The Genus *Kobresia* Willd. (Cyperaceae Juss.) in the flora of Mongolia

Dashzeveg Nyambayar

*Department of Botany, Faculty of Biology, National University of Mongolia, Ulaanbaatar 210646, Mongolia*  
e-mail: nyambayar@biology.num.edu.mn

**Abstract**

Taxonomic position of the Mongolian bog sedge species belonging to the genus *Kobresia* is revised. Seven species and one subspecies are recorded in the Mongolian Flora. Identification keys for the species, conspectus of all taxa and data on their habit, ecology and distribution in Mongolia are given. Distribution types are classified. Briefly discussed about history of dispersal of *Kobresia*-species in the Mongolian territory.

**Key words:** *Kobresia*, Cyperaceae, systematics, Mongolian Flora

**Introduction**

The genus *Kobresia* belongs to the most advanced tribe Cariceae in the family Cyperaceae, while this genus is primitive in the tribe. About 35 species of this genus are distributed in the temperate to frigid zones of the Northern Hemisphere. Almost all species are found in Asia.

The studies of this genus in the Mongolian flora have been conducted in the frame of flora research, but the detailed study defining the members of the genus is still lacking. Some data on identification of the species, species conspectus, habitat, distribution and edibility are can be found in the works by Grubov (1955, 1982), Yunatov (1968), Ulziikhutag (1985), Gubanov (1996) and others. The present work is a part of an ongoing project for creating the “Flora of Mongolia”.

**Materials and Methods**

The collections of the *Kobresia*-species from the Herbarium of the Institute of Botany, Mongolian Academy of Sciences (UBA) and the Herbarium of the National University of Mongolia (UBU) as well as additional literature data are used for the present study. There are 252 sheets of specimens in total, which were collected by a number of scientists between 1928 and 1997. This study was conducted using traditional methods of plant systematics, i.e. the identification keys to the flora of Mongolia, Siberia, Central Asia and USSR were used to identify species status and to gather information on the species distribution (Sergievskaya, 1935; Egorova, 1967, 1983; Grubov, 1982; Doronkin, 1990). The nomenclature was followed by Egorova (1983) and her key was partially used for the keys to the species. Distributions of the species in Mongolia are given in Gubanov (1996), ecological group classification is followed as in Ulziikhutag (1989), names and limits of the phytocoenoses for the distribution type definition are according to those in Takhtajan (1978). Species habitats are described mainly on the basis of collection data. In the following parts, species are listed in alphabetical order. Similarity index of the species is calculated using EstimateS 6.0b1, Statistical calculations with StatSoft 5.5; SPSS programs.

**Results**

**Systematical overview of the genus *Kobresia* in the flora of Mongolia.** Species composition of the genus in Grubov (1982) and Gubanov (1996) has been changed as follows. It is revealed that seven species and one subspecies of *Kobresia* occur in the Mongolian Flora. From the Gubanov’s list a species, *K. simpliciuscula* (Wahlenb.) Mackenz. is excluded. According to Doronkin (1990), the nominal subspecies of this species is distributed in Europe (Scandinavia, England, Pyrenees and Carpathian mountains) only. Previous data on this species now belongs to *K.simpliciuscula* subsp. *subgolarctica* Egor.

**Key to the species and subspecies of *Kobresia***

1. Perigynia utricle like, closed up to middle. Scales and perigynia ca. 10 mm long
K. robusta
- Perigynia margins free to base. Scales and perigynia shorter than 10 mm. .......................... 2.
  2. Abundant bladeless sheaths at the stem base.
- Stems cylindrical up to tip ........................................ 3.
  - Basal sheaths bearing blades. Stems triangular up to tip .............................................. 7.
  4. Perigynium enclosing additional 2 to 3 sterile scales .................................................. K. sibirica
- Perigynium not enclosing additional scales................................................................. K. smirnovii
  5. Inflorescences compound spike. Styles 2 to 3-fid. .................................................. K. filifolia
- Inflorescences simple spike. Styles 3-fid ................................................................. K. gracilis
  6. Spikelets 2-flowered with 1 pistillate flower and 1 staminate flower. Scales 2.5-3 mm long.
Leaves soft ................................................................. K. myosuroides
- Spikelets many flowered with 1 pistillate flower and 1-4 staminate flowers. Scales 4-5.5 mm long. Leaves not soft .................. K. capilliformis
  7. Inflorescences usually simple spike. 3-10 (13) cm tall plant .................................... K. humilis
- Inflorescences compound spike. 10-40 cm tall plant ................................................. K. simpliciuscula subsp. subgolarctica


Type species: K. caricina Willd. (=K. simpliciuscula (Wahlenb.) Mackenz.).

Habitat. Damp and swampy, sometimes in alkaline meadow, river and brook banks, stony slopes in alpine belt, rarely in middle and upper parts of forest belt.

Habitat. Damp and swampy waterside and forest meadows, river banks pebbles, stone fields in alpine and forest-steppe belts.

Habitat. Damp meadows, river banks, springs, steppy slopes, petrophytic forb-fescue steppes in middle montane, rarely alpine belts.

Habitat. Meadows, larch forest fringes, debris slopes, rocks, waterside pebbles, tundra, bogs, mountain steppes in alpine and forest-steppe belts.

Habitat. Sandy soils of larch forests in forest belt.

Habitat. Damp meadows, bogs, larch forests, brook banks pebbles, debris and stone fields in alpine and forest belts.
  7. K. simpliciuscula subsp. subgolarctica Egor. 1983, Novosti syst. vyssh. rast. 20: 83; Doronkin,

Habitat. Meadows, swampy fields, damp tundra, stony slopes in alpine and forest belts.


Habitat. Meadows, meadow slopes, soddy stone fields in alpine belt.

**Habits.** Sedge family members are mostly polycarpic herbs, belonging to perennials according to the Serebryakov’s (1964) classification and hemicyryptophytes according to Raunkiaer’s (1907) classification (Egorova, 1999). Based on the shoot characters of Carex, Alexeev (1996) distinguished seven life forms (habits): 1) false tufts; 2) true tufts; 3) tussocks; 4) rhizomate with underground shoots, not branching in a vegetation period; 5) rhizomate with underground shoots, branching in a vegetation period; 6) creeping rhizomate with ascending shoots; 7) stolon-rhizomate.

On the basis of principle used by Alexeev, we are proposing a classification of life forms of Mongolian Kobresia-species, which divided into three types (Table 1). In the classification, we considered shoot characters of bog sedges, which being easy and clear to use.

**Ecology.** Bog sedges are mainly adapted to frigid habitats and mostly occur in high altitudes. They play dominating role in forming cryoxerophytic meadow, the special vegetation type, named “bog sedge meadow”, which occupies the extra continental interiors of the high altitudes in Asia (Munkhbayar, 1988). Bog sedge meadows are more widespread in southern treeless slopes in Khangai and Mongol-Altai mountain ranges, as well as in higher elevated areas of Gobi-Altai mountain range. Bog sedges grow in diverse habitats in alpine belt, such as different types of meadows (alpine, waterside, steppy, swampy), debris and stony slopes, brook bank pebbles and sand, bogs (mostly herbaceous) and dryad tundra. Kobresia-species can be considered as a habitat generalist in high mountains. They go down along the southern slopes to the larch forests (mostly fringes), meadows in willow groves, damp meadows at end of the valleys, watered by brooks and streams, swampy meadows in forest belt, steppy slopes and stone fields in steppe belt of the mountains.

It was difficult to classify the habitat generalists into ecological groups. Basing on the predominant occurrence of the plants (collection data), four ecological groups were distinguished (Table 2). It should be noted that Mongolian bog sedges prefer habitats with certain amount of moisture, such as meadows, bogs and forests.

**Distribution in the vertical belts.** Kobresia-species grow mainly in high mountains of Asia, a

---

**Table 1. Habit types of Kobresia-species in the flora of Mongolia**

<table>
<thead>
<tr>
<th>Habit types</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>dense tufts</td>
<td><em>K. capilliformis, K. myosuroides, K. sibirica, K. smirnovii</em></td>
</tr>
<tr>
<td>loose tufts</td>
<td><em>K. humilis, K. robusta</em></td>
</tr>
<tr>
<td>rhizomate</td>
<td><em>K. filifolia, K. simpliciuscula subsp. subgolarctica</em></td>
</tr>
</tbody>
</table>

**Table 2. Ecological groups of Kobresia-species in the flora of Mongolia**

<table>
<thead>
<tr>
<th>Ecological groups</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>mesophytes</td>
<td><em>K. filifolia, K. humilis, K. sibirica, K. simpliciuscula subsp. subgolarctica</em></td>
</tr>
<tr>
<td>mesopetrophytes</td>
<td><em>K. capilliformis, K. myosuroides</em></td>
</tr>
<tr>
<td>mesotherophytes</td>
<td><em>K. robusta</em></td>
</tr>
<tr>
<td>mesopsychrophytes</td>
<td><em>K. smirnovii</em></td>
</tr>
</tbody>
</table>
few of them are found in arctic and subarctic regions
and high mountains of Northern Hemisphere. In
Mongolia, they occur in all mountain ranges, at
850-3200 m altitude, according to the present
comprehensive data and they grow in alpine,
mountain forest and mountain steppe belts (Table
3).

**Distribution in the botany-geographical
regions of Mongolia.** Bog sedges have been
found in 13 botany-geographical regions in
Mongolia (Table 4), among which as a rule, the
mountainous regions like Khangai, Mongol Altai,
Khartii, Khuvsgul and Gobi Altai are involve
higher species diversity of *Kobresia*.

**Distribution types.** The geographical ranges
of all species of *Kobresia* lie within the limits of
the Holarctic Kingdom. Based on the distribution
data, four types and seven sub-types of distribution
are distinguished. Four species belong to Iran-
Turanian-Siberian, two to Asiatic-North American,
one to Asiatic and one to Holarctic types (Table
5).

**Relationships among Kobresia-species in the
flora of Mongolia.** To reveal the relationships
among the species made a cladistic analysis by
some morphological characters, life forms and
distribution types. The characters, which could
show evolutionary trends, were chosen.

1. Life form: 0 = tufts, 1= creeping rhizomate
2. Distribution: 0 = more wide, 1 = not spread
far away from the center of origin (mainly in iran-
turanian region)
3. Height : 0 = tall (15-60 cm), 1 = small (3-15

---

**Table 3. Species distribution in vertical belts of mountains in Mongolia**

<table>
<thead>
<tr>
<th>Vertical belts</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mountain forest</td>
<td><em>K. capilliformis</em>, <em>K. filifolia</em>, <em>K. myosuroides</em>, <em>K. robusta</em>, <em>K. simpliciuscula</em> subsp. <em>subgolarctica</em></td>
</tr>
<tr>
<td>Mountain steppe</td>
<td><em>K. filifolia</em>, <em>K. humilis</em>, <em>K. myosuroides</em></td>
</tr>
</tbody>
</table>

---

**Table 4. Distribution of the species in botany-geographical regions of Mongolia**

<table>
<thead>
<tr>
<th>Botany-geographical regions</th>
<th><em>K. capilliformis</em></th>
<th><em>K. filifolia</em></th>
<th><em>K. humilis</em></th>
<th><em>K. myosuroides</em></th>
<th><em>K. robusta</em></th>
<th><em>K. simpliciuscula</em> subsp. <em>subgolarctica</em></th>
<th><em>K. smirnovii</em></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khuvsgul</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Khentii</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Khangai</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Mongol Daurian</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Great Khyanghan</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Khovd</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Mongol Altai</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Middle Khalkha</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>East Mongolia</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Depression of Great Lakes</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Valley of Lakes</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>East Gobi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Gobi Altai</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Zuungarian gobi</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Transaltai gobi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Alashan gobi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>total</td>
<td>2</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>
4. Inflorescence: 0 = large, branched, with many spikes, 1 = not branched, with a few spike
5. Number of flowers in a spike: 0 = many (up to 7), 1 = few (not more than 2)
6. Perigynia margins: 0 = free, 1 = more or less closed
7. Perianth segments: 0 = present, 1 = absent
8. Number of stigma: 0 = three, 1 = two

According to the cluster diagram, the species are divided into three groups (Fig. 1).
The first group includes itself: K. sibirica, second group: K. smirnovii, third group: other species. This grouping meets the Egorova’s (1983) system in some way. She grouped K. humilis and K. simpliciuscula subsp. subgolarctica in the same section and other five species (except K. robusta) in another section. K. sibirica and K. smirnovii were grouped in the same subsection of the last.

Dispersal of the Kobresia-species in the territory of Mongolia. Revealing the origin center of a taxon using palaeo-botanical methods is difficult, as herbaceous plant parts are non-resistant during the fossilization. Therefore, taxon concentration method is used more often. It is based on the idea that more species occur in the area where the genus is originated (Alekhin et al., 1961).

More than 90% of the total species of Kobresia, are found in Asia, mainly in the Himalayas and Hengdian Mountains in China. The area is not only the center of density, but also the center of diversity of Kobresia, thus it is considered as the center of the distribution of the genus.

The common ancestor of Kobresia and its closely related genus Schoenoxiphium was brought to Eurasia from the Gondwanaland and differentiated in the Himalayas and Hengdian Mountains. In the early Tertiary, Kobresia probably began to originate in the Himalayas and the genus reached its greatest speciation with the lifting of this mountain range. The species dispersed along the mountains in the Northern Hemisphere to Europe and Siberia, furthermore to eastern Canada and Colorado (Zhang et al., 1995).

We assume that increasing higher altitude aridity, coupled with decreasing temperatures during the Tertiary was the main reason of their dispersal to the north. According to Zhang et

---

**Table 5. Distribution types of the species**

<table>
<thead>
<tr>
<th>species</th>
<th>type</th>
<th>distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>K. capilliformis</td>
<td>Iran-Turanian-Siberian</td>
<td>Central Asiatic-Siberian</td>
</tr>
<tr>
<td>K. filifolia</td>
<td>Asiatic</td>
<td>North Asiatic-East Asian-Siberian-Mongolian</td>
</tr>
<tr>
<td>K. humilis</td>
<td>Iran-Turanian-Siberian</td>
<td>Central Asiatic-Turkestanian-Khangai</td>
</tr>
<tr>
<td>K. myosuroides</td>
<td>Holarctic</td>
<td>Circumpolar</td>
</tr>
<tr>
<td>K. robusta</td>
<td>Iran-Turanian-Siberian</td>
<td>Central Asiatic-Khangai</td>
</tr>
<tr>
<td>K. sibirica</td>
<td>Asiatic-North American</td>
<td>Arctic-Siberian-North American</td>
</tr>
<tr>
<td>K. simpliciuscula</td>
<td>Asiatic-North American</td>
<td>Arctic-Siberian-Mongolian-Siberian</td>
</tr>
<tr>
<td>K. smirnovii</td>
<td>Iran-Turanian-Siberian</td>
<td>Central Asiatic-Siberian</td>
</tr>
<tr>
<td>K. simpliciuscula subsp. subgalarctica</td>
<td>Asiatic-North American</td>
<td>North American</td>
</tr>
</tbody>
</table>

---

Figure 1. Relationships of Kobresia-species in the flora of Mongolia
Nyambayar. *Genus Kobresia in Mongolia*

al. (1995), there were three paths of the species dispersal, namely: to the east, to the north and to the west. The *Kobresia*-species probably came to Mongolia through eastern or Siberian path. After the first glaciations in Quaternary, Khangai mountain range became the second dispersal center of the species in Mongolia. At present time all species in the Mongolian flora are distributed in Khangai region. As Khangai mountain range was not completely covered by ice during the second glaciations in Quaternary (Tsegmid, 1969), plants in this area could survive, comparing to Mongol Altai, which is also rich in *Kobresia*-species. After the second glaciations, they seem to be dispersed to other mountainous areas, especially to Mongol Altai, Khentii, Khuvsgul and Gobi Altai.

**Conclusions**

There are seven species and one subspecies of *Kobresia* in the Mongolian Flora. The most common habit type among the Mongolian bog sedges is dense tufts, and most species are mesophytes. Almost all species occur in alpine belt and Khangai mountain forest-steppe (all species) and Mongol Altai mountain steppe (six species) regions are rich in *Kobresia*-species. *K. myosuroides* and *K. filifolia* are most widespread species in the territory of Mongolia (in nine botany-geographical regions). Analysis of distribution range showed that almost all species found in Mongolia are distributed in Central Asia and Siberia. Khangai mountain range might be the second dispersal center of *Kobresia*-species in Mongolia. *K. sibirica* and *K. smirnovii* possess most primitive characters among the species.

**Acknowledgements**

Sincere thanks due to Dr. E. Ganbold for reviewing the earlier draft of manuscript. Thanks also to the anonymous reviewers for their valuable comments on the manuscript.

**References**

# Хураангуй

Энэхүү өгүүлэл Монголын үргэлжлэн аймгийн тохиолдх бушилзны (Kobresia Willd.) төрлийн ангилалзүйн судалгааны дүнг багтаав. Одоогоор 7 зүйл, 1 дэд зүйл бүртгэдээд байгаагийн олон нь яага дээгүүлэвт амдран хэлбэрт хамаарч буй бол эсэхийн булаг ангилахад чийгсэг бүрэг давамгайлын буй нь тогтоодог. Бушилзны зүйлүүд Монгол өрсөн уулархаг нутгуудын ургах ба өндөрлүү бус бүслүүрийн хувьд таг, уулын ой, уулын хээрийн бүслүүрүүдэд тархана. Тус өрсөн үргэлжлэн газархууний 13 өгүүл болгон тохиолдох Хангай, Монгол-Алтай тойргоогоо хамгийн олон зүйл тэмдэглэхдээ байдаг. Зүйлүүрээс K. myosuroides, K. filifolia болон ам тогоогоо арга болохын тулд олон нь гэсэн үхээн ардчигдээ. Ареалын хэмээх шинээр нь ангиллахад Иран-Туран-Сибирийн 4, Азийн 1, Ази-Умард Америкийн 2, Голарктикийн тархалттай 1 зүйл байна. Гималайн нурууны үүсэн гэж үздэг бушилзны төрлийн ургамлын Монгол дахь тархалтын тов нь Хангай нуруу хэмээн үзэх ёстой. Монголд тархсан бушилзны зүйлүүд эсэхийн бүтэцтэй, үүсэл гарлын хувьд зэргийх нь K. sibirica ба K. smirnovii зүйлүүд юм.