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Relationship of Prior Heat Treatment to Growth and Fruiting of 'Thornless Oregon Evergreen' Blackberry[1]

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Additional index words. thermotherapy, *Rubus laciniatus*

Abstract. Propagules of 'Thornless Oregon Evergreen' blackberry (*Rubus laciniatus* Willd.) were obtained from mother plants grown at 37°C for 3 to 8 months. Subsequent field performance indicated that the number of floricanes per plant and the number of fruit per fruiting lateral of these propagules were not influenced by the length of the heat-exposure period. A subclone of this cultivar that has been heat-treated for 245 days and is free of known viruses is being released as 'Thornless Oregon Evergreen-80'.

Heat treatment has been widely used to secure clones of *Rubus* cultivars that are free of known viruses (1, 2, 3, 4, 8, 10). Plants undergoing thermotherapy are often kept for months at a constant 37°C before propagules are taken. This study was conducted to establish whether somatic mutations could be detected after prolonged exposure of *Rubus laciniatus* Willd. cv. Thornless Oregon Evergreen to 37°.

Four mother plants of the 'Thornless Oregon Evergreen-72', a USDA clone found by indexing to be free of known viruses (5), were well established in 19-cm pulp pots in a pasteurized soil mix (3 soil:2 peat:1 perlite) placed with peat moss packing into 23-cm pulp pots. The mother plants were placed in a growth chamber with 16 hr at 10,000 lux daily from a combination of incandescent and fluorscent lights. In the growth chamber pots were kept well watered only with ¼ x Hoagland's solution. The temperature in the growth chamber was raised from ambient to 37° over a period of 14 days. One-to-2 node shoots from new growth were removed from each mother plant at about monthly intervals (from 3 to 8 months) to be used as cuttings. In each case an average of 5 plants (range, 1 to 11) were rooted under intermittent mist in the greenhouse. Subclones were grown, and one set of plants from each propagule was kept in the screenhouse, while the second set was planted in the field at Oregon State University in October 1977.

Propagules from a given original mother plant were planted at random in the row (3.3 x 1.5 m spacing). The plants were given standard horticultural care and were trained onto two wires for the 1979 fruiting season. Vigor and fruitfulness were evaluated during the 1979 growth season by inspection, by measuring the number of floricanes that were 15 cm or less from ground level, and by counting the number of red or ripe fruits at one time on six randomly selected major fruiting laterals per plant.

No significant differences between mother plant lines were found in number of floricanes per plant or in number of fruit per lateral. The number of floricanes per plant (Table 1) did not vary significantly during the heat treatment. The coefficients for the linear regression of floricane numbers on days at 37°C for each of the 4 original mother plants were: b = 0.0009, 0.0210, —0.0280, and —0.0129 (none significant); and, for data from all 103 propagules pooled, b = —0.0003 (not significant). The extrapolated number of floricanes per plant for propagules taken on day 0 (before heat treatment) was 6.1; the average number on day 245 was 6.3.

The number of fruits per fruiting lateral (Table 1) likewise did not vary significantly with treatment duration. For these data, b values for the regression of fruit counts on time at 37°C for each of the 4 mother plants were b = —0.0006, 0.0044, 0.0034, and —0.0239 (none significant), and for all data pooled, b = —0.0020 (not significant). The extrapolated number of fruits per lateral for propagules taken on day 0 (before heat treatment) was 21; the average number on day 245 was 20.

During the 1979 fruiting season 14 'Thornless Oregon Evergreen' clones were selected in the test plots as being unusually vigorous and fruitful. They were equally representative of all 4 original mother plants and were drawn in about equal numbers from propagules taken from the heat chamber at 122, 157, 214, and 245 days.

Exposure to high temperature has been found to increase the incidence of visible somatic mutations in several plant species (6, 7).

Thermotherapy for virus elimination was thought to have caused somatic mutations in potato tubers (9, 11) but these results were interpreted by later workers (8) as effects of virus reinfection. No data have been obtained on the possible effects of prolonged high-temperature growth on the spontaneous mutation rate of vegetatively propagated crop plants.

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Table 1. Number of floricanes per plant and number of fruit per floricane lateral August 1979 for 'Thornless Oregon Evergreen' plants propagated from cuttings taken from 4 mother plants exposed for various periods to constant 37°C growing conditions and planted in test plots October 1977.

Mother plant no.	No. floricanes/plant from propagules, Days at 37°C						No. fruit/floricane lateral from propagules, Days at 37°C					
	92	122	157	183	214	245	92	122	157	183	214	245
1	5	6	6	5	5	6	20	19	21	22	19	19
2	3	7	6	7	6	8	10	20	21	22	20	20
3	10	–	6	4	7	4	21	–	20	18	22	21
4	4	6	6	7	5	7	25	22	20	22	20	20
Avg	6	6	6	6	6	6	21	21	20	21	20	20

No obvious somatic mutations were observed in the 103 'Thornless Oregon Evergreen' propagules examined in this study. If genetic changes were induced during the elevated temperature treatment, they were not detected in subsequent measurements of growth and fruitfulness. The slopes of the regressions of these measurements on time at 37°C did not differ significantly from zero.

The 'Thornless Oregon Evergreen-72' clone used in this experiment was free of known viruses and viruslike diseases when the thermotherapy work was begun. However, a new, fruitful, vigorous subclone developed from a 'Thornless Oregon Evergreen-72' plant that was kept for 245 days at 37°C is being increased for release by the USDA Science and Education Administration, Agricultural Research, as 'Thornless Oregon Evergreen-80'. The prolonged thermotherapy of 'Thornless Oregon-80' improves its chances of being free of viruses or viruslike pathogenic agents that may be present but undetected in previous stocks.

Heat treatment followed by tissue culture propagation of apical tips is one of the most effective general methods for eliminating viruses and viruslike agents from vegetatively propagated plants (8). It is now the policy of USDA SEA-AR, whenever possible, to develop, test, and release heat-treated, apical tip-cultured lines of the major U.S. small fruit cultivars and USDA selections (5). 'Thornless Oregon Evergreen-80' is currently being released as a subclone propagated from a small heat-treated shoot tip even though it does not differ horticulturally or pathologically, as far as we can detect, from the previous standard clone, 'Thornless Oregon Evergreen-72,' which was selected directly from the field. We expect to replace 'Thornless Oregon Evergreen-80' with a heat-treated, apical-tip-cultured clone when the latter is developed.

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Stunt Disease in Rabbiteye Blueberry[1]

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Abstract. **Tissue of 'Garden Blue' rabbiteye blueberry (*Vaccinium ashei* Reade) were collected from field-grown plants with typical symptoms of stunt disease in North Carolina. Electron microscopy examination revealed bodies having mycoplasmalike characteristics in the phloem sieve elements indicating that this species can be naturally infected with the stunt disease organism.**

Blueberry stunt disease occurs in blueberries from North Carolina to eastern Canada, westward into Michigan, and now appears to be present southwestward into Arkansas (2, 3). The disease affects both cultivated and wild *Vaccinium* spp. but is economically most important on cultivated highbush blueberry *(V. corymbosum L.)*. Stunt was for many years thought to be caused by a virus (8), but is now considered to be of mycoplasmal etiology (1, 2, 4). The organism is transmitted by the sharp-nosed leafhopper, *Scaphytopius magdalensis* (Prov.) (6).

Plants affected by stunt exhibit a yellowing of leaf margins and between lateral veins, with midribs and lateral veins retaining normal green coloration. Leaves are often cupped and reduced in size, and interveinal areas prematurely assume the normal red fall coloration. Diseased plants are restricted in size, have shortened internodes, and develop abnormal growth from normally latent buds. Both fruit set and berry size are reduced.

Highbush blueberry cultivars vary in susceptibility to stunt, with none reported to be immune (3). The rabbiteye blueberry (*V. ashei* Reade), adapted to and commercially grown in southern states, has not been reported to be affected by the stunt disease in nature. Hoffman (5) reported that rabbiteye blueberries 'Garden Blue' and 'Homebell' were experimentlly infected with stunt when grafted with buds from stunt-infected highbush plants. Stunt symptoms in 'Garden Blue' in the later stages of disease development were characterized by a slight reduction in leaf size and internode length and marginal chlorosis, but no leaf cupping.

There is increased interest in growing rabbiteye blueberry in southern states. There have been few diseases reported on this species (7). This investigation was

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