



Najmi U., Rilke S. & Schnittler M.

# Digital Key to the Flora of Mongolia

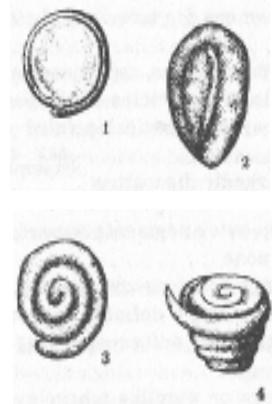
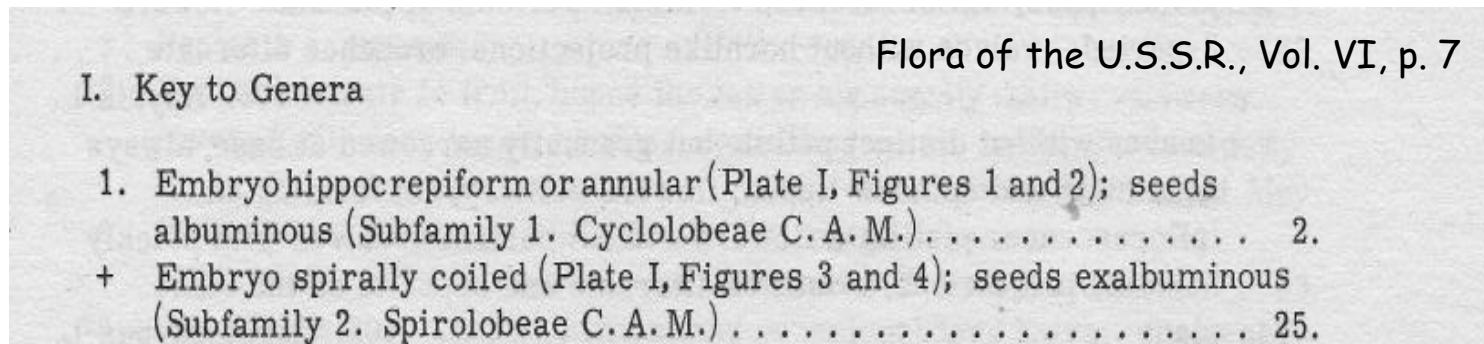
a follow-up of the project

## Virtual Guide to the Flora of Mongolia: Plant Database as practical approach

# Reliable determination of plants

From printed determination books to modern e-floras:

- ✓ No limited editions, available for everybody,
- ✓ number of pictures not limited, updatable



Long dichotomous keys:

- important tool for botanists

But:

- hard to use for non-specialists
- often not suitable for field work

# Reliable determination of plants as basis of ecological research

## Plant identification skills:

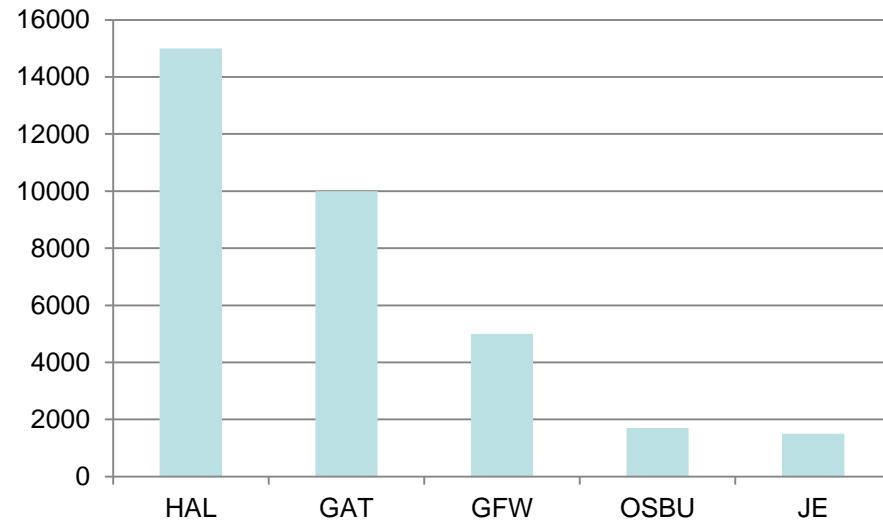
- for applied projects,  
e.g. in vegetation ecology,  
pasture management,  
forestry,  
medical plants....
- to teach students in universities and  
schools
- for interested lay persons and eco tourism
- **As well for skilled botanists**



# Why Mongolia?

- Long term research experience in Mongolia since 1962 at different Institutions in (former Eastern) Germany
- Large herbarium collections from Mongolia in Germany

Herbarium	No. Specimen
HAL	15000
GAT	10000
GFW	5000
OSBU	1700
JE	1500



90°0'0"E

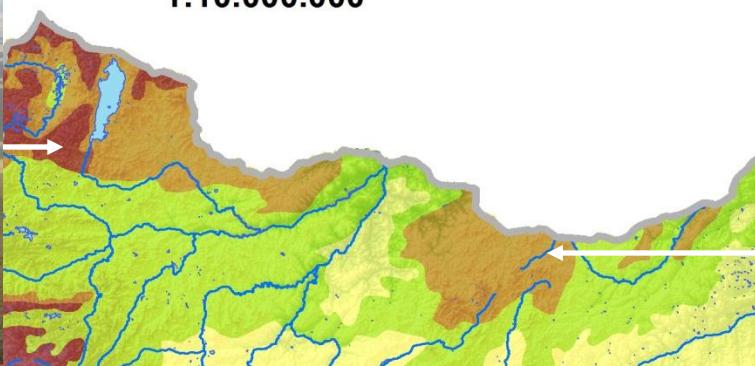
100°0'0"E

110°0'0"E

# VEGETATION ZONES OF MONGOLIA

1:10.000.000

50°0'0"N



45°0'0"N



40°0'0"N

## Legend

Alpine Vegetation

Mountain Forest Steppe and Mountain Steppe

Desert Steppe

Mountain Taiga

Dry Steppe

Desert

SOURCE:  
LAVRENKO 1979

0 125 250 500 750 1.000 Kilometers

Virtual Guide to the Flora of Mongolia – Plant Database as Practical Approach

<http://grei.uni-greifswald.de/noragrei>

Data – publishing, linking, using ecological data online

# Floristic Data

2876 species in 662 genera in 128 families (Based on Gubanov 1996)

## Asteraceae



400



320



## Poaceae



240

Our goal:

- acquirement of images and scans for as many species as possible
- providing of detailed information for taxonomically difficult groups, as:
  - *Artemisia* (key species for arid habitats)
  - *Chenopodiaceae* (key species on salty soils)



# Virtual Guide to the Flora of Mongolia

## Plant Database as Practical Approach



Home   Search Plant Database   WebGIS   Technical Terms   Information

Get an Overview...

Targeted Search

WebGIS

Map Search

Taxon data

Records

Herbar scans

Species photos

Search by:



Family: Polygonaceae

Scientific name:

Name acc. to:

Description:

Confuse with:

Comments:

Habitat:

Growthform:

Link to Flora of China

Distribution:

***Calligonum mongolicum* Turcz.**

Gubanov 1996

Taxonomic characteristic "pedicel 1-2 mm, jointed below" accord. to Flora of China, Vol. 5 (2003) is not always evident. Some specimen present pedicels jointed at middle. Pedicel 1-2 mm.

*Calligonum gobicum* Bunge ex Meissn.

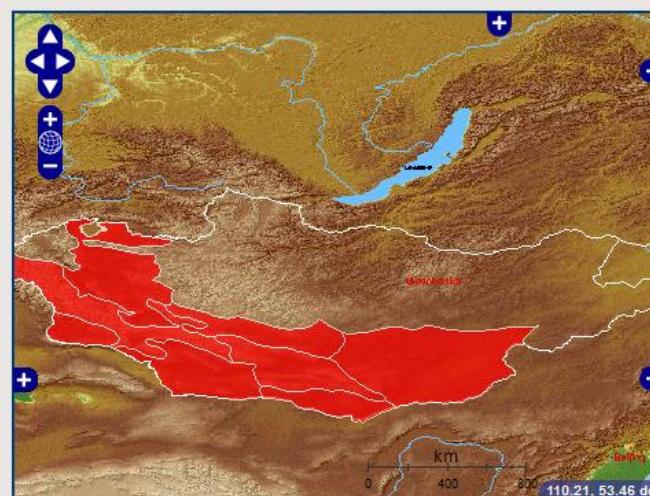
*C. mongolicum* differs from *C. gobicum* by achenes up to 10 mm in diam. and 10 mm long with slender bristles.

Sands in sandy steppes and deserts, Haloxylon woodlands, sandy bottom of sayrs and creek valleys, margins of saline depressions in desert-steppe and desert zones (Grubov 2001).

Shrubs (Flora of China, Vol. 5 2003)

[http://www.efloras.org/browse.aspx?flora\\_id=2&name\\_str=Calligonum+mongolicum](http://www.efloras.org/browse.aspx?flora_id=2&name_str=Calligonum+mongolicum)

Mongolian Altai, Depression of Great Lakes, Valley of Lakes, East Gobi, Gobi-Altai, Dzungarian Gobi, Transaltai Gobi, Alashan Gobi (acc. to Gubanov 1996)



[open map in a new window](#)

## FloraGREIF project:

presents the flora of Mongolia, combining:

- **taxa** (species descriptions, distribution and other)

- **plant images**

- **plant records**



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UNIVERSITÄT GREIFSWALD

Wissen lockt.  
Seit 1456

# FloraGREIF project

7206 plant records in 1249 of a total of 2876  
Mongolian plant species

- 1520 scans of herbarium specimens of 975 species
- 10600 plant images and 775 habitat images

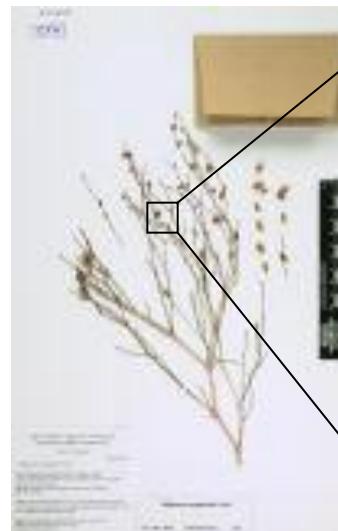
Search by:

Collector, coll. No.

Herbarium, Scan

Location, Habitat

Flowering status



# Digital Key

## User interface

**Ask for character states (traits) = Digital Key**

- allow multiple selection
- user determines the sequence of characters in question
- tracking the process of determination
- number of remaining taxa shown during determination process

### Character data base

### Taxon data base

**Enter characters:**

- name
- description
- states Text Value / Numerical Value

**Assign characters:**

- allow multiple selection
- inherit assignments of values from family → genus → species

## 1 Habit

<input type="button" value="save"/>	Name	Growth form	Category	Habit	<input type="button" value="delete"/>
<input type="button" value="+"/>	Description	Herb, shrub or tree			<input type="button" value="Sort Id"/>
<input type="button" value="-"/>	Req. Flowering Status	adult, vegetative	<input type="button" value="Accessibility"/>	visible (naked eye)	<input type="button" value="1"/>
				easy to recognize	

### Status Values for Character 'Growth form' (Category: Habit)

- herbaceous
- dwarf shrub
- shrub, multi-stemmed
- small tree, single-stemmed
- tree, single-stemmed

# Character data base

<input type="button" value="save"/>	Text Value	herbaceous	Description	herbaceous perennials are plants that die to the ground at the end of the growing season and from which new growth originates from the base or from the crown.	<input type="button" value="delete status"/>
<input type="button" value="Sort Id"/>	Num. Value (cm)	0	-	200	<input type="button" value="Upload Photo"/> Durchsuchen...
<input type="button" value="save"/>	Text Value	dwarf shrub	Description	dwarf shrub, multi-stemmed, at least base of stem woody	<input type="button" value="delete status"/>
<input type="button" value="Sort Id"/>	Num. Value (cm)	5	-	50	<input type="button" value="Upload Photo"/> Durchsuchen...
<input type="button" value="save"/>	Text Value	shrub, multi-stemmed	Description	shrub, multi-stemmed, shoots woody up to the top of the plant	<input type="button" value="delete status"/>
<input type="button" value="Sort Id"/>	Num. Value (cm)	50	-	500	<input type="button" value="Upload Photo"/> Durchsuchen...
<input type="button" value="save"/>	Text Value	small tree, single-stemmed	Description	small tree, single-stemmed	<input type="button" value="delete status"/>
<input type="button" value="Sort Id"/>	Num. Value (cm)	500	-	1000	<input type="button" value="Upload Photo"/> Durchsuchen...
<input type="button" value="save"/>	Text Value	tree, single-stemmed	Description	tree, single-stemmed	<input type="button" value="delete status"/>
<input type="button" value="Sort Id"/>	Num. Value (cm)	1000	-	1000000000	<input type="button" value="Upload Photo"/> Durchsuchen...
<input type="button" value="save"/>	Text Value		Description		<input type="button" value="delete status"/>
	Num. Value (cm)		-		<input type="button" value="Upload Photo"/> Durchsuchen...

int. remark

edited for FloraGREIF by

S. Rilke 2007-2010, H. Freitag 2010, A.P. Sukhorukov 2012

description

tax. comments

further comments

maybe confused with

 +  - Cotyledons +  - Flower +  - Fruit +  - Habit

# Taxon data base

Gestalt

not yet processed  
 no data/unknown  
 not applicable  
 full parasite (plant without chlorophyll, vegetation body often succulent fleshy)  
 grass-like (appearance like a grass, flowers inconspicuous)  
 aquatic, leaves floating  
 aquatic, submerged

Growth form

not yet processed  
 no data/unknown  
 not applicable  
 herbaceous (herbaceous perennials are plants that die to the ground each season, shoots are not woody)  
 dwarf shrub (dwarf shrub, multi-stemmed, at least base of the shoot woody)  
 shrub, multi-stemmed (shrub, multi-stemmed, shoots woody up to the tip)  
 small tree, single-stemmed (small tree, single-stemmed)

Parasite

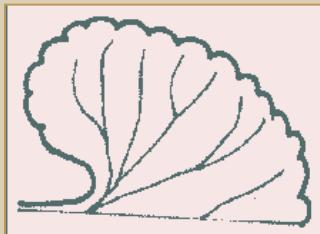
not yet processed  
 no data/unknown  
 not applicable  
 plant green (but roots may suck on other plants) (hemiparasites and fully autonomous plants)  
 plant not green (parasitic or saprophytic, without chlorophyll) (full parasites and saprophytes living symbiotic with fungi)

# Digital Key – Process of Determination

## User interface

Two levels for the help desk:

- lay person
- specialist



Ask for phenology to adapt character list:

- vegetative
- flowering
- fruiting

,easy-to-see' features have priority over ,hard-to-see' features

- visible (naked eye / hand lens)
- preparation/ magnification needed

- monitor the number of remaining plant species
- switch to result list at any point
- choose fuzziness
  - all character match
  - all but one
  - all but two



- ask for characters according to the selections made above
- enter states according to the plant in question

# Digital Key – Result List

Get an Overview

Targeted Search

WebGIS

Map Search

Taxon data

Records

Herbar scans

Species photos

Habitat photos

39 taxa found for family: **Chenopodiaceae** distribution: Khangai

## Scientific Name

*Anabasis brevifolia* C. A. Mey.  
Chenopodiaceae

*Atriplex fera* (L.) Bunge  
Chenopodiaceae

*Atriplex laevis* C. A. Mey.  
Chenopodiaceae

*Atriplex sibirica* L.  
Chenopodiaceae

*Atriplex tatarica* L.  
Chenopodiaceae

*Axyris amaranthoides* L.  
Chenopodiaceae

*Axyris hybrida* L.  
Chenopodiaceae

*Axyris prostrata* L.  
Chenopodiaceae

*Bassia dasypylla* (Fisch. et Mey.) O. Kuntze  
Chenopodiaceae

*Chenopodium acuminatum* Willd.  
Chenopodiaceae

*Chenopodium album* L.

## Synonym

## Record Data

31 herbar sheets  
15 photo records

7 herbar sheets

19 herbar sheets

22 herbar sheets  
1 photo record

9 herbar sheets  
1 photo record

10 herbar sheets  
1 photo record

23 herbar sheets  
1 photo record

28 herbar sheets  
2 photo records

Echinopsilon divaricatum Kar. et Kir.  
acc. to: Czerepanov 1995  
Kochia dasypylla Fisch et Mey.  
acc. to: Gubanov 1996

39 herbar sheets  
7 photo records

27 herbar sheets  
2 photo records

12 herbar sheets

## Image Data



Offer result list with

- taxa
- records
- images

# Thank you very much for your attention!

## Our Partners:

- Academy of Science of Mongolia, State University of Khovd
- Herbaria of Halle, Gatersleben, Berlin, Osnabrück and Jena
- Botanical Garden and Botanical Museum Berlin Dahlem
- The Museum of Natural History Görlitz
- Universities of Halle and Hamburg

## Project Members:

- S. Rilke, M. Schnittler, S. Starke (Institute of Botany and Landscape Ecology)
- B. Bobertz, J. Hartleib, R. Zöllitz (Institute of Geography and Geology)
- U. Najmi (Computer Center)