Fruit Growing Research, Vol. XXXV, 2019
http://publications.icdp.ro/index.php
DOI 10.33045/fgr.v35.2019.02

VARIABILITATEA ȘI EREDITATEA CARACTERISTICILOR „PRODUCȚIA" ȘI „GREUTATEA FRUCTULUI" LA HIBRIZII F1 DE CĂPȘUN

VARIABILITY AND HERITABILITY FOR „YIELD" AND „FRUIT WEIGHT" TRAITS OF F1 STRAWBERRY HYBRIDS

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Abstract

Strawberry (*Fragaria* × *ananassa* Duch.) growing is constantly increasing all over the world thanks mainly to the varietal innovations. One of the most efficient breeding strategies is the selection based on heritability especially for the traits of economic importance. This study was performed during 2016-2017 to evaluate the variability and heritability of two quantitative traits (yield and fruit weight) of 12 cultivars ('Alba', 'Benton', 'Cambridge Favourite', 'Clery', 'Elsanta', 'Honeoye', 'Idea', 'Premial', 'Marmolada', 'Mira', 'Miss', 'Record') used as genitors and ten F_1 hybrid populations. The results showed significant differences among hybrids in the samples involved in the study. Heritability coefficient (H^2) proved high values and ranged from 0.91 ('Elsanta' x 'Cambridge Favourite') to 0.99 ('Mira' x 'Idea').

Cuvinte cheie: *Fragaria* × *ananassa,* ameliorare, combinație hibridă.
Key words: *Fragaria* × *ananassa,* breeding, cross combination.

1. Introduction

The cultivated strawberry (*Fragaria x ananassa* Duch.) is a natural hybrid between the South American *Fragaria chiloensis* and the North American *Fragaria virginiana* (Hancock et al., 1991). It can be grown from the tropics to the cool temperate regions due to genetic characteristics inherited from the both parents. Strawberry is octoploid specie and the heritability is complicated because of narrow genetic base, high heterozygosity and gene linkage (Jacek, 2011). Most of plant and the fruit characteristics are transmitted quantitatively, being determined by minor genes systems. The genetic variability of yield is controlled and transmitted to offspring mainly by genes with additive effect and non-additive effect, as well (Coman and Chiriac, 1994). Heritability, gene action, and correlation among traits are very important in determination of parent and selection of progeny (Gurwinder et al., 2018). One of the most efficient breeding strategies for strawberry crop improvement is selection based on heritability and combing ability estimates for the traits with economic importance or commercial value. Achieving a superior cultivar with satisfactory yield and good fruit quality is an important objective for selection and further improvement. The study was performed in a field trial with 12 strawberry cultivars used as genitors, and in a seedling field with ten F1 hybrid populations to evaluate genetic variation and heredity of quantitative traits: "yield" and "fruit weight".

2. Material and methods

The fields were located at the Research Institute for Fruit Growing Pitesti, Romania and the study was done during 2017-2018 period. Biological material used was represented by 12 cultivars ('Alba', 'Benton', 'Cambridge Favourite', 'Clery', 'Elsanta', 'Honeoye', 'Idea', 'Premial', 'Marmolada', 'Mira', 'Miss' and 'Record') used as genitors and ten F_1 hybrid populations (Table 1). Fruit yield/plant and average of fruit weight were collected from individual plants of genitors and F_1 hybrids along of two cropping seasons.

The experimental data were classified using the MS Excel facilities their statistical processing was carried out using the Duncan test and variance.

Broad sense heritability and narrow sense heritability were noted and computed by classical model, $H^2=\sigma_G^2/\sigma_P^2$, $h^2=\sigma_{Ga}^2/\sigma_P^2$ (Holland et al., 2003; Piepho and Möhring, 2007).

The coefficient of variability/variation CV% =σ / x and CGV% = σ_G/x, where: σ is square root of the total variance among families; σG is square root of the genotypic variance among families; x is mean of trait (mean of notes for fruit size on F_1 hybrids).

3. Results and discussions

Yield. The highest value of fruit yield was recorded by 'Idea' cv. (592.3 g/plant) and the lowest value by 'Record' cv. (289.3 g/plant). In case of hybrid families, the descendants from 'Alba' x 'Premial' combination proved the highest value which was close to the genitors, without exceeding their mean value. It is interesting that the 44% of the descendants had a higher fruit yield than mean of genitors value (Figure 1).

For the genitors, the coefficient of heritability in the broad sense (H^2) is 0.69, and shows the influence of the environment on phenotypic of cvs. The contribution of genetic additive variant to the transmission of the production is relatively lowest (Table 2). Non-genetic effects contribute to the value of the coefficient of heritability in a broad sense (Bernando, 2002).

The low value of the coefficient of heritability in the narrow sense (h^2 = 0.19) suggests the necessity for the application of some individual genotyping selection methods by tracking in the descending of the value each selected plant. For all hybrid families the values coefficients of heritability in the broad and narrow sense were closer to 1.

The coefficients of variability had recorded low values (5.9-9.2) for all hybrid families, confirming the high probability of offspring to be used in new crosses for the yield trait.

Fruit weight

Besides the genitors, 'Record' cv. registered the highest average fruit weight (24.2 g), but the descendants from combination 'Premial' x 'Record' registered lower values than both, only 17% exceeding the mean of the genitors. The offspring of 'Alba' x 'Premial' had higher mean values than the genitors, significantly exceeding them (Figure 2). The values of the coefficient of heritability indicate a major contribution of the genotype to the fruit weight, and environmental influence as well.

As general view, both coefficients of heritability (H^2 and h^2) for fruit weight proved lower values than those for yield and only 7 families exceeded the genitors values (Table 2 and 3).

4. Conclusions

The value of the calculated coefficients allows the breeder to make the right choice of methods and selection forms to improve the analyzed characters.

The descendants from 'Alba' x 'Premial' will be selected and used in breeding for quality and earliness.

Acknowledgements

This paper was published under the project ADER 7.2.2/2019: "*Implementation of new breeding techniques of fruit tree species in order to increase the efficiency and to reduce de period of the selection process*".

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Fruit Growing Research, Vol. XXXV, 2019 DOI 10.33045/fgr.v35.2019.02
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Tables and Figures

Table 1. Cross combinations

Code	♀	♂	Code	♀	♂
12 – 5	Mira	Idea	12 – 13	Marmolada	Benton
12 – 6	Alba	Premial	12 – 13	Clery	Honeoye
12 – 7	Premial	Miss	12 – 16	Mira	Honeoye
12 – 9	Premial	Record	12 – 19	Benton	Cambridge Favourite
12 – 12	Benton	Marmolada	12 – 20	Elsanta	Cambridge Favourite

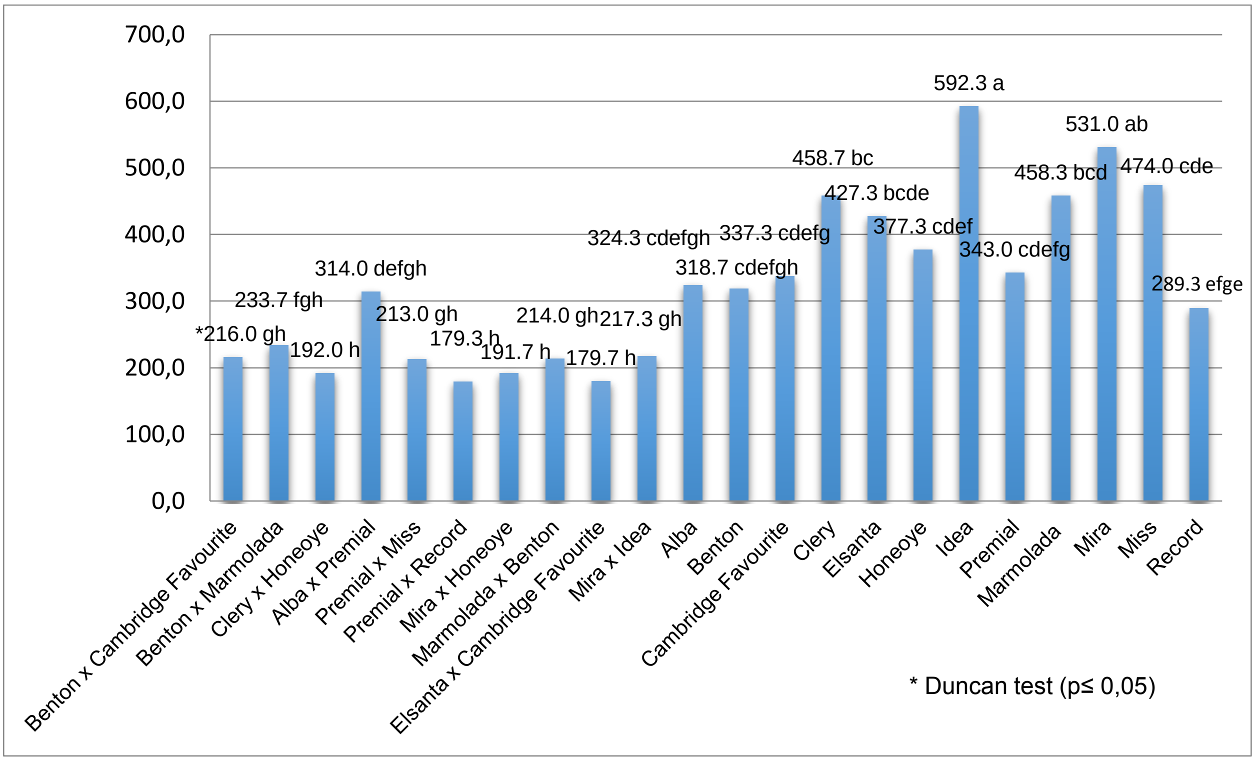

Fig. 1. Yield / plant (g) at genitors and F_1 hybrids

Table 2. Heritability and variability yield / plant (g) at genitors and F_1 hybrids

No.	Genitors / Cross-combination	Yield / plant		
		H^2	h^2	CV%
1	Genitori	0.69	0.19	21.8
2	12-5 (Mira x Idea)	0.99	0.95	7.2
3	12-6 (Alba x Premial)	0.98	0.94	5.2
4	12-7 (Premial x Miss)	0.99	0.96	8.2
5	12-9 (Premial x Record)	0.96	0.85	8.8
6	12-12 (Benton x Marmolada)	0.99	0.97	8.1
7	12-13 (Marmolada x Benton)	0.98	0.92	8.1
8	12-14 (Clery x Honeoye)	0.92	0.68	8.9
9	12-16 (Mira x Honeoye)	0.97	0,89	9.2
10	12-19 (Benton x Cambridge Favourite)	0.99	0.96	9.0
11	12-20 (Elsanta x Cambridge Favourite)	0.95	0.81	12.1

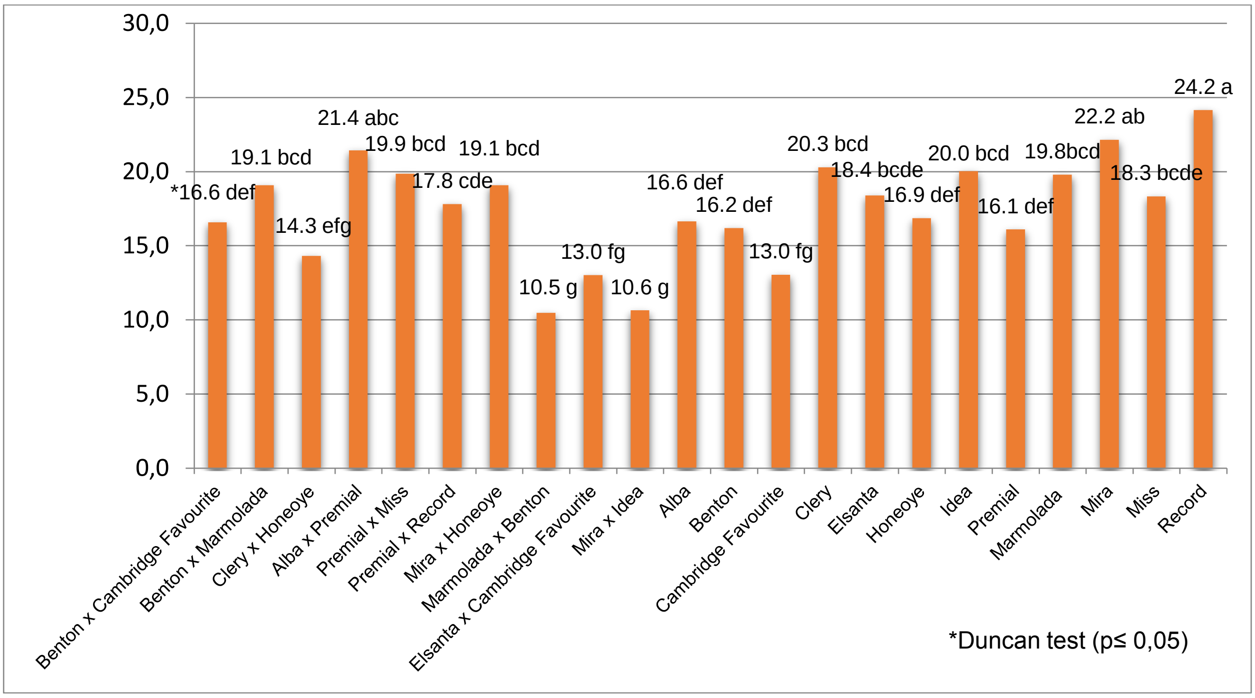

Fig. 2. Fruit weight (g) at genitors and F_1 hybrids

Table 3. Heritability and variability yield / plant (g) at genitors and F_1 hybrids

No.	Genitors / Cross-combination	Yield / plant		
		H^2	h^2	CV%
1	Genitori	0.77	0.32	12.7
2	12-5 (Mira x Idea)	0.82	0.42	20.0
3	12-6 (Alba x Premial)	0.69	0.20	12.5
4	12-7 (Premial x Miss)	0.80	0.39	11.0
5	12-9 (Premial x Record)	0.82	0.41	11.0
6	12-12 (Benton x Marmolada)	0.66	0.15	14.4
7	12-13 (Marmolada x Benton)	0.94	0.77	16.7
8	12-14 (Clery x Honeoye)	0.94	0.76	12.8
9	12-16 (Mira x Honeoye)	0.69	0.20	13.0
10	12-19 (Benton x Cambridge Favourite)	0.90	0.63	13.3
11	12-20 (Elsanta x Cambridge Favourite)	0.88	0.58	19.5