Inter-incompatibility of self-incompatible apricots and their varietal properties

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Key words: blooming, ripening, leaf size, fruit characters, fruit set.

Summary: There are four apricot varieties grown in Hungary derived from local selections known to bear fruits of giant (60 - 100 g) size: *Ceglédi óriás, Nagykörösi óriás, Szegedi mammut* and *Ligeti óriás*. Being morphologically similar, they seem to be closely related to each other. The detailed study of the morphology (of leaves and fruits) and phenology (of blooming and ripening dates) as well as the fertility relations was aimed to find out the degree of kinship between the varieties in question.

It was stated that the value of morphological traits is variable from the taxonomic point of view. The most important signs of common origin were the time of blooming and the leaf size. Less valuable are the date of maturity and the size of fruit because of their variability. In the literature *Szabó & Nyéki* (1991) published the first proof of inter-incompatible relation between apricot varieties. This should be considered as an argument of close genetic relation between those "giant" varieties of apricots.

The first three varieties, *Ceglédi óriás, Nagykörösi óriás* and *Szegedi mammut* are closer related in blooming and ripening date, as well as in size of fruit to each other than the variety *Ligeti óriás*.

1. Introduction

In the centre of the Carpatian region, in Hungary, a highly variable population of apricots developed since ancient times. A purposeful selection work started in the 1950-ies exploiting the existent germoplasm and its results were decisive in building up an assortment which is still used in production, and served as a basis for further combinations of cross breeding *(Nyujtó & Bana,* 1985). The local clones collected have been assigned to variety groups of which the best were used in plantations. There are e.g. the "giant" (óriás) types as their most popular representative, *Ceglédi óriás* and other, similar varieties, *Ligeti óriás, Nagykörösi óriás* and *Szegedi mammut.*

According to *Harsányi* (1979) *Ceglédi óriás, Szegedi mammut* and *Nagykörösi óriás* are hardly distinguished from each other either by their fruit, tree habit or time of maturity. *Ceglédi óriás* and *Ligeti óriás* are also most similar in their morphology of the branching system but the characters of fruit and ripening time are different. In earlier studies we presented proofs of self-sterility in the "óriás" group of varieties *(Szabó & Nyéki,* 1991) at the same time as *Egea* et al (1991) called attention on self- and cross sterility in apricots. Further results were presented in 1995 *(Nyéki & Szabó* 1995). In the present study morphology of the "óriás" varieties was considered.

2. Material and methods

From 1980 to 1995 eight apricot varieties were studied for morphological traits (of leaves and fruits) and for chemical composition (soluble solids, sugars and acids). The varieties of the "giant" group were compared with *Gönci magyar kajszi C-174, Gönci magyar kajszi C-694,* and *Magyar kajszi C-235* belonging to the group of *Magyar kajszi,* and in addition to those there was the variety *Ceglédi biborkajszi.* All the trees were grown at the Horticultural Research Station of Cegléd.

3. Results

3.1. Blooming period

The comparison of the time of flowering of the 8 varieties, 4 of them being of the "óriás" type, is presented in *Table 1* based on data raised over 12 years.

Blooming time of the two variety groups differed considerably. The "óriás" varieties started earlier as the *Magyar kajszi* group, regularly. It happened only two times (in 1986 and 1988) that the start of blooming in *Ceglédi óriás* preceded that of *Magyar kajszi C-235* by one day.

Variation of the start of blooming within the group of *Magyar kajszi* was 2 days at most (1987) whereas within the

Table 1 The time of blooming of apricot varieties

Year	Ceglédi óriás		Ligeti óriás		Szegedi mammut.		Nagykőrösi óriás		Magyar kajszi C-235		Gönci magyar k. C-174		Gönci magyar k. C-634		Ceglédi bíborkajszi	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1980	Apr.15	–1	Apr15	–1	Apr.15	–1	Apr.15	–1	Apr.16	–	Apr.16	–	Apr.16	–	Apr.17	+1
1981	Mar.30	–1	Mar30	–1	Mar.30	–1	Mar.30	–1	Mar.31	–	Mar.30	–1	Apr.1	+1	Mar.31	0
1982	Apr.10	–4	Apr12	–2	Apr.10	–4	Apr.10	–4	Apr.14	–	Apr.14	0	Apr.14	0	Apr.14	0
1983	Mar.31	–1	–	–	Mar.31	–1	Mar.30	–2	Apr.1	–	Apr.1	0	–	–	Apr.1	0
1984	Apr.7	–2	Apr.9	0	Apr.7	–2	Apr.7	–2	Apr.9	–	Apr.9	0	Apr.9	0	Apr.10	+1
1985	Apr.12	–1	Apr12	–1	Apr.12	+1	Apr.12	–1	Apr.13	–	Apr.13	0	Apr.13	0	Apr.13	0
1986	Apr.10	+1	Apr.9	0	Apr.9	0	Apr.9	0	Apr.9	–	Apr.9	0	Apr.9	0	Apr.10	+1
1987	Apr.21	–3	Apr24	0	Apr.23	–1	Apr.23	–1	Apr.24	–	Apr.23	–1	Apr.23	–1	Apr.21	-3
1988	Apr.6	+1	Apr.5	–1	Apr.5	0	Apr.4	–1	Apr.5	–	Apr.6	+1	Apr.6	+1	Apr.6	+1
1989	Mar.26	–2	Mar26	–2	Mar.27	–1	Mar.26	–2	Mar.28	–	Mar.28	0	Mar28	0	Mar.28	0
1990	Mar.17	–2	–	–	Mar.17	–2	Mar.15	–4	Mar.19	–	Mar.19	0	Mar19	0	Mar.17	–2
1991	Apr.6	–1	–	–	Apr.6	–1	Apr.5	–2	Apr.7	–	Apr.6	–1	Apr.6	–1	Apr.7	0
mean		–1.3		–0.9		–1.2		–1.75		–		–0.16		0		–0.08

A = Date of blooming B = Days to the blooming of Magyar kajszi C-235

"óriás" group it was 3 days at most (1987). Comparing all years, we can state that that the *Magyar kajszi* group was much more uniform in blooming time (in 6 years out of 11 they started on the same day) than the varieties of the "óriás" group. Varieties of the latter group started in relation to *Magyar kajszi C-235* earlier, i.e. by -4 to +1 days in *Ceglédi óriás*, 0 to -4 days in *Szegedi mammut* and *Nagykőrösi óriás*, 0 to -2 in *Ligeti óriás*.

In respect of blooming time, *Ligeti óriás* differed most from the other three óriás varieties on the average of years.

The *Magyar kajszi* group showed a much more uniform picture.

Blooming time as a mean of many (at least 10) years may be useful to state genetic relations between the varieties. The bulk of data at hand allowed an analysis of the start of blooming, time of the main blooming and their coincidences and deviations over varieties and years. There was also opportunity to describe the mean phenogram of the blooming process characteristic for the varieties.

The difference between the mean time of blooming was relatively small (1.75), thus we can distinguish two groups of blooming time, only. The "óriás" types belong to the early, the *Magyar kajszi* types to the medium group. The late blooming group comprises only two varieties of the assortment grown in Hungary: *Mandulakajszi* and *Bergeron*.

3.2. Date of maturity

The dynamics of ripening varied on a much more extended scale than the blooming date between as well as within the two group of varieties. The interval of extremes within the group was 8 days in the "óriás" group, whereas 9 days in the *Magyar kajszi* group. The time of maturity depends on great many factors. One of those is the fruit load of the tree. The difference in maturity may attend 10 days between trees of the same variety with a heavy or, alternatively, with a light fruit load. The effect of fruit load on the ripening process was especially conspicuous in 1980. Varieties of generally earlier maturity (*Ceglédi óriás, Nagykőrösi óriás, Ceglédi bíborkajszi*) started ripening later by 2–3 days if they bore higher yields than *Magyar kajszi C-235*.

The variety *Ligeti óriás* is distinct from the rest of the group also in the date of maturity. The high variability of ripening dates it is less suitable for tracing genetic relations between the varieties.

3.3. Leaf characters

In general, this is a good character for distinguishing fruit varieties. Data presented in *Table 2* are for orientation. The data are means of at least 10 measurements. The intra-varietal variability of measures and the relatively low number of samples does not allow wide reaching conclusions.

Table 2 Leaf measurements of apricot varieties (Cegléd, 1995) (mm)

Variety	Length of the leaf blade	Width of the leaf blade	Length/Width ratio	Length of the petiole
Ceglédi óriás	96.8	80.5	1.20	52.8
Ligeti óriás	96.8	86.2	1.12	55.2
Szegedi mammut	80.7	68.4	1.18	37.8
Magyar kajszi C-235	94.2	80.8	1.17	50.2
Gönci magyar kajszi C-694	90.8	80.2	1.13	50.2
Ceglédi bíborkajszi	91.6	75.1	1.22	45.2

The morphology of the leaf (the edge of leaf blade, distribution of glands) are identical within the variety-group. The dentition of the leaf edge is blunt, and the glands are located on the petiole in the "óriás" group. The dentition of the leaf edge is more rough (though also blunt), and the glands are often almost entering the leaf blade on the uppermost section of the petiole as typical to the *Magyar kajszi* group. *Ceglédi bíborkajszi*, on the other hand, has less blunt dentition on the edge of leaf blade.

The morphological traits are more reliable in diagnostics whereas measurements need much more replications.

3.4. Fruit characters

As the most important traits of a fruit variety, fruit characters are also subject to environmental effects of the growing site and the technology, but they are highly stable in many other respects. The mass and measures of individual fruits are comparable only if conditions of cultivation and the fruit load of the trees were nearly equal.

Fruit load may change the mass but also the shape of the fruit. The year 1985 was a "fallow" year, and the fruits were much more round than in other three years. The length (height) and the diameter parallel to the suture are more stable values than the diameter in a rectangle to the plane of suture. Fruits of *Ligeti óriás* are more elongated than that of the other members of the variety group.

The same is true for values of the fruit mass. In 1985 mass values approached to the possible maximum of the varieties. Values are less variable within the variety group of *Magyar kajszi* than within the "óriás" group. *Ligeti óriás* has a smaller fruit mass than the other varieties of the group.

Measures and shape index of the fruit stone are stable traits within the group of varieties, whereas differ substantially between the groups. The "óriás" varieties have longer and more slender stones, smaller related to the fruit mass, than those of the group of *Magyar kajszi*. Thus the fruit stones are distinctive between the groups but similar within the groups.

The dynamics of fruit mass during the ripening process are less suitable for the distinction of varieties because of their quick changes. Perhaps data of many years and replications may help. Similarly, soluble solids, sugars and acids are more variable over years than over varieties (*Table 3*). The difference between variety groups is not distinctive either. Some values are definitely more related to fruit load and stage of maturity.

High soluble solids and sugars are typical for the "fallow" years (1982, 1986) and for the small fruits, whereas low soluble solids are associated with heavy yields (1989, 1990).

Table 3 Chemical composition of apricot fruits (A = soluble solids %, B = sugars %, C = acids %)

Variety	compnent	1982	1983	1985	1986	1989	1990	1991	Mean
Ceglédi óriás	A	18.28	16.81	15.91	15.87	13.79		12.32	15.50
	B	–	–	10.96	12.27	10.86		8.23	10.58
	C	1.30	0.91	1.70	1.20	1.02		0.87	1.17
Ligeti óriás	A	15.13			16.37	13.82			15.11
	B	–			12.41	10.26			11.34
	C	1.50			1.35	0.81			1.22
Szegedi mammut	A	15.88		16.11	17.04	16.81		14.79	20.16
	B	–		11.44	13.11	12.51		10.86	11.98
	C	1.39		1.67	1.14	1.02		0.94	1.22
Nagykőrösi óriás	A	15.06		16.71	16.97	16.41	15.78	12.52	15.58
	B	–		11.35	13.25	12.41	11.68	8.32	11.40
	C	1.50		1.80	1.16	1.05	0.99	0.83	1.22
Magyar kajszi C-235	A	14.63		16.91	15.97	13.19	14.86	13.29	14.81
	B	–		11.53	11.56	9.89	10.12	9.54	10.53
	C	1.60		1.80	1.12	1.16	1.28	1.02	1.33
Gönci magyar kajszi C-174	A	16.55		17.61	18.47	13.99	14.46	13.19	15.93
	B	–		12.36	13.63	10.30	9.80	8.88	10.99
	C	1.84		1.79	1.44	1.18	1.44	0.95	1.44
Gönci magyar kajszi C-694	A	15.95		17.61	14.92	14.59	13.46	13.19	14.95
	B	–		12.14	11.37	10.90	9.38	9.17	10.59
	C	1.78		1.51	1.22	1.22	1.31	1.07	1.35
Ceglédi bíbor-kajszi	A	15.26	13.99	16.81	17.17	13.59		13.39	15.04
	B	–	–	12.57	12.88	10.53		9.49	11.37
	C	1.57	0.92	1.58	1.35	0.90		0.80	1.19

Table 4 Fruit set (%) of apricot varieties depending on conditions of pollination (Kecskemét, 1989–1991)

Polliniser Maternal variety	year	Ceglédi óriás	Nagykőrösi óriás	Szegedi mammut	Gönci magyar kajszi	Open pollination
Ceglédi óriás	1989		0	0	62.2	19.4
	1990		0	1.5	2.2	6.3
	1991		0	–	–	5.2
Nagykőrösi óriás	1989	0		1.4	–	–
	1990	1.0		0	–	10.9
	1991	0				
Szegedi mammut	1989	0	0		–	–
	1990	0	0		3.2	5.0
Gönci magyar kajszi	1990	14.6	10.7	37.3	–	47.7

3.5. Fertilisation

Artificial self pollination produced 17 fruit sets out of 4669 attempts made during the 10 years in *Ceglédi óriás*, i.e. the rate is 0.004%. This is coincident with the experiences collected on other sites. The fruit set under open pollination was variable between 0 and 48%. The self-sterile *Ceglédi óriás* is a good yielder at appropriate pollination.

Varieties of the "óriás" group should be pollinated by other varieties from outside the group. The mutual sterility of the "óriás" varieties is proved in an earlier paper (*Table 4*). All the four varieties belong to the same group of self-sterility, supposedly.

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