Fruit Varieties Journal 49(4):239-241 1995

Occurrence of Viable Eggs in Haploid Peach

M. R. Pooler[1] and R. Scorza

Abstract

Haploid peach trees (*Prunus persica* Batsch, 1X = 1n = 8) were evaluated for the presence of unreduced eggs as indicated by the production of normal fruit with viable seed following open pollination. Two of seven haploid genotypes produced unreduced eggs: 'PAla1-1N' and 'PRRL1-1N' produced normal fruit from 0.44% and 0.35% of the flowers studied, respectively. Unreduced pollen was also observed in haploid trees and occurred in all anthers sampled.

Unreduced gametes, both egg and pollen, have been reported in a large number of diverse crops and have proven useful for introgression of germplasm and for cytological and genetic studies (e.g., 1, 4, 5, 6). Although unreduced pollen has also been recognized in peach as "giant pollen" (2, 7), unreduced eggs in peach have not been reported. Using haploid material, we observed both unreduced eggs and pollen in peach trees.

Materials and Methods

Haploid trees isolated originally as twin seedlings, and their colchicine-derived doubled haploid counterparts were provided by Toyama (8) and have been growing on 'Bailey' rootstock at the Appalachian Fruit Research Station in Kearneysville, West Virginia since 1985. The haploids are characterized by less vigorous growth, narrower and lighter green leaves, and shorter internodes than their doubled haploid counterparts. The haploid flowers are small and shed very little pollen. Fruit of the haploids are usually smaller than two centimeters in diameter and contain a small seedless pit (personal observation).

In the spring of 1993, flowers were counted from one large marked branch of each of seven haploid trees (Table 1). Anthers collected from these trees and from the corresponding doubled haploids were stained with acetocarmine and examined under a light microscope. In the spring of 1995, pollen from the cultivars listed in Table 2 was collected, germinated in 15% sucrose liquid medium, stained with acetocarmine, and pollen diameter was measured using a light microscope.

Results and Discussion

A series of haploid peach plants is ideal material for searching for unreduced gametes, as only unreduced gametes containing the full chromosome complement will be viable. Previous studies of peach pollen have suggested the presence of 2n gametes by the incidence of "giant pollen" from diploid trees (2, 7) and by the incidence of viable 1n pollen from haploid trees (3). Consistent with these reports, we observed in the haploid anthers viable, presumable 1n pollen, which was recognized as plump, stainable grains (Figure 1). The diameter of the stainable pollen grains from haploid trees was equal to the diameter of pollen from the corresponding doubled haploids and to a standard diploid 'Bounty' (Table 2).

Estimates of the frequency of unreduced pollen production in haploid trees is not possible due to preferential development and shedding of 1n viable pollen over nonviable pollen. It can be noted, however, that stainable pollen was observed in every haploid anther examined.

Most of the haploid trees examined produced the typical small seedless

[1]USDA-ARS Appalachian Fruit Research Station, 45 Wiltshire Road, Kearneysville, WV 25430. Present address: USDA-ARS Fruit Lab, Bldg. 004, Beltsville Agricultural Research Center, Beltsville, MD 20705.

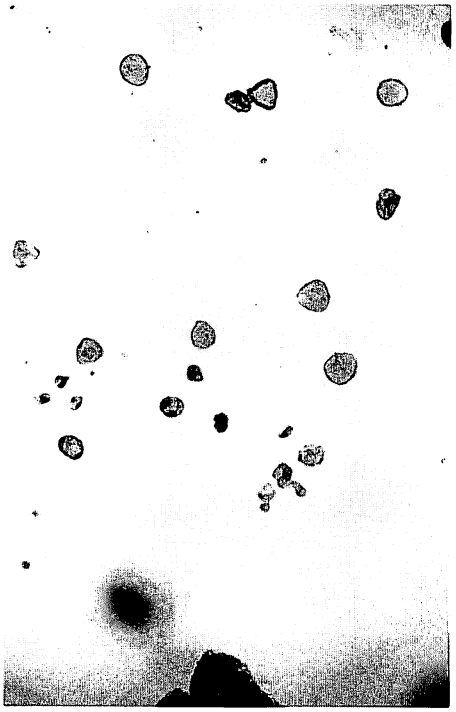

Figure 1. Unreduced pollen from haploid selection 'PRRL1-1N' germinating on 15% sucrose medium.

fruit previously described. However, two haploid trees, 'PAla1-1N,' isolated from the cultivar Alamar, and 'PRRL1-1N,' isolated from 'Rutgers Red Leaf' (8), produced large fruit which was easily distinguished from the typical small fruit on the tree. Seed from this fruit germinated in the greenhouse after three months of stratification and produced normal seedlings. The majority of the harvested seed was characterized by a split seed coat, presumably due to the inability of the maternally-derived haploid seed coat to accommodate the larger, diploid cotyledons of the seed. The incidence of unreduced egg formation was one in 225 flowers (0.44%) in 'PAla1-1N,' and 10 in 2880 flowers (0.35%) in 'PRRL1-1N' (Table 1).

There are several possible mechanisms for viable gamete production in peach. Parallel spindle formation during meiosis resulting in a second division restitution has been suggested by Hesse (3). Alternatively the eight chromosomes in a haploid meiocyte may migrate to the same pole by chance during meiosis I, resulting in viable gametes. Interestingly, the probability of such an event occurring $[(1/2)^8 = 0.39\%]$ is similar to the frequency of unreduced eggs observed in our study. Finally it is possible that viable, gametes and resulting seedlings are functional aneuploids. Although cytological evaluation of the seedlings was not performed, such a mechanism is unlikely based on the normal phenotype of the seedlings.

Our observations of haploid trees indicate that unreduced egg cells occur

Table 1. Origin of haploids and incidence of viable egg production from haploid peach.

Original open polinated peach parent	Haploid	Number of flowers counted	Number or seeds collected	Percent of unreduced eggs
Alamar	PAla1-1N	225	1	0.44
Elberta	PElb7-1N	537	0	0
Loring	PLor1-1N	181	0	0
Lovel	PLov1-1N	850	0	0
Rutgers Red Leaf	PRRL1-1N	2880	10	0.35
Sunhigh	PSun2-1N	492	0	0
Vineland 37016	PVin1-1N	636	0	0

Table 2. Mean diameter of unreduced pollen from haploids and normal pollen from diploids. ANOVA indicated no differences among means of all five cultivars.

Cultivar	Ploidy	Mean pollen diameter (mm)	Standard deviation
Bounty	2n	0.53	.004
PAla1-1N	1n	0.51	.004
PAla1-2N	2n	0.51	.008
PRRL1-1N	1n	0.53	.004
PRRL1-2N	2n	0.52	.004

in some genotypes, and unreduced pollen is common. Unreduced pollen could provide a means to use haploids directly as parents. Our results also suggest that while unreduced eggs may provide a mechanism for triploid production from diploid parents, unreduced pollen is the more likely natural mechanism due to the large number of pollen grains produced per tree versus egg cells.

Literature Cited

1. Chyi, T. S. and N. F. Weeden. 1984. Relative isoenzyme band intensities permit the identification of the 2n gamete parent of triploid apple cultivars. HortScience 19:818-819.
2. Dermen, H. 1938. Detection of polyploidy by pollen grain size: investigations with peaches and apricots. Proc. Amer. Soc. Hort. Sci. 35:96-103.
3. Hesse, C. O. 1971. Monoploid peaches, *Prunus persica* Batsch: Description and meiotic analysis. J. Amer. Soc. Hort. Sci. 96: 326-330.
4. Heyn, F. W. 1977. Analysis of unreduced gametes in the Brassiceae by crosses between species and ploidy levels. Z. Pflanzenzeucht 78:13-30.
5. Nijs, T. P. M. den and S. J. Peloquin. 1977. 2n gametes in potato species and their function in sexual polyploidization. Euphytica 26:585-600.
6. Ortiz, R. and N. Vorsa, L. P. Bruederle, T. Laverty. Occurrence of unreduced pollen in diploid blueberry species, *Vaccinium* sect. Cyanococcus. Theor. Appl. Genet. 85:55-60.
7. Pratassenja, G. D. and E. M. Trubitzana. 1938. Production of polyploid plants: A triploid *Prunus persica*. Comp. Rend. Acad. (Doklady) URSS 19:531-533.
8. Toyama, T. K. 1974. Haploidy in peach. HortScience 9:187-188.

Note on Interstate Restrictions of Ribes

Some states continue to restrict interstate movement of domestic *Ribes* plant germplasm. As of January 1995, Michigan, New Hampshire, North Carolina, Pennsylvania, Rhode Island, South Carolina, and Vermont prohibit any *Ribes* species from entering. Ten other states, Delaware, Maine, Massachusetts, Montana, New Jersey, New York, Ohio, Tennessee, Virginia and West Virginia, have either a regional restriction, i.e., by counties or townships, or restrict certain species from entering. Thirty-three states have no specific restriction on *Ribes* plants. Several states, including Michigan, Montana, Pennsylvania and Vermont, may review their *Ribes* restriction for possible repeal. New Mexico and Nevada are reviewing the possibility of instituting a restriction because of the severe infestation of white pine blister rust, *Cronartium ribicola* Fisher, in native *Ribes*. We at the Corvallis Repository have compiled a summary of *Ribes* regulations from each state. For a copy of this report please contact Kim E. Hummer, Research Leader/Curator, or Bruce Bartlett, Agricultural Science Research Technician, USDA-ARS National Clonal Germplasm Repository, 33447 Peoria Road, Corvallis, OR 97333.