Utilisation of data raised in blooming phenology of fruit trees for the choice of pollinisers of plum and apricot varieties

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Summary: Information concerning the blooming time of stone fruit varieties is, first of all, an important condition of finding suitable pollinisers securing adequate fruit set. For that purpose, varieties are assigned to blooming-time-groups. Depending on the number (3 or 5) of the groups, i.e. the length of intervals separating the groups established, pollenisers are to be chosen for self-incompatible and partially self-fertile varieties belonging to the same blooming-time-group. The mutually most overlapping blooming periods of the respective varieties should be found by raising data of their blooming phenology, i.e. dynamics, which is compared by drawing their phenograms and calculating blooming (V) indices. Variety combinations have to be checked, however, concerning mutual fertility relations of the respective pairs of varieties. That is most important in the case of Japanese plums because of the abundant incompatible combinations. Synchronous blooming has been determined by assigning the varieties to blooming-time-groups, or comparing overlaps of blooming phenograms, or by blooming (V) indices. Synchronous blooming phenology has been studied in European plum varieties (111 varietiy combinations) Japanese plums (156 varietiy combinations) and apricots (153 varietiy combinations) under Hungarian conditions, over several seasons. In determining overlaps, the less favourable season has been considered as decisive. Polliniser combinations have been chosen with at least 70% synchronous blooming. Blooming time of varieties is an important part of the variety descriptions. Blooming dates may serve also for the estimations of frost risk or security of yield.

Key words: flowering phenology, plum, apricot, polliniser

Introduction

Observations of the blooming phenology facilitate the choice of polliniser varieties for the plantation of any auto-incompatible or partially self-fertile variety in order to achieve maximal fruit set under most relatively unfavourable weather conditions. Compatible pollen should be available during a considerable period of blooming of the respective variety.

Open pollination cannot be achieved without synchronous blooming of the respective varieties. Optimal fertilisation depends on a perfect coincidence of the main blooming dates, moreover, most of their blooming periods is overlapping. At the beginning as well as the end the ratio of open flowers is low, therefore the chances of fruit set during those periods are negligible compared with the main blooming period from both points of view, pollen supply and receptive stigmata.

The coincidence of blooming of fruit varieties varies yearly. Several (at least 3–5) years and different ecological conditions of growing sites are to be considered in order to compare blooming dynamics of the respective varieties in order to be sure of the reliability of recommendations.

There are but few indications in the professional literature dealing with the comparative blooming dynamics of stone fruit varieties. *Rudloff & Schanderl* (1950) stated that adequate mutual pollination of a given pair of stone fruit varieties is expected if at least 25% coincidence of their main blooming periods has been secured.

Brózik (1971) postulated a 10–14 day-long blooming period involving at least 4–6 days overlap of sweet cherry varieties for mutually effective pollination, according to his experiments. *Nyujtó* (1958) claimed 3 days, as a minimum overlap of blooming periods of the sour cherry variety *Pándy* and its polliniser. However, for safety reasons, the plantation of 2 or 3 polliniser varieties are recommended in order to get sufficient fertilisation.

Coincidence of bloom between plum varieties has been studied by *Szabó & Nyéki* (1987). Auto-incompatible varieties, as *President* and *Čačanska najbolja* have been compared with the possible pollinisers as for their blooming periods. The length of their mutual overlap changed yearly. Effective pollination required 70% of coincident blooming with the polliniser variety.

Szabó (1989) analysed blooming dynamics and overlapping of blooming periods in several European and Japanese plum varieties. *Nyéki* (1989) explored blooming dynamics of as many as 322 stone fruit varieties. Coincidences of the whole and the main blooming periods have been considered as their yearly variation. New plum varieties have been dealt by *Szalay* et al., (1999), whereas new apricots by *Szalay & Szabó* (1999). The relation between the development of flower buds and frost resistance has been the subject of a study of *Szalay* (2001).

Material and method

The present account deals with data accumulated in three different growing sites. Each orchard has been planted to virus-free trees trained and cultivated according to the standard techniques without irrigation. The plantations have been spaced as 6–7 × 4 m, the grafts stood on Myrabolan stocks and trained to vase-type crowns. Observations are made on trees in full production and the dates are indicated on the respective Tables.

The dynamics of the blooming process have been expressed according to the method developed by *Nyéki* (1974), i.e. at the four cardinal points of the crown, 100–500 flowers having been observed and counted, in each case. After the beginning of the blooming period observations have been repeated daily or every second day, possibly at the same time (between 10 and 12 a.m.). Buds, open and fading flowers are counted separately each time on the same branches.

Flowers are considered as *open* if anthers and the pistil are visible and the stigma is still green or yellow. *Fading* flowers are recognised by their more or less brown stigma. The dynamics of the blooming period comprised the following criteria: the *beginning* (as the first flower opened, the *main bloom period* (as the 50% of flowers opened), the *main blooming day* (as the ratio of open flowers attained the maximum) and the *end of bloom* (as the last flower faded).

According to the beginning of blooming, varieties are assigned to either 3 (early, intermediate and late) or to 5 (early, medium early, intermediate, medium late and late) *blooming time groups*.

Coincidence or overlap of blooming is expressed in per cent ratios of either the whole blooming period or the main blooming period referred to each of the two varieties to be associated.

Results and discussion

Representation of the coincidence of blooming

Auto-incompatible and partially self-fertile stone fruit varieties need polliniser varieties planted within a short distance to them. The choice of suitable pollinisers ought to be decided on the base of their mutually overlapping blooming period. On northern, cool growing sites the difference in blooming dates of the same varieties are less conspicuous than on more southern regions with higher annual mean temperatures. In Hungary, those differences are relatively small, i.e. 3–4 days in most years between varieties within the same species, thus the coincidence of blooming periods is higher than further in the south. For the sake of more safe decisions longer periods (5–8 years) are to be considered.

The choice of polliniser varieties used to be based in the blooming-time groups (*Ifjú*, 1980). In the system of three blooming time groups, cross compatible varieties belonging to the same group could be associated safely as mutual pollinisers, whereas in the five group system, varieties belonging also to neighbouring groups could fulfil the expectation. That is the reason of less (3 or 5) blooming-time groups are sufficient in Hungary, whereas in warmer habitats, the time scale of the blooming period of the same fruit varieties is much longer.

Pollinisers could be chosen according to the overlaps of blooming periods of the respective varieties, which is expressed either by the number of days when both varieties are blooming, or by the per cent of the overlap over the whole blooming period of each variety. The same goal is achieved by the comparison of the main blooming periods (after the 50% of lowers were open) as *Nyéki* (1989) suggested. Additional information is gained if we know the dates of maximum rate of open flowers.

Ifjú (1980) claims the superiority of relying on the mutual overlap of blooming phenograms as a criterion of suitable pollination. More exact tracing of the blooming process is achieved by the application of blooming indices *Máthé* (1977), which has been adapted to stone fruits (*Máthé* et al., 1995/a; *Máthé* et al., 1995/b; *Máthé* et al., 1996/a; *Máthé* et al., 1996/b).

Blooming index (V-index) is calculated from the data of:

$$V - \text{index} = \frac{t-b}{b+v+t}$$

Where the symbols are :

b = number of buds,
v = number of open flowers,
t = number of faded flowers.

The idea of the formula is based on the fact that the point should be found where the numbers of buds and of the fading flowers are equal. Thus the blooming process is represented by a sigmoid curve, and if the values of V are between –0.25 and 0.25, the ratio of open flowers will exceed 75%, i.e. comprise the main blooming period.

V-indices of different varieties over several years are compared in order to find the suitable pollinisers for auto-incompatible plum varieties.

Most data referring blooming phenology are available in European plum varieties. There are a number of auto-incompatible as well as partially self-fertile varieties in production, thus the coincidence of blooming periods are easily displayed on that species.

In *Figure 1, overlaps of blooming periods* are presented over three years. We needed the exact data of beginning and end of blooming. According to the data, *Čačanska najbolja* as an auto-incompatible variety was provided by all the rest of varieties as successful pollinisers. The same is aimed by applying the day of maximum bloom (most number of open flowers), however, the latter needed more detailed phenological data. Small (1–2 days) differences in maximum bloom would mean sufficient coincidence of blooming.

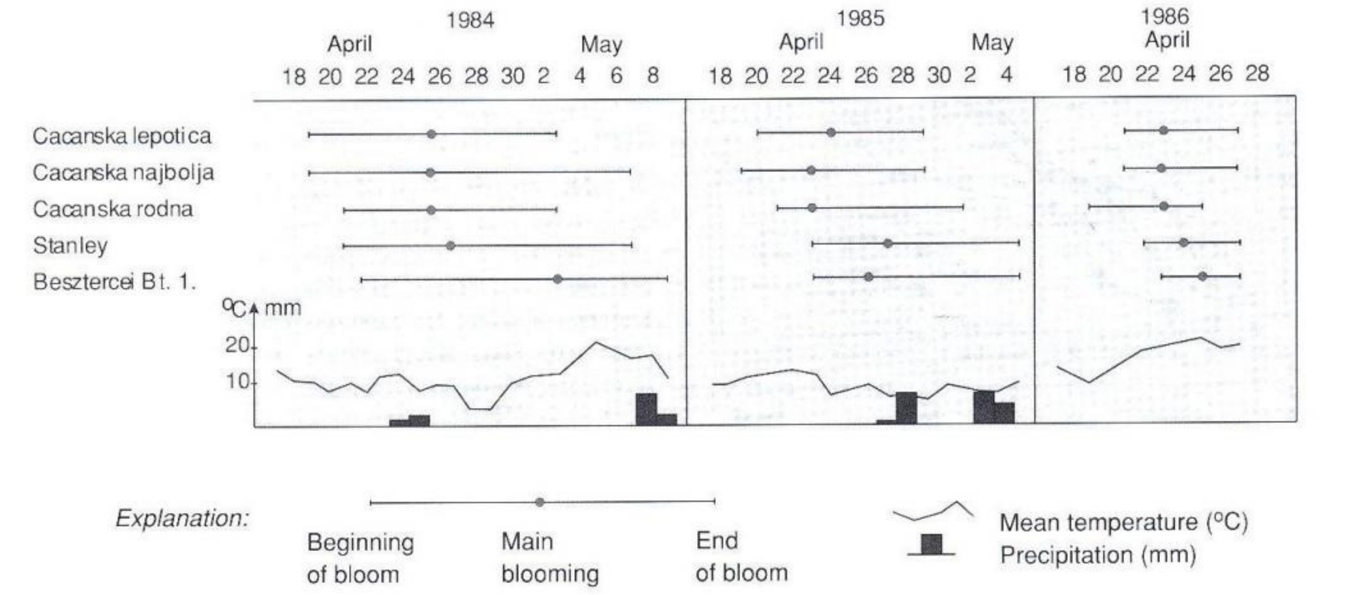

Figure 1 Blooming time of plum varieties in successive years (Csány) (Source: Szabó, 1989)

Exact information on the blooming process required daily observation. The daily ratio of open flowers is drawn as the *phenogram of blooming*. (*Figure 2*). The main flowering period is recognised on the picture (ratio of open flowers over 50%) as well as the day of maximum. The raising and the decreasing phases of blooming are also evident and comparable. *The auto-incompatible variety and its polliniser are visible on the same drawing with the corresponding overlaps in Figure 1.* Coincidence of blooming is expressed by the area of the overlapping space. The length of the blooming period of *Besztercei Bt. 1* overlapped conspicuously (60–84%) that of *Čačanska najbolja.* On the blooming phenogram, it is evident that the rate of blooming of *Besztercei Bt. 1* started slowly (by 4 days later) in 1984 and the main bloom occurred later (by 6 days) than that of *Cacanska najbolja.* During the first days of the blooming period (in 1984, the first 6 days, in 1985, 6 days and in 1986, 3 days) the low number of open flowers did not provide sufficient pollen for the variety *Čačanska najbolja.* Therefore, *Besztercei Bt 1* would not be recommended as a polliniser, only with an earlier blooming one. (e.g. *Čačanska lepotica*).

Values of the *index V* change according to *Figure 3*, where the other parameters, as blooming periods, main blooming times and the days of maximum bloom of the varieties are represented. For choosing effective pollinisers, those alternative methods are suitable. It is expressed well in stating that *Čačanska lepotica* is a right polliniser of *Čačanska najbolja* as the coincidence of their blooming phenograms showed it. *For reasons of safety, however, auto-incompatible varieties should be associated with two polliniser varieties instead of one.* From this point of view, some later bloomiong varieties are recommended (*Stanley* or *Besztercei Bt. 1*). As a result, *Čačanska najbolja* will safely receive pollen, abundantly, at the beginning as well as at the end of the blooming period.

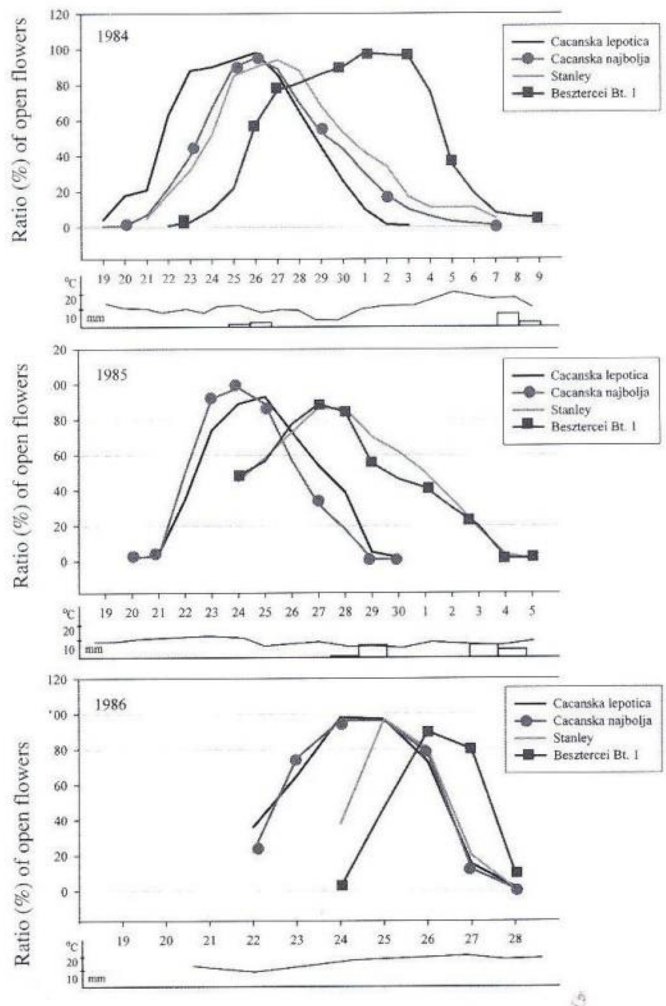

Figure 2 Phenograms of the blooming process (Csány 1984–1986) (Source: Szabó et al., 1990)
Below the graphs the values of temperature and precipitation are shown

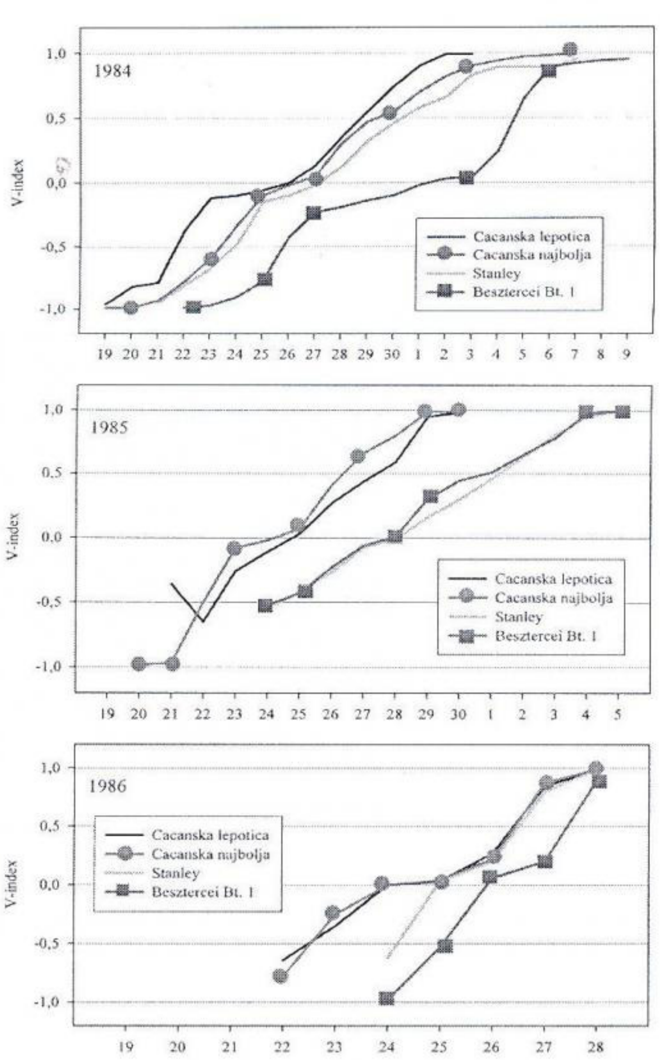

Figure 3 The V-indices of plum varieties in the successive years (Csány 1984–1986) (Source: Máthé et al., 1995/b)

The length of the blooming process depends, after all, on temperature. Weather conditions have been analysed by Szabó (1989) as for its influence on the decisive dates of beginning, duration, intensity and end of the blooming process in differnt plum varieites. As shown in *Figures 1–3*, the three years, observed produced considerable differneces. In 1984 low (around 10 °C) temperature caused a slow blooming process, whereas, in 1986, the low temperature, two days before bloom, was followed by a sudden warming up (to a mean of 20 °C), which caused a precipitous blooming, i.e. opening and fading of flowers. Temperature during blooming as well as humidity may cause considerable pathological risk on the flowers. A couple of the last years witnessed heavy infections by the fungus, *Monilia laxa*, a threat, which is expected when high humidity and a prolonged blooming prevails. So flower parts are damaged already at the beginning of the blooming period (*Holb*, 2003c). Anti-fungal treatment is justified, moreover, indispensable during the blooming season. For the sake of security, a system of phytosanitary forcasting is badly needed in plum and apricot plantation, as it was developed in apple growing, since long. (*Holb*, 2002a,b).

Plum

Szabó (1989) compiled available data on plums as for their blooming dynamics, especially refering to the coincidences of autoincompatible and partially self-fertile varieties and their possible pollinisers *(Table 1)*. Recommendations are based on data raised over several (at least two) years. Coincidences are expressed in% ratios. *A suitable polliniser should fulfill the requirement that at least 70% of its blooming period overlapped the blooming period of the target variety.* Taking into account the yearly variation of the dynamics of bloom, the safe solution suggests two polliniser varietes, one with earlier beginning (about 2 days) and another with sychronous or later (2 days) beginning of bloom. Thus a safen supply of pollen is secured from the first moment until the whole blooming period. Blooming diagrams of varieties belonging to the same blooming-time group overlapped each other sufficiently, i.e. by 75–100%. In a system of 5 groups, varieties of neighbouring blooming-time groups overlapped, in most cases exceeded 70%, i.e. acceptably.

Early blooming varieties (e.g. *Utility*) could be pollinated by other early blooming ones, whereas the late blooming, and consequently quickly fading varieties need pollinisers of the same group as *Besztercei Bt. 416*. Higher temperatures at the end of blooming season speed up the blooming process, so coincidences are more difficult to secure. It was observed that for the long period of medium early blooming *Čačanska najbolja* it was easy to find pollinisers with favourable overlap, mutually, with other auto-incompatible varieties. Blooming periods of early and late blooming varieties scarcely met each other in some years. The late blooming *Besztercei Bt 416* met at a rate of 18–43% the early blooming *Utility*. No combination was found, which did not display at least a minimum coincidence.

Th overlap of blooming periods should be completed by the information about the *coincidences of main blooming time* (when more than 50% of the flowers opened). That is the time of the maximum pollen supply and the receptivity of the respective stigmata is at an optimum. In *Japanese plum varieties* the coincidence of blooming and of the main blooming period has been assessed by *Szabó* (1989). The yearly variation of coincidences in Japanese plum varieties exceeded that of the European plums. It is explained by a higher genuine variation of the Japanese plum varieties, the earlier season with more hazardous changes of weather at that time.

Between 1994 and 1998, a series of new varieties, European and Japanese plums, have been studied (*Szalay* et al., 1999). Both, European and Japanese plums have been assigned to three blooming-time groups, separately. Overlap of blooming periods within the varieties of the whole series was more than 50% with a few exceptions. In the European group, the exceptions are associated with the variety

Table 1 Minimum and maximum coincidence (%) of blooming periods of European plum varieties (Kecskemét, 1985–1989)

♀ \ ♂	Besztercei Bb.416	Bluefre	Čačanska lepotica	Čačanska rodna	Stanley	Althann ringló	Čačanska najbolja	Debreceni muskotály	President	Silvia	Utility
Althann ringló	38–67	50–78	88–100	83–100	50–75	–	89–100	78–100	89–100	50–100	67–88
Čačanska najbolja	40–75	60–89	70–100	75–100	62–90	75–89	–	67–90	50–88	67–90	56–80
Centenar	71–75	62–100	88–100	75–86	62–86	75–100	100–100	71–88	86–88	71–75	57–62
Debreceni muskotály	33–71	56–62	78–100	86–100	50–67	86–89	75–100	–	69–100	86–100	71–89
Pescarus	43–78	62–100	88–100	67–100	62–89	75–100	89–100	56–100	67–100	56–100	44–86
President	38–62	50–100	75–100	62–100	50–75	75–100	57–100	88–100	–	88–100	75–88
Silvia	30–57	50–75	70–89	71–90	46–60	56–80	67–90	86–90	88–100	–	86–90
Tuleu gras	71–86	58–100	50–71	33–86	58–100	42–74	50–86	25–71	33–71	25–71	11–57
Utility	18–43	28–50	54–88	57–88	28–45	64–75	62–72	71–88	64–88	82–100	–
Bluefre	67–100	–	56–89	67–88	70–100	56–87	67–100	56–80	56–80	56–60	40–44
Čačanska lepotica	43–71	50–80	–	80–100	64–90	82–100	71–100	73–100	60–100	73–100	64–86

(Source: Szabó, 1989)

Primacotes, only. The safe pollination could be considered to be settled within the blooming time groups, i.e. overlaps exceeded 70%.

In *Table 2,* blooming dynamics of seven Japanese plum varieties (1–7) and six cherry plums (8–13 varieties) are presented as for their coincidences. The minima and maxima experienced during the three-year period are indicated. Overlaps of blooming periods were extensive in most of the cases. Japanese plum varieties bloomed at a rate of 58-100% coincidence. The really early blooming cherry plum variety, *Partizan,* and the late blooming Japanese plum, *Duarte,* produced the less coincidence (13-88%). On the base of information, the following planting models are recommended for Japanese plums:

A: Japanese plums planted in blocks of 2-4 rows

B: Cherry plums planted interspersed into the blocks of Japanese varieties at each tenth position. For each variety, two pollinators are recommended, one of earlier and one of later blooming dates.

Apricot

On the northernmost latitude of apricot production, the differences in blooming are small, 3–4 days only, thus all varieties grown bloom with sufficient coincidence. *Della Strada* et al. (1989) and *Pirazzini* (1997) stated that in Italy, conditions are not quite different, so it is a matter of concern to find adequate combinations for efficient inter-pollination, and claim to achieve coincidences of the main blooming period (when more than 50% of flowers opened). *Szabó & Nyéki* (1991) recommended a coincidence of more than 70% and two polliniser varieties at least for safety reasons.

New apricot varieties have been explored and published as for their blooming dynamics by *Szalay & Szabó* (1999).

Table 2 Overlaps of blooming periods (%) of Japanese plums (1–7 varieties) and cherry plums (8–13 varieties) (Szigetcsép, 1994–1995, 1998)

Serial number	Variety	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13
1.	Angeleno	–	67–100	79–100	71–100	64–100	94–100	79– 93	71–100	86–100	89–100	80– 89	86–100	80– 89
2.	Black Diamond	67– 78	–	80–100	71–100	87– 89	75	80– 94	59– 93	59– 80	59– 78	59– 80	59– 80	59– 80
3.	Black Star	71– 85	80– 95	–	80–100	81– 95	73– 89	76–100	62– 92	70–100	70– 92	62–100	75–100	62–100
4.	Burbank	79–100	67– 95	89–100	–	90– 95	90– 94	83–100	63– 92	79–100	88– 92	63–100	79–100	63–100
5.	Duarte	77– 89	75–100	92–100	85–100	–	80–100	77–100	71–100	75– 92	13– 88	71– 92	80– 92	71– 92
6.	MN Sun	78– 93	58– 89	79–100	80– 94	73– 94	–	72– 83	72– 95	87– 95	83– 95	72– 95	87– 95	72–100
7.	Simka	61– 79	83– 93	89–100	79– 93	72– 95	72– 86	–	63– 93	61– 93	61– 86	44– 93	61– 93	44– 93
8.	Olenyka	69– 89	56–100	78– 86	75– 89	75– 93	79–100	63– 93	–	82–100	75–100	86–100	86– 94	86–100
9.	Partizan	86– 89	56– 86	78– 94	88– 93	83– 88	93–100	65– 93	82–100	–	93–100	82–100	94–100	82–100
10.	Rumjnaja	88– 93	56– 82	78– 94	86– 89	79– 88	94–100	65– 86	71–100	93–100	–	82–100	93–100	82–100
11.	Szputnyik	75– 89	56– 86	78– 93	75– 93	75– 86	81–100	50– 93	86–100	88–100	88–100	–	94–100	100
12.	Vesuvies	83– 94	61– 86	83– 92	83– 93	83– 89	89–100	61– 93	83– 94	94–100	93– 94	83–100	–	83–100
13.	Zurna	75– 89	56– 86	78– 93	75– 93	75– 86	81–100	50– 93	86–100	88–100	88–100	100	94–100	–

(Source: Szalay et al., 1999)

Table 3 Blooming-time groups of apricot varieties (Szigetcsép 1994–1997)

Early	Medium	Late
Fracasso	Callatis	Harglow
Gönči magyar kajszi	Comandor	Harogem
Harlayne	Hargrand	Mandulakajszi
Lambertin No 1	Orangered	Sirena
Latter Sabatini	Rouge de Fournes	
Litoral	Selena	
Pannónia	Sulmona	

(Source: Szalay & Szabó, 1999)

Relatively small differences in dates, three blooming-time groups (early, medium, late) have been distinguished. *(Table 3)*. The varieties were of various origin, Hungarian *(Gönci magyar kajszi, Mandulakajszi, Pannonia)*, Rumanian *(Callatis, Comandor, Litoral, Selena, Sirena, Sulmona)*, Italian *(Fracasso, Latter Sabatini)*, French *(Lambertin No 1, Rouge de Fournes)*, from the USA *(Orangered)* and Canadian *(Harglow, Hargrand, Harlayne, Harogem)*.

Observations during a four-year period, nine auto-incompatible and partially self-fertile varieties have been assessed for their coincidence of bloom under the best and worst conditions *(Table 4)*. Most combinations displayed high overlaps (exceeding 60–70%). That was true also for the neighbouring blooming-time groups. Combinations of Rumanian varieties and the *Mandulakajszi* were mutually good pollinisers with long coincident blooming periods. Association of those varieties is recommended also because of their late fruit maturity.

Conclusions

Information concerning the blooming dynamics of stone fruit varieties is utilised in decisions related to the association of polliniser varieties but also in planning operations of cultivation (pruning, phytosanitary treatments, fruit thinning), which are closely interfering with the blooming process.

Varieties are assigned to blooming-time groups. Depending on the number of blooming-time groups, auto-incompatible or partially self-fertile varieties have to be associated with pollinisers belonging to the same group (if 3 groups are formed) or also to the neighbouring group (of the 5-group system). The most overlaps of the blooming periods are determined on the base of detailed observations of several years, and the graphic representations of the data (blooming phenograms, V-indices). Varieties of coincident blooming ought to be checked also for their fertility relations with the respective auto-incompatible varieties. Blooming phenograms and the V-indices are to be applied to achieve the right decisions. The latter is especially actual in Japanese plums as the chances of meeting cross-incompatible combinations are high.

In exploring coincidences of blooming of all stone fruit species, preferably, the less favourable years should be considered.

Professional literature, in Hungary as well as world wide, did not deal, but scarcely, with blooming dynamics of stone fruit species. Our results suggest the following important conclusions:

For auto-incompatible varieties (mainly plums and apricots) need to be associated with polliniser varieties, which provide for their pollen as far as their fertility relations are cleared and blooming periods are mutually overlapping at a rate of more than 70%, over several years' experiences. Information related to blooming dates are valid for a restricted area (Hungary) and are summarised in the variety lists of 3 blooming-time groups (early, medium, late).

Coincidences of the blooming periods of two varieties (auto-incompatible and its polliniser) are insufficient if they risk to be below 50%. Association of the respective varieties is not recommended.

Safe conditions of pollination are achieved by the use of more (2–4) polliniser varieties with sufficiently overlapping

Table 4 Minimum and maximum overlaps (%) of blooming periods of apricot varieties (Szigetcsép, 1994–1997)

Variety	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Comandor	94–100	–	63–94	60–88	71–94	69–94	50–100	71–94	57–82	19–94	69–94	77–88	75–100	69–100	57–100	94–100	86–100	94–100
Hargrand	100	83–100	62–100	54–100	67–100	–	46–100	92–100	69–88	8–100	67–100	67–88	77–100	69–88	69–100	83–100	67–100	63–88
Lambertin No 1	67–100	67–100	83–93	83–100	50–93	64–100	93–100	79–100	–	43–100	50–100	50–86	67–100	67–100	83–100	67–100	50–93	50–93
Litoral	73–100	73–100	80–94	80–100	60–100	60–100	67–100	73–100	60–100	47–100	–	75–100	73–100	87–100	60–100	73–100	73–100	67–100
Mandula-kajszi	77–93	77–93	57–82	65–71	71–94	57–82	64–88	57–100	43–86	29–70	71–86	–	71–93	59–86	43–86	77–93	77–100	47–100
Orangered	85–100	92–100	83–100	77–100	69–100	77–100	69–100	83–94	67–92	31–89	83–92	78–100	–	78–100	67–100	89–100	93–100	54–100
Selena	93–100	94–100	63–100	56–88	71–100	71–94	50–100	71–100	57–88	25–94	69–94	81–88	75–100	69–100	57–100	–	86–100	59–94
Sirena	94–100	90–100	67–100	60–88	83–100	67–94	53–94	67–100	50–81	20–94	74–94	81–100	68–100	74–100	50–100	90–100	–	53–88
Sulmona	87–100	87–100	80–100	73–100	73–100	73–100	67–100	80–100	60–100	30–100	87–100	80–100	70–100	86–100	60–100	93–100	87–100	–

(Source: Szalay L. & Szabó Z. non published)

Signes of varieties: 1 = Callatis, 2 = Comandor, 3 = Fracasso, 4 = Gönci magyar kajszi, 5 = Harlayne, 6 = Harglow, 7 = Hargrand, 8 = Harogem, 9 = Lambertin No 1, 10 = Latter Sabatini, 11 = Litoral, 12 = Mandulakajszi, 13 = Orangered, 14 = Pannónia, 15 = Rougé de Fournés, 16 = Selena, 17 = Sirena, 18 = Sulmona.

blooming periods with the respective auto-incompatible target variety. Closely synchronous blooming combinations showed yearly variable overlap with each other, therefore an auto-incompatible variety should be combined with 2 or 3 pollinisers with slightly different (earlier, synchronously and later) blooming periods and preferably self-fertile varieties.

The date of bloom and the resistance to winter- and spring-frosts is (negatively) correlated, thus the blooming-time groups indicate also the scale of frost resistance including the security of yields. Late blooming Japanese plum, apricot and peach varieties have a longer rest period, consequently, yield more regularly than early blooming ones.

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