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# Checklist of vascular plants of the Tian-Shan Mountain System

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## Preface

Central Asia has played a role as a hub for various cultures and trades that connects the Eastern and Western countries. Korea Forest Service proposed a conservation research project including flora survey as a part of comprehensive cooperation in forestry during the 7th Korea-Central Asia cooperation forum in 2014. Accordingly, Korea National Arboretum developed a project named 'Central Asia Green Road Project', which contains a series of research projects and education programs on Central Asia biodiversity conservation.

Central Asia is a biodiversity hotspot and a home to numerous plants with high economic values such as apples, chives and tulips. However, the procrastinating climate changes, overgrazing and habitat disruption pose a great threat to the biodiversity in the region. Since initiation of the Central Asia Green Road Project back in 2015, Korea National Arboretum has greatly contributed to conservation of biodiversity in Central Asia region. As a part of the great achievements for the past six years, we are publishing 'Checklist of vascular plants of the Tian-Shan Mountain System'. Hopefully the book will provide invaluable information on conservation and restoration acts maintaining biodiversity in Central Asia.

The phase II of the Central Asia Green Road Project is going to advance the research for the important area to conserve plant diversity at a national as well as Central Asian level through constant research cooperation. We hope our efforts could make a contribution to the policy and efforts of the conservation of plant diversity across the globe.

In closing, I appreciate the members of the CABCN and joint researchers of Korea for producing this kind of achievements through plant survey and researches.

Youngtae Choi  
Director General  
Korea National Arboretum



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## Introduction

Biodiversity inventory is critically important due to the increasing anthropogenic pressure and destruction of habitats, as well as the associated increasing threat of extinction of species occurring in a certain area or even globally. Plant diversity information is fundamental for biodiversity research and conservation. In this regard, there is an urgent need for modern checklists of the flora of individual countries and biogeographic regions. For countries, the value of such summaries also lies in the inventory of the national heritage of endemic and sub-endemic plant species. The study of the flora of wide biogeographic regions is of great importance for understanding the factors that determine the formation of floristic complexes and centres of endemism as well.

Taxonomic checklists summarize the hitherto available knowledge of biodiversity in a given area. They can be simple lists of names, or provide detailed information on each taxon. In well-explored areas, they are the basis for the development of a detailed floristic treatment; while in poorly known areas they provide a baseline for further investigation. Furthermore, checklists are also a mean for nomenclatural stability, providing a reliable taxonomic backbone. Checklists can potentially be of use for connecting information from different sources, ideally making biodiversity data interoperable through names (Marsellos & al., 2020).

The Tian-Shan Mountains is part of a global biodiversity hotspot, Mountains of Central Asia (<https://www.cepf.net/our-work/biodiversity-hotspots>), which includes also the Pamir-Alay Mountain System. The Tian-Shan Mountains are a natural physical and biogeographical unit with a rich and diverse flora that has long attracted the attention of botanists. This territory is a carrier of a rich gene pool of plant diversity, a unique composition of endemics and many relict species and phylogenetic lineages, remains of floras of past geological eras.

However, despite the long history of botanical research and a number of historical speculations, there is no modern summary on the flora of this region, covering the territories of four countries of Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan) and north-west China. There is also no analysis of the flora and data on its importance for solving the issues of conservation and sustainable use of plant resources in the Tian-Shan and adjacent territories of Central Asia. Traditionally, the revisional work was limited to individual taxa (usually genera) or territories (countries or their parts). Rather recent checklists are available for some countries (Kazakhstan, Kyrgyzstan) or their parts (Uzbekistan) but their background data have not been updated in entirety. For some regions, the existing floristic data are significantly outdated and require new research.

## The Tian-Shan Mountains. Location and geographical divisions

The Tian-Shan is a large mountain system that stretches as a broad stripe over 2,500 km, from west to east, with a width of up to 400 km, from north Tajikistan to north China (Chupakhin, 1964). It borders the western and northern ends of the Taklamakan Desert along the national borders of Kyrgyzstan, Kazakhstan, and Xinjiang Province of China. The Tian-Shan is part of the Himalayan orogenic belt that was created by the collision of the Eurasian and Indian tectonic plates. It is among the oldest mountain ranges in Central Asia ([www.worldatlas.com](http://www.worldatlas.com)). The altitude of the Tian-Shan mountain system lies in the range of 700–800 m to 7400 m. The highest peaks are located in a central cluster on the borders of China, Kyrgyzstan, and Kazakhstan, and include Peak Pobeda or Tuomuer Feng (7439 m) and Han Tengri (6995 m). The Inylchek Glacier, over 50 km long and the largest in the Tian-Shan, is also located in this part of the range (Mallon & al., 2004).

According to the major features of its flora and vegetation, the territory of the Tian-Shan is divided into three phytogeographical regions (*map*), namely Eastern Tian-Shan (ET), Northern Tian-Shan (NT), and Western Tian-Shan (WT). This scheme is based on the phytogeographic division of Kyrgyzstan developed by Kamelin (2002) but its original lines are corrected by the present authors to better match the species distributions as currently known.



The limit between the Western Tian-Shan and the Northern Tian-Shan cuts the Kyrgyz Range approximately at 73.5° E. Then the limit between the Western Tian-Shan and the Eastern Tian-Shan cuts off the western parts of the Dzhungal-Too, Kavak-Too, Moldo-Too, and runs along the eastern side of the Akshyryak-Too and the eastern and southern side of Fergana Range. The limit between the Tian-Shan and Alay is set along the Oytal (Alaykuu) River. The northern limit of the Western Tian-Shan includes smaller outposts (Karatau, Boralday) with the territories westwards up to the Syrdarya River.

The limit between the Northern Tian-Shan and the Eastern Tian-Shan runs along the watershed of the Kyrgyz Range, then follows the courses of the Chuy and Dzhon-Aryk Rivers and continues along the watershed of the Teskey Range until the border with China. The northern limit of the Northern Tian-Shan includes the lower mountains of the Dzhety-Dhol and Chu-Ili Mts., and the Ketmen Range in the north-east.

## Sources and structure of the checklist

The first detailed and fairly complete checklist of the flora of the Tian-Shan presented in this book is based on the materials of field studies carried out in Kyrgyzstan (G.A. Lazkov, A.N. Sennikov, Hyeok-Jae Choi, Chang-Gee Jang), Uzbekistan (K.Sh. Tojibaev, Chang-Gee Jang, A.N. Sennikov), Tajikistan (I.T. Turakulov, K.Sh. Tojibaev, Chang-Gee Jang), Kazakhstan (G. Sitpaeva, Chang-Gee Jang, G.A. Lazkov), critical analysis of herbarium specimens stored in Tashkent (TASH), Bishkek (FRU), Alma-Ata (AA), St. Petersburg (LE), Moscow (MW) and other small depositories and collections, and the extensive literature data. The main published sources were the “Flora and Vegetation of Western Spurs of Talas Alatau” (Karmysheva, 1982), “Checklist of Vascular Plants of Kazakhstan” (Abdulina, 1999), “Checklist of Vascular Plants of Kyrgyzstan” (Lazkov & Sultanova, 2014), “Flora of the South-Western Tian-Shan” (Tojibaev, 2010), “Flora of the Syrdarya Karatau” (Kamelin, 1990), “Conspectus Florae Asiae Mediae”, vol. 11 (Khassanov, 2015), “Flora of the Northern Tian-Shan. The Chu-Ili Mountains” (Kokareva & al., 2018), “A checklist of the geophytes of Fergana Valley” (Tojibaev & al., 2018), new “Flora of Uzbekistan”, vols. 1–3 (Sennikov & al., 2016, 2017, 2019)

and others. The most thoroughly studied areas of the Tian-Shan are the South-Western Tian-Shan with the Ugam, Pskem, Chatkal, Kurama, and Korjantau Ranges; the northern part of the Fergana Depression (parts of the Kurama and Chatkal Ranges); Chu-Ili Mountains (Northern Tian-Shan), and major nature reserves in other territories.

In contrast with previous studies, this checklist is consistently based on modern phylogenetic works at all taxonomic levels. The principle of monophyly is strictly employed throughout, except for a few cases when the current data are apparently incomplete or inconclusive.


The taxonomic circumscription of families follows PPG I (2016) for ferns and fern allies, Christenhusz & al. (2011) for gymnosperms, and APG IV (2016) for angiosperms. The taxonomic circumscription of genera is based on particular phylogenetic studies, too many to be cited. Many taxonomic decisions adopted here can be found on Plants of the World Online (<http://powo.science.kew.org/>) but some deviate when the most recent phylogenies became available. The species circumscription follows regional inventories and taxonomic revisions; in some cases the compilers' expertise was used to produce original decisions.

To allow the easiest use, the checklist is arranged according to the linear sequence of phylogenetic families (APG IV) and alphabetically at the rank of genus, species and subspecies.

The checklist consists of accepted names of plant families, genera, species and subspecies, with the authorship standardised according to the International Plant Name Index ([www.ipni.org](http://www.ipni.org)). The names of species and subspecies are accompanied with nomenclatural references, which are given in the IPNI format. The accepted species and subspecies include the relevant synonymy, which is organised according to nomenclatural types.

The taxonomic and nomenclatural data are supplemented with the geographical information. Species distributions within the Tian-Shan are specified according to the three phytogeographic regions outlined above and coded by the two-letter abbreviations. If a species is endemic to the study area, its status is indicated and its distribution is detailed according to major mountain ranges and depressions.

If a species or subspecies is non-native in the area or one of its major phytogeographic subdivisions, its status is indicated. The list of non-native taxa



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includes both neophytes and archaeophytes and is based on the revised version of checklists of non-native plant species published for Kyrgyzstan and Uzbekistan (Sennikov & al., 2018a, 2018b).

Hybrid taxa, which are considered not stabilised and therefore designated as nothotaxa, are placed separately as an appendix to the main list. Similarly to the non-hybrid taxa, synonymy, nomenclature and distributional data are provided for each taxon there. Hybrid origin is specified for each nothospecies and nothogenus.

## Plant diversity in the Tian-Shan

According to our checklist, the number of plant species and subspecies registered in the Tian-Shan is 4283, of which 4080 are considered native. These species belong to 835 genera (759 are native) and 116 families (110 are native). The greatest floristic diversity is registered in the Western Tian-Shan (3440 species and subspecies), whereas the plant diversity in the Northern Tian-Shan (2532 taxa) and the Eastern Tian-Shan (1361 taxa) are considerably smaller.

The undeniable value of the Tian-Shan is its endemic plant species, which provide evidence for its status as a global biodiversity hotspot. In the current checklist, we counted 821 taxa (species and subspecies) endemic to the territory. This figure is slightly below the count (871 taxa) in the recent inventory published by Tojibaev & al. (2020), due to some new synonymy and corrections in distribution ranges. The endemic flora is largely concentrated in the Western Tian-Shan (634 taxa), whereas the floristic originality of the Northern Tian-Shan (100 taxa) and the Eastern Tian-Shan (27 taxa) is much lower.

The checklist includes 34 hybrid species, which belong to 18 genera (including 3 nothogenera). These hybrids are not included in the main statistics because they occur together with their parental species.

Due to a consistent incorporation of the phylogenetic data and a careful revision of the nomenclature this checklist widely departs from traditional compilations based on the pre-phylogenetic taxonomy. This work is novel for Central Asia as a whole; for this reason, it led to major rearrangements in some families



and genera, including a number of new nomenclatural combinations (81) and 2 new nothogenera. The majority of new names appear in the plant families, where traditional generic limits were found highly unnatural (Amaranthaceae, Asteraceae, Boraginaceae, Campanulaceae, Fabaceae, Poaceae).

The authorship of new combinations published in this checklist should be treated as ascribed. For this reason, we acknowledge nomenclatural contributions of our taxonomic experts who kindly supplied their nomenclatural novelties for publication (D.A. German, N.V. Schegoleva).

As one of 36 global-scale biodiversity hotspots (Mittermeier & al., 2011), the Mountains of Central Asia, the Tian-Shan Mountains including are a region of diversity and a high rate of endemism in several genera, namely *Allium*, *Astragalus*, *Cousinia*, *Gagea* and *Oxytropis* (Tojibaev & al., 2020). The analysis of this valuable and intriguing diversity will follow shortly in a separate publication.

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Tojibaev Sh. Komiljon, Changgee Jang, Lazkov A. Georgii, Chang Kae Sun, Sitpayeva T. Gulnara, Safarov Neimatullo, Beshko Yu. Natalya, Muktubaeyeva K. Saule, Vesselova V. Polina, Turakulov Isakul, Abdurakhmanova Yu. Yoqutkhon, Nuree Na, Min-Su Park, Choi Kyung, Choi Hyeok-Jae, Byoung-Un Oh & Seung-Hwan Oh. (2020). An Annotated Checklist of Endemic Vascular Plants of the Tian-Shan Mountains in Central Asian Countries. *Phytotaxa* 464 (2): 117-158.