Precocious beginning of blossoming and tree decline in apricot cultivar Bergeron

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ABSTRACT: Tree mortality was recorded in a selection orchard of maintenance breeding of cv. Bergeron LE-2 in 1993–2002. The beginning of blossoming was examined in individual trees in the same orchard in 1999–2002. Considering the effect of year, a maximum difference in the average beginning of blossoming was 10 days in the whole set of trees. The beginning of blossoming of individual trees was not identical in the same year. A difference in the onset of phenophase "beginning of blossoming" between early and late blossoming trees was 1–4 days in the particular years. The trees maintained their early or late blossoming for the whole period of evaluation. No tree died in the orchard by 1998. From 1999 to 2002 50% of early blossoming trees died and only 2.38% of late blossoming ones (average of three replications). Two thirds of early blossoming trees died during vegetation, a third died during vegetation rest. No commercially important viroses were proved to be present. It is the reason why viruses could not be a potential cause of the above-mentioned facts. The presence of phytoplasm (ESFY) was confirmed by the method NESTED PCR in one case in a randomly selected early blossoming tree. The test was negative in two randomly selected late blossoming trees from underplanting. The early beginning of blossoming did not influence productivity. Correlations between the beginning of tree blossoming and blossom abundance, or between the beginning of blossoming and productivity, were insignificant ($r = 0.12$ or $r = –0.13$). Even though the causative agent of higher mortality in early blossoming trees was not confirmed unambiguously, it is desirable to select the best individuals only from the group of late blossoming ones during maintenance breeding of cv. Bergeron. These individuals should be used as prebasic material in a certification process and as basic material after prescribed repeated testing.

Keywords: apricot cv. Bergeron; precocious blossoming; decline

Phenotypic expressions of cultivars of the species *P. armeniaca* L. are a result of the effect of different environmental conditions on genotype and of rootstock effect. These factors influence plant metabolism and participate in final characteristics such as tree height, crown habit, productivity, fruit quality, etc. (BOSTAN, ISLAM 1997; SOUTHWICK et al. 1999; SUN-YAN XIANG et al. 2001; MIGNANI, BASSI 2000). Changes in the overground organs (their habit, course of phenophases) can also be caused by pathogenic agents (viruses, phytoplasms, bacteria, fungi). Their attacks can lead to precocious decline of trees (MORVAN 1968; ROZSNAY, KLEMENT 1973; PRUNIER et al. 1999; VACHŮN 2001; NAVRÁTIL 2002). The above-mentioned variability is of non-genetic character. In the course of maintenance breeding variability caused by diseases should be eliminated at first, and individuals representing the cultivar at a standard level should be chosen by individual selection. Clone selection is aimed not only at maintenance but also at improvement of a cultivar by fixation of permanent positive changes based on genetic variability. It is realistic to carry out maintenance breeding and clone selection exclusively in commercially very important varieties because both methods are costly. Bergeron is such a cultivar (MEHLENBACHER et al. 1991; AUDERGON et al. 1995, 1999).

The objective of the paper was to determine and evaluate differences in the onset of phenophase "beginning of blossoming" in individual trees in a ten-year period and to analyze potential causes and relations with precocious decline of trees in a selection orchard with maintenance breeding of apricot cultivar Bergeron LE-2 on generatively propagated rootstock M-LE-1.

MATERIAL AND METHODS

Currently, cv. Bergeron is an important apricot cultivar in the Czech Republic. Its characteristics have been evaluated for a long time in the conditions of this country. This effort resulted in clone LE-2 after many

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provenances of Bergeron imported from France in 1972 (INRA Pont-de-la-May) were tested and after its clone selection (VACHŮN 1972, 2002b). The best clone of Bergeron selected at Lednice was designated LE-2 (NOVOTNÁ 1980; VACHŮN 1985; KUTINA et al. 1991). In 1984 the health status of the best tree among individually evaluated trees of this clone was tested as the initial material for establishment of a stoolbed for scion production. Bergeron LE-2 was included in State Variety Tests in the same year. After evaluations in the Central Institute for Supervising and Testing in Agriculture certification of a new cultivar under the name Bergeron clone LE-2 was issued by the Ministry of Agriculture of the CR in 1996.

An experimental orchard of Bergeron LE-2, evaluated in this paper, was planted on the medium-texture loamy-sandy soil with pH 6.8 in spring 1993 on a demonstration and experimental plot of the Institute of Fruit-tree Growing and Viticulture of the Faculty of Horticulture at MUAF at Lednice. Registered rootstock cultivar M-LE-1 (*Prunus armeniaca* L.) was used as a rootstock. It is an allogamous generatively propagated rootstock of sizeable height and higher homogeneity in seedbed than in other registered rootstocks such as M-VA-1, M-VA-2 and M-VA-3 (VACHŮN 1986). Fifty trees of cv. Bergeron LE-2 were planted in total. Their form was a bush tree (stem height 0.7 m) with hollow crown. This planting was a selection orchard for maintenance breeding. Eight trees that failed to survive were underplanted by the same cultivar in autumn of the same year. Hence underplanted trees were a year younger than the other trees. It was decided to evaluate 42 trees only that grew since spring 1993 in order to exclude the effect of tree age on growth and productivity. But the blossom phenophase and health checks were also evaluated in underplanted trees as complementary observations. An experimental plot was a long parcel with three replications by 14 trees. Black fallow was maintained in this orchard, and drip irrigation and fertilization on the basis of soil analyses were used.

Symptomatic checks of the health status of trees aimed at the occurrence of viroses and chlorotic leaf roll were carried out since the orchard establishment. Tree mortality was recorded every year at the beginning and end of vegetation. Mortality was understood as a decline of the whole plant, not as a partial decline (decline of a crown part). Different blossom time of some trees was observed for the first time in 1999. Since that year the date of the phenophase "beginning of blossoming" was regularly recorded in the particular trees. It is not known whether there were any differences in the blossom phenophase before 1999. Trees were always evaluated by the same worker according to methodology described by VACHŮN et al. (1995).

In 2002 all trees were tested for the presence of commercially important viroses by DAS ELISA technique. Samples were taken according to methodology described by KAREŠOVÁ (1993). The tested leaf samples (blossom samples in assays for *Plum pox virus*) were proved not to contain any commercially important virus (ACLSV – *Apple chlorotic leaf spot virus*, ApMV – *Apple mosaic virus*, PPV – *Plum pox virus*, PNRSV – *Prunus necrotic ringspot virus*, PDV – *Prune dwarf virus*). A molecular biological technique NESTED PCR (ZHANG et al. 1998; LORENZ et al. 1995; NAVRÁTIL 2002; RICHTER, HASLINGER 2002) was employed in a test for phytoplasms (ESFY – European Stone Fruit Yellows). The test was performed in a randomly chosen

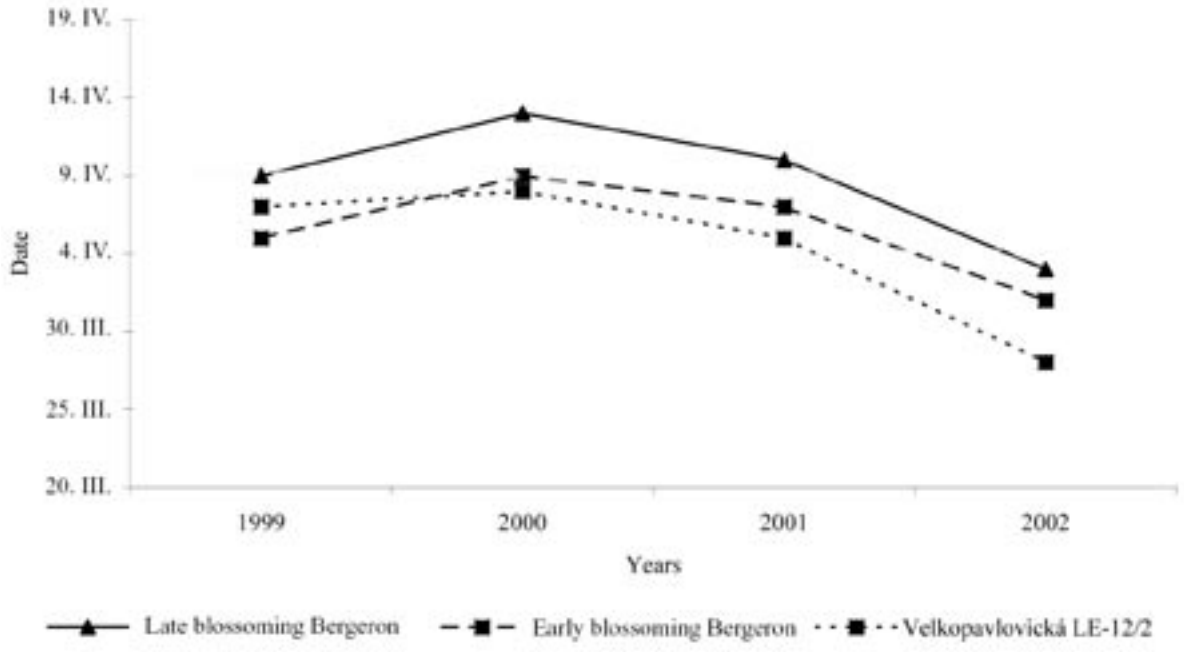

Fig. 1. Average date of the onset of phenophase "beginning of blossoming" in early and late blossoming group of trees of cv. Bergeron LE-2 and control cv. Velkopavlovická LE-12/2

Table 1. Beginning of blossoming in particular trees of cv. Bergeron LE-2 in 1999–2002

Tree No. (locally)	Replication	Date of blossom beginning in			
		1999	2000	2001	2002
1*	I	5. 4.	10. 4.	7. 4.	×
2**		9. 4. J	13. 4. J	11. 4. J	4. 4. J
3*	I	5. 4.	10. 4.	7. 4.	×
4*	I	5. 4.	10. 4.	8. 4.	2. 4.
5*	I	5. 4.	10. 4.	8. 4.	3. 4.
6*	I	5. 4.	×	×	×
7*	I	5. 4.	×	×	×
8**	I	9. 4.	12. 4.	9. 4.	3. 4.
9*	I	5. 4.	×	×	×
10*	I	5. 4.	11. 4.	8. 4.	3. 4.
11*	I	5. 4.	×	×	×
12**	I	9. 4.	12. 4.	9. 4.	3. 4.
13**		9. 4. J	13. 4. J	7. 4. J	4. 4. J
14**	I	9. 4.	13. 4.	9. 4.	3. 4.
15*	I	5. 4.	10. 4.	7. 4.	3. 4.
16*	I	×	×	×	×
17**		9. 4. J	14. 4. J	8. 4. J	4. 4. J
18**		9. 4. J	13. 4. J	8. 4. J	4. 4. J
19*	II	5. 4.	10. 4.	6. 4.	×
20*	II	5. 4.	9. 4.	6. 4.	2. 4.
21**	II	9. 4.	13. 4.	9. 4.	3. 4.
22*	II	5. 4.	9. 4.	7. 4.	31. 3.
23*	II	5. 4.	10. 4.	7. 4.	×
24**	II	9. 4.	13. 4.	9. 4.	3. 4.
25*	II	5. 4.	9. 4.	×	×
26*	II	5. 4.	9. 4.	×	×
27**	II	9. 4.	13. 4.	10. 4.	3. 4.
28**	II	9. 4.	13. 4.	10. 4.	2. 4.
29*	II	5. 4.	9. 4.	×	×
30**	II	9. 4.	13. 4.	10. 4.	×
31*	II	5. 4.	10. 4.	×	×
32*	II	5. 4.	9. 4.	9. 4.	×
33*	III	5. 4.	9. 4.	6. 4.	31. 3.
34*	III	5. 4.	×	×	×
35*	III	5. 4.	9. 4.	6. 4.	31. 3.
36**	III	9. 4.	14. 4.	10. 4.	3. 4.
37**	III	9. 4.	10. 4.	9. 4.	3. 4.
38*	III	5. 4.	9. 4.	6. 4.	31. 3.
39*	III	5. 4.	×	×	×
40*	III	5. 4.	×	×	×
41**	III	9. 4.	11. 4.	10. 4.	3. 4.
42**	III	9. 4.	13. 4.	10. 4.	3. 4.
43*	III	5. 4.	9. 4.	6. 4.	31. 3.
44**		9. 4. J	11. 4. J	9. 4. J	4. 4. J
45*	III	5. 4.	9. 4.	6. 4.	31. 3.
46**	III	9. 4.	14. 4.	10. 4.	3. 4.
47*	III	5. 4.	9. 4.	6. 4.	×
48**		9. 4. J	11. 4. J	9. 4. J	3. 4. J
49**		9. 4. J	11. 4. J	9. 4. J	4. 4. J
50**		9. 4. J	11. 4. J	9. 4. J	4. 4. J

*early blossoming tree, **late blossoming tree, × – decline as to the beginning of blossoming, J – complementary evaluation of underplanted trees, I, II, III – trees included in replications

Table 2. Cumulative mortality of trees over 10 years (1993–2002) in cv. Bergeron LE-2 evaluated at the end of vegetation in 2002, specified for replications in the groups of trees with different blossom time

Total tree number in experiment	Tree number per replication	Tree mortality by 2002 in groups by replications and blossom time (tree number)		Tree mortality by 2002 in groups by replications and blossom time (%)	
		*	**	*	**
42	14	8	0	57.14	0.00
	14	7	1	50.00	7.14
	14	6	0	42.86	0.00
Total	42	21	1		
Average	14	7.00	0.33	50.00	2.38

*early blossoming tree, **late blossoming tree

tree from the group of early blossoming trees and on two trees from among the late blossoming underplanted trees. The presence of bacteria (*Pseudomonas syringae*, etc.) was not examined. Current statistical methods were used for the statistical analysis of data.

RESULTS AND DISCUSSION

The phenophase "beginning of blossoming" occurred in cv. Bergeron LE-2 in the first half of April during the four-year period of evaluation 1999–2002. An average date of the beginning of blossoming in the evaluated set of trees was different in particular years, and in general it was related to the onset of vegetation in the year concerned. Since the entry into productivity period there existed some differences in the beginning of blossoming of trees within the same year. The date of phenophase "beginning of blossoming" was recorded individually since 1999 (Table 1). Trees coming into blossom early in the first year of evaluation were found to blossom earlier also in the other years of the four-year period. Late blossoming trees started blossoming on later dates in the other years of the period of observations. A difference in the beginning of blossoming between early blossoming and late blossoming trees in the same year was minimally one day and maximally four days. Control cultivar Velkopavlovická LE-12/2 came into blossom in the evaluated period before the early blossoming group of cv. Bergeron trees except in 1999 (Fig. 1). Differences in the beginning of picking maturity of particular trees were smaller than those in the beginning of blossoming of these trees. Fruits were picked from all trees on the same date in the particular years of the evaluated period. No significant correlations ($r = 0.12$ and $r = –0.13$) were determined between the beginning of blossoming (days in April), blossom abundance (scores) and productivity (kg of fruits per tree).

The health status of trees was very good in the first six years after planting, and no symptoms of health worsening were observed (e.g. changes in leaf color and form). The first tree died as late as in 1999, i.e. in the seventh year after planting. Tree mortality significantly increased since 2000. Symptoms of leaf yellowing were detected on three trees (trees Nos. 29, 32 and 33). Two

Table 3. Average cumulative mortality from replications, evaluated at the end of vegetation in the year concerned, expressed in % for the early blossoming group of trees of cv. Bergeron LE-2 in 1993–2002

Replication	Mortality (%)									
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
I.	0.00	0.00	0.00	0.00	0.00	0.00	35.71	35.71	50.00	57.14
II.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.29	50.00	50.00
III.	0.00	0.00	0.00	0.00	0.00	0.00	14.29	21.43	21.43	42.86
Average	0.00	0.00	0.00	0.00	0.00	0.00	16.67	23.81	40.48	50.00

Table 4. Average cumulative mortality from replications, evaluated at the end of vegetation in the year concerned, expressed in % for the late blossoming group of trees of cv. Bergeron LE-2 in 1993–2002

Replication	Mortality (%)									
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
I.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
II.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.14	7.14
III.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.38	2.38

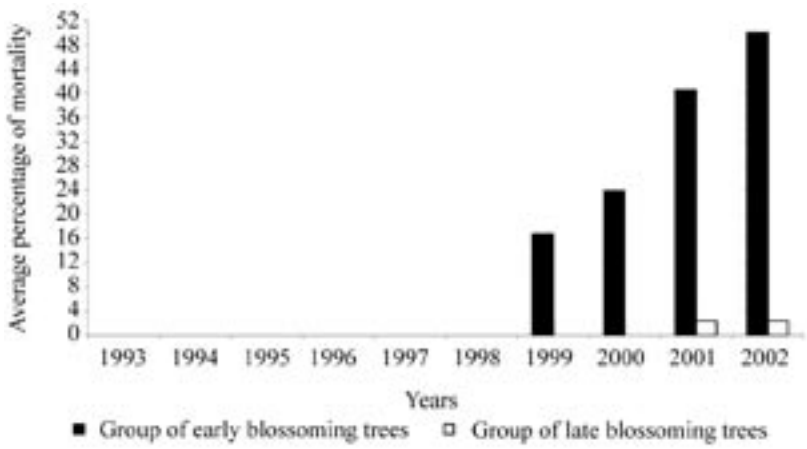

Fig. 2. Cumulative mortality of early and late blossoming group of trees of cv. Bergeron LE-2 in 1993–2002, recorded at the end of vegetation and expressed as average percentage of mortality from three replications

of them died (tree No. 29 in 2001 and tree No. 32 in 2002). One tree has survived until now (tree No. 33) and moreover, it did not display any symptoms of leaf yellowing in 2002.

Actual tree mortality was recorded every year in the blossom time and at the end of vegetation. Dead trees were distributed randomly on the whole area of the evaluated orchard. A remarkable finding is that only trees from the group of early blossoming ones died. The first tree, and the only one until now, from the group of late blossoming trees died as late as at the end of vegetation in 2001.

Throughout the ten years (from 1993 to 2002) a total of 22 trees died, i.e. 52.39%. Out of them, 21 trees (95.45%) were from the group of early blossoming trees and only one tree was from the group of late blossoming ones. Average cumulative mortality, calculated as average percentage of dead trees in replications, was 50.00% in the early blossoming group of trees and 2.38% in the late blossoming group of trees (Table 2). An annual increase in mortality in the early blossoming group of trees was significant (calculated F 4.62 and critical F 4.07 – significance was calculated from mortality in replications). Total mortality over the ten years was highly significantly higher in the early blossoming group of trees than in the group of late blossoming trees (calculated F 72.00 and critical F 18.51 – significance was calculated from mortality in replications – Tables 3 and 4 and Fig. 2).

As mortality was recorded on two dates every year, it could be evaluated for a period from end of vegetation to beginning of blossoming and from beginning of blossoming to end of vegetation. This evaluation naturally applies to the group of early blossoming trees because only one tree died from among late blossoming trees by 2002. From the group of 29 early blossoming trees 56.17% of trees died during vegetation, and 17.24% of trees during vegetation rest (Table 5 and Fig. 3). Fig. 4 shows cumulative mortality on the particular dates of evaluation in the year concerned.

Considering the fact that all evaluated trees of cv. Bergeron originated from a mother tree of one clone, there arises a question why all evaluated trees do not blossom in the same time. As every tree consists of two components – rootstock and cultivar, the two components could theoretically be a source of effect on blossom time. It is not possible to exclude a certain effect of generatively propagated rootstock, but it is little probable because the rootstock was selected for progeny homogeneity (VACHŮN 1986). In the other component, i.e. budded cultivar, there can be two causes of differences in blossom time: genetic and pathological ones. As for genetic causes, after long-term growing and evaluation in other countries (France) cv. Bergeron expressed itself as a cultivar with disposition to somaclonal mutations. These anomalies can be adjusted by clone selection. It is to admit theoretically that changes of this type occurred in the evaluated orchard. But it is hardly probable that two groups of trees with significantly different time of blossoming would be formed in this way. If it were so, another fact would be unexplained: high mortality of early blossoming trees of cv. Bergeron. All trees (with

Table 5. New mortality in particular years and periods in the group of early blossoming trees, expressed as tree number and percentage of the initial tree number (29 trees = 100%)

Year	Mortality (tree number)		Mortality (%)	
	from leaf fall to blossom	from blossom to leaf fall	from leaf fall to blossom	from blossom to leaf fall
1999	1	6	3.45	20.69
2000	1	2	3.45	6.90
2001	2	5	6.90	17.24
2002	1	3	3.45	10.34
1999–2002	5	16	17.25	55.17

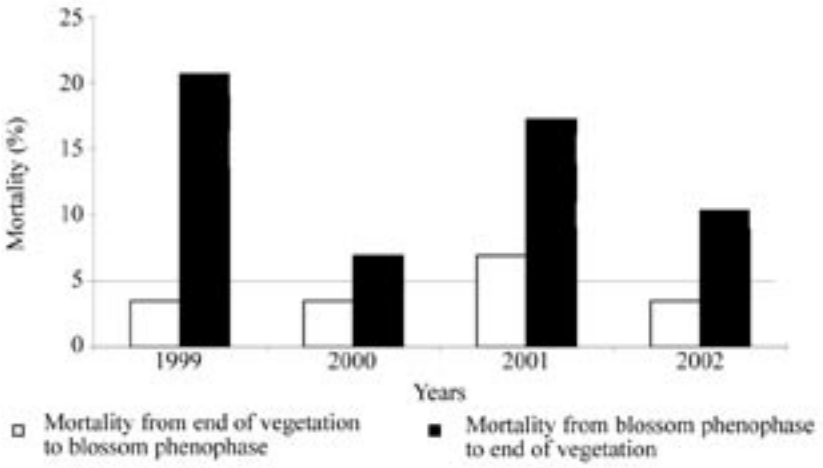

Fig. 3. New mortality in the group of early blossoming trees of cv. Bergeron LE-2, evaluated in two periods of the year. Expressed as % of the original number 29 trees

one exception) that died throughout 10 years were from the early blossoming group. It could be explained on a pathological basis. Different dates of blossoming could underlie uneven infection of blossoms by *Monilinia* sp. and higher occurrence of *Monilinia* blight could cause tree debilitation and their easier decline. No such differences were observed in the evaluated period.

The existence of different blossom time could be of pathological origin. Some pathogens can disturb the normal metabolism of trees, and consequently the course of phenophases. E.g. Apricot chlorotic leaf roll (ECA – enroulement chlorotique) causes precocious bud break (débourrement précoce) (MORVAN 1968; MORVAN, CASTELAIN 1969). In the conditions of southern France it is from leaf fall to beginning of normal vegetation. In mild winters vegetative buds of sensitive cultivars (e.g. Rouge de Roussillon) infected by ECA break dormancy precociously and form short annual shoots with chlorotic rolled leaves. This type of precocious break of vegetative buds has not been recorded in the CR. It is however possible that this process is expressed by earlier blossoming in the climatic conditions of this country: it could be related to a different course of dormancy or to other strains of the pathogen. In the CR conditions it could be phytoplasms from the group of Central European stone fruit yellows (ESFY). It is not probable in our specific case that scions were a source of infection because all scions came from one mother tree without pathological symptoms of chlorotic leaf roll (ESFY was not assayed by Nested PCR at that time). If ESFY was transmitted directly in the orchard by a vector (*Cacopsylla pruni*, *Fiebriella florii*, NAVRÁTIL 2002), an infected tree in adjacent orchards where the ESFY scarce presence was proved could be a source of infection. It could also be evidenced by random distribution of early blossoming trees on the experimental plot. In addition, the ESFY presence was demonstrated in 2002 by a control test in one randomly chosen early blossoming tree Bergeron No. 38. In case there is any relationship between ESFY presence and blossom earliness, we must ask a question why the number of early blossoming trees of Bergeron did not increase in the evaluated period when they could themselves be new sources of infection. Neither was it so in eight underplanted trees that belonged to the later blossoming group by their blossom time. A laboratory PCR test carried out in two underplanted trees (Nos. 17 and 18) was negative.

The cause of pathogen presence in the Bergeron orchard could possibly be explained by the fact that the mother tree was infected by ESFY partially when summer scions were taken, but without external manifestations on leaves, in productivity and fruit quality. It has

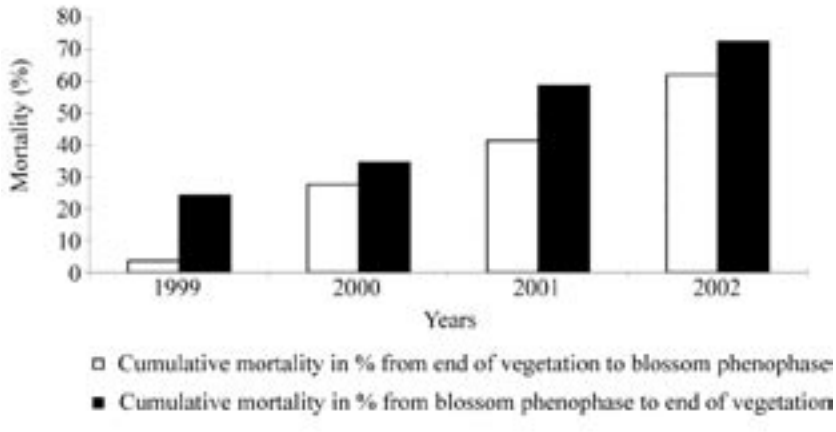

Fig. 4. Cumulative mortality in the group of early blossoming trees of cv. Bergeron LE-2 in 1999–2002, evaluated in two periods of the year. Expressed as % of the original number 29 trees

not been explained either why a sudden decline in the selection orchard occurred without any symptoms of leaf yellowing. These trees gave high individual yields until their decline without any influence on fruit quality. It could be associated with different sensitivity of the genotype to the pathogen or with different manifestation of the pathogen just in cv. Bergeron. The effects of other biotic and abiotic factors (*Bacterium syringae* pv. *syringae*, *Monilinia* sp., *Leucostoma cincta*, heavy frosts and especially temperature fluctuations) cannot be excluded either. These factors can be a cause of precocious decline of apricot trees either separately or synergistically. Hence it is not possible to identify ESFY unambiguously as the only cause of decline taking into account the present knowledge and extent of testing of the health status in evaluated trees of cv. Bergeron. It is also suggested by a finding that the percentage of annual mortality in apricot orchards remains in the same range from 1 to 5% per annum in comparable conditions of the CR and Europe (VACHŮN 1972, 2001). Under these circumstances the evaluation of cultivars in the CR conditions shows that Bergeron is a cultivar with relatively lower tree mortality (VACHŮN 2002a). Even though the effect of early or late blossoming on blossom abundance or tree productivity was not proved, a practical outcome of this research is that in cv. Bergeron (when selecting plants for the production of prebasic and basic material as the stock for establishment of scion stoolbeds within a certification process) it is necessary to use the best late blossoming individuals because their lower mortality was proved. It is desirable to continue examining tree decline in the experimental orchard in the years to come, to include other pathogens in these examinations and to test other trees of Bergeron LE-2 for ESFY presence.

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References

AUDERGON J.M., DUFILLOL J.M., GILLES F., SIGNORAT V., 1995. Apricot selection in France: 9 new apricot cultivars for French growers. Tenth Intern. Symp. on Apricot Culture, Izmir, Turkey, 20.–24. 9. 1993. Acta Hort., *384*: 237–244.

AUDERGON J.M., CHAUFFOUR D., CLAUZELG., DUFILLOL J.M. et al., 1999. Apricot breeding in France: 2 new apricot selections for French growers. Proc. of the XIth Int. Symp. on Apricot Culture, 25–30 May 1997, Veria-Makedonia, Greece. Acta Hort., *488*, *II*.: 143–147.

BOSTAN S.Z., ISLAM A., 1997. Cultivation of nursery trees of promising wild apricot forms. Ondokuzmayis Universitesi, Dergisi, *12*: 81–91.

KAREŠOVÁ R., 1993. Stanovitelnost viru šarky švestky v pozitivních stromech slivoní metodou ELISA. Věd. Práce Ovocn., Holovousy, VŠÚO, *1*: 33–49.

KUTINA J., BARBORKA A., CVOPA J. et al., 1991. Pomologický atlas 1. Praha, Brázda: 287.

LORENZ K.H., SCHNEIDER B., AHRENS U., SEEMULLER E., 1995. Detection of the apple proliferation and pear decline phytoplasmas by PCR amplification of ribosomal and nonribosomal DNA. Phytopatol., *85*: 771–776.

MEHLENBACHER S.A., COCIU V., HOUGH L.F., 1991. Apricots (*Prunus*), Chapter 2. In: Genetic Resources of Temperate Fruit and Nut Crops. Acta Hort., Tech. Com. of ISHS, *290-II*.: 65–107.

MIGNANI I., BASSI D., 2000. Rootstock influence on ripening and quality of apricot fruits. Riv. Fruttic. Ortofloric., *62* (4): 34–39.

MORVAN G., 1968. Methodes de diagnostic du virus de l´enroulement chlorotique de l´abricotier et de quelques autres virus rencontrés sur abricotier. IVth Intern. Symp. on Apricots and Apricot Culture, 8–13 July 1968, Subotica, Yugoslavia. Acta Hort., Tech. Com. of ISHS, III, *11*: 373–381.

MORVAN G., CASTELAIN C., 1969. Connection between infectious agents and apricot tree decline (with particular reference to apricot chlorotic leaf roll). 3rd Intern. Symp. on Apricots and Apricot Culture, Lednice 23.–28. 5. 1966, Czechoslovakia. Acta Hort., Tech. Com. of ISHS, Brno, Publ. University of Agriculture: 153–172.

NAVRÁTIL M., 2002. Fytoplazma evropské žloutenky peckovin. Rostlinolékař, Příloha Karanténní choroby, 4: 7–8.

NOVOTNÁ D., 1980. Hodnocení biologických a hospodářských vlastností vybraných introdukovaných kultivarů meruněk. [Diplomová práce.] Brno, MZLU, ZF Lednice: 120.

PRUNIER J.P., PSALLIDA P., SCORTICHINI M. et al., 1999. European co-operative research on apricot bacterial diseases. Proc. of the XIth Int. Symp. on Apricot Culture 25–30 May 1997, Veria-Makedonia, Greece. Acta Hort., *488, II*.: 699–704.

RICHTER S., HASLINGER E., 2002. Succeptibility of Austrian Apricot and Peach Cultivars to ESFY, EFPP. Disease Resistance in Plant Pathology. 6th Conference of the European Foundation for Plant Pathology, 8.–14. 9. 2002, Prague, Czech Republic. Book of Abstracts: 56.

ROZSNAY S.D., KLEMENT Z., 1973. Apoplexy of apricots II. Cytosporial die-back and simultaneous infections of *Pseudomonas syringae* and *Cytospora cincta* on apricots. Acta Phytopath. Acad. Sci. Hung., *8*: 57–69.

SOUTHWICK S.M., YEAGER J.T., KARAYANNIS I., 1999. Effect of rootstock, cultivar and orchard system on apricot production. Proc. of the XIth Int. Symp. on Apricot Culture, 25–30 May 1997, Veria-Makedonia, Greece. Acta Hort., *488, II*.: 483–488.

SUN YAN XIANG, LU ZENG REN, ZHANG CHENG HE, SUN Y.X., LU Z.R., ZHANG CH., 2001. Effect of different rootstocks on growth and physiological characteristics of apricot grafted seedlings. Acta Hort. Sinica, *28* (6): 551–553.

VACHŮN Z., 1972. Zpráva ze studijního pobytu ve Francii. Brno, MZLU, ZF Lednice, Ústav ovocnictví a vinohradnictví: 131, 21 tab., 32 obr.

VACHŮN Z., 1985. Studium a výběr meruňkových odrůd a klonů s optimálními vlastnostmi pro pěstitelskou praxi. [Závěrečná zpráva výzkumného úkolu.] Brno, MZLU, ZF Lednice: 44, 34 tab.

VACHŮN Z., 1986. Zpráva o vyšlechtění nové podnožové a kmenotvorné odrůdy pro meruňky M-LE-1. Brno, MZLU, ZF Lednice: 25.

VACHŮN Z., 2001. Health condition and decline in the set of 53 apricot genotypes within 10 year period after planting. Acta Hort. et Regiotect., Slovaca Univ. Agricult. Nitriae, *1*: 11–15.

VACHŮN Z., 2002a. Evaluation of precocious decline of new apricot (*Prunus armeniaca* L.) cultivars and seedlings in the first eight years after planting. Brno, Acta Univ. Agric. et Sylvic. Mendel., *1*: 33–44.

VACHŮN Z., 2002b. Introdukce odrůdy Bergeron na území ČR a aktuální stav rozdílných proveniencí na Ústavu ovocnictví a vinohradnictví ZF MZLU. Brno, MZLU, ZF Lednice, Ústav ovocnictví a vinohradnictví: 4.

VACHŮN Z., KRŠKA B., SASKOVÁ H., OBOŇOVÁ J., 1995. Metodika hodnocení fenologických, pomologických a pěstitelských znaků (vlastností) meruňkových odrůd a hybridů. Brno, MZLU, ZF Lednice: 8.

ZHANG Y., UYEMOTO J.K., KIRKPATRICK B.C., 1998. A small-scale procedure for extracting nucleic acids from woody plants infected with various phytopatogens for PCR Assay. J. Virol. Methods, *71*: 45–50.

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Předčasný začátek kvetení a úhyn stromů odrůdy meruňky Bergeron

ABSTRAKT: V období 1993–2002 byl ve výběrové výsadbě udržovacího šlechtění odrůdy Bergeron LE-2 zaznamenáván úhyn stromů. V letech 1999–2002 byl ve stejné výsadbě hodnocen u jednotlivých stromů začátek kvetení. Pod vlivem roku byl maximální rozdíl průměrného začátku kvetení celého souboru stromů 10 dní. Začátek kvetení jednotlivých stromů ve stejném roce nebyl identický. Rozdíl mezi nástupem fenofáze „začátek kvetení“ raně a pozdě kvetoucích stromů byl v jednotlivých letech 1–4 dny. Jednotlivé stromy zachovávaly rané či pozdní kvetení po celé hodnocené období. Do roku 1998 neuhynul ve výsadbě žádný strom. Od r. 1999 do r. 2002 uhynulo 50 % stromů raně kvetoucích a pouze 2,38 % pozdě kvetoucích (průměr tří opakování). Dvě třetiny raně kvetoucích stromů uhynuly v průběhu vegetace, jedna třetina uhynula v době vegetačního klidu. Nebyla prokázána přítomnost žádných hospodářsky významných viróz, proto viry nemohly být ani případnou příčinou uvedených jevů. Přítomnost fytoplazmy (ESFY) byla potvrzena metodou detekce NESTED PCR doposud v jednom případě u náhodně vybraného raně kvetoucího stromu. U dvou náhodně vybraných pozdě kvetoucích stromů podsadby byl test negativní. Raný začátek kvetení neměl vliv na plodnost. Korelace mezi začátkem kvetení stromů a bohatostí kvetení, případně mezi začátkem kvetení a plodností, byla neprůkazná ($r = 0{,}12$, případně $r = -0{,}13$). I když nebyl jednoznačně potvrzen původce vyšší mortality raně kvetoucích stromů, je žádoucí v udržovacím šlechtění odrůdy Bergeron vybírat nejlepší jedince pouze ze skupiny pozdě kvetoucích. Tito jedinci by měli sloužit v procesu certifikace jako prebasic materiál a po předepsaném opakovaném testování jako basic materiál.

Klíčová slova: meruňka Bergeron; předčasné kvetení; úhyn

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