

Comparison and relations of the Hungarian and the Mongolian flora

by

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Abstract: On the basis of the comparison of taxa of ferns and flowering plants, we can report on the agreement of 90.9% of plant families, 60.0% of plant genera and 17.3% of species. Most of the common species are composed of Holarctic, Eurasian and Continental flora elements, the latter ones enriching mainly the flora of the Hungarian forestal steppe as well as the "puszta" on loessic, sandy and sodic soil. Mutual relations of the flora between the two regions are demonstrated here on the basis of the history of the Crepis species within the two countries.

The investigation of floristical relations with foreign countries in Hungarian phytogeographical literature concentrated on the analysis of floristical elements mainly, following the basic monographies of SOÓ (1939) and MÁTHÉ (1940, 1941). The role of a given group of floristical elements within the Hungarian flora was studied, e.g., CSAPODY (1932) investigated the role of Mediterranean flora elements. SOÓ (1939) was concerned with that of the boreal relict plants, and a presentation of the spectrum of floristical elements became a seemingly compulsory item of cenological papers. At the same time, concrete comparison of the flora with other countries or rather, regions were almost exclusively met in foreign botanical papers only [like that of MEUSEL (1969) or HARA (1972), dealing with the relation of the Asian and the North American floras recently], though this latter approach can also promote the understanding on the relation between floras.

A comparison with the Mongolian flora can be supported by, at least, three arguments. In the first place, the area and flora of Mongolia forms a primeval part of the Central Asian mountainous region (GRUBOV 1955), comprising the mountain ranges Altai, Tiensan and the Himalayas where, at least, one of the evolutionary centres of angiosperms has been supposed (BORHIDI 1968). Secondly, Continental floristic elements comprise an essential part (14.5%) of the Hungarian flora, denoting, together with Pontian - Mediterranean elements, immigration of plants from Eastern direction. Finally, the flora of Mongolia became adequately studied only recently, grace to the comprehensive floristical monographies of GRUBOV (1955, 1982), thus the task of actual comparison could become topical in our days.

It is worth to note as well that in spite of the more than 7000 km distance separating the two regions, Mongolia has several endowments in common with Hungary. Lying along roughly the same latitudes within the Holarctic floristical kingdom, it contains some matching environmental formations (zones of forestal steppe and grassy steppe), and the number of flowering plant species described is roughly equal to ours. At the same time, the Mongolian

territory is 15 times larger and ecologically more differentiated, lying at higher altitudes (average 1580 m a.s.l.), and its climate is extremely dry, with 300–400 mm of annual precipitation on the northern parts and less than 100 mm at the southern parts.

The efficiency of a quantitative comparison of the floras, naturally enough, is influenced by some factors like these: neither of these countries comprise a complete phytogeographical unit or, the level of elaboration for the individual genera can be fairly different (e.g., *Rubus*, *Hieracium*). The disturbing effect of such factors could not be eliminated.

The comparison of the floras was performed in respect of ferns, gymnosperms and angiosperms. The comparison is mainly based on the recent monography of GRUBOV (1982) as well as on the monography „A magyar növényvilág kézikönyve” [(Handbook of the Hungarian vegetation) by SOÓ and JÁVORKA 1951, completed by SOÓ and KÁRPÁTI (1968) and SOÓ (1964–1980) as well as complementary data by DARJMAA (1983) and SZANCSIR et al. (1983, 1985).] The comparison was performed on the level of families, genera and species as well. Differences between the present flora of the two countries are treated mainly on the species level, whereas speaking about genera and families, elements in common are focused on. Finally, on the example of the genus *Crepis* [using the monography of BABCOCK (1947)]. I am trying to trace historical (phylogenetical) connections between the species.

COMPARISON OF THE FAMILIES

The number of indigenous families of ferns and flowering plants is, according to the systematics of SOÓ and JÁVORKA (1951), 112 for Hungary and 99 for Mongolia. The number of families in common is 90, 90.9% of the Mongolian families and 80.4% of the Hungarian families, respectively. The uniform structure of the Holarctic flora is demonstrated, in the first place, by the high agreement of taxa on the family level.

There were only 9 Mongolian plant families the representatives of which are absent from Hungary, most of them present even within the Mongolian flora represented by one species only. These 9 families can be grouped, according to their place of origin or distribution into four groups:

- the families Empetraceae and Scheuchzeriaceae are of boreal distribution, and their species can be found, nearest to Hungary, in the Carpathes

- the family of Cynomoriaceae is of Asian distribution, semiarid climatic indication and Palaemediterranean origin

- three families are of American origin and amphypacific distribution comprising *Incarvillea* of the family of Bignoniaceae, 1-1 *Cleome* species of the Capparaceae and one species of *Phlox* and two species of *Polemonium* from the family of Polemoniaceae in the Mongolian flora. According to GRUBOV (1955), *Incarvillea* originates from the Tertiary, mesophylous flora of East Asia

- most interesting among the families without Hungarian equivalents are possibly the Tropical families. *Menispermum dauricum* of the Menispermaceae reminds us, according to ENGLER (1897), the Tertiary flora, while SOÓ (1953) considered it to be the offspring of the ancient (Lower Cretaceous) genus *Menispermites*. The genus *Mollugo*, referred to the family of Aizoaceae (more recently that of the Molluginaceae) is of tropical and subtropical area, at humid productive areas. Representatives of the family of Frankeniaceae, occurring on all continents, are resistant to high salinity and originate equally from the Tropical regions.

In respect of Hungary, there are 22 native plant families which do not occur in Mongolia. They are also represented in low species number, the mean value/families being 2.5. These families can be divided, roughly, into two groups:

- in general, deciduous tree families of European (as well as East-Asian and North-American) distribution are missing like beech, linden and maple, Oleaceae (*Fraxinus*, *Ligustrum*), Anacardiaceae (*Cotinus*), Staphylaceae and, among the conifers, Taxaceae

- at least half of the other plant families missing from the Mongolian flora are of Mediterranean distribution like Amaryllidaceae or the family of Cistaceae.

It is interesting to examine, however, the common set of plant families as well. The largest 16 families (comprising at least 10 genera) among the 90 families in common are apparently the same in both countries. This can be considered as a further proof of the basic structural unity of the Holarctic flora. A list of these 17 families, including the number of species and genera are presented on Table 1.

Notably, the number of genera and species is fairly near to each other in several cases (e.g., Ranunculaceae, Labiatae, Cruciferae, Compositae). There are only a few among the 16 largest families which are definitely more abundant in one of the countries than in the other. For example, the family of Chenopodiaceae is unambiguously better represented in Mongolia (the number of genera and species being roughly two times more than in Hungary) and, according to the number of species, such are the families of Gramineae and Leguminosae as well. At the same time, members of the families Polypodiaceae, Umbelliferae and Orchidaceae, as well as by the number of species – Rosaceae are better represented in Hungary.

COMPARISON ON THE GENERIC LEVEL

As it is apparent from Table 1., there were 356 genera found which are present in both countries, comprising roughly 60% of the relevant Mongolian genera. This ratio of 60% seems fairly consistent, valid for cca. 10 families demonstrated on the Table. There are two families among the largest 16 where this ratio is essentially higher; 90-90% of the Mongolian genera of Polypodiaceae and Cyperaceae can be equally found in Hungary as well. In case of three families, however (Chenopodiaceae, Cruciferae and Boraginaceae), this ratio is ranging between 36-44%. In case of the family Chenopodiaceae, this is in accordance with the high ratio of endemic genera, namely 9 out of the 16 genera missing from Hungarian flora are, according to GRUBOV (1955), endemic genera of Central Asian origin (*Agriophyllum*, *Kalidium*, *Anabasis*, *Iljinia*, *Haloxylon*, *Nanophyton*, *Petrosimonia*, *Halogeton*, *Sympegma*).

In respect of species diversity, the most characteristic elements of the Mongolian flora comprise three families only, namely Leguminosae, Compositae and Gramineae. In the family of Leguminosae, the genera *Oxytropis* (78 species), *Astragalus* (71 species) and *Caragana* (13 species), in case of Compositae, *Artemisia* (70 species) and *Saussurea* (27 species) and, among the Gramineae, *Poa* (23 species) *Elymus* (21 species) and *Stipa* (18 species) are the most abundant ones. These three families contain genera rich in species in Hungary as well, however, the leading genera are different in case of the Leguminosae, *Trifolium* (27 species), *Vicia* (20 species) and *Lathyrus* (18 species), in case of Compositae, *Hieracium* (67 species) and *Centaurea* (22 species), among the Gramineae, *Festuca* (16 species) and *Bromus*

(13 species). Apart from the above mentioned taxa, the genera of *Carex* (81 species), *Salix* (40 species), *Pedicularis* (33 species) and *Allium* (31 species) are represented in great specific diversity; the genera *Carex* and *Allium* are also very rich in Hungary as well.

It is already apparent from the comparison of the genera which are most abundant in species, and even more prominent after a detailed study that the genera of Central Asian origin tend to be more abundant in species in Mongolia, while those of a Mediterranean distribution centre are more rich in species in Hungary. This tendency is reflected on Table 2. where the genera of fairly clear origin (evolutional centre, gene centre) were presented (Table 2.).

THE SPECIES IN COMMON

The number of species which are equally found in Mongolia and Hungary are 388*, comprising 17.3% of the Mongolian plant species (enumerated in the Appendix). The taxonomical distribution of the common species is fairly even within the different families. Only four of the 16 more important families can be mentioned as exceptions: 52% of the Mongolian species of the family of Orchidaceae, 39% of the Polypodiaceae can be found in Hungary as well, but only 7.3% of Leguminosae. From another aspect; 39% of the species of the family of Chenopodiaceae found in Hungary can be spotted in Mongolia as well.

Even more characteristic, we can observe a high ratio of common species within certain genera; in the extremes, we can meet 100% agreement as well – e.g., in ancient genera like *Lycopodium*, dissected lately into several genera. The most characteristic genera, from this point of view, are listed below.

	Number of common species	In percentage of Mongolian species	In percentage of Hungarian species
<i>Rumex</i>	9	69.2	50.0
<i>Potamogeton</i>	9	64.3	60.0
<i>Polygonum</i>	8	33.3	61.5
<i>Chenopodium</i>	9	56.2	50.0
<i>Juncus</i>	6	42.8	37.5
<i>Poa</i>	5	21.7	50.0
<i>Bromus</i>	4	57.1	30.8
<i>Calamagrostis</i>	3	23.1	50.0
<i>Orchis</i>	3	75.0	20.0

* native and subsontaneous species, together with recently extincted species

The other extremes are represented by genera occurring in both countries which have no species in common. Among the genera containing more than 10 species there were 23% of such cases. Most peculiar case among them is that of the genera *Aconitum*, *Euphorbia**, *Gentiana*, *Saxifraga*, represented in relatively large species number in both countries.

One of the reason of the lack of common species is the almost complete absence of Alpine species on the recent territory of Hungary (e.g., in case of *Saxifraga*). The other reason is that during the migration of species, new species were born under the effects of geological and climatical factors (e.g., in case of *Aconitum*, where aconites surviving the Ice Age on the European mountainous regions were split to several sections, species, subspecies and variants (VAJDA 1956) or, in case of *Gentiana*, where there was a W-E differentiation occurring within Eurasia. For example, the Eastern species pair of *Gentiana cruciata* in Mongolia is *Gentiana macrophylla* Pall. within the *Cruciata* section (MEUSEL et al. 1978).

It is interesting to note the distribution of the 388 common species according to floristical elements as well.

Cosmopolitan	58 species	14.95%
Circumpolar	97 species	25.00%
Eurasian	143 species	36.86%
Continental	57 species	14.69%
Others	33 species	8.50%
(mainly Mediterranean)		
	388 species	100.00%

Accordingly, 77% of the species common in both countries can be found there because they are widely distributed all over the world, the Northern Hemisphere or Eurasia in general.

Among the species of *Lathyrus*, for example, there are three species in common (*L. palustris*, *L. pisiformis*, *L. pratensis*) which are of Holarctic or Eurasian distribution. All of them belong to the section *Orobastrum* which is an ancient, primeval ("ursprünglich") taxon according to MEUSEL et al. (1965).

In the following let us turn to the 57 Continental elements of the flora, about which we can suppose an Eastern origin in Hungary, possibly from those parts of Asia where Mongolia is situated. The bulk of the 57 species are true Continental (Eastern) floristical elements, that is, not Pontian – coming from, and possibly spread towards Mongolia from the Russian steppes lying nearer to Hungary. Based on the monography "A magyar növényvilág kézikönyve", only 6 of these species are of Pontian or Pontian-Mediterranean distribution, but the assignment of these taxa can be questioned. For example, *Limonium gmelini* is assigned to the Pontian province, but it is listed by MÁTHÉ (1940, 1941) among the Continental elements.

Examining the community relations of these Continental floristical elements in common we find that in Hungary they can be associated basically with four types of associations. The first group enriched the species of the dry oak forests (*Quercetalia pubescentis*) and the karstic groves (Orno-Cotinetalia). In the first place, we have to mention here the species of the forestal steppes like *Anemone sylvestris*, *Bromus inermis*, *Crepis praemorsa*, *Dracocephalum ruschiana*, *Lathyrus pisiformis*, *Phlomis tuberosa*, *Senecio integrifolius*, because the zone of the forestal steppe is equally important in Mongolia as well. While in Mongolia, however, the cold-continental forestal steppe is occurring exclusively, most of them are temperate-continental (submediterranean) woodlands in Hungary. *Dracocephalum ruschiana* is known

* disregarding *E. humifusa* Willd., which is adventive in Hungary.

to occur in Hungary only in relict spots of the cold-continental forestal steppe, but the rest of the species are known to occur equally (or exclusively) in temperate woodlands where they might have got as secondary elements. Species of the karstic groves include *Spirea media* and *Cotoneaster niger*, while the species *Carex tomentosa*, *Rosa spinosissima*, *Thalictrum minus* and *Veratrum nigrum* are species of the dry oak forests.

The other group comprises species of the grassy steppe („puszta”), *Festucion rupicolae*: *Agropyron pectinatum*, *Erysimum diffusum*, *Ceratoides latens*, *Nonea pulla*, as well as *Orobanche caesia* and *O. coerulescens*, parasites on wormwood species, *Scabiosa ochroleuca*, *Sisymbrium polymorphum*, *Veronica incana*, *Viola collina*. We can refer to this group the species *Allium montanum* and *Scorzonera austriaca* as well, occurring mainly on rocky grasslands and finally, *Euphrasia tatarica*. In Mongolia, however, some of these species are known to occur in different associations: *Ceratoides latens* and *Scorzonera austriaca* in open semi-arid association, whereas *Allium montanum* on cold-continental forestal steppes.

Several characteristic species of the Hungarian sodic puszta (*Puccinellio-Salicornea*) agree with those of Mongolia. In the first place, let us mention two species of the Gramineae, *Festuca pseudovina* and *Puccinellia distans*, but the rest of the species in common are also interesting: *Acorellus pannonicus*, *Chenopodium botryodes*, *Kochia prostrata*, *Lepidium crassifolium*, *Limonium gmelini*, *Melandrium viscosum**, *Melilotus dentatus**, *Rumex pseudonatronatus* and *R. stenophyllus*, *Suaeda maritima*, *Taraxacum bessarabicum*. A part of these species, however, can be considered as steppean relict species like *Kochia prostrata* and *Melandrium viscosum*, which can be found outside the sodic vegetations in Mongolia as well.

As the fourth group, we can mention some characteristic species of the sandy puszta like *Carex ericetorum*, *Gypsophila paniculata*, *Helichrysum arenarium*, *Iris humilis* ssp. *arenaria*, *Koeleria glauca*, *Silene borysthénica* and *Stipa joannis*.

Finally, some of the species in common occur at humid habitats like *Astragalus sulcatus* (the only species in common from the genus *Astragalus*), *Cuscuta lupuliformis*, a parasite of willows and poplars, the species *Thalictrum simplex* as well as *Typha minima*. Some adventive floristical elements of Continental origin were added also to our weed vegetation like *Artemisia annua*, *Geranium sibiricum*, *Kochia scoparia*, *Orobanche cernua* ssp. *cumana*, *Rumex patientia*, *Trigonella coerulea*, *Lappula patula*.

On the actual migration process of these floristical elements to Hungary, previous Hungarian botanical literature supposed an immigration during the Postglacial, notably, Boreal period with warm and dry climate when the Hungarian Mid-Mountains were populated by hazelnut groves and dry oak forests and the loessy and sandy lowland regions of the Great Hungarian Plains were covered by steppe. SOÓ (1964–1980) dated the immigration of Continental elements to four phases; Late Glacial, Boreal (hazelnut-period), Atlantic (oak-period) and Historical Period (see pp. 60 and 90 in Vol. I.) On the basis of the palynological investigations of JÁRAI-KOMLÓDI (1966), the occurrence of the *Chenopodiaceae* (*Chenopodium*, *Kochia*, *Ceratoides*) and the abundant occurrence of *Artemisia* species, as well as the presence of the genera *Rumex* and *Polygonum* can already be proved at the Great Hungarian Plain during the Würm Glaciation. On the other hand, opposed to the loessy pusztas already existing during the Würm glaciation, the emergence, or rather, extension of sandy puszta meadows and sodic puszta vegetation can be postulated for the Boreal phase only.

* These are species which are known to occur on sodic soil and they are also fairly resistant to salinity

To get a better impression on the actual connection of Mongolian and Hungarian species, the migration of Continental floristical Elements, the last part of this paper is devoted to the floristic history of the *Crepis* species in both countries. The genus *Crepis* was chosen because we have an up-to-date monography on the subject (BABCOCK 1947), and the author placed the origin of the genus to the region of the Altai-Tiansan Mts., the number of recent species present in the two countries are equal (11-11 species), and the ratio of the species common in both countries (2 species, 18.2%) is fairly near to that of all common species (17.3%), therefore this genus can be considered justly as representative.

CONNECTION OF THE SPECIES OF THE GENUS *CREPIS*

According to BABCOCK (1947), the genus *Crepis* possibly originated from the genus *Dubyaea* by the middle of the Tertiary period [at the earliest, in the Late Oligocene, at the latest, the Early Miocene*]. This latter genus is currently not represented in Mongolia, but there are 3 species of the genus *Youngia* known there which is closely related to *Crepis*.

On the basis of a thorough morphological, genetical and cytological study, BABCOCK classified the sections and the species into three groups within the genus: group I. ancient, perennial species (with rhizome), group II. fairly primitive species, bulk of them perennial, group III. more evolved species, bulk of them annual or biannual ones.

About half of the recent 11 species of *Crepis* belong to group I, the rest to group II (one species, namely *C. czuensis* Serg. is missing from the monography), that is, youngest species representing group III cannot be found there at all. In Hungary, representatives of all the three groups can be found but mostly those of group III (see Table 3).

From the gene centre of the Altai-Tiansan region, the species of *Crepis* migrated towards four directions:

- towards the West, to Europe
- towards the South-West, to the Mediterranean and Africa
- towards the North-East, to Northern America
- towards the South-East, to tropical regions of Asia.

Among the species belonging to the ancient group I, *Crepis sibirica*, *C. paludosa*, *C. mollis* and *C. praemorsa* did reach, during their route towards the West, Northern Europe** during the Miocene as yet, when the southern part of the of the Ural Mts. and the more elevated parts of the recent Kirgizian steppe were emerging from the Ob-sea and, migrating from there towards the South reached our territories somewhen during the Pliocene or the Pleistocene. Among these four species, the *C. mollis* is already extinct from Hungary, and *C. sibirica* reached as far as the Carpathes only. Among these four species, we find the species *C. sibirica* and *C. praemorsa* currently living in Mongolia. From the other species in group I, *C. multicaulis* reached only as far as Scandinavia (where, as a nunatak species, it survived the Ice Age), while *C. polytricha* and *C. chrysanth* remained as species with Central and Eastern Asian distribution (that is, we can witness essential differences in the adaptation capacities and aggressivity of the species).

*Most of the species originated, however, during the Pliocene and the Pleistocene already.

**A fossil fruit of *C. mollis* was found in Great Britain from Upper Pliocene beds

Species of group II with true root system were probably evolved from group I as a result of adaptation to more dry habitats. Among the Hungarian species, *C. pannonica* and *C. biennis* were originated during of a SW migration in the Pleistocene, the former one reaching our territories through the steppe of Betpak-Dala in Kazakhstan, the latter from the Caucasus, turning round the Caspean and the Black seas through the Balkans. The rest of the Mongolian species of group II like *C. crocea*, *C. nana*, *C. flexuosa* and *C. bungei* remained all of Central and Eastern Asian distribution. On the other hand, *C. bungei* is one of the ancestral forms of the species *C. tectorum*, occurring in both countries.

The youngest species of *Crepis*, belonging to group III were originated from the species of group II as a result of climatic and topographical changes during the Pliocene and the Pleistocene on the regions of the Turanian Lowlands, the Iran Plateaux, and the Eastern Mediterranean regions. These six species (*C. capillaris*, *C. nicaeensis*, *C. pulchra*, *C. rhoeadifolia*, *C. setosa* and *C. polymorpha*) reached Hungary therefore not as Continental or European elements, but as Mediterranean ones, from Southern direction.

Summarizing the relations of the *Crepis* species we can state that though we have, at the moment, only two species in common with the Mongolian region (*C. praemorsa*, *C. tectorum*), the connections according to ancestral relations are wider than that: on one hand, the ancient ancestral species of group I were equally originated from Central Asia, the environs of the Altai and the Tiensan Mts. (*C. paludosa*, *C. mollis*) and reached Central Europe migrating towards the West, through Scandinavia and, on the other hand, our youngest species of *Crepis* treated as Mediterranean elements within the flora are also the results of a flora migration started from Central Asia, through a South-Western route.

This migration of plants starting from Central Asia could be observed, naturally enough, not only for the species of the genus *Crepis* only. The fact of plant migrations from here was already mentioned by ENGLER (1879), demonstrating the main routes on maps, differentiating movements dated at the beginning and the end of the Tertiary period as well as migrations during the Ice Age. The South-Western route must have brought to Hungary many species of Continental and Mediterranean floristical elements, while the Western route (through Scandinavia) possibly brought several elements considered European today on the basis of their recent areas. The study of phyletic relations and plant migrations for several genera could add up to a more precise delineation of the Neogene floristical history, as well as a completion of vegetation-historical studies from a phytogenetical approach.

COMMON SPECIES OF HUNGARY AND MONGOLIA

1. *Huperzia selago* (L.) Bernh.
2. *Diphasium complanatum* (L.) Rothm.
3. *D. tristachyum* (Pursh.) Rothm.
4. *Lycopodium clavatum* L.
5. *L. annotinum* L.
6. *Equisetum sylvaticum* L.
7. *E. arvense* L.
8. *E. palustre* L.
9. *E. fluviatile* L. em. Ehrh.
10. *E. ramosissimum* Desf.
11. *E. variegatum* Schleich. in Web. et Mohr
12. *Botrychium lunaria* (L.) Sw. in Schrad.
13. *Pteridium aquilinum* (L.) Kuhn.
14. *Phegopteris connectilis* (Michx.) Watt (*Thelypteris phegopteris* (L.) Sloss. in Grubov)
15. *Gymnocarpium robertianum* (Hoffm.) Newm.
16. *Athyrium filix-femina* (L.) Roth
17. *Cystopteris fragilis* (L.) Bernh.
18. *Woodsia ilvensis* (L.) R. Br.
19. *Dryopteris dilatata* (Hoffm.) A. Gray
20. *Pinus sylvestris* L.
21. *Caltha palustris* L.
22. *Cimicifuga europaea* Schipczinskij (*C. foetida* L. in Grubov)
23. *Anemone sylvestris* L.
24. *Batrachium circinatum* (Sibth.) Spach
25. *B. trichophyllum* (Chaix) van den Bosch
26. *B. aquatile* (L.) Dum.
27. *Ranunculus sceleratus* L.
28. *R. repens* L.
29. *Thalictrum foetidum* L.
30. *Th. minus* L.
31. *Th. simplex* L.
32. *Ceratophyllum demersum* L.
33. *Spiraea salicifolia* L.
34. *S. media* Fr. Schm.
35. *Cotoneaster niger* Fr. (*C. melanocarpa* Lodd. in Grubov)
36. *Rubus saxatilis* L.
37. *Comarum palustre* L.
38. *Potentilla supina* L.
39. *P. anserina* L.
40. *Geum aleppicum* Jacq.
41. *Filipendula ulmaria* (L.) Maxim.
42. *Sanguisorba officinalis* L.
43. *Rosa spinosissima* L.

44. *Chrysosplenium alternifolium* L.
45. *Parnassia palustris* L.
46. *Ribes nigrum* L.
47. *Trigonella coerulea* (L.) Ser.
48. *Medicago lupulina* L.
49. *M. sativa* L.
50. *M. falcata* L.
51. *Melilotus albus* Desr.
52. *M. dentatus* (W. et K.) Pers.
53. *Trifolium repens* L.
54. *T. pratense* L.
55. *Lotus corniculatus* L.
56. *Astragalus sulcatus* L.
57. *Vicia cracca* L.
58. *V. sativa* L.
59. *Lathyrus sativus* L.
60. *L. palustris* L.
61. *L. pisiformis* L.
62. *L. pratensis* L.
63. *Pisum sativum* L. ssp. *arvense* (L.) Celak.
64. *Hippophaë rhamnoides* L.
65. *Epilobium hirsutum* L.
66. *E. palustre* L.
67. *Chamerion angustifolium* (L.) Holub.
68. *Myriophyllum verticillatum* L.
69. *M. spicatum* L.
70. *Hippuris vulgaris* L.
71. *Impatiens noli-tangere* L.
72. *Eryngium planum* L.
73. *Anthriscus sylvestris* (L.) Hoffm.
74. *Cicuta virosa* L.
75. *Carum carvi* L.
76. *Angelica sylvestris* L.
77. *Heracleum sphondylium* L. ssp. *sibiricum* (L.) Ahlfv.
78. *Galium humifusum* M.B.
79. *Galium boreale* L.
80. *G. spurium* L.
81. *G. uliginosum* L.
82. *G. verum* L.
83. *Valeriana officinalis* L.
84. *Scabiosa ochroleuca* L.
85. *Adoxa moschatellina* L.
86. *Malva neglecta* Wallr.
87. *Hibiscus trionum* L.
88. *Linum usitatissimum* L.
89. *Oxalis acetosella* L.
90. *Geranium pratense* L.
91. *G. sibiricum* L.

92. *Tribulus terrestris* L.
93. *Callitriche palustris* L.
94. *Centaurium pulchellum* (Sw.) Druce
95. *Menyanthes trifoliata* L.
96. *Nymphoides peltata* (Gmel.) Ktze.
97. *Cuscuta lupuliformis* Krock.
98. *C. scandens* Brot.
99. *C. europaea* L.
100. *Convolvulus arvensis* L.
101. *Lappula squarrosa* (Retz.) Dum. (*L. myosotis* Moench in Grubov)
102. *Lappula patula* (Lehm.) Menyh. [*L. marginata* (M.B.) Gürcke in Grubov]*
103. *Asperugo procumbens* L.
104. *Nonea pulla* (L.) Lam. et DC.
105. *Pulmonaria mollis* Wolff ex Hornem.
106. *Myosotis caespitosa* K. F. Schultz
107. *M. sylvatica* (Ehrh.) Hoffm.
108. *Scutellaria galericulata* L.
109. *Nepeta pannonica* L.
110. *Dracocephalum ruyschiana* L.
111. *Phlomis tuberosa* L.
112. *Galeopsis bifida* Boenn.
113. *Lamium album* L.
114. *Leonurus cardiaca* L.
115. *Origanum vulgare* L.
116. *Mentha arvensis* L.
117. *Hyoscyamus niger* L.
118. *Limosella aquatica* L.
119. *Veronica anagallis-aquatica* L.
120. *V. beccabunga* L.
121. *V. longifolia* L.
122. *V. pallens* Host
123. *V. spuria* L.
124. *Euphrasia tatarica* Fisch.
125. *Odontites vulgaris* Moench
126. *Pinguicula alpina* L.
127. *Utricularia vulgaris* L.
128. *U. minor* L.
129. *Orobanche coerulescens* Steph.
130. *O. cernua* ssp. *cumana* (Wallr.) Soó
131. *O. caesia* Rchb.
132. *Plantago maritima* L.
133. *P. major* L.
134. *Chelidonium majus* L.
135. *Brassica juncea* (L.) Czern.
136. *B. rapa* L. em. Metzger ssp. *campestris* (L.) Clapham

* The identity of the species is not certain

137. *Eruca sativa* Mill.
138. *Raphanus raphanistrum* L.
139. *Lepidium crassifolium* W. et K.
140. *L. densiflorum* Schrad.
141. *L. ruderales* L.
142. *Isatis tinctoria* L.
143. *Thlaspi arvense* L.
144. *Capsella bursa-pastoris* (L.) Medik.
145. *Neslea paniculata* (L.) Desv.
146. *Alyssum desertorum* Stapf
147. *Draba nemorosa* L.
148. *Cardamine parviflora* L.
149. *C. pratensis* L.
150. *Hesperis matronalis* L. ssp. *spontanea* Soó
151. *Erysimum cheiranthoides* L.
152. *E. hieracifolium* L.
153. *E. diffusum* Ehrh.
154. *Descurainia sophia* (L.) Webb. in Prantl
155. *Sisymbrium Loeselii* L.
156. *S. polymorphum* (Murr.) Roth
157. *Camelina sativa* (L.) Cr.
158. *C. microcarpa* Andr.
159. *Arabis hirsuta* (L.) Scop.
160. *Rorippa palustris* (L.) Bess.
161. *Drosera rotundifolia* L.
162. *D. anglica* Huds.
163. *Viola biflora* L.
164. *V. collina* Bess.
165. *V. rupestris* F. W. Schm.
166. *Hypericum perforatum* L.
167. *Campanula glomerata* L.
168. *C. rotundifolia* L.
169. *Adenophora liliifolia* (L.) Bess. (*A. Lamarckii* Fisch. in Grubov)
170. *Aster tripolium* L. (*Tripolium vulgare* Nees. in Grubov)
171. *Erigeron acris* L.
172. *Filago arvensis* L.
173. *Antennaria dioica* (L.) Gärt.
174. *Gnaphalium uliginosum* L. (*G. baicalense* Kirp. in Grubov)
175. *Helichrysum arenarium* (L.) Mönch
176. *Inula salicina* L.
177. *I. britannica* L.
178. *Xanthium strumarium* L.
179. *Bidens tripartita* L.
180. *B. cernua* L.
181. *Achillea millefolium* L.
182. *Matricaria chamomilla* L. (*M. recutita* L. in Grubov)
183. *Tanacetum vulgare* L.
184. *Artemisia scoparia* W. et K.

185. *A. annua* L.
186. *Senecio integrifolius* (L.) Clairv.
187. *S. vulgaris* L.
188. *S. erucifolius* L.
189. *S. jacobaea* L.
190. *S. nemorensis* L.
191. *Ligularia sibirica* (L.) Cass.
192. *Echinops ruthenicus* (Fisch.) M.B. (*E. ritro* L. in Grubov)
193. *Carduus nutans* L.
194. *C. crispus* L.
195. *Cirsium arvense* (L.) Scop.
196. *Cichorium intybus* L.
197. *Hypochoeris maculata* L. [*Achyrophorus maculatus* (L.) Scop. in Grubov]
198. *Picris hieracioides* L.
199. *Scorzonera austriaca* Willd.
200. *S. parviflora* Jacq.
201. *Taraxacum bessarabicum* (Hornem.) Hand.-Mazz.
202. *T. officinale* Weber ex Wiggers
203. *Sonchus arvensis* L.
204. *S. oleraceus* L.
205. *Lactuca serriola* Torn. ex L.
206. *Crepis praemorsa* (L.) Tausch
207. *C. tectorum* L.
208. *Hieracium echinoides* Lumn.
209. *H. umbellatum* L.
210. *Moneses uniflora* (L.) A. Gray
211. *Orthilia secunda* (L.) House
212. *Pyrola rotundifolia* L.
213. *Monotropa hypopitys* L.
214. *Vaccinium vitis-ideae* L.
215. *V. myrtillus* L.
216. *Portulaca oleracea* L.
217. *Agrostemma githago* L.
218. *Silene vulgaris* (Mönch) Garcke
219. *S. borysthena* (Gruner) Walters
220. *Gypsophila paniculata* L.
221. *Melandrium viscosum* (L.) Celak.
222. *Dianthus superbus* L.
223. *Stellaria media* (L.) Cyr.
224. *S. graminea* L.
225. *S. palustris* Ehrh. in Retz.
226. *Cerastium vulgatum* L.
227. *C. arvense* L.
228. *Minuartia verna* (L.) Hiern
229. *Spergularia marina* (L.) Griseb.
230. *Herniaria glabra* L.
231. *Chenopodium aristatum* L.
232. *Ch. botrys* L.

233. *Ch. vulvaria* L.
234. *Ch. hybridum* L.
235. *Ch. rubrum* L.
236. *Ch. botryodes* Sm.
237. *Ch. glaucum* L.
238. *Ch. album* L.
239. *Ch. urbicum* L.
240. *Atriplex tatarica* L.
241. *Ceratoides latens* Reveal et Holmgren
242. *Kochia scoparia* Schrad.
243. *K. prostrata* (L.) Schrad.
244. *Salicornia prostrata* Pall.
245. *Suaeda maritima* (L.) Dum. ssp. *prostrata* (Pall.) Soó
246. *Suaeda maritima* (L.) Dum. ssp. *salsa* (L.) Soó
247. *Amaranthus retroflexus* L.
248. *A. blitoides* S. Watson
249. *Primula farinosa* L.
250. *Androsace maxima* L.
251. *Glaux maritima* L.
252. *Limonium gmelini* (Willd.) Ktze.
253. *Rumex maritimus* L.
254. *R. crispus* L.
255. *R. pseudonatronatus* Borb.
256. *R. aquaticus* L.
257. *R. patientia* L.
258. *R. acetosella* L.
259. *R. acetosa* L.
260. *R. stenophyllus* Ledeb.
261. *R. thyrsoiflorus* Fingerh.
262. *Polygonum amphibium* L.
263. *P. lapathifolium* L.
264. *P. minus* Huds.
265. *P. hydropiper* L.
266. *P. patulum* M. B.
267. *P. aviculare* L.
268. *Fallopia dumetorum* (L.) Holub
269. *Fallopia convolvulus* (L.) A. Löve
270. *Cannabis sativa* L.
271. *Urtica dioica* L.
272. *Populus tremula* L.
273. *Salix triandra* L.
274. *S. rosmarinifolia* L.
275. *S. viminalis* L.
276. *S. caprea* L.
277. *Alisma gramineum* Gmel.
278. *A. plantago-aquatica* L.
279. *Butomus umbellatus* L.
280. *Potamogeton natans* L.

281. *P. perfoliatus* L.
282. *P. crispus* L.
283. *P. lucens* L.
284. *P. pectinatus* L.
285. *P. filiformis* Pers.
286. *P. obtusifolius* M. et K.
287. *P. pusillus* L.
288. *P. gramineus* L. ssp. *heterophyllus* (Fries) Sch. et K.
289. *Triglochin maritimum* L.
290. *T. palustre* L.
291. *Najas marina* L.
292. *Veratrum nigrum* L.
293. *V. album* L. ssp. *lobelianum* (Bernh.) Rchb.
294. *Hemerocallis lilio-asphodelus* L.
295. *Allium victorialis* L.
296. *A. montanum* F. W. Schm.
297. *Lilium martagon* L.
298. *Majanthemum bifolium* (L.) F. W. Schm.
299. *Polygonatum odoratum* (Mill.) Druce
300. *Paris quadrifolia* L.
301. *Iris humilis* Georgi
302. *I. sibirica* L.
303. *Juncus articulatus* L.
304. *J. alpinus* Vill.
305. *J. compressus* Jacq.
306. *J. gerardii* Lois
307. *J. bufonius* L. ssp. *ranarius* (Song et Perrier) Hiitonen
308. *Luzula pallescens* (Wahlbg.) Sw.
309. *Cypripedium calceolus* L.
310. *Goodyera repens* (L.) R. Br.
311. *Epipogium aphyllum* (Schm.) Sw.
312. *Platanthera bifolia* (L.) Rich.
313. *Coeloglossum viride* (L.) Hartm.
314. *Gymnadenia conopsea* (L.) R. Br.
315. *Herminium monorchis* (L.) R. Br.
316. *Orchis militaris* L.
317. *Dactylorhiza sambucina* (L.) Soó
318. *D. maculata* (L.) Soó
319. *Corallorhiza trifida* Châtelain
320. *Acorellus pannonicus* (Jacq.) Palla
321. *Cyperus fuscus* L.
322. *Eriophorum latifolium* Hoppe
323. *E. angustifolium* Honckeny
324. *Blysmus compressus* (L.) Panzer*
325. *Scirpus sylvaticus* L.

* According to GRUBOV, it is synonymous with *Blysmus sinocompressus*, however, the identity is not certain

326. *S. radicans* Schkuhr
327. *Eleocharis acicularis* (L.) R. et Sch.
328. *E. uniglumis* (Lk.) Schult.
329. *Carex diandra* Schrk.
330. *C. leporina* L.
331. *C. canescens* L.
332. *C. caespitosa* L.
333. *C. tomentosa* L.
334. *C. ericetorum* Poll.
335. *C. caryophyllea* Latour.
336. *C. alba* Scop.
337. *C. rostrata* Stokes
338. *Bromus squarrosus* L.
339. *B. japonicus* Thunbg.
340. *B. inermis* Leyss.
341. *B. tectorum* L.
342. *Festuca ovina* L.
343. *F. pseudovina* Hackel ex Wiesb.*
344. *F. rubra* L.
345. *Brachypodium pinnatum* (L.) P.B.
346. *Puccinellia distans* (Jacq.) Parl.
347. *Poa pratensis* L.
348. *P. angustifolia* L.
349. *P. trivialis* L.
350. *P. nemoralis* L.
351. *P. palustris* L.
352. *Catabrosa aquatica* (L.) P.B.
353. *Melica nutans* L.
354. *Agropyron pectinatum* (M. B.) R. et Sch.
355. *A. repens* (L.) P.B.
356. *Phragmites australis* (Cavan.) Trin. et Steud.
357. *Eragrostis pilosa* (L.) P.B.
358. *E. minor* Host
359. *E. megastachya* (Koel.) Link
360. *Nardus stricta* L.
361. *Deschampsia caespitosa* (L.) P.B.
362. *Avena fatua* L.
363. *Heli ctotrichon pubescens* (Huds.) Pilger
363. *Koeleria glauca* (Schkuhr) DC.
365. *K. cristata* (L.) Pers. em. Borb. [*K. macrantha* (Ldb.) Schult, in Grubov]
366. *Agrostis stolonifera* L.
367. *Calamagrostis stricta* (Timm ex Siemssen) Koeler
368. *C. epigeios* (L.) Roth
369. *C. pseudophragmites* (Hall. f.) Koel.

* According to GRUBOV, it is synonymous with *Festuca valesiaca* Gaud, which is not identical with *F. valesiaca* Schleich. living in Hungary.

370. *Phleum phleoides* (L.) Karsten
371. *Alopecurus pratensis* L.
372. *A. aequalis* Sobol.
373. *Crypsis aculeata* (L.) Ait.
374. *Stipa capillata* L.
375. *S. Joannis* Celak.
376. *Tragus racemosus* (L.) Desf. (*T. monogolorum* Ohwi in Grubov)
377. *Hierochloë repens* (Host) P.B.
378. *Anthoxanthum odoratum* L.
379. *Typhoides arundinacea* (L.) Mönch
380. *Echinochloa crus-galli* (L.) P.B.
381. *Setaria pumila* (Poir.) R. et Sch.
382. *S. viridis* (L.) P. B.
383. *Acorus calamus* L.
384. *Lemna trisulca* L.
385. *L. minor* L.
386. *Sparganium emersum* Rehmann
387. *Typha minima* Funck
388. *T. angustifolia* L.

Comment: In case we want to interpret the notion of the species wider than it is accepted by GRUBOV (1982), we can find some more species in common, e.g., on the basis of MEUSEL et al. (1965, 1978) the following ones:

In Hungary:

Rubus idaeus L.
Dictamnus albus L.
Bupleurum falcatum L.

Armeria elongata (Hoffm.) C. Koch

In Mongolia:

R. sachalinensis Lev.
D. dasycarpus Turcz.
B. bicaule Helm. and
B. scorzonrifolium Willd.

A. sibirica Turcz.

According: to
 MEUSEL et al.,
 these are:

subspecies
 race
 subspecies
 subspecies

subspecies of
A. maritima

Table 1. Comparison of plant families comprising more than 10 genera in Hungary and Mongolia

Name of family	Number of genera			Number of species		
	in Mongolia	in Hungary	common in both countries	in Mongolia	in Hungary	common in both countries
Compositae	66	65	38	297	284	40
Gramineae	56	64	34	211	153	45
Cruciferae	52	48	23	118	115	26
Umbelliferae	28	41	17	55	80	6
Rosaceae	28	27	18	101	149	11
Leguminosae	23	27	12	236	138	17
Caryophyllaceae	18	24	14	75	87	14
Chenopodiaceae	25	11	9	88	41	16
Labiatae	23	23	12	67	78	9
Ranunculaceae	21	22	14	94	72	11
Boraginaceae	22	16	9	41	39	7
Orchidaceae	16	19	11	21	45	11
Liliaceae	15	20	10	59	61	9
Schrophulariaceae	13	18	8	69	79	8
Cyperaceae	10	18	9	111	94	18
Polypodiaceae	10	15	9	18	31	7
Sum of 16 families	426	458	247	1661	1546	255
Sum of flora	593	665	356	2249	2165	388
ratio of 16 families (in %)	71.8	68.9	69.4	73.8	71.4	65.7

Table 2. Comparison of species number of genera of Asian and Mediterranean origin

Name	Number of species			Gene centre in the references
of genera	in Mongolia	in Hungary	common in both countries	
Genera of Asian origin				
Astragalus	71	11	1	Meusel et al. (1965)
Allium	31	16	2	Meusel et al. (1965)
Oxytropis	78	1	—	Meusel et al. (1965)
Pedicularis	33	1	—	Meusel et al. (1978)
Taraxacum	19	5	2	Handel-Mazetti (1907)
Aconitum	11	4	—	Engler (1879)
Ribes	12	4	1	Engler (1879)
Limonium	14	1	1	Meusel et al. (1978)
Spiraea	8	3	2	Meusel et al. (1965)
Sum of 9				
Asian genera	276	46	9	
Genera of Mediterranean origin:				
Trifolium	4	27	2	Engler (1879)
Centaurea	3	22	—	Engler (1879)
Bromus	7	13	4	Meusel et al. (1965)
Orchis	4	15	3	Engler (1879)
Silene	9	13	2	Meusel et al. (1965)
Dianthus	5	11	1	Engler (1879)
Medicago	5	10	3	Good (1947)
Campanula	5	12	2	Engler (1879)
Scabiosa	2	4	1	Engler (1879)
Sum of 9				
Mediterranean genera	44	127	18	

Table 3. Important characteristics of the Mongolian and Hungarian species of *Crepis*

Species	Group according to age	Section	Haploid Chromosome number	Floristic element or area	Ecological temperature	demands humidity	Direction of migration
A. Only in Mongolia							
<i>C. sibirica</i> L.	I.	1.	5	Eua.	temp.	meso.	N
<i>C. chrysanth</i> (Ldb.) Turcz.	I.	4.	4	Central and E. Asia	alpine	meso.	
<i>C. polytricha</i> (Ldb.) Turcz.	I.	4.	8	Central and E. Asia	alpine	meso.	
<i>C. multicaulis</i> Ldb.	I.	21.	4	N. Eua.	temp.	meso.-xero.	
<i>C. crocea</i> (Lam.) Bab.	II.	11.	8	Central and E. Asia	temp.	meso.-xero.	
<i>C. nana</i> Richards	II.	12.	7	Central and E. Asia	alpine	meso.	
<i>C. flexuosa</i> (Ldb.) Clarke	II.	12.	7	Central and E. Asia	alpine	meso.	
<i>C. bungei</i> (Ldb.)	II.	14.	4	Central and E. Asia	temp.	meso.-xero.	
B. species in common							
<i>C. praemorsa</i> (L.) Tausch	I.	13.	4	Kont. (Eua.)	temp.	meso.-xero.	NW
<i>C. tectorum</i> L.	II.	14.	4	Eua. (Kont.)	temp.	meso.-xero.	
C. Only in Hungary							
<i>C. paludosa</i> (L.) Monch	I.	1.	6	Eu.	temp.	meso.	NW
<i>C. mollis</i> (Jacq.) Asch.	I.	5.	6		temp.	meso.	NW
<i>C. biennis</i> L.	II.	10.	20	Eu.	temp.	meso.-xero.	SW
<i>C. pannonica</i> (Jacq.) C. Koch	II.	10.	4	Pont.-Pann.	temp.	meso.-xero.	SW
<i>C. rhoeadifolia</i> M.B.	III.	20.	5	Pont.-M.	temp.	meso.-xero.	W
<i>C. capillaris</i> (L.) Wallr.	III.	24.	3	K.eu.-M.	temp.	meso.-xero.	
<i>C. nicaeensis</i> Balb.	III.	24.	4	M.-K.eu.	temp.	meso.-xero.	SW
<i>C. setosa</i> Hall.f.	III.	26.	4	M.-K.eu.	temp.	meso.	
<i>C. polymorpha</i> Thuill.	III.	25.	4	Atl.-M.	temp.	meso.-xero.	
<i>C. pulchra</i> Thuill.	III.	19.	4	M.-K.eu.	temp.	meso.-xero.	

(*) Based on the monography of BABOCK (1947), the sections are listed also in a sequence of their primitive or more evolved character

(**) Floristical elements: Eua. = Eurasian, Eu. = European, K.eu. = Central European, M = Mediterranean, Atl. = Atlantic, Pont. = Pontian, Pann. = Pannonian, Kont. = Continental

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