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Flora of the Gurvan Saykhan Mountains

Ts. Jamsran, B. Oyuntsetseg & R. Tungalag

Abstract

Although two major books have been published on the Mongolian flora regional data are often still lacking due to the vast expanses of the country. Therefore we used published information and data from our own fieldwork to compile a relatively comprehensive inventory of the flora of the Gobi Gurvan Saykhan mountains in southern Mongolia.

Keywords Mongolia, flora, Gobi Gurvan Saykhan

Introduction

Until today the principal reference works on the vascular plants of Mongolia are the 'Key to the vascular plants of Mongolia' by Grubov (1955, 1982) and the 'Conspectus of the flora of Outer Mongolia' by Gubanov (1996). However, despite of the tremendous amount of work that went into these volumes, several vegetation zones and administrative regions such as the Goby Gurvan Saykhan mountains were not covered in detail due to the vast expanses of the country. Therefore we studied the flora of the Gobi Gurvan Saykhan in greater detail, and are now able to present an overview of the knowledge on the flora of this region, thereby adding our own recent findings to previously published data.

Studies on the flora of the Gobi Gurvan Saykhan date back at least to the findings of Ikonnikov Galitskii who recorded 428 plant species for the Gobi-Altay mountain flora in 1931 (Grubov, 1955, p. 20). In addition to the Gobi Gurvan Saykhan mountains his records also cover Bayan Bor, Bayan-Tsagaan, and Zoolongiyin mountain ranges and the valley of Bayan-Tokom. Tsatsenkin and Yunatov (1951) also included the Gurvan Saykhan and the neighboring ranges in the Goby-Altay mountain desert-steppe region. Later on, records from Gordeeva (1974) and Sanchir (1986) provided data for the pediments north of the Gurvan Saykhan mountains.

Gubanov (1996) recorded 64 families and 760 species in the Gobi-Altay province but records on the flora of the Gurvan Saykhan mountains are not comprehensive. Grubov (1982) gives much more detailed information on the distribution of vascular plants in the area, with localities being indicated on the level of single mountain ranges within the Gobi Gurvan Saykhan system (see table 1).

However, also these data are far from showing the complete flora of the Gobi Gurvan Saykhan mountains. Therefore we tried to compile a new more comprehensive species list of the Gobi Gurvan Saykhan vegetation based on the references mentioned above and our own data.

Table 1: Richness of vascular plant families, genera, and species in the different mountain ranges of the Gobi Gurvan Saykhan according to Grubov (1982).

	Züün Saykhan	Dund Saykhan	Baruun Saykhan	Gurvan Saykhan
Family	30	12	4	27
Genus	53	16	5	63
Species	70	20	6	96

Study area

The Gobi Gurvan Saykhan National Park (designated in 1995) is located in the semi-desert zone and belongs to the Gobi-Altay mountains. Its summits range from 2400 m to 2800 m, and display the Gobi type of vertical vegetation zonation. The upper slopes are dominated by rocky dry steppe including the *Stipa krylovii* Roshev. and *Stipa-Artemisia* (*Artemisia frigida* Willd. - *Stipa*) associations, the mid-zone is a montane desert steppe with *Stipa glareosa* P. Smirn. and *S. gobica* Roshev. The foot zones of the mountains are covered by desert steppes with *Salsola passerina* Bge. (Yunatov, 1950).

The uppermost sites show remnants of alpine meadows with *Kobresia* and *Carex* communities, plus some groves with the following species: *Betula reznitzenkoana* (Litv.) Schischk., *Betula fusca* Pall. ex. Georgi, *Salix ledebouriana* Trautv., *Salix bebbiana* Sarg., *Salix taraikensis* Kimura, *Spiraea aquilegifolia* Pall., *Spiraea media* F. Schmidt, *Spiraea flexuosa* Fisch., *Cotoneaster melanocarpa* Lodd., *Cotoneaster uniflora* Bge., *Grossularia acicularis* (Smith.) Spach., *Ribes rubrum* L., *Rosa acicularis* Lindl., while *Lonicera microphylla* Willd. and *Lonicera altaica* Pall. grow in some steep gorges on the northern side of the mountains (Ulziyhutag, 1989).

Methods

The new species list was compiled based on available literature and on own field investigations in 1996. That year, teachers and 3rd year biology students from the National University of Mongolia prepared a report on Yolín Am (Züün Saykhan) and Gegeetiyn Am (Baruun Saykhan) containing 300 species (in 175 genera of 51 families), and submitted it to the German Technical Co-operation Agency, GTZ (Jamsran & Oyuntsetseg, 1997).

Results & Discussion

In general the Züün Saykhan range has been studied most intensively. For all three mountains, however a total of 178 species are listed (from 98 genera / 36 families), which is probably comprehensive (table 2). However, we recently discovered *Thesium repens* Ldb., *Paeonia anomala* L., *Peganum harmala* L., *Carum carvi* L., *Myosotis sylvatica* (Ehrh.) Hoffm., and *Polygonum viviparum* L.

According to Grubov (1982), there are an additional 327 species (166 genera in 46 families) in the entire Gobi Altay region, for which the exact location is not mentioned. That data is still not sufficient, and further detailed studies are needed, requiring approximately 2–3 years of field work (early spring until late autumn).

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Appendix

Table 2: List of plant species of the Gobi Gurvan Saykhan. GA = Gobi Altay, ZS = Züün Saykhan, DS = Dund Saykhan, and BS = Baruun Saykhan

Plant species	GA	ZS	DS	BS
Polypodiaceae				
<i>Woodsia ilvensis</i> (L.) R.Br.	+	+		
<i>Cystopteris fragilis</i> (L) Bernh.	+	+	+	
<i>Asplenium exiguum</i> Bedd.	+	+		
<i>Cheilanthes argentea</i> (S.G.Gmel) Ktze.	+			
Cupressaceae				
<i>Juniperus sabina</i> L.	+	+	+	+
Ephedraceae				
<i>Ephedra sinica</i> Stapf	+		+	+
<i>E. monosperma</i> G.G. Gmel. ex C.A.Mey.	+	+		
Juncaginaceae				
<i>Triglochin maritimum</i> L.	+			
<i>T. palustre</i> L.	+		+	
Poaceae				
<i>Setaria viridis</i> (L) P.B.	+	+	+	+
<i>Aristida heymannii</i> Rgl.	+	+	+	+
<i>Achnatherum inebrians</i> (Hance) Keng.	+	+	+	+
<i>Ptilagrostis pelliottii</i> (Danduy) Grib.	+		+	+
<i>Stipa sibirica</i> (L.) Lam.	+	+	+	+
<i>S. krylovii</i> Roshev.	+	+	+	+
<i>S. gobica</i> Roshev.	+		+	
<i>S. glareosa</i> P.Smirn.	+	+	+	+
<i>Alopecurus brachystachyus</i> M.B.	+	+	+	
<i>Calamagrostis macilenta</i> (Griseb.) Litv.	+	+		
<i>Trisetum sibiricum</i> Rupr.	+	+		
<i>Helictotrichon schellianum</i> (Hack.) Kitag.	+	+	+	
<i>Chloris virgata</i> Sw.	+	+	+	+
<i>Enneapogon borealis</i> (Griseb.) Honda.	+	+	+	+
<i>Phragmites communis</i> Trin.	+		+	
<i>Cleistogenes songorica</i> (Roshev.) Ohwi.	+	+	+	
<i>Eragrostis minor</i> Host.	+	+	+	+
<i>Koeleria macrantha</i> (Ldb.) Schult.	+	+	+	
<i>Catabrosa aquatica</i> (L.) P.B.	+		+	
<i>Poa subfastigiata</i> Trin.	+	+		
<i>P. tibetica</i> Munro ex Stapf.	+	+	+	
<i>P. pratensis</i> L.	+	+	+	
<i>P. palustris</i> L.	+	+		
<i>P. attenuata</i> Trin.	+	+	+	
<i>P. steposa</i> (Kryl.) Roshev.	+	+		
<i>Puccinellia tenuiflora</i> (Griseb.) Scribn. et Merr.	+	+	+	
<i>Festuca rubra</i> L.	+	+		
<i>F. ovina</i> L.	+	+	+	+
<i>F. lenensis</i> Drob.	+	+	+	

continued on next page

Plant species	GA	ZS	DS	BS
<i>Bromus inermis</i> Leyss.	+	+	+	
<i>Agropyron cristatum</i> (L) P.B.	+	+	+	+
<i>A. repens</i> (L) P.B.	+	+	+	+
<i>Hordeum brevisubulatum</i> (Trin.) Link.	+	+	+	+
<i>H. distichon</i> L.	+	+		
<i>Elymus chinensis</i> (Trin.) Keng	+	+	+	+
<i>E. secalinus</i> (Georgi) Bobr.	+	+	+	
<i>E. transbaicalensis</i> (Nevski) Tzvel.	+	+		
<i>E. nutans</i> Griseb.	+	+		
<i>E. schrenkianus</i> (Fisch. et Mey.) Tzvel.	+	+		
<i>E. dahuricus</i> Turcz. ex Griseb.	+	+		
<i>E. gmelinii</i> (Lbd.) Tzvel.	+	+		
<i>E. brachypodioides</i> (Nevski) Peschk.	+	+	+	
<i>E. komarovii</i> (Nevski) Tzvel.	+		+	
Cyperaceae				
<i>Eleocharis intersita</i> Zinserl.	+	+	+	
<i>Kobresia bellardii</i> (All.) Degl.	+	+	+	
<i>K. humilis</i> (C.A.Mey. ex Trautv.) Serg.	+		+	
<i>Carex obtusata</i> Liljebl.	+	+		
<i>C. duriuscula</i> C.A.Mey.	+	+	+	+
<i>C. stenophylloides</i> V.Krecz.	+		+	+
<i>C. enervis</i> C.A.Mey.	+	+	+	
<i>C. orbicularis</i> Boott.	+	+		
<i>C. melananthiformis</i> Litv.	+	+	+	
<i>C. pediformis</i> C.A.Mey.	+	+	+	
<i>C. korshinskyi</i> Kom.	+		+	
<i>C. delicata</i> Clarke	+	+		
Juncaceae				
<i>Juncus bufonius</i> L.	+	+	+	
Liliaceae				
<i>Allium altaicum</i> Pall.	+	+	+	
<i>A. polyrrhizum</i> Turcz. ex Rgl.	+	+	+	+
<i>A. odorum</i> L.	+	+	+	
<i>A. flavidum</i> Lbd.	+		+	
<i>A. eduardii</i> Stearn	+	+	+	+
<i>A. amphibolum</i> Lbd.	+	+		
<i>A. senescens</i> L.	+	+	+	+
<i>A. mongolicum</i> Rgl.	+	+	+	+
<i>A. prostratum</i> Trev.	+			+
<i>A. anisopodium</i> Lbd.	+	+	+	+
<i>A. tenuissimum</i> L.	+		+	
<i>Lloydia serotina</i> (L.) Reichb.	+	+		
<i>Asparagus gobicus</i> Ivanova ex Grub.	+		+	+
Iridaceae				
<i>Iris lactea</i> Pall.	+	+	+	+
<i>I. bungei</i> Maxim.	+	+	+	+
<i>I. potaninii</i> Maxim.	+	+	+	+

continued on next page

Plant species	GA	ZS	DS	BS
Salicaceae				
<i>Salix ledebouriana</i> Tratv.	+			
<i>S. taraikensis</i> Kimura	+	+		
<i>S. bebbiana</i> Sarg.	+	+	+	
<i>Populus laurifolia</i> Ledeb.	+	+		
Betulaceae				
<i>Betula platyphylla</i> Sukacz.	+	+		
<i>B. reznitzenkoana</i> (Litv.) Schischk.	+	+	+	
<i>B. microphylla</i> Bge.	+	+		
<i>B. fusca</i> Pall. ex Georgi	+	+		
Ulmaceae				
<i>Ulmus pumila</i> L.	+		+	+
Urticaceae				
<i>Urtica cannabina</i> L.	+	+	+	+
Santalaceae				
<i>Thesium refractum</i> C.A.Mey.	+	+		
Polygonaceae				
<i>Rheum nanum</i> Sievers.	+		+	+
<i>R. undulatum</i> L.	+	+	+	+
<i>R. compactum</i> L.	+			
<i>Rumex pseudonatronatus</i> Bobr.	+			+
<i>R. popovii</i> Pachom.	+			+
<i>Atraphaxis pungens</i> (M.B) Jaub. et Spach.	+			+
<i>A. frutescens</i> (L) K.Koch.	+	+	+	+
<i>Polygonum aviculare</i> L.	+	+	+	
<i>P. viviparum</i> L.	+	+	+	
<i>P. sibiricum</i> Laxm.	+	+	+	+
<i>P. angustifolium</i> Pall.	+	+		
<i>P. alpinum</i> All.	+	+	+	
Chenopodiaceae				
<i>Chenopodium aristatum</i> L.	+	+	+	+
<i>C. glaucum</i> L.	+	+	+	+
<i>C. acuminatum</i> Wild.	+	+	+	
<i>C. prostratum</i> Bge.	+		+	+
<i>C. vulvaria</i> L.	+		+	
<i>C. album</i> L.	+	+	+	+
<i>Atriplex sibirica</i> L.	+	+	+	+
<i>Eurotia ceratoides</i> (L.) C.A.Mey.	+	+	+	+
<i>Axyris prostrata</i> L.	+	+	+	+
<i>A. hybrida</i> L.	+		+	
<i>Bassia dasyphylla</i> (Fisch. et Mey.) Ktze.	+	+	+	+
<i>B. hyssopifolia</i> (Pall) Ktze.	+	+	+	+
<i>Kochia prostrata</i> (L.) Schard.	+	+	+	+
<i>K. melanoptera</i> Bge.	+		+	
<i>Corispermum mongolicum</i> Iljin	+	+	+	+
<i>Suaeda prostrata</i> Pall.	+		+	+
<i>Salsola passerina</i> Bge.	+		+	+
<i>S. collina</i> Pall.	+	+	+	+

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Plant species	GA	ZS	DS	BS
<i>S. pestifera</i> Nets.	+	+	+	+
<i>Anabasis brevifolia</i> C.A.Mey.	+		+	+
<i>Micropeplis arachnoidea</i> (Moq.) Bge.	+		+	+
Caryophyllaceae				
<i>Stellaria dichotoma</i> L.	+	+	+	+
<i>S. petraea</i> Bge.	+		+	
<i>S. graminea</i> L.	+		+	
<i>S. brachypetala</i> Bge.	+	+	+	
<i>Cerastium arvense</i> L.	+	+	+	
<i>C. vulgatum</i> L.	+			
<i>Arenaria capillaris</i> Poir.	+	+		
<i>A. meyeri</i> Fenzl.	+	+	+	
<i>Moehringia lateriflora</i> (L.) Fenzl.	+	+	+	
<i>Silene jensisseensis</i> Willd.	+	+	+	
<i>S. repens</i> Patr.	+	+	+	+
<i>Melandrium apricum</i> (Turcz) Rorhb.	+	+		
<i>M. brachypetalum</i> (Hornem) Fenzl.	+	+	+	
<i>M. apetalum</i> (L.) Fenzl.	+	+		
<i>Gypsophila desertorum</i> (Bge.) Fenzl.	+	+	+	+
<i>Dianthus versicolor</i> Fisch.	+	+	+	
Ranunculaceae				
<i>Paeonia anomala</i> L.	+	+		
<i>Leptopyrum tumarioides</i> (L.) Reichb.	+	+	+	
<i>Aquilegia viridiflora</i> Pall.	+	+	+	+
<i>Delphinium triste</i> Fisch.	+		+	
<i>D. grandiflorum</i> L.	+	+		
<i>D. cheilanthum</i> Fisch.	+	+	+	
<i>Aconitum barbatum</i> Pers.	+	+	+	
<i>A. septentrionale</i> Koelle.	+		+	
<i>Atragene sibirica</i> L.	+	+	+	
<i>Clematis songarica</i> Bge.	+	+	+	+
<i>C. fruticosa</i> Turcz.	+		+	+
<i>C. tangutica</i> (Maxim.) Korsh.	+	+	+	+
<i>Halerpestes salsuginosa</i> (Pall. ex. Georgi.) Greene	+		+	+
<i>H. sarmentosa</i> (Adams) Kom.	+	+	+	+
<i>Ranunculus natans</i> C.A.Mey	+	+		
<i>R. sceleratus</i> L.	+		+	
<i>Thalictrum foetidum</i> L.	+	+	+	+
<i>T. simplex</i> L.	+	+		
<i>T. minus</i> L.	+	+		
Berberidaceae				
<i>Berberis sibirica</i> Pall.	+	+	+	+
Papaveraceae				
<i>Papaver rubro-aurantiacum</i> (DC.)	+	+		
<i>P. croceum</i> Lbd.	+	+		
<i>P. saichanense</i> Grub.	+	+	+	
<i>Corydalis sibirica</i> (L. f.) Pers.	+	+	+	
<i>C. adunca</i> Maxim.	+			

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Plant species	GA	ZS	DS	BS
<i>Chiazospermum lactiflorum</i> Kar. et Kir.	+	+	+	+
Brassicaceae				
<i>Lepidium densiflorum</i> Schrad.	+		+	
<i>L. cordatum</i> Willd.	+	+	+	+
<i>L. latifolium</i> L.	+	+		
<i>Isatis costata</i> C.A.Mey.	+	+	+	+
<i>Thlaspi cochleariforme</i> DC.	+	+	+	
<i>Ptilotrichum canescens</i> C.A.Mey.	+	+	+	+
<i>P. tenuifolium</i> (Steph.) C.A.Mey.	+			
<i>Galitzkya macrocarpa</i> (Ik.-Gal.) V.Bocz.	+	+	+	+
<i>Draba nemorosa</i> L.	+	+	+	
<i>D. lanceolata</i> Royle	+	+		
<i>D. hirta</i> L.	+	+	+	
<i>Arabis pendula</i> L.	+	+		
<i>A. rupicola</i> Kryl.	+	+	+	
<i>Rorippa islandica</i> (Oed.) Bobr.	+		+	+
<i>Dontostemon micranthus</i> C.A.Mey.	+	+		
<i>D. integrifolius</i> (L.) C.A.Mey.	+	+	+	+
<i>D. senilis</i> Maxim.	+		+	
<i>D. crassifolius</i> Bge.	+			
<i>Dimorphostemon pectinatus</i> (DC.) V. Golubk.	+	+		
<i>Chorispora sibirica</i> (L.) DC.	+	+		
<i>Clausia aprica</i> (Steph.) Korn.-Tr.	+	+	+	
<i>Erysimum flavum</i> (Georgi) Bobr.	+	+	+	+
<i>E. cheiranthoides</i> L.	+	+	+	
<i>E. diffusum</i> Ehrh.	+		+	
<i>E. hieracifolium</i> L.	+	+		+
<i>Sisymbrium heteromallum</i> C.A.Mey.	+		+	
<i>Arabidopsis mollissima</i> (C.A.Mey.) N.Busch	+	+		
<i>Descurainia sophia</i> (L.)	+	+	+	+
<i>Smelovskia alba</i> (Pall.) Rgl.	+		+	
Crassulaceae				
<i>Rhodiola rosea</i> L.	+	+	+	
<i>Sedum aizoon</i> L.	+			
<i>S. purpureum</i> (L.) Schult.	+	+	+	
<i>Orostachys fimbriata</i> (Turcz.)	+			+
<i>O. spinosa</i> (L.) C.A.Mey.	+	+	+	
Saxifragaceae				
<i>Saxifraga cernua</i> L.	+			
<i>S. sibirica</i> L.	+	+		
<i>Ribes nigrum</i> L.	+	+		
<i>R. rubrum</i> L.	+	+		
<i>Grossularia acicularis</i> (Smith) Spach	+	+	+	+
Rosaceae				
<i>Spiraea aquilegifolia</i> Pall.	+	+	+	+
<i>S. flexuosa</i> Fisch.	+		+	
<i>S. media</i> F.Schmidit	+	+	+	
<i>Cotoneaster mongolica</i> Pojark.	+		+	

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Plant species	GA	ZS	DS	BS
<i>C. megalocarpa</i> M. Pop.	+	+	+	
<i>C. melanocarpa</i> Lodd.	+	+	+	
<i>C. uniflora</i> Bge.	+			
<i>Comarum salesovianum</i> (Steph.) Archers. et Gr.	+		+	+
<i>Potentilla anserina</i> L.	+	+		
<i>P. bifurca</i> L.	+	+		
<i>P. multifida</i> L.	+	+	+	
<i>P. conferta</i> Bge.	+	+	+	
<i>P. ikonnikovii</i> Juz.	+	+	+	
<i>P. sanguisorba</i> Willd.	+	+	+	+
<i>P. viscosa</i> G. Don.	+			+
<i>P. nudicaulis</i> Willd. ex Schlecht.	+	+		
<i>P. evestita</i> Th. Wolf	+	+	+	
<i>P. nivea</i> L.	+		+	
<i>P. gelida</i> C.A.Mey.	+		+	
<i>P. desertorum</i> Bge.	+	+	+	
<i>Sibbaldianthe adpressa</i> Bge. Juz.	+	+	+	+
<i>S. sericea</i> Grub.	+			
<i>Chamaerhodos trifida</i> Ldb.	+	+		
<i>C. erecta</i> (L.) Bge.	+		+	
<i>C. sabulosa</i> Bge.	+	+	+	
<i>Rosa acicularis</i> Lindl.	+	+	+	+
<i>Amygdalus pedunculata</i> Pall.	+		+	+
<i>A. mongolica</i> Maxim.	+			+
Fabaceae				
<i>Thermopsis przewalskii</i> Czefr.	+			
<i>T. schischkiniï</i> Czefr.	+			
<i>T. mongolica</i> Czefr.	+			
<i>Melilotus suaveolens</i> Lbd.	+	+	+	
<i>Trifolium eximium</i> Steph. ex Fisch. et Stev.	+		+	
<i>Sphaerophysa salsula</i> (Pall.) DC.	+			+
<i>Caragana leucophloea</i> Pojark.	+	+	+	
<i>Astragalus frigidus</i> (L.) Bge.	+	+		
<i>A. mongolicus</i> Bge.	+	+	+	
<i>A. melilotoides</i> Pall.	+		+	
<i>A. multicaulis</i> Lbd.	+	+	+	
<i>A. adsurgens</i> Pall.	+	+	+	
<i>A. monophyllus</i> Bge.	+	+	+	+
<i>A. fruticosus</i> Pall.	+	+		
<i>A. variabilis</i> Bge.	+	+	+	+
<i>A. brachybotrys</i> Bge.	+	+	+	+
<i>A. miniatus</i> Bge.	+	+	+	+
<i>A. laguroides</i> Pall.	+		+	
<i>A. saichanensis</i> Sanzcz.	+	+	+	+
<i>A. galactites</i> Pall.	+		+	+
<i>A. vallestria</i> R.Kam.	+	+	+	+
<i>A. junatovii</i> Sanzcz.	+		+	+
<i>A. grubovii</i> Sanzcz.	+	+	+	

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Plant species	GA	ZS	DS	BS
<i>Oxytropis aciphylla</i> Ldb.	+	+	+	+
<i>O. tragacanthoides</i> Fisch.	+	+	+	+
<i>O. filiformis</i> DC.	+	+	+	
<i>O. glabra</i> (Lam.) DC.	+	+	+	
<i>O. pauciflora</i> Bge.	+		+	
<i>O. pumila</i> Fisch.	+	+	+	
<i>O. pavlovii</i> B.Fedtsch. et Basil.	+		+	
<i>Glycyrrhiza uralensis</i> Fisch.	+		+	+
<i>Hedysarum fruticosum</i> Pall.	+			+
<i>Vicia semenovii</i> (Rgl. et Herd.) B.Fedtsch.	+	+	+	
<i>V. multicaulis</i> Ldb.	+	+		
<i>V. costata</i> Ldb.	+	+	+	+
Geraniaceae				
<i>Geranium pratense</i> L.	+	+	+	
<i>Erodium stephanianum</i> Willd.	+		+	+
<i>E. tibetanum</i> Edgew.	+		+	
Linaceae				
<i>Linum sibiricum</i> DC.	+		+	+
Zygophyllaceae				
<i>Peganum harmala</i> L.	+		+	+
<i>P. nigellastrum</i> Bge.	+	+	+	+
<i>Zygophyllum potaninii</i> Maxim.	+		+	+
<i>Z. pterocarpum</i> Bge.	+			+
<i>Tribulus terrestris</i> L.	+	+	+	+
<i>Nitraria sibirica</i> Pall.	+		+	+
Rutaceae				
<i>Haplophyllum dauricum</i> (L.) G.Don	+	+	+	+
Polygalaceae				
<i>Polygala tenuifolia</i> Willd.	+	+	+	
Euphorbiaceae				
<i>Euphorbia humifusa</i> Willd.	+	+	+	
<i>E. kozlovii</i> Prokh.	+	+	+	
<i>E. mongolica</i> Prokh.	+	+		
<i>E. lunulata</i> Bge.	+	+		
Tamaricaceae				
<i>Reaumuria soongorica</i> (Pall.) Maxim.	+	+	+	+
Violaceae				
<i>Viola dissecta</i> Ldb.	+	+		
<i>V. mauritii</i> Tepl.	+	+		
Onagraceae				
<i>Epilobium palustre</i> L.	+	+	+	
<i>Chamaenerion latifolium</i> (L.) Fries et Lange	+		+	+
Apiaceae				
<i>Sphallerocarpus gracilis</i> (Bess. ex Trev.) K.-Pol.	+		+	+
<i>Bupleurum bicaule</i> Helm.	+		+	+
<i>B. pusillum</i> Kryl.	+	+	+	
<i>Cicuta virosa</i> L.	+			+
<i>Carum carvi</i> L.	+	+		

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Plant species	GA	ZS	DS	BS
<i>Aegopodium alpestre</i> Ldb.	+	+		
<i>Cnidium multicaule</i> (Turcz.) Ldb.	+	+		
<i>Phlojodicarpus sibiricus</i> (Steph.) K.-Pol.	+	+	+	
<i>Ferula bungeana</i> Kitag.	+	+	+	
<i>Peucedanum hystrix</i> Bge.	+	+	+	+
<i>Heracleum dissectum</i> Ldb.	+	+		
<i>H. sibiricum</i> L.	+	+		
Pyrolaceae				
<i>Pyrola incarnata</i> (DC.) Freyn	+	+		
Primulaceae				
<i>Primula farinosa</i> L.	+	+		
<i>P. serrata</i> Georgi.	+	+		
<i>P. longiscapa</i> Ldb.	+	+		
<i>Androsace maxima</i> L.	+	+	+	+
<i>A. septentrionalis</i> L.	+	+	+	+
<i>A. chamaejasme</i> Host.	+	+		
<i>A. incana</i> Lam.	+	+	+	
<i>A. dasyphylla</i> Bge.	+	+		
<i>Glaux maritima</i> L.	+	+	+	
Plumbaginaceae				
<i>Goniolimon speciosum</i> (L.) Boiss.	+	+		
<i>Limonium flexuosum</i> (L.) Ktze.	+	+	+	
<i>L. aureum</i> (L.) Hill et Ktze.	+	+	+	+
<i>L. tenellum</i> (Turcz.) Ktze.	+	+	+	
Gentianaceae				
<i>Gentiana decumbens</i> L. f.	+	+	+	
<i>G. barbata</i> Froel.	+	+	+	
<i>G. acuta</i> Michx.	+	+	+	
<i>G. azurea</i> Bge.	+	+	+	
<i>G. leucomelaena</i> Maxim.	+	+		
Asclepiadaceae	+	+		+
<i>Vincetoxicum sibiricum</i> (L.) Decne.	+	+	+	+
<i>V. lanceolatum</i> (Grub.) Grub.	+	+		
Convolvulaceae				
<i>Convolvulus ammannii</i> Desr.	+	+	+	+
<i>C. arvensis</i> L.	+		+	+
Cuscutaceae				
<i>Cuscuta europaea</i> L.	+	+		
Boraginaceae				
<i>Myosotis sylvatica</i> (Ehrh.) Hoffm.	+	+		
<i>Lappula intermedia</i> (Ldb.) M.Pop.	+		+	+
<i>L. myosotis</i> Moench.	+	+		
<i>L. consanguinea</i> (Fisch. et Mey.) Gurke	+	+		
<i>Eritrichium pauciflorum</i> (Ldb.) DC.	+	+	+	
<i>Amblynotus rupestris</i> (Pall.) M.Pop. ex Serg.	+	+	+	+
Verbenaceae				
<i>Caryopteris mongolica</i> Bge.	+	+	+	+

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Plant species	GA	ZS	DS	BS
Lamiaceae				
<i>Amethystea coerulea</i> L.	+	+	+	
<i>Scutellaria grandiflora</i> Sims.	+	+	+	
<i>Lophanthus chinensis</i> (Raf.) Benth.	+	+	+	+
<i>Nepeta sibirica</i> L.	+	+	+	+
<i>Schizonepeta annua</i> (Pall.) Schischk.	+		+	+
<i>S. multifida</i> (L.) Brig.	+	+	+	
<i>Dracocephalum foetidum</i> Bge.	+	+	+	+
<i>D. fruticosum</i> Steph.	+	+		+
<i>Leonurus deminutus</i> Krecz.	+	+	+	
<i>Panzeria lanata</i> (L.) Bge.	+	+	+	+
<i>Lagochilus ilicifolius</i> Bge.	+	+	+	+
<i>Ziziphora bungeana</i> Juz.	+	+		
<i>Thymus gobicus</i> Tschern.	+	+	+	+
Solanaceae				
<i>Physochlaina physaloides</i> (L.) G.Don	+	+	+	+
<i>Hyoscyamus niger</i> L.	+		+	+
Scrophulariaceae				
<i>Linaria acutiloba</i> Fisch. ex Reichb.	+	+		
<i>Scrophularia incisa</i> Weinm.	+	+		
<i>Veronica anagallis-aquatica</i> L.	+		+	+
<i>V. incana</i> L.	+	+		
<i>Lagotis integrifolia</i> (Willd.) Schischk.	+	+		
<i>Euphrasia tatarica</i> Fisch. ex Spreng.	+	+		
<i>Pedicularis resupinata</i> L.	+	+		
<i>P. flava</i> Pall.	+	+	+	+
<i>P. myriophylla</i> Pall.	+	+		
<i>P. abrotanifolia</i> M.B. ex Stev.	+	+	+	
<i>Cymbaria dahurica</i> L.	+		+	+
Orobanchaceae				
<i>Orobanche coerulescens</i> Steph.				
Plantaginaceae				
<i>Plantago minuta</i> Pall.	+			+
<i>P. major</i> L.	+	+		+
<i>P. depressa</i> Willd.	+	+	+	
Rubiaceae				
<i>Galium verum</i> L.	+	+	+	
<i>G. vaillantii</i> DC.	+		+	+
<i>G. boreale</i> L.	+	+	+	
Caprifoliaceae				
<i>Lonicera microphylla</i> Willd.	+	+	+	+
<i>L. altaica</i> Pall.	+	+		+
Adoxaceae				
<i>Adoxa moschatellina</i> L.	+	+	+	
Valerianaceae				
<i>Valeriana petrophila</i> Bge.	+	+	+	
<i>V. saichanensis</i> Kom.	+	+	+	+

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Plant species	GA	ZS	DS	BS
Campanulaceae				
<i>Campanula turczaninovii</i> Fed.	+	+		
Asteraceae				
<i>Heteropappus altaicus</i> (Willd.) Novopokr.	+	+	+	+
<i>H. hispidus</i> (Thunbg.) Less.	+		+	
<i>Aster alpinus</i> L.	+	+	+	
<i>Erigeron elongatus</i> Ldb.	+	+	+	
<i>Leontopodium ochroleucum</i> Beauvd.	+	+	+	
<i>Cancrinia discoidea</i> (Ldb.) Poljak.	+		+	+
<i>Ajania trifida</i> (Turcz.) Poljak.	+	+	+	+
<i>A. achilleoides</i> (Turcz.) Poljak.	+	+	+	+
<i>A. fruticulosa</i> (Ldb.) Poljak.	+	+	+	+
<i>Artemisia dracunculus</i> L.	+	+	+	+
<i>A. pectinata</i> Pall.	+	+	+	+
<i>A. macrocephala</i> Jacquem.	+	+	+	
<i>A. sieversiana</i> Willd.	+	+	+	
<i>A. palustris</i> L.	+	+	+	
<i>A. scoparia</i> Waldst. et Kit.	+	+	+	+
<i>A. annua</i> L.	+			+
<i>A. santolinifolia</i> Turcz. ex Bess.	+	+	+	+
<i>A. leucophylla</i> (Turcz. ex Bess.) Turcz.	+	+		
<i>A. obscura</i> Pamp.	+		+	
<i>A. mongolica</i> Fisch. ex Nakai.	+		+	+
<i>A. argyi</i> Lévl. Et Vaniot.	+		+	+
<i>A. xerophytica</i> Krasch.	+		+	+
<i>A. rutifolia</i> Steph. ex Spreng.	+	+	+	
<i>A. caespitosa</i> Ldb.	+		+	+
<i>A. frigida</i> Willd.	+	+	+	+
<i>A. obtusiloba</i> Ldb.	+		+	+
<i>A. xanthochroa</i> Krasch.	+	+	+	+
<i>A. dolosa</i> Krasch.	+	+	+	
<i>Senecio dubius</i> Ldb.	+		+	+
<i>S. pricei</i> Sims.	+			
<i>S. campester</i> (Retz.) DC.	+		+	+
<i>Echinops gmelinii</i> Turcz.	+	+	+	+
<i>Saussurea saichanensis</i> Kom. ex Lipsch.	+	+	+	+
<i>S. pricei</i> Sims.	+	+	+	
<i>S. alpina</i> (L.) DC.	+	+	+	
<i>Jurinea mongolica</i> Maxim.	+		+	
<i>Olgaea leucophylla</i> (Turcz.) Iljin.	+			+
<i>Serratula centaurioides</i> L.	+	+		
<i>Acroptilon repens</i> (L.) DC.	+	+	+	+
<i>Scorzonera divaricata</i> Turcz.	+	+	+	+
<i>S. pseudodivaricata</i> Lipsch.	+	+	+	+
<i>S. mongolica</i> Maxim.	+			
<i>S. capito</i> Maxim.	+		+	+
<i>S. austriaca</i> Willd.	+		+	+
<i>S. ikonnikovii</i> Lipsch.	+		+	

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Plant species	GA	ZS	DS	BS
<i>Tragopogon trachycarpus</i> S.Nikit.	+	+	+	+
<i>Sonchus arvensis</i> L.	+			
<i>Lactuca tatarica</i> (L.) C.A.Mey.	+		+	
<i>Youngia stenoma</i> (Turcz.) Ldb.	+			
<i>Y. tenuicaulis</i> (Bax. Et Stebbins) Czer.	+	+	+	+
<i>Y. tenuifolia</i> (Willd.) Babc. et Stebbins.	+	+	+	+
<i>Taraxacum dealbatum</i> (D.Don) DC.	+	+	+	+
<i>T. leucanthum</i> (Ldb.) Ldb.	+	+		
<i>T. commixtiforme</i> Soest	+		+	
<i>Crepis crocea</i> (Lam.) Babc.	+	+	+	
<i>C. flexuosa</i> (Ldb.) Clarke.	+			+