

## European wild relatives of *Prunus* fruit crops

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### Abstract

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A survey is given of the European wild species of *Prunus* s. lato, their classification and relationship to the fruit crops of the genus. Most important in this respect are the subgenera *Prunus* and *Cerasus*. A lack of knowledge of the infraspecific diversity of the more widespread and variable wild taxa is emphasized and consequently our lack of knowledge with any degree of certainty, of the evolutionary pathways from the wild relatives to the cultivated taxa of the genus. The wild relatives are valuable genetic resources for future breeding programmes, and their natural populations need in many cases to be protected by *in situ* conservation projects.

Europe contains about 20 wild and cultivated species of *Prunus*, i.e. only 5% of the c. 400 species known (Tutin & al. 1968). There are rather conflicting ideas on the classification of this group. The more traditional concept accepts a large complex genus *Prunus* subdivided into several subgenera while many recent publications prefer the splitting of this genus into several smaller genera, based mainly upon the former subgenera (Table 1). In the following discussion, for convenience the broad concept will be used and the different subgroups with their European representatives will be briefly characterized, partly in tabular form (Tutin & al. 1968, Meusel & al. 1965, Scholz & Scholz 1994/95).

### Subgenus *Prunus* (see Table 2)

This is economically the most important group of the genus but our knowledge of the variability of its species and populations and of their taxonomic relations is very incomplete. The statement made by Boissier more than 120 years ago (1872), in his revision of the genus, is still true: 'Species nonnullae ob herbariorum specimina saepius quoad flores vel fructus maturos manca imperfecte notae et accurate in locis natalibus investigandae'.

Table 1. Intrageneric subdivision of *Prunus* L. *sensu lato*, and the taxa recognized in this group when *sensu strictu* classification was applied.

subgenus <i>Laurocerasus</i> (Duh.)	<i>Laurocerasus</i> Duh.
subgenus <i>Cerasus</i> (Mill.) Focke section <i>Cerasus</i> (Mill.) Pers. section <i>Mahaleb</i> Koehne section <i>Microcerasus</i> (Spach) Schneid.	<i>Cerasus</i> Mill.
subgenus <i>Padus</i> (Mill.) Focke	<i>Padus</i> Mill.
subgenus <i>Prunus</i>	<i>Prunus</i> L. <i>sensu stricto</i>
subgenus <i>Amygdalus</i> (L.) Focke	<i>Amygdalus</i> L. <i>Persica</i> Mill.

Besides the rather isolated *P. armeniaca* – omitted here because of the lack of European wild relatives – the subgenus includes several wild species, the cultivated plum (*P. domestica* = *P. pumila*) and *P. cerasifera* with both wild and cultivated forms. As is general in the genus, the taxa of subg. *Prunus* are either diploid and self-incompatible or polyploid and self-compatible. There are some exceptions which will be mentioned later. The first three species in Table 2 constitute the polyploid *spinosa*-complex: with the widespread European *P. spinosa* itself, distributed in N.W. Kazakhstan, N. Iran, Caucasus, N. Turkey and N.W. Africa, the local endemic *P. ramburii* from mountains of S. Spain and the dubious pentaploid *P. fruticans* from very scattered localities in Central Europe. The latter is almost certainly of hybrid origin, difficult to distinguish from true *P. spinosa*, and may represent an old abandoned fruit crop. The tetraploid *P. spinosa*, a common shrub in hedgerows, forest edge communities, dry slopes, gallery forests with summer-dry soils, is a very variable species. Its infraspecific variation has been studied so far mostly on a regional basis by Czech botanists. In Table 3 a classification of the black thorn is reproduced, based on proposals by Domin (1944) and Hrabetová-Uhrová (1958), adopted later by Kühn (1988) and supplemented with a recently described Portuguese subspecies.

The distribution of these subspecies is scarcely known outside Bohemia, Moravia and Austria but subsp. *megalocarpa* has also been reported from France. Recently Scholz & Scholz (1994/95) accepted, besides the typical subspecies, only subsp. *dasyphylla* with a rather wide distribution in the southern parts of the area of the species.

The variation within *P. spinosa* is still more complex through the occurrence of cultivated populations and their remnants or escapes, to which for example accessions with large and/or sweet fruits may belong. The sloe had been quite often planted since the Middle Ages as hedge plant, but also for its fruits.

A comprehensive analysis of the *spinosa*-complex is urgently needed. This is a very urgent problem because the more rare taxa or population groups in particular in Central

Europe are endangered by the frequent clearings of hedges and hedgerows and the abandonment of old plantations.

Table 2. Subdivision of *Prunus* subgenus *Prunus*,  $x = 8$ .

<i>P. spinosa</i> L.	4x, self-compatible, widespread, variable
<i>P. ramburii</i> Boiss.	local, S. Spain
x <i>P. fruticans</i> Weihe	5x ( <i>P. spinosa</i> × domest. <i>P. domestica</i> )
<i>P. cerasifera</i> Ehrh. subsp. <i>cerasifera</i> (= <i>P. divaricata</i> Ldb.) several wild subspp. in S. W. Asia	2x (4x, 6x), self-incompatible rather widespread, variable
<i>P. domestica</i> L.	6x, ± self-compatible, cultivated, widespread, variable
<i>P. cocomilia</i> Ten.	2x, local, S. Balkan, S. Italy, Sicily
<i>P. brigantina</i> Vill.	2x, local, S. W. Alps
<i>P. armeniaca</i> L.	2x, N.W. China, Middle Asia, self- compatible, mostly cultivated, variable outside Europe

Table 3. Classification of *Prunus spinosa* L.

<i>Prunus spinosa</i> L.
subsp. <i>spinosa</i> (small, globular, sweet fruits)
subsp. <i>moravica</i> Dom. (small, globular sweetish fruits)
subsp. <i>megalocarpa</i> Dom. (big, globular fruits)
subsp. <i>fechtneri</i> Dom. (small, conical fruits)
subsp. <i>ovoideoglobosa</i> Dom. (big, conical fruits)
subsp. <i>dasyphylla</i> (schur) Dom. (small, globular or conical fruits)
subsp. <i>cerasina</i> Hrab.-Uhr. (relatively small, globular sweetish fruits)
subsp. <i>insititioides</i> Franco (relatively small, globular fruits)

The second group of species of subg. *Prunus* (Table 3) comprehends diploid taxa, among them the two more locally distributed *P. cocomilia* and *P. brigantina* with inedible fruits, although for *P. cocomilia* the occurrence of sweetish variants and their use as wild fruits has been reported (Pignatti 1982). These species are less variable, but also less studied and nothing is known as to whether their spontaneous populations are more or less endangered.

To this group also belongs the cherry or myrobalan plum (*P. cerasifera*), in Europe, occurring spontaneously only in some countries of the Balkan peninsula and the Crimea but much more widespread in S.W. Asia and the Caucasus. From this area several

deviating populations had been described at various ranks, but mostly as subspecies. The species is likewise an important cultivated plant: in Europe it is mostly known as ornamental or as rootstock for plum, less often as fruit crop; in S.W. Asia, especially in the Transcaucasus, it is one of the most important fruit trees with many cultivars. The cherry plum had been involved in the evolution of *P. domestica*, either as one of the cross-parents (together with *P. spinosa*) which probably gave rise to the hexaploid plum after chromosome doubling of the sterile primary triploid hybrid, or as a direct descendent from polyploid individuals (or populations?) which had been recently observed among Caucasian wild forms of *P. cerasifera* (cf. the discussion by Rybin 1936, Beridze & Kvatchadze 1981, Zohary & Hopf 1993).

The wild populations of the species therefore represent very valuable genetic resources, that are obviously nowhere seriously endangered, but that are likewise urgently in need of a thorough modern taxonomic analysis which must comprehend the Asiatic taxa of the species too as well as the cultivated groups. There is much confusion in the literature even with regard to the name (*P. cerasifera* versus *P. divaricata*).

#### Subgenus *Cerasus* (see Table 4)

This subgenus also contains several wild species in Europe, the cultivated sour cherry (*P. cerasus*), and *P. avium* with wild and cultivated forms. Two diploid species are taxonomically distinct and do not even belong to the secondary genepool of European fruit crops. The first, *P. prostrata*, occurs scattered in south European mountains, from Spain to Greece and Crete, and in the Asiatic countries of the East Mediterranean region. It is a member of the mainly East-Asiatic sect. *Microcerasus* (Spach) Schneid. (sometimes referred to sect. *Amygdalocerasus* Koehne of subgen. *Lithocerasus* Ingram). The second, *P. mahaleb* (sect. *Mahaleb* Koehne) is widespread in the submediterranean and southern part of the temperate zone of Europe (also in Morocco and S.W. Asia), and has recently been invading disturbed areas in Central Europe as a neophyte. The rock cherry itself, however, is important as a rootstock for sweet and sour cherry, and was formerly grown also in Europe for the production of pipe tubes and is a fruit crop in Middle Asia. It is rather variable and taxonomically subdivided into four mostly S. and S.E. European subspecies.

In the type section of the subgenus, the correlation between polyploidy and compatibility mentioned above is evident once more: the diploid sweet cherry (*P. avium*), conspecific with wild forms, is self-incompatible; it is widespread in the submediterranean and temperate Europe with scattered localities and dispersed local areas in N.W. Africa, the Caucasus region and N. Anatolia. These populations are variable in regard to fruit taste — sweet in Central Europe, bitter in the Caucasus. A more thorough analysis should give indications of the presumed place of domestication.

The tetraploid self-compatible sour cherry (*P. cerasus*) and *P. fruticosa* are very closely related and freely cross-compatible. *P. fruticosa* is a thermophilous component of (sub)continental shrub associations, occurring in eastern Europe, S.W. Siberia and Kazakhstan, confined to the steppe belt, and has disjunct, more or less local areas in S.E. and Central Europe. Here it is endangered and locally extinct through habitat destruction and genetic erosion in the strict sense. Frequent hybridization with the sour cherry, that is widely cultivated in these parts of Europe, led to genetic introgression of the crop species

into the wild one and to a rapid decrease of true *fruticosa* individuals in the Central European populations. Wójcicki (1991) established a cline of the frequency of *fruticosa* × *cerasus*-hybrids within the area of *P. fruticosa* which ranges from zero in the Ural region to almost 70 % in Central German *fruticosa*-populations. *Prunus fruticosa* is one of the presumed parental species of the sour cherry and therefore an important genetic resource and should be one of the target species of *in situ* conservation especially of its endangered populations in Central- and S.E. Central-Europe.

Table 4. *Prunus* subgenus *Cerasus*,  $x = 8$ .

<i>P. prostrata</i> Labill.	2x, self-incompatible, wild, local in Mediterranean mountains, less variable
<i>P. avium</i> L.	2x, self-incompatible, wild and cultivated, widespread, variable, especially the cultivars
<i>P. fruticosa</i> Pall.	4x, self-compatible (but outcrossing), wild, rather widespread in C., S.E. and E. Europe, not variable, ancestor of <i>P. cerasus</i> ?
<i>P. cerasus</i> L.	4x, self-compatible, cultivated, widespread, also often naturalized, Hybrids between <i>P. cerasus</i> and <i>P. fruticosa</i> ( <i>P. × eminens</i> Beck) frequently occur
<i>P. mahaleb</i> L.	2x, self-incompatible, mostly wild widespread, less variable, colonizer of disturbed habitats outside its natural area

#### Subgen. *Amygdalus* (see Table 5)

The almond subgenus is poorly represented in the European wild flora. Besides the distinctly separated *P. tenella* (sect. *Chamaeamygdalus* Spach), a continental species, distributed from N. Kazakhstan, the Pontic and Pannonic provinces to E. Austria and S. Moravia, there are only two species more or less closely related to the cultivated almond.

*P. discolor* belongs to a strictly Near Eastern series of species that is restricted within Europe to some East Aegean islands, whereas *P. webbii* is a member of the species complex based on *P. dulcis* itself. Self-fertility has been reported for this Balkan-Anatolian species. It is unknown however if this is true for single individuals or for total populations (Browicz & Zohary 1996).

The Apulian land-races of the almond constitute another exceptional self-fertile cultivar group within this otherwise self-incompatible subgenus. Sporadic hybridization does occur

within the almond species complex, thus it cannot be excluded that the self-fertility was introgressed from *P. webbii* into the sympatric local almond cultivars in S. Italy (cf. Zohary & Hopf 1993, Browicz & Zohary, l.c.).

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Table 5. *Prunus* subgenus *Amygdalus*,  $x=8$ .

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<i>P. tenella</i> Batsch (= <i>A. nana</i> L.)	E. C., E., S.E. Europe, not variable
<i>P. discolor</i> (Spach) Schneid. (= <i>A. graeca</i> Lindl.)	local, E. Aegean islands
<i>P. webbii</i> (Spach) Vierh.	local, S. Balkan, S. Italy
<i>P. dulcis</i> (Mill.) Webb (= <i>A. communis</i> L.)	self-incompatible, both wild and cultivated, widespread, moderately variable, 2 wild or weedy subspecies interconnected with the cultivated varieties

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Table 6. *Prunus* subgenera *Padus* and *Laurocerasus*,  $x=8$ .

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subgenus *Padus*

<i>P. padus</i> L.	4x, self-compatible, widespread, less variable
subsp. <i>padus</i> subsp. <i>borealis</i> Cajand.	common in the north, elsewhere on mountains
( <i>P. serotina</i> Ehrh.	4x, E. North-Amer., Mexico, aggressive neophyte)

subgenus *Laurocerasus*

<i>P. lusitanica</i> L.	8x, self-compatible, not variable, 2 subspp. in S. W. Europe, Azores
<i>P. laurocerasus</i> L.	12-22x, self-compatible, local, E. Balkan peninsula, not variable, naturalized

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Conspecific wild and weedy subspecies of *P. dulcis*, as the true ancestors of the crop, occur only in the Levant, but *P. webbii* should receive attention as a member of the

primary genepool of the crop and be considered seriously for *in situ* conservation programmes.

#### Subgenus *Padus* (see Table 6)

For the sake of completeness, the remaining European taxa of two further subgenera will be mentioned, although they are not related to any European fruit crop.

Species of this group are however minor fruit crops in several Asiatic and American countries.

Subgenus *Padus* is usually a tetraploid, self-compatible, holarctic group, represented in Europe by the widespread Eurasiatic *P. padus* which is represented in boreal Fennoscandinavia and in high mountains of Central Europe by a special subspecies, subsp. *borealis* (subsp. *petraea* (Tausch) Domin).

In this century the North-American species *P. serotina*, introduced during past centuries into Europe, became an aggressive colonizer, an invader of natural ecosystems and a troublesome forest weed.

The success of this species may be caused partly by its great regeneration capacity and its very high fruit and seed productivity every year.

#### Subgenus *Laurocerasus* (see Table 6)

This palaeopolyploid group of (sub)tropical origin consists of evergreen woody plants. The two European species have a restricted, refugial distribution in the Western and Eastern Mediterranean area. *P. laurocerasus*, is a widespread ornamental shrub in countries with mild winters and a minor fruit crop in the Transcaucasus; it also occurs along the Black Sea coast in Anatolia, the Caucasus region and in N. Iran.

There is obviously no serious threat to the diversity within the European populations of the taxa of this subgenus, nor those of subg. *Padus*.

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