Table 2. Plantlet production from strawberry anthers.

Cultivar	Culture medium	Light conditions	No. of plants
Tioga	L.S. 35 days → G.D.1	dark 70 days → light (16 hr day)	2
Pocahontas	G.D.1	dark 70 days → light (16 hr day)	5
Gorella	G.D.1	dark 70 days → light (16 hr day)	8
Rabunda	G.D.1	light (16 hr day)	31

give the positive results described by Gressoff and Doy for tomato (5), nor did transferring undifferentiated calluses to G.D.5, as recommended by the same authors. Transfer of a callus obtained on G.D.1 or on L.S. from the dark to the light was necessary for generation (Table 2).

Plant generation always occurred from relatively young etiolated calluses within 4 months. Older calluses did not give any positive result in spite of numerous divisions and transplants on G.D.1 and other media. Calluses which developed a green or a red color never generated a plant regardless of age although red calluses often gave heavy root proliferation.

The chilling response of 'Rabunda' is consistent with that as described by Nitsch and Norreel (16) as bringing about rapid and uniform growth and subsequent plant regeneration, but not for stimulating greater number of calluses to develop.

Much is written about the regeneration and multiplication of strawberry plants from meristem cultures and this technique is a routine method to obtain plants free from virus and other pathogens (13). This is the first report of successful generation of strawberry plants starting from an undifferentiated callus (Fig. 1).

As stated in the introduction, the object of our investigation was to obtain pure homozygous octoploid strawberry plants passing through a haplotetraploid stage. As shown in the results, all of the plants we obtained from *in vitro* callus were octoploid, 2n=56. The origin of the octoploid in these plants can be explained as due either to the development from the somatic tissue of the anthers or to the cytological instability of the haplotetraploid callus derived from microspores. It is known that in most of the higher plants the cells of a callus cultured *in vitro* show high cytological instability. Hence, generation from such material might generate plants having different ploidy levels (3).

In order to discriminate between the two hypotheses, we have to compare the new plants with the original clones. If they differ, we shall then determine whether there is normal genetic segregation among the offspring. Results with 'Rabunda' plantlets indicate they may have developed from gametic origin. 'Rabunda' is an everbearer which resulted from crossing a short day with an everbearing parent (11). If all

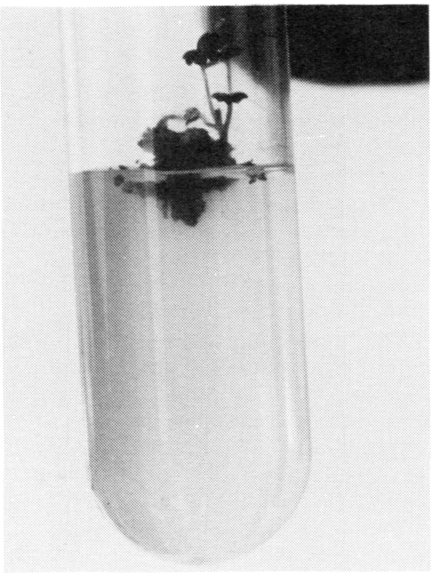

Fig. 1. Strawberry plantlet from anther culture

plantlets originated from somatic cells, they should be everbearers. However, if they developed from gametic cells they should segregate for the short day trait. Of 7 plants obtained from another culture and grown together under the same conditions for 6 months under long day photoperiods (16 hr or more) 4 plants bloomed after 4 months whereas the other 3 have not flowered after 6 months. This suggests that the plantlets are of gametic origin.

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Evaluating Genetic Sources of Fruit Detachment Traits in Strawberry[1]

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Abstract. **The components of strawberry capping (i.e. removal of fruit from the calyx) including capping percentage, capping force, and pedicel breaking force were evaluated in *F.* × *ananassa* Duch. cvs. Juspa, Fresno, Surecrop, Tennessee Beauty, Md-US 3082 and *F. virginiana* Duch. clone 27. Capping percentage varied from 100% for *F. virginiana* to 1.1% for Md-US 3082 and were intermediate in progenies from crosses that differ widely in respect to this character. Although clones did not differ phenotypically in required capping force, progenies from *F.* × *ananassa* x *F. virginiana* crosses required significantly less force to cap than progenies derived wholly from *F.* × *ananassa.* Pedicel breaking forces varied from 562 g for Md-US 3082 to 262 g for 'Surecrop' with progeny means near the low parent mean.**

The separation of the strawberry fruit from the calyx (commonly called capping or plugging) is one method of fruit detachment proposed for mechanized multi-harvest systems (3,

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4). None of the commercial cultivars now grown in Arkansas has suitable capping ease for mechanical multi-harvest. The objectives of this study were to objectively evaluate cultivars for ease of capping and to compare an easy capping wild strawberry with selected commercial cultivars as parental sources of fruit detachment genes.

The tests were conducted during the winter of 1970-71 in a greenhouse at Fayetteville, Arkansas. Each selection used as a parent was planted in 5 single plant replications in a randomized complete block design. The parents were classified by an amendment of Darrow's capping classification (2) as "easy" ('Juspa' and *F. virginiana* clone 27), "good" ('Fresno' and 'Tennessee Beauty') and "difficult" ('Surecrop' and Md-US 3082). Six hybrid progenies (Table 1) were selected for evaluation in a randomized complete block with 2 replicates of 15 plants of each progeny in each replicate.

The first 5 ripe berries from each plant were evaluated with the "capometer," a modification of a Chatillon push-pull pressure tester (1). The capometer measures the force required either to cap a fruit or break its pedicel, whichever occurs first.

Pedicel breaking force and capping force as determined with the capometer measures much the same thing. They are considered separately because one of our objectives was to identify the part of pedicel breaking and capping force that are under different genetic control. For example, 'Surecrop' a very poor capper, required a mean force of 262 g to break the pedicel and the 8.5% of the fruit that capped required a mean force of 268 g to cap (Table 1). Md-US 3082, the poorest capper, required a mean force of 562 g to break the pedicel. The hypothetical production of a fruit with the low capping force of 'Surecrop' on a pedicel with the high breaking force of Md-US 3082 should result in 100% fruit capping.

Capping percentage, which varied from 100% for *F. virginiana* to 1.1% for Md-US 3082, closely approximated the original capping ease classification (Table 1). Capping force, unlike capping percentage, did not differ significantly among cultivars nor between species. Force at which capping occurs is often thought to be an important factor affecting capping percentage but other factors also influence capping percentage. The 2 cultivars with the highest capping frequency varied almost 200 g in the average force required to cap. Pedicel breaking force did vary statistically among cultivars. One presumption is that all berries will cap if the pedicel does not break first. We found no apparent relationship between capping percentage and pedicel breaking force; apparently they are under different genetic control.

Table 1. Capping traits for cultivars and progeny means of selected crosses as determined by the capometer.

Clone or cross	Original classification or parental capping %	Capping[z] (%)	Capping force (g)	Pedicel breaking force (g)
Clone				
F. virginiana clone 27	easy	100a[y]	288	x
F. X *ananassa*				
Juspa	easy	79b	465	383b
Fresno	good	63b	320	362b
Tenn. Beauty	good	37bc	275	313bc
Surecrop	difficult	8cd	268	262c
Md-US 3082	difficult	1d	x	562a
Crosses				
Interspecific				
Surecrop x *F. virginiana*	8 x 100	72a	268b	290bc
Md-US 3082 x *F. virginiana*	1 x 100	42b	280b	286c
Intraspecific				
Fresno x Juspa	63 x 79	44b	384a	350a
Md-US 3082 x Juspa	1 x 79	50b	368a	351a
Fresno x Tenn. Beauty	63 x 37	86a	368a	340ab
Md-US 3082 x Fresno	1 x 63	38b	350a	292bc

[z]Percentage data transformed to arc sine for analysis.

[y]Mean separation within column within clones or crosses by Duncan's multiple range test, 5% level.

[x]Deleted: insufficient data for meaningful statistical analysis.

Although capping force performance of the various clones was evaluated in a greenhouse environment, an attempt was made to separate the genotypic effects through a study of certain hybrid progenies. The progeny means varied significantly for capping percentage and for capping and pedicel breaking force (Table 1).

Of the 6 crosses rated for capping percentage, the 4 crosses involving the greatest differences gave progeny with intermediate mean values, suggestiing additivity. However, in 'Fresno' x 'Tennessee Beauty' the progeny mean exceeded the high parent and in 'Fresno' x 'Juspa' the progeny mean was below the low parent suggesting either dominance or epistasis effects or the presence of other factors which obscure the response.

The hybrid progenies separated statistically into 3 classes for pedicel breaking force. Four of the 6 crosses have means less than the low parent suggesting that in these crosses low pedicel breaking force was dominant. In the other 2 crosses ('Surecrop' x *F. virginiana*) and 'Fresno' x 'Tennessee Beauty') the progeny means were intermediate between the parents and in both crosses the parents were similar for this character. The means for pedicel breaking force of the interspecific crosses did not differ statistically from the means of 2 of the 4 intraspecific crosses.

The hybrid progenies separated statistically into 2 classes for capping force although their parents did not differ significantly. The 2 interspecific hybrid progenies capped with significantly less force than the hybrid progenies within *F.* X *ananassa.* This suggests that the *F. virginiana* clone may have additional and/or different dominant genes for lower capping force than the *F.* X *ananassa* cultivars.

While *F. virginiana* clone 27 appears to be an excellent source of genes for low capping force this clone is an undesirable parent for other characteristics. Our data suggest that the proper combination of low capping force and high pedicel breaking force can be found in recombinants involving crosses within the cultivated strawberry. This appears to be a promising approach in developing clones adapted to multi-harvest systems. It is apparent from these results that a clone must be tested for each component of capping separately (i.e. capping percentage, required capping force, and pedicel breaking force) in order to fully evaluate its genotype and phenotype.

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