

Discovery of Watermelon Gynoecious Gene *gy*

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Abstract: Watermelon gynoecious was firstly discovered in 1996. Genetic segregation and χ^2 test have proved that watermelon gynoecious was controlled by recessive gene, so it is named as *gy* gene.

Key words: Watermelon; Gynoecious; Variation

西瓜全雌基因 *gy* 的发现

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摘要: 1996年在西瓜制种田中发现全雌性突变株, 经4年杂交和系统选择, 于2000年培育出西瓜全雌系‘全雌1号’。经世代遗传分离的 χ^2 试验证实全雌性由1对隐性基因控制, 将该基因命名为 *gy*。

关键词: 西瓜; 全雌系; 突变

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It was reported that gynoecious lines were found in cucumber (*Cucumis sativus*), *Cucurbita foetidissima* and ridge gourd (*Luffa acutangula*) from Cucurbitaceae (Esquinas-Acazuz & Gulick, 1983). No gynoecious lines were found in 162 genes of Gene list of watermelon of 2003 Cucurbits Genetics Cooperative Report (Guner & Wehner, 2003). It was the first time that watermelon gynoecious lines and its gene *gy* are reported in present study.

1 Discovery of watermelon (*Citrullus lanatus*) gynoecious individual

The ratio of pistillate and staminate flower of watermelon was 1.5 - 8 in normal condition. The author found the individuals of higher ratio pistillate flower in the watermelon Lijuan 001 in early 1990s. After several generations of self-crossing and selection, strong gynoecious lines with nearly 1.1 of pistillate and staminate flower was obtained. Mutant of gynoecious individual with pistillate flower in each node was found in the field of strong gynoecious lines. It cannot be selfed for germplasm conservation due to no male flower in mutant, so by sib-cross using male flower of sib-plant of the strong gynoecious lines, one ripen fruit with 138 seeds inside was obtained. Eighty-eight out of 138 seeds were sown in the next spring, and no gynoecious individual was found in survived plants, but the ratio of female flower to male flower reached to 1.6:1. Strong gynoecious individuals appeared by continuous self-pollination in progenies of mutants from 1998 to 1999, but they were not conserved because of no male flowers for pollination. In 2000, the male flowers were induced by silver nitrate in mutant gynoecious watermelons generation, and the steady gynoecious lines was obtained and named Gynoecious 1.

Gynoecious 1 watermelon is early-mature with only 70 - 75 days from sowing to fruit maturity. There is only one female flower on each node of the main shoot and no male flower (Fig. 1). The fruit shape is round, average fruit mass is 4 kg. The pericarp is thin and its color is light-green with dark green striation. The sarcocarp is red, crisp, sweet and juicy. Soluble solid content is 12.6%. A little seeds are yellow, and small.

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Fig 1 The gynoecious watermelon

2 Results and analysis

² test of inheritance of gynoecious gene was conducted at Sanya Academy of Agricultural Sciences in Hainan Province from December 2005 to April 2006. The experiment was laid out in a randomized design based on generation type. Each generation type consisted of 50 - 100 individuals (Table 1). Flower sex form of each generation type was recorded during the anthesis of plant

Table 1 Genetic segregation and ² test of gynoecious

Generation	Expectation		Observation		²
	Normal	All gynoecious	Normal	All gynoecious	
P ₁	0	1	0	59	
P ₂	1	0	60	0	
F ₁	1	0	116	0	
F ₂	3	1	86	18	2.8442
BC1.1	1	1	59	43	2.5
BC1.2	1	0	101	0	

$P_{0.05} = 3.84$, $^2 < P_{0.05}$, $P > 0.05$.

Results showed that F₁, derived from the cross of gynoecious line P₁ of Gynoecious 1 with monoecious line P₂ of A1-3, was normal monoecious which is the common sex form (Table 1). The ratio of normal sex form to gynoecious form was 86 : 18 in F₂, and in progeny of backcrosses was 59 : 43. The statistic analysis suggested that difference in the value of observation and the expectation (3 : 1 and 1 : 1) was not significant ($P > 0.05$). It means that the gynoecism in watermelon is controlled by one recessive gene.

Three types of flower (staminate, pistillate and hemaphrodite) in Cucurbitaceae can form 8 combinations (Poole & Grimball, 1939), that are: monoecious, andromonoecious, gynomonoecious, hemaphrodite, trimonoecious, gynoecious, androecious and dioecious. One hemaphrodite muskmelon from Hebei Province in China is a basic germplasm to produce gynoecious muskmelon. In this research, gynoecious watermelon was discovered from a mutant of strong gynoecious individual with the ratio of female to male flower is 1.6 : 1. So the genetic background is quite different in these two gynoecious individuals.

Gynoecious 1 can also be crossed with other normal type of watermelon to obtain the same genetic segregation results as A1-3. The author had transferred the gynoecism to yellow, black, stripe pericarp and integrifolious watermelon, and got several new gynoecious watermelon lines. The author suggests that the recessive gene contained in Gynoecious 1 is named gynoecism, and denoted with *gy*.

The new gynoecious watermelon germplasm has the characteristics of more female flower, so its habit and fruit-setting rate are higher than the normal one. In the meantime, it is an efficient system for hybrid production as it does not need emasculation and manual self-pollination and ensures that most of the seeds harvested are hybrids.

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