

GENETIC RESOURCES OF CHERRY

AK SHUKLA, KK PRAMANICK, SANTOSH WATPADE AND MADHU PATIAL

ICAR-IARI, Regional Station, Amartara Cottage, SHIMLA-171004 India
Corresponding authors E-mail: akshuklahort@gmail.com

Abstract: There are many cherry species, but only a few have been domesticated. The tart cherry, is sometime called “red cherry” or “sour cherry” and may have arisen from an unreduced pollen grain of *Prunus avium* crossed with *Prunus fruticosa*. Trees are very cold hardy, but are shorter lived than sweet cherry. The fruit is relatively small, and have higher acid and lower sugar content than sweet cherry. Tart cherries are used for processing, jam, and pie filling. The Duke cherry is a hybrid of *Prunus avium* and *Prunus cerasus* and all gradations between the two species exist, but most varieties more closely resemble sweet cherry. There are a number of varieties. **Sweet cherries** are the variety most often found in markets. They have a thick, rich, and almost plumb-like texture. **Sour cherries** are not usually eaten raw, but are widely used for making preserves, candy etc. Sour cherries are much smaller than sweet cherries and all varieties are self-fertile. Botanically, the cherry fruit is a drupe (stone fruit), this fruit belongs to many plants of the genus *Prunus* and packed with healthy nutrients and excellent antioxidants. Cherries are cultivated all over the world and the top 3 producers of cherry are Turkey, USA and Iran. The cultivated forms are of the species sweet cherry (*Prunus avium*) to which most cherry cultivars belong, and the another sour cherry (*P. cerasus*), which is used mainly for making preserve etc. Both species originate in Europe and western Asia; they do not cross pollinate. Some other species, although having edible fruit, are not grown extensively for consumption, except in northern regions where the two major species is difficult to grow.

INTRODUCTION

Cherry trees required highest chilling among the temperate fruit and do not thrive where summers are long and hot or where winter temperatures are high for short periods. Most sweet and tart cherry varieties have chilling requirements of about 1,000 hours during the winter are required. Critical temperatures for fruit buds are (-) 6°C at the green tip stage, (-) 3.9° at the 1/2 inch green stage (when young shoots are about 1/2 inch long), (-)2.2° at tight cluster through bloom, and (-) 1.1°C at petal fall (when flower petals have just fallen off the flowers). Well drained soil, with a pH of 6.2 to 6.8, and have a rooting depth of at least 1 m. Cherry roots are extremely sensitive to excessive moisture, which may stunt tree growth or kill the tree. Tree losses caused by the soil-borne fungus *Phytophthora* (crown rot or collar rot) tend to be greater in

wet or poorly drained soils. Where soil moisture is excessive, trees may be planted on bunds or raised beds 18 to 30 inches high and 5 feet wide at the base. Cherry trees can be easily grown from seed specially for rootstock purpose. Seeds should be removed from the ripe fruit and can be stratified and planted in the spring. If field is under cold zone area direct sowing can be practiced. To stratify seeds, put them in a sand layers then place them in a container or plastic bag then place them in the refrigerator for 90 to 150 days in temperatures of 3-4 degrees centigrade. Grafting is very common method of propagation in temperate and sub-temperate region. Presently, whip, cleft and tongue grafting are being practiced in multiplication of cherry. Medium Hard wood cutting is preferred for cherry propagation. In this method, a twig or small shoot is cut from the tree and dipped

the cut end into a rooting hormone (IBA), it is placed in a growing medium until the roots formed. There are different media used for rooting, some of the most common ones are sand, peat, perlite and FYM or vermicompost, as well as mixtures of these. In old plantation suckers are emerged from lateral side of main stem. Generally suckers are profusely rooted but if numbers of suckers are more from one tree then root system are poor and there is need to promote rooting by application of rooting hormones. Rooting of cherry suckers has been made possible with use of rooting hormones like IBA (6000 ppm) in combination with NAA (2000 ppm).

USES AND NUTRITIONAL VALUE

Cherries are packed with essential elements needed by the body including antioxidants, vitamins, carbohydrates, and minerals such as potassium, zinc, calcium, manganese, phosphorous, and iron. Health benefits derived from consuming this fruit range from weight loss to fighting cancer, gout arthritis, blood pressure, headaches, neurological ailments, aging, and heart disease. Cherries are an excellent source of fibre which aids in digestion. The fruit is versatile and can be consumed raw, added to food as well as strained for juice. The cherry tree is highly valuable because of its rich grain and exotic colour. It is widely used in the furniture industry.

TAXONOMY

Sweet cherry (*Prunus avium* L) belongs to family Rosaceae sub-family Prunoideae and order Rosales. It is diploid in nature with chromosome number $2n = 16$. The first diploid *Prunus* species originated in central Asia, and sweet, sour and ground cherries were early derivatives of this ancestral *Prunus* (Watkins, 1976). *P. fruticosa* Pall., the ground cherry is considered the probable parent of both *P. avium* and *P. cerasus* (Fogle, 1975). Sour cherry is believed to be a natural hybrid of ground cherry and sweet cherry. The sweet cherry trees are large (30-40 feet tall) and usually pyramid shaped. Branches grow upright. The fruits are large, have a deep stem cavity, vary in colour from light yellow to dark red to

purplish black. Flowers arise from clusters of 2 to 5 flowers on short spurs with multiple buds at tips; the distal bud develops into a leafy shoot. The flesh ranges in texture from tender to firm, and is sweet. Most sweet cherries are consumed as fresh fruit. Duke cherries (*P. gondouinii* (Pot. & Turpin) Rehd.) are hybrids between sweet and sour cherry varieties. Leaves are relatively larger, elliptic with mildly serrate margins, acute tips, petioled, and strongly veined. Fruit is a fleshy drupe (stone) with thin edible exocarp and fleshy mesocarp. The hard stony endocarp contains seed.

CENTRE OF DIVERSITY

Basically, cherries are native to Europe and Asia regions. Sweet (*Prunus avium* L.) and sour (*P. cerasus* L.) cherries are native to Near East centre which includes Asia Minor, Iran, Iraq and Syria (Vavilov, 1951). More specifically, sour cherry is native to Carpathian Basin. Sweet cherries (mazzard) have been grown in southern Russia, north of the Caucasian mountains to the north of France for a long time. Natural range of sweet cherry also includes the temperate regions of Europe, from the northern part of Spain to the south eastern part of Russia (Hedrick, 1915). Ground cherry (*P. fruticosa* Pall.) is native to western and central Asia, specifically in Russia (Watkins, 1976; Iezzoni, 2008), and widely spread over the major parts of central Europe, Siberia and northern Asia. *P. tomentosa* Thunberg (Nanking or Hansen Bush cherry) is native to north west China (Kask, 1989).. Cherry laurel (*P. laurocerasus* L.) originated in central and west Asia, south eastern Europe and Anatolia (Olden and Nybom, 1968; Schquenbergh and Paris, 1975). Cherry was brought under cultivation first in Greece (Marshall, 1954), and in 74 B.C the Roman General Lucullus brought to Rome from Cerasunt on the Black Sea. Promising exotic cultivars like Bigarrean Napoleon, Black Heart, Guigne Noir for J&K and cultivars like Black Tartarian Bing, Napoleon (white) Sam, Sue (White), Shella for H.P. have been identified. For warmer climate, cultivars like Summit, Sunburst, Lapins, Compacat and Stella have been found to be promising. Turkey is the largest producer of cherry fruits with production of 480,748 tons

which is closely followed by USA 384,646 tons production. Iran and Italy are other world top producers of cherry, producing 200,000 and 104,766 metric tons respectively. In India Cherry is mainly cultivated in Jammu and Kashmir, Uttarakhand and Himachal Pradesh.

POLLINATION BEHAVIOUR

All commercial varieties of sour cherry are self-fertile, and there is no need to plant more than one variety. Pollination requirements for sweet cherries are complicated that most commercial varieties are self-sterile, and some combinations are incompatible, so it is critical to select varieties that are compatible. In addition, good pollinating varieties must bloom at the same time. Eighteen incompatibility groups have been identified. Varieties in the same group cannot be used to pollinate each other. To ensure effective pollination in commercial plantings, at least three varieties should be planted. It is easier to manage solid rows of a single variety than rows containing more than one variety. To ensure adequate pollination, alternating rows of varieties is ideal. An acceptable planting pattern includes two or three rows of one variety adjacent to at least one row of a compatible variety.

VARIETIES

Recommended for Jammu and Kashmir : Bigarreau Noir Gross, Guigne Noir Hative, Early Purple Black Heart, Guigne Pour ova Precece, Black Heart, Bigarreau Napoleon, Guigne Pour ova Precece, CITH-Cherry-1, CITH-Cherry-2, Bing, Lapinus and Stella.

Recommended for Himachal Pradesh (Shukla, 2020): White Heart, Stella, Lambert, Pink Early, Napoleon White, Black Tartarian, Van, Early Rivers and Black Republican.

Dark coloured varieties - Cavalier, Black Tartarian, Kristin, Ulster, Hedelfingen, Hudson

Light coloured varieties - Emperor Francis, Gold, Napoleon, Rainier

Self-fertile varieties- Vandalay, Stella, Tehranivee, Sonata, Whitegold, Symphony, Blackgold, Sunburst, Lapins, Skeena, Sweetheart

Varietal description (Ken Slingerland 2008)

Bing: A large, black, firm, good-quality cherry susceptible to cracking. Bing originated

in the Pacific Coast region and is a major cultivar in Washington, Oregon, and British Columbia. The production has been inconsistent in Niagara orchards in the past. It was fairly extensively planted in Ontario but has competed in the same season as Viscount and Vandalay in grower plantings.

Cavalie: A medium to large fruited, early season cherry, which ripens around the same time as Vista and Viva. The tree is moderately vigorous with a slightly upright growth habit and a low to average yield potential. Similar in firmness and colour to Hedelfingen but it has a lower incidence of splits.

Cristalina: A large fruited, early season cherry which matures one day after Viva. Slightly firmer, but paler than Hedelfingen. Stem length is medium and does not tear from fruit. Tree shape is moderately vigorous with an upright growth habit and becomes spreading as the tree matures. Yields are average and cropping is consistent.

Hartland: Early season, high yielding cherry which matures the same time as Viva. Fruit size is average and slightly firmer than Hedelfingen. Splits to the same degree as Hedelfingen. Tree is spreading and early bearing.

Hedelfingen: A medium to large, firm, good quality black cherry with good resistance to cracking. Hedelfingen is the cultivar most extensively planted in Ontario. Trees bear fruit early and are very productive. Fruit colour early before they are fully mature.

Kristin: Small fruited, but high yielding early season cherry which matures 1 day after Viva. Fruit is firm with similar colour to Hedelfingen. The tree is vigorous, and crops early and consistently.

Lapins: Matures about a week after Hedelfingen. The bloom is self-fertile and blooms in mid season. The tree is very vigorous and upright and is difficult to manage while young. Precocity is medium to good with heavy cropping and occasionally over-cropping. Fruit are dark red when mature, very large, and firm with round shape. Taste is mild to good. Cracking is low to medium. Stems are short to medium.

Napoleon: A large, firm, white-fleshed and productive cherry, known as Royal Ann on the Pacific Coast.

New star: Large fruited, early season cherry with yields similar to Hedelfingen but more susceptible to cracking. Ripens 1 day after Viva. Fruit is firm, but colour is lighter than Hedelfingen. Tree is very spreading, comes into production early, and fruit is well distributed.

Royalton: Large fruited, early season cherry with relatively low yields and susceptible to cracking. It has good quality, flavourful fruit. Tree is spreading.

Somerset: High yielding, early-mid season cherry, maturing 2 days before Hedelfingen. Fruit is similar in size and amount of cracking to Hedelfingen, but firmer. Tree is spreading and early bearing.

Sonata: An average sized, self-fruitful cherry, with low yields and fruit with average quality. Stem length is medium to long. Tree is vigorous and upright. Matures 3 days before Hedelfingen.

Star: A productive, good-quality, medium-large, semi-firm, heart-shaped black cherry with good crack resistance. Ripens one day before Valera.

Stella: Dwarf stature plant, Late maturing variety, having large, firm, black, fair-quality cherry fruit. Its outstanding feature is its self-fertility.

Sunburst: Fruit are large and tend to be firm, dark red with good colour. The tree is self-fertile and sets heavy crops. Matures 3-4 days after Van depending on climate.

Sweet heart: A self-fruitful, high yielding smaller fruited cherry. The tree is very precocious and has potential to bear heavy crop. Fruit is firm with good flavour. Tree is moderately vigorous and spreading. Management of tree vigour and crop load is extremely important to maintain good fruit size and quality.

Ulster: A medium-sized, firm, dark-skinned, dark-fleshed cherry. This very productive cherry, which resembles Schmidt, ripens with Venus and Valera and produces fair quality fruit with fairly good crack resistance.

Valera: The tree is vigorous, comes into bearing early and has been a consistent cropper. Valera is a sister seedling of Venus, but has darker colour, richer flavour and a more consistent crop record than Venus. Fruit are less clustered on

the tree and less susceptible to brown rot than Venus.

Van: A medium-sized, firm, attractive, good-quality, short-stemmed black cherry. It is hardier than Bing and less susceptible to cracking. It ripens in the same season as Hedelfingen.

Vega: A very large, white-fleshed, attractive white cherry. The pit is small and easily removed. Larger, firmer and earlier than most white cultivars, Vega is too tart for dessert purposes until very ripe. Requires a careful spray program because brown rot has occasionally been a problem.

Venus: A large, attractive, excellent-quality, shiny black cherry. Venus has shown a tendency to overbear in some years especially under orchard conditions that favour good cross-pollination. Venus and Valera are the best mid-season black sweet cherries for Ontario.

Viscount: A hybrid that has Hedelfingen and Bing in its parentage, Viscount produces medium to large, firm, good quality, dark glossy red cherries which ripen with Bing. It is productive and has good crack resistance. It should be propagated only on Mazzard rootstock. Viscount is very similar to Bing and less susceptible to cracking.

Vista: A Hedelfingen x Victor seedling that ripens just ahead of Black Tartarian. It is larger, much firmer and attractive but in some years cracking is a serious problem especially in young plantings.

Viva: A medium sized, semi-firm, long-stemmed, good-quality, dark red cherry, ripening a day later than Vista. Viva lacks the finish and firmness of Vista, but is highly resistant to splitting. Fruit are less clustered on the tree than Vista and consequently less susceptible to brown rot.

Vogue: A large, shiny, firm, dark red cherry with a small pit. It ripens one day later than Bing and is good for canning. Vogue is more productive than Bing, and more crack-resistant. In heavy crop years, the fruit sets in clusters and requires careful spraying for brown rot control.

Windsor: A small, productive, light-coloured cherry, Windsor once was the main sweet cherry cultivar in Ontario, but since has decreased greatly. Plantings of Hedelfingen and

Vic, which have better size, colour and quality, have replaced this cultivar.

Variability in Root stocks (Pramanick *et al* 2015, Verma, 2014)

Mahaleb: It is a wild seedlings of *Prunus mahaleb* L. It is slightly dwarfing. Tolerant to cold and drought, trees are more productive at a young age, but trees are often shorter lived. It is resistant to crown gall, bacterial canker and some nematodes. It is susceptible to collar rot. Some varieties, such as 'Van', are not compatible with mahaleb.

Mazzard: Mazzard is a wild seedling of *Prunus avium* L, sweet cherry. It produces a larger tree, compatible, induces fruiting at a later age, and is more tolerant of wet soils.

Gisela: The Gisela rootstocks were developed in the early 1960s, at Justus Liebig University in Giessen, Germany.

Gisela 1: It is a hybrid of *Prunus fruticosa* 'Klon 64' and *Prunus avium*. It is a triploid and produces a tree about 25% the size of Mazzard, and induces early and heavy production. It can be used for both sweet and tart cherry. It is sensitive to pollen-born viruses like *Prunus necrotic ringspot virus* and *prune dwarf virus*.

Gisela 5: It is a hybrid of *Prunus cerasus* 'Shattenmorelle' and *Prunus canescens*. It is a triploid, produces a tree about 45% the size of Mazzard, and can be used for both tart and sweet cherry. Gisela 5 induces early and heavy production. It is tolerant of cherry viruses, and heavy soils.

Gisela 6: It is a hybrid of *Prunus cerasus* 'Shattenmorelle' and *Prunus canescens* and can be used for both tart and sweet cherry. It is a triploid and produces a tree about 60% to 95% the size of Mazzard, depending on the scion variety. It has good resistance to cherry viruses, does not require support, and is propagated from green wood cuttings.

Gisela 7: It is a hybrid of *Prunus cerasus* 'Shattenmorelle' and *Prunus canescens*. It produces a tree about 50% the size of Mazzard, and can be used for both tart and sweet cherry. It induces very early bearing, and good lateral branching. Gisela 7 is sensitive to *Prunus necrotic ring spot virus* as Mazzard or Mahaleb.

Dwarfing rootstocks: Colt, CAB 6 P, CAB 11E, W-10, W-11, W-13,

Cold hardy rootstocks: CAB 6P, CAB 11E, W-10, W-13.

Resistant to crown and root rot: Colt, M x M-2, M x M 39, M x M-97, W-10, W-11 & W-13.

Resistant to crown gall: F 12/1

Resistant to canker/gummosis: F 12/1, Charger, M x M-14, 39, 97 and 60

Prunus japonica: It is a dwarfing rootstock for grafting of all stone fruits identified at I.C.A.R.-I.A.R.I., Regional Station, Shimla as a multiscionic rootstock suitable for grafting in different stone fruits. It has been successfully evaluated as a dwarfing rootstock for majority of the stone fruits viz; apricot, peach, plum, almond, cherry etc . It is highly precocious and starts fruiting in the same year after grafting with more than 90% graft success. Propagated through mound layering before the onset of monsoons has been found very successful. This selection has a potential for use as a standardized dwarfing rootstock for high density plantings of apricot, plum, almond, cherry and peach as well as for kitchen gardening of stone fruits.

References

- Fogle HW (1975). Cherries. In Janick J, Moore JN (eds.) *Advances in Fruit Breeding*, Purdue Univ. Press, West Lafayette, pp. 348-366.
- Hedrick UP (1915). *The cherries of New York*. J. B. Lyon, Albany, New York.
- Iezzoni AF (2008). *Prunus avium*-sweet cherry, *Prunus cerasus*- sour cherry, *Prunus fruticosa*- ground cherry. In Janick J, paull RE (eds.) *The Encyclopedia of Fruits and Nuts*, CAB International, UK., pp. 687-694.
- Kask K (1989). The tomentosa cherry, *Prunus tomentosa* Thunb. *Fruit Var. J.*, 43: 50-51.
- Ken Slingerland (2008) *Cherry Cultivars - Sweet and Tart - former Tender Fruit & Grape Specialist/ OMAFRA*; Bill Lay - former University of Guelph. <http://www.omafra.gov.on.ca/>
- Marshall RE (1954). Cherries and cherry products. In *Economic crops*, , Interscience, New York. 5.
- Olden EJ, Nybom N (1968). On the origin of *Prunus cerasus*. *Hereditas*. 59: 327-345.
- Pramanick KK, J Kumar, Shukla AK, DK Kishore, YP Sharma, SS Randhava, PN Gupta, AM Goswami and Santosh Watpade (2015) *Compendium on*

- Rootstock germplasm of pome and stone fruits in Indiapp. 1-110
- Schquenberg PA, Paris F (1975). Healing plants. BLV. Verlagsgesellschaft, Munchen wien Zurih.
- Shukla A K, K K Pramanick, S Watpade and M. Patial, 2020. Cherry. In: Production Technology of Temperate fruits and Plantation Crops. Pp50-62
- Vavilov NI (1951). Phylogeographic basis of plant breeding. In Chester, K. S. (ed.) The Origin, Variation, Immunity and Breeding of Cultivated Plants, *Chronica Bot.*, 13(1/3): 13-54.
- Verma M K. 2014. Cherry production Technology. In: Training manual on teaching of post-graduate courses in horticulture (Fruit Science). Eds SK Singh, AD Munshi, KV Prasad, AK Sureja. Post Graduate School, Indian Agricultural Research Institute, New Delhi-110012, India
- Watkins R (1976). Cherry, plum, peach, apricot and almond. *Prunus* spp. In Simmonds NW (ed.) Evolution of Crop Plants, Longman, London, pp. 242-247.