom Nak, Kluai Namwa Luang, Kluai Kung, Kluai Klong Chang, Kluai Phama Haek Kuk, Kluai Nang Klai, Kluai Hom Tia, Kluai Namwa Khom and Kluai Khai Bong (Silayoi & Sompen, 1991). They were hybrids of *Musa acuminata* Colla. and *Musa balbisiana* Colla. The karyotypes were metacentric, submetacentric and subtelocentric chromosome.

Furthermore, it was shown that bananas with the same genome tend to have somewhat different chromosomal sizes and shapes. This results in a slightly distinct chromosome structure, and these traits will be crucial for categorizing each banana species and determining the ancestors of bananas.

4. Conclusion

The chromosome number of Pisang Awak (Kluai Namwa Tanao Sri) from Suan Phueng district, Ratchaburi province, was determined by using the squashing root tip technique and acetocarmine stain. The outcome indicated the presence of a triploid (3*n*=33). The length of long and short arms was measured to study their karyotype, which was then categorized into metacentric, submetacentric, acrocentric, and telocentric chromosomes. The lengths ranged between 0.742 and 1.697 μm. The chromosome of Kluai Namwa Tanao Sri is hybrids of *Musa acuminata* Colla. and *Musa balbisiana* Colla. The karyotypes were metacentric, submetacentric and acrocentric chromosome. No telocentric banana chromosomes were discovered in this investigation.

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