Fruit Size in Melon in Monoecious and Andromonoecious Isolines

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Rosa (2), as early as 1928, noted the association of elongate fruit with pistillate flowers and globular fruit with perfect flowers among monoecious and andromonoecious cultivars, in an occasional pistillate fruit in a round-fruited andromonoecious cultivar, and in F_2 populations segregating for monoecious and andromonoecious flowering habits. Later, both Kubicki (1) and Wall (4) made a similar observation that in populations segregating for monoecious (A-) and andromonoecious (aa) flower types, elongate fruit shape was strongly associated with pistillate flowering, either through linkage or pleiotropy. Anecdotal observations by breeders suggest that the "A" allele also increases fruit size, and as a result, the "A" gene for monoecity has been incorporated into several large-fruited eastern cultivars of cantaloupe. The data presented here were obtained because the effect of pistillate versus perfect flower type on fruit size and other morphological traits had not, to my knowledge, been systematically examined in near isogenic progeny segregating for monoecious and andromonoecious flowering.

Methods: The present study employed two breeding lines, NH6414 and NH6888, segregating for monoecious and andromonoecious flowering habits in the F_6 generation. The breeding lines were grown in a melon breeding nursery at the Kingman Research Farm in Madbury, New Hampshire. On 8 June of 2000, 20 transplants of each breeding line were planted into raised beds spaced 1.8 m apart. Beds were covered with 1.25 mil black plastic and supplied with 8 mil drip irrigation tubing (emitter spacing 30 cm). Within-row spacing was 0.3 m. At harvest in August, data were taken on fruit weight, maximum fruit diameter (midpoint between stem and blossom end), fruit length (stem to blossom end), midpoint cavity diameter, and width of blossom scar.

Results and Discussion: Even though sample sizes were small in the fruit comparisons, differences in several fruit morphological traits between fruit derived from either pistillate or perfect flowers were large enough to be statistically significant (Table 1). In segregants from the F_6 population of NH6888, fruit from pistillate flowers averaged 130% larger than those from perfect flowers. Fruit size was larger in the population derived from NH6414, and although the absolute weight difference between ovary types (844 g) was similar to NH6888 (878 g), the percentage increase in size of fruit developed from pistillate as compared to perfect flowers was much smaller (68%). Both fruit length and fruit width were greater in pistillate than in perfect fruit. However, the ratio of fruit length to fruit width in pistillate fruit was higher (1.13 for NH6888 and 1.17 for NH6414) than in perfect fruit (0.91 for NH6888 and 0.89 for NH6414), and the ratios were similar for the two populations.

Observations of breeders suggest that two other traits appear to differ between fruit derived from pistillate or perfect flowers. Diameter of seed cavities and blossom scars appear to be smaller in fruit from pistillate than in fruit developed from perfect flowers. Rosa (1) reported that oblong fruits of melon generally had a higher density than oblate or globular fruit. Scott (3) found a similar association, but the coefficients of correlation were small. Fruit with small or tight seed cavities have greater density than open-cavity fruits, and tight seed cavity is generally considered a desirable trait. Based on visual appearance, cavities appeared to be smaller in pistillate than in perfect fruits. Actual measurements did not reveal significant differences in cavity diameter (Table 1), but flesh was thicker in pistillate than in perfect fruit so the relative proportion of cavity area was smaller. Pistillate fruit have a longer seed cavity than perfect fruit, so overall fruit density may not have differed between the two fruit types. The effect of flower type on fruit blossom scar was likewise not statistically significant, but there was considerable variability in size of blossom scars in fruit derived from perfect flowers. The COVs for blossom scars were 0.15 and 0.28, respectively for pistillate and perfect fruit of NH6888, and 0.12 and 0.22, respectively, for pistillate and perfect fruit NH6414. Blossom scars are always small in fruit derived from pistillate flowers because the base of the hypanthium fused to the ovary is small. In perfect flowers, the size of the hypanthium base, and resulting blossom scar, can vary considerably both within a line, as was the case in this study, and between lines (personal observations, author).

The monoecious gene is therefore useful in a breeding program to achieve greater fruit size and a smaller blossom scar, but may cause fruit to be undesirably elliptical or oblong. Fruit shape in monoecious cultigens can be modified, however, by genes that are epistatic to the elongating effect of pistillate flowers on fruit shape, so it is possible to breed globular fruit in monoecious strains. In addition, the effect of monoecity on fruit shape is incompletely dominant (Wall, 1967; author, unpublished data), so that F_1 hybrids produced from pistillate x perfect flowered lines show reduced elongation as compared to fruit from pistillate x pistillate crosses.

Literature Cited:

1. Kubicki, B. 1962. Inheritance of some characters in muskmelon (*Cucumis melo* L.). Genet. Polon. 3:265-274.
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3. Scott, G.W. 1930. Correlation studies on the fruit of Cucumis melon L. Proc. Amer. Soc. Hort. Sci. 27:333-334.
4. Wall, J.R. 1967. Correlated inheritance of sex expression and fruit shape in *Cucumis*. Euphytica 16:199-208.

Table 1. Morphological traits of fruit harvested from two breeding lines of *Cucumis melo* segregating in the F_6 generation for monoecious (pistillate + staminate) verses andromonoecious (perfect + staminate) flowering pattern. Replications are given in parentheses after flower type.

Breeding line and flower type	Fruit wt. (g)	Avg. fruit length (mm)	Ave. fruit width (mm)	Diameter cavity (mm)	Mesocarp diam. (mm)	Blossom scar diam. (mm)
NH6888						
pistillate (7)	1554	158	140	46	47	19
perfect (5)	676	101	110	47	32	25
$LSD_{0.05}$	**457**	**15**	**16**	**NS**	**7**	**NS**
NH6414						
pistillate (5)	2086	181	155	53	51	21
perfect (5)	1242	126	141	55	43	25
$LSD_{0.05}$	**389**	**13**	**12**	**NS**	**7**	**NS**