



Checklist of national key protected wild plants on the Qinghai-Tibetan Plateau

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Abstract

Background

Qinghai-Tibetan Plateau is a global biodiversity hotspot due to the unique geographical environment. However, there are few reports on the list of national key protected plants and the distribution pattern of their diversity in this area. Based on the flora and online database, this paper summarised the species diversity and distribution patterns of national key protected wild plants on the Qinghai-Tibet Plateau.

New information

The results showed that there were 350 species of national key protected wild plants on the Qinghai-Tibetan Plateau, belonging to 72 families and 130 genera. Amongst them, 22 species were under class I protection, 328 species were under class II protection and 168 species were endemic to China. Its endangered status involves EW 1 species, CR 17 species, EN 90 species, VU 90 species, NT 30 species, LC 60 species and DD 62 species. Species diversity declined gradually from the southeast to the northwest with hotspots located within Sanjiang Valley subregion (III E14a). The list of national key protected wild plants and their diversity and distribution patterns in the Qinghai-Tibetan Plateau can

provide basic data for the conservation of regional biodiversity and the formulation of conservation strategies.

Keywords

Qinghai-Tibetan Plateau, national key protected wild plants, diversity characteristics, distribution pattern

Introduction

China is one of the most biodiverse countries in the world. There are approximately 483 families, 4,275 genera, 38,493 species and 7,507 subspecies of higher plants, of which approximately 18,000 species are endemic to China (Liu and Qin 2022). However, biodiversity in China is still under great pressure. On the one hand, species diversity is seriously affected by sharp population growth, rapid economic development and the degradation or even loss of natural ecosystems. On the other hand, excessive mining, alien species invasion and natural disasters severely damage the species diversity (Liu et al. 2020). The Chinese government attaches great importance to biodiversity conservation. Relevant laws and policies have been promulgated and the legal framework has been continuously improved. The State Council issued "the List of National Key Protected Wild Plants (First Batch)" in 1999, which includes 246 plant species (varieties) and eight plant categories (State Forestry Administration and the Ministry of Agriculture, P.R. China 1999). The protection of wild plants in China has undergone significant changes since the release of the list in 1999. Some endangered wild plants have been effectively protected and the degree of endangerment has reduced. However, significant changes have occurred in the protection of wild plant diversity in China over the past 20 years. Therefore, in September 2021, the National Forestry and Grassland Administration and the Ministry of Agriculture and Rural Affairs released "the List of National Key Protected Wild Plants (2021)" (hereinafter as *List (2021)*), which includes approximately 1,101 species (455 species and 40 categories) of wild plants, of which 54 species and four categories of wild plants are under first-class state protection and 401 species and 36 categories of wild plants under second-class state protection (State Forestry and Grassland Administration and the Ministry of Agriculture and Rural Affairs, P. R. China 2021). The 15th UN Biodiversity Conference (COP15), held in October 2021, discussed the Post-2020 Global Biodiversity Framework, with the main objective of responding to the continuing deterioration of biodiversity worldwide. Therefore, strengthening the protection of wild plants to reverse the decline of wild populations and extinction of species was one of the key topics. In this context, based on the *List (2021)*, it is necessary to investigate and sort the species, family and genus composition, endemism, endangered status, geographical distribution and other characteristics of national key protected wild plants in specific areas, especially in ecologically fragile areas, to provide important references for in situ protection, ex situ protection and standardised use of species.

Known as the "roof of the world" and the "third pole", the Qinghai-Tibetan Plateau is the highest and youngest plateau in the world. With diverse vegetation types and complex floristic components, the Qinghai-Tibetan Plateau is the most biodiverse region on Earth. It is also a vulnerable area of ecosystem and is sensitive to climate change. This region contains three global biodiversity hotspots: the Himalayas, mountains of Southwest China and Indo-Burma (Myers et al. 2000). The unique natural environment and strong changes in the historical geological environment make the Qinghai-Tibetan Plateau possess many complex fragmented habitats and rich species. According to the second Qinghai-Tibet Scientific Survey data, there are 14,634 vascular plant species on the Qinghai-Tibetan Plateau, accounting for 45.8% of vascular plants in China (Fu et al. 2021). Amongst these, 3,764 species of seed plants endemic to the Qinghai-Tibetan Plateau were included (Yu et al. 2018).

With the intensification of global climate change and owing to the vulnerability and sensitivity of the Qinghai-Tibetan Plateau to climate change and increasing human activities, the biodiversity of this region is facing a severe threat (Liu et al. 2022) and various wild plants are highly endangered. However, there are only a few reports on the diversity and distribution patterns of national key protected plants on the Qinghai-Tibetan Plateau. Therefore, based on the *List* (2021), this study preliminarily sorted out the species of national key protected wild plants in the Qinghai-Tibetan Plateau Region, analysed their diversity, endangered status and endemic status and explored their distribution patterns, hoping to provide a reference and basis for the study of national key protected wild plants on the Qinghai-Tibetan Plateau.

Materials and methods

Determination of plant list

With reference to the Qinghai-Tibetan Plateau boundary data (Zhang 2019), plants in the *List* (2021), distributed only in the Qinghai-Tibetan Plateau Region, were collected. First, based on the Flora of China (Wu et al. 1994), specimen information was obtained from the National Specimen Information Infrastructure (NSII, <http://www.nsii.org.cn/2017>) and the Chinese Virtual Herbarium (CVH, <https://www.cvh.ac.cn/index.php>). Combined with field scientific survey records collected in recent years, the family and species lists, as well as county-level distribution of key protected wild plants on the Qinghai-Tibet Plateau were, sorted out. Threatened status and endemism of species were confirmed from the IUCN Red List of Threatened Species 2021 ([IUCN Red List of Threatened Species](#)), China Red List of Biodiversity (Higher Plants Volume) (Ministry of Environmental Protection of the People's Republic of China and Chinese Academy of Sciences 2018). Based on cataloguing, diversity characteristics of national key protected wild plants on the Qinghai-Tibetan Plateau were analysed and summarised, including family and genus composition characteristics, protection level, endemism, endangered status and geographical distribution characteristics. Floristic division scales of Qinghai-Tibetan Plateau were according to the Floristics of seed plants from China (Wu et al. 2010). The summarised checklist was arranged in order of Bryophyta, Lycopodiophyta, Pteridophyta,

Gymnospermae and Angiospermae and the Angiospermae genera are arranged according to the APG IV system (The Angiosperm Phylogeny Group et al. 2016).

Statistical analysis

According to *List* (2021), the basic characteristics of key protected plants distributed on the Qinghai-Tibetan Plateau were summarised, including the quantity and proportion of families, genera and species, protection level classification, quantity of endangered plants and endemic species to China.

Diversity pattern analysis

County-scale distribution data of key protected plants on the Tibetan Plateau were collected. The Qinghai-Tibet Plateau covers 221 county-level administrative regions (including municipal districts), including 45 in Qinghai Province, 74 in Tibet Autonomous Region, 48 in Sichuan Province, 28 in Gansu Province, 12 in Yunnan Province and 14 in Xinjiang Uygur Autonomous Region. The data collection sources of species distribution at the county level mainly included: (1) Annals and monographs, such as *Flora of China* (Wu et al. 1994), *Flora of Qinghai* (Northwest Institute of Plateau Biology, Chinese Academy of Sciences 1996), *Flora of Sichuan* (Volumes 1–21) (Editorial Committee of *Flora Sichuanica* 1981), *Flora of Yunnan* (Kunming Institute of Botany, Chinese Academy of Sciences 1977), *Flora of Tibet* (Wu 1983), *Flora of Kunlun* (Wu 2014), *Vascular Plants and their Ecogeographical Distribution in the Qinghai-Tibet Plateau* (Wu 2008) and the *Second Survey of National Key Protected Wild Plant Resources in Gansu Province* (Zhu and Kou 2020); (2) Online databases, such as National Specimen Information Infrastructure (NSII, <http://www.nsii.org.cn/2017>) and the Chinese Virtual Herbarium (CVH, <https://www.cvh.ac.cn/index.php>); (3) Field survey data of the Qinghai-Tibetan Plateau.

According to species in each county and floristic division, ArcGIS 10.6 was used to plot the diversity pattern of national key protected wild plants on the Qinghai-Tibet Plateau at county and floristic division scales.

Checklist of National Key Protected Wild Plants on the Qinghai-Tibetan Plateau

Leucobryum juniperoideum C. Müller, 1845

Conservation status: LC

Distribution: East Asia, Europe

***Sphagnum multifibrosum* X.J. Li & M. Zang, 1984**

Conservation status: LC

Distribution: China

***Sphagnum squarrosum* Crome, 1803**

Conservation status: LC

Distribution: East Asia, Europe, Oceania, North America

***Takakia ceratophylla* (Mitt.) Grolle, 1963**

Conservation status: VU

Distribution: China, North America

***Takakia lepidozoides* S. Hatt. & Inoue, 1958**

Conservation status: EN

Distribution: China, Japan, North America

***Huperzia appressa* (Desv.) Á. Löve & D. Löve, 1961**

Conservation status: DD

Distribution: Asia, Europe, North America

***Huperzia bucahwangensis* Ching, 1981**

Conservation status: DD

Distribution: China

***Huperzia chinensis* Ching, 1981**

Conservation status: NT

Distribution: China

***Huperzia crispata* Ching, 1981**

Conservation status: VU

Distribution: China

***Huperzia delavayi* Ching, 1981**

Conservation status: DD

Distribution: China

***Huperzia dixitiana* P. Mondal & R.K. Ghosh, 1995**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Huperzia emeiensis* Ching & H.S. Kung, 1981**

Conservation status: DD

Distribution: China

***Huperzia herteriana* (Kumm.) T. Sen & U. Sen, 1978**

Conservation status: DD

Distribution: China, Bhutan, India, Nepal

***Huperzia kangdingensis* Ching, 1981**

Conservation status: DD

Distribution: China

***Huperzia lajouensis* Ching, 1981**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Huperzia liangshanica* (H.S. Kung) Ching & H.S. Kung, 1981**

Conservation status: DD

Distribution: China

***Huperzia quasipolytrichoides* (Hayata) Ching, 1981**

Conservation status: VU

Distribution: China, Japan

***Huperzia rubicaulis* S.K. Wu & X. Cheng, 1985**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Huperzia selago* (L.) Bernh. ex Schrank & Martius, 1829**

Conservation status: LC

Distribution: America, Asia, Europe, Pacific islands

***Huperzia serrata* (Thunb.) Trevis, 1875**

Conservation status: EN

Distribution: East Asia, the Pacific, Russia, Oceania, Central America

***Huperzia sutchueniana* (Herter) Ching, 1981**

Conservation status: DD

Distribution: China

***Huperzia tibetica* Ching, 1981**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Phlegmariurus cancellatus* (Spring) Ching, 1982**

Conservation status: DD

Distribution: China, India, Bhutan

***Phlegmariurus fargesii* (Herter) Ching, 1982**

Conservation status: DD

Distribution: China, Japan

***Phlegmariurus hamiltonii* (Spreng.) A. Löve & D. Löve, 1977**

Conservation status: DD

Distribution: China, India, Nepal, Bhutan, Myanmar

***Phlegmariurus nylamensis* (Ching & S.K. Wu) H.S. Kung & Li Bing Zhang, 1999**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Phlegmariurus pulcherrimus* (Hook. & Grev.) Á. Löve & D. Löve, 1977**

Conservation status: DD

Distribution: China, Bhutan, India

***Phlegmariurus squarrosus* Á. Löve & D. Löve, 1977**

Conservation status: NT

Distribution: China, India, Nepal, Myanmar, Thailand, Vietnam, Laos, Cambodia, Bangladesh, Sri Lanka, Malaysia, Philippines, Polynesia, Madagascar

***Phlegmariurus subulifolius* (Wall. ex Hook. & Grev.) S.R. Ghosh, 2009**

Conservation status: DD

Distribution: China, India, Nepal

***Phlegmariurus yunnanensis* Ching, 1982**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Isoetes hypsophila* Handel-Mazz., 1923**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Isoetes shangrilaensis* Xiang Li, Yuqian Huang, X. Dai & Xing Liu, 2019**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Angiopteris esculenta* Ching, 1940**

Conservation status: DD

Distribution: China

***Angiopteris wallichiana* C. Presl, 1845**

Conservation status: DD

Distribution: China, India, Nepal

***Angiopteris fokiensis* Hieron., 1919**

Conservation status: DD

Distribution: China, Japan

***Cibotium barometz* (L.) J. Smith, 1842**

Conservation status: LC

Distribution: China, India, Indonesia, Japan, Malaysia, Myanmar, Thailand, Vietnam

***Sphaeropteris brunoniana* (Hook.) R.M. Tryon, 1970**

Conservation status: EN

Distribution: China, Bhutan, Nepal, India, Bangladesh, Myanmar, Vietnam

***Gymnosphaera andersonii* (J. Scott ex Bedd.) Ching & S.K. Wu, 1983**

Conservation status: DD

Distribution: China

***Gymnosphaera khasyana* (Moore ex Kuhn) Ching, 1984**

Conservation status: DD

Distribution: China, India, Myanmar

***Gymnosphaera metteniana* (Hance) Tagawa, 1951**

Conservation status: DD

Distribution: China, Japan

***Alsophila costularis* Baker, 1906**

Conservation status: LC

Distribution: China, Bhutan, India, Vietnam, Myanmar, Bangladesh

***Alsophila spinulosa* (Hook.) R.M. Tryon, 1970**

Conservation status: NT

Distribution: China, Japan, Vietnam, Cambodia, Thailand, Myanmar, Bangladesh, Bhutan, Nepal, India

***Cystopteris chinensis* (Ching) X.C. Zhang & R. Wei, 2014**

Conservation status: EW

Distribution: China

***Podocarpus macrophyllus* (Thunb.) Sweet, 1818**

Conservation status: LC

Distribution: China, Japan

***Podocarpus neriifolius* D. Don, 1824**

Conservation status: LC

Distribution: China, Nepal, India, Bhutan, Myanmar, Vietnam, Laos, Indonesia, Malaysia

***Cupressus chengiana* S.Y. Hu, 1964**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cupressus gigantea* W.C. Cheng & L.K. Fu, 1975**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cupressus torulosa* D. Don, 1824**

Conservation status: LC

Distribution: China, India, Nepal, Bhutan

***Taiwania cryptomerioides* Hayata, 1906**

Conservation status: VU

Distribution: China

***Thuja sutchuenensis* Franch., 1899**

Conservation status: EN

Distribution: China

***Cephalotaxus hainanensis* H.L. Li, 1954**

Conservation status: EN

Distribution: China, Vietnam

***Cephalotaxus griffithii* Hook. f., 1888**

Conservation status: EN

Distribution: China, Myanmar

***Amentotaxus argotaenia* (Hance) Pilg., 1916**

Conservation status: NT

Distribution: China, Vietnam

***Taxus contorta contorta* Griff., 1854**

Conservation status: EN

Distribution: China, India, Kashmir, Nepal, Pakistan

***Taxus florinii* Spjut, 2007**

Conservation status: DD

Distribution: China

***Taxus wallichiana* Zucc., 1843**

Conservation status: EN

Distribution: China, Bhutan, N India, Laos, Myanmar, Vietnam

***Taxus wallichiana* var. *mairei* (Lemée & H. Lév.) L.K. Fu & Nan Li, 1997**

Conservation status: VU

Distribution: China, India, Laos, Myanmar, Vietnam

***Taxus wallichiana* var. *chinensis* (Pilg.) Florin, 1948**

Conservation status: VU

Distribution: China, Vietnam

***Taxus yunnanensis* W.C. Cheng & L.K. Fu, 1975**

Conservation status: DD

Distribution: China

***Torreya fargesii* Franch., 1899**

Conservation status: VU

Distribution: China

***Torreya yunnanensis* W.C. Cheng & L.K. Fu, 1975**

Conservation status: DD

Distribution: China

***Abies chensiensis* Tiegh., 1892**

Conservation status: LC

Distribution: China

***Keteleeria fortunei* var. *cyclolepis* (Flous) Silba, 1990**

Conservation status: DD

Distribution: China

***Keteleeria hainanensis* Chun & Tsiang, 1963**

Conservation status: EN

Distribution: China

***Picea neveitchii* Mast., 1903**

Conservation status: DD

Distribution: China

***Pseudotsuga brevifolia* W.C. Cheng & L.K. Fu, 1975**

Conservation status: VU

Distribution: China

***Pseudotsuga forrestii* Craib, 1920**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Pseudotsuga sinensis* Dode, 1912**

Conservation status: VU

Distribution: China

***Saruma henryi* Oliv., 1889**

Conservation status: EN

Distribution: China

***Horsfieldia hainanensis* Merr., 1932**

Conservation status: DD

Distribution: China

***Horsfieldia kingii* (Hook.f.) Warb., 1897**

Conservation status: VU

Distribution: China, India, Bangladesh

***Horsfieldia tetratepala* C.Y. Wu & W.T. Wang, 1957**

Conservation status: DD

Distribution: China

***Houpoea officinalis* (Rehder & E.H. Wilson) N.H. Xia & C.Y. Wu, 2008**

Conservation status: NT

Distribution: China

***Houpoea rostrata* (W.W. Sm.) N.H. Xia & C.Y. Wu, 2008**

Conservation status: VU

Distribution: China, Myanmar

***Lirianthe henryi* (Dunn) N.H. Xia & C.Y. Wu, 2008**

Conservation status: EN

Distribution: China, Myanmar, Thailand

***Alcimandra cathcartii* Dandy, 1927**

Conservation status: LC

Distribution: China, India

***Liriodendron chinense* (Hemsl.) Sarg., 1903**

Conservation status: NT

Distribution: China, Vietnam

***Michelia wilsonii* Finet & Gagnep., 1906**

Conservation status: EN

Distribution: China

***Oyama sinensis* (Rehder & E.H. Wilson) N.H. Xia & C.Y. Wu, 2008**

Conservation status: VU

Distribution: China

***Oyama wilsonii* (Finet & Gagnep.) N.H. Xia & C.Y. Wu, 2008**

Conservation status: NT

Distribution: China

***Cinnamomum longepaniculatum* (Gamble) N. Chao ex H.W. Li, 1975**

Conservation status: NT

Distribution: China

***Machilus nanmu* (Oliv.) Hemsl., 1891**

Conservation status: EN

Distribution: China

***Phoebe bournei* (Hemsl.) Yang, 1945**

Conservation status: NT

Distribution: China

***Phoebe hui* Cheng ex Yang, 1945**

Conservation status: NT

Distribution: China

***Phoebe zhennan* S.K. Lee & F.N. Wei, 1979**

Conservation status: VU

Distribution: China

***Scheuchzeria palustris* Linnaeus, 1753**

Conservation status: VU

Distribution: China, Japan, Korea, Mongolia, Russia, SW Asia, Europe, North America

***Ottelia acuminata* (Gagnep.) Dandy, 1934**

Conservation status: VU

Distribution: China

***Ottelia acuminata* var. *crispa* (Hand.-Mazz.) H. Li, 1981**

Conservation status: NT

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Acanthochlamys bracteata* P.C. Kao, 1980**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Paris axialis* H. Li, 1984**

Conservation status: VU

Distribution: China

***Paris bashanensis* F.T. Wang & Tang, 1978**

Conservation status: NT

Distribution: China

***Paris delavayi* Franch., 1898**

Conservation status: VU

Distribution: China, Vietnam

***Paris dulongensis* H. Li & Kurita, 1992**

Conservation status: CR

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Paris fargesii* Franch., 1898**

Conservation status: NT

Distribution: China, Vietnam

***Paris fargesii* var. *petiolata* (Baker ex C.H. Wright) F.T. Wang & Tang, 1978**

Conservation status: EN

Distribution: China

***Paris forrestii* (Takht.) H. Li, 1984**

Conservation status: EN

Distribution: China, Myanmar

***Paris mairei* H. Lév., 1912**

Conservation status: EN

Distribution: China

***Paris marmorata* Stearn, 1956**

Conservation status: DD

Distribution: China, Bhutan, India, Nepal

***Paris polyphylla* Sm., 1813**

Conservation status: VU

Distribution: China, Bhutan, India, Laos, Myanmar, Nepal, Thailand, Vietnam

***Paris polyphylla* var. *alba* H. Li & R.J. Mitch., 1986**

Conservation status: VU

Distribution: China

***Paris polyphylla* var. *chinensis* (Franch.) H. Hara, 1969**

Conservation status: VU

Distribution: China, Laos, Myanmar, Thailand, Vietnam

***Paris polyphylla* var. *latifolia* F.T. Wang & C.Yu Chang, 1978**

Conservation status: LC

Distribution: China

***Paris polyphylla* var. *stenophylla* Franch., 1888**

Conservation status: NT

Distribution: China, Bhutan, India, Myanmar, Nepal

***Paris polyphylla* var. *thibetica* (Franch.) H. Hara, 1969**

Conservation status: NT

Distribution: China

***Paris polyphylla* var. *yunnanensis* (Franch.) Hand.-Mazz., 1936**

Conservation status: NT

Distribution: China, India, Myanmar

***Paris rugosa* H. Li & S. Kurita, 1992**

Conservation status: EN

Distribution: China

***Paris thibetica* Franch., 1888**

Conservation status: NT

Distribution: China, Bhutan, Myanmar, India

***Paris thibetica* var. *apetala* Hand.-Mazz., 1925**

Conservation status: DD

Distribution: China, Bhutan, Myanmar, India

***Paris wenzianensis* Z.X. Peng & R.N. Zhao, 1986**

Conservation status: CR

Distribution: China

***Cardiocrinum cathayanum* (E.H. Wilson) Stearn, 1948**

Conservation status: LC

Distribution: China

***Fritillaria cirrhosa* D. Don, 1825**

Conservation status: NT

Distribution: China, Bhutan, India, Nepal

***Fritillaria crassicaulis* S.C. Chen, 1977**

Conservation status: VU

Distribution: China

***Fritillaria dajinensis* S.C. Chen, 1983**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Fritillaria davidii* Franch., 1888**

Conservation status: EN

Distribution: China

***Fritillaria delavayi* Franch., 1898**

Conservation status: VU

Distribution: China, Bhutan, India

***Fritillaria fusca* Turrill, 1943**

Conservation status: EN

Distribution: China

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***Fritillaria przewalskii* Maxim., 1882**

Conservation status: VU

Distribution: China

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***Fritillaria sichuanica* S.C. Chen, 1983**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Fritillaria sinica* S.C. Chen, 1981**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Fritillaria unibracteata* Hsiao & K.C. Hsia, 1977**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Fritillaria unibracteata* var. *longinectarea* S.Y. Tang & C.H. Yueh, 1991**

Conservation status: CR

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Fritillaria walujewii* Regel, 1879**

Conservation status: EN

Distribution: China, Kazakhstan

***Lilium fargesii* Franch., 1892**

Conservation status: NT

Distribution: China

***Lilium papilliferum* Franch., 1892**

Conservation status: NT

Distribution: China

***Tulipa dasystemon* Regel, 1879**

Conservation status: LC

Distribution: China, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan

***Anoectochilus roxburghii* Lindl., 1832**

Conservation status: EN

Distribution: China, Japan, Thailand, Laos, Vietnam, India, Bhutan, Nepal, Bangladesh

***Anoectochilus medogensis* H. Z. Tian & Yue Jin, 2021**

Conservation status: DD

Distribution: China

***Bletilla striata* Rchb.f., 1878**

Conservation status: EN

Distribution: China, Korea, Japan

***Calanthe dulongensis* H. Li, R. Li & Z.L. Dao, 2003**

Conservation status: CR

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Changnienia amoena* S.S. Chien, 1935**

Conservation status: EN

Distribution: China

***Corybas taliensis* Tang & F.T. Wang, 1951**

Conservation status: EN

Distribution: China

***Cremastra appendiculata* (D. Don) Makino, 1904**

Conservation status: NT

Distribution: China, Nepal, Bhutan, India, Vietnam, Thailand, Japan

***Cymbidium concinnum* Z.J. Liu & S.C. Chen, 2006**

Conservation status: DD

Distribution: China

***Cymbidium cyperifolium* Wall. ex Lindl., 1833**

Conservation status: VU

Distribution: China, Nepal, Bhutan, India, Myanmar, Thailand, Vietnam, Cambodia, Philippines

***Cymbidium eburneum* Lindl., 1847**

Conservation status: EN

Distribution: China, Nepal, India, Myanmar

***Cymbidium elegans* Lindl., 1833**

Conservation status: EN

Distribution: China, Nepal, Bhutan, India, Myanmar

***Cymbidium ensifolium* (L.) Sw., 1799**

Conservation status: VU

Distribution: China, Japan, Southeast and South Asia

***Cymbidium erythraeum* Lindl., 1858**

Conservation status: VU

Distribution: China, Nepal, Bhutan, India, Myanmar

***Cymbidium faberi* Rolfe, 1896**

Conservation status: EN

Distribution: China, Nepal, India

***Cymbidium floribundum* Lindl., 1833**

Conservation status: VU

Distribution: China, Vietnam

***Cymbidium goeringii* Rchb.f., 1852**

Conservation status: VU

Distribution: China, Japan, Korea

***Cymbidium hookerianum* Rchb.f., 1866**

Conservation status: EN

Distribution: China, Nepal, Bhutan, India

***Cymbidium iridioides* D. Don, 1825**

Conservation status: VU

Distribution: China, Nepal, Bhutan, India, Myanmar

***Cymbidium kanran* Makino, 1902**

Conservation status: VU

Distribution: China, Japan, Korea

***Cymbidium motuoense* W. Q. Hu, Q. H. Zhang & Z. J. Liu, 2021**

Conservation status: DD

Distribution: China

***Cymbidium nanulum* Y.S. Wu & S.C. Chen, 1991**

Conservation status: EN

Distribution: China

***Cymbidium* × *nujiangense* X. P. Zhou, S. P. Lei & Z. J. Liu, 2007**

Conservation status: DD

Distribution: China

***Cymbidium serratum* Schltr., 1919**

Conservation status: NT

Distribution: China

***Cymbidium sichuanicum* Z.J. Liu & S.C. Chen, 2006**

Conservation status: NT

Distribution: China

***Cymbidium sinense* Willd., 1805**

Conservation status: VU

Distribution: China, India, Myanmar, Vietnam, Thailand, Japan

***Cymbidium tracyanum* L. Castle, 1890**

Conservation status: LC

Distribution: China, Myanmar, Thailand

***Cymbidium tortisepalum* Fukuy., 1934**

Conservation status: VU

Distribution: China

***Cypripedium bardolphianum* W.W. Smith & R.J. Farrer, 1916**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cypripedium calcicola* Schltr., 1924**

Conservation status: EN

Distribution: China

***Cypripedium cordigerum* D. Don, 1825**

Conservation status: VU

Distribution: China, Nepal, Bhutan, India, Pakistan

***Cypripedium debile* Rchb.f., 1874**

Conservation status: VU

Distribution: China, Japan

***Cypripedium elegans* Rchb.f., 1886**

Conservation status: EN

Distribution: China, Nepal, Bhutan, India

***Cypripedium fargesii* Franch., 1894**

Conservation status: EN

Distribution: China

***Cypripedium farreri* W.W. Sm., 1916**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cypripedium fasciolatum* Franch., 1894**

Conservation status: EN

Distribution: China

***Cypripedium flavum* P.F. Hunt & Summerh., 1966**

Conservation status: VU

Distribution: China

***Cypripedium forrestii* P.J. Cribb, 1992**

Conservation status: CR

Distribution: China

***Cypripedium franchetii* Rolfe, 1912**

Conservation status: EN

Distribution: China

***Cypripedium guttatum* Sw., 1800**

Conservation status: LC

Distribution: China, Bhutan, Korea, Russia, Europe, North America

***Cypripedium henryi* Rolfe, 1892**

Conservation status: VU

Distribution: China

***Cypripedium himalaicum* Rolfe ex Hemsl., 1892**

Conservation status: EN

Distribution: China, Nepal, Bhutan, India

***Cypripedium japonicum* Thunb., 1784**

Conservation status: EN

Distribution: China, Japan

***Cypripedium lichiangense* S.C. Chen & P.J. Cribb, 1994**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cypripedium ludlowii* P.J. Cribb, 1997**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cypripedium macranthos* Sw., 1800**

Conservation status: LC

Distribution: China, Japan, Korea, Russia

***Cypripedium margaritaceum* Franch., 1888**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cypripedium micranthum* Franchet, 1894**

Conservation status: EN

Distribution: China

***Cyripedium palangshanense* Tang & F. T. Wang, 1936**

Conservation status: EN

Distribution: China

***Cyripedium plectrochilum* Franch., 1885**

Conservation status: NT

Distribution: China, Myanmar

***Cyripedium shanxiense* S.C. Chen, 1983**

Conservation status: NT

Distribution: China, Japan, Russia

***Cyripedium sichuanense* Perner, 2002**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cyripedium subtropicum* S.C. Chen & K.Y. Lang, 1986**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cyripedium taibaiense* G.H. Zhu & S.C. Chen, 1999**

Conservation status: CR

Distribution: China

***Cyripedium tibeticum* King ex Rolfe, 1892**

Conservation status: LC

Distribution: China, India, Bhutan

***Cypripedium wardii* Rolfe, 1913**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Cypripedium yunnanense* Franch., 1894**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Dendrobium aphyllum* C.E.C. Fisch., 1928**

Conservation status: LC

Distribution: China, India, Burma, Laos, Vietnam

***Dendrobium capillipes* Rchb.f., 1867**

Conservation status: EN

Distribution: China, India, Myanmar, Thailand, Laos, Vietnam

***Dendrobium cariniferum* Rchb.f., 1869**

Conservation status: EN

Distribution: China, India, Myanmar, Thailand, Laos, Vietnam

***Dendrobium catenatum* Lindl., 1830**

Conservation status: CR

Distribution: China, Japan

***Dendrobium chryseum* Rolfe, 1888**

Conservation status: EN

Distribution: China

***Dendrobium chrysanthum* Wall., 1828**

Conservation status: VU

Distribution: China, Nepal, Bhutan, India, Myanmar, Thailand, Laos, Vietnam

***Dendrobium densiflorum* Lindl. ex Wall., 1830**

Conservation status: VU

Distribution: China, Nepal, Bhutan, India, Myanmar, Thailand

***Dendrobium denneanum* Kerr, 1933**

Conservation status: VU

Distribution: China, India, Nepal, Bhutan, Myanmar, Thailand, Laos, Vietnam

***Dendrobium devonianum* Paxton, 1840**

Conservation status: EN

Distribution: China, Bhutan, India, Myanmar, Thailand, Vietnam

***Dendrobium fimbriatum* Dalzell, 1852**

Conservation status: VU

Distribution: China, Bhutan, India, Myanmar, Nepal, Thailand, Vietnam

***Dendrobium hancockii* Rolfe, 1903**

Conservation status: EN

Distribution: China, Korea, Vietnam, Myanmar

***Dendrobium heterocarpum* Wall. ex Lindl., 1830**

Conservation status: VU

Distribution: China, Sri Lanka, India, Nepal, Bhutan, Myanmar, Thailand, Laos, Vietnam, Philippines, Malaysia, Indonesia

***Dendrobium hookerianum* Lindl., 1858**

Conservation status: VU

Distribution: China, India

***Dendrobium kwangtungense* Tso, 1933**

Conservation status: DD

Distribution: China

***Dendrobium linawianum* Rchb.f., 1861**

Conservation status: EN

Distribution: China

***Dendrobium lituiflorum* Lindl., 1856**

Conservation status: CR

Distribution: China, India, Myanmar, Thailand, Laos

***Dendrobium longicornu* Lindl., 1829**

Conservation status: EN

Distribution: China, Nepal, Sikkim, Bhutan, India, Vietnam

***Dendrobium moniliforme* (L.) Sw., 1799**

Conservation status: DD

Distribution: China, India, Korea, Japan

***Dendrobium monticola* P.F. Hunt & Summerh., 1961**

Conservation status: VU

Distribution: China, India, Nepal, Thailand

***Dendrobium nobile* Lindl., 1830**

Conservation status: VU

Distribution: China, India, Nepal, Bhutan, Myanmar, Thailand, Laos, Vietnam

***Dendrobium officinale* Kimura & Migo, 1936**

Conservation status: CR

Distribution: China, Japan

***Dendrobium salaccense* (Blume) Lindl., 1830**

Conservation status: VU

Distribution: China, Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam

***Dendrobium stuposum* Lindl., 1838**

Conservation status: VU

Distribution: China, Bhutan, India, Indonesia, Malaysia, Myanmar, Philippines, Thailand

***Dendrobium williamsonii* Day & Rchb.f., 1869**

Conservation status: EN

Distribution: China, India, Burma, Vietnam

***Gastrodia angusta* S. Chow & S.C. Chen , 1983**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Gastrodia elata* Blume, 1856**

Conservation status: VU

Distribution: China, Bhutan, India, Japan, Korea, Nepal, Russia

***Gymnadenia conopsea* (L.) R.Br., 1813**

Conservation status: DD

Distribution: China, Japan, Korea, Russia, Europe

***Gymnadenia orchidis* Lindl., 1835**

Conservation status: VU

Distribution: China, Bhutan, India, Pakistan

***Paphiopedilum armeniacum* S.C. Chen & F.Y. Liu, 1982**

Conservation status: EN

Distribution: China, Myanmar

***Paphiopedilum insigne* (Wall. ex Lindl.) Pfitzer, 1888**

Conservation status: CR

Distribution: China, India

***Paphiopedilum spicerianum* (Rchb.f.) Pfitzer, 1888**

Conservation status: CR

Distribution: China, India, Vietnam

***Paphiopedilum tigrinum* Koop. & N. Haseg., 1990**

Conservation status: EN

Distribution: China, China

***Paphiopedilum venustum* (Wall. ex Sims) Pfitzer, 1888**

Conservation status: EN

Distribution: China, Nepal, Bhutan, Sikkim, India, Bangladesh

***Paphiopedilum wardii* Summerh., 1932**

Conservation status: EN

Distribution: China, Myanmar

***Phalaenopsis wilsonii* Rolfe, 1909**

Conservation status: VU

Distribution: China, India, Vietnam

***Pleione arunachalensis* Hareesh, Kumar & M. Sabu, 2017**

Conservation status: CR

Distribution: China, China

***Pleione bulbocodioides* (Franch.) Rolfe, 1903**

Conservation status: DD

Distribution: China, Endemic to China

***Pleione formosana* Hayata, 1911**

Conservation status: VU

Distribution: China, Endemic to China

***Pleione forrestii* Schltr., 1912**

Conservation status: EN

Distribution: China, Endemic to China

***Pleione grandiflora* (Rolfe) Rolfe, 1903**

Conservation status: CR

Distribution: China, Vietnam

***Pleione hookeriana* (Lindl.) Rollisson, 1875**

Conservation status: VU

Distribution: China, Nepal, Bhutan, India, Myanmar, Laos, Thailand

***Pleione kaatiae* P.H. Peeters, 2003**

Conservation status: DD

Distribution: China, China

***Pleione limprichtii* Schltr., 1922**

Conservation status: VU

Distribution: China, Myanmar

***Pleione praecox* D. Don, 1825**

Conservation status: VU

Distribution: China, Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Thailand, Vietnam

***Pleione saxicola* Tang & F.T. Wang ex S.C. Chen, 1987**

Conservation status: EN

Distribution: China, Bhutan

***Pleione scopulorum* W.W. Sm., 1921**

Conservation status: VU

Distribution: China, India, Myanmar

***Pleione yunnanensis* (Rolfe) Rolfe, 1903**

Conservation status: VU

Distribution: China, Myanmar

***Iris narcissiflora* Diels, 1924**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Caryota obtusa* Griff., 1845**

Conservation status: VU

Distribution: China, India, Laos, Myanmar, Thailand, Vietnam

***Trachycarpus nanus* Becc., 1910**

Conservation status: EN

Distribution: China

***Achnatherum breviaristatum* Keng & P.C. Kuo, 1976**

Conservation status: VU

Distribution: China

***Agropyron mongolicum* Keng, 1938**

Conservation status: LC

Distribution: China

***Aristida triseta* Keng, 1941**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Elymus alashanicus* (Keng) S.L. Chen, 1994**

Conservation status: LC

Distribution: China

***Elymus atratus* (Nevski) Hand.-Mazz., 1936**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Elymus brevipes* (Keng) S.L. Chen, 2006**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Elymus purpuraristatus* C.P. Wang & H.L. Yang, 1984**

Conservation status: LC

Distribution: China

***Elymus sinosubmuticus* S.L. Chen, 2006**

Conservation status: VU

Distribution: China

***Gaoligongshania megalothyrsa* (Hand.-Mazz.) D.Z. Li, Hsueh & N.H. Xia, 1995**

Conservation status: NT

Distribution: China

***Kengyilia kokonorica* (Keng) J.L. Yang, C. Yen & B.R. Baum, 1992**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Orinus kokonorica* (K.S. Hao) Keng, 1957**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Sinochasea trigyna* Keng, 1958**

Conservation status: VU

Distribution: China

***Hordeum innermongolicum* P.C. Kuo & L.B. Cai, 1987**

Conservation status: VU

Distribution: China

***Meconopsis barbisetata* C.Y. Wu & H. Chuang ex L.H. Zhou, 1979**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Meconopsis punicea* Maxim., 1889**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Meconopsis torquata* Prain, 1906**

Conservation status: NT

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Corydalis saxicola* G.S. Bunting, 1966**

Conservation status: LC

Distribution: China

***Dysosma aurantiocaulis* (Hand.-Mazz.) Hu, 1937**

Conservation status: VU

Distribution: China, Myanmar

***Dysosma delavayi* (Franch.) Hu, 1937**

Conservation status: DD

Distribution: China

***Dysosma tsayuensis* T.S. Ying, 1979**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Dysosma versipellis* (Hance) M. Cheng ex T.S. Ying, 1979**

Conservation status: VU

Distribution: China

***Sinopodophyllum hexandrum* (Royle) T.S. Ying, 1985**

Conservation status: LC

Distribution: China, Afghanistan, Bhutan, India, Nepal, Pakistan

***Kingdonia uniflora* Balf. f. & W.W. Sm., 1914**

Conservation status: VU

Distribution: China

***Coptis chinensis* Franch., 1897**

Conservation status: VU

Distribution: China

***Coptis teeta* Wall., 1842**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Nelumbo nucifera* Gaertn., 1788**

Conservation status: DD

Distribution: China, Bhutan, India, Indonesia, Japan, Korea, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Russia, Sri Lanka, Thailand, Vietnam, Australia

***Tetracentron sinense* Oliv., 1889**

Conservation status: LC

Distribution: China, Bhutan, India, Myanmar, Nepal, Vietnam

***Paeonia delavayi* Franch., 1887**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Paeonia decomposita* Hand.-Mazz., 1939**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Paeonia ludlowii* (Stern & G.Taylor) D.Y. Hong, 1997**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Paeonia rockii* (S.G. Haw & Lauener) T. Hong & J.J. Li, 1992**

Conservation status: VU

Distribution: China

***Paeonia rockii* subsp. *linyanshanii* T. Hong & G.L. Osti, 1994**

Conservation status: DD

Distribution: China

***Paeonia rotundiloba* D.Y. Hong, 2011**

Conservation status: EN

Distribution: China

***Paeonia sterniana* H.R. Fletcher, 1959**

Conservation status: LC

Distribution: China

***Cercidiphyllum japonicum* Siebold & Zucc., 1846**

Conservation status: LC

Distribution: China, Japan

***Rhodiola crenulata* (Hook.f. & Thomson) H. Ohba, 1976**

Conservation status: EN

Distribution: China, Bhutan, Nepal, India

***Rhodiola fastigiata* (Hook.f. & Thomson) Fu, 1965**

Conservation status: LC

Distribution: China, Bhutan, India, Kashmir, Nepal

***Rhodiola himalensis* (D.Don) Fu, 1965**

Conservation status: LC

Distribution: China, Bhutan, Nepal, India

***Rhodiola quadrifida* Fisch. & C.A. Mey., 1841**

Conservation status: LC

Distribution: China, Kazakhstan, Mongolia, Russia

***Rhodiola rosea* L., 1753**

Conservation status: VU

Distribution: China, Japan, Kazakhstan, Korea, Mongolia, Russia; Europe, North America

***Rhodiola sacra* (Raym.-Hamet) Fu, 1965**

Conservation status: VU

Distribution: China

***Rhodiola tangutica* (Maxim.) S.H. Fu, 1986**

Conservation status: VU

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Rhodiola wallichiana* (Hook.) Fu, 1965**

Conservation status: LC

Distribution: China, Bhutan, India, Myanmar, Nepal

***Rhodiola yunnanensis* (Franch.) Fu, 1965**

Conservation status: LC

Distribution: China

***Cynomorium songaricum* Rupr., 1869**

Conservation status: VU

Distribution: China, Afghanistan, Mongolia, Iran

***Glycine soja* Siebold & Zucc., 1845**

Conservation status: LC

Distribution: China, Afghanistan, Japan, Korea, Russia

***Glycyrrhiza inflata* Batalin, 1891**

Conservation status: LC

Distribution: China, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan

***Glycyrrhiza uralensis* Fisch. ex DC., 1825**

Conservation status: LC

Distribution: China, Mongolia, Russia

***Ormosia henryi* Prain, 1900**

Conservation status: VU

Distribution: China, Vietnam, Thailand

***Ormosia hosiei* Hemsl. & E.H. Wilson, 1906**

Conservation status: EN

Distribution: China

***Salweenia bouffordiana* H. Sun, Zhi M. Li & J.P. Yue, 2011**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Salweenia wardii* Baker f., 1935**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Malus rockii* Rehder, 1933**

Conservation status: LC

Distribution: China, Bhutan

***Malus sieversii* M.Roem., 1847**

Conservation status: VU

Distribution: China, Kazakhstan, Russia

***Malus sikkimensis* (Wenz.) Koehne ex C.K. Schneid., 1906**

Conservation status: DD

Distribution: China, Bhutan, India, Nepal

***Prunus kansuensis* Rehder, 1922**

Conservation status: DD

Distribution: China

***Prunus mira* Koehne, 1912**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Prunus mongolica* Maxim., 1879**

Conservation status: VU

Distribution: China, Mongolia

***Prunus tenella* Batsch, 1801**

Conservation status: EN

Distribution: Europe, West and Central Asia

***Rosa chinensis* var. *spontanea* (Rehder & E.H. Wilson) T.T. Yu & T.C. Ku, 1985**

Conservation status: EN

Distribution: China

***Rosa lucidissima* H. Lév., 1911**

Conservation status: CR

Distribution: China

***Rosa odorata* var. *gigantea* (Crép.) Rehder & E.H. Wilson, 1915**

Conservation status: DD

Distribution: China, Myanmar, Thailand, Vietnam

***Rosa praelucens* Bijh., 1929**

Conservation status: CR

Distribution: China

***Berchemiella wilsonii* (C.K. Schneid.) Nakai, 1923**

Conservation status: LC

Distribution: China

***Zelkova schneideriana* Hand.-Mazz., 1929**

Conservation status: VU

Distribution: China

***Morus macroura* Miq., 1851**

Conservation status: LC

Distribution: China, Bhutan, Indochina, Malaysia, Myanmar, India, Thailand

***Morus notabilis* C.K. Schneid., 1916**

Conservation status: LC

Distribution: China

***Quercus oxyphylla* Hand.-Mazz., 1929**

Conservation status: NT

Distribution: China

***Sapria himalayana* Griffi., 1844**

Conservation status: VU

Distribution: China, India, Myanmar, Thailand, Vietnam

***Terminalia myriocarpa* Van Heurck & Müll. Arg., 1871**

Conservation status: VU

Distribution: China, Bangladesh, Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Thailand, Vietnam

***Lagerstroemia minuticarpa* Debberm. ex P.C. Kanjilal, 1934**

Conservation status: EN

Distribution: China, India, Bhutan

***Trapa incisa* Sieb. et Zucc., 1845**

Conservation status: DD

Distribution: China, Japan, Vietnam, Thailand, Laos, Malaysia, Indonesia

***Acer amplum* subsp. *catalpifolium* (Rehder) Y.S. Chen, 2008**

Conservation status: VU

Distribution: China

***Acer pentaphyllum* Diels, 1931**

Conservation status: CR

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Eurycorymbus cavaleriei* (H. Lév.) Rehder & Hand.-Mazz., 1934**

Conservation status: NT

Distribution: China

***Handeliodendron bodinieri* (H. Lév.) Rehder, 1935**

Conservation status: EN

Distribution: China

***Citrus cavaleriei* H. Lév. ex Cavalerie, 1911**

Conservation status: DD

Distribution: China

***Phellodendron chinense* C.K. Schneid., 1907**

Conservation status: LC

Distribution: China

***Aglaia lawii* (Wight) C.J. Saldanha, 1976**

Conservation status: LC

Distribution: China, Indonesia, Laos, Malaysia, Thailand, Vietnam

***Toona ciliata* M. Roem., 1846**

Conservation status: LC

Distribution: China, Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam, Australia

***Paradombeya sinensis* Dunn, 1902**

Conservation status: EN

Distribution: China

***Hopea shingkeng* (Dunn) Bor, 1941**

Conservation status: EN

Distribution: China

***Firmiana major* (W. W. Smith) Hand.-Mazz., 1878**

Conservation status: EN

Distribution: China

***Fagopyrum dibotrys* (D.Don) H. Hara, 1966**

Conservation status: LC

Distribution: China, Bhutan, India, Kashmir, Myanmar, Nepal, Vietnam

***Psammosilene tunicoides* W.C. Wu & C.Y. Wu, 1945**

Conservation status: EN

Distribution: China

***Sinojackia henryi* (Dümmer) Merr., 1937**

Conservation status: DD

Distribution: China

***Baolia bracteata* H.W. Kung & G.L. Chu, 1978**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Davidia involucrata* Baillon, 1871**

Conservation status: LC

Distribution: China

***Pomatosace filicula* Maxim., 1881**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Camellia sinensis* (L.) Kuntze, 1887**

Conservation status: DD

Distribution: China, India, Japan, Korea

***Camellia sinensis* var. *assamica* (J.W. Mast.) Kitam., 1950**

Conservation status: VU

Distribution: China, Laos, Myanmar, Thailand, Vietnam

***Actinidia arguta* Miq., 1867**

Conservation status: LC

Distribution: China, Japan, Korea

***Actinidia chinensis* Planch., 1847**

Conservation status: LC

Distribution: China

***Rhododendron dauricum* L., 1753**

Conservation status: LC

Distribution: China, Japan, Korea, Mongolia, Russia

***Rhododendron williamsianum* Rehder & E.H. Wilson, 1913**

Conservation status: EN

Distribution: China

***Emmenopterys henryi* Oliv., 1889**

Conservation status: NT

Distribution: China

***Neonauclea tsaiana* S.Q. Zou, 1988**

Conservation status: EN

Distribution: China

***Lomatogniopsis alpina* T.N. Ho & S.W. Liu, 1980**

Conservation status: EN

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Merrillanthus hainanensis* Chun & Tsiang, 1941**

Conservation status: EN

Distribution: China, Cambodia

***Arnebia euchroma* (Royle ex Benth.) I.M. Johnst., 1924**

Conservation status: EN

Distribution: China, Afghanistan, India, Kazakhstan, Kyrgyzstan, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan

***Lycium ruthenicum* Murray, 1780**

Conservation status: LC

Distribution: China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan, Georgia, Turkey, Azerbaijan

***Fraxinus mandshurica* Rupr., 1857**

Conservation status: VU

Distribution: China, Japan, Korea, Russia

***Fraxinus sogdiana* Bunge, 1852**

Conservation status: LC

Distribution: China, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan

***Neopicrorhiza scrophulariiflora* (Pennell) D.Y. Hong, 1984**

Conservation status: EN

Distribution: China, Nepal

***Scrophularia stylosa* P.C. Tsoong, 1994**

Conservation status: VU

Distribution: China

***Cistanche deserticola* Ma, 1960**

Conservation status: EN

Distribution: China, Mongolia

***Leucomeris decora* Kurz, 1872**

Conservation status: DD

Distribution: China, Vietnam, Thailand, Myanmar

***Saussurea balangshanensis* Ya Z. Zhang & H. Sun, 2019**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Saussurea gossipiphora* D. Don, 1821**

Conservation status: LC

Distribution: China, India, Pakistan, Nepal, Bhutan

***Saussurea laniceps* Hand.-Mazz., 1937**

Conservation status: DD

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Saussurea medusa* Maxim., 1881**

Conservation status: DD

Distribution: China, India, Pakistan

***Nardostachys jatamansi* (Jones) DC., 1830**

Conservation status: CR

Distribution: China, India, Nepal, Bhutan

***Panax bipinnatifidus* Seem., 1868**

Conservation status: VU

Distribution: China, India, Nepal, Vietnam

***Panax bipinnatifidus* var. *angustifolius* (Burkill) J. Wen, 2001**

Conservation status: DD

Distribution: China, Bhutan, India, Nepal, Thailand

***Panax pseudo-ginseng* C.A. Mey., 1842**

Conservation status: LC

Distribution: China

Notes: Endemic to Qinghai-Tibetan Plateau

***Panax stipuleanatus* Tsai & K.M. Feng, 1975**

Conservation status: EN

Distribution: China, Vietnam

***Panax vietnamensis* Ha & Grushvitzky, 1985**

Conservation status: DD

Distribution: China, Vietnam

***Panax wangianum* S.C. Sun, 1946**

Conservation status: DD

Distribution: China

***Chuanminshen violaceum* M.L. Sheh & R.H. Shan, 1980**

Conservation status: EN

Distribution: China

Analysis

Statistical analyses of families and genus

There were 330 species, 18 varieties and two subspecies of national key protected wild plants on the Qinghai-Tibetan Plateau, belonging to 72 families and 130 genera, including five species of Bryophyta in three families and three genera, 27 species of Lycopodiophyta in two families and three genera, 11 species of Pteridophyta in three families and six genera, 25 species of Gymnospermae in five families and 12 genera, 262 species, 18 varieties and two subspecies of Angiospermae in 59 families and 106 genera (Suppl. material 1). These accounted for 1.43%, 7.71%, 3.14%, 7.14% and 80.57% of the national key protected wild plants on the Qinghai-Tibetan Plateau, respectively.

The *List* (2021) contains approximately 1,101 species (455 species and 40 categories), including five species of Bryophyta, eight species and seven categories of Lycopodiophyta and Pteridophyta (~ 106 species), 35 species and seven categories of Gymnospermae (~ 107 species), 397 species and 26 categories of Angiospermae (~ 830 species). According to the *List* (2021), the nationally protected wild plants distributed on the Qinghai-Tibetan Plateau accounted for 31.88% of the total in the *List* (2021), amongst which Bryophyta were all distributed on the Plateau, Lycopodiophyta and Pteridophyta, Gymnospermae and Angiospermae, accounted for 35.85%, 23.36% and 34.10% of the total species in the *List* (2021), respectively.

In terms of family composition, the national key protected wild plants on the Qinghai-Tibetan Plateau belonged to 72 families. Orchidaceae was the only family with over 100 species, with 103 species accounting for 29.34% of the national key protected wild plants (350 species) on the Qinghai-Tibetan Plateau. This was followed by Lycopodiaceae (24 species) and Melanthiaceae (21 species), which accounted for 6.83% and 5.98% of the national key protected wild plant species (350 species), respectively. Families with over 10 species also included Liliaceae (15 species), Poaceae (13 species), Rosaceae (11 species) and Taxaceae (10 species). A total of 33 families had only one species, accounting for 45.83% of all families (Fig. 1).

In terms of genus composition, the national key protected wild plants on the Qinghai-Tibet Plateau belonged to 130 genera. Genera with more than 20 species included *Cypripedium* (29 species), *Dendrobium* (24 species) and *Paris* (21 species), accounting for 8.26%, 6.84%, and 5.98% of the total species (350 species) on the Qinghai-Tibetan Plateau,

respectively. However, the genus with only one species included 77 genera, accounting for 59.23% of all the genera (Fig. 2).

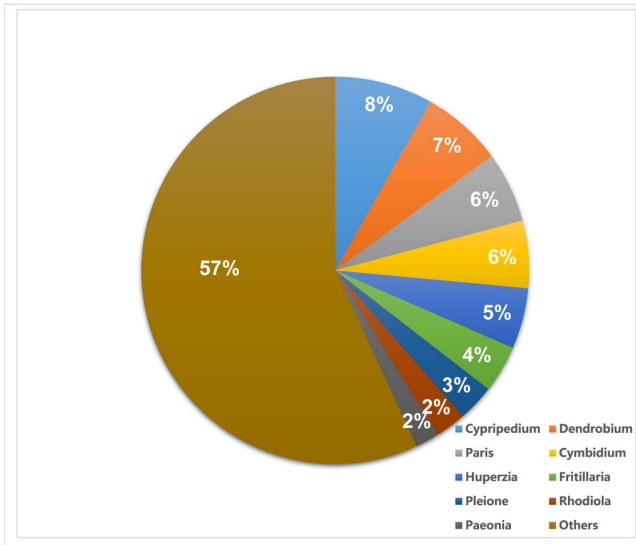


Figure 1. [doi](#)

Statistics of the proportion of each family of national key protected wild plants on the Qinghai-Tibetan Plateau.

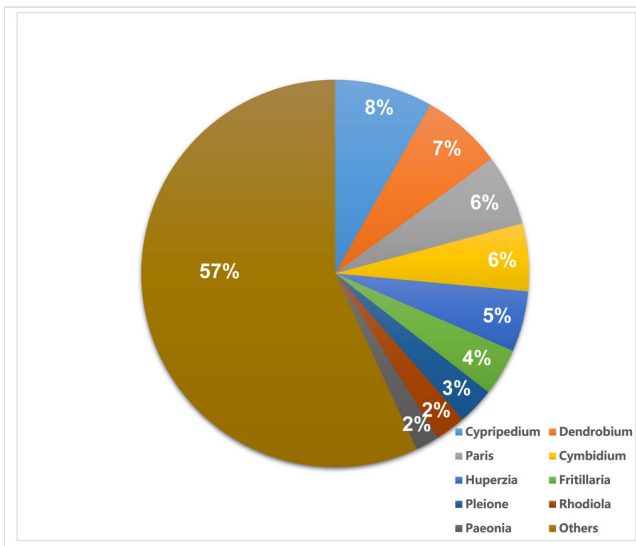


Figure 2. [doi](#)

Statistics of the proportion of each genus of national key protected wild plants on the Qinghai-Tibetan Plateau.

Endemic and endangered status of taxa

According to statistics, there are 14,939 species of endemic seed plants in China and 3,764 species of endemic seed plants in the Qinghai-Tibetan Plateau (Yu et al. 2018). The national key protected wild plants distributed on the Qinghai-Tibetan Plateau included 168 species endemic to China, including 16 species of Lycopodiophyta, three species of Pteridophyta, 14 species of Gymnospermae and 135 species of Angiospermae. The species of seed plants (Gymnospermae and Angiospermae) endemic to China (149 species) accounted for 1.00% of the total species endemic to China. There were 57 species endemic to the Qinghai-Tibetan Plateau, including eight species of Lycopodiophyta, three species of Gymnospermae and 46 species of Angiospermae. The species of seed plants (Gymnospermae and Angiospermae) endemic to the Qinghai-Tibet Plateau (49 species) accounted for 1.30% of the total seed plants endemic to the Plateau.

In terms of protection level, there were 22 species of Class-I protected plants, including two species of Lycopodiophyta, one species of Pteridophyta, nine species of Gymnospermae, nine species of Angiospermae and one species of Cyanophyta. There were 328 species of Class II protected plants, including five species of Bryophytes, 24 species of Lycopodiophyta, 10 species of Pteridophyta, 16 species of Gymnospermae and 273 species of Angiospermae.

In terms of endangered status, one species, *Cystopteris chinensis*, was extinct in the wild (EW), 17 species were critically endangered (CR), such as *Calanthe dulongensis*, 91 species were endangered (EN), such as *Cephalotaxus lanceolata*, 90 species were vulnerable (VU), such as *Cypripedium henryi* and 30 species were near threatened (NT), such as *Paris polyphylla* var. *yunnanensis*, 60 species were of least concern (LC), such as *Huperzia selago* and 62 species had data deficiency.

Geographical distribution pattern

On the Qinghai-Tibetan Plateau, the diversity distribution pattern of national key protected wild plants showed a decreasing trend from the southeast to northwest. There were 169 species and 13 varieties in the Yunnan Province, with 13 Class-I and 156 Class-II species. In Sichuan Province, 169 species, 12 varieties and one subspecies were distributed, including nine Class-I species and 173 Class-II species. In the Tibet Autonomous Region, 155 species and five varieties were distributed, including nine Class-I species and 151 Class-II species. In Gansu Province, 75 species, five varieties and one subspecies were distributed, including six Class-I species and 75 Class-II species. In Qinghai Province, 46 species were distributed, which were all Class-II species. Eighteen species were distributed in the Xinjiang Uygur Autonomous Region, including 18 Class-II species.

From the distribution at the county-level (Fig. 3), the distribution of nationally protected wild plants on the Qinghai-Tibetan Plateau was the highest in Gongshan and Yulong counties in Yunnan and Motuo County in Tibet, with at least 80 species. Species distribution in Deqin, Weixi and Fugong counties of Yunnan; Chayu County of Tibet; and Kangding, Luding and Tianquan counties of Sichuan was concentrated, with 51–80 species. The species

distribution in most areas from southeast to northwest Tibet was very low, with fewer than 10 species.

From the floristic distribution (Fig. 4), the species distributed in the Sanjiang Valley subregion (IIIE14a) and the South Hengduan Mountain subregion (IIIE14b) were the most dense, with more than 160 species, followed by species distributed in Southeast Asia of Tibet (IIIE15b) and Taohe-Minshan subregion (IIIE14d). Only less than 10 species were found in the Qaidam Basin subregion (IIC6b) and Pamir-Kashi Kunlun subregion (IIF17c).

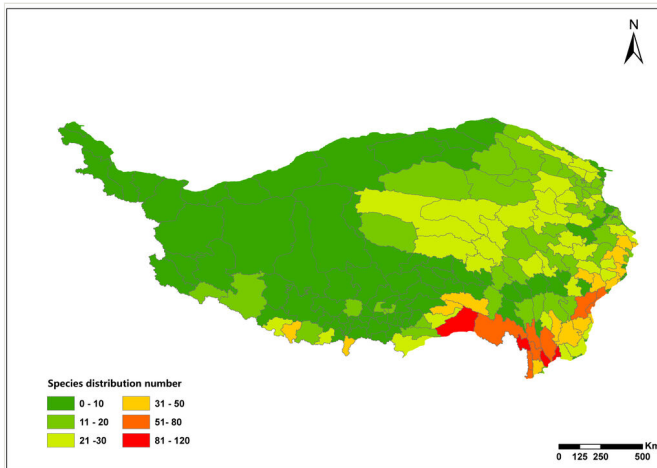


Figure 3. [doi](#)

Number of national key protected wild plants on the Qinghai-Tibetan Plateau, based on county-level distribution.

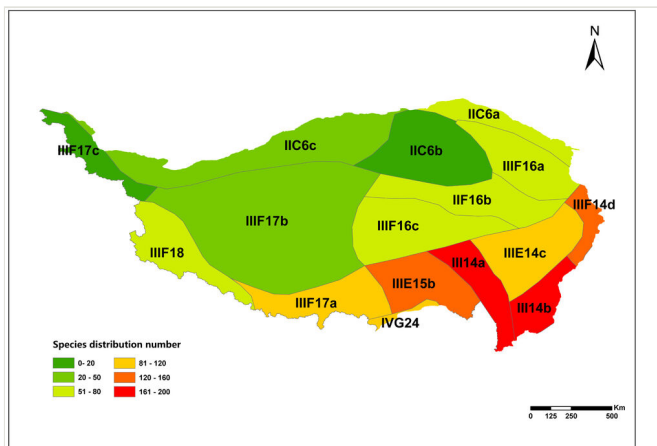


Figure 4. [doi](#)

Distribution and quantity of number of national key protected wild plants on the Qinghai-Tibetan Plateau, based on the floristic scale.

Discussion

The Qinghai-Tibetan Plateau is not only a gene pool for plateau species and a hotspot for global biodiversity protection, but also an important ecological security barrier for China and Asia, which is one of the key areas of ecological civilisation construction in China. Due to the fragility and irreversibility of the alpine ecosystem, their environmental sensitivity and the increasing impact of climate warming and human disturbance, their biodiversity is facing serious challenges. Therefore, the protection of biodiversity and ecological security is the core task of ecological protection in the Qinghai-Tibetan Plateau. To date, 196 naturally-protected areas, including national parks, nature reserves, wetland parks, national forest parks and national geoparks, have been designated on the Qinghai-Tibetan Plateau (Hu 2020). These natural protected areas play an irreplaceable role in the protection of biodiversity resources on the Tibetan Plateau, especially in the protection of endangered and critical species on the Plateau (Fu et al. 2021). However, in the literature review, it was found that the population status of national key protected wild plants in this area, including the distribution of wild species, population size and genetic background information, is not yet clear and there are still blind areas of species distribution. Therefore, it was necessary to conduct a comprehensive investigation and assessment of the current status of these protected plants in the field.

Plant diversity patterns play an important role in maintaining the ecological balance of the Qinghai-Tibetan Plateau. Historical orogeny and related climatic changes are the main driving forces behind the formation of plant diversity patterns in the Qinghai-Tibetan Plateau (Muellner-Riehl 2019). On the one hand, the uplift of the Qinghai-Tibetan Plateau has greatly changed the surface pattern of the region and the geographical barriers such as mountains, canyons and "sky island" formed have restricted the gene flow amongst plant populations and promoted species differentiation (Ren et al. 2015, Khan et al. 2018). On the other hand, the uplift of the Qinghai-Tibetan Plateau also leads to the Indian and East Asian monsoons (Tada et al. 2016) and the change in the monsoon climate may be another important driving force for plant evolution in this region (Liu et al. 2013, Wen et al. 2014, Sun et al. 2015). In addition, the alternation of Ice Ages experienced in this region since the Pleistocene has led to habitat fragmentation of many originally continuously distributed species, which retreat to isolated Ice-Age sanctuaries, resulting in the lineage differentiation and the generation of many new species through allogeneic speciation (Wang et al. 2010, Ren et al. 2017). Under the influence of these special natural geographical conditions and speciation mechanisms, most of the national key protected plants on the Qinghai-Tibetan Plateau have a narrow distribution and small population size, which highlights the importance and urgency of sorting, investigating, collecting and protecting these germplasm resources.

In this study, the species distribution information was mainly sorted based on flora, virtual specimens and part of the field investigation data; thus, errors in the data are inevitable. Subsequent research on physical specimens and field investigation data can further clarify the distribution status of national key protected plants on the Qinghai-Tibetan Plateau.

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Author contributions

Ronglian Chen: Methodology, Investigation, Writing. Faqi Zhang: Resources, Revised writing. Shilong Chen: Supervision. Xiaofeng Chi: Conceived and designed the research framework, Data curation, Funding acquisition.

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Supplementary material

Suppl. material 1: Checklist of National Key Protected Wild Plants on the Qinghai-Tibetan Plateau [doi](#)

Authors: Ronglian Chen, Faqi Zhang, Shilong Chen, Xiaofeng Chi

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