

## Same Gene for *Bush Growth Habit* in *Cucurbita pepo* ssp. *pepo* as in *C. pepo* ssp. *ovifera*

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*Cucurbita pepo* L. is highly polymorphic for reproductive as well as vegetative characteristics. Growth habit is among the variable vegetative traits. Many forms have a spreading, viney growth habit, with long, thin internodes. Others have a compact, bushy growth habit with short, thick internodes. Only one locus, designated *Bu*, has heretofore been identified as conferring bush or vine growth habit, with the allele for bushiness, *Bu*, incompletely dominant to the allele for vineness, *bu*. However, as the degree of vineness and bushiness can vary, other loci must exist that modify the expression of *Bu*.

On the basis of fruit shape, edible-fruited *C. pepo* have been considered as eight cultivar-groups: Acorn, Cocozelle, Crookneck, Pumpkin, Scallop, Straightneck, Vegetable Marrow, and Zucchini (4). On the basis of allozyme variation and seed morphology, each of these groups is considered to belong to one of two subspecies: *C. pepo* ssp. *pepo* or *C. pepo* ssp. *ovifera* (1). Cultigens of each of the two subspecies apparently were developed independently and in different regions thousands of years ago (1). Nonetheless, some horticulturally valuable characteristics not present in wild forms but present in cultigens have existed in both subspecies for quite some time. One of these is bush growth habit, a characteristic that facilitates multiple harvesting. Bush growth habit was illustrated in botanical herbals of the 16<sup>th</sup> century in forms of both subspecies (5). It seems possible that bush mutants were selected by indigenous peoples separately in *C. pepo* ssp. *pepo* and *C. pepo* ssp. *ovifera*. Therefore, it appears worthwhile to determine if these bush forms are derived from mutations at separate loci or if the same mutation occurred in the two subspecies.

As bushiness and vineness can vary in degree, it seemed to us imperative to develop two near-isogenic

lines carrying bush growth habit, one carrying the bush gene from *C. pepo* ssp. *pepo* and the other carrying the bush gene from *C. pepo* ssp. *ovifera*. This was accomplished by using 'Fordhook Zucchini' (*C. pepo* ssp. *pepo* Zucchini Group) as one donor parent of bush growth habit (3) and 'Bush Ebony' (*C. pepo* ssp. *ovifera* Acorn Group) as the other. The recurrent parent was the viney 'Vegetable Spaghetti' (*C. pepo* ssp. *pepo* Vegetable Marrow Group). The F<sub>1</sub>s of crossing 'Fordhook Zucchini' and 'Bush Ebony' with 'Vegetable Spaghetti' were semi-bush, thus bush growth habit was incompletely dominant, as previously reported (2). The bush characteristic was introgressed from the donor parents to 'Vegetable Spaghetti' by six generations of backcrossing, selecting for semi-bush growth habit in each generation. This was followed by two to three generations of self-pollination, until true-breeding bush lines were obtained.

The two true-breeding bush lines, 85a-30-45-17 (bush habit from 'Fordhook Zucchini') and 823a-13-20-17 (bush habit from 'Bush Ebony'), did not appear to differ from one another in expression of bush growth habit and were crossed. The F<sub>1</sub> plants were of bush habit that was of no greater or lesser expression than that of the parents. Some F<sub>1</sub> plants were then testcrossed to an inbred, designated VSP-4-10-4, of the viney 'Vegetable Spaghetti', or to a viney near-isogenic line of 'Vegetable Spaghetti' designated 85k-9-107-2 (6). All of the 39 progeny of these testcrosses that were observed had semi-bush growth habit (Table 1). Apparently, the gene for bush growth habit in *C. pepo* ssp. *pepo* 'Fordhook Zucchini' is identical to that in *C. pepo* ssp. *ovifera* 'Bush Ebony'. Had there been two genes for bush habit at separate loci, then one or more viney individuals should have occurred among the 39 plants observed.

Table 1. Parental lines and F<sub>1</sub>s observed for growth habit. Sown 8 March 2000 in flats, transplanted to the field 28 March, observed 17 May.

<u>Line</u>	<u>No. plants</u>	<u>Growth habit</u>
P <sub>1</sub> , VSP-4-10-4	7	Vine
P <sub>2</sub> , 85a-30-45-17	13	Bush, derived from FZU
P <sub>3</sub> , 823a-13-20-17	8	Bush, derived from BEB
P <sub>4</sub> , 85k-9-107-2	8	Vine
1014 (P <sub>2</sub> × P <sub>3</sub> )	8	Bush
1033 (P <sub>2</sub> × P <sub>3</sub> ) × P <sub>1</sub>	16	Semi-bush
1033Ra P <sub>1</sub> × (P <sub>2</sub> × P <sub>3</sub> )	12	Semi-bush
1034 (P <sub>2</sub> × P <sub>3</sub> ) × P <sub>4</sub>	7	Semi-bush
1034Ra P <sub>4</sub> × (P <sub>2</sub> × P <sub>3</sub> )	4	Semi-bush

FZU = Fordhook Zucchini, BEB = Bush Ebony

#### Literature Cited

1. Decker, D.S. 1988. Origin(s), evolution, and systematics of *Cucurbita pepo* (Cucurbitaceae). *Econ. Bot.* 42: 4-15.
2. Denna, D.W. and H.M. Munger. 1963. Morphology of the bush and vine habits and the allelism of the bush genes in *Cucurbita maxima* and *C. pepo* squash. *Proc. Amer. Soc. Hort. Sci.* 82: 370-377.
3. Edelstein, M., H.S. Paris, and H. Nerson. 1989. Dominance of the bush growth habit in spaghetti squash. *Euphytica* 43: 253-257.
4. Paris, H.S. 1986. A proposed subspecific classification for *Cucurbita pepo*. *Phytologia* 61: 133-138.
5. Paris, H.S. 2000. History of the cultivar-groups of *Cucurbita pepo*. *Horticultural Reviews* 25(2001): 71-170, 4 pl. J. Janick, ed. Wiley, New York.
6. Paris, H.S. and H. Nerson. 1986. Genes for intense pigmentation of squash. *J. Hered.* 77: 403-409.

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