

Certain Morphological Characteristics in Different Ploidy Level of Thai Banana

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Abstract

The investigation on leaf thickness, leaf weight, petiole weight, number and size of stomata, number and size of pollen grain of fifteen clones of Thai banana at different ploidy were conducted. Such characters were compared to those of wild diploid plants namely Kluai Pa (*Musa acuminata*) and Kluai Tani (*Musa balbisiana*) using X^2 -test in experimental analysis. The results showed that the polyploid had significantly thicker leaves, heavier weight, greater number of stomata, and larger size of stomata and pollen grain. However significantly less dry weight of petiole and smaller number of pollen grain were noticed in the polyploids than in the diploid.

Thailand is rich in hybrid banana cultivars of *Musa acuminata* Colla and *Musa balbisiana* Colla. These two species cross freely, thus numerous diploid and triploid hybrid combinations are found in the nature. The diversity ranges from delicate edible diploid types to hardy triploid and tetraploid bi-specific origin. Study on chromosome number is one of the methods in evaluation of banana cultivars. Accepting the basic chromosome number as 11, the euploid clones should have somatic chromosome numbers of 22, 33, 44, and so on. (Simmonds, 1984; 1962; Purseglove, 1978).

Among wild and edible forms of *M. acuminata*, triploids are markedly superior to diploid. There is maximum vigor among clones of predominantly *balbisiana* origin upto the maximum of tetraploid level. Higher polyploidy levels are not as vigorous, thus suggesting that tetraploidy is the optimum limit (Simmonds, 1962 and Vakili, 1967). In polyploids,

the leaf lamina is perceptibly thicker and heavier than the diploids and there is a breakage near the junction of petiole and lamina in the polyloids. The fruits at maturity in polyploid are usually double the size of fruits in corresponding diploids. (Simmonds, 1952; 1962).

Materials and Methods

1. Fifteen clones of Thai banana at the ploidy level of diploid, triploid and tetraploid were collected and the following characters were examined.

- leaf thickness and leaf weight
- fresh and dry weight of leaf petiole
- number and size of stomata
- number and size of pollen grain

2. Comparison of every characters of those clones with *M. acuminata* and *M. balbisiana* by using X^2 -test was conducted.

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Results and Discussion

Leaf thickness and leaf weight

Leaf thickness were measured at proximal and distal ends of leaf blade. The results showed that, the 3X and 4X plants were significantly thicker than 2X except for Klui Nom Mi and Klui Ngoen. For fresh weight they were higher than 2X highly significant (Table 1).

Table 1. Leaf thickness and leaf weight

Cultivars	Thickness (mm)		Fresh weight (g)
	Proximal	Distal	
K. Tani (2X)	0.040	0.033	626.67
K. Khai Thong Rong (2X)	0.047	0.032	558.33
K. Khai Pra Tabong (3X)	0.045	0.035	521.67
K. Namwa Khom (3X)	0.097	0.041	674.67
K. Namwa Luang (3X)	0.052	0.037	761.67
K. Namwa Khao (3X)	0.047	0.038	1,250.00
K. Namwa Sai Daeng (3X)	0.045	0.038	730.00
K. Klong Chang (3X)	0.048	0.038	1,126.67
K. Nom Mi (3X)	0.038	0.030	670.00
K. Hom (3X)	0.042	0.030	485.00
K. Ngoen (3X)	0.040	0.031	766.67
K. Ngu (2X)	0.040	0.036	673.33
K. Lep Chang Kut(3X)	0.042	0.033	811.67
K. Teparot (4X)	0.047	0.035	988.33
K. Pa (2X)	0.038	0.030	678.33

It means that, the polyploids, in general, had significantly thicker leaves than the diploids. The leaf thickness was positively and significantly correlated with the leaf weight. As such, because of heavier leaves the polyploids tend to droop more often than the diploids (Purseglove, 1978; Simmonds, 1962; Vikili, 1967).

Leaf petiole weight

One hundred grams of leaf petiole were dried in oven at 65°C. The dry weight was measured as shown in Table 2.

Table 2. Dry weight of 100 gm petiole

Cultivars	dry weight (gm)	% water
K. Tani (2X)	12.94	87.06
K. Khai Thong Rong (2X)	11.81	88.19
K. Khai Pra Tabong (3X)	11.89	88.11
K. Namwa Khom (3X)	10.64	89.36
K. Namwa Luang (3X)	11.45	88.55
K. Namwa Khao (3X)	10.89	89.11
K. Namwa Sai Daeng (3X)	7.94	92.06
K. Klong Chang (3X)	9.99	90.01
K. Nom Mi (3X)	8.23	91.77
K. Hom (3X)	13.23	86.77
K. Ngoen (3X)	5.86	94.14
K. Ngu (2X)	12.10	87.90
K. Lep Chang Kut (3X)	9.27	90.73
K. Teparot (4X)	10.21	89.79
K. Pa (2X)	13.04	86.96

Petiole weights, both fresh and dry, show the same sort of trend as leaf thickness. The dry weight of the petiole declines in the polyploids, except K. Khai Pra Tabong, K. Namwa and K. Hom, in other words, the polyploid leaves are more liable to breakage in windy conditions and tend to droop more than diploids. Further, the polyploids have a tendency not to have as well formed leaves as the diploids.

Number and size of stomata

The stomata of upper and lower leaves were observed and the results were shown in Table 3.

Table 3. Stomatal number and size

Cultivars	No. of Stomata/mm ²		Size (mm)	
	Upper	Lower	Upper	Lower
	leaves	leaves	leaves	leaves
K. Tani (2X)	2.35	282.35	0.029	0.029
K. Khai Tong Rong (2X)	32.94	110.87	0.017	0.017
K. Khai Pra Tabong (3X)	31.76	168.24	0.017	0.017
K. Namwa Khom (3X)	4.71	217.65	0.017	0.029
K. Namwa Luang (3X)	7.06	195.29	0.021	0.029
K. Namwa Khao (3X)	9.41	217.65	0.024	0.029
K. Namwa Sai Daeng (3X)	17.65	195.29	0.026	0.033
K. Klong Chang (3X)	3.59	104.71	0.017	0.029
K. Nom Mi (3X)	3.53	250.59	0.017	0.029
K. Hom (3X)	32.94	130.59	0.017	0.029
K. Ngoen (3X)	3.53	250.59	0.017	0.029
K. Ngu (2X)	3.53	248.24	0.017	0.020
K. Lep Chang Kut (3X)	3.53	174.12	0.028	0.029
K. Teparot (4X)	2.35	250.59	0.029	0.029
K. Pa (2X)	52.94	170.59	0.029	0.017

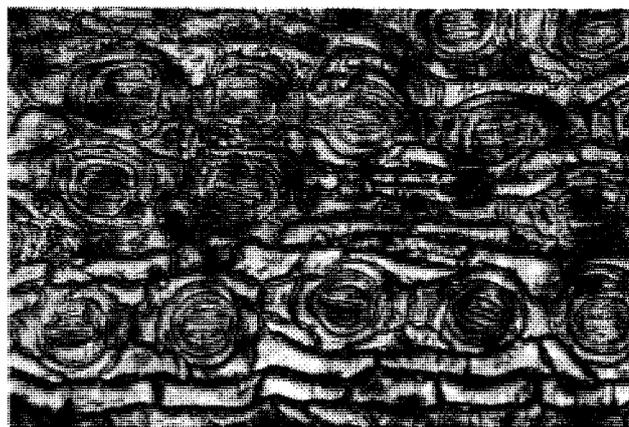


Fig. 1. The stomatal sizes of diploid (A) triploid (B) and tetraploid of Thai banana (450x). A = Diploid; B = Triploid; C = Tetraploid, (450x)

The stomata in the lower leaves are more numerous than in the upper leaves. The number as well as size of stomata in the polyploids (Fig. 1B, 1C) were significantly higher than those in the diploids (Fig. 1A).

Pollen grain

The number and size of pollen grains were observed and are shown in Table 4.

Table 4. Pollen grains number and size of diploid, triploid and tetraploid bananas

Cultivars	Number/cm ²	Size (mm)
K. Tani (2X)	112.50	0.061
K. Khai Thong Rong (2X)	96.50	0.131
K. Khai Pra Tabong (3X)	8.50	0.141
K. Namwa Khom (3X)	2.75	0.166
K. Namwa Luang (3X)	0.75	0.193
K. Namwa Sai Daeng (3X)	1.00	0.186
K. Klong Chang (3X)	4.25	0.141
K. Nom Mi (3X)	4.25	0.129
K. Hom (3X)	20.25	0.133
K. Ngoen (3X)	6.25	0.152
K. Ngu (2X)	22.75	0.142
K. Lep Chang Kut (3X)	7.00	0.138
K. Teparot (4X)	28.25	0.136
K. Pa (2X)	93.00	0.061

The diploids exceeded the polyploids in the number of pollen grains, but the polyploids had significantly larger pollen size than the diploids.

Conclusions

The leaf thickness, leaf weight, number of stomata, size of stomata and pollen grain of polyploid were significantly greater than those of diploid. The significantly less dry weight of petiole and smaller number of pollen grain were found in polyploids.

The polyploid plants were bigger and healthier than diploid ones but their leaves have tendency to droop more than diploid. Beside the polyploid were not suitable for breeding program due to the small amount of pollen grains.

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