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Nine Hungarian almond cultivars in the Republic of Macedonia

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SUMMARY - Since the fall 1986 in the region of Skopje at an altitude of 240 and 600 m nine Hungarian cultivars of almond trees have been planted. As control-standard cultivars Nonpareil and Ferragnes were used. Regular phenological observation, resistance, yield and quality of fruits are here studied. Hungarian cultivars of almond are distinguished by an early and moderate blooming which is about one week before Nonpareil and two weeks before Ferragnes. Besides, the early blooming cultivars of Tetenyi record and Szigetcsépi 92, are distinguished by a resistance to spring frosts. With winter frosts of -25°C (January 7, 1993) the most resistant was Tetenyi kemenheju with 11% of frozen flower buds. Most of the Hungarian almond cultivars, ripe early, before Ferragnes, and later (October) with ripening is Szigetcsépi 55. With regular and abundant production in both localities there are cultivar T. record (1460 kg/ha), T. kedvenc (1060 kg/ha) and T. kemenheju (698 kg/ha kernels). According to fruitfulness, resistance to frosts, early ripening and quality of fruits, these cultivars are considered not only for the breeding but for the production of the commercial orchards on the hilly and colder regions also.

Key words: Almond, varieties, environmental conditions.

RESUME - "Neuf cultivars hongrois d'amandier dans la République de Macédoine". Depuis l'automne 1986 dans la région de Skopje à une altitude de 240 et 600 m neuf cultivars hongrois d'amandier ont été plantés. On a utilisé comme témoins standard Nonpareil et Ferragnes. On a fait des observations régulières pour la phénologie, ainsi que pour la résistance, le rendement et la qualité des fruits. Les amandiers de type hongrois se distinguent par une floraison précoce et modérée qui vient environ une semaine plus tôt que pour Nonpareil et deux semaines plus tôt que pour Ferragnes. En outre, les types à floraison précoce, Tetenyi record et Szigetcsépi 92, se distinguent par une résistance aux gelées de printemps. Pendant une gelée d'hiver à -25°C (7 janvier 1993) le plus résistant a été Tetenyi kemenheju avec 11% de bourgeons floraux gelés. La plupart des types d'amandier hongrois, mûrissent précocement, avant Ferragnes, et le dernier (octobre) à fleurir est Szigetcsépi 55. Avec une production régulière et abondante dans les deux localités, nous avons les cultivars T. record (1 460 kg/ha), T. kedvenc (1 060 kg/ha) et T. kemenheju (698 kg/ha de noix d'amandes). En raison de la productivité, de la résistance aux gelées, de la récolte précoce et de la qualité des fruits, ces types sont à considérer non seulement pour la sélection mais aussi pour les vergers commerciaux des régions montagneuses plus froides.

Mots-clés : Amandier, variétés, conditions environnementales.

Introduction

The almond in Macedonia is performing an old and a traditional fruit kind which is propagating through the seed, without grafting.

In recent twenty years through Faculty of Agriculture and Institute of Fruit Growing- Skopje have been started with a selection of autonomous types of almond trees and introduction of perspective cultivars, and up to now are collected over hundred cultivars which are studying in the Institute of fruit production- Skopje and other characteristic regions in Republic of Macedonia and from the best cultivars are raising commercial orchards, without irrigation.

Under conditions of the continental and arid climate in the selection we look to the resistance on the low temperatures and drought, fruitfulness and quality of fruits. In this paper will be present such investigations on nine Hungarian cultivars of almond.

Material and methods

Since the summer 1985 from the Horticulture Institute of Kecskemet, Hungary have been introduced scions of nine cultivars of almond (Tetenyi kedvenc, Tetenyi record, Tetenyi kemenheju, Tetenyi botermo, Budatetenyi 1, Budatetenyi 70, Szigetcepi 55, Szigetcepi 92, H-2/7). On fall 1986 were planted two experimental orchards in the region of Skopje. One of them was on the altitude of 240 m and another on the hilly terrain with an altitude of 600 m. On two experimental orchards is performing a clean cultivation. The distance of planting of the first plantage is 4.5 x 3.5 m (635 trees per hectare), while in the second it is 5 x 4 m (500 trees per hectare). Like a control-standard cultivars were used Nonpareil and Ferragnes.

From the fourth year when is started fruitfulling, regularly are doing phenological observation, fruit selting and its falling, resistance to the winter and spring frosts, resistance to drought, diseases, pests, measurements of yield and quality of fruits.

At this studying of cultivars was used the method of Monastra (1982), Almond descriptors (Gülcan, 1985), Barbara *at al.* (1987).

Results and discussion

Blooming of fruit trees

Hungarian cultivars of almond are distinguishing with a very early to the blooming. The earliest is Szigetcepi 55 (from 23 March to 4 April) and the latest is Szigetcepi 92 (from 29 March to 9 April), together with the cultivar Nonpareil (Fig. 1). Early blooming cultivars are exposed on the higher risk to spring frosts like it was since 1992. But it has some privilege because fruits are forming earlier till the moisture in the soil.

CULTIVAR	MARCH					APRIL									Pick 1990/92	
	22	24	26	28	30	1	3	5	7	9	11	13	15	17		19
1. Szigetcepi 55				x												4. X
2. Budatetenyi 1					x											4. IX
3. Budatetenyi 70					x											17. IX
4. Tetenyi kedvenc					x											10. IX
5. Tetenyi record						x										21. IX
6. Tetenyi kemenheju						x										7. IX
7. Tetenyi botermo						x										7. IX
8. H - 2/7							x									25. IX
9. Szigetcepi 92								x								14. IX
10. Nonpareil									x							29. VIII

Fig. 1. Blooming and picking of almonds in Skopje region at 240 m altitude (average 1990/93).

Blooming of almond trees is not in the same time in all years. Differences in some year are up to 30 days. For instance the cultivar Szigetcepi 55, in 1990 with blooming it started 10 March, while in 1993 on 7 April or for 28 days later (Table 1).

Considerable differences of blooming there are between the first location (240 m, see elevation) and the second (600 m, s. e.). Since 1990 the blooming of almond trees, in the first location was for about 6 days earlier than in the second hilly location, while in 1992, this difference is amounting 12 to 13 days, and until 1993 this difference is only 2 to 3 days.

All these nine Hungarian cultivars are self incompatibility.

Table 1. Blooming and maturing of cultivar Szigetcsépi 55 in the region of Skopje

Year	Blooming			Maturing
	Beginning	Full	End	
1990	10.03	17.03	24.03	20.09
1991	23.03	28.03	3.04	10.10
1992	23.04	27.03	2.04	12.10
1993	7.04	10.04	20.04	
Average	23.03	28.03	4.04	4.10

Harvest maturity

Most Hungarian cultivars of almond are distinguishing with an early maturity before Ferragnes, a few days later maturing Tetenyi record, and latest is Szigetcsépi 55 (October). Early maturity here is a big privilege for an avoiding on the drought, the harvesting, hulling and drying are easier.

In the heat 1990 at the first plantage (240 m see elevation) all cultivars matured from 18 August to 5 September, except Szigetcsépi 55 which matured 20 September. On the hilly location (600 m, s. e.) maturity was several days latter. Since the coldly and rainy 1991, the maturity at all cultivars was 2-3 weeks latter than 1990. On the hilly location Szigetcsépi 55, did not matured even up to the end of vegetation.

Resistance to spring frosts

During 1992 there were two spring frosts, on 30 March -2.5°C and April -2.1°C . Since the first frost, all almond trees were in the phase of blooming, except Ferragnes, while until the second frost, all cultivars were over bloomed (Fig. 2). The first frost occurred the highest damages on the early bloom cultivars, somewhat on the moderate bloom and none at late bloom cultivars. However, the cultivars Tetenyi record, beside sits early blooming showed a big resistance to the early and late spring frost, when the freezing was 21 and 44% only. A similar resistance showing the cultivar Szigetcsépi 92 where the freezing was 28% and 20% (Table 2). Most resistance are standard cultivars Nonpareil and Ferragners where are not noticed any freezing.

Besides, the freezing of blooms and fruits, the frosts are disturb the fertilization, forming and develop of embryos, and occur a massively falling on the fruits after the blooming. Unsuitable weather and the temperature hesitates had there after the blooming especially on 19 May, when the weather immediately become cold and temperature fold below 8°C . On these weather disasters (frosts, cold temperatures) the highest resistance and vitality have shown the cultivar Nonpareil which gave the yield of 2.6 kg per tree. From Hungarian cultivars the most resistant is Tetenyi record and with a yield of 1.1 kg per hectare.

Resistance to winter frosts

The temperature in the region of Skopje fallen -25°C on 5 to 7 January 1993. This frost occur a massively freezing of the flower buds from 11 to 99% (Table 3). The most resistant to the frost, was Hungarian cultivar Tetenyi kemenheju (11% only), and then Nonpareil (42%).

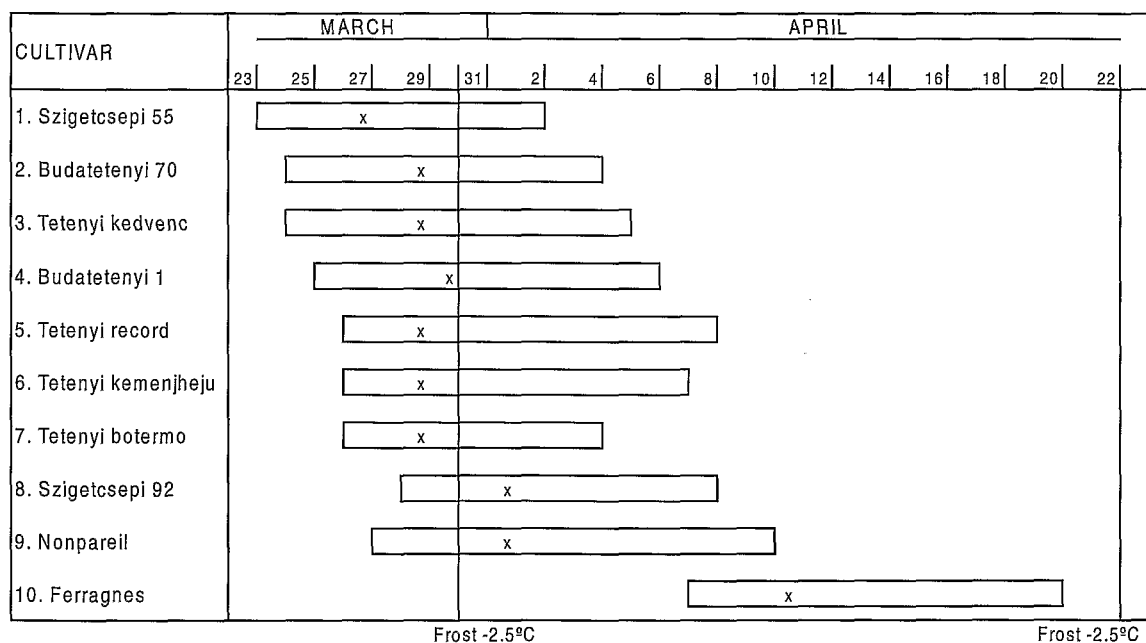


Fig. 2. Blooming of almond and appearance of spring frosts since 1992 in the Skopje region (altitude 240 m).

Table 2. Damages of spring frosts since 1992 in region of Skopje (altitude of 240 m)

Cultivar	Frozen flowers and fruits (%)		Obtained yield (kg/tree)
	On 30 March	On 22 April	
Szigetcepi 55	95	52	0.8
Butatetenyi 70	90	53	0.1
Tetenyi kedvenc	84	36	0.1
Budatetenyi 1	99	44	0.1
Tetenyi record	21	44	1.1
Tetenyi kemenjheju	68	34	0.1
Tetenyi botermo	93	37	0.1
Szigetcepi 92	28	20	0.0
Nonpareil	0	4	2.6
Ferragnes	0	0	0.1

Later on in the phase of awoken up to the blooming was noticed a falling on flowers buds, which been most expressed at ferragnes 94% (Table 3). At the cultivar *Fragulio grande* 68% of flower buds were frozen, while the rest buds flowers, but 100% of them fallen in the phase of the full blooming. From these observations could be statement that consequences from winter frosts are manifesting later on during the growing buds, flowering and falling of fruits, what is noticed of Ristevski (1987).

Besides, the cultivar *Tetenyi kemenjheju* considerable resistance showed cultivars *Tetenyi kedvenc* and *Tetenyi record* which have good flowering and fruit set (Table 3).

Yield of almond trees

The fruitfulling is estimated the yield obtained 1990 and 1991 but not through 1992 when the meteorological conditions were extremely bad during and thereafter flowering.

With regular and high yields at both locations are Tetenyi kedvenc 1060 kg kernels per hectare, Tetenyi record 1460 kg/ha, Tetenyi kemenheju 698 kg/ha (Table 4). The cultivar Ferragnes gave a satisfied yield (1067 kg/ha) is go in the first location. The yield in 1991 is small, because during the flowering weather was cold and rainy. This cultivar is giving also low yields on the hilly terrans where there is not heat enough.

Table 3. Damages of winter frosts from 5 to 7 January 1993 (-25°C) in the region of Skopje (altitude 240 m)

Cultivar	Frozen flower buds (%)	Falling of growing flower buds (%)	Estimation of blooming from 0-5 points	Estimation of fruits set from 0-5 points
Szigetcsépi 55	96	-	0.2	0.1
Budatetenyi 1	99	-	0.1	0.0
Butatetenyi 70	95	-	0.3	0.3
Tetenyi kedvenc	62	15	3.0	1.8
Tetenyi botermo	88	11	0.8	0.3
Tetenyi record	58	12	3.0	1.8
Tetenyi kemenjheju	11	14	4.7	3.5
Szigetcsépi 92	99	-	0.1	0.0
Nonpareil	42	21	3.5	2.0
Ferragnes	82	94	0.1	0.1

Table 4. Average yield of fruits and kernels from both localities (240 m and 600 m altitude) during two years (1990/91)

Cultivar	Fruits (kg)		Kernels (kg)	
	per tree	per ha	per tree	per ha
Tetenyi kedvenc	4.89	2677	1.91	1060
Tetenyi record	5.65	3588	2.30	1460
Tetenyi kemenjheju	4.62	2699	1.20	698
Budatetenyi 1	1.45	817	0.48	268
Butatetenyi 70	1.50	952	0.82	521
Tetenyi botermo	2.86	1584	1.14	632
Szigetcsépi 55	3.08	1708	1.69	943
Szigetcsépi 92	3.76	1954	0.72	375
H-2/7	1.24	620	0.56	280
Ferragnes	2.14	1267	0.74	441

Pomological characteristics of almond fruits

Cultivar Budatetenyi 70 and Szigetcsépi 55, have nondescript length, diminutive fruits with a soft shell and a high percentage (56.97 and 59.52) of kernels (Table 5). Tetenyi kedvenc and Tetenyi record have medium large fruits with a nice shape, semi soft or semi hard and testable kernels. Szigetcsépi 92 has large fruits with a nice external shape, but with a very hard shall and 20% kernels.

Cultivars Tetenyi kedvenc, Tetenyi record, Tetenyi kemenheju and Szigetcsépi 92 easy are picking and hulling what is very important economic characteristics.

Table 5. Mechanical analyses of fruits

Cultivar	Weight (g)		% of kernel	Hardness of shell
	Fruit	Kernel		
Tetenyi kedvenc	2.94	1.27	42.78	Semi soft
Tetenyi record	3.51	1.44	41.03	Semi hard
Tetenyi kemenjheju	3.47	1.13	32.36	Hard
Budatetenyi 1	2.82	1.20	42.55	Semi soft
Butatetenyi 70	1.65	0.94	56.97	Soft
Tetenyi botermo	2.90	1.12	38.62	Semi soft
Szigetcsepi 55	2.10	1.25	59.52	Soft
Szigetcsepi 92	6.40	1.33	20.78	Very hard
H-2/7	2.35	1.07	45.53	Semi soft
Ferragnes	4.02	1.42	35.32	Semi hard

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