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Pomology of gene resources bearing resistance to *Erwinia amylovora*

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Summary: The ecological farming and an increasing demand for healthy fruits free from chemical residuals necessitated the reevaluation of the existing cultivars and breeding suitable cultivars for the new requirements. We have gathered the old genotypes known in the Carpathian Basin, and we have selected the most suitable ones according to fruit quality and resistance to diseases in the last fifteen years. The main aim was the selection of resistant genotypes against fire blight and powdery mildew as gene sources for our breeding program. On the other hand, we consider the best quality traditional cultivars as extensive landscape elements (wayside tree rows or extensive squash producing plantations).

During the pathological evaluation 'Szemes alma', 'Pónyik', 'Sikulai', 'Tordai piros kálvil' and 'Szabadkai szercsika' cultivars proved to be good resistance sources (due to their outstanding resistance to fire blight). The latter four cultivars are not susceptible even to fungal diseases, and their quality is also acceptable so those are commendable for ecological farming or for renewing the sparse orchards. According to fruit quality and low susceptibility to diseases 'Batul' and 'Vilmos renet' can also be offered for extensive organic production.

We have made original or renewed pomological descriptions of the selected cultivars, and we also publish their characters according to the terms of UPOV TG/14/8 based on to our evaluations.

Key words: fire blight, resistance, apple cultivars, description, pomological characteristic

Introduction

Apple is the most significant and most consumed fruit of the temperate zone. The fresh apple as well as its products have been essential items in human nutrition since ancient times. *Juniper* et al (1999) supposed that this fruit has been cultivated for thousands of years. Remnants of apple have been found in archeological sites e.g. in the Jordan valley at Jericho and in Anatolia, which have been dated to 6500 B. C. (*Morgan & Richards*, 1993). According to *Zohary & Hopf* (1994) apple has been grown in Israel around 1000 B.C. *Morgan & Richards*, (1993) takes it as a proved fact that fruit growing and consumption, including apple, was a current phenomenon during the first millennium before Christ in everyday life all over Mesopotamia, Armenia, Turkey and Greece. In ancient Persia, the apple was held in high esteem because of its refreshing sugar and acid content, the best ones being served up as a dessert or last dish, whereas the inferior quality was a constituent of mixed dishes combined with meat or legumes. The apple occupied an important position in the gastronomy of old times, and was comparable with eggs and olives.

Ethnographic studies of *Andrásfalvy* (2001) prove that fruits – including apple – were an everyday food of rural life within the Carpathian basin up to the end of the 18th century. The general expropriation of the commons by the landlords caused that woods, tide land and pastures used earlier in common, set limits, nay, prohibited the popular fruit growing by the emancipated population of serfs. Herdsmen used earlier to graft the local cultivars on spontaneous crab seedlings in those areas. Subsequently, apple became a delicacy only, whereas the general consumption of fruit diminished to a small fraction of the old volume within a period of about two generations. Jointly, the utilisation of cultivars changed a lot, i.e. many cultivars have been abandoned as being less tasty but more productive, firm, preservable, overwintering, at spring time softening and consumed in a mealy condition.

The recent generation is already rather fastidious in choosing fruit quality, appearance and taste, moreover, it is commonly known that vitamins, fibers, minerals, in addition, anti-oxidant compounds are needed to preserve health. The large number of cultivars available represents a wide scale of variability in colour, shape, taste and consistency. In the case of apples, consumers recognise most of the cultivars, thus the widening the offer with new cultivars would be a promising task to challenge the attention of gourmets as well as of experts.

Nevertheless, health and environmental protection require that in the future only special technologies will be admitted, which are conform with the integrated intense production of commodities. The majority of goods are already offered by integrated technologies, but the alternatives of environmentalism (closed systems of bio-production, home gardens, scattered and regional orchards, areas of mixed

Table 1 Characteristics of Ponyik, Sikulai and Szemes alma

CHARACTERISTIC	PÓNYIK ALMA	SIKULAI	SZEMES ALMA
Tree: vigor	Vigorous	Medium	Vigorous
Tree: habit (columnar types excluded)	Spreading	Upright	Drooping
Dormant one-year-old shoot: pubescense	Medium	Strong	Weak
Dormant one-year-old shoot: thickness	Medium	Thick	Thin
Dormant one-year-old shoot: length of internode	Medium	Length	Medium
Dormant one-year-old shoot: number of lenticels	Few	Medium	Few-medium
Leaf blade: length	Medium	Length	Length
Leaf blade: width	Medium	Medium	Medium
Leaf blade: ratio length/width	Medium	Large	Large
Petiole: length	Medium	Medium	Short
Fruit: size	Large	Medium	Medium
Fruit: ratio height/width	Small	Small	Small
Fruit: position of maximum width	Towards stalk	Towards eye	In middle
Fruit: shape	Flat globose	Globose conical	Flat globose
Fruit: ribbing	Weak or medium	Weak	Absent or very weak
Fruit: aperture of eye	Close	Close	Open
Fruit: size of eye	Small	Medium	Medium
Fruit: depth of eye basin	Medium	Medium	Medium
Fruit: width of eye basin	Medium	Medium	Medium
Fruit: thickness of stalk	Medium	Medium	Thick
Fruit: length of stalk	Short	Short	Short
Fruit: depth of stalk cavity	Deep	Small	Small
Fruit: width of stalk cavity	Small	Small	Small
Fruit: bloom of skin	Absent	Small	Absent
Fruit: greasiness of skin	Absent	Absent	Absent or very weak
Fruit: ground colour (if visible)	Yellow-green	yellow	Green-yellow
Fruit: amount of overcolour	Absent or low	Very high	Low
Fruit: over colour	orange	red	red
Fruit: intensity of over colour	Absent or light	Dark	Light
Fruit: pattern of over colour of skin	Absent	Solid flush with stripes	Solid flush
Fruit: amount of russet around eye basin	Large	Absent	Absent
Fruit: amount of russet on cheeks	Absent or very low	Absent or low	Absent
Fruit: amount of russet around stalk cavity	Large	Medium	Very low
Fruit: size of lenticels	Large	Large	Medium
Fruit: firmness of flesh	Medium	Very firm	Medium firm
Fruit: colour of flesh	Yellowish	Yellowish	White
Time of beginning of flowering (10% open flowers)	Medium early	Medium early	Medium
Time of maturity for consumption	Medium	Medium late	Medium

utilisation, alleys) also should be considered. Programs of rural development should be taken into account, too. *Timon* (2002) e.g. called the attention to the possibility of organising „fruit excursions" in West-Transdanubia as a way to stimulate economical as well as social development of the region.

Technologies being environment-conscious require competitive cultivars with adequate quality, productivity, adaptation to local ecological conditions, but first of all resistance to common diseases. All that requires a re-evaluation of the existing assortment of cultivars and its completion with new ones.

Preliminaries and results of research

The breeder's work started with the thoughtful choice of parents to be crossed. In our department, breeding started 15 years ago (*Tóth* et al., 1994) and some cultivar candidates appeared soon (*Tóth* et al., 2004), but a search, evaluation and preservation of genetic resources proved to be a fundamental condition of progress. For this purpose, old cultivars grown in the Carpathian basin have been collected (*Tóth*, 2005) and a regular test has been performed on accessions regarding susceptibilty or resistance to fire blight (*Kása* et al., 2002, *Tóth* et al., 2005a, 2005b). Development of multiple resistance and good fruit quality being the purpose of the program, an identification of genetic resources for resistance to scab (*Venturia inaequalis*), powdery mildew (*Podosphaera leucotricha*) and fire blight (*Erwinia amylovora*) was our main task.

The cultivars to be examined have been collected during journeys of the 1990s to Sub-Carpathia (Visk, Ukraina), moreover, we received precious items by courtesy of the British National Collection (*Tóth*, 2005). The first tests with *in vitro* inoculations of the bacteria of fire blight (*Tóth* et al., 2005a, 2005b) revealed that some cultivars are moderately resistant to *Erwinia amylovora* – 'Szemes alma', 'Pónyik', 'Sikulai', 'Tordai piros kálvil' and 'Szabadkai szercsika' – therefore, they are eligible as parents. The last four of them seemed to be less susceptible to fungal diseases too, and their fruit is of acceptable quality. In ecological fruit production, in scattered orchards, they could be recommended even for plantations.

Presentation of the gene sources

For resistance to fire blight, the following old Hungarian cultivars ('Szemes alma', 'Pónyik alma', 'Sikulai alma', 'Szabadkai szercsika', 'Tordai piros kálvil') are pomologically characterised according to the terms of UPOV TG/14/8 and presented in *Tables 1* and *2*. Pomological description of 'Szemes alma' has been accomplished in our department, whereas the rest of cultivars are referred to the original descriptions, where the native sites (Sub-Carpathia, Transylvania and the British National Collection) are also considered. A short description is given in the alphabetic order. The genotypes are available in our department.

Pónyik alma:

It was found in Alsófejér county on a clearing near the village "Poiana-mic" (Kismező). Its parents are unknown.

It ripens late, at about mid October. The fruit has an irregular flattened form, often asymmetric. It is of large or extra-large size. The calyx is small and closed. The peduncle is variable mostly medium long, but always lignified and bulging. The peduncular depression is narrow, medium deep, funnel shaped, radial rusty stripes. The skin is thick, glossy, yellow-green, pretty yellow after ripening with orange buff on the sunny side. The flesh is yellowish white, sometimes with greenish tint, compact, cracking, melting, sweet like honey, smelly, spicy, very tasty. The middle axis of the fruit is open. Its season of consumption and utilisation is between November and February, though at cooler growing sites it could be kept until spring. It could be assigned to the group of kitchen–table cultivars, and processed as baby food.

The tree is vigorous, productive with spreading branches, loose canopy and large crown. Shoots are thick, long, erect with yellow, downy skin. Leaves are oval with thorny tip, regularly, deeply serrated. Their tissue is thick, the adaxial surface is smooth, the abaxial is downy. Blooming time is semi-late immediately after that of Golden Delicious.

Its synonym is: Török mocskotár. Many variants are known.

Sikulai alma:

An ancient Hungarian cultivar, originating from the village Sikula on the river Fehér-Körös, where *Bereczki* (1886) claimed that it existed since the Turkish occupation.

Ripening ensues at the end of September or the beginning of October. The fruit is conical-round or flat-round, often asymmetric. The otherwise large fruits become easily small when crowded. The peduncle is short, medium thick, in a depression of rusty sides. The fruit skin is smooth, golden yellow with deep red stripes, which may cover the majority of the surface. The flesh is yellowish white, juicy, sour-sweet. The follicular cavity is half open, several seeds are produced. It is consumed from December to April as fresh dessert or used for culinary purposes, moreover, recommended for processing to fruit juice or concentrates.

The tree is moderately vigorous, productive, starts fruiting early. Shoots are thick, erect, dark brown with small lenticels and short internods. Leaves are large, rigid with thick tissue, their stems are short, medium thick, downy. Stipules are small, filamentous.

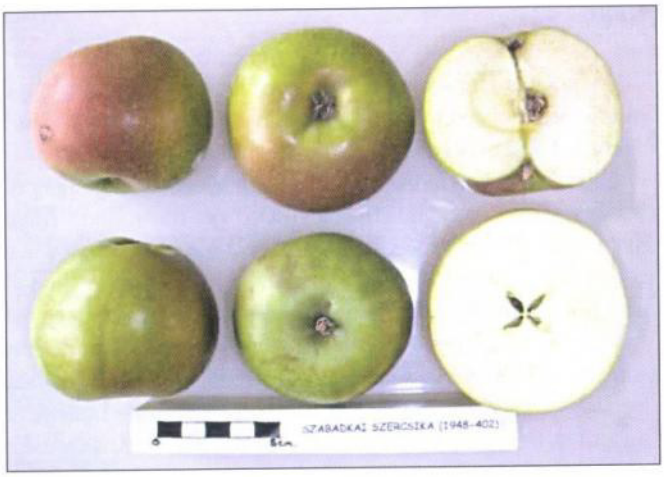
Along riverbanks, flood plains, muddy areas with warm weather are its preferred growing sites.

Synonyms: Pomme de Sikula, Sikulaerapfel, Székely alma, Seklerapfel. Many variants exist.

Szabadkai szercsika:

A native of Hungary, most likely from a region of the Great Plain between the two main rivers, Danube and Tisza. South to Szeged, there were extended plantations of it. Máté Bereczki, the prominent pomologist of the 19th century treated it as 'Szabadkai nagy szercsika' assigned to the group of 'Rambúr-apples'.

Ripening time is late, i.e. the second part of October, and was kept until April with success. Large or extra large fruits conical-round, somewhat flattened, often asymmetric in shape. The surface is a little vaulted and ribbed, irregular. The peduncle is short, stout, thickening toward the fruit, ending in a funnel shaped depression, where hardly any rusting occurs. The calyx is closed in a deep, wavy dish. The skin is tender and smooth, growing waxy during storage. The ground colour is first vivid green turning lemon-yellow with a reddish-brown



buff on the sunny side. The whole surface is sparsely dotted with remarkable large, white lenticels. The flesh is yellowish white, crispy, firm and juicy. It tastes sweet-sour, slightly scented, deliciously spicy, being the most favourable around February. It was consumed after a prolonged storage, thus, it was sold by piece as fresh dessert apple.

The tree is vigorous with a relatively dense canopy. After an early start, it becomes a good yielder, but its high productivity depends on the growing site and good weather. The leaves are large, thick, tough textured, broad oval, irregularly serrate. The leaf stem is short or medium long, the stipules are underdeveloped. The early blooming coincides with that of „Idared". It is not prone to premature fruit drop.

Synonyms: Szegedi szercsika, Szabadkaer szercsika.

Szemes alma:

It has been found in the Sub-Carpathian area as a widely grown cultivar. Its origin is unknown, most likely a random seedling.

Its harvest is actual at the end of September, and the fruits are kept for a long period. The medium-sized fruits are flat-round. The peduncle is short, medium thick, the calyx is small and often open. Ground colour is greenish yellow, at maturity yellowish green with a washy light red cover on the sunny side. The surface is glossy, not rusting, however, less attractive because of flecks of different size caused by scab and similar scared areas. The flesh is white, medium firm, delicious, juicy at maturity and acidulous. It is used for culinary purposes and recommended for processing of juice and concentrate.

The tree is vigorous, its crown is spreading with drooping branches. It is productive, the shoots are medium thick, the down and lenticels are less expressed.

No synonyms are known.

Tordai piros kálvil:

The cultivar has been found in Transylvania, near the town Torda, its origin is unknown.

Its maturity is expected around the beginning or mid of August, and the fruit is usually kept until the end of September. The fruit is conical-round, often irregular combined with a small or medium size. Its surface is slightly and irregularly ribbed. The peduncle is long, medium thick in a deep depression sometimes boarded with radial, light corky strips. The open or demi-closed calyx is in a shallow depression. The fruit skin is tender, glossy, golden yellow at maturity as its ground colour. At favourable light conditions, the whole surface becomes washed light red with dark red stripes. Scattered lenticel dots contribute to the attractivity of the fruit. The flesh is yellowish white, soft, melting, juicy, susceptible to squeezes. Its taste is sweet-acidulous with a delicious, spicy strawberry smell. It is recommended first of all for culinary purposes, especially for making purée.

The tree is moderately vigorous, starts fruiting early, yields profusely and regularly. The shoots are medium thick, downy, reddish brown with scattered lenticels. The internods are relatively long, the leaves are large or medium large with thick and hard texture, broad oval shaped, regularly serrate. The leaf stem is medium long, thick and stiff, the lanceolate stipules are spreading apart.

Its blooming time is early, coincident with that of the summer cultivars.

No synonyms are known. Its first description was presented by M. Bereczki. The accession used in our present work does not quite conform with the original.

Table 2 Characteristics of Szabadkai szercsika and Tordai piros kálvil

CHARACTERISTIC	SZABADKAI SZERCSIKA	TORDAI PIROS KÁLVIL
Tree: vigor	Medium	Medium
Tree: habit (columnar types excluded)	Spreading	Upright
Dormant one-year-old shoot: pubescense	Strong	Medium
Dormant one-year-old shoot: thickness	Medium	Medium
Dormant one-year-old shoot: length of internode	Length	Medium
Dormant one-year-old shoot: number of lenticels	Few	Few
Leaf blade: length	Length	Medium
Leaf blade: width	Width	Medium
Leaf blade: ratio length/width	Medium	Medium
Petiole: length	Short	Medium
Fruit: size	Large to very large	Small
Fruit: ratio height/width	Small	Medium
Fruit: position of maximum width	Towards stalk	Towards stalk
Fruit: shape	Globose conical	Globose conical
Fruit: ribbing	Medium	Weak
Fruit: aperture of eye	Close	Open
Fruit: size of eye	Medium	Large
Fruit: depth of eye basin	Deep	Small
Fruit: width of eye basin	Medium	Medium
Fruit: thickness of stalk	thick	Thin-medium
Fruit: length of stalk	Short	Long
Fruit: depth of stalk cavity	Deep	Deep
Fruit: width of stalk cavity	Law	Law
Fruit: bloom of skin	Absent	Absent
Fruit: greasiness of skin	Medium	Absent
Fruit: ground colour (if visible)	Yellow, lemon coloured	Gold-coloured, yellow
Fruit: amount of overcolour	Small	Small
Fruit: over colour	Brown-red	Pink
Fruit: intensity of over colour	Light	Medium
Fruit: pattern of over colour of skin	Solid flish	Solid flush with stripes
Fruit: amount of russet around eye basin	Absent	Very low
Fruit: amount of russet on cheeks	Very low	Low
Fruit: amount of russet around stalk cavity	Low	Low
Fruit: size of lenticels	Large	Small
Fruit: firmness of flesh	Very firm	Soft
Fruit: colour of flesh	Yellowish	Yellowish
Time of beginning of flowering (10% open flowers)	Early	Early
Time of maturity for consumption	Late	Early

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