Pál Maliga, founder of the research in floral biology of fruit species in Hungary

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Summary: Pál Maliga founded the Hungarian research in floral biology of fruit species during his more than forty-year-long carrier. Almost all pome and stone fruit species have been covered by his activities, but he also dealt with the fertility of walnut and chestnut. Regularities have been revealed and the methodical studies opened the way to approach and elaborate alternatives for the association of varieties in planning high yielding commercial plantations. In his breeding activity the choice of crossing parental varieties was based on the knowledge in fertility relations. The obtained sour cherry varieties represent the world-wide maximum quality, reliability and security of yields. Hungarian renewed sour cherry cultivation owes its fame and prosperity to those varieties, nevertheless also to the radical knowledge of the biological bases of fertility.

Key words: floral biology, fruit trees, breeding for fertility

The systematic experimental approach upon relations of fertilisation amongst fruit species was performed between 1920 and 1940 in Europe. During the 1930-es researches also started in Hungary. The importance of floral biology has been recognised as soon as fertilisation proved to be a decisive condition of yield. It was not relevant as long as multi-varietal, mixed plantations prevailed. The National Pomological Committee and the Certification Committee of Fruit Trees, which selected the trees intended to be multiplied by nurseries, adopted the idea due to the necessity of exploring their floral biology. In mono-varietal plantations, grafts of certified trees did not display the fertility expected because of the lack of adequate compatible pollinisers.

Systematic trials started in Hungary by *Magyar* (1935), *Husz* (1943) and *Maliga* (1942). Due to *Pál Maliga*, the results of research corresponded with those of the advanced fruit growing countries *(Brózik & Nyéki,* 1975, *Nyéki,* 1980, *Nyéki & Soltész*, 1996, *Nyéki* et al., 2002).

Most conspicuous problems with low yields showed up mainly in **sour cherry** plantations of the variety *Pándy meggy*. Since the middle of the 19th century the variable fertility of that variety has been a matter of controversy.

As a young researcher, Maliga was aware of the actual problem and attacked first the floral biology of *Pándy meggy*. He proved its auto-incompatibility and the necessity of the presence of pollinisers in the neighbourhood *(Maliga,* 1942). Further studies led to decisive conclusions concerning *Pándy meggy (Maliga,* 1944). It was stated that the polliniser varieties may moderate the inherent low fertility but the problem cannot be solved definitively. A kind of genetically founded partial sterility still causes yield losses. Maliga warned that conditions of fertilisation should be examined through of the registered mother trees. The necessity of undertaking parallel observations at ecologically different growing sites concerning blooming and fertilisation was underlined. The publications referred and approached the question of reduced yields from a practical point of view involving the diversity of the possible causes and the sources of contradiction derived from methodical difficulties. Thus he presented an exemplary sample of Hungarian fruit growing research. Between different clones of the *Pándy meggy* variety and the rest of varieties combinations have been tested as many inter-sterile relations were found. The role of coincidence in blooming time including the functional period of sexual organs and methods of pollination within the design of plantation has been exposed. Maliga set also the objectives of further research: self-fertile varieties are to be bred of the same quality and commercial value corresponding that of *Pándy meggy*.

Maliga (1948) did not miss the importance of **apricot** as an important fruit of Hungary also being hit by problems of fertility. Examining the causes of inherent low yielding potential in apricot, the type of pistils as a varietal character and the development of bearing shoots are indicated as responsible factors, the latter being highly influenced by pruning policy.

The examination of **sweet cherries** was also actual being often combined in plantations with sour cherries as potential

pollinisers. *Maliga* (1952) found all sweet cherry varieties auto-incompatible and in a few cases also inter-incompatible (*Germersdorfi óriás* x *Olivet, Badacsonyi óriás* x *Olivet*).

The most important (mostly local Hungarian) varieties have been assigned to 4 blooming time groups, therefore the appropriate polliniser varieties could be identified.

Studies upon floral biology between 1947 and 1952 in **sour cherry** were published successively *(Maliga,* 1953a, 1954). The fertility at open pollination was equally subject to seasonal and varietal effects, the latter being in relation with some tendency of self-fertility. However, observations revealed the futility of searching for occasionally self-fertile clones in *Pándy meggy*. For the purpose of serving as inter-fertile pollinisers 16 sour cherry and 6 sweet cherry varieties have been recommended. More favourable combinations for safe fertilisation have been presented mainly with sweet cherry varieties. Attention has been called upon the sour cherry variety group designated as *Cigánymeggy* for the purpose of pollinisers. Taking into consideration also the relative blooming time periods, regarding the main blooming time, 5 blooming time groups are distinguished among the sour cherries, whereas 8 groups have been justified as far as sweet cherries and the purposeful association of varieties are also considered. In the later system, sweet cherries alone are comprised in groups 1 and 2, whereas sour cherries in the groups 7 and 8 without sweet cherries. Clones of the *Pándy meggy* are considerably different regarding their blooming time. However, their inadequacy as mutual pollinisers is beyond doubt.

Maliga performed between 1943 and 1952 experimental studies in floral biology of 37 **apple** varieties *(Maliga,* 1953b, 1956). The efforts have been centred on the leading variety of that time in Hungary, the *Jonathan*. For this auto-incompatible variety adequate pollinisers have been recommended being mutually inter-fertile with *Jonathan*. Pollinisers of further 4–5 commercially important apple varieties have been also considered. Apple varieties assigned to four blooming time groups have been compared as being auto-pollinated and cross-pollinated, and the importance of cross-pollination as well as the difference between natural and artificial auto-pollination has been revealed. The seed content of fruits has been taken as an indication of the quality of pollination, whereas the role of parthenocarpy has been proved to be of negligible importance in contributing to yield.

Maliga (1957) considered the high ratio of empty pollen in ***Pándy meggy*** as consequence of interspecific hybridity. Difficulties in comparing data published in the literature are due to the fact that the same variety type has been mentioned in surrounding countries by different names or different varieties are referred by the same. The former publication reported results of 10 thousand crosses, made between 1949 and 1954 for the purpose of breeding.

The wide scope of activities in research, education and organisation of *Pál Maliga* is amply reflected in his publications as author of scientific handbooks all along his professional carrier. Based on the relevant literature Maliga summarised his experiences concerning the blooming as well as fertilisation of the most important 17 fruit species grown in Hungary and recommendations for the practice *(Maliga,* 1946, *Okályi & Maliga,* 1956). The handbooks are still actual and useful as presented for **sweet-** and **sour cherry** *(Mohácsy & Maliga,* 1956), **chestnut, almond** and **hazelnut** *(Mohácsy, Porpáczy & Maliga,* 1957), **pear** *(Maliga,* 1958) and **peach** *(Mohácsy, Maliga & Mohácsy* jun., 1967).

Results obtained in growing **pears** during 1954–1956 are treated in a detailed study *(Maliga,* 1961), whereas a book has been assigned to explain exhaustively the multiple causal interactions between phenomena of low fertility, fruit shed, parthenocarpy and fake self-fertility, blooming periods in the choice of polliniser associations in plantations, etc. *(Maliga,* 1958).

Results of experiments exploring the relations of fertilisation and their utilisation in growing practice are summarised *(Maliga,* 1961). They withstood the proofs of time and are still consulted in most of the questions emerging actually. Sour and sweet cherries, apricots, apples, pears, quinces and peaches have been examined (about 149 varieties) and only between 1941 and 1956 more than 350 thousand flowers. In the same volume, concerning the sour cherry *Pándy meggy,* blooming-phenological observations representing 20, respectively 32 growing sites were summarised.

Maliga emphasised that there are no generally valid recipes in determining optimal conditions for fertilisation or achieving maximum yields. The thoughtful weighing of the complex of general principles combined with special local conditions is much more important. Detailed examples are presented in order to demonstrate the complexity of the decisions in considering the fertility relations, blooming periods, starting fructification, the quantity of pollen production in polliniser varieties, the number and the ratio of varieties associated and their placement as well as the transfer of pollen. According to Maliga a dream haunting by the professional literature of an "universal" polliniser variety is a futile illusion.

Later works having dealt with **apricot** *(Maliga,* 1966a) indicated that the number of auto-incompatible varieties tended to be increased, but fortunately the self-fertility of those grown in Hungary is still sufficient. Since then, auto-incompatible Hungarian varieties already have been found, but it turned out only after the death of Maliga.

Maliga (1966b) also examined the fertility of **quince**, contributing to the clearing of a weak point of our knowledge of floral biology. Decisively, the necessity of cross pollination has been stated. Maliga was one of those who considered the high number of seeds in the quince fruit and its relation to fruit set. However, the range of varieties did not coincide when seed number and alternatively the rate of fruit set have been taken into account. It has been proved that pollen of pear, hawthorn, Japanese quince (*Chaenomeles*) and sorb-apple (rowan-berry) do not fertilise the flowers of quince.

Maliga (1969a) summarised the pollination and fertilisation-biology of **chestnut** as a contribution to a monograph. The relevant information is still valid except some statements concerning the self-fertility of some varieties to be revised.

Valuable contributions are owed to *Maliga* (1969b) in referring to the problems associated with maintenance of fruit varieties. It is different according to the species, if the role of mutations in changing the varietal characteristics of particular varieties as far as dates of blooming and properties of fertilisation are considered.

Pál Maliga produced a host of hybrids with the purpose of breeding in apple, peach and apricot, however their evaluation was unfortunately thwarted. Some seedlings of the abolished populations (by reasons of saving space) could be rescued, those were mainly apricots.

Comprehensive and permanent results are achieved in the breeding of varieties in **sour cherry**. The problems,how to produce self-fertile varieties also have been solved in his treatise *(Maliga,* 1970). The variety *Pándy meggy* as maternal parent produced in crosses with similarly auto-incompatible males 1.6–11.2 per cent self-fertile progenies, according to the respective families. However, with self-fertile varieties as pollinisers the ratio of self-fertile progenies as well as the rate fruit set after self pollination increased. Data raised and personal advises given by Pál Maliga were utilised in planning of new sour and sweet cherry plantations, where the association and ratio of varieties and mutually fertilising pollinisers are placed on particular growing sites. Special emphasis has been put on the sweet and sour cherry pollinisers eligible to pollinate *Pándy meggy* as the most praised sour cherry variety. The research initiated by Maliga, resulted the foundation of a successful and profitable industry of sour cherries, as the biological aspects have been excellently elaborated *(Brózik* et al., 1974).

At the end of his life work Maliga (1980) undertook the detailed study of blooming phenology and fertility relations of his own developed sour cherry varieties.

The expertise of Pál Maliga has been amply exploited by his personal disciples and a wide population of contemporary and younger professionals, who endeavoured to work and publish in the related fields of sciences. His influence is palpable in many relevant handbooks and publications, which he read or advised as active participant in education and training of graduate and advanced students. As co-author of important handbooks like the one, which dealt with pruning in fruit growing *(Mohácsy, Maliga & Gyuró,* 1968), he traced mainly the physiological relations of the growing and fruiting tree. Maliga was a master in co-ordinating the timeliness and actuality of his activities as well as his publications. He never strived to increase the volume of his literary products, he rather ripened his thoughts and weighed their significance in the service of advancement. That is the reason of the permanent actuality of his professional statements, which are well-founded and still endure criticism. He did not head to reach the top of the professional pyramid, so he arrived there as unintended but with the unanimous consensus of his colleagues.

Hungarian fruit production traditions, horticultural science and education as well as the practice are fully grateful to Pál Maliga, but undoubtedly students of floral biology are the most indebted. His scientific school produced quite a flock of students in Hungary following his footsteps and endeavoured studies in **pear** Pál Nagy, in **sweet** and **sour cherry** and **almond** Sándor Brózik, in **walnut** and **chestnut** Péter Szentiványi, in **apricot** and **sour cherry** Ferenc Nyujtó, in **almond** Bogdán Pejovics, in **plum** Elek Tóth, in **black currant** Aladár Porpáczy jun., in **small fruits** Achmet Seljahudin, in **strawberry** Kálmán Szilágyi and in **raspberry** László Kollányi.

The present authors are involved in apple, pear, quince and also in stone fruit species and received decisive initiatives from their master Pál Maliga. He was a model for us and a personal support for our first steps in the way of research. The life-work of Pál Maliga would be an ideal for students and professionals.

The moral of the life of Pál Maliga

1. He belonged to those, who recognised the technological aspects first beyond the data of blooming and fertilisation in the complex task of associating varieties for commercial plantations.
2. Adapted to the special conditions of the experimental orchard at Kamaraerdő, the fruit species and varieties are compared as for their blooming and properties of fertilisation under identical ecological conditions in order to derive general conclusions as regularities.
3. He concentrated in his observations and investigations upon the old Hungarian local and regional varieties, but also international standard varieties have been considered.
4. He was the first, who applied the method of microphenology in Hungary, which is the most accurate in determining the overlap of blooming periods of varieties, one to be pollinated and the others as potential pollinisers.
5. In the breeding of sour cherries, he chose the varieties to be crossed according to their data characterising fertility relations. That was the most promising way to produce self-fertile varieties for substituting the variety *Pándy meggy*.
6. His activity founded a scientific school – unconsciously – the members of it profess themselves as disciples of the Master, whose teaching and example is indispensable for them.

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