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# RECONSTITUTION OF *FRAGARIA X ANANASSA* 1-SEED GERMINATION, TRNASPLANT PRODUCTION AND ITS HETEROSIS AND ACHENES MORPHOLGY

# [24]

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## ABSTRACT

This study was conducted in the period from 1997 to 2002 to produce some new strawberry hybrids (specific hybrids) from the specific hybridization between the two-octaploid species viz. *Fragaria chiloensis* and *Fragaria virginiana*. Seeds of two parents and their $F_1$ hybrids were germinated on two tested media using tissue culture technique. Seed germination percentage and germination speed were calculated. Seedlings of the two tested parents and their F1 hybrids were multiplied, and rooted using tissue culture moreover, transplants were acclimatized in plastic house using peat-moss, vermiculite and perlite medium. Transplants were planted in a fumigated nursery and transplants production, quality and heterosis of some transplants characters were calculated. Seeds of the two used parents, F1 hybrids and reciprocal $F_1$ hybrids were photographed using scanning electron microscope (S.E.M). According to the yield performance (in the second paper), Twelve hybrids and two parents were subjected to nursery trial in a randomized block design with 3 replicates. Results indicated that there were no significant differences between the two types of media on seed percentage of genotypes except for seed produced from hybrids (*F. chiloensis* x *F. virginiana*) whereas, M.S. medium gave the best results. Also there was no significant differences between the two media in speed germination .A2 hybrid transplants produced the highest number of leaves and B8 hybrid gave the tallest transplant and largest crown diameter .B5 hybrid produced the highest number of runners. A2 had the highest fresh and dry weight of leaves, crowns, roots and total transplants. Positive highest heterosis in number of runners relative to the mid- parents was shown by hybrids B8, B5 and A4.Also,A2 had the highest heterosis in number of leaves, fresh and dry weight/transplant. Only B6 and B8 showed highest positive values for crown diameter/transplant. Photographes for the achenes of the produced hybrid showed inheritance of the hair trait from the *F. chiloensis* used as female parent to their hybrids.


**Key words:** Strawberry, Hybrids, Seed germination, Transplant quality, Heterosis, Morphology of achenes

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## INTRODUCTION

Strawberry is considered one of the very important horticultural crops for exportation in last few years. Production of new good quality strawberry cultivars are highly desirable for both consumer and exporter. Among the Fragaria species only *Fragaria x ananassa* Duch., is a natural hybrid between two octaploid species (2n = 56),i.e., *Fragaria virginiana* and *Fragaria chiloensis* L., **Coman *et al* (2000)**, is commercially cultivated to a great extent. Nowadays, high yielding and highly adapted strawberry cultivars are essentially derived from controlled hybridizations mainly among other octaploid cultivars. Also, utilization of the genetic diversity of wild clones of the parents species could help for development of new strawberry cultivars **(Daubeny 1990, Coman *et al* 2000)**. Hybridization between *F. virginiana* and *F. chiloensis* had been conducted by **Ahokas (1993), Staudt (1997) and Hancock *et al* (2001)**. **Melville *et al* (1980)** reported that seed germination of the nine strawberry progenies differed significantly among them and ranged from 53 to 79%. **Miller and Chandler (1990) and Miller *et al* (1992)** reported that tissue culture technique increased the germination percentage and decrease the time for germination of strawberry achenes. **El-Shimi (1978), Melville *et al* (1980) and El-Miniawy (1991)** reported that significant differences were detected among the strawberry genotypes in seed germination speed.

**Ragab (1996)** reported significant differences in number of leaves, crown diameter and number of runners/transplant in the nursery of strawberry cultivars. He also, found that the dry weight of crowns, leaves, roots and total dry weight of transplants were greatly differed between Chandler and Selva strawberry cultivars. **Geater *et al* (1997)** reported that there were highly significant differences in number of runners, leaf and root dry weight for *F. chiloensis* and *F. virginiana,* strawberry species. **Sonsteby (1997)** pointed out that Senga Sengana strawberry daughter plants had significantly had more leaves than the other evaluated cultivars. **Jungnickel and Bajaj (1988)** found significant differences among the cultivars in crown diameter.

**Ragab *et al* (2000)** reported that large crown diameter transplants significantly increased yield and fruit quality. Few studies had been conducted on heterosis of some strawberry characters, **El-Shimi (1978)** reported that the F1 hybrids showed heteoritic effects of number of plants producing runners, number of runner per plants, total yield and early yield. **Melville *et al* (1980)** mentioned that intercrossing or outcrossing of inberds restored vigor. **Matsuda *et al* (1988)** pointed out that leaves number in F1 strawberry plants was similar or intermediate to that in the parents. **Ahmadi and Bringhurst (1992)** reported that strawberry hybrids exhibited heterosis for runner's production. **Staudt (1997)** found that the strong evidence for a maternal cytoplasmic effect of *F. virginiana* and genes for male organs of *F. chiloensis* may be inactivated by the cytoplasm of *F. virginiana*. **Taylor *et al* (1997)** found that the use of cryo-SEM provides considerably more fine details of the tissue surfaces and allows the pattern of initiation of individual floral organs to be observed with precision. **Dale and Sjulin (1990)** stated that more informations are needed to determine the role of cytoplas-

mic variations in the development of new strawberry cultivars. Therefore, this study aimed to produce new strawberry hybrids through the resynthesis of the hybrid structure between two octaploid Fragaria species.

## MATERIAL AND METHODS

This study was carried out at the tissue culture Lab of Strawberry and Non-Traditional Crops Center, Faculty of Agriculture, Ain Shams University and its Experimental station at Nubaria during the period from 1997 to 2002.

### 1- Genetic materials

Two genetic diverse species from Fragaria, namely *Fragaria chiloensis* (2n = 56) and *Fragaria virginiana* (2n = 56), were selected as parents for producing two way crosses (direct and reciprocal) between them. Seeds of the two parents were imported from the National Clonal Germplasm Repository, Corvallis, Oregon, USA.

### 2- In vitro parents seed germination experiment and medium effect

The seeds of the two parents were examined for germination percentage and germination speed on two different media, viz., modified M.S. medium (**Murashige and Skoog, (1962) and Damiano (1980)** (D) media. Seeds were surface-strelized with 10% (v/v) clorox solution (5.25% NaOCl) for 15 min followed by four rinses in sterile double-distilled water. The seeds remained in the final rinse for 5 hr then placed on two types of semi-solid media .Complete randomized design with three replicates were used, each replicate contained 10 jars, each one contained 30 ml of medium with 5 seeds of the two parents and were kept in the growth chamber at 25°C under 16 hr light and 8 hr dark conditions with 2000 Lux for six weeks. Germination started after 10 days from culturing. Data on seed germination percentage and germination speed were recorded for 6 weeks. Obtained seedlings of the two parents were proliferated and rooted on modified Damiano medium then transferred to green house on December 15th under low tunnel for acclimatizion for 4 months in 1 peat-moss: 1 vermiculite: 1 perlite medium. Transplants of the two parents were planted in the fumigated nursery at Nubaria in mid April to obtain the mature daughter plants.

### 3- Production of hybrids seeds

In March 1999, crosses were made between *F. chiloensis* and *F. virginiana*. Seventy- one seeds of F1 hybrids were obtained. The hybrid seeds were separated from the full ripe fruits and kept in a dried test tubes in the refrigerator at + 4°C for two months as described by **Miller and Chandler (1990).**

### 4- In vitro hybrids seed germination experiment

In January 2000,the obtained seventy-one hybrids seeds were examined for germination percentage and germination speed as mentioned for the parents seed germination. After recording the data on seed germination, percentage and germination speed for the hybrids were calculated. Each hybrid seedling from *F. virginiana* x *F. chiloensis* was named as A1 to A16 and the hybrid seedlings form

*F. chiloensis* x *F. virginiana* was named as B1 to B55. The obtained seedlings of hybrids were proliferated for three subculture and rooted to secure identical individuals from the same seed. This procedure permitted a shortenning of the breeding programe. The seventy- one F1 hybrid plantlets and their two parents were acclimatized under low plastic tunnel at green hause for four months, as the above mentioned method.

**5- Nursery stage**

After the acclimatization of the hybrid plantlets and their parents, transplants were transferred to the fumigated nursery at Nubaria region. Soil texture was sandy with pH of 7.4. Treatments (hybrids and two parents) were distributed in a randomized complete blocks design with three replicates. Piot area was $25m^2$ and transplants were spaced at 1.25 x 1.25m. All replicates received similar practices as regards to cultivation, irrigation, fertilization, pest and disease control, and other agriculture practices as commonly followed in this district.

**5.1- Data Recorded**

**5.1.1- Growth parameters**

Random sample of 10 transplants from each plot was chosen in mid September 2000 to determine number of leaves/transplant, transplant length, crown diameter and the transplants were cleaned and weighted to calculate the fresh weight. For dry weight, transplants were dried in an oven at 70°C until constant weight, then the dried transplants were weighed and calculated. Number of transplants/genotype was counted at mid September for 5 random plants in each plot. Data were tested by Duncan's multiple range test (**Duncan, 1955**).

**5.1.2- Heterosis**

Heterosis was computed according to the following equations reported by **Singh and Singh (1994)**. Best-parents heterosis %= F1- B.P / B.P X 100.

Where: F1 and B.P represent mean performance of the F1 and best-parents values. To test the significance of differences between the F 1 means and their best-parents values, the T-test was applied. The standard error was calculated according to the formula: $SE = (EMS / r + EMS / 2r)^{1/2}$

Where: EMS is the mean squares due to error from the analysis of variance and r is number of replications.

**6- Achenes scanning electron microscope**

Achenes of the two parents, hybrids and reciprocal hybrids were sputter coated with gold, then examined and photographed through a Jeol scanning electron microscope (S.E.M., T-300 A).

## RESULTS AND DISCUSSION

**1- Seed Germination**

**1.1- Seed germination percentage**

In Table (1), seed germination percentage on M.S. medium ranged form 10.4 to79.7% and on D. medium ranged from 12.3 to 64.1%. The highest value was recorded from *F.chiloensis x F. virginiana*, while the lowest value was ob-

served for the *Fragaria chiloensis* sp. These results confirm those obtained by **Thompson (1969)** who reported that *F.chiloensis* germinated slowly and more irregularly. On the same type of medium the genotypes differed significantly in seed germinatoin percentage. These results are in agreement with **El-Shimi (1978), Mellive *et al* (1980) and El-Miniawy (1991).**

### 1.2- Speed of germination

Speed of germination values ranged from 37.67 to 11.92 days and there were no significant differences between M.S and D. media for each genotype (Table 1).

Generally, *F. virginiana* seeds (P2) and hybrids which *F. virginiana* as female (B) were germinated more rapidly than the other genotypes. Similar results were obtained by **Thompson (1969)**. He reported that *F. virginiana* germinated readily within a short time of sowing. Also, these results are in agreement with those of **El-Shimi (1978), Melville *et al* (1980) and El-Miniawy (1991)**. They found significant differences among the strawberry genotypes in germination speed.

## 2- Nursery stage

### 2.1- Number of leaves/transplant

Differences among different genotypes in leaf number/transplant (Table, 2) were found, whereas A2, A1, P1, B10 and B12 recorded significant increments in number of leaves/transplant. On the contrary genotypes B5, B6, B11, P2 and B7 had the lowest values. **Sonsteby (1997)** reported that Senga Sengana strawberry daughter plants had significant more leaves than the other evaluated cultivars. In Table (4) three out of twelve hybrid genotypes showed significant positive heterosis .The remaining 8 hybrids exhibited negative significant form best-parents for number of leaves, except the hybrid B12 had no heterosis for number of leaves/transplant. Leaf number of $F_1$ plants was similar or intermediate to that in the parents **Matsuda *et al* (1988)**. **El-Shimi (1978)** reported that the $F_1$ strawberry hybrids were intermediate between their parents and no heterotic effect was noticed in all the $F_1$ hybrids.

### 2.2- Transplant length

Results in Table (2) show that the highest values of transplant length were recorded for P2 (13.81 cm) and B8 (14.08 cm) with insignificant difference between them followed by B10 (11.18 cm), while medium values were achieved from the genotypes between them, A2, B9, B12, A4 with significant difference among them and B4. The lowest values were recorded for P1, A3 and B6 with insignificant differences between them and A1, B5 and B7 with insignificant differences among them. These results agree with those obtained by **Foley** and **Hennerty (1993)**. Transplant length is correlated sometimes with fruits rot percentage in the field, which indirectly negatively affect early and total yield of strawberry. All tested hybrids showed significant negative best-parent heterosis, except B8, gave positive heterosis for transplant length as shown in Table (4).

### 2.3- Transplant crown diameter

Results presented in Table (2) indicate that P2 (*F. virginiana*) had the highest

Table 1. Seed germination percentages and speed of germination for two strawberry species and their F1 hybrid and reciprocal hybrid cultured on two different media

| Genotypes | Media types | Seed germination (%) | Germination speed |
|---|---|---|---|
| P1 | M.S | 10.45 e | 37.67 a |
| | D | 12.37 e | 36.46 ab |
| P2 | M.S | 42.88 c | 11.92 e |
| | D | 40.26 cd | 18.48 de |
| A | M.S | 31.69 cd | 19.15 cde |
| | D | 27.72 d | 27.78 bc |
| B | M.S | 79.72 a | 14.83 de |
| | D | 64.15 b | 23.04 cd |

Values in the same column followed by the same letter(s) do not differ significantly from each other according toDuncan's multiple range test 5%

P1= *F. chiloensis* P2 = *F. virginiana*
A = *F. virginiana x F. chiloensis* B = *F. chiloensis x F. virginiana*
MS =Murashige & Skoog Medium D = Damiano Medium

Table 2. Transplant length, number of leaves, crown diameter and number of transplants/plant for 12 selected strawberry hybrids and their parents

| Genotypes | No. leaves/ Transplant | Transplant length (cm) | Crown diameter (cm) | No. Transplants/ Plant |
|---|---|---|---|---|
| P1 | 6.397 b | 9.020 ef | 0.5200 g | 5.08 k |
| P2 | 5.453 de | 13.810 a | 1.1370 a | 10.88 I |
| A1 | 6.340 b | 7.943 h | 0.7433 de | 22.22 ef |
| A2 | 7.237 a | 10.820 c | 0.8233 c | 21.59 f |
| A3 | 6.547 b | 8.953 f | 0.8233 c | 15.93 g |
| A4 | 5.937 c | 9.943 d | 0.6767 f | 31.47 c |
| B5 | 5.270 e | 8.510 g | 0.7700 d | 38.41 a |
| B6 | 5.517 d | 9.313 e | 0.9500 b | 24.84 d |
| B7 | 5.027 f | 8.210 gh | 0.6433 f | 12.93 h |
| B8 | 5.587 d | 14.080 a | 0.9533 b | 30.83 c |
| B9 | 5.920 c | 10.620 c | 0.8333 c | 23.12 e |
| B10 | 6.500 b | 11.180 b | 0.8567 c | 15.37 g |
| B11 | 5.370 de | 9.723 d | 0.6733 f | 8.77 j |
| B12 | 6.397 b | 10.520 c | 0.7233 e | 35.80 b |

Values in the same column followed by the same letter(s) do not differ significantly from each other according to Duncan's multiple range test 5%

P1= *Fragaria chiloensis* P2 = *Fragaria virginiana*
A = *F. virginiana x F. chiloensis* B = *F. chiloensis x F. virginiana*

value of crown diameter. On the other hand, P1 (*F. chiloensis*) had the lowest value as compared with all tested F1 hybrids. Meanwhile B6, B8, A2, A3, B9 and B10 had moderate values. The rest genotypes recorded higher values than P1. Crown diameter affected positively early yield of strawberry production as mentioned by **Ragab *et al* (2000)** who attributed this finding to the high carbohydrates content in the thicker transplants. For crown diameter (B.P) heterosis results in Table (4) indicated that all hybrids showed significant negative heterosis.

### 2.4- Number of transplants/plant

The highest number of transplants per plant was obtained from B5, B12, A4 and B8 genotypes, moreover medium values were achieved from A1, A2, B6 and B9. On the other side, the genotypes A3, A7, B10, B11, P1 and P2 had the lowest values (Table 2). Similar results were obtained by **Jungnickel and Bajaj (1988), Simpson *et al* (1993) and Chandel and Badiyala (1996)** who found significant differences in number of runners according to the used cultivars.Comparing some lines of *Fragaria virginiana* and *Fragaria chiloensis* to their ability for runner production in the nursery **Geater *et al* (1997)** reported that significant differences were found between the two tested species in runner production.For number of transplants/plant, heterosis in Table (4) all tested hybrids showed positive heterosis and there were highly significant differences between them except the hybrid B11 which gave significant negative heterosis. **El-Shimi (1978)** reported that the F1 hybrids showed a great increase in the number of runners per plant and the degree of heterosis was highly significant in the F1 hybrids. **Ahmadi and Bringhurst (1992) and Bauer *et al* (1994)** found that strawberry hybrids exhibited heterosis for runner production and regulative vigor.

### 2.5- Leaf fresh and dry weights

As shown in Table (3), P1 had the highest value of fresh and dry weights followed by A2, B9 and B12 as compared with the other tested genotypes. Significant decreases in leaf fresh and dry weight were detected by most of the genotypes. However, the lowest values were obtained from B7 and P2, for leaf fresh and dry weights respectively. The high values of fresh and dry weights of leaves could be correlated with high fruit yield of such hybrids. Similar results were obtained by **Ragab (1996)** who mentioned that leaf fresh and dry weights of Chandler and Selva transplants were differed.

### 2.6- Crown fresh and dry weights

As respect to crown fresh weight, results in Table (3) show that P1 and A2 had the highest values with no significant difference between them followed by A4 and B11. While, significant decrement was detected to B7 as compared with all tested genotypes, except B5. A2 hybrid gave the highest crown dry weights as compared with other genotypes followed by P1. These results did not agree with those obtained by **Ragab (1996)** who found that the average values for crown diameter dry weight/transplant were 2.23 to 2.53 gm for Chandler and Selva transplants. This results may be the reason for the reduction of yield of this genotypes

Table 3. Fresh and dry weight of leaves, crown, roots and total transplant of two strawberry species and their 12 F1 hybrids

| Genotypes | Leaves fresh weight | Leaves dry weight | Crown fresh weight | Crown dry weight |
|---|---|---|---|---|
| P1 | 4.727 a | 1.540 a | 0.603 a | 0.227 b |
| P2 | 1.957 I | 0.713 d | 0.357 def | 0.123 e |
| A1 | 2.793 ef | 0.963 c | 0.377 de | 0.167 cd |
| A2 | 4.177 b | 1.430 ab | 0.583 a | 0.333 a |
| A3 | 2.523 j | 1.013 c | 0.320 efg | 0.167 cd |
| A4 | 2.677 fj | 1.050 c | 0.503 b | 0.137 e |
| B5 | 1.203 j | 0.527 e | 0.223 hi | 0.093 f |
| B6 | 2.607 fj | 0.923 c | 0.410 cd | 0.190 c |
| B7 | 1.750 i | 0.730 d | 0.197 I | 0.093 f |
| B8 | 2.757 efj | 0.930 c | 0.363 def | 0.163 d |
| B9 | 3.120 d | 1.400 ab | 0.317 fg | 0.117 ef |
| B10 | 3.010 de | 1.360 b | 0.267 gh | 0.123 e |
| B11 | 3.270 h | 0.930 c | 0.463 bc | 0.133 ef |
| B12 | 3.483 c | 1.060 c | 0.407 cd | 0.127 e |

Table 3. Cont.

| Genotypes | Roots fresh weight | Roots dry weight | Total transplant fresh weight | Total transplant dry weight |
|---|---|---|---|---|
| P1 | 1.707 a | 0.967 a | 7.037 a | 2.917 a |
| P2 | 0.343 f | 0.200 h | 2.657 h | 1.037 j |
| A1 | 0.593 cd | 0.433 d | 3.740 def | 1.563 e |
| A2 | 0.930 b | 0.620 b | 5.69 b | 2.383 b |
| A3 | 0.517 e | 0.323 f | 3.360 j | 1.323 gh |
| A4 | 0.660 c | 0.417 d | 3.840 de | 1.603 e |
| B5 | 0.320 f | 0.270 g | 1.747 i | 0.890 k |
| B6 | 0.510 e | 0.253 g | 3.527 fj | 1.367 fg |
| B7 | 0.623 c | 0.380 e | 2.570 h | 1.203 hi |
| B8 | 0.647 c | 0.470 c | 3.767 def | 1.563 e |
| B9 | 0.527 de | 0.317 e | 3.963 d | 1.833 c |
| B10 | 0.487 e | 0.263 g | 3.763 def | 1.747 d |
| B11 | 0.947 b | 0.447 cd | 3.637 ef | 1.490 ef |
| B12 | 0.387 f | 0.240 g | 4.277 c | 1.427 fg |

Values in the same column followed by the same letter(s) do not differ significantly from each other according to Duncan's multiple range test 5% .

A = *F. virginiana x F. chiloensis* B= *F.chiloensis x F.virginiana*

**2.7- Root fresh and dry weight**

In Table (3) P1and A2 had significant increments in root fresh and dry weight as compared with all tested genotypes. Significant decrement in root fresh and dry weights was detected by P2, B5, B6, B10 and B12 with significant difference among them. These results were not similar to those obtained by **Ragab (1996)** who found no significant differences in transplant root dry weight in Selva and Chandler strawberry cultivars.

**2.8- Transplant fresh and dry weights**

Data obtained in Table (3) show that P1and A2 had the highest fresh and dry weight/transplant as compared with all tested genotypes. The lowest values of fresh and dry weight of transplant were recorded by B5, A3, B7 and P2. Fresh and dry weight of transplant could be an indicator for transplant growth vigor and carbohydrates content in the roots and crowns which affect transplant quality. **Geater *et al* (1997)** stated that fresh and dry weight of transplants are genetically affected. In respect to transplant fresh and dry weight, results in Table (4) show that all evaluated hybrids gave significant negative values compared with best-parents value. With respect to transplant dry weight, all obtained hybrids for (B.P) heterosis show the same direction of transplant fresh weight.

Table 4. Heterosis of 12 F1 strawberry hybrids evaluated relative to their best-parents (h%) for transplant length, no. of leaves, crown dimeter, no. of transplants, plant fresh weight and plant dry weight

| Hybrid | Transplant length | No. of Leaves | Crown diam. | No. of Transplants | Transplant fresh weight | Transplant dry weight |
|---|---|---|---|---|---|---|
| A1 | -42.484 | -0.891 | -34.626 | 104.23 | -46.85 | -46.42 |
| A2 | -21.651 | 13.131 | -27.590 | 98.44 | -19.14 | -18.31 |
| A3 | -35.170 | 2.345 | -27.590 | 46.42 | -52.25 | -54.65 |
| A4 | -28.001 | -7.191 | -40.484 | 189.25 | -45.43 | -45.05 |
| B5 | -38.378 | -16.054 | -23.278 | 352.97 | -75.17 | -69.48 |
| B6 | -32.563 | -13.756 | -16.447 | 128.31 | -49.88 | -53.14 |
| B7 | -40.550 | -21.416 | -43.421 | 18.84 | -63.48 | -58.76 |
| B8 | 1.955 | -12.662 | -16.447 | 183.36 | -46.47 | -46.42 |
| B9 | -23.099 | -7.457 | -26.711 | 112.50 | -43.68 | -37.16 |
| B10 | -19.044 | 1.610 | -24.652 | 41.27 | -46.52. | -40.11 |
| B11 | -29.594 | -16.054 | -40.783 | -19.39 | -48.32 | -48.92 |
| B12 | -23.823 | 0.0 | -36.385 | 229.04 | -39.22 | -51.08 |

A = *F. virginiana x F. chiloensis* B = *F. chiloensis x F. virginiana*

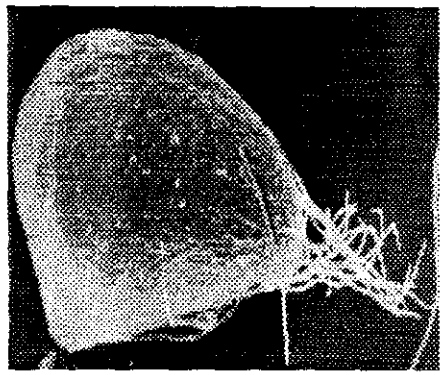

Fig. 1. *F. chiloensis*

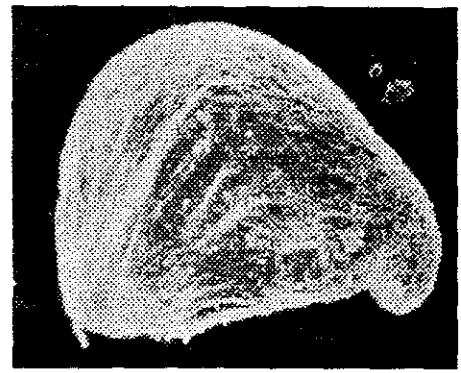

Fig. 2. *F. virginiana*

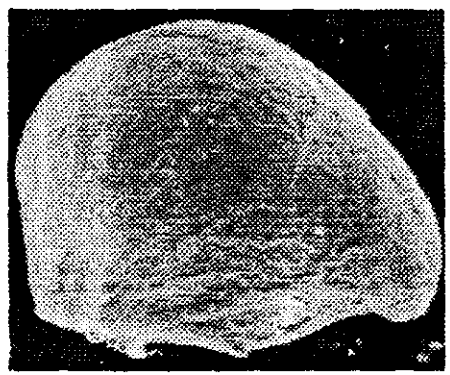

Fig. 3. *F. chiloensis x F. virginiana*

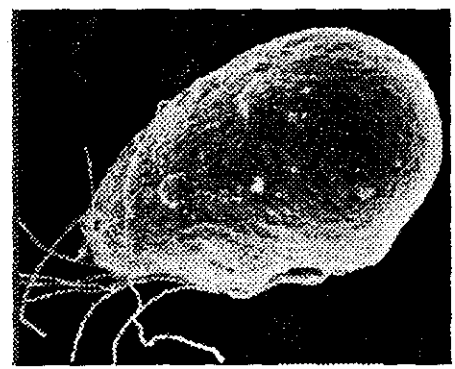

Fig. 4. *F. virginiana x F. chiloensis*

Photographs of achenes of the two parents (*Fragaria virginiana* and *F. chiloensis*), their hybrids and reciporcal crosses

**3- Achenes Morphology**

Over thirty scanning electron microscope micrographs (SEM) were taken during this study recording in detail the morphology of the achenes genotypes. Results in Fig. (1) showed that, *Fragaria chilonesis* achenes are triangular with tuft of hairs, the hairs emerge from either the tip or laterally, but the achenes of *Fragaria virginiana* are not hairy Fig (2). Achenes of crosses which *Fragaria chiloensis* used as male parent has a kidney shape without any hairs at both ends, Fig. (3). On the other hand, the achenes of crosses that *Fragaria chiloensis* as female parent are hairy at one end Fig. (4). This observation showed the cytoplasmic ma-

ternal inheritance for the hairy achenes and transmitted from *Fragaria chiloensis* used as female parent. In this respect, **Taylor *et al* (1997)** found that the use of Cryo-S.E.M is an excellent method for recording the detailed morphology of flower development in strawberry. **Barrite *et al.*(1982) and Dale and Sjulin (1990)**, reported that the strawberry have not been analyzed to show the cytoplasmic contribution of different maternal founding clones to the gene pool of North American cultivars. **Coman *et al* (2000)** found that June yellow is thought to be trasmitted by cytoplasmic gene.

The study concluded that new strawberry hybrids could be produced by crossing between the two main parents for all commercial strawberry cultivars, viz., *F.chiloensis and F.virginiana* to be promising hybrids for further selection. However scanning electron microscope proved to be a good method for distinguishing hybrids those through achenes scanning morphology.

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مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م٤٨ ، ع(١)، ٣٢٩-٣٤٢ ، ٢٠٠٣

# إعادة تكوين الفراجارايا × أناناسا

## ١- إنبات البذور وإنتاج الشتلات ودرجة تفوقها ومورفولوجيا الأكينات

## [٢٤]

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أجريت هذه الدراسة فى معمل زراعة الأنسجة بمركز تنمية الفراولة والمحاصيل غير التقليدية بكلية.الزراعة جامعة عين شمس ومحطة تجارب المركز بالنوبارية خلال الفترة من عام ١٩٩٧حتى عام ٢٠٠٢. وتهدف الدراسة إلى إعادة تكوين الفراولة من خلال إجراء التهجين بين النوعين الثمانيين فراجاريا شلونسس وفرا جاريا فرجينيانا لانتآج تراكيب وراثية وتقييم الهجن الناتجة تحت الظروف المصرية وذلك بعد محاولة إنبات بذورهما. فقد استخدم تكنيك زراعة الأنسجة لإنبات البذور على نوعين من البيئات وهما موراشيج وسكوج وبيئة دامياتو وتم حساب نسبة وسرعة الإنبات لبذور الأباء والهجن والعكسية الناتجة . تم إكثار وتجذ ير الأباء والهجن الناتجة معمليا ثم أقلمة الشتلات الناتجة فى صوب بلاستيكية ثم زرعت الشتلات فى المشتل فى تربة معقمة بغاز بروميد الميثيل .تم حساب عدد الشتلات وجودتها ودرجة تفوقها فى بعض الصفات .

وطبقا لنتائج المحصول ( فى البحث الثانى ) فقد اختير ١٢ هجينا وتم زراعتهم فى المشتل مع الآبين فى قطاعات كاملة العشوائية من ٣ مكررات .

**وكانت أهم النتائج المتحصل عليها مايلى**

١- أدى استخدام بيئة موراشيج وسكوج إلى زيادة معنوية فى نسبة انبات بذور الهجن الناتجة بالتهجين بين الفراجاريا شلونسس والفراجاريا فرجينيانا بينما لم يكن بين البينتين فرق معنوى فى انبات بذور الهجن الناتجة عن الفراجاريا فرجينيانا وفرا جاريا شلونسس كهجن عكسية لم تؤثر البيئة المستخدمة على سرعة انبات بذور الهجن والهجن العكسية.لم تؤثر البيئة المستخدمة على سرعة انبات لهجن والهجن العكسية.

٢- عند مقارنة الأبوين تحت الدراسة أعطى الأب فراجاريا فرجينيانا أعلى نسبة إنبات بالأب وأقل عدد من الأيام للوصول لهذه النسبة مقارنة بالأب

فراجاريا شلونسس وذلك باستخدام البيئتين تحت الدراسة بدون فرق معنوى بينهما.

٣- سجل الهجين$_A$ ٢ اعلى قيمة لعدد الأوراق بيتما سجل الهجين$_B$ ٥ أعلى القيم بالنسبة لارتفاع الشتلة وسمك التاج.أما الهجين$_B$ ٥ فقد أعطى اعلى قيمة بالنسبة لعدد المدادات على النبات.

٤- كانت اعلى القيم فى الوزن الطازج والجاف للأوراق والبذور والتيجان والشتلات فى الهجين$_A$ ٢.

٥- عند دراسة تقدير قوة الهجين فقد تفوق الهجين$_A$ ٢ فى صفات عدد الأوراق والوزن الطازج والجاف للشتلات. أما الهجن $_A$ ٤ و $_B$ ٥ و $_B$ ٨ فقد تفوقت فى صفة عدد المدادات فى الشتلة وبالنسبة لقطر التاج فقد سجل الهجين$_B$٦ و $_B$ ٨ تفوقا على باقى الهجن تحت الدراسة.

٦- أظهرت صور الاكينات توارث صفة وجود الأهداب بالاكين عن طريق النوع فراجاريا شلونسس للهجن المتمثل بها كأم وتعد هذه طريقة مورفولوجية حديثة للتميز بين هجن الفراولة. وتجمل هذه الدراسة أنة يمكن بالتهجين بين نوعى الفراولة الثمانية فراجاريا شلونسس وفرجينيانا إنتاج هجن جديدة يمكن أن تكون مبشرة أو تدخل فى برامج تربية أخرى ويمكن التفرقة بين الهجن الناتجة بطريقة فحص الأكينات.

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