Hazelnut Pollenizers ‘Gamma’, ‘Delta’, ‘Epsilon’, and ‘Zeta’

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‘Gamma’, ‘Delta’, ‘Epsilon’ and ‘Zeta’ are four new hazelnut (*Corylus avellana* L.) pollenizer cultivars. They were released by the Oregon Agricultural Experiment Station in February 2002. They shed pollen at different times during the flowering season, spanning the time that female inflorescences of most cultivars are receptive. They have complete resistance to eastern filbert blight caused by *Anisogramma anomala* (Peck) E. Müller. ‘Gamma’ and ‘Delta’ carry resistance from ‘Gasaway’, while ‘Epsilon’ and ‘Zeta’ carry resistance from ‘Zimmerman’. The traditional pollenizers ‘Daviana’ and ‘Butler’, and four selections (VR4-31, VR11-27, VR20-11, and VR23-18) previously released as pollenizers for ‘Barcelona’, express incompatibility allele S_3 in their pollen (Mehlenbacher and Thompson, 1991). Although compatible on ‘Barcelona’ females ($S_1 S_2$), their pollen is incompatible on females of recently released ‘Lewis’ and ‘Clark’ (both $S_3 S_8$) (Mehlenbacher et al., 2000, 2001). ‘Gamma’, ‘Delta’, ‘Epsilon’, and ‘Zeta’ provide growers with additional pollenizer options for recently released and standard cultivars.

Origins

The four pollenizers resulted from controlled crosses made by S.A. Mehlenbacher and D.C. Smith (Fig. 1). ‘Gamma’, tested as OSU 589.028, resulted from a cross of ‘Casina’ x VR 6-28 made in 1991. ‘Delta’, tested as OSU 510.041, resulted from a cross of OSU 249.159 x VR 17-15 made in 1989. ‘Epsilon’, tested as OSU 669.073, resulted from a cross of OSU 350.089 x ‘Zimmerman’ made in 1992. ‘Zeta’, tested as OSU 670.095, resulted from a cross of OSU 342.019 x ‘Zimmerman’ made in 1992. Hybrid seeds were harvested in August, stratified, and planted in flats in the greenhouse as they germinated. The resulting seedlings were grown in 3.8-L pots in the greenhouse during the summer and then moved outdoors to harden before planting in the field in October. Nuts of the pollenizers were harvested and evaluated for four years, when the seedlings were 5 to 8 years old, as described

by Mehlenbacher et al. (1993). Nuts of four cultivars were harvested and evaluated from a replicated trial in a nearby orchard planted in 1995 at the Smith Horticulture Research Farm in Corvallis for comparison. Susceptibility to bud mites (primarily *Phytoptus avellanae* Nal.) was rated in December 1999 on a scale of 1 (no blasted buds) to 5 (highly susceptible). Incompatibility alleles were identified by fluorescence microscopy as described by Mehlenbacher (1997b). The number of catkins, time of pollen shed, and time of female receptivity were rated during mid-winter for three winters (December 1998 to March 2001). Pollen was collected from each of the four pollenizers to assess quantity and used in controlled pollinations to verify viability. The names of the pollenizers are letters of the Greek alphabet, and subsequent pollenizers will be similarly designated. The first two letters had already been used, ‘Alpha’ for an obsolete grower selection in Oregon, and ‘Beta’ for several selections in southern Russia.

‘Gamma’ has incompatibility alleles S_2 and S_{10} , but only S_{10} is expressed in the pollen because of dominance (Mehlenbacher, 1997a). The trees set many catkins, and pollen is shed in midseason, at about the same time as ‘Daviana’. The pollen-shedding period is short, and thus ‘Gamma’ should not be the sole pollenizer in an orchard. It is a suitable pollenizer for ‘Lewis’ ($S_3 S_8$) and ‘Barcelona’ ($S_1 S_2$), but sheds pollen too early for ‘Clark’ ($S_3 S_8$) and ‘Ennis’ ($S_1 S_{11}$). It is incompatible on its parent ‘Casina’ ($S_{10} S_{21}$). Nuts and kernels resemble those of ‘Casina’ but are slightly larger (Table 1). Nut maturity is a few days before ‘Barcelona’, and about 80% of the nuts fall free of the husk at maturity. The frequency of moldy kernels is very low. The original seedling tree was vigorous and moderately productive. Bud mite ratings are intermediate.

‘Delta’ has incompatibility alleles S_1 and S_{15} ; both are expressed in the pollen. The trees set many catkins, and shed copious amounts of pollen in late midseason with ‘Hall’s Giant’. It is a suitable pollenizer for ‘Lewis’ and for early-emerging females of ‘Clark’, but is incompatible on ‘Barcelona’, ‘Ennis’ ($S_1 S_{11}$), and ‘Willamette’ ($S_1 S_3$). The nuts are slightly larger than those of ‘Casina’ (Table 1) and mature a few days later than ‘Barcelona’. About 85% of the nuts fall free of the husk at maturity, while a few remain attached to the husk at the edge of the basal scar. The original seedling tree was

Fig. 1. Pedigrees of four OSU pollenizer selections.

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Table 1. Frequency of good nuts, and of nut and kernel defects in four pollenizer and four standard hazelnut cultivars.

Cultivar	Years ²	Nut wt (g)	Percent kernel ³	Fiber ⁴	Pellicle removal ⁵	Bud mite ⁶	Avg frequency (%)							
							Good	Blanks	Brown stain	Poor fill	Shriveled kernels	Moldy kernels	Black tips	Twin kernels
Gamma	1996–99	2.5	52	2.8	7.0	3.1	78.8	9.5	2.0	7.8	1.0	1.3	0.0	0.0
Delta	1994–97	2.4	49	1.9	5.1	1.3	77.0	9.8	1.0	7.3	0.8	3.5	0.5	0.5
Epsilon	1997–2000	2.6	52	3.0	6.9	1.0	79.5	4.8	2.0	4.8	0.8	7.5	0.0	1.0
Zeta	1997–2000	2.5	50	1.9	4.9	2.5	76.0	11.5	1.5	6.8	0.5	0.5	0.5	2.8
Barcelona	1997–2000	3.8	43	2.8	4.3	1.0	60.1	11.9	1.5	19.0	0.9	2.8	0.2	3.2
Casina	1997–2000	2.1	54	2.8	5.5	2.2	75.2	7.4	0.6	13.8	1.3	0.8	0.8	0.1
Clark	1997–2000	2.5	51	2.7	2.6	2.7	82.0	4.9	1.8	6.9	0.5	3.0	0.6	0.3
Lewis	1997–2000	3.0	45	1.6	3.9	1.6	77.0	5.4	0.1	7.3	0.7	8.4	0.9	1.1
LSD (0.05)		0.4	2.1	0.8	0.8	0.6	11.3	7.5	1.9	9.3	2.1	2.9	1.5	1.5

²Evaluation data for pollenizers is from first four crops on original seedlings. Evaluation data for cultivars is from a trial planted in Spring 1995 with five single-tree replications. LSD values were calculated from data for these four cultivars in this trial. All trees were evaluated at the Smith Horticulture Research Farm in Corvallis, Ore.

³Percent kernel = kernel weight/nut weight.

⁴Fiber on the kernel pellicle rated from 1 (none) to 4 (heavy).

⁵Pellicle removal after roasting at 150 °C for 15 min was rated from 1 (all removed) to 7 (none removed).

⁶Bud mite susceptibility rated in Dec. 1999 from 1 (no blasted buds) to 5 (many blasted buds).

moderately vigorous, moderately productive, and resistant to bud mites.

‘Epsilon’ has incompatibility alleles S_1 and S_4 , but only S_1 is expressed in the pollen. The trees set many catkins that shed copious amounts of pollen late in the season, after ‘Hall’s Giant’. It is a suitable pollinizer for ‘Clark’ and ‘Casina’ ($S_{10}S_{21}$), but is incompatible on ‘Barcelona’ and ‘Ennis’. The nuts are slightly larger than those of ‘Clark’ (Table 1) and mature a few days before ‘Barcelona’. About 80% of the nuts fall free of the husk at maturity. The original tree was moderately vigorous, moderately productive, and highly resistant to bud mites. The frequency of moldy kernels has averaged about 8%, which is excessive for a main crop cultivar, but should not pose a problem for a pollenizer.

‘Zeta’ is homozygous for incompatibility allele S_1 . The trees set a moderate number of catkins that shed pollen late in the season, after ‘Hall’s Giant’. It is a suitable pollinizer for ‘Clark’ and ‘Casina’, but is incompatible on ‘Barcelona’ and ‘Ennis’. The nuts are similar in size to those of ‘Clark’ (Table 1), mature a few days before ‘Barcelona’, and kernel quality is high. About 85% of the nuts fall free of the husk at maturity. The original tree was vigorous, moderately productive, and moderately resistant to bud mites.

Nut yield and quality are not primary concerns in the selection of pollenizers. In older ‘Barcelona’ orchards, ‘Daviana’ was the sole pollenizer, representing about 11% of the total number of trees. In recent years, the frequency of pollenizers is commonly only 5.5%. The planting of three pollenizers that shed pollen at different times during the flowering season is recommended, as this increases the likelihood that females of the main cultivar will be pollinated.

All four pollenizers are completely resistant to eastern filbert blight caused by *Anisogramma anomala* (Peck) E. Müller based on greenhouse inoculation and ELISA, as described by Coyne et al. (1996). All four pollenizers carry the 800 base pair RAPD marker produced by primer UBC152 that is linked to the dominant resistance gene in ‘Gasaway’ (Davis and Mehlenbacher, 1997). ‘Zimmerman’, the male parent of ‘Epsilon’ and ‘Zeta’, is completely resistant to eastern filbert blight and is believed to be a seedling of ‘Gasaway’.

Availability

The four pollenizers were released as public varieties and may be propagated without restriction. A list of nurseries may be obtained from S.A. Mehlenbacher. Small quantities of

scion wood may be obtained from the senior author.

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