The name crack willow “Salix fragilis” has historically been applied to taxonomically different willows. The binomial \( S. \textit{fragilis} \) has been used not only for one of the most commonly cultivated and naturalized complex hybrid group of willows, but for a species from Asia Minor as well.

The 2009 publication “Nomenclature of \( S. \textit{fragilis} \) L. and a new species, \( S. \textit{euxina} \) (Salicaceae)” (Belyaeva, 2009) clarifies what should be understood by the name \( S. \textit{fragilis} \) and how this name – as \( S. \times \textit{fragilis} \) L. – should be applied to the widely distributed hybrid crack willow, while the pure species from Asia Minor is newly described as \( S. \textit{euxina} \) I.V.Belyaeva, or Euxine willow.

\textit{All living and herbarium specimens previously labelled as \( S. \textit{fragilis} \) should be revised, and the name “\( S. \times \textit{fragilis} \) L.” should be applied to those, which are likely to be hybrids of \( S. \textit{alba} \) L. and \( S. \textit{euxina} \).}

\textit{Salix euxina} I.V.Belyaeva, or \textit{Euxine willow}. The specific epithet “\textit{euxina}” reflects the natural distribution of the species from Euxeinos Pontos [Πόντος Εὐξέινος] the ancient Greek name for the Black Sea (Belyaeva, 2009). According to Skvortsov (1968, 1973, 1999), the original distribution of this species previously known as \( S. \textit{fragilis} \) auct., non L. is within a narrow region near the Black Sea, including northern Asia Minor and the Armenian High Plateau, where it inhabits the banks of mountain streams. \( S. \textit{euxina} \) is naturalized in Europe, but it occurs much more rarely than its hybrid cross with \( S. \textit{alba} \), \( S. \times \textit{fragilis} \), as approximately only one tenth of all specimens represent pure \( S. \textit{euxina} \).

\( S. \textit{euxina} \), which attains 15 to 20 m in height and up to 1 m in trunk diameter, has a wide crown and deeply fissured bark on old trunks. Its smooth olive green branchlets are glabrous and very brittle at the base: this species propagates itself by easily broken branches (fragmentation). Euxine willow leaves, which are glabrous with pale green underside surface, have stomata on the lower surface only (hypostomatous leaves) (Belyaeva, 2009).
A clone of Euxine willow, *S. euxina* ‘Bullata’ (formerly *S. fragilis* ‘Bullata’ or *S. fragilis* var. *sphaerica* Hryn.), which originated in the Baltic countries in the late 18th century, represents a mutation with a short trunk and very dense globular crown resembling a foamy sphere. It is currently popular as an ornamental tree in Europe. Photo by Y.A. Kuzovkina.

*Salix × fragilis* L. (*S. alba* L. × *S. euxina* I.V.Belyaeva), or *hybrid crack willow* is similar in size to *S. euxina* and has branches, which are also highly brittle at the base. Yet, its branches and branchlets are hairy (a character inherited from *S. alba*) or glabrescent with age. The uniformly dense stomata are located on both leaf surfaces (*amphistomatous leaves*). Catkins with pistillate flowers of *S. × fragilis* are slender and loosely flowered while catkins of *S. euxina* are stout and moderately densely flowered.

*S. × fragilis* was widely planted for erosion control, reforestation, fuel, construction lumber, and as a nectariferous plant for pollinators and became widely naturalized in various parts of the world including Europe, Asia, Africa and North and South America. In Australia and New Zealand, it is considered as a noxious invasive plant.

In summary, the old binomial, *Salix fragilis*, represents two different taxa in herbaria:

- *Salix euxina* I.V.Belyaeva, Euxine willow or pure crack willow
- *Salix × fragilis* L. or hybrid crack willow.

There are binomials – such as *S. × rubens* Schrank and *S. × viridis* Fr. – that were previously assigned to cultivated representatives of the *S. alba*–*S. euxina* complex, and which should now be considered as synonyms of *S. × fragilis.*
Salix × fragilis, hybrid crack willow, naturalized in many parts of the world, where it forms extensive stands along waterways. Photo by Y.A. Kuzovkina.

A recent European study on the population genetic structure of riparian Salix species by Puyvelde (2013) focused on the dynamics of hybridization and introgression of the S. alba–S. euxina complex in tributaries of the Mosel (Luxemburg) and Rhine (Germany) rivers. The DNAs of this complex were analyzed using microsatellite markers involving two Bayesian clustering methods and chloroplast markers.

The authors established the presence of three entities in Europe – S. alba, S. euxina and their hybrids, and also confirmed the findings of Belyaeva that historically the name S. fragilis has been unintentionally applied to both taxa – the pure species and the hybrid with S. alba.

Interestingly, based on the molecular data, the Linnaeus type specimen collected in the Fyrisån river region in Sweden and described by Linnaeus in Herbationes Upsaliensis (1753) as S. fragilis L., appeared to be a hybrid of S. alba and S. euxina.

References: