Table 1. Resistance scores and numbers of twospotted spider mite on clones of *Fragaria chiloensis* and actual number of mites on *F.* × *ananassa* 'Totem' in 1982.

Clone	Dates					Total no. of mites[z]
	22 Apr.	5 May	20 May	7 June	Total	
F. chiloensis			*Resistance scores*[y]			
BSP-14	0	0	0	0	0	6
LCM-19	0	0	0	0	0	82
RCP-37	1	0	0	0	1	69+
LPB2-14	1	0	0	1	1	110+
CA-12	1	0	0	0	1	109+
DL-40	1	0	0	0	1	112+
PSG-51	1	0	0	0	1	116+
RCP-19	1	0	0	0	1	123+
TDM-8	1	0	0	0	1	157+
LCM-10	2	0	0	0	2	102+
LPB2-1	2	0	0	0	2	106+
PSB-51	1	1	0	0	2	110+
YSP-2	1	1	0	0	2	119+
YSP-15	0	2	0	0	2	135+
TR-4	1	1	0	0	2	144+
BSP-3	0	3	0	0	3	123+
WL-8	1	1	0	1	3	124+
KBT6-2	3	0	0	0	3	130+
YSP-14	1	2	0	0	3	163+
KBT3-8	1	1	0	2	4	153+
YSP-4	4	0	0	0	4	166+
YB-7	3	1	0	0	4	201+
YSP-7	2	3	0	0	5	221+
DL-20	6	0	0	0	6	176+
DL-39	4	2	0	0	6	194+
YSP-18	4	3	0	0	7	197+
YSP-9	1	4	1	1	7	257+
YSP-24	5	4	0	0	9	242+
Del Norte	5	4	0	1	10	252+
PSG-43	6	4	0	3	13	265+
F. x ananassa 'Totem'[x]	110.2	73.2	79.8	28.7		1751

[z]Total mites counted on 3 leaflets from 6 plants on 4 dates. Since populations above 25% of those on 'Totem' were not determined, the highest possible determined population on *F. chiloensis* would have been 432+. The '+' indicates that more mites were present but the total was not counted.
[y]On each date, one point was scored for each of the 6 plants of a clone that had a mite population greater than 25% of that on 'Totem'. Highest possible score for all 4 dates was 24.
[x]Mean number of mites/3 leaflets/plant.

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HortScience 19(5): 641–642 1984.

Inheritance of Size Relationship of Primary and Secondary Berries of Strawberry

P.J. Pelofske
North Willamette Experiment Station, Oregon State University, 15210 NE Miley Rd., Aurora, OR 97002

F.J. Lawrence
Agricultural Research Service, U.S. Department of Agriculture, Department of Horticulture, Oregon State University, Corvallis, OR 97331

Additional index words. *Fragaria*, fruit breeding

Abstract. **A wide range in ratio of the size of primary vs. secondary (P/S) berries was found in 17 cultivars and selections of strawberry (*Fragaria* ×*ananassa* Duch.) Populations from 6 crosses of parents with low, intermediate, and high P/S indicated quantitative inheritance for P/S ratios. Some seedlings exceeded the upper and lower bounds of the range of either parent.**

Large berry size is important in commercial strawberry production for hand harvest and certain processed products, i.e., individually quick frozen berries. The primary fruit usually is the largest, because fruit size declines in the inflorescence dichasium (1, 2). Yet, uniform fruit size facilitates mechanical harvest and improves pack appearance. The weights of a single primary, 2 secondaries, and 4 tertiaries were reported as sufficiently equal that the combined weight of a primary and 2 secondaries could be used in the selection of large fruited strawberry selections (7). In a study of fruit size inheritance, Sherman et al. (8) found specific combining ability to be more important than general combining ability in large fruited cultivars.

Powers (5) and Spangelo et al. (9) studied the inheritance of a number of fruit characters, including size (weight), but did not report the inheritance of size uniformity. Moore (4) noted the importance of both large berries and maintenance of size in later harvests. He found that cultivars with large primaries tended to have a greater decline in fruit size

Table 1. Primary/secondary fruit size ratios of 6 strawberry cultivars and 11 ORUS selections.

Cultivar or selection	P/S[z] ratio	Fruit size ($P+S_1+S_2$)
ORUS 4695	2.32	50.4
ORUS 4612	1.90	27.6
Olympus	1.82	48.2
Totem	1.79	60.4
ORUS 4867	1.71	28.9
Tyee	1.67	43.2
Hood	1.66	55.9
ORUS 4816	1.63	43.2
Linn	1.63	40.8
ORUS 4600	1.61	32.5
ORUS 4441	1.58	43.0
ORUS 6050	1.55	30.4
ORUS 4930	1.54	37.9
ORUS 4445	1.51	38.0
ORUS 6058	1.50	31.7
ORUS 4459	1.50	46.8
Benton	1.37	48.6

[z]P = primary fruit weight; S = secondary fruit weight.

Received for publication 5 Mar. 1984. Oregon Agr. Expt. Sta. Technical Paper No. 7100. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

Table 2. Primary/secondary fruit ratios (P/S) for parents, midparent and progeny mean of 6 strawberry crosses and the frequency distribution in percentage and sample size of the progeny.

Cross	P/S ratios				Frequency distribution (%)							
	Seed parent	Pollen parent	Mid-parent	Progeny mean	0.90–1.29	1.30–1.69	1.70–2.09	2.10–2.49	2.50–2.89	2.90–3.29	3.30–3.69	No. plants
ORUS4695 x Benton	2.32	1.37	1.84	1.75	0	53	36	7	2	0	2	44
ORUS6050 x ORUS4867	1.55	1.71	1.63	1.55	14	56	28	2	0	0	0	50
Benton x Tyee	1.37	1.67	1.52	1.56	24	57	4	11	2	0	2	46
ORUS6050 x Benton	1.55	1.37	1.46	1.48	30	44	24	2	0	0	0	50
ORUS4930 x Benton	1.54	1.37	1.46	1.62	14	50	26	8	2	0	0	50
ORUS6058 x Benton	1.50	1.37	1.44	1.55	28	42	18	10	2	0	0	50

through successive harvests. Hansche et al. (3) determined that fruit size was heritable and that selection for high yield should result in increased fruit size. Scott and Lawrence (6) summarized much of the breeding progress in the strawberry but did not mention uniformity of size or the relationship of the size of primary and secondary fruits. The objective of this investigation was to study the inheritance of the size ratio of primary to secondary strawberry fruits.

P/S ratios for a number of breeding selections and commercial cultivars were determined by marking 10 plants per cultivar at random in the field. Four cymes per plant were tagged and a primary and 2 secondary fruit per cyme were harvested when ripe. As the fruit ripened over a period of time, successive harvests were necessary.

Immediately after harvest, caps were removed and berries were weighed. The P/S for each cyme was determined by dividing the weight of the primary fruit by the mean of the weight of the 2 secondary fruits. The P/S obtained ranged from 1.37 to 2.32 with a mean of 1.66 (Table 1). A low P/S ratio infers improved uniformity of fruit size. Ratios of 1.50 or less were classified as low, 1.51 to 1.89 intermediate, and 1.90 or greater as high. Of the cultivars tested, 'Benton' had the lowest P/S ratio and 'Olympus' the highest, agreeing with harvest observations that 'Olympus' fruit size decreased more rapidly than 'Benton' fruit size. A P/S range from 1.18 to 2.50, with a mean of 1.64, was calculated from the data of Sherman and Janick (7), but no cultivars or selections were common to our study.

The weight of the primary fruit plus the sum of the 2 secondaries ($P+S_1+S_2$) was used to estimate fruit size. To determine if mean berry size and P/S ratio are related, P/S was regressed on $P+S_1+S_2$. An r value of 0.20 suggested no relationship between P/S and fruit size.

In order to determine the inheritance of P/S ratio, about 50 random plants were taken from F_1 populations of 6 crosses of parents with various P/S ratios. 'Benton' was a common parent of 5 crosses, representing a low P/S type. Two cymes per seedling plant were selected, and the primary and secondary fruits were harvested, weighed, and the P/S determined for each cyme as previously described.

The frequency distributions for the P/S of the progeny of the 6 selected crosses show a wide range and indicate that inheritance is quantitative (Table 2). Few individuals were found with very high P/S values, especially in 2 crosses, ORUS 4695 x 'Benton' and 'Benton' x 'Tyee'. Individuals were found in each cross exceeding the high and low P/S of the parents, showing that there is opportunity to select for low P/S in each cross. The greatest gain would be made by using parents with low P/S.

Of the 6 crosses listed in Table 2, only the first 2 have midparent values higher than the progeny mean. ORUS 4695 had the highest P/S in this study and may represent an extreme type. Because of apparently quantitative inheritance for P/S in *Fragaria*, extremely high or low P/S ratios are expected to be infrequent.

There seems to be a tendency for progeny means to approach a P/S of about 1.55 to 1.60 for the material studied. With progeny mean as the dependent value, a regression of midparent and progeny mean values from Table 2 gave an r value of 0.79, indicating there is a relationship between midparent and progeny mean values.

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