GENETIC TRAITS OF APRICOT ADAPTABILITY

CARACTERISTICI GENETICE ALE ADAPTABILITĂŢII CAISULUI

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Abstract. *From complexity of elements that give an insight into apricot adaptability, are presenting in this paper the results of the characteristics and traits of flowering***,** *of resistance or susceptibility of apricot phenotypes, preserved in the collection (655 phenotypes), of the parents and of the descendants,(9000 hybrids), at low temperatures during winter and fluctuations of temperature in late winter and spring, and their reaction to the attack of stable pathogens.*
Key words: apricot, phenotype, resistance, susceptibility, low temperatures, pathogens.

Rezumat. *Din complexitatea elementelor care dau o imagine asupra adaptabilităţii caisului, sunt prezentatate în lucrare rezultate cu privire la caracteristici şi însuşiri ale înfloriri, ale rezistenţei sau sensibilităţii fenotipurilor de cais prezervate în colecţie (655 fenotipuri), a genitorilor şi a descendenţilor (9000 hibrizi) la temperaturile scăzute din timpul iernii şi la fluctuaţiile de temperatură de la sfârşitul iernii şi din primăvară, precum şi comportarea acestora la atacul agenţilor patogeni stabili.*
Cuvinte cheie: cais, fenotip, rezistenţă, sensibilitate, temperaturi scăzute, agenţi patogeni

INTRODUCTION

Knowledge about genetics apricots are low compared with simple genetic organisms such as *Drosophila*, or *Arabidopsis* sp.

This is due to the sexual cycle and predominance of the diploid phase, and to space and time needed for growth and development of F2 families.

Nevertheless, develop deeper knowledge of the peculiarities of this fruit growing species which has little ecological plasticity, but required the world, mainly due of the nutritional quality and therapeutic of fruit, can be achieved mainly based on genetic studies, technically possible because of floral biology, which allows controlled hybridization and self-fertilization

In this paper are summarized research results on inheritance of physiological traits, such as flowering, ripening fruit, photosynthesis, respiration, and traits of resistance to winter frost, reaction to attack of the main pathogens, as elements of apricot adaptability.

MATERIAL AND METHOD

Biological material for study on induced variability, of different genetic mechanisms and for the selection of new phenotypes was obtained by intra-and interspecific hybridization, self-fertilization, backros, physical and chemical mutagenesis (Bălan Viorica, 1999).

By the hybridization were obtained 9000 intraspecific hybrids and 1100 interspecific hybrids.

There were obtained 15-82 C1 progeny by self-fertilization of apricot phenotypes: Comandor, Olimp, Selena, Sulina, Litoral.

By the physical mutagenesis, using mutagenic agent 60 Co 3000R, resulted 140 mutant Comandor V2. By the backcross resulted 120 descendants.

To be highlighted inheritance of physiological traits and resistance traits to cold and wintering were determined free and bound water content, and carbohydrate content, in the rest phase and the phase of vegetation, cryo-sensitivity of malate dehydrogenase and peroxidase in the buds naturally exposed to frosts in winter and the death rate of flower buds (Bălan Viorica, 1999; Guerriero R. et all. 2006).

Parents were selected for disease resistance and studied heredity of characteristics of resistance to the attack pathogens *Monilinia laxa* (Aderh et Ruhl) Honey (Nicotra A. et all., 2006), *Stigmina carpophila* (lev) M. B.Ellis, and *Cytospora cincta* Sacc., *Pseudomonas siringae p.v.siringae* van Hall (Bălan Viorica, 1999), and *Plum pox virus*, particularly (Audergon J.M. et all., 1988; Karayannis I. et all., 2006; Krska B. et all., 2006).

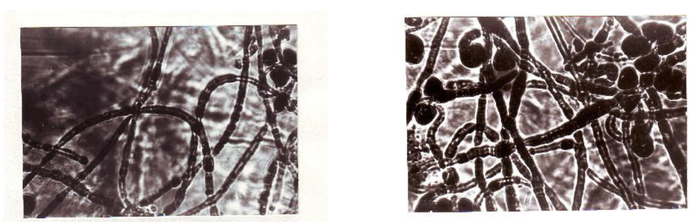
RESULTS AND DISCUSSIONS

Flowering and fruit maturity onset phase

By controlled hybridization resulting F1 progeny which are outside the range of variation of the parental phenotypes reflecting transgressive inheritance of flowering trait.

Differences between F1 progeny from the same parents, alternative use that as a mother and father, showed cytoplasmic heredity, in this case being mentioned standard phenotypes Comandor and Excelsior. Normal pollen tube germination, showed the ability of each of the two phenotypes to be a good partner as father also (fig. 1).

a



b

Fig. 1. Pollen tubes to phenotypes Comandor (a) and Excelsior (b)

In what concerns the heredity of fruit ripening, have revealed three cases: *transgressive (7%)*, to very early (5 June 25), in type of the combination**:** ♀ late maturing x ♂semiearly maturingin ♀Comandor × ♂Dacia; *dominant* for the early maturation of the father genitor, in the combination of ♀late maturation (August)

× ♂very early maturation (June) in ♀Comandor × ♂77.3.52 BV; and *intermediary*, in the combination of ♀average maturation × ♂late maturation in ♀Comandor × ♂Excelsior and ♀Excelsior × ♂Comandor.

The photosynthesis-respiration balance, both during the intensive growth of the shootlets and fruit, 15 May-15 June, and during the inactive phase (quiescence), pointed to the normal metabolism of the accumulated organic matter available for the vital activities, which reflected the physiological adaptation of the phenotypes selected as genitors, as well as their descendants, in the areas under study, i.e. the Romanian Plain.

Frost and wintering resistance (-18^{0}C), and temperature fluctuations in February March (-16^{0}C+16^{0}C), of flower buds, was transmitted to progeny transgressively, be observed more resistant progeny than parents,, but also by 10-25% more susceptible descendants than the genitors, e.g. in ♀Comandor × ♂Excelsior,♀Excelsior × ♂Goldrich.

The starch content of the annual shootlets varied widely, as the variation coefficient s% ranged between 21.7 in the F1 ♀Comandor × ♂Excelsior descendants, and 78.9 in the F1 ♀Comandor × ♂77.3.52BV descendants in their dormant stage, and between 45.5 and 60.7 in their vegetation period. The variation limits of the starch amount were recorded in December-February, between 0.17-4.32 mg/100 g dry matter in the F1 ♀Comandor × ♂Dacia descendants, and 0.30-6.0 in the F1 ♀Comandor× ♂77.3.52.BV descendants, whereas in April-May the variations were 0.30-1.45 mg/100 g in the former, and 0.39-6.10 in the latter.

The soluble carbon hydrate content varied widely, recording higher values than starch, i.e. 1.35-13.85 mg glucose/100 g dry matter, compared with 0.17-4.32 mg starch/100 g in the F1 ♀Comandor × ♂Dacia descendants in December-February, and 4.36-11.95 mg glucose/100 g, compared with 0.30-1.45 mg starch/100 g in April-May.

The correlation between the starch-carbon hydrate rapport and the frost resistance of the flowering buds was observed in the F1 ♀Excelsior × ♂Goldrich descendants, where 8% recorded losses of only 20-30%, while the starch amount was 1.54 mg/100 g higher than the amount of soluble carbon hydrates.

The bound water content was higher in the hybrid descendants F1 than in their parents, e.g. 0.4-5.5 mg/100 g dry matter in the descendants F1 of ♀Comandor × ♂Dacia, 0.3-3.50 mg/100 g in the genitor ♀Comandor, and 0.26-4.1 mg/100 g in the genitor ♂Dacia. The heterosis of the bound water content was determined in the descendants F1, compared with their parents.

The free water-bound water balance varied inversely, as the bound water level was higher than the free water level in the dormant stage and lower in the vegetation period.

The cytoplasmic and mitochondrial malate dehydrogenase had evident lower activity in the dead buds, compared with the living buds, in the genitors ‘Comandor’ and 77.3.52 BV, which emphasised their cryosusceptibility.

However, peroxidase manifested cryoresistance, as the peroxidasic isosimic spectrum indicated no differences reflecting cryoinactivation, both in the living and the dead buds.

Peroxidase cryoresistance and malate dehydrogenase cryosusceptibility were employed as control indicators for cryoresistance variation in the descendants F1.

Behaviour under the attack of the main diseases

The results show that the consecutive three-year absence of treatments and the conditions provided by the Bucharest area, where *Monilinia laxa* Aderh *et*. Ruhl Honey and *Stigmina carpophila* M. B. Ellisse may produce over 70-80% damage, created favourable conditions for screening. Thus, out of 1600 descendants of 64 genomic families resulted from dialelic breeding between geographically distant partners, complex hybridisation, and backcrossing, only 13 descendants of nine genomic families were selected according to their field resistance to the two pathogens. The degree of attack (DA%) of the 13 descendants was limited to 2.5-7.5 in *Monilinia laxa*, and 1.8-7.5 in *Stigmina carpophila*.'Marculesti 19' was the maternal genitor in three of the nine genomic families, and 'Re Umberto' was the maternal genitor in five families and the paternal genitor in one of the selected families

The selected elites were retested by artificial inoculation under glasshouse conditions, and no difference was observed, compared with their behavior under natural infection conditions. The selection 83.15.23 (♀Re Umberto × ♂Timpurii de Chişinău/Early of Chişinău) was also resistant to inoculation based on fragments of *Cytospora cincta* colonies whereas selections 83.29.4 B1 and 83.29.3 B1 (♀Mr.19 × ♂CR5-180) showed average resistance. The selection 83.29.4B1 was highly resistant to pathogens and temperature fluctuations, and produced top-quality fruit; therefore, it was homologated in 1984 under the name of 'Dacia', and was protected by a patent. The phenotypes that resisted the attack of stable pathogens were the basis for the genetic study of resistance to diseases, as well as genitors in the genetic breeding programme for apricot trees. The study of the F1 descendants resultant from ♀resistant ('Dacia', 83. showed high variability to the attack of the pathogens under study. The transgressive heredity of the reaction to the pathogenic action of the fungus *Stigmina carpophila* was determined in the following descendants F1: ♀Comandor × ♂Excelsior, ♀Excelsior × ♂Goldrich, ♀Excelsior × ♂Comandor, ♀Comandor × ♂Excelsior, ♀Early Orange × ♂Don Gaetano, (Table 1).

The hybrid descendants F1 ♀Excelsior × ♂Goldrich, ♀Comandor × ♂Dacia, of the ♀susceptible × ♂resistant type, and ♀Comandor × ♂77.3.52.BV of the ♀susceptible × ♂average resistant type, reacted to *Cytospora cincta* Sacc., manifested heterosis under conditions of inoculation with the virulent strains C36 and C41.

The 60 CO physical mutagenesis, in a rate of 3000R, induced resistance to the fungus *Stigmina carpophila* in 33% of the total mutants V2 Comandor.

Table 1

F1 hybrid generation reaction to the action of pathogenic fungi *Stigmina carpophila* (lev) M. B.Ellis*, Cytospora cincta sacc* and of the bacteria *Pseudomonas siringae p.v.siringae* van Hall

Parents/Descendants	*Stigmina carpophila*	*Cytospora cincta*	*Pseudomonas siringae p.v.siringae*
♀Excelsior	S	MR	I
♂Goldrich	S	MR	I
♀Excelsior x ♂Goldrich	I	MR	R
♀Comandor	S	S	I
♂Excelsior	S	MR	I
♀Comandor x ♂Excelsior	MR	R	I
♀Excelsior	S	MR	I
♂Comandor	S	S	I
♀Excelsior x ♂Comandor	S	MR	I
♀Comandor	S	S	I
♂ Dacia	I	MR	I
♀Comandor x ♂ ♂Dacia	S	R	I
♀Comandor	S	S	I
♂77.3.52.B V	S	S	I
♀Comandor X ♂77.3.52.B V	S	R	I

Explanation Table 1: S-sensitive. I-intermediate, MR-middle rezistant, R-rezistant

CONCLUSIONS

1 By controlled hybridization resulting F1 progeny which are outside the range of variation of the parental phenotypes reflecting transgressive inheritance of flowering trait

2. Have revealed three cases of the fruit ripening heredity: *transgressive (7%),* to very early (5 June 25), in type of the combination ♀ late maturing x ♂semiearly maturing, dominant for the early maturation of the father genitor, in the combination of ♀ late maturation (August) × ♂ very early maturation (June); and intermediary, in the combination of ♀ average maturation × ♂ late maturation.

3. The correlation between the starch-carbon hydrate rapport and the frost resistance of the flowering buds was observed, in the F_1 ♀ Excelsior x ♂ Goldrich descendants.

4. Peroxidase cryoresistance and malate dehydrogenase cryosusceptibility were employed as control indicators for cryoresistance variation in the descendants F1.

5. The heterosis of the bound water content was determined in the descendants F1, compared with their parents

6. The transgressive heredity of the reaction to the pathogenic action of the fungus *Stigmina carpophila* was determined in the F1: ♀Comandor × ♂Excelsior, ♀Excelsior × ♂Goldrich, ♀Excelsior × ♂Comandor, ♀Comandor × ♂Excelsior, ♀Early Orange × ♂Don Gaetano descendants.

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