

Scepticism in nomenclature and taxonomy of the genus *Salix* L (Salicaceae) from Spiti valley, Himachal Pradesh, India

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ABSTRACT

The existing literature on *Salix* in the cold desert of trans-Himalayan Spiti lacks taxonomic studies that facilitate field identification. The absence of comprehensive taxonomic work in Spiti has hindered knowledge of this genus, leading to confusion among researchers. To address this, the ICFRE – Himalayan Forest Research Institute, Conifer Campus, Shimla, undertook a study on the field taxonomic aspects of *Salix*, aiming to develop a simple identification key for Spiti. This paper discusses 13 *Salix* species and one variety found in the Spiti valley, incorporating both field observations and species reported by other authors but not observed during this study period. During sample verification visits to renowned herbaria (DD and BSI, Dehradun), authenticating sheets were seldom found. This taxonomic impediment is hindering the field identification of *Salix* in Spiti. The paper focuses on the taxonomic confusion surrounding *Salix*, particularly concerning the two cultivated/planted tree forms, *S. alba* and *S. fragilis*, both likely introductions to the region. Scepticism in this field arises from uncertainties or disagreements regarding classification, naming conventions or precise species identification.

Keywords: *Salix*; trans-Himalaya; Spiti; cold desert; taxonomy; herbaria; classification

INTRODUCTION

The generic name *Salix* (willow) comes from the Celtic word ‘*Sal lis*’ (near water). Approximately, 300-520 species (including hybrids) of *Salix* are deciduous arboreal forms, mainly trees and shrubs and found growing in moisture laden soils of the cool and temperate regions in the northern hemisphere (Argus 1997, 1999, Skvortsov 1999, Ali 2001, <https://wcvp.science.kew.org>, <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:325916-2#children>).

Troup (1986) reported 25 species of willow from the Indian Himalayan region (IHR), while others put the figure at *ca* 30 (Hooker 1888, Brandis 1906). There are reports of 15 species and 2 sub-species of *Salix* across the Kashmir valley (Javeid 1972), besides the report of 24 species from west Pakistan and Kashmir including Ladakh (Stewart 1972). Kachroo et al (1977) documented 12 species from Ladakh. Most recent reference is that of Malik et al (2020), wherein

18 species have been reported from Jammu and Kashmir and Ladakh (Srivastava and Shukla 2015).

Interestingly, *Salix* represents the most diverse genera of arboreal plants in the cold desert landscape of Spiti in Himachal Pradesh. Not much work has been done on the taxonomic and distributional aspects of *Salix* in the region. The flora of Lahaul and Spiti (Aswal and Mehrotra 1994), that documented 10 species of *Salix*, mainly correspond to the better moisture laden Lahaul region in contrast to the drier landscape of Spiti. In spite of extensive research on *Salix* over the years, the taxonomy for this genus is poorly understood in the region. Here, an effort has been made to survey and study the various species found in the Spiti valley. In this harsh cold desert landscape of Lahaul and Spiti valleys, most species are found thriving in marshy/moist areas, except *S. denticulata*, which is found mainly on the southern dry scree slopes. In the extremely xeric cold desert environs of Spiti, only two tree species of *Salix* (*S. fragilis* L and *S. alba* L) and 3 species of

poplar (*Populus ciliata* Wall ex Royle, *P balsamifera* L and *P nigra* L) have adapted in the cold desert agroforestry and forestry systems (Rawat et al 2006). *S fragilis* and *S alba* are extensively cultivated in the region through traditional shoot-cuttings plantation method in indigenous agroforestry and forestry systems for fuelwood and fodder (Singh et al 1998, Rawat et al 2009, Jishtu and Goraya 2020). In the present century, a number of studies have focussed on *Salix* in the Lahaul and Spiti region (Rawat et al 2006, 2009, Sharma et al 2011, Rawat and Everson 2013, Sharma and Sharma 2022) but seldom has the taxonomic part been studied (Aswal and Mehrotra 1994, Chowdhery and Wadhwa 1984).

METHODOLOGY

Total of 13 species and 1 variety of *Salix* have been discussed in this report from Spiti area, which included field observations and some reported by other authors but not observed during this study period. The two major species encountered during the surveys were *S alba* and *S fragilis*; both of them were found mainly in plantations. Most species found here were sporadic and confined to specific niches, while the two tree forms of *S alba* and *S fragilis* were commonly found across the Spitian landscape, on mountain slopes or in the lowlands forest department plantations. Within the valley, these two main cultivated species differed according to different elevational zones and habitat niche. Their ability, to grow from shoot and stump cuttings under extreme climatic conditions of the cold deserts, made them ecologically suited and socially acceptable for homesteads and afforestation works of the forest department.

RESULTS and DISCUSSION

Salix taxonomy

The genus *Salix* is the largest and also most widespread of the Salicaceae. Taxonomically, it is separated from other ca 51 members of Salicaceae – by buds that are sheathed by a single scale, catkins with entire scales and with small glands on the perianth. In habit, they are deciduous, dioecious trees and shrubs, with very few prostrate shrublets. The genus is classified into 3 sub-genera - *Salix*, *Vetrix* and *Chamaetia* (Meikle 1984, 1992, Skvortsov 1999, <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:325916-2#children>, <https://alchetron.com/Salix-fragilis>.

Salix is characterized by trees and shrubs having branchlets erect or pendulous, leaves mostly lanceolate and acuminate, inflorescence as catkin and flowering coetaneous (male and female flowers appearing as catkins on separate plants; catkins produced early in the spring, mainly with or before the leaves) or slightly precocious.

Taxonomic confusion of *Salix*

There is also confusion in the nomenclature of some species of *Salix*, like *S wilhelmsiana* M Bieb, which earlier was referred to as *S angustifolia* Willd, but POWO places it as a nomen illegitimum, synonym of a separate species (*S wilhelmsiana* var *wilhelmsiana*). The article also highlights the complexity and ongoing debates surrounding the taxonomy of *S fragilis* and its closely related species as well as the challenges in classifying hybrids and varieties within the group. Some nomenclature has been in vogue for over three centuries now, since Linnaeus first introduced it in 1753 for the arboreal willows widely distributed in the Eurasian landscapes and yet there is still disagreement among researchers regarding their exact identities, distributions and relationships. *S fragilis* has been considered by many researchers as a primary source of many natural and artificial hybrids, with branches that easily broke (Belyaeva 2009). However, the taxonomic position of *S fragilis* has been of much debate in the region. *S fragilis* and *S alba* are native across most regions of Europe and also across major parts of western and central Asia. Both, *S fragilis* and *S alba* are closely associated with *S pentandra*, which is found across northern and central Europe and western Asia, extending to Mongolia (Skvortsov 1999, <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:325916-2#children>). Skvortsov provided a detailed study of *S pentandra* and later in 1973, he provided an in-depth description of *S fragilis*, highlighting the morphological characteristics that differentiate it from *S alba* (Skvortsov 1973). A form of *S fragilis* {*S fragilis* var *decipiens* (Hoffm) K Koch}, ca 5 m, with completely hairless leaves is found growing with *S fragilis*. According to some botanists, it is considered a separate species (treated as *S decipiens* Hoffm), while some others regard *S decipiens* as a hybrid between *S fragilis* and *S triandra*. Further studies for evidence are required to support either of these suggestions (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:325916-2#children>).

Christensen and Jonsell (2005) proposed nomenclatural changes after identifying the specimen linked to the description of *S fragilis* as *S pentandra* and argued that Linnaeus had unknowingly described the same species with different names: *S pentandra* and *S fragilis* (Marchenko and Kuzovkina 2022). To clarify the understanding of *S fragilis*, Belyaeva (2009) proposed that *S fragilis* would be more accurately applied to the common hybrid between a species native to northern Turkey and Transcaucasian Georgia with *S alba*. Through elaborate reasoning, the author lectotypified *S fragilis* in the sense of *S × rubens* Schrank, identifying it as *S × fragilis*, a hybrid of *S alba* × *S euxina* and described it as a new species, *S euxina* IV Belyaeva.

This new species was previously being referred to as *S fragilis*. Later, Marchenko and Kuzovkina (2022), in their recent evaluation, proposed the retention of *S fragilis* L for the crack willow, suggesting that *S euxina* IV Belyaeva and *S × rubens* Schrank should be replaced by *S × fragilis* L (*S alba* L × *S euxina*). Some cultivated forms of *S alba* in Spiti have also been recorded with golden-yellow erect twigs, which could be *S alba* var *vitellina* (L) Stokes, a cultivar of *S alba*. However, further detailed studies are required to verify the same.

The nomenclature, *S fragilis* L, *S alba* L, *S pentandra*, is found in all taxonomic and floristic references, but today the Kew website does not place *S fragilis* L; instead it has *S fragilis* Forssk, the name being unplaced (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:325916-2#children>). *Salix* has been undergoing hybridisation resulting in a large number of hybrids (Triest 2001). Among them, *Salix* × *fragilis* L was first published by Linnaeus (1753) and is today an accepted hybrid. This hybrid has a number of confirmed synonyms (*S × rubens* Schrank, *S decipiens* Hoffm and *S fragilis* L var *decipiens* WDJ Koch). *S fragilis* is being treated as synonyms (*S fragilis* Host as synonym of *S euxina* IV Belyaeva, as synonym of *S pentandra* L) in the Kew website. A similar case of the golden willow (*S vitellina* L), which was described earlier by Linnaeus (1753), was later on recognized to be closely related to *S alba* and since then, its taxonomic status has been revised to a variety, sub-species etc. Thereafter, a proposal designated it as a form of *S alba* × *S fragilis* (Marchenko and Kuzovkina 2023), requiring that *S fragilis* and *S alba*, reported from Spiti to be investigated with concerted efforts, including nrDNA sequencing, in addition to the

study of HPLC analysis of their phenolic compounds to evaluate the extent of their hybridization.

While referring to research on *Salix* in the cold desert Spiti valley, two main tree species, *S alba* and *S fragilis* are found. But in the renowned herbaria (DD and BSI, Dehradun, Uttarakhand), sheets were seldom found to authenticate the same. After in-depth scan of literature on *Salix* from Spiti valley, it comes to light that, in general, the taxonomy of *Salix* group is not very clear. No fitting study focussed on taxonomy has been conducted in Spiti, limiting the knowledge on this genus.

CONCLUSION

The *Salix* genus or willows, exhibits significant diversity in temperate zones, including the challenging cold desert of Spiti. In this region, *Salix* species are notably adapted to the harsh climate, with their distribution influenced by environmental factors like elevation and habitat. Their adaptability makes them ecologically and socially valuable.

This study, relying solely on morphological characteristics, encountered limitations due to the considerable variability within the *Salix* genus. This highlights the need for advanced taxonomic approaches to accurately classify *Salix* species in Spiti. Understanding the specific ecological requirements of individual species is crucial for appreciating the full extent of *Salix* diversity and its ecological roles in cold deserts.

The study also underscores the difficulties researchers face in biodiversity-rich but underexplored regions like Spiti. The scarcity of comprehensive taxonomic studies on *Salix* in Spiti, compounded by hybridization, makes species identification challenging. The reclassification of *S fragilis* L to *S fragilis* Forssk and the recognition of the hybrid *Salix* × *fragilis* L further illustrates the dynamic nature of plant taxonomy and the complexities of species delimitation.

The absence of suitable *Salix* specimens in herbaria at Dehradun (DD and BSI) suggests either a lack of adequately documented specimens or a regional gap in taxonomic studies have not fully captured the nuances of *Salix* species and hybrids in Spiti. While classical taxonomy emphasizes distinct morphological features, modern taxonomy, based on phylogeny, incorporates genetic, evolutionary and morphological

data. The subtle variations exhibited by plants, especially in harsh environments like Spiti, necessitate a nuanced approach to classification and highlight the ongoing debate in taxonomic practices.

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