

## Sporetetrad and Pollen Fertility of Three Cultivars of *Citrullus lanatus* (Thunb) Matsum & Nakai

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### Abstract

*Citrullus lanatus* is a prostrate or climbing annual plant with several herbaceous, firm and stout stems up to 3m long. The young parts are densely woolly with yellowish to brownish hairs while the older parts are hairless. The leaves are herbaceous but rigid becoming rough on both sides but usually deeply 3 lobed with segments again lobed or doubly lobed; the central lobe is much the largest. The leafstalks are hairy. The tendrils are rather robust and usually divided in the upper part. Sporetetrad and pollen fertility were studied in the cultivars of *Citrullus lanatus* (Thunb) Matsum & Nakai such as (cv. 855, cv Hotel and cv 825 belonging to the family Cucurbitaceae widely grown in Chaung U Township. In the present study, it was found that three cultivars possessed the ranges of micronuclei per sporetetrad were 1.88 (cv 825) to 2.54 (cv 855). These three cultivars showed the percentage of normal pollen was greater than abnormal pollen. Thus, to improve their fertility and yield characters, it is essentially needed to understand pollen mother cell cycle that produces pollen and sporetetrad.

**Keywords:** Cultivar 855, Hotel, 825, Chaung U Township

### Introduction

*Citrullus lanatus* (Thunb) Matsum & is one of the most important vegetable crops in the tropical and subtropical region of the world (Schippers, 2000). *Citrullus lanatus* belongs to the family Cucurbitaceae. It is a family of about 130 genera and about 800 species distributed mainly in tropical and subtropical regions of the world. (Kocyan *et al* 2007).

The scientific name of the watermelon is derived from both Greek and Latin roots. The *Citrullus* parts come from a Greek word Citrus which is a reference to the fruit. The lanatus part is latin and has the meaning of being woolly referring to the small hairs on the stem and leaves of the plant (Baker *et al.*, 2012).

Watermelon is thought to be originated in Southern Africa because it is found growing wild throughout the area and reaches maximum diversity of forms there. It has been cultivated in Africa for over 4000 years. *Citrullus lanatus* was brought to America by Spanish and quickly become very popular crop. (Robison and Decker, 1997).

*Citrullus lanatus* is a prostrate or climbing annual plant with several herbaceous, firm and stout stems up to 3m long. The young parts are densely woolly with yellowish to brownish hairs while the older parts are hairless. The leaves are herbaceous but rigid, becoming rough on both sides but usually deeply 3 lobed with segments again lobed or doubly lobed; the central lobe is much the largest. The leafstalks are hairy. The tendrils are rather robust and usually divided in the upper part. Male and female flower occur on the same plant (monoecious). The fruit in the wild form is subglobose and indehiscent; the fruit stalk is up to 50mm long. (Vanetal, 2004; Fursa 1981, Myanard, 2001, Oyolu, 1977).

Thus, in the present investigation, sporetetrad and pollen fertility of *Citrullus lanatus* (Thunb) Matsum & Nakai were also examined. In order to fulfill this little gap for the convenient of future research works, this investigation was carried out to highlight the pollen mother cell characters of *Citrullus lanatus* (Thunb) Matsum & Nakai commercially in Chaung U Township, Sagaing Region.

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## Materials and Methods

### Material

The specimens (Pollen mother cells – PMCs) of *Citrullus lanatus* (Thunb) Matsum & Nakai cv. 855, cv. Hotel, cv. 825 were collected from Ngan Shan Village, Chaung U Township.

### Methods

#### Collection of Pollen Mother Cells (PMCs)

The samples of pollen mother cell (i.e. anther in the flower) were collected at the early bud stages till moderately mature bud stages and immediately fixed in freshly prepared 3:1 (alcohol solution, Carnoy's solution: acetic acid) containing brown glass vials. Specimens for each species and from each collection sites were collected in each of the separate bottle, which were labeled precisely of the collection sites, species, date and time of collection. The sample collections were carried out in the cultivated field at 6:30 to 8:30 AM (i.e. the optimal collection time). The collected samples were fixed for at least three days at the room temperature.

#### Slide Preparation

Various sizes of flower buds were used in studying. After fixing for three days in the fixative solution, one of the flower bud was selected and placed on the glass slide. By the help of needle pointer and a pair of forceps, the anthers from the flower were removed and the remaining parts of the flowers were discarded. The anther was crushed by specially prepared silver knife. One or two drops of Giemsa staining solution was added on the dissected anther. The undesired materials were then again removed from the glass slide the sample was covered with thin glass cover slip. Using the unique thumb pressure, the cover slip was gently pressed to get well spread slide desired stages.

#### Micronuclei counting at spore-tetrad stage

These were observed in spore-tetrad stages. The spore-tetrad that has only one large nucleus (normal nucleus) and has no any small nucleus was recorded on normal spore-tetrad. The spore-tetrad with one or many micronuclei besides the large normal nucleus was recorded as spore-tetrad with micronuclei. This observation was also done on 48 spore-tetrads for each of the variety studies.

#### Determination of normal and abnormal pollen

Pollen possessing one generative and two tube nucleus are marked as normal pollen. The one lacking one nucleus or both of them or having more than one on the same nucleus in each of the pollen, this was decided as the abnormal pollen. Number of normal and abnormal pollen was also recorded for 100 cells.

#### Photomicrograph

Both the normal and abnormal sporetetrad and pollen having well spread, clear and possessing distinct image of pollen or tetrad were recorded by taking photomicrograph.

#### Statistical Analysis

Comparison on normal and abnormal pollen were made using the 2×2 contingency Chi-square test were conducted. The occurrence of micronuclei per tetrad were also compared by the help of student 't' test of Steel and Torrie (1960).

## Results

### Morphological Study

Scientific name - *Citrullus lanatus* (Thunb) Matsum & Nakai (Fig 1, A, B, C)

Myanmar name - Hpa-ye

English name - Water melon

Family - Cucurbitaceae

Annual monoecious, creeping herbs; stems and branches covered with patently woolly at the apex, solid, green, woolly; tendrils bi-fid, green, scabrous. Leaves simple, deeply parted or lobed; petioles slender, green, woolly, blades ovate or triangular-ovate, broadly cordate of the base, dentate along the margin, acuminate at the apex. Staminate and pistillate flower axillary solitary, yellow. Calyx 5-lobed, tube campanulate. Corolla widely campanulate, deeply 5 fid. Ovary inferior, unilocular with many ovules on the three parietal placentas, green with longitudinal dark stripes, woolly; style short, glabrous; stigma 3, glabrous. Pepo large, sweet, fleshy, smooth, dark green or greenish-yellow. Seeds very many, embedded in red or yellowish-white pulp, obovoid, compressed, smooth, black or reddish-brown.

Table 1. Comparison on sporetetrad and pollen fertility of *Citrullus lanatus* (Thunb).  
Matsum & Nakai

Cultivar	Micronuclei per sporetetrad		Normal pollen			Abnormal pollen		
	Mean $\pm$ S.E	't' value	%	Arc-Sine Value	$\chi^2$ value	%	Arc-Sine Value	$\chi^2$ value
855 Vs Hotel	2.54 $\pm$ 1.64	1.91	87	68.87	0.49	13	31.13	0.49
	1.96 $\pm$ 1.40		83	65.65		17	24.35	
855 Vs 825	2.54 $\pm$ 1.64	2.08	87	68.87	0.04	13	31.13	0.04
	1.88 $\pm$ 1.50		79	62.72		21	37.28	
Hotel Vs 825	1.96 $\pm$ 1.40	0.28	83	65.65	0.22	17	24.35	0.22
	1.88 $\pm$ 1.50		79	62.72		21	37.28	

### Spore tetrad

825 cultivar possessed (1.88  $\pm$  1.50) in lowest mean number and 855 cultivar possessed (2.54  $\pm$  1.64) mean number micronuclei per spore tetrad. All three cultivars showed no significantly different. (Table 1, Figure 2).

### Pollen characters

855 Cultivar, Hotel cultivar and 825 cultivar possessed 87, 83 and 79 percent of normal pollen but did not exhibit significantly different number of pollen. (Table 1, Figure 3).



(A) Cultivar 855 (Hpa-Ye)



(B) Cultivar Hotel (Hpa-Ye)



(C) Cultivar 825 (Hpa-Ye)



Figure (1) Plant Habit of *Citrullus Lanatus* (Thunb) Matsum & Nakai and Fruit of *Citrullus Lanatus* (Thunb) Matsum & Nakai



(A) 855 (Tetrad)                      (B) Hotel (Tetrad)                      (C) 825 (Tetrad)

Figure (2) Spore-tetrad (A,B,C) characters of *Citrullus Lanatus* (Thunb) Matsum & Nakai



(A) 855 (Normal Pollen)    (B) Hotel (Normal Pollen)    (C) 825 (Normal Pollen)



(D) 855 (Abnormal Pollen)    (E) Hotel (Abnormal Pollen)    (F) 825 (Abnormal Pollen)

Figure (3) Normal Pollen (A,B,C) and Abnormal Pollen (D,E,F) characters of *Citrullus Lanatus* (Thunb) Matsum & Nakai

## Discussion and Conclusion

*Citrullus lanatus* (Thunb) Matsum & Nakai is a cross pollinated crop and germplasm often exists in the form of heterozygous genotypes which could be improved through intraspecific hybridization. Other close relative of *C. lanatus* are *C. colocynthis*, *C. ecirrhosus*, *C. nandianus* and *C. mucospermus*, all having chromosome counts of  $2n = 22$  as reported by Wehner and Barrett (1996). Stickiness poor stainability and extremely small size of the chromosome are factors millitating against cytogenetic studies in *Citrullus* species.

Extensive genetic studies and breeding experiment since 1903 have identified more than one hundred gene. These genes are related to phenotypes in seed and seedling, vine, flower and fruit (Robison *et al.*, 1976, Cucurbit Gene list committee, 1979, 1982, Henderson 1992, Rhodes and Dane, 1999; Wehner, 2008).

The irregularities in chromosome pairing and the presence of an extra chromosome affected the later stage of meiosis as laggard and micronuclei at spore tetrad (Hashemi *et al.*, 1989). In the present study, high percentage of micronuclei also observed in 855 cultivar (2.54) and low percentage found in 825 cultivar (1.88).

Darlington (1965) proposed that yield of plants can be assumed from its meiosis characters especially from the study of their normality and abnormality of the spore tetrad formation and fertility and sterility of pollen.

In the present study, normal pollen was between 87% (855 cultivar) and 79% (825 cultivar).

These results showed that the studied cultivars may be possessed genetic stability and highest pollen fertility.

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