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Induction of seedlessness through intergeneric pollen in watermelon (*Citrullus lanatus* Thunb.)

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Abstract

A field experiment was carried out during *Rabi* 2016 at College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem (A.P) to study the effect of intergeneric pollen on induction of parthenocarpy in watermelon. Among the intergeneric pollen studied, bottle gourd pollen has induced parthenocarpy, but the fruit flesh is slightly filled with papery seeds. However, empty seed count was highest when mixed pollen of bottle gourd + pointed gourd (60.50) was used and lowest was recorded with ash gourd pollen (37.20). Among the intergeneric pollen used, the maximum fruit diameter (438.53 mm) and yield per plant (4.75 kg) were observed when female flowers of watermelon were pollinated with bottle gourd pollen whereas, less rind thickness (1.12 cm) was observed with bottle gourd + bitter gourd pollen. The qualitative characters like TSS (10.75 °Brix) and total sugars (11.91 %) were highest when flowers were pollinated with bitter gourd pollen.

Keywords: intergeneric pollen, parthenocarpy, bottle gourd *etc.*

Introduction

Watermelon (*Citrullus lanatus* Thunb.) also known as Tarbuj (Hindi), Palmpanna (Tamil), Kalingarakaya (Telugu). It is a trailing vine, monoecious and belongs to Cucurbitaceae family. It is originated from Southern Africa. Watermelon is a major cucurbit in India covering an area of 0.91 million hectares, with an annual production of 21, 82, 000 MT (NHB, 2017). Terada and Masuda (1938) [5] showed that seedless watermelon could be produced by artificially induced parthenocarpy. In the distant past, seedless watermelons are produced by a triploid technique by which diploid pollen (male parent) is used to pollinate pistillate flowers of tetraploid watermelon (Kihara, 1951) [2]. Sugiyama and Morishita (2000) [4] developed a method for producing seedless watermelon in diploid plants using soft-X-irradiated pollen of intergeneric pollen. The reason behind this approach was to prevent the penetration of normal pollen by pollinating with intergeneric pollen before anthesis of pistillate watermelon flowers. Hence, the present investigation was undertaken to study the induction of parthenocarpy through intergeneric pollen in watermelon and to identify which pollen have more impact on induction of parthenocarpy.

Material and Methods

The experiment consisted of 8 treatments *viz.*, T₁- Bottle gourd pollen, T₂- Bitter gourd pollen, T₃ - Pointed gourd pollen, T₄ -Ash gourd pollen, T₅ - Bottle gourd + Bitter gourd pollen, T₆ - Bottle gourd + Ash gourd pollen, T₇ - Bottle gourd + Pointed gourd pollen and T₈ – Control, laid out in Randomized Block Design with three replications. The seed variety Arka Muthu collected from Indian Institute of Horticultural Research (IIHR), Banagaluru. The healthy and disease free seeds were sown in black poly bags of 10 × 8 cm size filled with well mixed farm yard manure. The seedlings obtained from nursery were planted in the plots at a spacing of 2.0 m × 0.6 m at a depth of 2-3 cm. The pollinizer plants *i.e.*, bottle gourd, bitter gourd, pointed gourd, ash gourd were grown adjacent to the experimental field for artificial pollination. The male flowers were bagged with butter paper covers before collection of pollen from male flowers for pollination to avoid contamination of foreign pollen. The female flowers of watermelon are also bagged with butter paper covers. Next day morning the pollen were collected from the bagged flowers and immediately pollinated on watermelon flowers as per the treatment. The pollen were applied with brush gently on the stigma after pollination, flowers were bagged. The data on fruit characters, parthenocarpy and yield characters were recorded and analysed statistically by using OPSTAT software.

Results and Discussion

Yield attributes

Average fruit diameter

Fruit diameter was significantly influenced by different intergeneric pollen (Table 1). The maximum fruit diameter of 438.53 mm was observed when the flowers pollinated with bottle gourd pollen and it was found to be at par with control (444.63 mm). The minimum fruit diameter (396.76 mm) was recorded in treatment where bitter gourd pollen was used.

Fruit length

From the data (Table 1), it was evident that the fruit length was found to be significantly influenced by different types of intergeneric pollen. Fruit length of 13.69 cm was observed in the treatment where bottle gourd + pointed gourd pollen used for pollination. However, the lowest fruit length (11.74 cm) was observed in treatment where bottle gourd pollen was used for pollination.

Number of normal seeds and apomictic seeds per fruit

The parthenocarpic watermelon fruits were developed when bottle gourd pollen was used for pollination (Plate 1). Whereas more number of apomictic seeds (186.06) was observed with bottle gourd + pointed gourd pollen (Table 1). The parthenocarpy observed with bottle gourd pollen might be due to the inability of bottle gourd pollen to fertilize the watermelon ovaries soon after pollination. Sugiyama *et al.* (2014) [3] envisaged that, induction of parthenocarpy in watermelon by pollination with bottle gourd pollen is

stimulative parthenocarpy which is caused by pollen grain or pollen tube growth hormones (Yasuda, 1934 and Gustafson, 1937) [6, 1]. The seeds are formed by the intergeneric pollen was might be due to apomixis.

Number of empty seeds or papery seeds per fruit

The minimum number of empty seeds were present with the application of ash gourd pollen (37.20) followed by the flowers pollinated with bottle gourd + ash gourd pollen (61.50) and bottle gourd + pointed gourd pollen (60.50). These results are in conformity with sugiyama *et al.* (2014) [3] in watermelon.

Yield per plant

Yield per plant found to be significantly influenced by the different intergeneric pollen. Yield of 4.75 kg per plant (Table 2) was observed in treatment where bottle gourd pollen was used for pollination. Obviously maximum yield (5.84 kg) was recorded in control. Lowest yield (3.43 kg) was recorded in treatment where pointed gourd pollen was used for pollination.

Rind thickness

The lowest rind thickness of 1.12 cm (Table 2) was observed in fruits pollinated by bottle gourd + bitter gourd pollen. Maximum rind thickness (1.65 cm) was observed in control and it was on par with bottle gourd pollen (1.60 cm). These results were similar to findings of Sugiyama *et al.* (2014) [3] in watermelon.

Table 1: Effect of intergeneric pollen on induction of parthenocarpy

Treatments	Average fruit diameter (mm)	Fruit length (cm)	Number of apomictic seeds per fruit	Number of empty seeds per fruit
T1: Bottle gourd pollen	438.53	11.74	0.00	58.96
T2: Bitter gourd pollen	396.76	11.81	70.40	40.96
T3: Pointed gourd pollen	416.20	11.60	114.53	39.96
T4: Ash gourd pollen	434.13	13.02	77.43	37.20
T5: Bottle gourd + Bitter gourd pollen	398.06	11.90	112.06	47.40
T6: Bottle gourd + Ash gourd pollen	411.63	12.80	168.73	61.50
T7: Bottle gourd + Pointed gourd pollen	398.5	13.69	186.06	60.50
T8: Control	444.63	14.57	268.50	77.53
SE(m)±	3.6	0.20	3.26	2.29
CD at 5%	11.02	0.61	9.98	7.03
CV (%)	1.49	2.75	4.52	7.5

Table 2: Effect of intergeneric pollen on quality characters of watermelon

Treatments	Yield per plant (kg)	Rind thickness (cm)	TSS (° Brix)	Total sugars (%)
T1 : Bottle gourd pollen	4.75	1.60	9.48	11.63
T2 : Bitter gourd pollen	3.81	1.34	10.75	11.91
T3 : Pointed gourd pollen	3.43	1.23	9.81	11.36
T4 : Ash gourd pollen	3.80	1.18	10.10	10.88
T5 : Bottle gourd + Bitter gourd pollen	3.99	1.12	10.13	10.92
T6 : Bottle gourd + Ash gourd pollen	4.12	1.37	10.15	10.98
T7 : Bottle gourd + Pointed gourd pollen	4.27	1.23	9.71	10.69
T8 : Control	5.84	1.65	12.03	12.34
SE(m)±	0.13	0.04	0.20	0.14
CD at 5%	0.39	0.13	0.62	0.44
CV (%)	5.27	5.63	3.43	2.19

TSS (° Brix)

The effect of intergeneric pollen on TSS (Total Soluble Solids) was found to be significant (Table 2). Highest TSS (12.03 ° Brix) was observed in control where watermelon pollen was used followed by flowers pollinated with bitter gourd pollen (10.75 ° Brix). Lowest TSS (9.48 ° Brix) was

recorded in fruits pollinated by bottle gourd pollen. The lowest TSS recorded with bottle gourd pollen might be due to metaxenia effect.

Total sugars

The maximum total sugars found in control (12.34 %) and it

was on par with the bitter gourd pollen (11.91 %) Minimum total sugars (10.69 %) was recorded in the treatment where a combination of bottle gourd + pointed gourd pollen was used (Table 2). The maximum total sugars was found in control was due to the sugar distribution was mainly confined to seed area, which generally recorded higher than central portion of both seeded and seedless watermelon.

Based on results obtained, parthenocarpy was induced successfully with bottle gourd pollen. However TSS of the fruit is less compared to control. Among different intergeneric pollen, highest yield was observed when the bottle gourd pollen was used. The rind thickness was less in fruits where mixture of bottle gourd + pointed gourd pollen was used to pollinate the female flowers of watermelon.

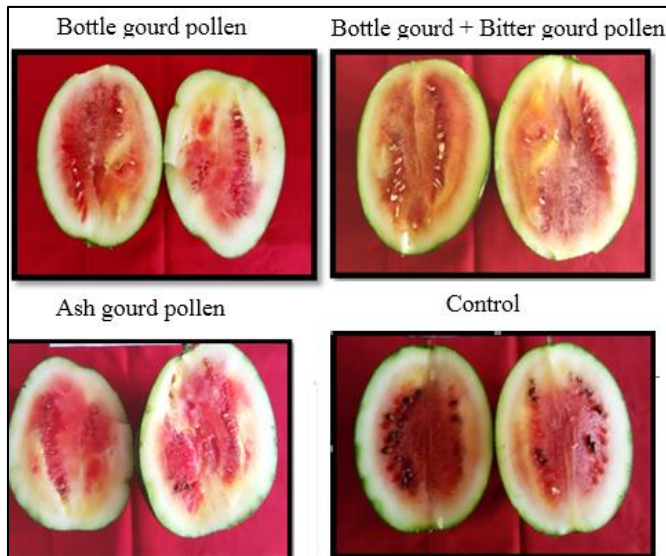


Plate 1: Effect of different intergeneric pollen on induction of parthenocarpy.

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