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## Clubroot-resistant Broccoli Breeding Lines OSU CR-2 to OSU CR-8

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*Additional index words.* *Brassica oleracea*, *Plasmodiophora brassicae*, vegetable breeding

Broccoli (*Brassica oleracea* L. Italica Group) breeding lines OSU CR-2 to OSU CR-8 were selected and tested for clubroot (*Plasmodiophora brassicae* Wor.) resistance in the field at Corvallis and Tillamook, Oregon. All of the lines have shown resistance to downy mildew [*Peronospora parasitica* (Fr.) Tul.] in the field at Corvallis, and most have useful horticultural characteristics and are potentially useful as parents for  $F_1$  hybrids.

### Origin

Clubroot resistance in OSU CR-2 to OSU CR-8 originally was obtained from line F, a selection from a group of accessions received in 1953, and crossed with 'Northwest Waltham' (NWW). Following a series of backcrosses to NWW, with 2 or more years of progeny testing for resistance in the field between backcrosses, lines OSU CR-2 to OSU CR-5 were selected from the cross B150. 'Oregon CR-1', a cultivar released in 1976 (1) also was derived from cross B150. Crosses of B150 selections x downy mildew resistant line M16 [(P.I. 231210 x NWW) x 'Harvester'] resulted in OSU CR-7. Crosses of B150 selections x H16-1 [a clubroot susceptible line with elongated stem, released as OSU 102 (3)] resulted in OSU CR-6. Following the appearance in the Corvallis test plot of a *P. brassicae* race pathogenic to the OSU broccoli lines but not to OSU cabbage

breeding material, broccoli lines were crossed with C 39, a major parent in the pedigree of cabbage lines Oregon 100, 123, 140, and 142, released in 1981 (2). These cabbage x

broccoli crosses resulted in the selection of OSU CR 8.

After pedigree breeding through the  $F_6$  or  $F_7$  generation, these lines have been maintained by hand self-pollination of bulked single plant selections.

### Description

Partial descriptions of OSU CR-2 to OSU CR-8 are given in Table 1, and plants of lines OSU CR-2, OSU CR-3, OSU CR-6, and OSU CR-8 are shown in Figure 1. OSU CR-3 to OSU CR-5 are similar, with heavy, compact heads and excellent bud type. They tend to produce  $F_1$  hybrids with large, well-formed heads but are late in maturity. OSU CR-7 resembles OSU CR-3 to OSU CR-5 except

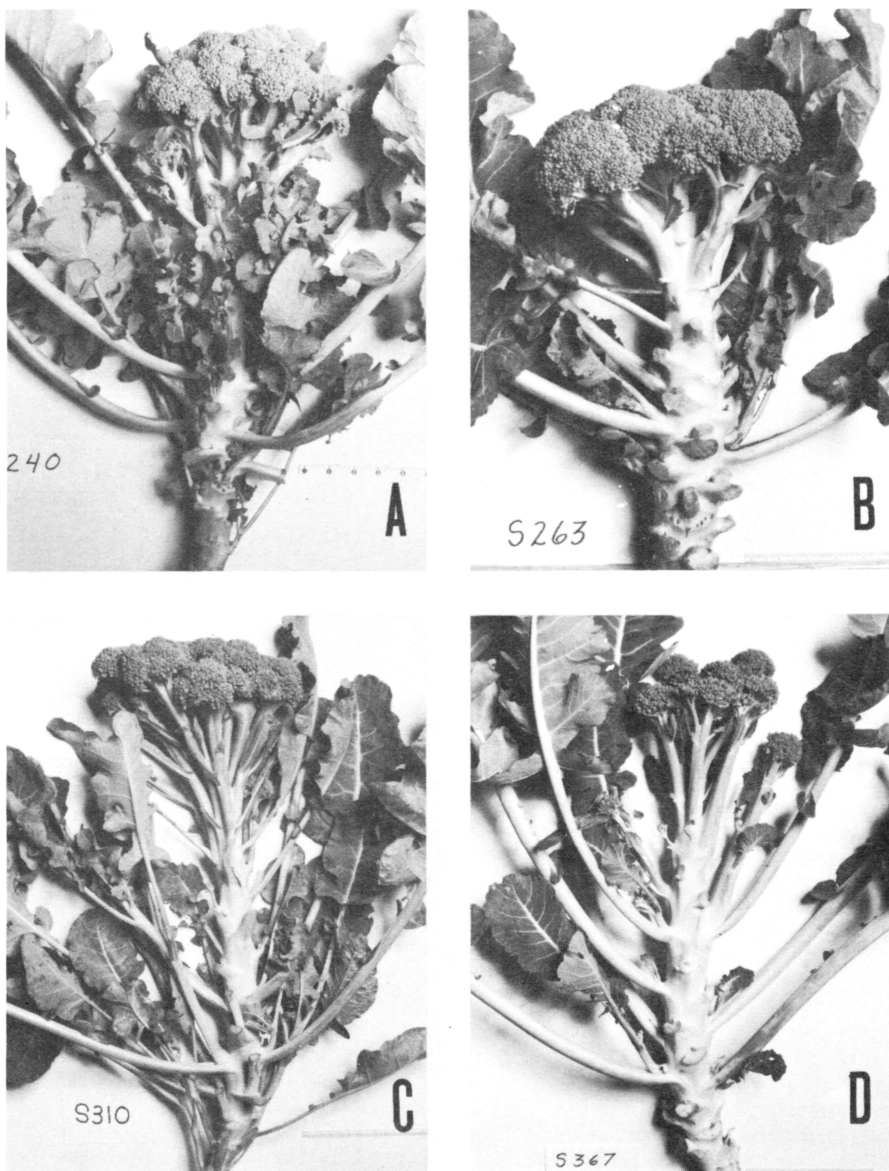


Fig. 1 Mature plants of OSU CR-2 (A), OSU CR-3 (B), OSU CR-6 (C), and OSU CR-8 (D).

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Table 1. Characteristics of clubroot resistant broccoli lines OSU CR-2 to OSU CR-8.<sup>z</sup>

OSU CR line	Days to mature	Head diam. (cm)	Plant ht (cm)	Side shoot production	Self incompatibility <sup>y</sup>
2	87	20	53	Late	High to low
3	97	30	51	Good	High to low
4	104	25	51	Good, late	Slight to none
5	95	30	48	Good, late	Partial (more data needed)
6	88	15	61	Good	High to low
7	84	13	41	Medium, late	Slight
8	109	13	61	Good, late	High to low

<sup>z</sup>Observed in the field in rows 0.9 m apart with plants about 0.4 m apart.

<sup>y</sup>From comparison of hand self-pollinations of open flowers and bud self-pollination in the greenhouse. OSU CR-2 and OSU CR-3 carry incompatibility allele S<sub>2</sub>, OSU CR-5 carries S<sub>39</sub>; S-alleles for remaining lines not determined. High to low indicates segregation for degree of self-incompatibility.

the plant is shorter and the head is smaller and more dome shaped. OSU CR-2 differs from others in having a more segmented, deeply branched head. It tends to produce hybrids with excellent florets and heads with large segments and earlier maturity than hybrids involving OSU CR-3 to OSU CR-5. OSU CR-6 is somewhat branchy at the base, but the head is well above the branches and major leaves. OSU CR-8, the latest maturing line in the group, also has the least desirable horticultural characteristics and was included because it may have a broader range of clubroot resistance. Head exsertion (extension of head above the leaves) is good in OSU CR-2, and fair in OSU CR-3 to OSU CR-8.

These lines will require reselection for uniformity if they are used as F<sub>1</sub> hybrid parents, but most should generally be homozygous because they have been maintained by self-pollination, even though the seed from selfed selections have been bulked.

OSU CR-2 to OSU CR-8 generally are resistant to clubroot in the Pacific Northwest where race 7 (ECD code 16/02/31) of *P. brassicae* predominates and have also shown resistance to race 6 (ECD code 16/02/30) (4, 5, 6). Resistance is similar to that of Oregon CR-1 broccoli (1) and Oregon 100, 123, 140, and 142 cabbage lines (2). However, OSU CR-2 to OSU CR-7 are susceptible to a *P. brassicae* race, present in test plots at Corvallis, Ore., to which the Oregon cabbage lines are resistant. OSU CR-8, which was developed from crosses of the resistant cabbage lines with the broccoli progenitors of OSU CR-2 to OSU CR-7, is resistant in the Corvallis test plots.

All of the lines have excellent resistance to downy mildew in the field, at Corvallis scoring 1 on a scale where 1 = trace to no visible infection and 5 = severe infection with most older leaves covered with spores. Examples of susceptible cultivars in the same test were 'Spartan Early' (score 5), 'Green Duke' (score 4), and 'Mercedes' (score 3).

#### Availability

Small quantities of seed may be obtained by breeders from J.R. Baggett, Dept. of Horticulture, Corvallis, OR 97331. The small supply available does not permit distribution for general testing.

It is requested that credit be given to the Oregon Agricultural Experiment Station if any of these lines are used directly as F<sub>1</sub> hybrid parents, or in the development of inbred lines for F<sub>1</sub> hybrids.

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## 'Benning's Yellow Tint' Summer Squash

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**Additional index words.** *Cucurbita pepo*, scallop squash, patty-pan squash, gene *B*, pleiotropy, vegetable breeding

'Benning's Yellow Tint' is a summer squash (*Cucurbita pepo* L.) of the scallop or patty-pan cultivar group that has uniformly light yellow exterior color and excellent quality.

#### Origin

'Benning's Yellow Tint' originated from a breeding program aimed at transferring gene *B* into a wide spectrum of genetic backgrounds of *C. pepo*. The primary effect of *B* is precocious yellow fruit pigmentation: ovaries are yellow or bicolor (yellow and green) rather than green (*B*<sup>+</sup>*B*<sup>+</sup>) well before anthesis. However, gene *B* can have a variety of secondary effects, some detrimental and others horticulturally beneficial. Which of the secondary effects will be manifested upon transferring *B* into another genetic

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background is, for the most part, unpredictable (3).

'Benning's Yellow Tint' was derived from a cross between 'Benning's Green Tint' (*B*<sup>+</sup>*B*<sup>+</sup>) as the female parent, and Precocious Foodhook Zucchini breeding line (*BB*) (3), as the male. The initial cross was followed by 6 generations of backcrossing to 'Benning's Green Tint', with a plant having yellow ovaries selected for backcrossing in each generation. In the BC<sub>6</sub> generation, such a plant was self-pollinated. A *BB* plant of the BC<sub>6</sub>F<sub>2</sub> generation, recognizable by its completely yellow ovaries and partially yellow peduncles (*B*<sup>+</sup>*B* plants had ovaries which were mostly yellow but green at the polar regions and peduncles which were completely green), was in turn self-pollinated. After 2 additional generations of single plant selection and self-pollination, the progenies were bulked; 'Benning's Yellow Tint' is a bulk population of BC<sub>6</sub>F<sub>5</sub> generation seeds.

#### Description

'Benning's Yellow Tint' closely resembles its recurrent parent, 'Benning's Green Tint'. Plants are bushy, have side branches, a closed growth habit, leaf blades unmottled with silver, and spiny petioles. Maturity is rather late. Fruit are deeply and attractively scalloped. At the prime edible stage (2 to 6

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