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Flower bud differentiation in apricot

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Summary: The flower bud development is an especially complex process from initiation to blooming. Our main objective was to analyze paradormancy; the first stage of this process in our collection of varieties in the vicinity of Budapest, in Hungary. We have analyzed three varieties with different winter hardiness. 'Ceglédi bíborkajszi' is one of the most frost susceptible in our collection of varieties, when the flower bud differentiation started in early August, and all flower organ initials evolved in beginning of September. The flower bud differentiation of the most winter hardy variety, 'Rózsakajszi C.1406' started in the end of August, and all flower organs were noticed at middle of September. 'Gönci magyar kajszi' is a medium frost hardiness apricot variety, its phenological process composes transition between two mentioned above varieties.

Key words: flower bud differentiation, bud dormancy, *Prunus armeniaca*, flower organ initials

Introduction

Flower bud initials evolve between the end of July and middle of September, and continue to grow till the first chilly days. The sepal, the petal, the ovary, the shaft and the stamen initials are distinguishable by late autumn. The flower initials develop continuously on frostless days (3–5 °C). All parts of flower evolve in the beginning of winter (*Nyújtó & Tomcsányi*, 1959). The period of paradormancy of flower bud development lasts between 1.5 to 2.5 months by examinations of *Ro* (1929).

The vegetative apical meristem produces the floral organ initials under the tunica-corpus part, after its development slows down for some time. Till then the conical meristem becomes flat, because of intensive function of lateral meristem, and it is transformed into an inflorescence meristem (reproductive phase) (*Ryugo*, 1988; *Gracza,* 2004). This is the first stage, whereupon sepal and petal primordia appear and enlarge. The ovary initials develop with the shaft initials almost at the same time (*Gracza,* 2004). Goff (cit. *Tufts* et al., 1925) found that in the individual flower bud, the calyx was first to be formed, and concluded that in the normal order of development the corolla originates next after the calyx, and is followed in turn by the stamens and pistils.

Tissue differentiation does not start in the floral organs yet, a sporogenous tissue, the archesporium is noticeable in the anther initials, and in the ovary initials there are no trace of ovarian cavity and generative organs. Continually increasing bud scales protect the organs from winter chilling during endodormancy.

Elmanov (1959, cit. *Solohov,* 1970) has also analyzed the paradormancy period and described six developing phases, *Molnár* (1962) divided the six phases into eight, while *Szmükov* (1975) again defined six phases. *Elekné* (1982) analyzed the bud differentiation in apple and cherry varieties; she described eight phases in apple, and seven stages in cherry.

Material and methods

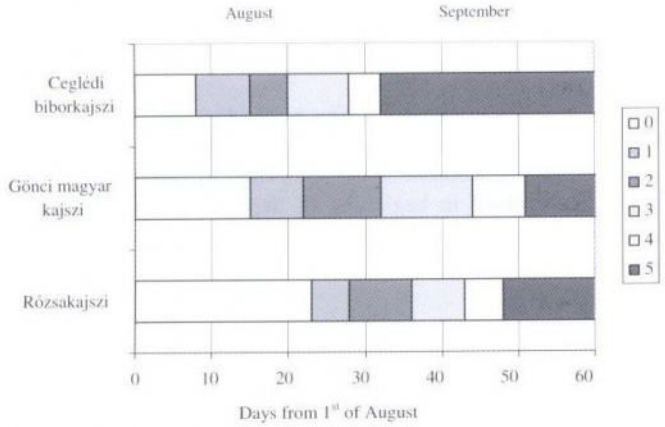
We have investigated paradormancy on three traditional apricot varieties: 'Ceglédi bíborkajszi', 'Magyarkajszi C.235', and 'Rózsakajszi C.1406', which were collected in the vicinity of Budapest. We picked samples, the long shoots from 1,5 – 2 m height of canopy twice a week.

We have noticed flower bud development by preparing flower bud sections between 1st August 2007 and 2nd October 2007; this interval is the floral bud formation period. The sections were made from flower buds of central part of long shoots. The buds were embedded in ice, and cut with freezing microtome. We had analyzed the sections under transparent light microscope. Five developing phases were distinguished: palling of meristem, sepal primordia formation, petal primordia formation, stamen development, and carpel initial formation.

Results and discussion

We chose three differing frost hardy varieties, so we can demonstrate the representative groups, namely a frost susceptible ('Ceglédi bíborkajszi'), a medium ('Gönci magyar kajszi') and a frost hardy variety ('Rózsakajszi C.1406'). Significant difference was found in the development dynamics of examined varieties. Flower part initials evolved the earliest in 'Ceglédi bíborkajszi' in early August, all flower part initials appeared in beginning of

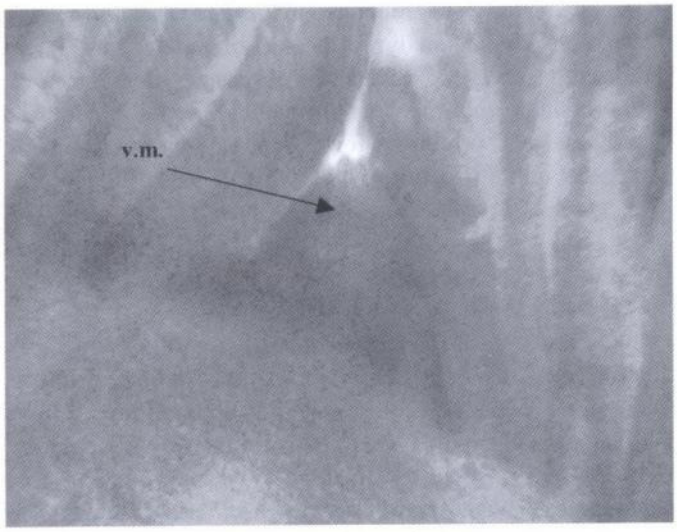
September. The flower bud differentiation of the most frost and winter hardy variety, 'Rózsakajszi C.1406' started at the end of August, and all floral organs were noticed in mid-September. 'Gönci magyar kajszi' is a medium frost hardy apricot variety, its phenological process composes transition between two above varieties, and the reproductive phase started in mid-August (*Figure 1*).



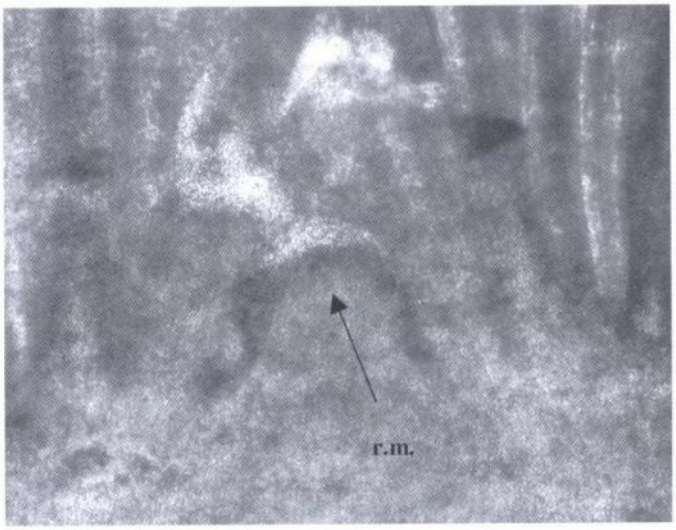
Notation: 0 – vegetative phase
1 – palling of meristem (starting of reproductive phase)
2 – sepal primordia formation
3 – petal primordia formation
4 – stamen development
5 – carpel initial formation

Figure 1. Phenological process of flower bud development of apricot varieties (Soroksár, 2007)

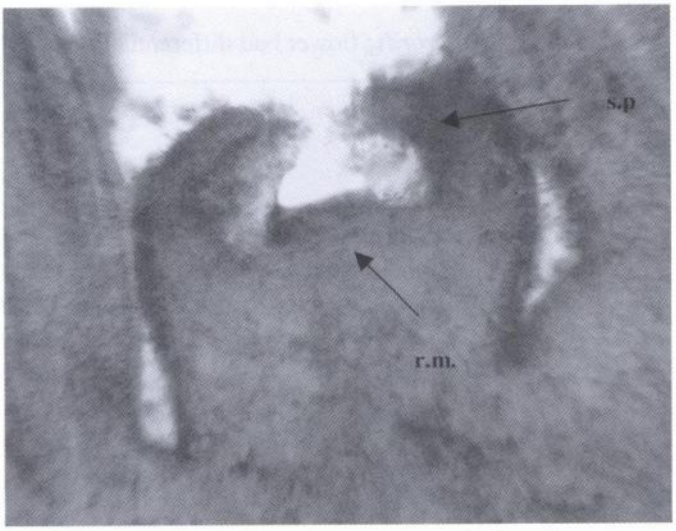
Nyújtó and Surányi (1981) analyzed flower bud development also between 1976 and 1977 in Hungary. In their examination the differentiation of 'Ceglédi bíborkajszi' started in the end of July, and differentiation of late-blooming Rózsa type apricot variety started in early August. According to the study of Thufts et al. (1925) the Royal apricot showed first signs of differentiation on 10th August. Walker (1917, cit. Tufts et al., 1925) observed the initial stage on 4th August 1915, and 10th August 1916, and Wiggans (1923, cit. Tufts et al., 1925) showed it on 10th August 1922.



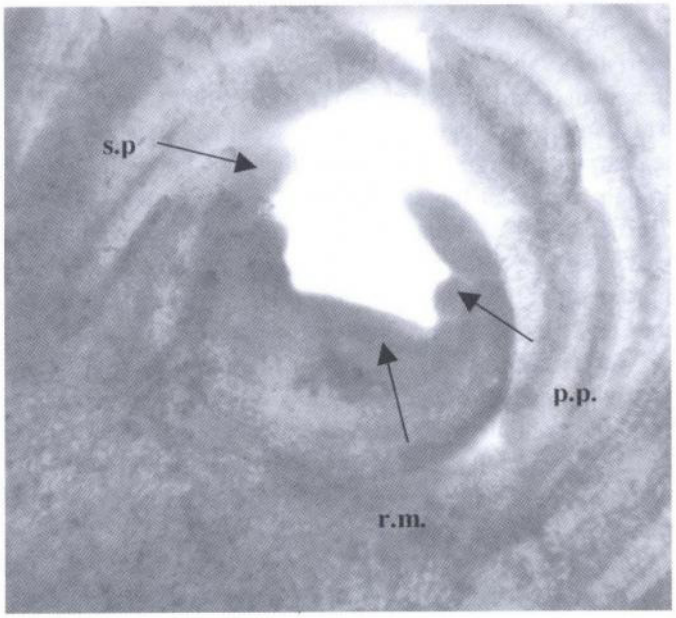
v.m. – vegetative meristem
Figure 2. Vegetative apical meristem



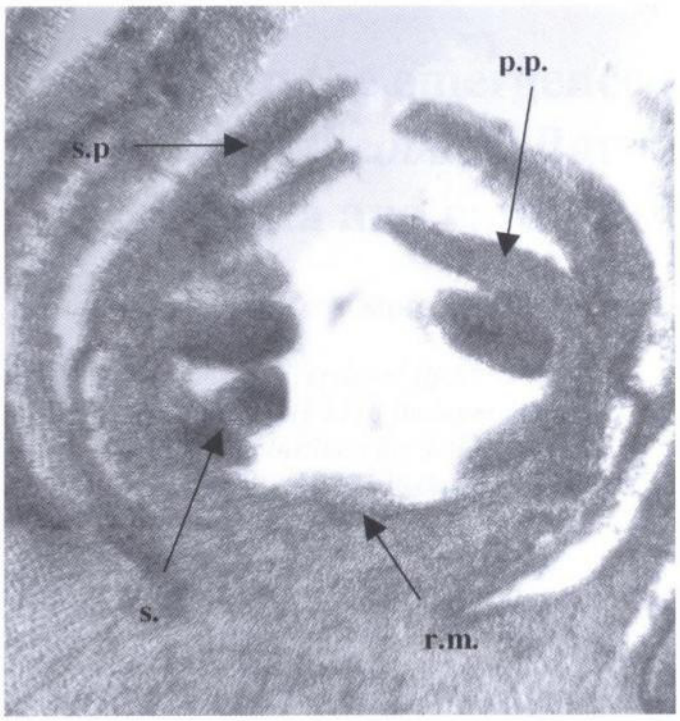
r.m. – reproductive meristem
Figure 3. Palling of meristem



r.m. – reproductive meristem; s.p. – sepal primordia
Figure 4. Sepal primordia formation

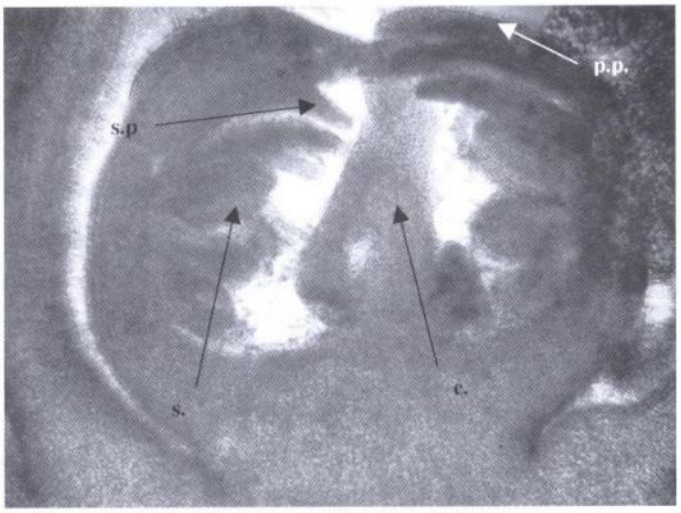


r.m. – reproductive meristem; s.p. – sepal primordia; p.p. – petal primordia
Figure 5. Petal primordia formation



r.m. – reproductive meristem; s.p. – sepal primordia; p.p. – petal primordia; s. – stamen

Figure 6. Stamen development



s.p. – sepal primordia; p.p. – petal primordia; s. – stamen; c. – carpel

Figure 7. Carpel initial formation

We described five developing stages. The apical meristem (*Figure 2*), or growing tip, is a completely undifferentiated meristematic tissue found in the buds, its main function is to begin growth of new cells. When the apical meristem is palling, the reproductive phase is started; this is the first stage (*Figure 3*), which term is one week. After the sepal primordia starts evolving (*Figure 4*); this phase may be keeping between 5 and 10 days depending on varieties. The period of petal primordia formation (*Figure 5*) is similar to the previous phase, it is only quantitative change. The stamen development (*Figure 6*) is rapid, as against the carpel initial formation (*Figure 7*) is a slow process.

Acknowledgments

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